Kartverket

The Norwegian Mapping Authority

GUIDANCE

Registration instructions for Port Data

Version 3.01

Photo: Trygve Emil Tønnesen

GUIDANCE

Registration instructions for Port Data

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Note: Previous editions of this guidance document have been published exclusively in Norwegian. This is the first edition translated into English. It's been chosen to have the same version number as the corresponding Norwegian edition, to avoid confusion. The original version of the registration instruction and product specification is the Norwegian versions.

Change log version 3.00

- The instructions have been updated to current version of data model and product specification (Port data 3.0). For details at feature and attribute level on the difference between Port data 2.0 and Port data 3.0, see change log in the product specification.
- *Chapter 1 Introduction* and *Chapter 2 General guidelines and requirements for registration* has been updated, restructured and partly rewritten.
- Added some new images of feature types.
- Appendix that contained change log, diagrams and SOSI syntax is removed, as this is part of the product specification for Port data 3.0.
- Added appendix with abbreviations used in this document.

Change log version 3.01

- Added missing attribute in tables (*loadId* for *LoadLimitationArea*).
- Corrected figure text for figure 30 and 31.
- Corrected attribute name for *FuelConnection* (*dateAvailableTo/dateAvailableFrom*).
- Corrected figure 24, where the numbering for the mooring devices was missing.
- Updated the headline and example in Appendix B, for calculating the height above chart datum, to not only apply to a specific port.
- Added *SSR* as an abbreviation in appendix C.

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1 Introduction

This guidance document contains registration instructions for Port data. The registration instructions are a guide on how Port data should be captured/mapped. The purpose of a national guidance document is to obtain a uniform and standardized registration of port data.

For a full description of the product and dataset *Port Data* and associated data model, see the product specification for Port Data.

1.1 Definitions and concepts

In this chapter you will find definitions and terms related to Port data. The definitions are based on Port and Waterways Act (*Havne- og Farvannsloven)* (including related regulations) and *IHO S-32 Hydrographic Dictionary*. The definition for Marina (småbåthavn) includes aspects from *Veiledning til forskrift om kart, stedfestet informasjon, arealformål og digitalt planregister*.

A common agreement on the definitions and terms used in the Port data standard contribute to eliminate misunderstandings on how to registrate, delimit and update the different objects and features in the standard. Norwegian terms are given in brackets.

Port data (Havnedata): Port data is detailed information about ports, quays, and associated objects, such as port facilities, quay fronts, water outlets, power connection, emergency response equipment, sensor, waste facilities, cranes, slipway, fender, mooring facilities, fences, etc. Regulations in the form of legislation, rules or restrictions, that are related to ports and have a spatial extent that can be mapped, are part of the standard. The standard is designed so that it can be managed according to the same management concept as SFKB.

Port (Havn): A defined geographical area that contains quay/quays and associated land and sea areas that are arranged for the transfer of goods or people between land and sea. Or an area adapted to the reception and mooring of commercial, public service, fishing vessels or leisure boats. Ports are often protected from weather and wind by natural landscape formations (harbour) or man-made structures such as breakwaters.

Port Facility (Havneanlegg): Areas, buildings, facilities and other infrastructure used in port operations or to port purposes. Including: quays, terminal buildings, loading and unloading and transhipment facilities and warehouse and administration buildings.

ISPS Port Facility (ISPS Havneanlegg): Port facilities that have been approved by the Norwegian Coastal Administration to serve international ship traffic, and which are subject to maritime security or port security in accordance with the ISPS regulations (International Ship and Port Facility Security code), which are international regulations for the security of ships and facilities in ports.

Quay (Kai): A quay is a structure, usually parallel to the coastal contour or from land out to sea, where vessel can dock or moor.

Quay Front (Kaifront): Quay front is the outermost part of the quay, which separates the sea from land, along which vessel can be moored.

Quay Area (Kaiområde): Quay area is the area directly within the quay front, which belongs to the same quay or structure.

Berth: The space a ship is assigned or occupies when it is at anchor or when it is moored along a quay, wharf or other structure. The term can be used for anchorage areas or other allocated areas at sea, a berth is not limited to lying alongside land. A ship's voyage is considered to go from berth to berth. Berth is not a feature type in the Port data standard, but a central term used in ports and harbours.

The municipality's sea area (Kommunens sjøområde): The area where the municipality has planning authority according to the Planning and Building Act (Plan- og bygningsloven), with the exception of the main and secondary fairways. The main and secondary fairways do not belong to the municipality's sea area and are managed by the Norwegian Coastal Administration.

Figure 1. The figure illustrates the different levels of the layout in a port/harbour. This is not an example on how the feature types should be registered but gives a picture of the different areas a port can be divided into, and their order of magnitude in relation to each other. Berth, which is marked with green in the image, is not a feature type in Port data. It has been included in the figure because it's a central term regarding ports.

1.1.1 Alternative terms and concepts

Some of the feature types in Port data is called by different names depending on the different stakeholders and professional environment. Table 1 shows different alternative everyday terms used in the port for the feature types included in the Port data standard.

Table 1: Table with alternative everyday terms used for features and objects in the port.

Feature types in Port data	Alternative everyday terms used in the port
AdministrativeHarbourArea	Harbour area (administrative)
SolidWasteDisposal	Waste station, recycling stations, waste management, waste facility, waste handling
EmergencyResponseEquipment	Referred to by type of equipment: for example: life buoy, ladder, oil boom, fire hydrant, fire hose, boat hook, emergency information poster. See code list Type of Emergency response equipment for more examples.
FuelConnection	Fuel, bunkering
ElectricityConnection	Power outlet, Shore power, distribution cabinet
Fender	Fender, yokohama fender
FloatingDock	Wet dock, dock
MooringFacilities	Bollard, mooring, mooring structure
PortFacility	Port Facility, Terminal, ISPS Port facility ISPS-area, port safety area
PortFacilityBoundary	Port Facility
PortFence	ISPS fence
PortFenceEntrance	Gate, entrance to port facility
PortArea	Port, Harbour area
Portsensor	Mentioned by type of sensor, for example: weather station, water level gauge, gate sensor or other sensor.
QuayFront	Wharf, pier, jetty, dock, landing, water front, harbour works
QuayArea	quayside, dock area
QuayAreaBoundary	quayside, dock area
Camera	Surveillance camera
Crane	Crane
LoadLimitationArea	Load capacity, permissible load, load limit
LoadLimitationAreaBoundary	Load capacity, permissible load, load limit
LoadingUnloadingEquipment	Referred to by type of equipment: for example: boat lift, loading unloading ramp, hopper. See code list Type of Equipment for more examples.
Slipway	Slipway, boat slip
Toilet	Toilet
LiquidWasteDisposal	Septic, septage receiving station
DryDock	Dry dock, dock
WaterConnection	Fresh-water supply, water supply services, fresh water bunkering
Regulations	
SpeedRegulation	Restriction, Restriction area, speed limit at sea/for ships
SpeedRegulationBoundary	Restriction, Restriction area, speed limit at sea/for ships
ProhibitedArea	Prohibited area
ProhibitetAreaBoundary	Prohibited area

2 General guidelines and requirements for registration

This chapter presents general guidelines and requirements for registering Port data. The chapter is mainly directed to surveying companies and other who will be involved in the process of data capture.

2.1 Preparation

In this chapter you will find information that is relevant prior to the registration of Port data, such as preparations, different data capture methods that can be used, map projections to be used, as well as height reference model (Norwegian vertical datum and chart datum).

2.1.1 Overview of existing data and overlapping data sets

Before registration and surveying, the port authorities should be contacted, to access all available data about the port. The ports have usually good knowledge about their port facilities, but what information that is digitalized vary greatly. The information is usually not standardized or stored on a standardized format. It's recommended to contact the port as early as possible in the process, as this will make the registration easier.

It's important to be aware that there are feature types that match or partially overlap with feature types in other data models/data sets, such as FKB (Felles Kartdatabase/Common Map database). FKB is a collection datasets with some of the most detailed map data in Norway. Municipalities will often have local databases with themes such as recycling, water, sewage, electricity, etc. Contact the municipality and check what data is available.

The table below provides an overview of datasets that partially overlap with feature types in Port data. In these data sets there are objects that might be the same feature types as in Port data. For reuse of existing data, se chapter 2.1.3 Data capture.

Table 2: Table with overview over datasets that might overlap with feature types in Port data. It's the Norwegian names of the datasets that are given, as English translations are not available.

Feature types in Port data	Partly overlapping datasets
AdministrativeHarbourArea	Administrative enheter i Norge, N50 Kartdata
SolidWasteDisposal	FKB – BygnAnlegg (feature type *Avfallsbeholder*)
EmergencyResponseEquipment	Hjertestarterregisteret, FKB LedningVA (feature type *VA_hydrant*)
FuelConnection	
ElectricityConnection	FKB-Ledning (feature type *Skap*)
Fender	
FloatingDock	Sjøkart - dybdedata Sjøkart - Maritim infrastruktur
MooringFacilities	FKB – BygnAnlegg (feature type *Pælebukk*)
PortFacility	ISPS Havneanlegg

PortFacilityBoundary	
PortFence	FKB – BygnAnlegg (feature type *Gjerde*)
PortFenceEntrance	
PortArea	
PortSensor	Oversikt over målestasjoner (observasjoner og værstatstikk, Norsk kilmaservicesenter.
QuayFront	FKB – Vann (feature type *KystkonturTekniskeAnlegg*) / FKB – BygnAnlegg (feature type *KaiBryggeKant*)
QuayArea	FKB – BygnAnlegg (feature type *KaiBrygge*)
QuayAreaBounadry	FKB – BygnAnlegg (feature type *fiktivAvgrensningForAnlegg*)
Camera	
Crane	
LoadLimitationArea	
LoadLimitationAreaBoundary	
LoadingUnloadingEquipment	
Slipway	FKB BygnAnlegg (feature type *Slipp*) Sjøkart - dybdedata
Toilet	FKB Bygning (registered as a building)
LiquidWasteDisposal	
DryDock	Sjøkart - dybdedata
WaterConnection	
Regulations	
SpeedRegulation	For næringsfartøy - alle fartsgrenser på sjøen For næringsfartøy – statlige fartsgrenser på sjøen etter HFL For fritidsfartøy – alle fartsgrenser på sjøen Statlige fartsgrenser på sjøen for næringsfartøy Statlige fartsgrenser på sjøen for fritidsfartøy
SpeedRegulationBoundary	FKB Vann (feature type *Kystkontur)*
ProhibitedArea	Sjøkart - Maritim infrastruktur (feature type *Restriksjonsområde*)
ProhibitetAreaBoundary	Sjøkart - Maritim infrastruktur (feature type *Restriksjonsgrense*) FKB Vann (feature type *Kystkontur*)

2.1.2 Defining the geographical area to be mapped

The geographical area to be mapped is defined in cooperation with the port authorities. The area should be defined with a demarcation polygon. The purpose of this polygon is to support the surveying company to get an overview of the extent that shall be mapped. The demarcation polygon is not measured in field. It should also be clarified what kind of area the areas to be surveyed are (marina, industry, traffic, fishing). Type of area can affect the accuracy requirement, as small ports such as marinas do not have the same accuracy requirements as larger ports (industry or traffic).

2.1.3 Data capture

There are various methods of data capture for Port data. See Appendix A for a description of the various mapping methods that can be used for data capture.

Surveying is the data capture method that gives the most accurate results. It's particularly effective to register port data with land surveying together with a representative from the port administration – you can register attribute information about the physical objects already in field (as opposed to doing it as the part of the post-processing/finishing work).

Laser scanning with car or drone (mobile mapping) produces high resolutions point clouds – a detailed 3D model of the port, where the physical objects can be located, and the geometry can be extracted. The point cloud has several application areas in addition to being used as a data capture method.

Photogrammetry can be used where land surveying is not a requirement. Photogrammetry is an efficient data capture method in areas where there are very many objects to be measured.

Use of existing data

Existing FKB data or original data from the port can be used where they coincide with feature types in the Port data standard, if they meet the accuracy requirements in chapter 2.3.

Note that existing data in FKB may have a different height reference than that required in Port data. Features in FKB – which are usually registered with photogrammetry – have a height reference at the top of the physical objects, while the height reference for corresponding objects in port data is at the bottom. This applies, among other things, to the feature type *PortFence.* If you are to generate a surface by reusing geometry from other features (curve geometry or line segments) that have a different height reference, this will be incorrect (the surface becomes an inclined plane in 3D). The problem can be avoided by measure the object (i.e., not reusing data where the height reference is different from the requirement for Port data) or use available laser data at høydedata.no to drape data over.

Measure methods to be avoided

Some data capture methods provide inaccurate registrations, such as GPS on mobile phone or digitizing on a computer from a georeferenced PDF document. Some older measurements are done using these methods. Land surveying, photogrammetry or laser scanning is required for new mapping projects or surveys.

See chapter 4.4 for more information about older and inaccurate data capture methods.

2.1.4 Map projections

As the official map projection in ETRS89 (EUREF89) we use UTM (Universal Transverse Mercator). This projection is used for measure Port data. In Norway the zones 32, 33 and 35 are used for mapping. Ports located within UTM zone 31 and 32 must use zone 32. Ports located within UTM zone 33 and 34 must use zone 33. Ports located within UTM zone 35 must use zone 35. UTM zones to be used for registration are shown in figure 2. More information about map projections can be found on the Mapping Authority's website here.

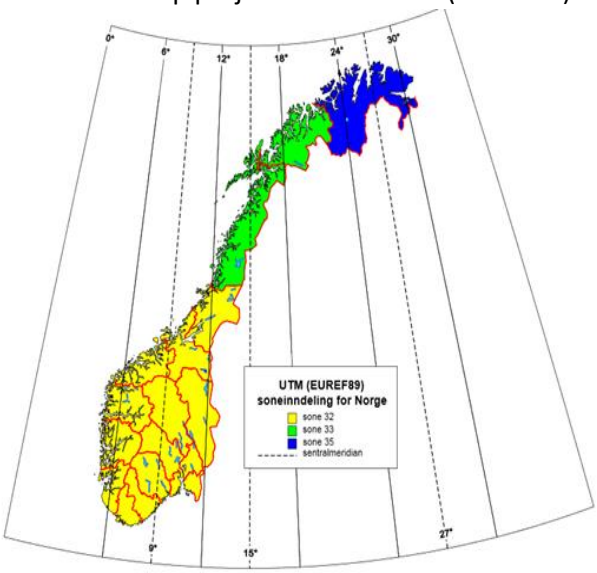


Figure 2: UTM zones, which are used for technical and economic map series in Norway. Source: Koordinatbasert referansesystem, Kartverket

2.1.5 Height reference model: Norwegian vertical datum and chart datum

NN2000 (Norwegian Vertical datum of 2000) must be used as a height reference model when measuring objects. This is the value that is recorded as the z-value on the features. For certain objects in the port, it's also important to know how high above chart datum the object is located. Use the attribute *heightAboveChartDatum* to register the height above chart datum. Round to two decimal places.

The height above chart datum must be calculated by using the value for NN2000 relative to chart datum for the port or area in question. This value can be found at Se havnivå. The method for calculate height above chart datum is described in more detail in Appendix B.

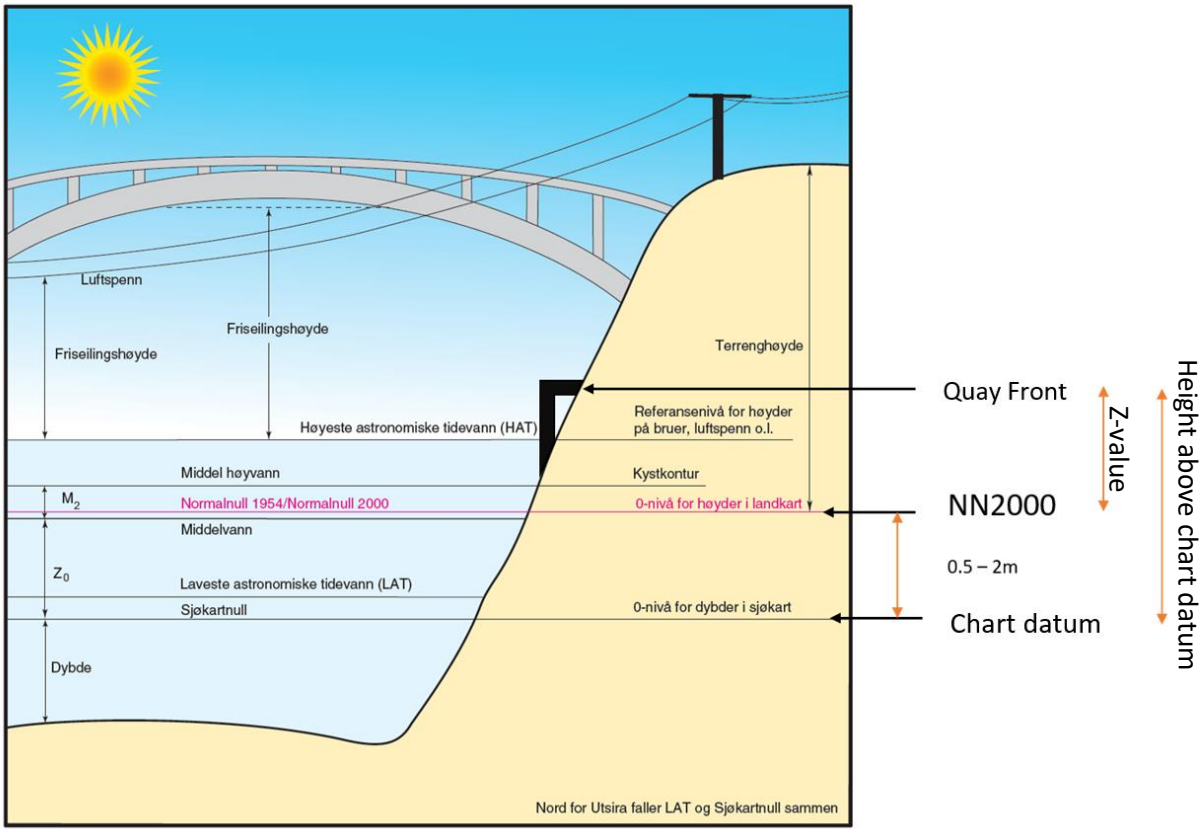


Figure 3: Overview over different reference levels, and the relation between chart datum and NN2000.

2.2 Registration

This chapter contains information relevant for registration, such as a description of different types of geometry to be used, general guidelines for registering attribute information and guidelines for the use of id (attribute information containing name or id).

The following information must be registered for each individual object:

- Feature type (correct classification of the object)
- Geometry (in accordance to specified height reference and other descriptions)
- Required attributes (common properties and specific properties for the feature type)
- Optional properties (where information is available)

Chapter 3 contains a registration description for all feature types and associated attributes. The registration description explains how the various feature types are to be registered.

2.2.1 Geometry types

The following geometry types must be used for registration:

- **GM_Point** is a geometry type that represent one position. It is registered as a single point.
- **GM_Curve** is a geometry type which consist of several points in a sequence, where each point has a position. Together the points form a line.
- **GM_Surface** is a continuous area or a surface. Feature types in Port data with surface geometry is divided into two different types, in the same way as surface feature types in FKB 5.0: one type with associated delimiting boundary feature and one type without associated delimiting boundary feature:

Type 1: Surface feature types without associated delimiting boundary features
Where the delimiting boundary features have no function beyond delimiting the surface features ("simple-feature" surfaces). No delimiting boundary features or references to other features ("fully owned geometry"). This applies to the feature types *PortArea*, *AdministrativeHarbourArea*, *DryDock*, *FloatingDock* and *Slipway*.

Type 2: Surface feature types with associated delimiting boundary features
Where there are separate delimiting boundary features and there is a requirement for a connection between the surface feature and the boundary feature. The surface feature knows which bounding feature make up the surface boundary and the direction and order of these features ("shared geometry"). This applies to the feature types *PortFacility, QuayArea*, *LoadLimitationArea*, *ProhibitedArea* and *SpeedRegulation*.
See figure 4, which shows the difference between shared and fully owned geometry.

In software types, which are adapted to the SOSI standard, the surface is registered with a representative point. This is generated within the curves (the boundary feature) according to the SOSI standard. The boundary and the point form the surface together. The representative point contains the attribute information to the surface.

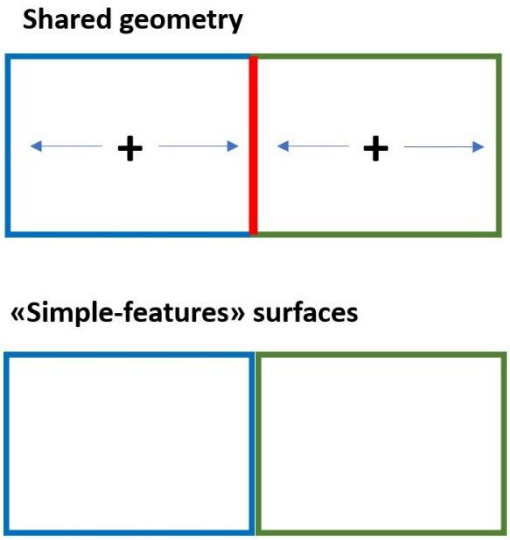


Figure 4: Shared and fully owned geometry.

Table 3: Tablet hat shows which geometry types that can be used in Port data for the different formats. (Harmonized with FKB 5.0).

UML (ISO 19107)	SOSI Geometry	GML Geometry	JSON Geometry
GM_Point	.PUNKT	gml:Point	point
GM_Curve	.KURVE	gml:Curve	linestring
GM_Surface	.FLATE	gml:Surface	polygon

2.2.2 Registration of attributes

Each feature type in Port data contains several attributes. It varies if the attributes is required or optional. All required attribute fields must be filled. For all feature types the attributes *dataCaptureDate*, *identification* and *quality(positionQuality)* must be registered. This is required common properties. Optional attributes are filled in if information is available. The information can be retrieved from the port administration (the port's own collected data) or registered in cooperation with the port. The data owner must ensure quality and fill in missing information as part of the finishing work (see chapter 2.4). Attributes for name and id are optional, but it's highly recommended to fill in all available information for these fields. See chapter 2.2.3.

Multiplicity: All attributes have a multiplicity. The multiplicity indicates how many times the attribute can occur for an instance of a feature type. For some attributes, it is possible to enter several values from the same code list. This is indicated in the tables which list the attributes for each individual feature type in chapter 3.

Table 4: Overview over different multiplicity values and their description.

Multiplicity	Description
[1..1]	Required attribute: one instance.
[0..1]	Optional attribute can contain zero or one instance.
[0..*]	Optional attribute, can contain zero or more instances.
[1..*]	Required attribute, at least one instance.

Height reference: All point features, curve features that are not boundaries, and the surface features *DryDock, FloatingDock* and *Slipway* has the attribute *heightReference*. This attribute indicates where on the object the coordinate registration was made (top or foot). Each individual feature type can have different requirements for what height reference is to be used. This is stated in the registration description for the feature type in question.

Unknown values: Attribute fields that are optional, where no information is available, should be left blank. Avoid entering dummy values such as 99, 0, 1000, BLANK, EMPTY or similar.

Decimal numbers: Decimal numbers are rounded down and rounded off to two decimal places.

Code lists: Code list – open ended lists of allowed values – is used for some attribute fields in Port data. All code list in the standard is managed at Geonorge kodelisteregister (code list registry). In the UML model there are empty code list with reference to the code list at Geonorge. This means that the code list in the standard, can be changed without changing the product specification, or changing the version number of the product specification.

The code list at Geonorge code list registry contains 3 values: code name, description and code value. It is the code values that are exchanged in the data for all formats, while code name and description will be what is presented to users in most cases. Codes that have the status *Retired* must not be used when updating the dataset.

Associations: The feature types in Port data is independent features that can exist independently of other features. The associations generally express some kind of association between two object types. In Port data it is mainly boundary features and surface features that have associations, for example *QuayAreaBoundary* which delimits *QuayArea*.

2.2.3 Guidelines for names and id's

A port's geographical and administrative layout is unique and varies from place to place. The users of the port usually relate to a division into different layout levels, see figure 1. The port data standard has a structure based on the different layout levels. These are named port, port facility, quay and object.

The layout levels or areas usually have a name, an identification (id) or other reference that is used when the port and its users have to refer to the area in reality. Attributes for names, id or other references have been added for the feature types in the standard. The features are thus linked to the various layout levels through the attributes. For example, a mooring device will hold information about which quay, harbour facility and port it is located in/belongs to. The purpose of this is a unique identification and reference to the object in reality. These references are in addition to the datatype *Identification* and the attribute *localId*, that identifies the objects in the database.

Guidelines for filling in attribute fields for name and id:

- All feature types must contain *localId* (identification).
- Place names from SSR (Sentralt Stedsnavns Register / Central Placename registry) must be used if they exist for the place (registered as navneobjekttype *kai*, *brygge, ferjekai, molo* og *havn* in SSR). Applies to the attributes: *portName*, *portFacilityName* and *QuayName*.
- The name used should be the same as that used for the corresponding quay/port facility/area registered in SSN.
- Features must have a minimum of one id/reference associated with the port (placename or UNLOCODE) *or* quay (*quayId*, *quayIdInternal*), alternatively have an MRN/GLN-number.
- For marinas and small ports: *quayIdInternal* and *localId* on features are sufficient here.
- The feature types *SpeedRegulation*, *ProhibitedArea* and their associated boundary features does not have attributes for id, other than *localId*.

See also *Guidelines for registration of characteristics, attributes and delimitation of port facility*, chapter 3.3.2, and *Guidelines for serial number for point feature types*, chapter 3.5.

2.3 Accuracy and quality

Position quality (*dataCaptureMethod* and *accuracy*) must be specified for each feature/object. Accuracy requirements are listed in table 5 and stated for each individual feature type in chapter 3. Reuse of existing data is described in chapter 2.1.3.

*Table 5: Overview of accuracy requirements for all feature types in Port data. Applies to the types of Ports: industry, fishing and traffic. See separate guidelines for marina. (*PortFacility, LoadLimitationArea and QuayArea is generated by the geometry of associated boundary features. See accuracy requirements listed for boundary features.)*

Feature type	Accuracy requirements
AdministrativeHarbourArea	100 cm
SolidWasteDisposal	Fixed installation: 20 cm Movable installation: Representative point on the quay.
EmergencyResponseEquipment	30 cm
FuelConnection	Fixed installation: 20 cm. Movable installation: Representative point on the quay.
ElectricityConnection	20 cm
Fender	20 cm
FloatingDock	100 cm
MooringFacilities	10 cm (Dolphin: 20 cm)
PortFacility	See PortFacilityBoundary*
PorFacilityBounadry	35 cm
PortFenceEntrance	35 cm
PortFence	35 cm
PortArea	100 cm
PortSensor	Fixed installation: 30 cm. Buoy: 50 cm
QuayFront	10 cm
QuayArea	See QuayAreaBoundary*
QuayAreaBoundary	The demarcation between land and sea should exactly coincide with the accuracy of the quay front. Other boundaries: 30 cm
Camera	30 cm
Crane	Fixed installation: 30 cm. Movable installation: Representative point on the quay.
LoadingUnloadingEquipment	Fixed installation: 30 cm. Movable installation: Representative point on the quay.
LoadLimitationArea	See LoadLimitationAreaBoundary*
LoadLimitationAreaBoundary	50 cm
Slipway	35 cm
Toilet	30 cm
LiquidWasteDisposal	Fixed installation: 20 cm. Movable installation: Representative point on the quay.
DryDock	35 cm
WaterConnection	20 cm
Regulations	
SpeedRegulation	100 cm
SpeedRegulationBoundary	100 cm
ProhibitedArea	100 cm
ProhibitedAreaBoundary	100 cm

2.3.1 Guidelines for quality in smaller ports

Ports or port facilities that are smaller ports, smaller harbours or marinas may deviate from the accuracy requirements in table 5. Accuracy requirements applies to other types of ports (industry, fishing or traffic ports). For smaller ports and marinas, the best accuracy available is used. Data can be generated from other sources (no requirement for new registration). If the accuracy is unknown, fill in the value “1000” in the attribute field for *accuracy*. Data with unknown accuracy or low accuracy should be improved. Improving the data quality is done when updating the data or when there are changes in the port (which in turn triggers an updating of the dataset).

2.4 Finishing work, after registration

In this chapter you will find information about recommended routines for first-time registration of port data, quality assurance of first-time registration, updating and management of port data, as well as information about user support.

2.4.1 Initial registration of Port data

After registration of port data (data capture), the data must be entered into the Port data database. This can be done via QGIS plug-in NGIS-OpenAPI client. Municipalities can use their usual GIS-tools (Gisline, Winmap or equivalent) for updating, but this requires configuration before first use. Contact the system supplier to set up access. When registering port data for the first time in a port, the municipality or the Norwegian Mapping Authority (v/fylkeskartkontorene (district office)) can be helpful in entering the data into the database. Contact the municipality or one of the fylkeskartkontor in the relevant county if you need assistance.

When entering the data into the database, the data is checked using def.-files (e.g. in the software *sosi-kontroll*). This control check if the data is in accordance with the standard. If there are errors in the data, they will not be able to be entered into the database until the errors have been corrected. Checking against the standard does not detect "typing-errors" or whether incorrect attribute information has been entered.

2.4.2 Quality assurance of initial registration

New data entered into the database must be quality assured by checking that the information of the attributes and code values used are correct. When data is collected (mapping or data capture), you may not have all the information about the objects available. For the data set to be as complete as possible and provide as much necessary information as possible to the end user, it's important that a port administration (or other data owner) updates the data with more attribute information on features that lack this.

Fill inn empty attribute fields and missing attributes. For code list/code values, the correct code should be used. Use the codes *other* or *unknown* only where it's necessary. Check that the geometry and topology of the objects match – e.g., that all bollards are located on land, that areas do not overlap, etc.

2.4.3 Updating and management of Port data

It's important that port data is kept up to date. When there is a change in the port (development, updating of quay areas, changes on the infrastructure, or the like) the port data must also be updated with new information. This could be to update attribute information or obtain new geometry (new data capture/measurements). Data owner is responsible for updating the dataset.

In the case of construction work, extensions or the like, working drawings (as-built) should be in accordance with the port data standard, so that the changes is easy to enter into the database. For features with a high accuracy requirement, such as *Quayfront*, it should be measured that the object is in accordance with the working drawings.

2.4.4 User support

For user support the municipality can be contacted. They have often GIS competence and can help with entering and updating data (checking geometry and control of data in accordance with the standard). The municipality can also help with photogrammetry or other registration of port data in their own municipality. Especially in larger municipalities, it's an advantage to establish a good cooperation between the ports and the municipality, regarding the routines for managing and updating port data. This is for example been done in Kristiansand municipality.

The Norwegian Mapping Authority (via fylkeskartkontorene (the district offices)) can also be contacted if user support is needed.

3 Feature types and attributes

In this chapter you will find registration description and registration methods for all feature types in Port data, as well as a description for all attributes for each feature type. Included is image examples for the various feature types, which illustrates delimitation of the feature types or where on the object the measurement should be made, or how the object looks.

Chapters 3.1 to 3.5 is a guidance on how the registration of the features in port data should be measured (by a mapping company or similar), while *chapter 3.6 Regulations* are mainly aimed at the authority responsible for establishing regulations that regulate traffic or use of the municipality's sea area. The chapter is a guidance on how speed regulations or other regulation are registered.

How to read the tables in chapter 3

For each feature type there is attributes specific for the feature type listed in tabular form. The feature types has also common properties, which are common properties/attributes that all feature types in port data holds. I addition to common properties, the standard has abstract feature types, which do not have their own geometry, but hold inherited attributes – this is attributes that several feature types have in common.

The attributes from common properties and abstract feature types are not listed for each individual feature type but are marked at the top of the tables with light grey rows. These rows refer to the respective tables, witch specify the attribute fields, which attributes is included in for example *CommonProperties*. These are attributes to be included for the feature types, in addition to attributes specific for the feature type itself.

The column *datatype* specify which values that are allowed for the attribute field: code list, integer, real (decimal number), text, etc. The column *multiplicity* specifies if the attribute is required or optional, and how many times it can occur for an instance of the feature type. See table 4 for an explanation of the multiplicity values. Multiplicity does not specify the attribute field itself, but the value that is entered. All attributes must be included, regardless of multiplicity.

3.1 Common Properties

In the UML model for Port data, common properties is modelled as two separate abstract feature types: *CommonPropertiesRequired* and *CommonPropertiesOptional.* All feature types must have attributes from *CommonPropertiesRequired*, and most of the feature types must also have attributes from *CommonPropertiesOptional* (with the exception of boundary features). The attributes are optional for the feature type *CommonPropertiesOptional*.

3.1.1 CommonPropertiesRequired

Definition: Abstract feature type that holds common properties used for all feature types in the dataset. Required properties.

Required attributes are *identification*, *dataCaptureDate* and *quality*. For *quality* the attributes from the datatype *positionQuality* is included: *dataCaptureMethod*, *dataCaptureMethodHeight*, *accuracy*, *accuracyHeight* and *visibility*. *DataCaptureMethod*, *dataCaptureMethodHeight* and *visibility* has code lists. The links in table 6 refers to the data types and code list at Geonorge. For *identification* the attributes from the datatype *Identification* is included: *localId*, *namespace*, *versionId. Identification* is automatically generated when updating to the database and is not registered manually.

Table 6: Required common properties.

Attributes	Description	Date type	Multiplicity
identification	Unique identification of an object. Generated automatically when updating to the database. (For identification the attributes *localId*, *namespace* and *versionId* are included, marked with grey text in the rows below).	Datatype Identification	[1..1]
localId	Unique identification within the namespace. For NGIS UUID is used.	Character String	[1..1]
namespace	Namespace that uniquely identifies the data source of an object, in the form for an URI.	Character String	[1..1]
versionId	Identification of a special version of a geographical object (instance).	Character String	[0..1]
dataCaptureDate	Date for when the data was captured.	Date	[1..1]
positionQuality	Description of the quality of the measurement. (Attributes marked with grey text in the rows below, is included in the datatype positionQuality).	Datatype PositionQuality	[1..1]
dataCaptureMethod	Specifies method for data capture. Describes how the vector data itself is positioned from a data base and not the process of obtaining the underlying data basis.	Code list DataCaptureMetod	[1..1]
accuracy	Standard deviation for point. In floor plan for points, and transverse deviation for lines. Specified in cm.	Real	[1..1]
visibility	Specifies the visibility of the object when it was measured.	Code list Visibility	[0..1]
dataCaptureMethodHeight	Specifies method of measurement used for height measures.	Code list DataCaptureMetod	[0..1]
accuracyHeight	Accuracy for height, specified in cm.	Real	[0..1]

3.1.2 CommonPropertiesOptional

Definition: Abstract feature type that holds common properties used for all feature types in the dataset. Optional properties.

Attributes for *CommonPropertiesOptional* is *information, link* and *updateDate*. *UpdateDate* is filles in if/when the object is updated or edited.

Table 7: Optional common properties:

Attributes	Description	Date type	Multiplicity
updateDate	Date for when the last changes to the data were made.	Date (DateTime)	[0..1]
information	General information.	Character String	[0..1]
link	Link in the form of a URL or other reference.	Character String	[0..1]

3.2 PortId

Definition	Abstract feature type that contains properties for unique identification of a port. The properties are inherited down to other feature types in the dataset.
Geometry type	Abstract feature type (does not have geometry)
Associations	*PortId* inherits attributes from the feature type CommonPropertiesRequired and CommonPropertiesOptional. The attributes for *PortId* is inherited by all feature types in chapter 3.2, chapter 3.3, chapter 3.4 and chapter 3.5 (with the exception of boundary features).

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
portName	Name of the port that have been allocated a UNLOCODE.	Character String	[0..1]
UNLOCODE	Location code from the UNLOCODE-system that identifies a port. See list with allowed codes : https://service.unece.org/trade/locode/no.htm	Character String	[0..1]
MRN	Marine Resource Name. Numbering system for unique identification of maritime resources on a global basis.	Character String	[0..1]
GLN	Global location number. Numbering system for identification of legal entities and physical locations, managed by GS1.	Character String	[0..1]

Example on how to register attributes: For the port of Kristiansand the properties will be:
portName: Kristiansand
UNLOCODE: NOKRS
All objects that are located geographically in the port of Kristiansand must have the UNLOCODE and portName that correspond to Kristiansand. It is a geographical reference and not linked to ownership.

Figure 5: Port of Kristiansand (Norkart, 2020)

3.2.1 AdministrativeHarbourArea

Definition	Area for which a port administration or a municipality is responsible for managing. This area often coincides with the municipality's sea area.
Geometry type	GM_Surface, GM_Point
Registration method	Draw the outer boundary of the surface. An optional representative point can be added.
Registration description	Only one area is registered per municipality or municipal/intermunicipal port administration. If the administrative area is not one continuous area, several surfaces/areas can be used. In such cases, the attribute information must be the same for all the areas. Municipal boundaries can be used as a starting point for delimitation. At sea, the area should not extend further than 1 nautical mile (nm=1.85 km) beyond the baseline. The area must cover all sea areas. The area must not contain holes. The *AdministrativeHarbourArea* must cover islands, as well as the main and secondary fairways. Municipalities that consist of large land areas and small sea areas, can clip the area that covers main land, with a buffer that extends 200 meters onto land. Main and secondary fairways is not cut out. Register information in the required attribute fields and any other available information.
Accuracy requirement	100 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and PortId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
..OBJTYPE	AdministrativeHarbourArea	Character String	[1..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]
Position	Optional point of representation.	GM_Point	[0..1]
Managedby	The responsible for managing the area. Usually a municipality, inter-municipality or port administration on behalf of the municipality.	Character String	[0..1]

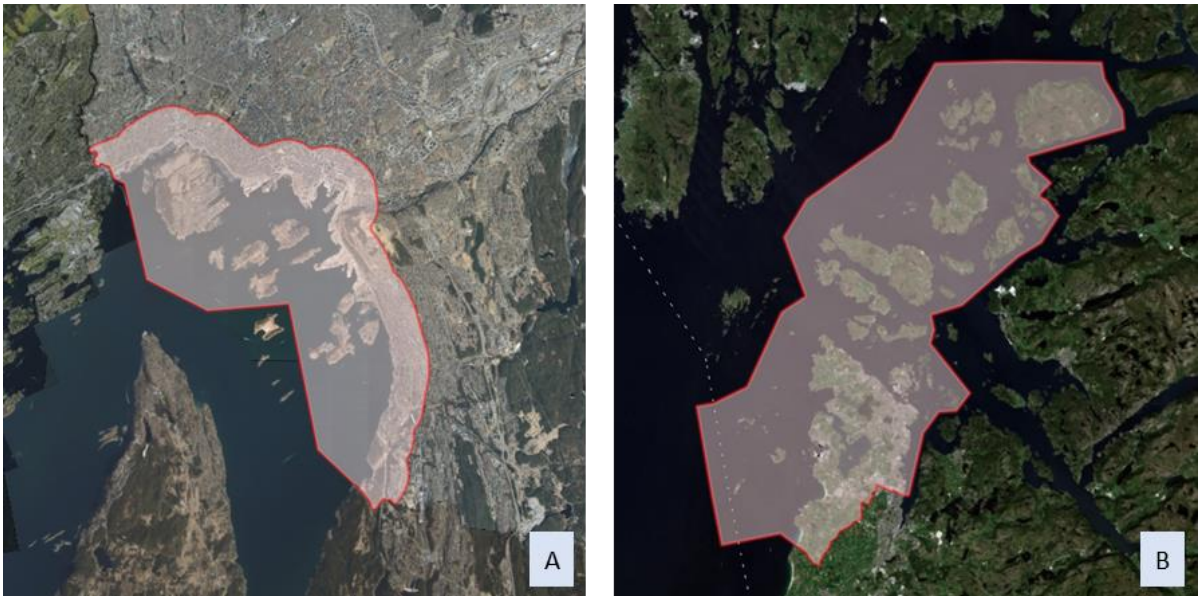


Figure 6. Example of two alternatives for registration of Administrative Harbour Area: A. Administrative Harbour Area with main land areas cut out – Oslo. Municipalities that consist of large land areas and small sea areas, can clip the area that covers main land with a buffer that extends 200 meters onto land. B. Administrative Harbour Area – Stavanger. Here the area is kept in its entirety without cutting away land areas.

3.2.2 PortArea

Definition	Area that shows the extent of the port, with quays, land and sea areas for transfer of goods and persons between land and sea. The area have usually an allocated UNLOCODE and must contain at least one quay and one quay front.
Geometry type	GM_Surface, GM_Point
Registration method	Draw the outer boundary of the surface. An optional representative point can be added.
Registration description	Port area is limited to one polygon/area per port («port» refers to the attribute *namePort* from *PortId*). The area must cover the entire harbour area, where the ports sea and land area is completely covered. The area must overlap or cover all objects and features linked to the specific port. Natural landscape formations, property boundaries, FKB data or common sense. Use coincident geometry where available. Register information in the required attribute fields and any other available information.
Accuracy requirement	100 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and PortId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
..OBJTYPE	PortArea	Character String	[1..1]
Area	Polygon showing geographical extent.	GM_Surface	[1..1]
Position	Optional point of representation.	GM_Point	[0..1]
managedBy	Who is responsible for managing the area.	Character String	[0..1]

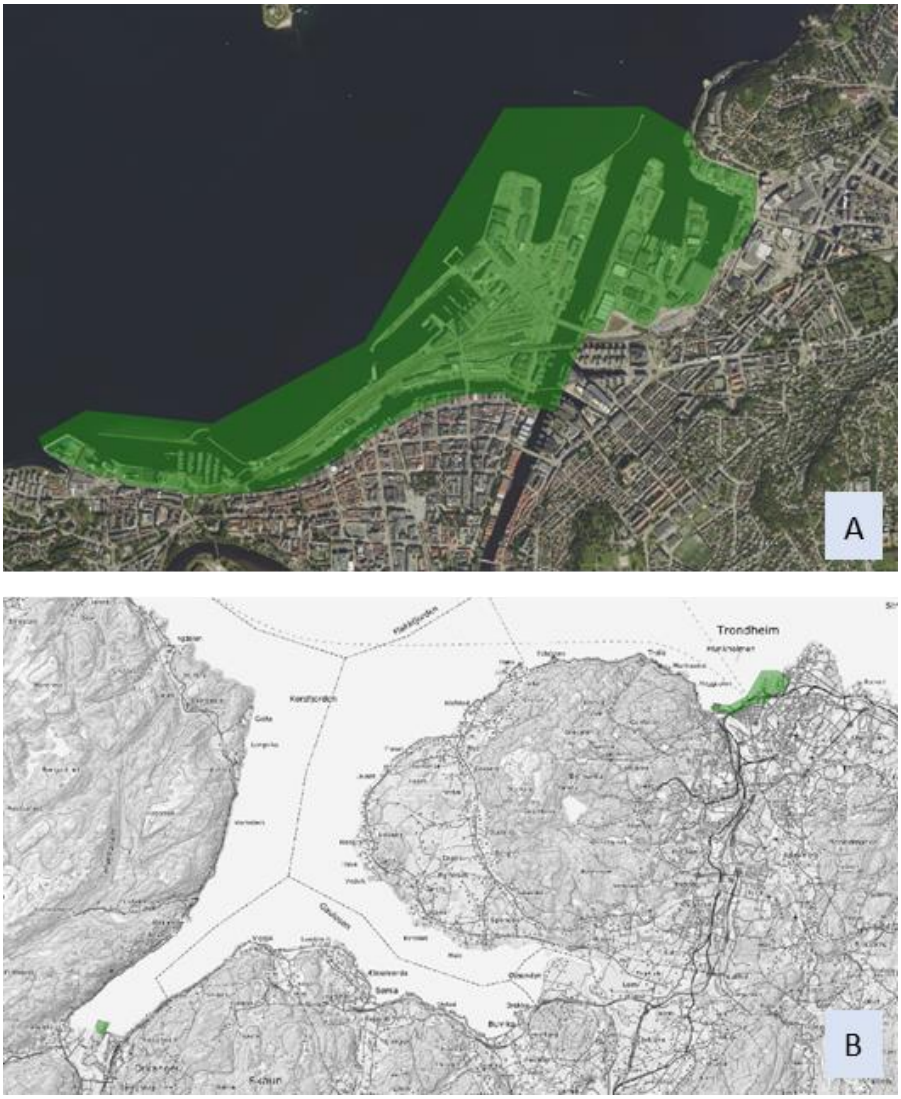


Figure 7. Example PortArea: A. Port of Trondheim, B. Port of Trondheim – Orkanger.

3.2.3 PortSensor

Definition	Device that collects data, measure or registers data in connection with a port.
Geometry type	GM_Point
Registration method	Single point
Registration description	Fixed-mounted port sensor or port sensor on buoy is registered as a single point. Can be obtained from aerial photo if measuring is hard to get to. If the port sensor has built-in GPS, this position can be used. Height reference: top, foot, depending on measurement. Register information in the required attribute fields and any other available information.
Accuracy requirement	30 cm for fixed-mounted port sensor. 50 cm for buoy.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and PortId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
..OBJTYPE	PortSensor	Character String	[1..1]
heightReference	Measurement point on the object.	Code list	[1..1]
objectId	Unique identification of the individual objects on the quay.	Character String	[0..1]
status	Status of the object.	Code list	[0..1]
typeOfSensor	Type sensor.	Code list	[0..1]
Owner	Owner of the sensor.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Height reference

Code list for the attribute height reference.

Code	Description
top	Measurement is taken at the top of the object.
foot	Measurement is taken at the foot of the object.
unknown	Unknow height reference. Not to be used for new registrations.

Code list Status

Status of the object.

Code	Description
removed	Object is removed.
obsolete	Object is obsolete.
inUse	Object is in use.
inDecay	Object is in decay.
notInUse	Object is not in use.
temporary	Object is temporary.
discontinued	Object is discontinued.
periodic	Periodic object.
planned	Planned object.
private	Private object.
damaged	Object is damaged.
unknownState	Object condition is unknown.
underConstruction	Object is under construction.

Code list Type of sensor

Specifies type of sensor. If none of the codes is suitable, use «other».

Code	Description
other	Other type of sensor.
doorSensor	Door sensor.
speedSensor	Sensor that measure speed for vehicles.
camera	Camera
airQuality	Sensor that measures air quality.
gateSensor	Gate sensor.
lifebuoySensor	Sensor that measures if life buoy cabinet has been opened.
current	Sensor that measure current.
soundLevels	Sensor that measure sound levels.
temperature	Thermometer
waterLevel	Water level gauge
wind	Anemometer or other device to measure wind speed.
weatherStation	Sensor that measure wind, temperature and water level.

3.2.4 Camera

Definition	Camera
Geometry type	GM_Point
Registration method	Single point
Registration description	Register fixed-mounted camera. Can be obtained from aerial photo if measuring is hard to get to. If the camera has built-in GPS, this position can be used. Height reference: top, foot, depending on measurement. Register information in the required attribute fields and any other available information.
Accuracy requirement	30 cm for fixed-mounted camera.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and PortId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
..OBJTYPE	Camera	Character String	[1..1]
height reference	Measurement point on the object.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
objectId	Unique identification of the individual objects on the quay.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

3.3 PortFacilityId

Definition	Abstract feature type that contains properties for unique identification of a port facility. The properties are inherited down to other feature types in the dataset.
Geometry type	Abstract feature type (does not have geometry)
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and PortId. The attributes for *PortFacilityId* is inherited by all feature types in chapter 3.3, chapter 3.4 and chapter 3.5 (except for boundary features).
Additional information	The following applies to the *ISPS* attribute: All features located within an ISPS area must set this attribute to «Yes» (true). For other features «No» (false) is used. This applies to the feature types that inherit the attributes of *PortFacilityId*.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	Unique identification of the individual port facility.	Character String	[0..1]
portFacilityName	Name of the port facility. The name should match entries in Safe Sea Net Norway.	Character String	[0..1]
ISPS	Boolean value that indicates whether the port facility is an ISPS Port Facility.	Boolean (yes/no)	[0..1]

3.3.1 PortFacilityBoundary

Definition	Boundary to delimit PortFacility.
Geometry type	GM_Curve
Registration method	Single point in sequence.
Registration description	Delimits *PortFacility*. PortFacility must only be registered on land and is demarcated by the sea or the rest of the hinterland (land, infrastructure, roads, buildings or other things that are not connected to port operations). The coastal contour, quay front or similar is used as a demarcation between sea and land. To delimit the area towards the hinterland, cadastre, property boundaries, roads, FKB data or similar can be used. Port facilities that have different attribute information, must be divided into separate areas. For example, an ISPS area located within a larger port facility that is not subject to the ISPS regulations must be divided into its separate area. The attribute information that identifies the port facility (id/name/reference) is kept the same on all the areas in question. Where there is a need to split an area in two or more is where there is a difference in ISPS-status, different UNLOCODE, ownership, etc. Certain port facilities do not contain quays. This can be storage areas or other rear areas (see figure 9). Register information in the required attribute fields and any other available information.
Accuracy requirement	35 cm
Associations	Delimit PortFacility. *PortFacilityBoundary* inherits attributes from CommonPropertiesRequired.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6)		[1..1]
..OBJTYPE	PortFacilityBoundary	Character String	[1..1]
boundary	Line segment that delimit an area.	GM_Curve	[1..1]

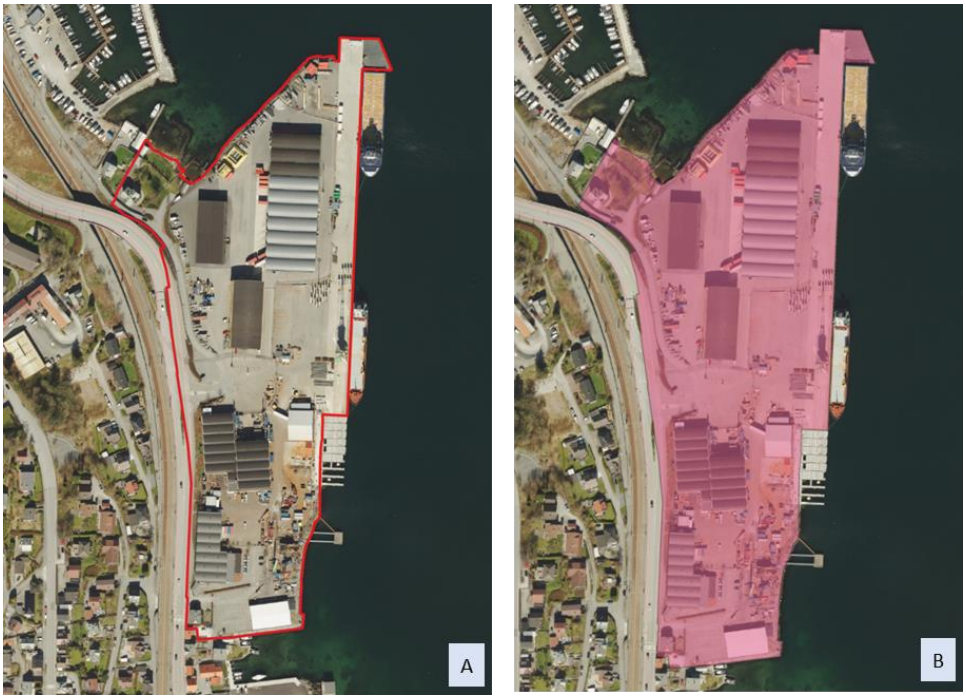


Figure 8: Example of demarcation of a port facility – Port of Sandnes. A. PortFacilityBoundary, B. PortFacility.

Figure 9: Port facility without quay. Risavika – Stavanger.

3.3.2 PortFacility

Definition	Areas, buildings, facilities and other infrastructure used in port activities or to port purposes. Including: quays, terminals, buildings, loading and unloading, transhipment facilities, warehousing and administration buildings. **ISPS Port Facility**: Port Facilities that are approved by the Norwegian Costal Administration to serve international ship traffic, and which are subject to maritime security or port security in accordance with the ISPS regulations, which are international regulations for securing of ships and facilities in port.
Geometry type	GM_Surface, GM_Point
Registration method	Single point (surface information). Generated by PortFacilityBoundary.
Registration description:	Register as a single point within the associated *PortFacilityBoundary*. ISPS Port facilities (ISPS areas) in the port must be registered as Port facilities with «Yes» for ISPS (chapter 3.3 *PortFacilityId*) ISPS Port facilities must also fill in information in the attributes for the data type *ISPSPortFacility*. Register information in the required attribute fields and any other available information.
Associations	Delimited by PortFacilityBoundary. The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional, PortId and PortFacilityId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
..OBJTYPE	PortFacility	Character String	[1..1]
owner	Owner of the Port Facility.	Character String	[0..1]
typeOfOwnership	Type of ownership.	Code list	[1..*]
Operator	Who the port facility is operated or managed by.	Character String	[0..1]
ISPSPortFacility	Attributes specific to ISPS Port Facilities. See data type *ISPSPortFacility* for which attributes that is included in the data type. To be filled in for port facilities that are subject to ISPS.	Date type ISPSPortFacility	[0..1]
typeOfPort	Type of port or port facility.	Code list	[1..*]
address	Address attributes for the port facility. See data type *Address* for which attributes that is included in the data type.	Date type Address	[0..1]

wastePlanRequirements	Requirements for waste plans in ports and port facilities. See data type *WastePlanRequirement* for which attributes that is included in the datatype.	Date type WastePlanRequirement	[0..1]
imageLink	URL that refers to an image of the object.	Character String	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]
position	Optional point of representation.	GM_Point	[0..1]

Code list Type of ownership

Specifies ownership to the port facility.

Code	Description
other	Other type of ownership.
county	Owned by the county municipality.
municipality	Owned by the municipality.
public	Public ownership.
private	Private ownership.
state	State ownership.
unknown	Unknown ownership.

Code list Type of Port

Type of port or port facility.

Code	Description
fishing	Port facilities with activities related to fishing.
industry	Port facilities with activities related to industry, freight traffic, offshore supply, cargo or other.
marina	Port facilities that are adapted to the reception and mooring of small boats or leisure boats.
traffic	Port facilities with activities related to sea transport with passengers and/or cars.

Date type ISPSPortFacility

Attributes specific for the data type ISPSPortFacility:

Attributes	Description	Date type	Multiplicity
portFacilityNrIMO	Location code for the ISPS Port Facility. Consist of UNLOCODE, as well as a 4-dgit number code.	Character String	[0..1]
securityBarrier	If the area is fenced or have other form of security barrier.	Boolean (yes/no)	[0..1]
contactInformationPFSO	Contact information for the Port Facility Security Officer.	Character String	[0..1]
typeOfSecurity	Type of security.	Code list	[0..1]
statusApproval	Status of the ISPS Approval.	Character String	[0..1]

Code list Type of security

Type of security of port facility.

Code	Description
permanentlySecured	The area is permanently secured.
securedWhenCallingOfShips	The area is only secured when calling of ships.
other	Other type of safety.

Date type Address

Address for the port facility. Attributes specific for the data type Address:

Attributes	Description	Date type	Multiplicity
visitingAddress	Address for visiting the port facility.	Character String	[0..1]
propertyUnitNumber	Each cadastral unit is subdivided into one or more property units (bruk) in the Norwegian land registry (matrikkelen).	Integer	[0..1]
county	Name of county.	Character String	[0..1]
cadastralUnitNumber	The number of a farm unit in the Norwegian land registry (matrikkelen).	Integer	[0..1]
municipalityNumber	Municipality number.	Integer	[0..1]
postalAddress	Postal address for the port facility.	Character String	[0..1]
zipcode	Postal code for the postal address of the port facility.	Character String	[0..1]
postalArea	Place name of the zipcode.	Character String	[0..1]

Date type WastePlanRequirements

Specifies requirements for waste plans in ports and port facilities. Attributes specific for the data type:

Attributes	Description	Date type	Multiplicity
typeOfWastePlanRequirement	Specifies type of waste plan requirement.	Code list	[1..1]
validPlan	Specifies if the port or port facility has a valid waste plan	Boolean (yes/no)	[1..1]

Code list Type of Waste Plan Requirement

Type of requirements for waste plans in port.

Code	Description
notRequired	Waste plan not required.
municipalRenovation	Part of municipal renovation.
required	Waste plan is required.
uncertainRequirement	Uncertain or unknown requirement.

Figure 10: An ISPS Port Facility (ISPS area) can be delimited by a building or port fence, as shown in the example above. The feature type PortFacility can be registered based on the geometry of these objects (Photo: Port of Stavanger, 2020).

Guidelines for registration of characteristics, attributes and delimitation of port facility

Example of how characteristics must be registered for port facility:

Figure 11. Svartebukt Larvik, port facility.

1) Example on how to register attributes (from *portId* og *portFacilityId*): **Larvik**

- *portName*: Svartebukt
- *UNLOCODE*: NOSVB
- *portFacilityId*: NOLAR-0004
- *portFacilityName*: Svartebukt
- *ISPS*: Yes

(See example on how to draw the port facility: figure 11)

2) Example on how to register attributes: **Sandnes**

- *portName*: Sandnes
- *UNLOCODE*: NOSAS
- *portFacilityId*: NOSAS-0004
- *portFacilityName*: Sandnes Havn
- *ISPS*: Yes

(See example on how to draw the port facility: figure 8)

Examples of different types of port facilities – drawing and demarcation:

- **Industry port:** see example figure 8.
- **Traffic port** (ferry dock): see example A figure 12.
- **ISPS area** for parts of a port facility: see example B in figure 12.
- **Small boat harbour/marina:** The area must cover the sea area that is considered as the area that is used for floating dock, as well as relevant land areas. See example C in figure 12.
- **Fishing port**: See example D in figure 12.
- **Port facility without quay**: see example in figure 9.

The different types of port facilities are specified with the attribute *typeOfPort*.

Figure 12. Examples on how to draw and demarcate different types of port facilities. A. Ferry dock, B. ISPS area(purple) within a part of a port facility (red), C. Marina, D. Fishing port. The images is meant as examples and is not retrieved from surveying (Norkart, 2022).

3.3.3 PortFence

Definition	Fence or other barrier.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	The fence is measured along the bottom. Height reference: foot. Register information in the required attribute fields and any other available information. Fences are often mapped in *FKB BygnAnlegg*, but with a different height reference (the top of the object). *PortFence* will also often be mapped in FKB-BygnAnlegg as *Gjerde*, wall (*mur*), etc. If so, these objects should have the same geometry. See more details in chapter 2.1.3, under *Use of existing data*.
Accuracy requirement	35 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional, PortId and PortFacilityId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
..OBJTYPE	PortFence	Character String	[1..1]
heightReference	Measurement point on the object. Use foot for portFence.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent fence.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent fence.	Character String	[0..1]
centerLine	Line segment.	GM_Curve	[1..1]
typeOfFence	Categorization of fence according to type of use.	Code list	[0..1]

Code list Type of Fence

Code	Description
other	Other type of fence.
onOffMovable	Fence that can be moved or is not always present. Used for fences that are seasonal or set up for an ISPS areal that alternates between on-off-status.
permanent	Permanent fence.
notISPS	Fence that is not related to ISPS activity.

Figure 13: Example of PortFence in the port of Kristiansand. Height reference: foot. (Norkart, 2020).

3.3.4 PortFenceEntrance

Definition	Entrance, opening or driveway to the area that is fenced in by *PortFence*.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	Measured along the bottom of the gate or entrance. Height reference: Foot. Register information in the required attribute fields and any other available information. Fences are often mapped in *FKB BygnAnlegg*, but with a different height reference (the top of the object). See more details in chapter 2.1.3, under *Use of existing data*.
Accuracy requirement	35 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional, PortId and PortFacilityId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
..OBJTYPE	PortFenceEntrance	Character String	[1..1]
heightReference	Measurement point on the object. Use foot for PortFenceEntrance.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
typeOfBarrier	Type of barrier used for the entrance.	Code list	[1..1]
typeOfOpening	Type of opening mechanism of the port, gate or other barrier that blocks the entrance.	Code list	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent or fixed entrance.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent or fixed entrance.	Character String	[0..1]
centerLine	Line segment.	GM_Curve	[1..1]

Code list Type of Barrier

Specifies type of barrier used for *PortFenceEntrance*.

Code	Description
other	Other type of barrier.
door	Door as access or barrier of entrance to area.
automaticTrafficBarrier	Automatic traffic barrier.
foldableGate	Foldable gate.
liftingGate	Gate that opens by raising it vertically up, in the same way as a road barrier is opened.
combinationGate	Gate having a combination of opening mechanism, e.g., a combination of sliding door with a special mid-section that is foldable.
manualTrafficBarrier	Manual traffic barrier.
manualGate	Manual gate.
foldingGate	Gate that opens by folding.
accessControlPerson	Access barrier for people in/out of an area.
turnstileGate	Turnstile gate that allows for passage of one person at a time.
slidingGate	Sliding gate.
slucieGate	Sluice gate for passage of persons in/out of a controlled area.
swingGate	Gate that swings open.
unknown	Unknown type of barrier.

Code list Type of Opening

Type of opening for a gate or other entrance in *PortFenceEntrance*.

Code	Description
other	Other type of opening mechanism.
remoteControlled	Remote controlled gate or barrier.
mustBeOperated	Opening mechanism requires on-site service.
unknown	Unknown opening mechanism.

Figure 14: A. Examples of PortFenceEntrance – swing port. B. PortFenceEntrance – door. Height reference: foot.

3.3.5 DryDock

Definition	Narrow basin large enough for ships to sail in and out. The inlet can be closed with gates and water can be pumped out, so ships can stand dry for maintenance and repair.
Geometry type	GM_Surface, GM_Point
Registration method	Draw the outer boundary of the surface. An optional representative point can be added.
Registration description	Register the edge of the pool in the dock. Photogrammetry can be used for measurement if desired. Dry docks can in some cases be partially registered in *FKB BygnAnlegg* as *Gjerde* or *MurLodrett* (fence or wall). It is not registered as a separate complete feature. Existing data can be used as a starting point, but the dock must be registered in port data as a complete feature. Register information in the required attribute fields and any other available information.
Accuracy requirement	35 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional, PortId and PortFacilityId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
..OBJTYPE	DryDock	Character String	[1..1]
heightReference	Measurement point on the object.	Code list	[1..1]
liftingCapacity	Lifting capacity, specified in metric tons.	Integer	[0..1]
maxVesselWidth	Maximal width of the vessel that the dock can accommodate. Specified in meters.	Real	[0..1]
maxVesselDraft	Maximum draft of the vessel that the dock can accommodate. Specified in meters.	Real	[0..1]
maxVesselLength	Maximum length of the vessel that the dock can accommodate. Specified in meters.	Integer	[0..1]
name	Name of the dock.	Character String	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]
position	Optional point of representation.	GM_Point	[0..1]
status	Status of the object.	Code list	[0..1]

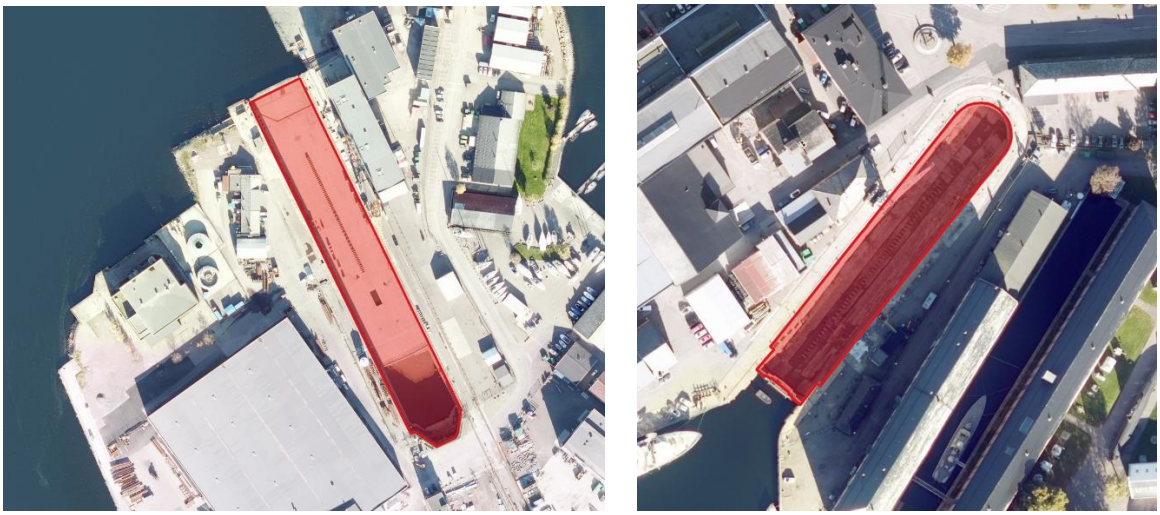


Figure 15. Examples from Horten on how to draw Drydock.

3.3.6 FloatingDock

Definition	Floating platform for lifting ships out of the sea for maintenance or repair.
Geometry type	GM_Surface, GM_Point
Registration method	Draw the outer boundary of the surface. An optional representative point can be added.
Registration description	Register the outer limits of the dock. Photogrammetry can be used for measurement if desired. Floating docks can in some cases be wrongly registered as floating docks in FKB-BygnAnlegg. Register information in the required attribute fields and any other available information.
Accuracy requirement	100 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional, PortId and PortFacilityId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
..OBJTYPE	FloatingDock	Character String	[1..1]
heightReference	Measurement point on the object.	Code list	[1..1]
liftingCapacity	Lifting capacity, specified in metric tons.	Integer	[0..1]
maxVesselWidth	Maximum width of the vessel that the dock can accommodate. Specified in meters.	Real	[0..1]
maxVesselDraft	Maximum draft of the vessel that the dock can accommodate. Specified in meters.	Real	[0..1]
maxVesselLength	Maximum length of the vessel that the dock can accommodate. Specified in meters.	Integer	[0..1]
name	Name of the dock.	Character String	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]
position	Optional point of representation.	GM_Point	[0..1]
status	Status of the object.	Code list	[0..1]

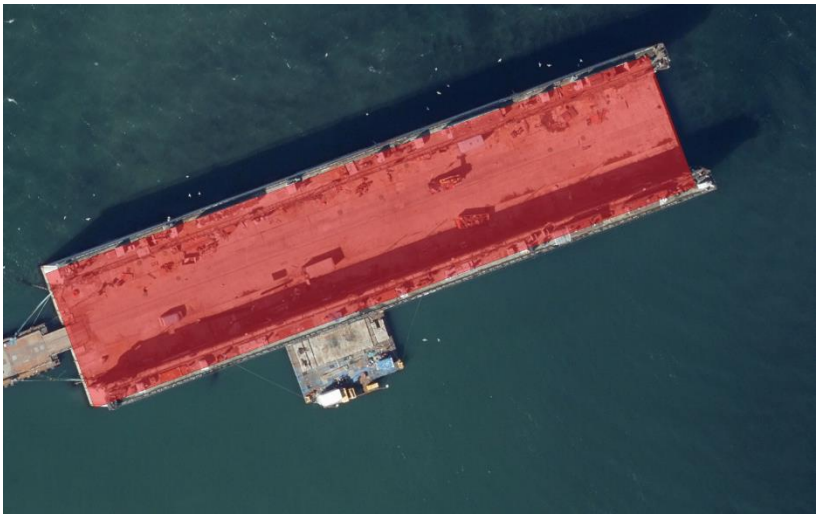


Figure 16: Example floating dock.

3.4 QuayId

Definition	Abstract feature type that contains properties for unique identification of objects.
Geometry type	Abstract feature type (does not have geometry)
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId and PortFacilityId. The attributes in *QuayId* is inherited by all feature types in chapter 3.4 and chapter 3.5 (with exception of boundary features).
Additional information	When a standardized and national system for numbering quays is in place, the attribute *QuayId* must be used to hold this information. Work has done on this, but it's not yet in place. For now, use the same reference as *QuayIdInternal* for both fields. The attribute must not contain name of the quay, as this is a separate attribute.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
quayId	Unique identification of the individual quay. Length is limited to 20 characters due to a limit in the system for AIS messages.	Character String	[0..1]
quayName	Name of the quay. The same quay name is used on all quay fronts and quay areas that are considered to belong to the same quay. The name should correspond to the name used in SafeSeaNet.	Character String	[0..1]
quayIdInternal	The port's custom numbering of quays. Numbering varies from port to port, some using only numbers or letters, while others use a combination.	Character String	[0..1]

3.4.1 QuayAreaBoundary

Definition	Boundary to delimit *QuayArea.*
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	*QuayAreaBoundary* is registered around the entire quay area, see figure 17. Existing FKB data, property boundaries or data from the port can used to demarcate the area. Boundaries that coincides with the quay front along the water line/sea, must coincide with the feature type *QuayFront*. Note that this feature type has a stricter accuracy requirement than *QuayAreaBoundary* and require to be measured (no reuse of existing data). Register information in the required attribute fields and any other available information.
Accuracy requirement	30 cm Demarcation towards the sea should coincide with the accuracy of the feature type *QuayFront* (10 cm).
Associations	Delimits QuayArea. *QuayAreaBoundary* inherits attributes from CommonPropertiesRequired.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6)		[1..1]
..OBJTYPE	QuayAreaBoundary	Character String	[1..1]
boundary	Line segment that delimits an area.	GM_Curve	[1..1]

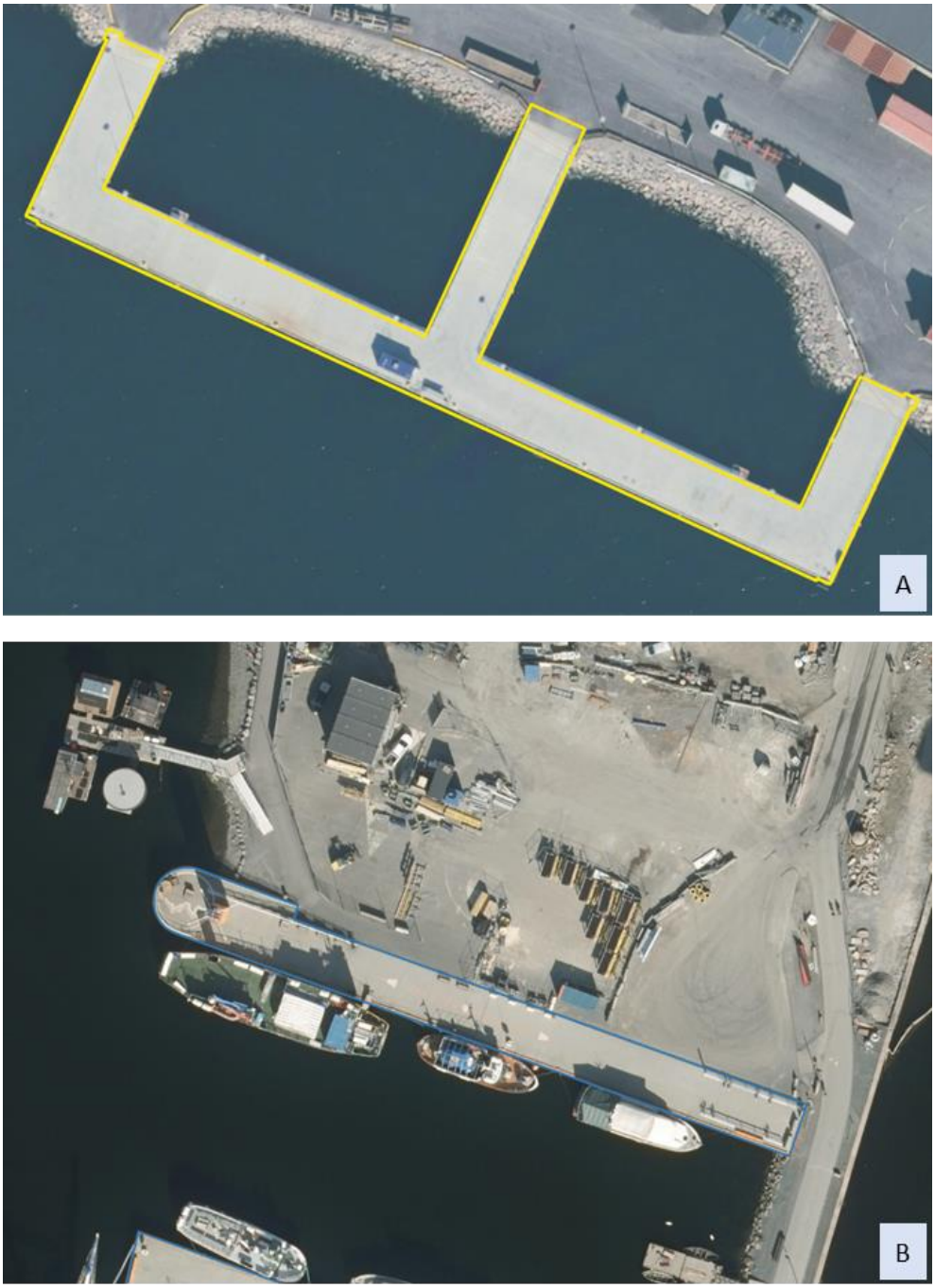


Figure 17. Example of registration for QuayAreaBoundary. QuayAreaBoundary must be registered around the entire QuayArea (Norkart, 2020).

3.4.2 QuayArea

Definition	Area adjacent to the quay front. The area is considered a part of the same quay as the quay fronts. A quay is a structure, usually parallel to the coastal contour or from land out to sea, where vessel can dock or moor.
Geometry	GM_Surface, GM_Point
Registration method	Single point (surface information)
Registration description	Registered with a single point within *QuayAreaBoundary*. Register information in the required attribute fields and any other available information. The attribute information from *QuayId* must match the attribute information for the quay fronts for the same area (see figure 26 - *QuayFront*). A quay area can adjoin one or more quay fronts.
Accuracy requirement	30 cm. Demarcation towards the sea should coincide with the accuracy of the feature type *QuayFront* (10 cm).
Associations	Delimited by QuayAreaBoundary. The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId and QuayId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
..OBJTYPE	QuayArea	Character String	[1..1]
typeOfQuay	Intended use of the quay.	Code list	[0..1]
typeOfQuayConstruction	Surface material at the quay.	Code list	[0..1]
imageLink	URL that refers to an image of the object.	Character String	[0..1]
position	Optional point of representation.	GM_Point	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]

Code list Type of Quay

The code list specifies different types of quays. It's possible to choose multiple types for one feature.
For the code *multipleUse*, specify the usage of the quay in the attribute field *information*.

Code	Description
other	Other type.
bulk	Quay for loading or unloading wet or dry bulk.
charter	Quay for charter boats.
container	Quay for loading and unloading containers.
cruise	Quay for cruise ships.
deepwaterQuay	Quay that can accommodate deep-draft ships.
fishing	Fishing quay.
multipleUse	Multiple use. Specify the usage in the information attribute.
leisure	Smaller quay for leisure boats etc.
highSpeedCraft	Quay for high-speed craft or fast ferry.
lo-lo	Lift-on – lift-off. Loading/unloading of containers using a container crane.
localFerry	Quay for local ferries.
offshore	Offshore quay.
lay-up	Quay for lay-ups of ships or vessels out of operations.
ro-ro	Roll-on – roll-off. Quay where rolling cargo can be driven directly from the quay on to the ships.
serviceRepair	Quay for service or repair.
stone	Quay for stone or material of stone.
lumber	Quay for lumber.
ferryAbroad	Quay for international ferries.
waiting	Quay where ships can wait.

Code list Type of quay surface

The code list specifies different types of surface material at the quay.

Code	Description
other	Other material
asphalt	Asphalt cover
pavingStones	Paving stones or flag stone.
concrete	Concrete cover
wood	Wooden deck

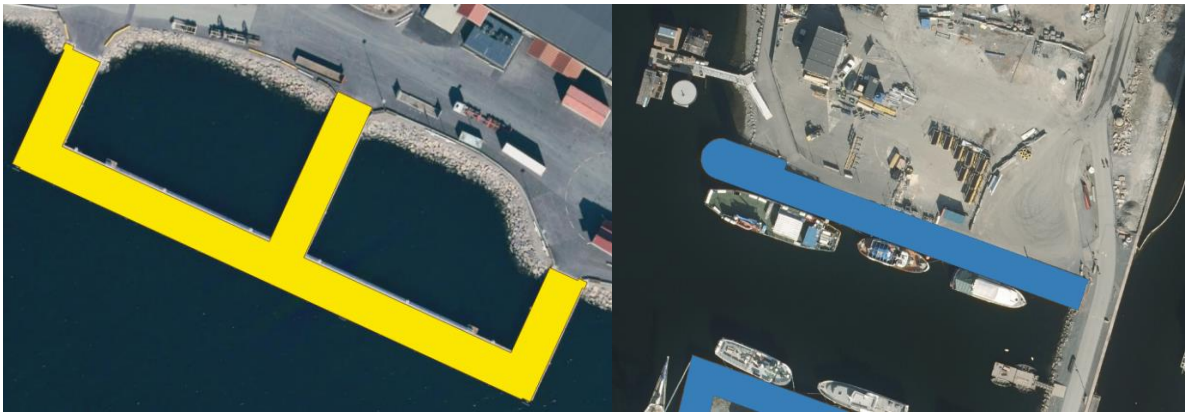


Figure 18: Example on how to draw a QuayArea. QuayArea is delimited by QuayAreaBoundary (Norkart 2021).

Figure 19: A. Surface material, wooden deck, B. Surface material, concrete.

3.4.3 LoadLimitationAreaBoundary

Definition	Boundary to delimit LoadLimitationArea.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	Prior to registration, the port should be contacted. Ports may have documents that describe areas that have restrictions regarding to what the area can withstand of load (se figure 22). Registration of the areas should be done in accordance with documented information/description. Register information in the required attribute fields and any other available information. *LoadLimitationArea* can coincide with *QuayArea*, but there can be several LoadLimitationAreas within one QuayArea. There may also be LoadLimitationAreas in a port outside QuayAreas (e.g. areas specifying maximum load restriction for storage of containers, for a back-area of the port).
Accuracy requirement	50 cm
Associations	Delimits LoadLimitationArea. The feature type inherits attributes from CommonPropertiesRequired.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6)		[0..1]
..OBJTYPE	LoadLimitationAreaBoundary	Character String	[1..1]
boundary	Line segment that delimits an area.	GM_Curve	[1..1]

Figure 20: Example of LoadLimitationAreaBoundary. LoadLimitationAreaBoundary must delimit LoadLimitationArea and encompass the entire area. In this hypothetical example pictured, its drawn two individual boundaries (pink and blue) for two different LoadLimitationAreas (Norkart, 2020).

3.4.4 LoadLimitationArea

Definition	Area within the port that has restrictions to what it can withstand of load.
Geometry	GM_Surface, GM_Point
Registration method	Single point (surface information)
Registration description:	Registered with a single point within *LoadLimitationAreaBoundary*. Register information in the required attribute fields and any other available information.
Associations	Delimited by LoadLimitationAreaBoundary. The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId and QuayId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
..OBJTYPE	LoadLimitationArea	Character String	[1..1]
typeOfQuaySurface	Surface material of the area.	Code list	[0..1]
typeOfUseClass	Categories of different weight classes. Use class indicates the maximum permissible axle load and total weigh of a vehicle.	Code list	[0..1]

axleLoad	Total weight felt by the roadway for all wheels connected to a given axle of a wheeled vehicle. The maximum allowable weight, specified in metric tons.	Real	[0..1]
pointLoad	Load applied to a single point. The maximum allowable weight from a point load, specified in metric tons.	Real	[0..1]
minimumDistancePointLoad	The minimum distance two point loads can be placed to avid overloading the area. Specified in meters.	Real	[0..1]
loadReference	Reference to original document, drawing etc. that contain information about weigh limitations.	CharacterString	[0..1]
loadId	Number or text used by the port to identify a loadLimitatonArea.	CharacterString	[0..1]
loadLimitation	Upper limit for evenly distributed load. Specified in metric tons per square meters (t/m^2).	Real	[0..1]
position	Optional point of representation.	GM_Point	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]

Code list Type of use class

Type of use class. There are different weight classes, which indicates the maximum permissible axle load and total weight. As described in *Forskrift om bruk av kjøretøy* and Statens vegvesen *handbook R412*.

Code	Description
Bk10	Use class Bk10
Bk6	Use class Bk6
Bk8	Use class Bk8
BkT8	Use class BkT8, a variant of Bk8. It has the same maximum axle load as bk8, but the total allowed weight is higher.
other	Other type of use class

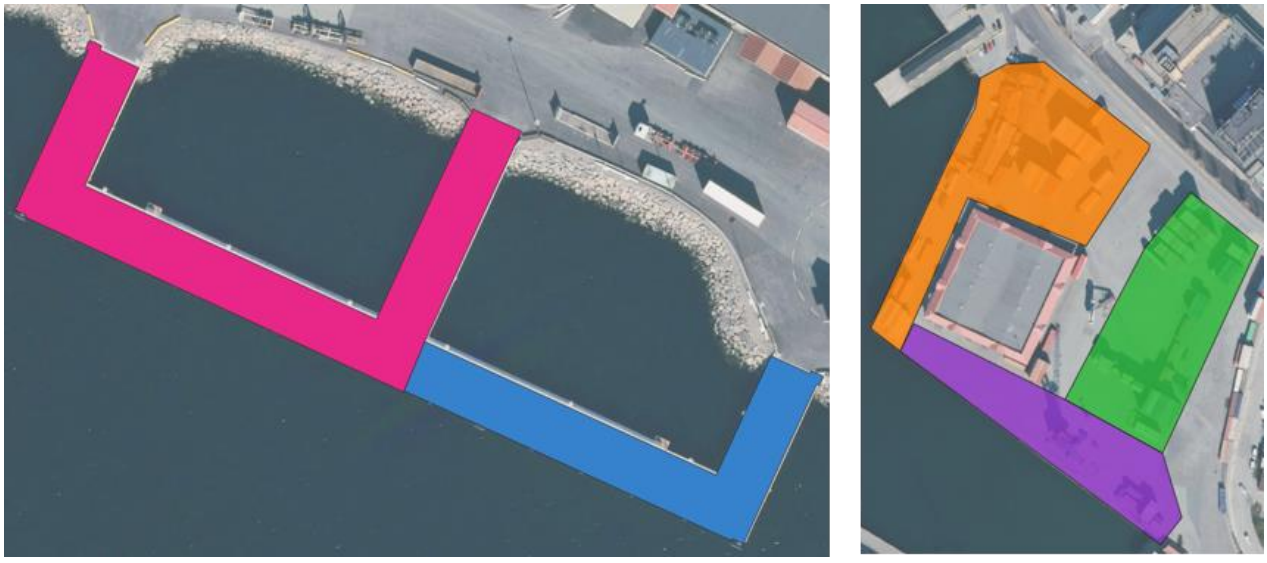


Figure 21: LoadLimitationAreas drawn in the examples are not checked against reality and are hypothetical. The example on the left hand illustrates how a quay may have several areas with different weight limits and must therefore be divided into individual areas. Image to the right: A loadLimitationArea is not necessarily overlapping or identical with the quay area. You can have load limitations for back areas or cargo storage areas in the port (Norkart, 2020).

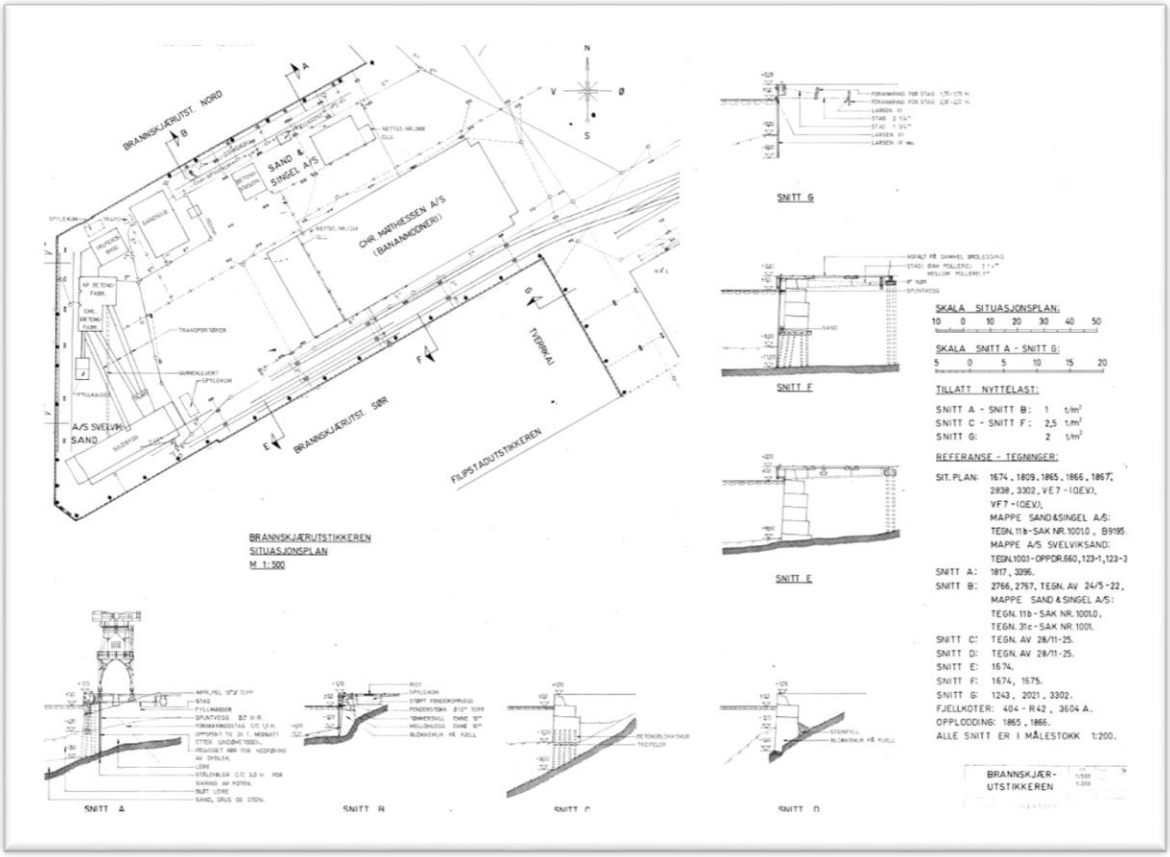


Figure 22: Example on an older outdated drawing of a quay in the port of Oslo, with registered load limitation areas (Port of Oslo KF).

3.4.5 Slipway

Definition	A ramp on the shore which ships, or boat can be hauled up from a floating position and up on dry land.
Geometry type	GM_Surface, GM_Point
Registration method	Draw the outer boundary of the surface. An optional representative point can be added.
Registration description:	Register the outer edge of the inclined plane. If an area contains three different slips with different capacities, this should be registered as three different objects. The minimum size for registering a slipway is 6m^2. *Slipp* is a feature type in *FKB BygnAnlegg* that is registered with line geometry. Here, both outer sides that run across the coastal contour are registered. Slipway without rails are classified as ramps. These are registered as the feature type *QuayFront*, with *typeOfQuayConstruction: ramp* (se figure 28). Slipways at private boathouses or covered halls/workshops is not registered. These are registered as buildings in *FKB Bygning*. Register information in the required attribute fields and any other available information.
Accuracy requirement	35 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId and QuayId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[1..1]
..OBJTYPE	Slipway	Character String	[1..1]
heightAboveChartDatum	Height of slipway in meters above water. The reference level for height is LAT (lowest astronomical tide/chart datum) unless otherwise stated.	Real	[1..1]
heightReference	Measurement point on the object.	Code list	[1..1]
status	Status of the object.	Code list	
typeOfAccess	What kind of fuser that has access to the object.	Code list	[0..*]
typeOfQuaySurface	Type of surface cover or material.	Code list	[0..1]

slipwayCapacity	Lifting capacity for the slipway, specified in metric tons.	Integer	[0..1]
craneCapacity	Lifting capacity for the crane connected to the slipway, specified in metric tons.	Integer	[0..1]
maxVesselLength	Maximum length of the vessel that the slipway can accommodate. Specified in meters.	Real	[0..1]
maxVesselWidth	Maximum width of the vessel that the slipway can accommodate. Specified in meters.	Real	[0..1]
maxVesselDraft	Maximum draft of the vessel that the slipway can accommodate. Specified in meters.	Real	[0..1]
name	Name of the slipway.	Character String	[0..1]
specification	Detailed description of the object, or other technical features.	Character String	[0..1]
position	Optional point of representation.	GM_Point	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]

Code list Type of access

What kind of user that has access to the object.

Code	Description
all	Access for all.
allShip	Access for all ships.
other	Other type of access.
otherVessel	Access for other vessel.
cruiseShip	Access for cruise ships.
fishingBoat	Access for fishing boats.
freightVessel	Access for freight vessels.
portOperations	Access for port operations.
tenant	Access for tenants.
leisureBoat	Access for leisure boats.

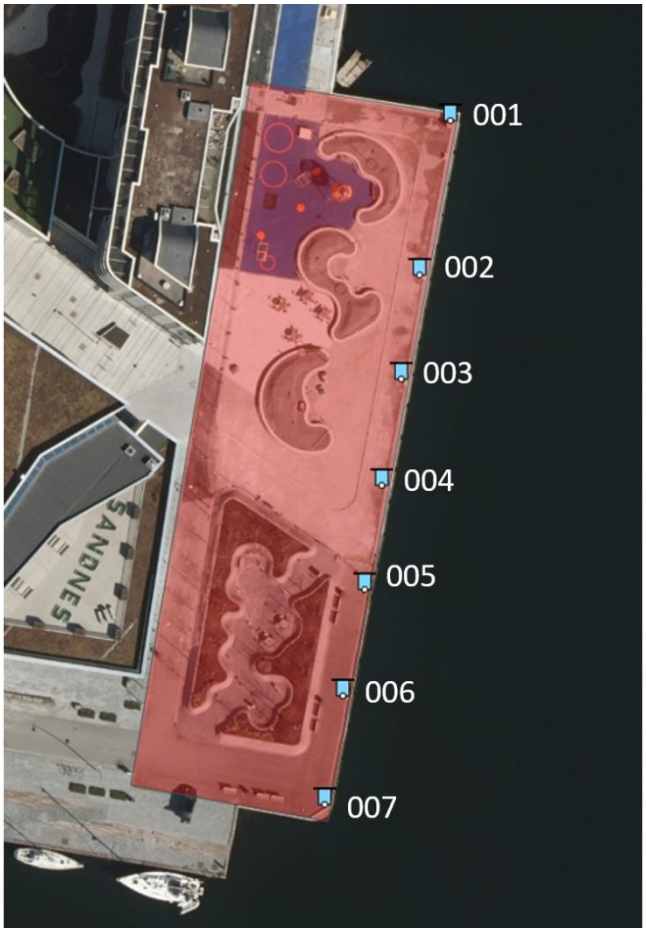
Figure 23. Example slipway.

3.5 ObjectId

Definition	Abstract feature type that contains properties for unique identification of objects.
Geometry type	Abstract feature type (does not have geometry)
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId and QuayId. The properties in *ObjecId* is inherited by all feature types in chapter 3.5.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
objectIdInternal	The port's custom numbering of objects. Numbering varies from port to port, some using only numbers or letters, while others use a combination.	Character String	[0..1]
objectId	Unique identification of the individual objects on the quay.	Character String	[0..1]



Guidelines for serial number for point feature types:
The attribute *objectId* is used for unique identification of objects on the quay. It is recommended that the numbering starts at 001 for each quay, and that objects that are numbered such as bollards, gets a sequential order (serial number) according to their location along the quay front. See example figure 24. The starting point for serial number (where no. 1 is placed) should be placed in the end or the side of the quay where a ship first passes when entering the port.

Figure 24. Example from the port of Sandnes with bollards along the quay front. The approach to the port of Sandnes is from the north, and the serial numbering therefore starts at the northern end of the quay.

3.5.1 QuayFront

Definition	Part of the quay that is suitable for mooring a vessel.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	The feature type *QuayFront* must be measured. There is a requirement for surveying – existing data or re-use of geometry must not be used for registration of the quay front. Quay fronts can have matching geometry with *KystkonturTekniskeAnlegg* (FKB Vann) or *KaiBryggeKant* (FKB BygnAnlegg). The geometry from these feature types must not be reused. Quay front is measured from the top, with height reference *top*. Register information in the required attribute fields and any other available information. *QuayFront* is not used as delimitation or boundary for *QuayArea*. *QuayAreaBoundary* that coincide with QuayFront along the waterline/sea must have coinciding geometry. All quay fronts must have attribute information in the attribute fields *portName* or *UNLOCODE* (se *PortId*). A quay (the object itself in reality) will consist of one or more quay fronts, one quay area and a quay area boundary. When registering or mapping a port, the quay fronts, quay areas (with boundaries) that together make up a quay (in reality) must have the same *quayId* and *quayName* in the attribute information. A quay area usually borders one or more quay fronts (see picture 26). The quay front must be split into several parts where: • The quay has a larger breaking point (e.g.,90 degrees, for a smaller breaking point it's not necessary to split the object). • The attribute information is different (different type of quay, different type of quay surface, different height above chart datum, etc.) • In the distinction between port facilities that are ISPS.
Accuracy requirement	10 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity

CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	QuayFront	Character String	[1..1]
heightAboveChartDatum	Height in meters above water. The reference level for height is LAT (lowest astronomical tide/chart datum), unless otherwise stated.	Real	[1..1]
heightReference	Measurement point on the object. Use top for *QuayFront*.	Code list	[1..1]
status	Status of the object.	Code list	[1..1]
typeOfQuayConstruction	Type of quay construction.	Code list	[0..1]
typeOfQuay	Intended use for the quay.	Code list	[1..*]
Length	Length of quay front in meters. The length is measured on the part of the quay front that is suitable for docking. Length can also be calculated from the length of the geometry.	Real	[1..1]
centerLine	Line segment.	GM_Curve	[1..1]

Code list Type of Quay Construction

Code	Description
other	Other type of construction
wharfQuay	Wharf or quay
seawall	Constructed of stone or masonry.
ramp	Ramp, steepled inclined plane.
Ro-roRamp	(roll on/roll off) Adjustable ramp or boarding platform.
sheetPiling	Supporting construction of sheet materials with interlocking edges, driven into the ground to prevent seepage into an excavation.
pillars	Quay on piles or pillars.
landingSteps	Quay where steps are part of the quay construction or form the outer part of the quay.
unknown	Unknown construction type.

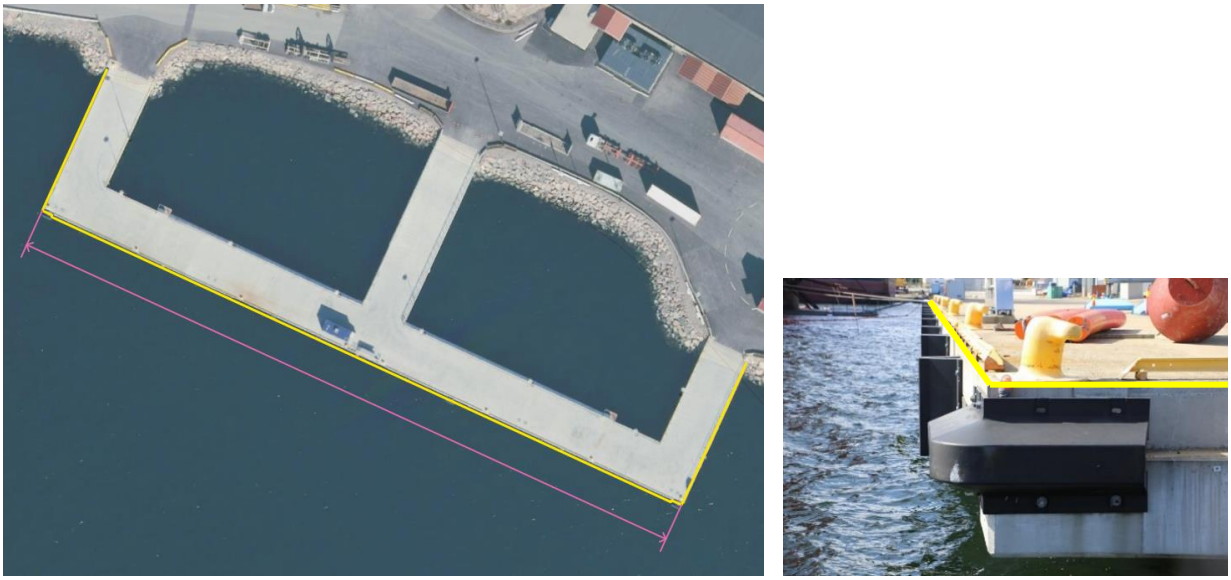


Figure 25: Example on how to register QuayFront (yellow line). The length is measured along the part of the quay front that is suitable for docking (purple line). Height reference: Top (Norkart, 2020).

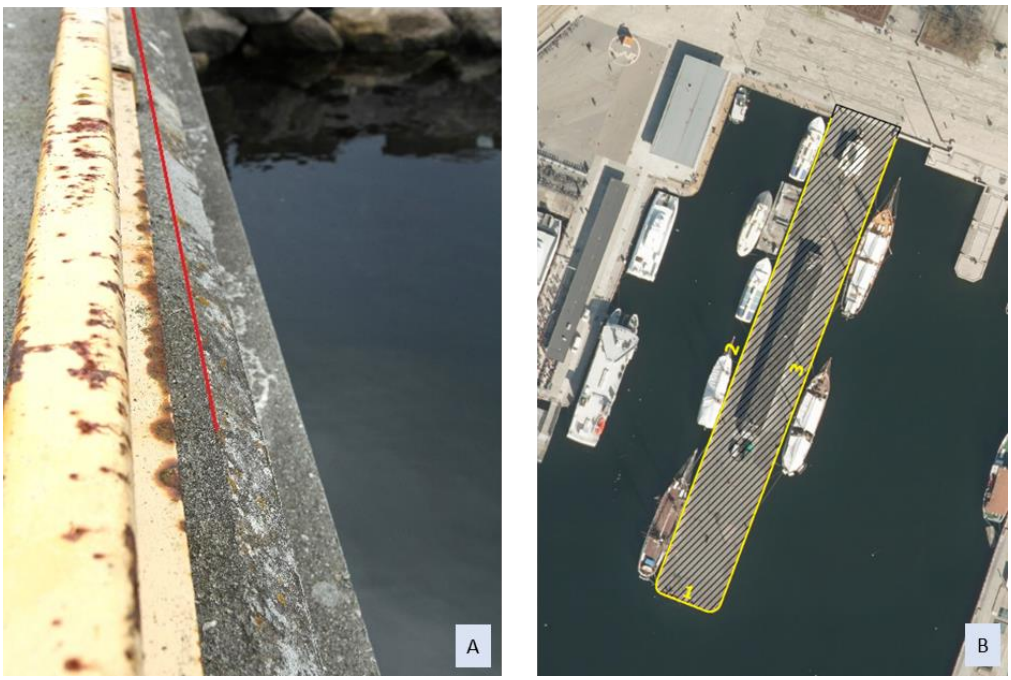


Figure 26: A. The quay is often not a sharp 90 degree bend but can have a bevelled edge or other form of rounding. The quay front is measured from the top, at the outermost line, before the construction is sloped or rounded. See line drawn in red. B. QuayFront is not associated with QuayArea. One quay area is registered for one quay or jetty, even if there is multiple quay fronts along the area (nr. 1-3), as the figure shows. QuayArea must be delimited by QuayAreaBoundary.

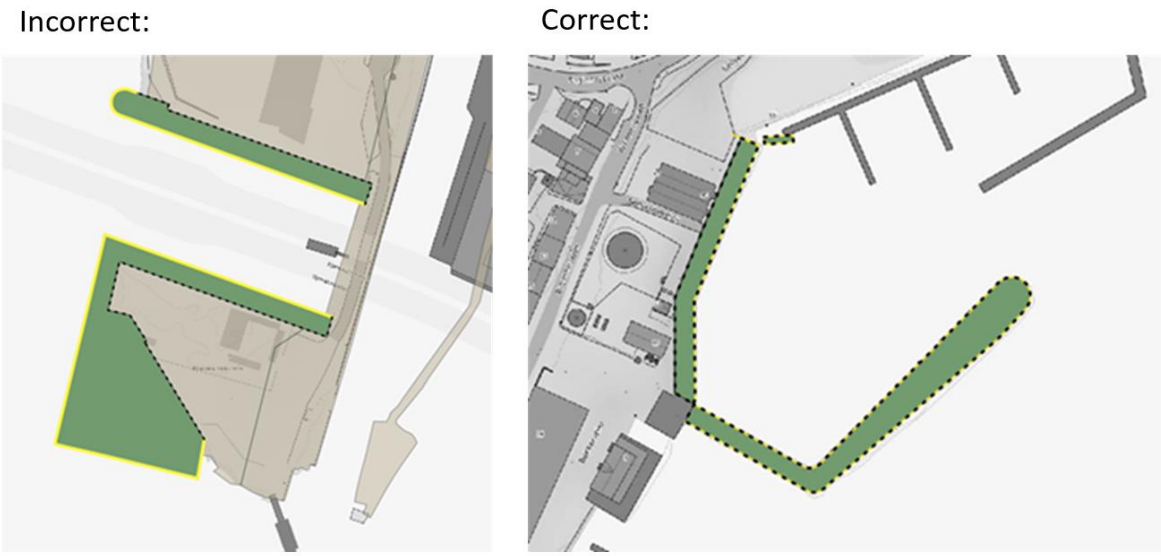


Figure 27. Example on how to draw QuayFront. In the image on the left, which is incorrect, QuayFront is used as a part of the delimitation for the QuayArea. It's only QuayAreaBoundary that can delimit QuayArea, as shown in the image to the right. QuayFront is an independent feature type, which should not delimit other objects. Coinciding geometry for QuayFront and QuayAreaBoundary is allowed.

Figure 28: A. Ramp. Registers as QuayFront – type of quay construction «ramp». Measure at the water's edge at medium high tide. B. Quay on pillars.

3.5.2 MooringFacilities

Definition	Mooring facilities at the berth or quay area.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point at the object's vertex, use height reference *top*. Permanently mounted mooring facilities must be measured. There is a requirement for surveying – existing data or re-use of geometry must not be used for registration. Dolphin (which is freestanding in the sea) can be measured with photogrammetry, since this is difficult to get to with surveying. Dolphin can have the same coinciding geometry as the feature type *Pælebunt* in *FKB BygnAnlegg*. Register information in the required attribute fields and any other available information. The angle that the mooring ropes can have from the boat down to the mooring device, as illustrated in figure 29, can be specified in the attribute fields *allowedMooringAngleFloorPlan* and *allowedMooringAngleProfile.*
Accuracy requirement	10 cm (Dolphin: 20 cm)
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	MooringFacilities	Character String	[1..1]
heightAboveChartDatum	Height in meters above water. The reference level for height is LAT (lowest astronomical tide/chart datum), unless otherwise stated.	Real	[1..1]
heightReference	Measurement point on the object. Use top for *mooringFacilities*.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
typeOfMooringFacility	Type of mooring.	Code list	[1..1]
maximumLoad	Maximum load for bollard, measured in metric tons.	Real	[0..1]
certificationDate	Date for last certification.	Date	[0..1]
allowedMooringAngleFloorPlan	Allowed angle for mooring as seen from above. Example: +/-90°.	Character String	[0..1]
allowvedMooringAngleProfile	Allowed angle for mooring as seen in profile. Example: +75°/-15°.	Character String	[0..1]

specification	Detailed description of the object, or other technical features.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Type of mooring facility

Specifies type of mooring device.

Code	Description
other	Other mooring device.
buoy	Buoy
dolphin	Dolphin or pole, often extending into the water and not connected to shore. Used to mooring vessels using rope to attach.
cableWire	Cable or wire as mooring device.
mooringBolt	Mooring bolt, often mounted on rock. Usually used for mooring medium or small vessels.
bollard	Bollard
ring	Ring
releaseHook	Hook with hinge that can be released to be opened.

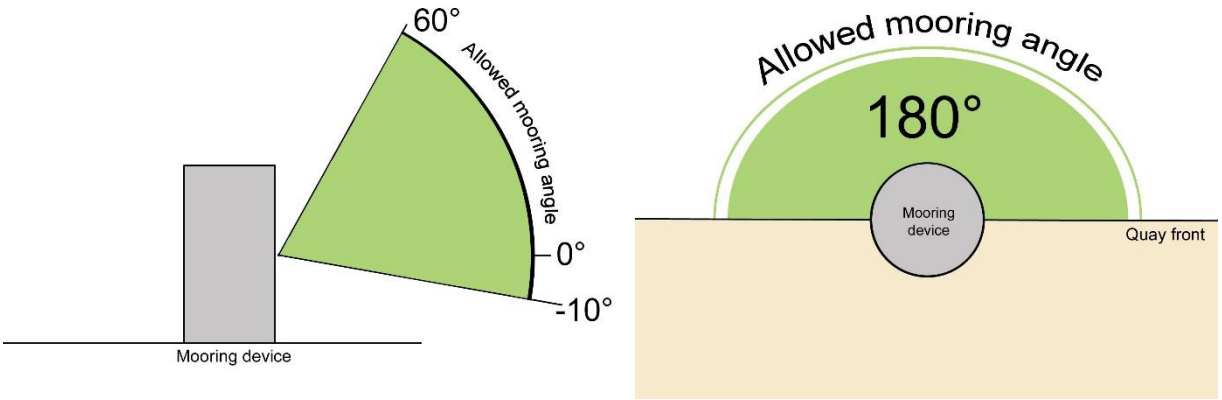


Figure 29: Attribute fields for allowedMooringAngleFloorPlan and allowedMooringAngleProfile is used to specify the angle that the mooring ropes can have from the ship and down to the mooring device, for example a bollard (Kartverket, 2021).

Figure 30: Height reference or measurement point for various mooring facilities. The images shows some of the different types of mooring devices. A. - E. Bollard, F. Ring. G. Dolphin, H. Release hook, I and J. Mooring bolt. Height reference: Top. (Norkart and Port of Oslo KF, 2020)

3.5.3 Fender

Definition	Bumpers designed to absorb the kinetic energy of a vessel berthing.
Geometry type	GM_Point, GM_Curve (when grouping fenders)
Registration method	Single point or single point in sequence (if grouping of fenders).
Registration description	When registering individual fenders, point geometry is used. If there are many fenders of the same type (D-fenders, small V-fenders or tire fenders) line geometry can be used (to group fenders). Fenders must have either point or line geometry. The geometry must follow the quay front if line geometry is used. The number of fenders is specified in the attribute field for *numberOfFenders* and distance between the fenders is specified in the information field. Fenders is measured at the top point, where they are mounted to the dock/quay, with height reference *top*. Register information in the required attribute fields and any other available information.
Accuracy requirement	20 cm for both point and line features.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	Fender	Character String	[1..1]
heightAboveChartDatum	Height in meters above water. The reference level for height is LAT (lowest astronomical tide/chart datum), unless otherwise stated.	Real	[1..1]
heightReference	Measurement point on the object. For fender use top (where its mounted).	Code list	[1..1]
Specification	Detailed description of the object, or other technical features (dimension, height, width, diameter, etc.).	Character String	[0..1]
typeOfFender	Type of fender	Code list	[0..1]
fenderOrientation	The orientation of the fender.	Code list	[0..1]
status	Status of the object.	Code list	[0..1]
numberOfFenders	Number of fenders. Used when grouping of fenders.	Integer	[0..1]
centerLine	Line segment that can be used when grouping of fenders of the same type.	GM_Curve	[0..1]
position	Geographical location.	GM_Point	[0..1]

Code list Fender Orientation

Code list for the attribute fender orientation.

Code	Description
otherOrientation	Other orientation
verticalOrientation	Vertical orientation
horizontalOrientation	Horizontal orientation

Code list Type of Fender

Specifies different types of fenders. The code list is used to specify the attribute *typeOfFender*.

Code	Description
square	Square shaped fender.
D-fender	Rubber pipe with D-shaped cross section.
tireFender	Fender from tires.
tugboatFender	Tugboat fender.
rollingFender	Rolling fender.
round	Round fender.
PUR-fender	Fender made of polyurethane.
floatingFender	Floating fender.
pneumaticFender	Large sausage-shaped floating rubber fender filles with high-pressure air, often covered with tires.
coneFender	Cone-shaped fender mounted vertically on the berth/quay, with a flange on top.
cylindricalFender	Cylindrical fender. Also used for circle or half-circle shaped fender.
trapezeFender	Trapeze-shaped fender.
V-fender	Fender with V-shaped cross section.
torsion	Fender with torsion spring or torsion bar suspension.
bottomFoundedFender	Bottom founded fender
fenderPanel	Fender as a panel.
otherFeder	Other type of fender.

Figure 31: Examples of some different fender types and their measurement points. The pictures are from the port of Kristiansand and the port of Oslo.(Photo: Norkart and port of Oslo KF). A. Fender panel (Yellow line in the image shows where the quay front is behind the fenders.) B. Torsion fender, C. V-fender, D. D-fender, E. Cone fender. F. V-fender. These can be measured with single points or as grouped fenders (line segment), G. Tire fender, H. Pneumatic fender. This type of fender is usually stored some place in the port and is moved between vessels as needed. Registered as a point at the storage location if the port has a fixed storage location for this fender type. I. Cylindrical fender, J. V-fender. Measurement is made on the back of the fenders, where they are mounted to the quay. The attribute specification is used to specify the dimension of the fender. (Photo A – H, Norkart, 2020. Photo H and I: Port of Oslo, 2021).

3.5.4 Crane

Definition	Device for lifting or moving heavy objects, located on the quay or in the port.
Geometry type	GM_Point
Registration method	Single point
Registration description	There is a distinction between fixed or movable (mobile) cranes. A fixed crane is mounted at a fixed point in the port or at the quay, while mobile cranes can be moved. Rail-mounted cranes or their semi-mobile cranes are classified as mobile. Cranes are registered as a single point, but for mobile cranes the point is registered as a representative coordinate at a suitable location. The point must be given an accuracy that indicates great uncertainty. Assessment of the location should be done in dialogue with the port. Register information in the required attribute fields and any other available information. The port should be contacted regarding providing attribute information such as range, load or other technical details and information about the crane.
Accuracy requirement	Fixed installation: 30 cm. Movable installation: Representative point on the quay.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	Crane	Character String	[1..1]
heightReference	Measurement point on the object. For crane use foot.	Code list	[1..1]
typeOfCrane	Type of crane	Code list	[1..1]
energySource	Source of energy that the crane uses.	Code list	[0..*]
mobile	Fixed or movable object. A fixed-mounted crane stands at a fixed point on the quay while mobile cranes can be moved. Rail-mounted cranes or other semi-mobile cranes are classified as mobile. For movable objects, the value true (yes) is used, while for fixed objects false (no) is used.	Boolean (true/false)	[1..1]
status	Status of the object.	Code list	[0..1]

specification	Detailed description of the object, or other technical features.	Character String	[0..1]
range	Working radius of the crane. Measured from the quay front, in meters.	Real	[0..1]
maximumLoadRange	Maximum lifting capacity with maximum range/working radius. Specified in metric tons.	Real	[0..1]
maximumLoad	Maximum lifting capacity. Specified by the shortest lift, in metric tons.	Real	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Type of Crane

Specifies type of crane, for the feature type Crane.

Code	Description
other	Other type of crane.
portCrane	Crane located in the port.
mobileCrane	Mobile crane, often mounted on a vehicle.
bulkCrane	Crane for bulk handling.
gantryCrane	Gantry crane, built on a gantry, which is a structure used to straddle an object.
reachstacker	Vehicle for lifting and transporting containers.
rail-goingCrane	Crane mounted on rails.
swingCrane	Swing crane.
tranverseCrane	Crane that is movable in three planes: two horizontal and one vertical.

Code list Energy source

Energy source for crane or other object.

Code	Description
other	Other energy source.
battery	Battery as energy source.
diesel	Diesel as energy source.
electrical	Electrical power supply.

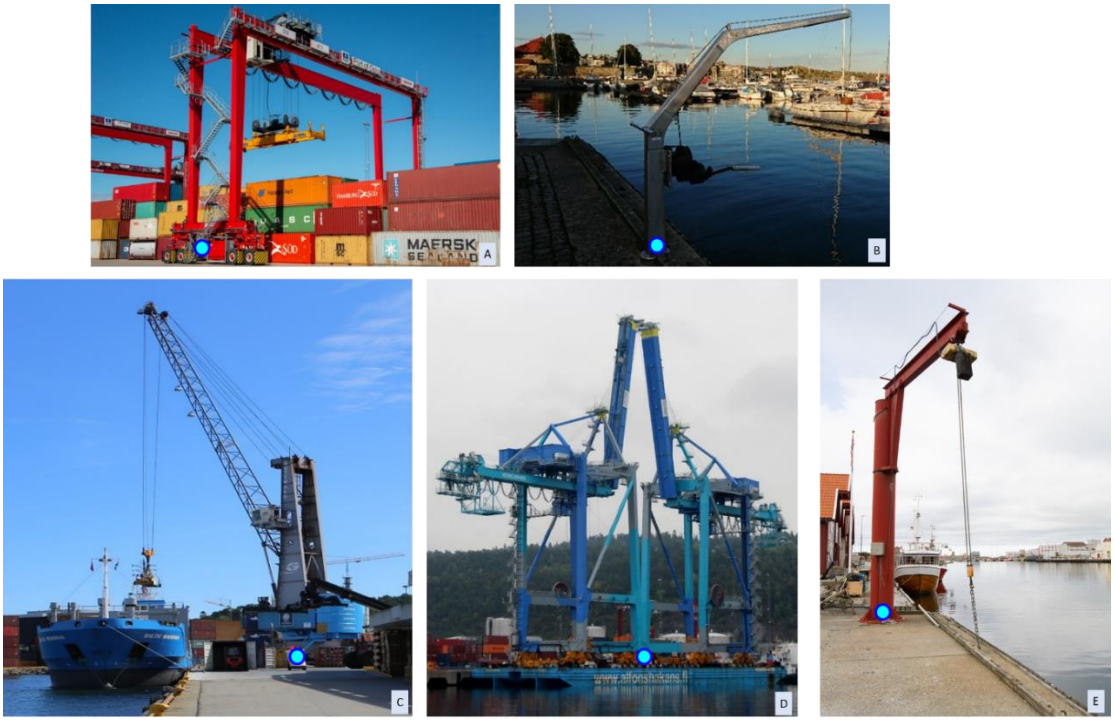


Figure 32: Example of different types of cranes, with measuring points. A. Transverse crane in port of Oslo, B. A fixed crane in a marina - Kristiansand, C. Mobile crane in Kristiansand, D. Container crane in Oslo, E. Fixed crane in Sirevåg. Height reference: Foot. (Photo: Port of Oslo KF, Norkart and Kartverket)

3.5.5 LoadingUnloadingEquipment

Definition	Equipment that is part of the permanent infrastructure in the port and is used for loading or unloading ships.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point. Height reference: top, foot, unknown – depending on measurement. There is a distinction between fixed or movable (mobile) equipment. In case the equipment is movable, its classified as mobile. Movable objects is registered as a point with a representative coordinate at a suitable location. The point must be given an accuracy that indicates great uncertainty. Assessment of the location should be done in dialogue with the port. Register information in the required attribute fields and any other available information.
Accuracy requirement	Fixed installation: 30 cm. Movable installation: Representative point on the quay.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	LoadingUnloadingEquipment	Character String	[1..1]
heightReference	Measurement point on the object. For loadingUnloadingEquipment use foot.	Code list	[1..1]
typeOfEquipment	Type of equipment for loading or unloading.	Code list	[1..*]
typeOfUsage	Type of usage of the equipment. Specifies if it's used for loading and/or unloading.	Code list	[1..*]
mobile	Fixed or movable object. For movable objects, the value true (yes) is used, while for fixed objects false (no) is used.	Boolean (True/False)	[1..1]
position	Geographical location.	GM_Point	[1..1]
status	Status of the object.	Code list	[0..1]
specification	Detailed description of the object, or other technical features.	Character String	[0..1]

Code list Type of Equipment

Type of loading or unloading equipment.

Code	Description
other	Other type of loading or unloading equipment.
boatlift	A machine for lifting boats out of the water.
hopper	Funnel for unloading materials transported in bulk.
hopperWithConveyorBelt	Hopper connected conveyor belt for bulk unloading of raw materials in loose form.
loadingUnloadingRamp	Ramp for loading materials in bulk, directly from rolling vehicles onboard ship.
loadingTower	Tower for loading and unloading bulk.
marineLoadingArm	Mechanical arm consisting of pipes, for transfer of wet bulk between vessel and port.
unloadingManifoldDryBulk	Connection point for unloading dry bulk. Manifold or pipe branch where vessels connect with hoses.
unloadingManyfoldWetBulk	Connection point for unloading wet bulk. Manifold or pipe branch where vessels connect with hoses.
conveyorBelt	Belt that is kept in motion and is used to transport gods from one end of the belt to the other.

Code list Type of Usage

Code	Description
loading	Equipment used for loading.
unloading	Equipment used for unloading.

Figure 33: Examples of loading and unloading equipment, with measurement points. A: loading point manifold, B: hopper, C: loading crane with conveyor belt (Photo: Port of Oslo, Port of Trondheim).

3.5.6 ElectricityConnection

Definition	Location for power connection.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point at the objects top centre. Height reference: top. Register information in the required attribute fields and any other available information. Feature types with coinciding geometry can occur in e.g., *FKB Ledning* or other local databases at the municipality or the electricity company (elverket). The attribute *ElectricityConnections* have multiplicity [0..*] which means that it is possible to enter multiple instances of the attribute for the same point feature. If there are several electrical connection points at a location (e.g., several sockets at the same location), all attribute information can be registered for a single point object (as opposed to several overlapping points, where one point is established per contact/connection).
Accuracy requirement	20 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	ElectricityConnection	Character String	[1..1]
heightReference	Measurement point on the object. For *ElectricityConnection* use top.	Code list	[1..1]
heightAboveChartDatum	Height in meters above water. The reference level for height is LAT (lowest astronomical tide/chart datum), unless otherwise stated. For points that may be at risk of being flooded during storm surges, it may be relevant to record the height above chart datum (the port authorities can disconnect relevant electrical cabinets that may come under water).	Real	[0..1]
typeOfElectricalConnection	Types of power connections that are available.	Code list	[1..*]
electricalConnections	Possible types of power connections.	Date type ElectricityConnection	[0..*]
status	Status of the object.	Code list	
typeOfAccess	What kind of user that has access to the object.	Code list	[0..*]
rangeCable	Length of cable, or range for available cable drum.	Integer	[0..1]

dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Type of Electrical Connection

Specifies type of electrical connection.

Code	Description
other	Other type of electrical connection.
shorePower	Shore power facilities.
powerCabinet	Power cabinet with various types of connections.
chargingSystem	Electrical system used for charging.
powerConnectionCrane	Electrical system where it is possible to connect the power supply for cranes.

Date type ElectricityConnectionProperties

Attributes to specify the different types of power connections available:

Attributes	Description	Date type	Multiplicity
power	Electric power produced pr. second, measured in watt.	Integer	[0..1]
phase	The distribution of load. Specification of the individual poles or conductors in an AC system.	Character String	[0..1]
frequency	The rate of oscillation of an alternating current, per second. Specified in Hertz.	Code list	[0..1]
connectionId	Id-number of other description specifying the type of connection.	Character String	[0..1]
current	The rate of flow of electric charge past a point or region. Specified in ampere.	Integer	[0..1]
voltage	Electrical potential specified in volt.	Code list	[0..1]

Code list Voltage

Voltage for electrical connections. Measured in volt.

Code	Description
11000V	High voltage, 11 kV
22000V	High voltage 22kV
230V	230 Volt
400V	400 Volt
440VOr690V	Power connection with 440V or 690V.

440V	440 Volt
6600VOr110000V	High voltage. Power connection with 6.6kV or 11kV.
6600V	High voltage, 6,6 kV
690V	690 Volt
unknown	Unknown voltage.

Code list Frequency

The code list specifies the frequency used. Measured in Hz.

Code	Description
50HzOr60Hz	Power connection that can deliver 50 Hz or 60 Hz.
50 Hz	Frequency 50 Hz
60 Hz	Frequency 60 Hz
directCurrent	Direct current.
unknown	Unknown frequency.

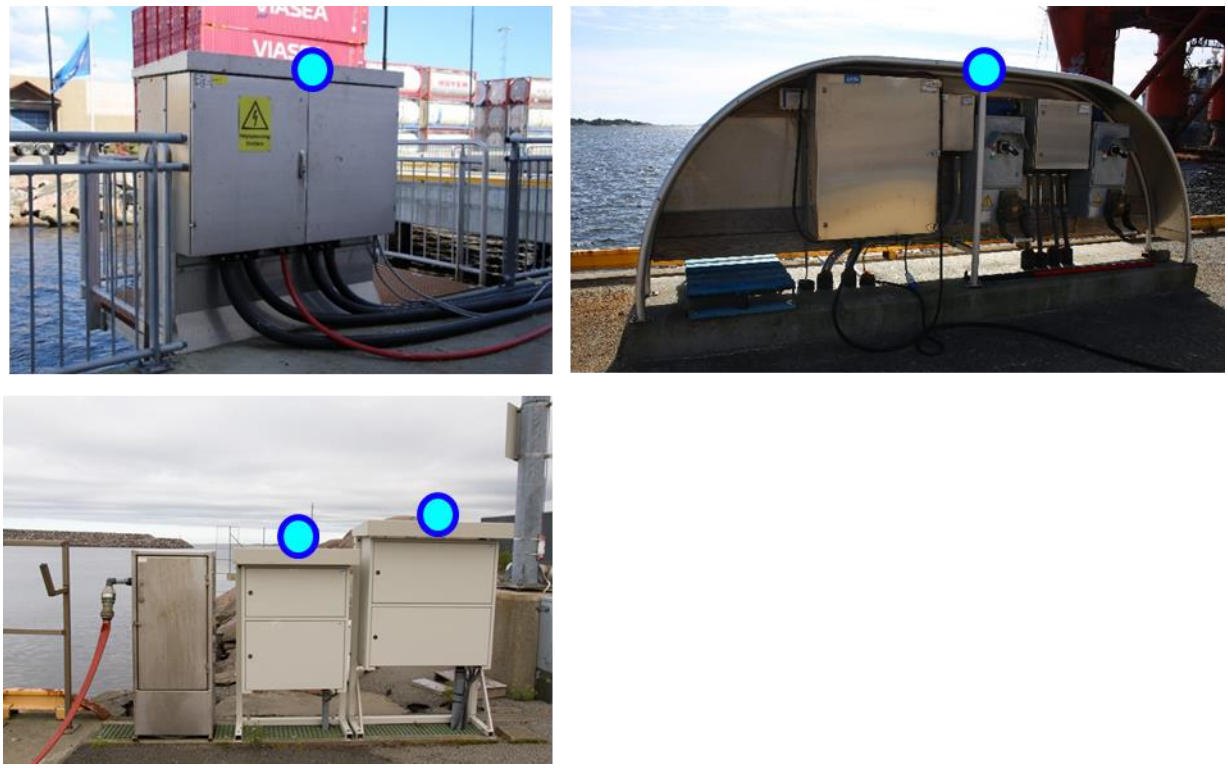


Figure 34: Examples of ElectricalConnection with measurement points. The top two picture is from Port of Kristiansand, the bottom picture is from Sirevåg. Registered as single point, measured at the object's vertex, correspondingly as the feature type "Fordelingsskap" in FKB. Height reference: Top. (Norkart, 2020).

3.5.7 WaterConnection

Definition	Location for water connection.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point in the middle of the object. The height reference used depends on where on the object the measurement is made. See examples of measurement points in figure 35. If a manhole or similar object can be found in the municipality's database for water and wastewater, the geometry can be retrieved from this. Register information in the required attribute fields and any other available information.
Accuracy requirement	20 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	WaterConnection	Character String	[1..1]
heightReference	Measurement point on the object.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
waterConnectionType	Type of water connection.	Code list	[1..*]
typeOfAccess	What kind of user that has access to the object.	Code list	[0..*]
manholeNumber	ID-marking of manholes.	Integer	[0..1]
Capacity	Capacity for filling or emptying water. Unit of measure is m^3 pr. hour.	Integer	[0..1]
connectionSize	Dimensions of the pipes to be connected.	Character String	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list type of Water Connection

Specifies type water connection.

Code	Description
other	Other type. Specify type in the information attribute field.
freshWater	Fresh water or drinking water for refilling.

Figure 35: Examples of different WaterConnections with measurement points. A. Measuring point on the top of the cabinet. B. On smaller water connection points the measurement is taken at the water tap. C. Water connection in the port of Kristiansand. Here, the point is registered in the middle of the water connection intake. Height reference: Top. (Norkart, 2020).

3.5.8 LiquidWasteFacility

Definition	Facility for emptying liquid waste, such as waste water, septic or equivalent.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point in the middle of the object. The height reference used depends on where on the object the measurement is made. If a corresponding object can be found in the municipality's database for water and wastewater, the geometry can be retrieved from this. There is a distinction between fixed or movable (mobile) objects. This can be in the form of a tanker or other vehicle. Movable objects is registered as a point with a representative coordinate at a suitable location. The point must be given an accuracy that indicates great uncertainty. Assessment of the location should be done in dialogue with the port. Register information in the required attribute fields and any other available information. If a septic tank that is used for recreational purposes (emptying for leisure boats)is registered, the codes *typeOfLiquidWaste = septic* and *typeOfAccess = leisureBoat* are used.
Accuracy requirement	Fixed installation: 20 cm. Movable installation: Representative point on the quay.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	LiquidWasteFacility	Character String	[1..1]
heightReference	Measurement point on the object-	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
typeOfAccess	What kind of user that has access to the object.	Code list	[0..*]
liquidWasteType	Type of liquid waste that can be disposed of.	Code list	[1..*]
Capacity	Capacity for emptying. Unit of measure is m^3 pr. Hour.	Integer	[0..1]
manholeNumber	ID-marking of manholes.	Integer	[0..1]

mobile	Fixed or movable object. For movable objects, the value true (yes) is used, while for fixed objects false (no) is used.	Boolean (True/False)	[1..1]
connectionSize	Dimension of the pipes to be connected.	Character String	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Type of Liquid Waste

Type of liquid waste that can be disposed of.

Code	Description
other	Other type of liquid waste.
greywater	Facility for receiving greywater from a boat or vessel.
septic	Facility for receiving septic or sewer.
blackwater	Facility for receiving blackwater (water containing oil, etc. that must be handled separately).

3.5.9 EmergencyResponseEquipment

Definition	Location for emergency response equipment.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point in the middle of the object, at the level of the quay front where the emergency equipment is placed. The height reference used depends on the location of the object. For ladders, this is measured at the top of the ladder (which is at the level of the quay front), while for a fire hydrant the measurement point should be at the foot of the object. For equipment that is mounted on a wall or similar, the point is registered at the top centre of the object. If a corresponding object can be found in FKB or municipal database, the geometry can be retrieved from this. Register information in the required attribute fields and any other available information.
Accuracy requirement	30 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	EmergencyResponseEquipment	Character String	[1..1]
heightReference	Measurement point on the object. Use foot or top.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
typeOfEmergencyResponseEquipment	Type of equipment available.	Code list	[1..*]
Specification	Detailed description of the object, or other technical features.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Code list Type of Emergency Response Equipment

Type of emergency response equipment.

Code	Description
emergencyAccessArea	Facilitated access to a building, reserved for the fire brigade or emergency services.
Other	Other equipment.
firealarmControlCentre	Control centre in a fire alarm system.
flammableMaterial	Storage of good or materials that are flammable.

fireHydrantOverground	Permanently mounted equipment overground. Point which the fire brigade can connect to water supply.
fireHydrantUnderground	Permanently mounted equipment underground. Point which the fire brigade can connect to water supply.
fireExtinguisher	Fire extinguisher.
Firehose	Fire hose
boatHook	Boat hook
explosiveMaterials	Danger or risk of explosion.
firstAid	First aid equipment.
gasesUnderPressure	Location where containers with gas under pressure is stored.
Defibrillator	A defibrillator is used to restart the heart in cases of cardiac arrest.
highVoltage	High voltage
emergencyPosterInformationPoint	Emergency poster or point of information.
keyCabinet	Key cabinet or safe for use by the fire brigade.
oilBoom	Temporary floating barrier used to contain an oil spill.
lifebuoy	Lifebuoy
smokeHatch	Hatch, panel or other that can be opened or removed to ventilate heat and smoke from a building on fire.
emergencyAssemblyPoint	Assembly point in case of evacuation.
sprinklerControl	Control Centre for sprinkler system.
ladder	Ladder
voiceAlertCenter	Voice alert centre.

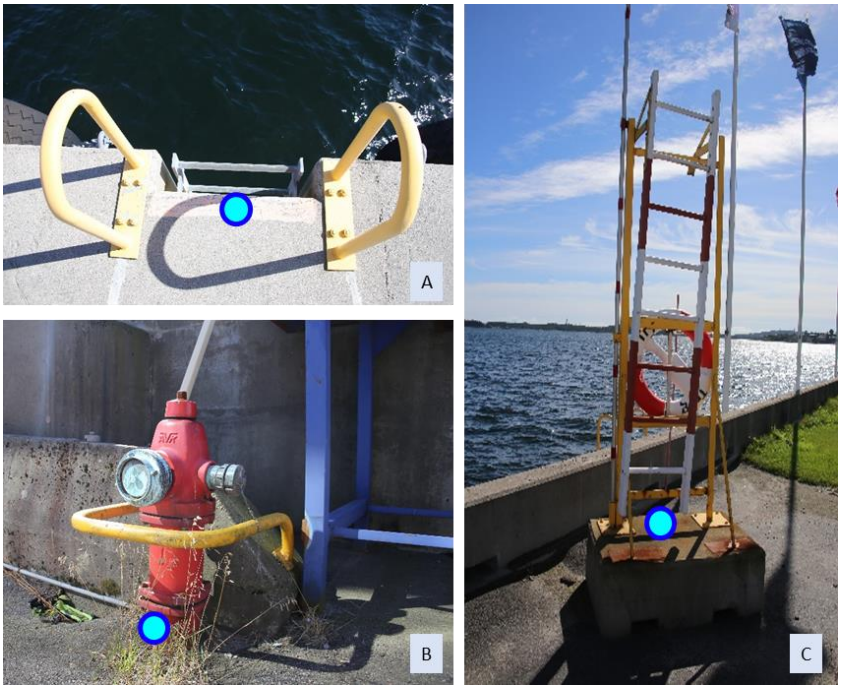


Figure 36: Different emergency response equipment. A. Ladder. Height reference: Top, B. FireHydrantOverground. Height reference: Foot, C. Ladder and lifebuoy. There is possible to use multiple codes in the code list (multiplicity [1..]). Height reference: Foot. (Norkart, 2020).*

3.5.10 FuelConnection

Definition	Location for fuel or refuelling.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point at the object's foot. Height reference: foot. There is a distinction between fixed or movable (mobile) object. This can be in the form of a tanker or other vehicle. Movable objects is registered as a point with a representative coordinate at a suitable location. The point must be given an accuracy that indicates great uncertainty. Assessment of the location should be done in dialogue with the port. Register information in the required attribute fields and any other available information.
Accuracy requirement	Fixed installation: 20 cm. Movable installation: Representative point on the quay.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	FuelConnection	Character String	[1..1]
heightReference	Measurement point on the object. Use foot for *FuelConnection*.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
typeOfAccess	What kind of user that has access to the object.	Code list	[0..*]
mobile	Fixed or movable object. For movable objects, the value true (yes) is used, while for fixed objects false (no) is used.	Boolean (True/False)	[1..1]
typeOfFuel	Type of fuel.	Code list	[1..*]
capacity	Capacity for filling fuel, specified in m^3 per hour.	Integer	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-	Character String	[0..1]

	MM. The attribute is not used for permanent objects.		
position	Geographical location.	GM_Point	[1..1]

Code list Type of Fuel

Type of fuel.

Code	Description
ammonia	Ammonia (NH3).
other	Other type of fuel.
gasoline	Gasoline
biodiesel	Biodiesel
gasolineDiesel	Gasoline and Diesel
diesel	Diesel
hydrogen	Hydrogen (H2)
VLSFO	Very-low sulphur fuel oil (VLSFO).
LNG	Liquefied natural gas
methan	Methane (CH4)
methanol	Methanol (CH3OH)
ULSFO	Ultra-low sulphur fuel oil (ULSFO).

Figur 37: Example FuelConnection with measurement point. Height reference: foot.

3.5.11 SolidWasteDisposal

Definition	Location for solid waste disposal.
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point. The measurement is made in the centre of the object. The object can be measured either at the top or at the foot (when using foot, this must be level with the quay front where the object is located). There is a distinction between fixed or movable (mobile) object. This can be in the form of a vehicle or other. Movable objects is registered as a point with a representative coordinate at a suitable location. The point must be given an accuracy that indicates great uncertainty. Assessment of the location should be done in dialogue with the port. In case a corresponding object exist in FKB or a municipal database, the geometry can be retrieved from there. Register information in the required attribute fields and any other available information.
Accuracy requirement	Fixed installation: 20 cm. Movable installation: Representative point at the quay.
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	SolidWasteDisposal	Character String	[1..1]
heightReference	Measurement point on the object. For *SolidWasteDisposal* use foot or top.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
wasteDeliveryProcedure	Reference to a delivery procedure that provide information about waste reception and waste management for users of the port.	Character String	[0..1]
typeOfWaste	Type of waste.	Code list	[0..*]
typeOfWasteContainer	Type of waste container.	Code list	[0..1]
mobile	Fixed or movable object.	Boolean (True/False)	[1..1]
typeOfAccess	What kind of fuser that has access to the object.	Code list	[0..*]

dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
position	Geographical location	GM_Point	[1..1]

Code list Type of Waste

Type of waste. The code list is used for the feature type *SolidWasteDisposal*. It's possible to choose several options, as some waste points have the possibility to deliver several types of waste.

Code	Description
other	Other type of waste
asphalt	Asphalt waste
batteries	Waste batteries
ElectricalWaste	Electrical waste. Including fluorescent lamps.
glass	Waste glass
lightbulb	Lightbulb
paint	Waste paint
foodWaste	Food waste
metal	Metal waste
impregnatedWood	Impregnated wood waste
oilyWaste	Waste containing oil
paper	Paper or cardboard waste
plastic	Plastic waste
stone	Stone
residualWaste	Residual waste

Code list Type of Waste Container

Type of waste container.

Code	Description
other	Other type of container
refuseBind	Refuse bin
container	Container
underground	Underground waste disposal system.
wasteBin	Waste bin

Figure 38: Examples of some types of waste, that can be selected in the code list Type of Waste. (Port of Oslo, 2020).

Figure 39: Examples of solid waste disposal objects in the ports of Oslo and Kristiansand. Height reference: Foot or top (Photo: Port of Oslo, Norkart, 2020).

3.5.12 Toilet

Definition	Public toilet
Geometry type	GM_Point
Registration method	Single point
Registration description	Registered as a single point at the bottom of the toilet building, either at the entrance door to the toilet or at the centre of the toilet building. Height reference: foot. In case a corresponding object exist in *FKB Bygning* (the toilet building can be registered as a building) or a municipal database, the geometry can be retrieved from there.. Register information in the required attribute fields and any other available information.
Accuracy requirement	30 cm
Associations	The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional , PortId, PortFacilityId, QuayId and ObjectId.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
PortId	See chapter 3.2 PortId		[0..1]
PortFacilityId	See chapter 3.3 PortFacilityId		[0..1]
QuayId	See chapter 3.4 QuayId		[0..1]
ObjectId	See chapter 3.5 ObjectId		[0..1]
..OBJTYPE	Toilet	Character String	[1..1]
heightReference	Measurement point on the object. Use foot for toilet.	Code list	[1..1]
status	Status of the object.	Code list	[0..1]
dateAvailableFrom	Date the object is available from. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
dateAvailableTo	Date the object is available to. Used for objects that are only available part of the year or in a season (summer/winter). Date is given as DD-MM. The attribute is not used for permanent objects.	Character String	[0..1]
position	Geographical location.	GM_Point	[1..1]

Figure 40: Toilet with measurement point. Height reference: Foot. (Port of Oslo, 2020).

3.6 Regulations

In this chapter you will find regulations, which are a package in the UML model for Port data, and contains the feature types *SpeedRegulation* and *ProhibitedArea*, as well as associated boundary features.

This chapter is mainly aimed at the authorities responsible for setting regulations that regulate speed, traffic or use of the municipality's sea area. It is usually the municipality, the municipal council or the port administration on behalf of the municipality.

The authority to set speed limits at sea is shared between the Norwegian Coastal Administration and the municipalities according to sections §7 and §8 in *havne- og farvannsloven*:

- The Norwegian Coastal Administration regulates speed for the main and secondary fairways, and for commercial vessels.
- The municipality regulates speed for recreational vessels in the municipality's sea area.

Read more about speed limits at sea on the Norwegian Coastal Administration's website.

When registering the feature types in this chapter, the guidelines in chapter 3.6.1 must be followed. See also chapter 2, for general guidelines and requirements for registration.

3.6.1 Procedure for establishing new speed regulations or regulations for use of the municipality's sea area

Guidelines for registration (mapping) of regulations that regulate traffic or use of the municipality's sea area:

- It is recommended to draw up regulatory text that is comprehensible to seafarers and that facilitates easy enforcement of the regulations.
- During the preparation of the regulation, when a regulation is drawn up, it should be considered that the regulation must be able to be drawn up on a map (it must be possible to delimit and drawn the areas (on a map), where traffic is regulated.

Speed regulations at the sea are used in services such as the Norwegian Coastal Administrations app *Båtfart*. The app tells you the speed limit where you are and can also notify you if you are driving too fast. For this service to work, the app depends on the regulation being mapped in an appropriate way.

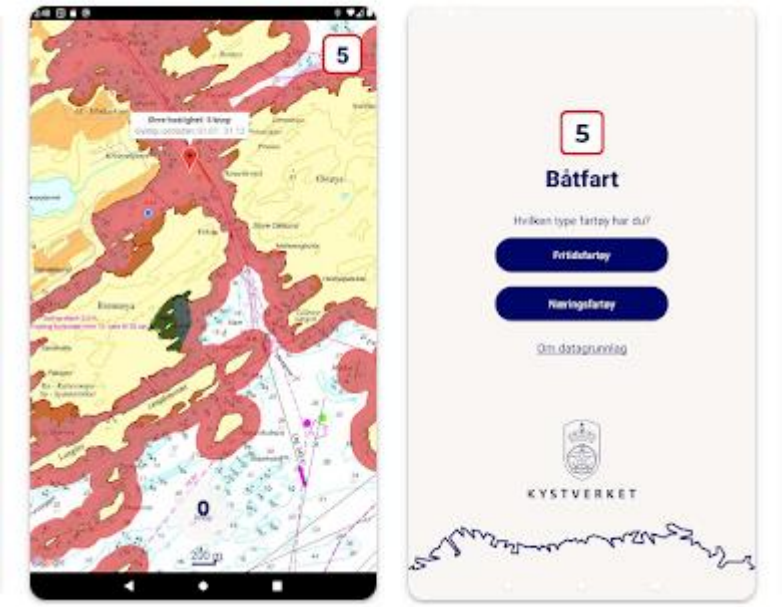


Figure 41: The Norwegian Coastal Administrations app Båtfart. The app can tell you what's the speed limit where you are and can notify you if you are driving too fast.

- Avoid using buffer zones of the type «buffer 100 meters from land», as this results in complicated areas that are difficult for users to understand, and creates unintentional «free zones», se figure 42.
- The demarcation should be described in a way that leaves no room for misunderstandings. References based solely on place names should be avoided. The demarcation should be described with specific positions (geographic coordinates and datum).

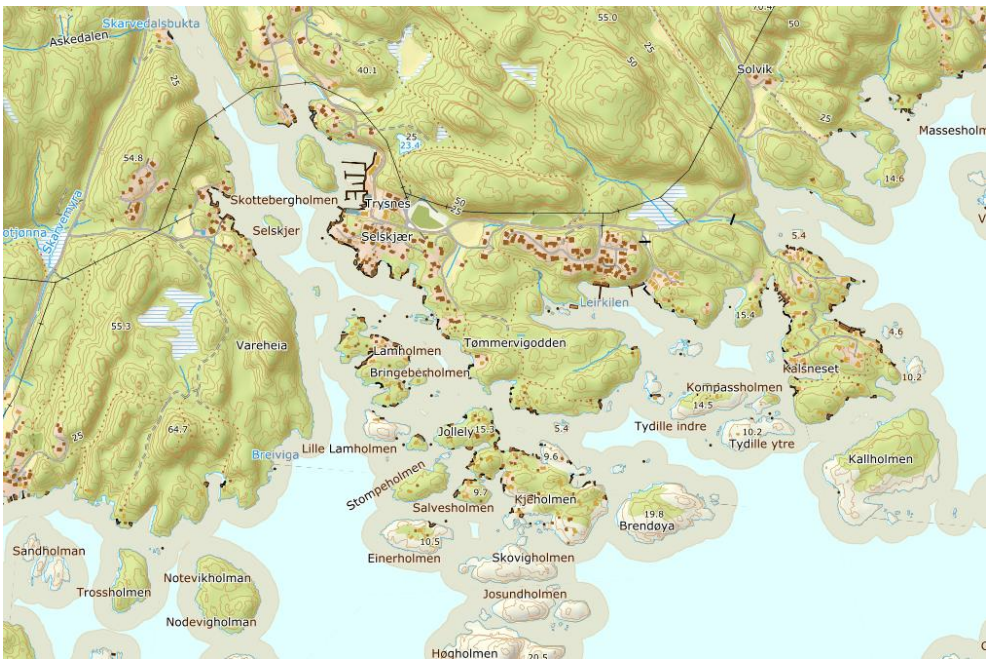


Figure 42: Light yellow areas shows buffer zone at 50 meters along the shore. The use of buffer zones can create complicated areas and unintentional "free zones".

- According to §4 in Forskrift om fartsgrenser på sjøen the responsible authority must notify the Norwegian Mapping Authority after the new regulation has been announced in *Norsk Lovtidend*. This is done by registering the areas as *SpeedRegulation* or *ProhibitedArea* in Port data. If Port data has been updated with the areas described in the regulation(s), §4 is considered to have been fulfilled.
- For user support, see chapter 2.4.4.

3.6.2 CommonPropertiesRegulations

Definition	Abstract feature type that holds common properties used for regulations.
Geometry type	Abstract feature type (does not have geometry)
Associations	The feature type inherits attributes from CommonPropertiesRequired and CommonPropertiesOptional. *CommonPropertiesRegulations* is an abstract feature type that holds common properties that is inherited by SpeedRegulation and ProhibitedArea.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
dateValidFrom	Date valid from. Used for speed restrictions that have a time limit or only applies to parts of the year. Year is not required to fill in. If the year is not stated, the dates in considered to apply each year.	Character String	[0..1]
dateValidTo	Date valid to. Used for speed restrictions that have a time limit or only applies to parts of the year. Year is not required to fill in. If the year is not stated, the dates is considered to apply each year.	Character String	[0..1]
legalAuthority	Who the regulation is laid down by.	Character String	[0..1]
regulationLink	Link to the regulation at lovdata.no	Character String	[1..1]
regulationName	Name of the regulation.	Character String	[1..1]
appliesToArea	Geographical area to which the regulation applies. It is specified in the legal text, usually a municipality or port area.	Character String	[0..1]
appliesToTypeOfVessel	Type of vessel covered by the regulation.	Code list	[1..1]
legalFramework	Reference to the law or legal framework in which the regulation is based.	Character String	[0..1]

Code list Type of Vessel

Type of vessel.

Code	Description
all	All vessels or floating devices designed to move through the water.
other	Other type of vessel.
leisureboatsUnder24m	Leisure boats that have a hull less than 24 meters in length.
utilityVessels	Vessels used for commercial traffic or in industry. Fishing boats included.
personalWatercraft	Vehicle where the hull length is less than 4 meters, and the vessel is equipped with an inboard internal combustion engine that drives a water jet unit as the main means of transport.

3.6.3 SpeedRegulationBoundary

Definition	Boundary to delimit *SpeedRegulation*.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	The area/boundary must correspond to the coordinates or the area description in the regulations. Field surveying is not expected, boundaries can be digitalized or registered using maps/GIS. Coastal contour from *FKB Vann* or the quay front can be used as demarcation towards land. The authority that lays down the regulations is responsible for speed restrictions being registered and mapped in Port data (cf. §4 in Forskrift om fartsgrenser på sjøen). Register information in the required attribute fields and any other available information.
Accuracy requirement	100 cm
Associations	Delimits SpeedRegulation. The feature type inherits attributes from CommonPropertiesRequired.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6)		[1..1]
..OBJTYPE	SpeedRegulationBoundary	Character String	[1..1]
boundary	Line segment that delimit an area.	GM_Curve	[1..1]

3.6.4 SpeedRegulation

Definition	Area that are subject to restrictions related to traffic and speed for vessels traveling within the area.
Geometry type	GM_Surface, GM_Point
Registration method	Single point (surface information)
Registration description	Registered as a single point within *SpeedRegulationBoundary*. Register information in the required attribute fields and any other available information.
Associations	Delimited by SpeedRegulationBoundary. The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and CommonPropertiesRegulations.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
CommonPropertiesRegulations	See chapter 3.6.2 CommonPropertiesRegulations		[1..1]
..OBJTYPE	SpeedRegulation	Character String	[1..1]
speedLimit	Maximum allowable speed for an area.	Integer	[1..1]
position	Optional point of representation.	GM_Point	
area	Polygon showing geographical extent.	GM_Surface	[1..1]

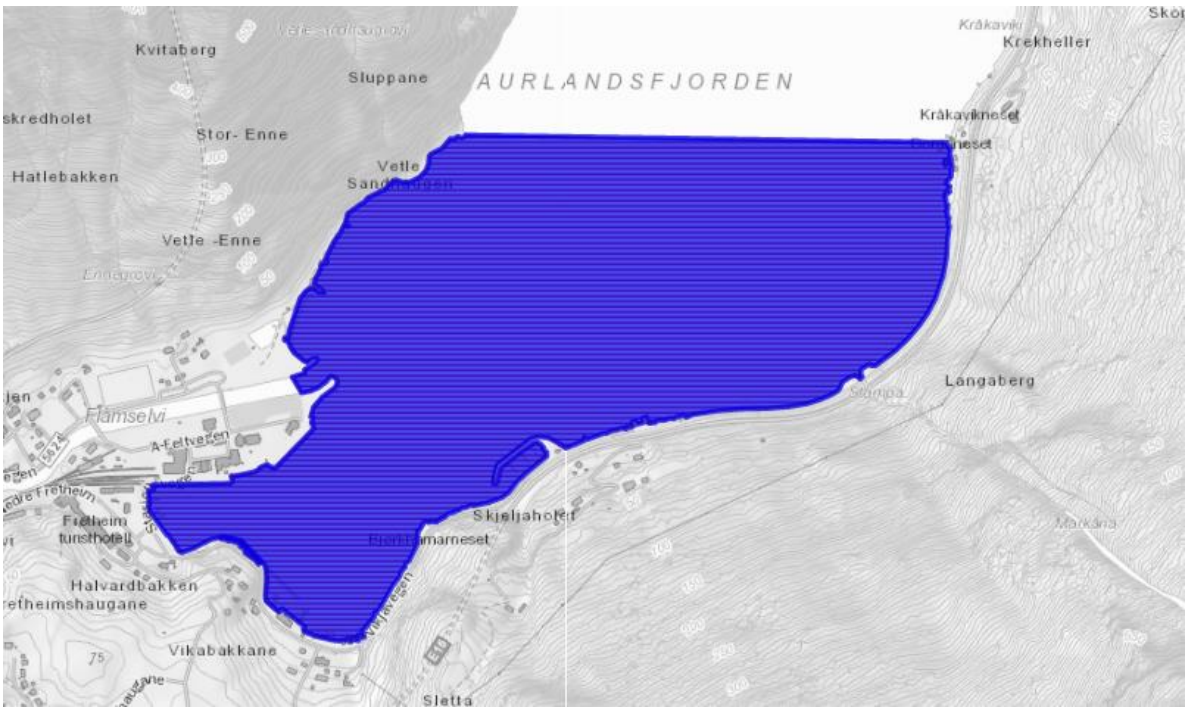


Figure 43. Example of speed restriction from Aurland municipality. From the regulation:«5 knop er høgste tillate fart i følgjande farvatn: Indre del av Aurlandsfjorden, sør for ei line trekt mellom følgjande posisjonar: 60° 52.181' N, 7° 07.446' Ø og 60° 52.235' N, 7° 08.502' Ø.» This translates to: «5 knots is the maximum permitted speed in the following waters: Inner part of the Aurlandsfjord, south of a line drawn between the following positions: 60° 52.181' N, 7° 07.446' Ø and 60° 52.235' N, 7° 08.502' Ø.»

3.6.5 ProhibitedAreaBoundary

Definition	Boundary to delimit *ProhibitedAreaBoundary*.
Geometry type	GM_Curve
Registration method	Single point in sequence
Registration description	The area/boundary must correspond to the coordinates or the area description in the regulations. These are areas that are subject to prohibition, such as e.g., use of personal watercraft. Field surveying is not expected, boundaries can be digitalized or registered using map/GIS. Costal contour from *FKB Vann* or the quay front can be used as demarcation towards land. Register information in the required attribute fields and any other available information. The authority that lays down the regulation is responsible for the areas being registered and mapped in Port data.
Accuracy requirement	100 cm
Associations	Delimits ProhibitedArea. The feature type inherits attributes from CommonPropertiesRequired.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6)		[1..1]
..OBJTYPE	ProhibitedAreaBoundary	Character String	[1..1]
boundary	Line segment that delimit an area.	GM_curve	[1..1]

3.6.6 ProhibitedArea

Definition	Area that are subject to prohibition, such as prohibition for personal watercraft in certain areas.
Geometry type	GM_Surface, GM_Point
Registration method	Single point (surface information)
Registration description	Registered as a single point within *ProhibitedAreaBoundary*. Register information in the required attribute fields and any other available information.
Associations	Delimited by ProhibitedAreaBoundary. The feature type inherits attributes from CommonPropertiesRequired, CommonPropertiesOptional and CommonPropertiesRegulations.

Attributes specific for the feature type:

Attributes	Description	Date type	Multiplicity
CommonProperties	See chapter 3.1 (table 6 and 7)		[1..1]
CommonPropertiesRegulations	See chapter 3.6.2 CommonPropertiesRegulations		[1..1]
..OBJTYPE	ProhibitedArea	Character String	[1..1]
typeOfProhibition	Type of prohibition.	Code list	[1..1]
position	Optional point of representation.	GM_Point	[0..1]
area	Polygon showing geographical extent.	GM_Surface	[1..1]

Code list Type of prohibition

Type of prohibition

Code	Description
anchoring	Anchoring prohibited.
other	Other type of prohibition.
diving	Diving prohibited.
traffic	Traffic prohibited.
fishing	Fishing prohibited.
snowDumping	Snow dumping prohibited.
discharge	Discharge prohibited.
unknown	Unknown prohibition.

Figure 44: Example of a prohibited area in Oslo municipality. From the regulation: «Diving in the following areas requires a permit from port of Oslo: Kongen marina (N 59° 54,6' Ø 010° 42,4') to Skurvegrunnen light buoy (N 59° 53,97' Ø 010° 42,08') over Kavringsanden (N 59° 54,21' Ø 010° 43,32') to the quay at the north side of Hovedøya (N 59° 53,94' Ø 010° 43,84') from Sandtangen light (N 59° 53,7' Ø 010° 44,55') to Bleikøya light (N 59° 53,48' Ø 010° 44,59'), from the range markers on Bleikøya's south eastern side (N 59° 53,37' Ø 010° 44,6') to Sjursøya's south western point (N 59° 53,16' Ø 010° 44,73') and to Raudskjær (N 59° 52,42' Ø 010° 45,21'), further to Ormsund (N 59° 52,8' Ø 010° 45,8').»

4 Appendix A, Mapping methods

The appendix describes various cartographic methods that can be used in connection with the registration of port data. See chapter 2.1.3 Data capture for general guidelines and requirements for data capture.

Surveying is the method that gives the most accurate results. It is particularly flexible to register port data with land surveying together with a representative from the port. You then can register some of the attribute information directly in the field.

Laser scanning with a car or drone (mobile mapping) produces high definition point clouds – a detailed 3D model of the port, where the objects can be retrieved. The point cloud have several application areas in addition to being used as a data capture method for port data. Photogrammetry can be used where land surveying is not a requirement. Photogrammetry is an appropriate data capture method in areas where there are many objects to be measured.

Bathymetric data or depths is not part of the port data standard and is therefore not discussed here in more detail. However, good and accurate depths in the harbour basin are important. For depth surveying of the seabed in the harbour basin, use an approved surveying company, which is certified by the Norwegian Hydrographic Service. Bathymetric data collected by certified companies can be used by the Norwegian Hydrographic Service in official navigational charts and other navigational publications. Read more about the approval scheme for seabed mapping here. Here is also an overview of which companies that are certified.

See also Standarder for geografisk informasjon, for national industry standards for maps, surveying and geographic information.

4.1 Surveying

Land surveying is a very accurate method for digital data capture, which is used if the accuracy requirements for the feature types are high. In surveying the earth's surface and elevation are measured and calculated. This involves determining coordinates in the terrain using advanced instruments. Advanced technical equipment is used, such as levelling binoculars, satellite receivers, total stations and laser scanners.

Until recently, this has mostly been done with angle and distance-determining binoculars (theodolites, total stations etc.). Today, it is mostly carried out with GPS-based instruments in combinations with total stations.

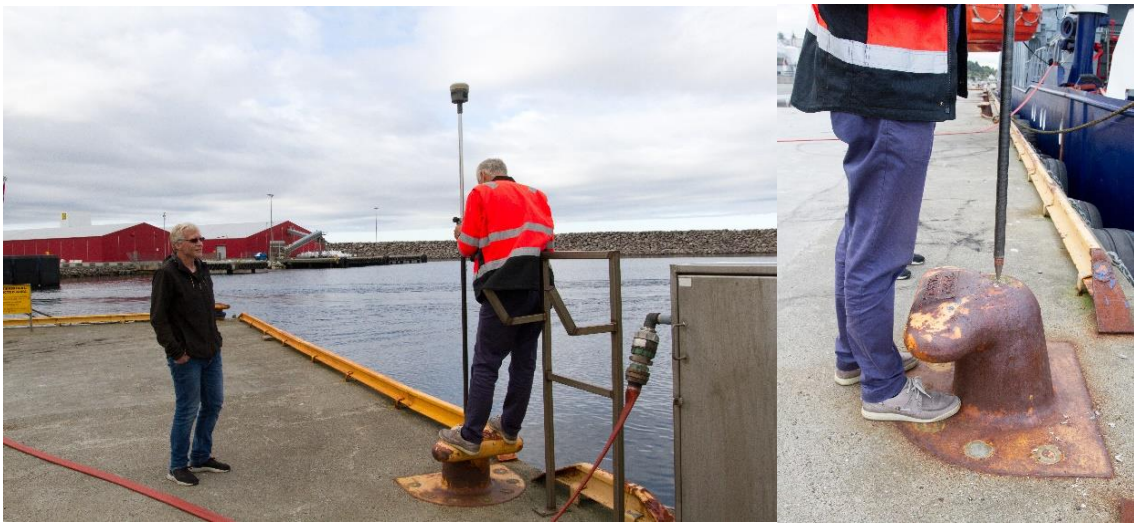


Figure 45: Surveying in the port of Sirevåg.

Surveying with GPS

Global Positioning System (GPS) is a satellite-based system for determination of location and is a simple and fast method for measuring objects in the field. With GPS you will quickly locate points, lines and surfaces with high accuracy. There must be a direct line of sight between the satellites and the receiver.

Figure 46: Surveying, The Norwegian Mapping Authority (photo: Morten Brun).

4.2 Measurement with laser data

Today drones is frequently used by consulting companies to do laser scanning of the terrain. Laser scanning can also be done from an airplane or with mobile mapping from a car.

Figure 47: Data capture with mobile mapping in the port of Kristiansand (Photo: Norkart, 2020).

Mobile mapping with laser scanner mounted on a vehicle is an efficient method for gathering large amounts of data. The result is a detailed point cloud, which is georeferenced. The point cloud from the laser scan forms the basis for digitizing the objects in the port. The advantage with this method for data capture, is that the measurement itself can be carried out quickly, while a large part of the work can be carried out in the office. This method also makes it possible to quickly register new objects directly from the 3D point clouds.

The laser scan gives you a detailed 3D model of the port, that have several application areas in addition to being used as a data capture method. The point clouds will be distributed at høydedata.no.

4.3 Photogrammetry

Photogrammetry is a common source for data capture of larger scale and will therefore be suitable for mapping larger harbour areas with large amounts of data. Here photographic images is used to create a geometrical reconstruction of an object in 3D. In simple terms it can be described as mapping with aerial photos. The method is widely used for new mapping and large-scale update mapping. The aerial photographs are taken so that they overlap each other. By processing the images in pairs in a stereo instrument, you get a stereo view and can process the data in 3D. This is used to measure and map the objects' size and location. By using special computer, maps of the objects can then be constructed. To achieve 100 % completeness of the data, inspection and supplementary surveying will be necessary. Inspection can also be used to confirm the correct indication of various attribute values.

- **Advantages**: It is a more efficient method than land surveying and is well suited for the reconstruction of a larger number of objects.
- **Sources of error**: Some objects are too small to be shown in the aerial images. These must be marked with signal plates in the terrain before flying. You do not get the same level of accuracy as with land surveying. Accuracy in photogrammetry will partly depend on image resolution. Accuracy in FKB-A/ FKB-B is respectively 15 cm/ 20 cm for precise objects such as *Fortøyningskar* (FKB BygnAnlegg 4.6). For measuring the quay front and mooring facilities, land surveying should be used to achieve the accuracy requirement of 10 cm.

Digitization from orthophoto: Digitization on screen from orthophoto is not the same as photogrammetry and does not provide same level of accuracy. If older registrations have been made using this method, it is important that the correct code for this is entered for the attributes *data capture method* and *position quality* of the objects in question.

4.4 Outdated and inaccurate methods

The port administration in a port have many older or inaccurate records of objects and data from their port. Much of the information have been stored in PDF-documents or Excel sheets, and not drawn on a map. The data also come in many different formats, as there has not been a standard to adhere to when previously making requirements for measurements.

4.4.1 Digitalization from PDF-document

Many ports have stored information about their objects and facilities in PDF-documents. Digitization from a georeferenced PDF have sometimes been necessary to quickly get the data into the map base. If this is the case, it is important that this information get captured in the attributes for the objects in question. Having data is better than not having it, but its accuracy must be described, and inaccurate data must be replaced as soon as possible. The port data or information in the PDF-documents are often surveys that have been ordered and measured by different consulting firms that use different formats. There can be detailed descriptions and drawing of the various port objects in a map, but this usually have a relative and not geographical coordinates.

To get the objects registered from the PDF-document, the attached map in the document has often been georeferenced before the object(s) have been digitized on the screen in a map tool. This method should not be used for registration of port data in ports in the future, as it does not provide an accurate enough registration.

4.4.2 Data capture with GPS on a mobile phone

It can be tempting to use GPS on a mobile phone in connection with data capture, but this will give a very inaccurate result. It should possibly only be used as a temporary registration of point objects that is located at the quay, until the exact registration of the port objects is done. Objects such as quay fronts and mooring devices must NOT be measured using this method. If any object initially is measured with GPS on a mobile phone, it is important that this information is given in the attributes of the objects (data capture method), and that you have a specific plan for when the accurate registration is to be carried out.

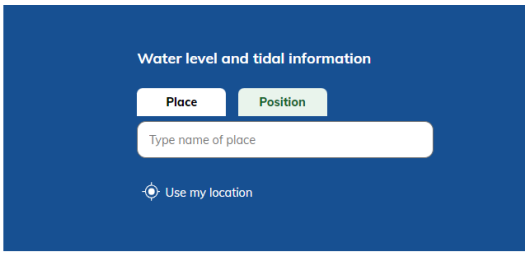
5 Appendix B, Calculation of height above chart datum

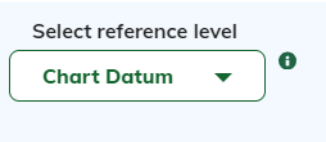
For certain feature types the attribute *heightAboveChartDatum* must be registered. This value must be calculated. This is done with the following formula:

Height of quay above chart datum = *z-value* + *NN2000 relative to chart datum*

- *z-value* = measured height of the object, above NN2000 (Norwegian Vertical datum of 2000).
- *NN2000 relative to chart datum* = the difference between the zero point for NN2000 and chart datum.

You can find *NN2000 relative to chart datum* for the port in question by searching for the port at kartverket.no/sehavniva:





- Find the specific port or place.
- Scroll down in the list of different levels, check if chart datum is selected as the reference level in the menu.
- Read the value for NN2000. This is the *NN2000 relative to chart datum* for this port.

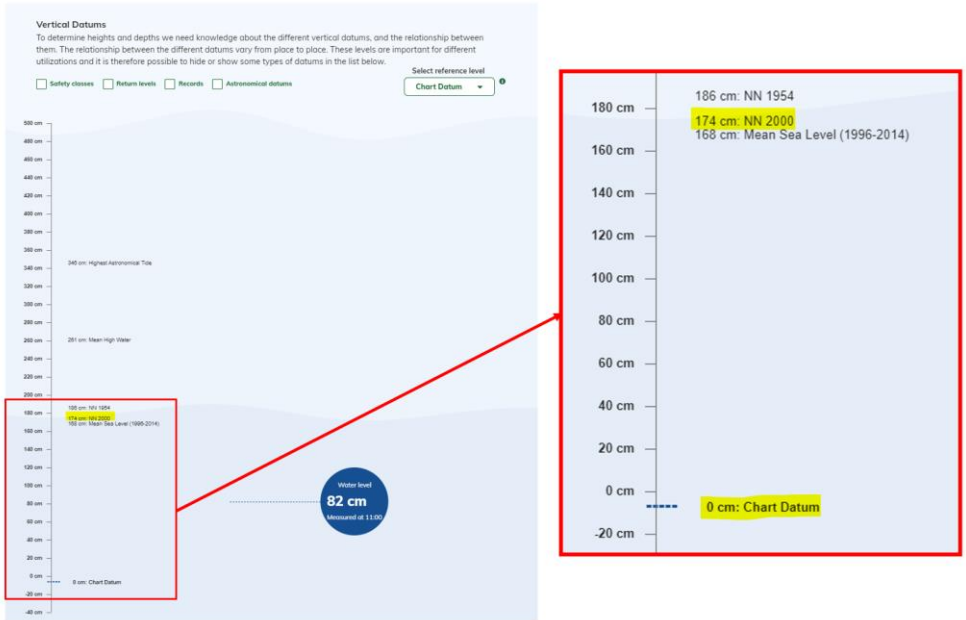


Figure 48: The picture illustrates how to find NN2000 relative to chart datum for a particular port.

Height above chart datum for the object will then be: *z-value* + *NN2000 relative to chart datum*.
Example: A quay with a height of 1 m (z-value) for this port, where *NN2000 relative to chart datum* = 1.74 m, will then have a height above chart datum of 2.74 m.

NN2000 relative to chart datum is precisely determined for ports where the Norwegian Mapping Authority has a permanent water level gauge, that is part of the permanent network of water level stations. See overview over where the permanent water level stations is located. For other ports that do not have a permanent water level gauge, the NN2000 relative to chart datum is calculated based on models and has a non-negligible uncertainty.

6 Appendix C, Abbreviations

FKB: Felles Kartdatabase. Common map database. The database contains some of the most detailed topographical data in Norway. Hosted by the Norwegian Mapping Authority.

GLN: Global Location Number. Global number system for identification of legal entities and physical locations, managed by GS1.

GPS: Global Positioning System

IMO: International Maritime Organization

ISPS: International Ship and Port Facilities Security Code. International regulations for the security of ships and facilities in port.

MRN: Marine Resource Name. Id-system for unique identification of maritime resources on a global level.

NGIS: Nasjonalt geografisk informasjonssystem. National geographical information system. A platform where geographical data is managed and updated in a central database, hosted by the Norwegian Authority. The database gives all users access to updated and quality-assured data.

PSFO: Port Facility Security Officer. All port facilities that are approved to receive ISPS ships are obliged to have a security officer.

SFKB: Sentral Felles Kartdatabase. Central common map database. Management system where municipalities, the Norwegian Mapping Authority and other parties update geographical data (FKB) directly in a common database.

SOSI: Samordnet Opplegg for Stedfestet Informasjon. Systematic Organization of Spatial Information. Norwegian geospatial vector data format used for exchange of geographical information.

SSN: Safe Sea Net, is the national single window ship reporting system where vessel can report mandatory arrival and departure information to Norwegian authorities and ports. Managed by the Norwegian Coastal Administration.

SSR: Sentralt stedsnavnregister. Central Placename registry. A register of Norwegian place names in public use.

UNLOCODE: United Nations Code for Trade and Transport Locations. The UN code for trade and transport locations, which is used in trade and transport with functions such as ports, railways, and road terminals etc.

URI: Uniform Resource Identifier. Unique sequence of characters that identifies a logical or physical resource.

UTM: Universal Transverse Mercator

UUID: Universally unique identifier