Input paper for consideration by S-100WG

Portrayal of complex data structures and pick reports

Submitted by:	NIPWG Task group on Portrayal of Complex pick reports
Executive Summary:	S-100 based nautical publication product specifications include complex attribute and relationships for data that do not lend itself well to basic pick report visualization. This paper highlights some of these challenges and proposes some options for how to address these.
Related Documents:	NIPWG10-08.2A (S100WG8 6.10) (Complex Portrayals and Pick Reports)
Related Projects:	S-100, S-98, IHO S-100 Product Specifications

Introduction

Following several discussions of structured pick reports, NIPWG established a task group on complex pick reports at NIPWG 10. The aim of this task group was to:

1. Identify use-cases where additional functionality for portrayal of pick-reports is needed.
2. Provide visual samples or descriptions to support development of complex portrayal.
3. Consider available short-term solutions and priorities.

The initial aim was to produce visual samples of complex portrayal, showing how the mariner would like to see complex information in NIPWG S-100 datasets displayed. These samples would support NIPWG input on Complex Portrayal to the S100WG. During the discussions it became clear that the most limiting factors in such portrayal are actually the technical aspects consisting of the absence of available functionality in S-100 to specify the construction of pick report content and structure from S-1xx datasets. This paper reports the identified use-cases and related discussions. It supplements the discussions of technical factors in the paper NIPWG10-08.2A (Complex Portrayals and Pick Reports) which is being submitted as a companion paper to the S-100 WG at this meeting.

Background

The paper NIPWG10-08.2A on Complex Portrayals and Pick Reports explains the problem related to complex portrayal in more detail. In short, S-100 introduced complex attributes, information types and feature and information associations. These additions have resulted in more complex data structures than those present in S-57. Portrayal of such complex structures using simple "name-value pairs", common to the S-57 ECDIS pick-reports, will produce results that are difficult for mariners to understand.

The above paper describes three options for solutions to the problem:

1. Additional static (HTML) support files are provided together with the dataset.
2. New Portrayal rules in XSLT or LUA to dynamically generate the pick-reports.
3. Templates (a combination of static templates and dynamic population by rules).

The recommended long-term solution (3) is to define Templates as part of the Portrayal Catalogue of each Product Specification.

An interim solution was mentioned at NIPWG 10, in the form of defining “system attributes” containing pre-generated and pre-formatted content, generated from attribute values of the owning feature as well as related features/information types, and directing ECDIS (in S-98) to display this as the pick report when the owning feature (features? Information types?) are “picked” by the mariner.

The solution, whether interim or not, would ideally work, or at least be conceptually the same, for all three data formats described by S-100 – ISO 8211, GML, and HDF5.

Additional to the solutions above, it was also discussed, that many of the NIPWG Product Specifications include the options to add narrative text using *textContent* and *information* attributes, even this is not the recommended solution.

S-52 describes the pick-report functionality as information that should be displayed on demand. This information could be displayed on the chart display or on an additional graphic or text display. Information to be shown include "*object description and associated attributes in human readable language".*

S-98 version 1.0.0 05/2022 describes pick reports in S-98 “Main” clause 10.12 and “Annex C” clause C-15. S-98 “Main” clause 10.12 states that pick reports may be specified in the individual Product Specifications, and later reused within an Interoperability Catalogue. Clause C-15 in Annex C describes common principles for pick reports applying to all Product Specifications, and makes a start at defining a common format for some cases (e.g., tidal streams, which are expected to be common to S-101 and S-111). A future version of S-98 could define either:

1. General rules that that would work similarly for all Product Specifications.
2. A machine readable styling rule implementation, which can be customized by each Product Specifications. (= an Extension to Portrayal Catalogue functionality)

S-98 recognizes the need for data organization to support navigation through complex structures. This navigation could include expandable tree controls or tabs. Especially when combining pick reports from data in several Product specifications, the amount of data could be substantial. Within combined pick-reports, it should be clear to the user from which product each attribute is retrieved.

Extensive use of the associations available in NIPWG Product Specifications might produce large and complex data structures also within a Product Specification, even if interoperability was not used.

Analysis/Discussion

Following FeatureTypes were identified as needing Complex portrayal, and were further discussed in the NIPWG task group established following NIPWG 10:

- ServiceHours (including scheduleByDayOfWeek)
- ContactDetails
- textContent (including information) and featureName
- Regulations (also Recommendations, Restrictions etc.)
- Applicability association

Additionally, a few features not used by NIPWG product specifications were considered:

- Time series of water level data (S-104)
- Tidal stream panel (table of speed and direction)(S-101).

The group noted previous input on S-104 data visualization, and the ongoing discussion on the feature Tidal Stream Panel, but took no further actions.

- https://github.com/iho-ohi/98-interoperability/issues/9
- https://github.com/iho-ohi/S-101-Documentation-and-FC/issues/85

In addition to selected structures, additional portrayal consideration might be needed to support:

- Filtering by context parameters and language-specific settings
  - Language of the user interface and Feature catalogue
  - Languages available in the dataset
  - Additional context parameters needed for filtering (for example vessel dimensions and particulars for information type *Applicability*)
- Long chains of Feature- and Information- associations possible in S-12X and S-131
- Additional volume of information using interoperability between S-100 layers
- Attribute ordering or suppressing of attributes.
  - S-57 category C- attributes were brought up. These are displayed only by user specific request. A similar construct is not available in S-100.

Some examples of nautical publication information that require complex portrayal are shown in Annex A.

Conclusions

NIPWG S-100 datasets consist of information traditionally included in publications, that is encoded into data-centric structures. The encoded data should be machine-readable to support combination, filtering and display of relevant data based on the user needs in different situations, such as route monitoring and route planning. Information should also be easily comprehensible by the mariner, and therefore preferable displayed in a familiar way.

Portrayal rules and best practices for display of complex information within pick reports are currently not available, and there is no easy way for a data producer to consider or test data usability and display. In order to support the data production process, S-98 Annex C should further define the functionality and capability to be supported by the pick report functionality. Without further definition of common guidelines, complex portrayal cannot be further specified not prototyped and considerations cannot be further reflected in DCEG of Product Specifications, nor considered by data producers.

Context parameters allow filtering of data. Availability of context parameters will determine how data can be filtered and whether some attributes could be displayed on request only. Context parameters are listed in the IHO GI Registry. Product Specifications should address which context parameters are available, and what are the fallback arrangements if parameters are not available.

Complex structures are re-used in several different contexts and product specifications. At least one of the identified complex structures, *ServiceHours* is used in S-101. If templates and rules are built in such a (modular) way that structures within separate context can be processed, it might provide a lighter set of rules and templates.

Examples:

- *information* is often wrapped in *textContent* but sometimes also used as a standalone construct

- *scheduleByDayOfWeek* is often wrapped within a *ServiceHours* structure, but also used as a standalone construct in *telecommunications*
- *ServiceHours* was defined for use in NIPWG product specifications but afterwards also adopted in S-101.

Actions Requested

The S-100 WG is invited to:

a. note this paper

b advise on specification and prototyping of complex portrayal

c advise on other use-cases for complex portrayal

d advise on technical feasibility of solution approaches paraphrased in the background section including the interim solution and document extensions needed in S-98

e ensure that the solution works for other data formats than Part 10b GML (specifically, ISO 8211 and HDF5 formats).

Annex A – Examples in various degree of development

ServiceHours

A sample and further description of portrayal of schedules and service hours is available in S-131 Product specification.

Operations	Days	Times	Notes
(Table sub-header, from *featureName* if present - omit this row if *featureName* is not present) Links to other unusual attributes like source and graphic can be included here.			
Normal, Closed, Unmanned OR other: abcde Attribute *categoryOfSchedule* From *ServiceHours* Date ranges *fixedDataRange*, *periodicDateRange*	(Day(s) of week) DoW (single day) OR DoW - DoW (if *dayOfWeekIsRange* = *true*) OR DoW, DoW (if *dayOfWeekIsRange* = false)	(Times of day) hh:mm–hh:mm hh:mm–hh:mm ... *timeOfdayStart*, *timeOfDayEnd*	(Additional information) *complex attribute information*
(repeat according to multiplicity of scheduleByDayOfWeek)			
Exceptions *NonStandardWorkingDay* associated to the above *ServiceHours*	(fixed and variable date(s) from *dateFixed* or *dateVariable*)		(Additional information) *complex attribute information*
(repeat both rows above, according to multiplicity of ServiceHours associated to the feature or information type)			

ContactDetails

Sample data encoded into the format of S-127 datasets, was discussed. It was noted, that *Contact details* provide radio, postal, online and telecommunication service contacts in one common structure. It was concluded, that not all attributes are needed for display, and there might be a need to either split data into separate logical instances of Contact details, or filter / group data to be displayed in the pick-report.

The task group members provided additional samples of how Contact Details are used in publications today.

- theContactDetails
  - ContactDetails
    - featureName
      - language = **EN**
      - name = **West Coast VTS Contact details**
    - callName = **West Coast VTS**
    - categoryOfCommPref = **preferred calling**
    - communicationChannel = **9**
    - communicationChannel = **16**
    - contactAddress
      - deliveryPoint = **Turunkatu 123**
      - deliveryPoint = **PBOX123**
      - cityName = **Turku**
      - countryName = **FINLAND**
      - postalCode = **012345**

    - contactInstructions = **West Coast VTS can be contacted on VHF channels 9 (or 16), email westcoast.vts@fintraffic.fi and phone +358 20 448 6645. Please note that all phone calls will be recorded.**
    - frequencyPair
      - frequencyShoreStationTransmits = **2177**
      - frequencyShoreStationReceives = **2189**
      - contactInstructions = **MF 2189,5 KHz (ship transmit)/ 2177 KHz (ship receive).**
    - information
      - text = **All phone calls will be recorded.**
    - onlineResource
      - linkage = **https://www.fintraffic.fi**
      - protocol = **https**
      - onlineResourceDescription = **The webpage of the contact.**
      - onlineFunction = **browsing**
      - protocolRequest = **GET**
    - telecommunications
      - telecommunicationIdentifier = **westcoast.vts@fintraffic.fi**
      - telecommunicationService = **email**
    - telecommunications
      - telecommunicationIdentifier = **supervisors.west@fintraffic.fi**
      - telecommunicationService = **email**
    - telecommunications
      - telecommunicationIdentifier = **+358 20 448 6645**
      - telecommunicationService = **voice**
    - telecommunications
      - telecommunicationIdentifier = **+358 20 448 6522**
      - telecommunicationService = **voice**

Figure 1 Sample of S-127 Contact Details data structure where most optional attributes are included, and without additional formatting.

- onlineResource
  - linkage = **https://www.fintraffic.fi**
  - protocol = **https**
  - onlineResourceDescription = **The webpage of the contact.**
  - onlineFunction = **browsing**
  - protocolRequest = **GET**
- telecommunications

Figure 2 Online resource attributes in S-127. Those marked with blue are not necessarily needed by end user. Linkage, online function and description might be useful. In case data services such as FTP, WFS etc. are encoded, this data might be needed to access the service, but this would in most cases be irrelevant for an onboard ECDIS-user.

CONTACT DETAILS:

Southampton Vessel Traffic Service (VTS)
Call: Southampton VTS
VHF Channel: Ch 09 12 14 20
Telephone: +44(0)23 80608208 (VTS Data Centre, Mon-Fri 0900-1700 LT. Other times VTS Ops Room)
E-mail: vtssouthampton@abports.co.uk
Website: www.southamptonvts.co.uk

King's Harbour Master (KHM), Portsmouth
Call: King's Harbour Master (KHM)
VHF Channel: Ch 11 13 71 74
Telephone: +44(0)23 92723694 (KHM Supervisor)
E-mail: portsmouth@khm.mod.uk
Website: www.royalnavy.mod.uk/khm/portsmouth

Solent Coastguard
Call: Solent Coastguard
VHF Channel: Ch 16; 67
Telephone: +44(0)23 92552100

CONTACT DETAILS:

Bristol VTS
Call: Bristol VTS
VHF Channel: Ch 12
Telephone: +44(0)117 9802638
E-mail: bristolvts@bristolport.co.uk
signal.station@bristolport.co.uk (Electronic documentation)

Newport Radio
VHF Channel: Ch 71

Sharpness Radio
Call: Sharpness Radio
VHF Channel: Ch 13; 09 13

HOURS: H24

HARBOUR/MARINA	VHF RADIO CHANNELS	AREA DIALLING CODE	TELEPHONE NUMBER	WEB ADDRESS
Lymington Yacht Haven	37/80	+44(0)1590	677071	www.yachthavens.com
Lymington Marina	80	+44(0)1590	647405	www.berthon.co.uk

UNITED KINGDOM

Estuary Sector (Seaward limit of VTS Area to Sea Reach No 4 Lt buoys (N and S))
VHF Channel: Ch 18 (Secondary) 69 (Main)

River Sector (Sea Reach No 4 Lt buoys (N and S) to Crayford Ness)
VHF Channel: Ch 20 (Secondary) 68 (Main)

Emergency
VHF Channel: Ch 16; 67

Chief Hr Mr
Telephone: +44(0)1474 562268
+44(0)1474 562266 (Deputy)

Hr Mr (Lower Thames)
Telephone: +44(0)1474 562212

(2) Thames Barrier Navigation Centre
Call: London VTS
Telephone: +44(0)20 32607711
Fax: +44(0)20 88547422

Barrier Sector (Crayford Ness to Teddington Lock)
VHF Channel: Ch 14 (Main) 22 (Secondary)

Emergency Only
VHF Channel: Ch 16; 67

Hr Mr (Upper Thames)
Telephone: +44(0)20 7437906

(3) AIS: London VTS operates an AIS Network of 5 active base stations and 1 passive base station. For AIS addressed messages, send to the group MMSI: 002320900

HOURS: H24

PROCEDURE:

Figure 3 Sample of contact details in UK Publications and nautical charts

3.6.3.1 Contact/Delivery of Safety Advisory

If contact cannot be made with Iqaluit MCTS Centre, either directly or through another ship, the vessel shall broadcast her position to advise any vessels in the area.

Iqaluit MCTS Centre

Telephone: 867-979-0310
Facsimile: 867-979-4264

Telex (Telefax): 063-15529
Telegraphic Identifier: NORDREG CDA

Email: Iqamck01@innav.gc.ca (West)
iqanordreg@innav.gc.ca (East)

3.8.3.11 NORDREG Report Delivery

NORDREG reports shall be sent to:

Iqaluit MCTS Centre

Operational from approximately mid-May to late December.

Telephone: 867-979-5724
Facsimile: 867-979-4264

Telex (Telefax): 063-15529
Telegraphic Identifier: NORDREG CDA

Email: IQANORDREG@INNAV.GC.CA

Prescott MCTS Centre

Operational from approximately late December to mid-May.

Telephone: 613-925-4471
Facsimile: 613-925-4519

Email: IQANORDREG@INNAV.GC.CA

All vessels should maintain a continuous radio watch on the Western Arctic Emergency and Calling Frequency, 5803 kHz (SSB), from the time that they reach the first reporting point previous to entering a danger area until the time that they report clear of the danger area.

If contact cannot be made with the Iqaluit MCTS Centre on 5803 kHz, VHF Ch16 (156.8 MHz) may be used where available either directly or through another ship, for possible relay to the Iqaluit MCTS Centre.

The Safety Advisory calls should consist of the following information:

Figure 4 Sample of contact details in Canadian nautical publications.

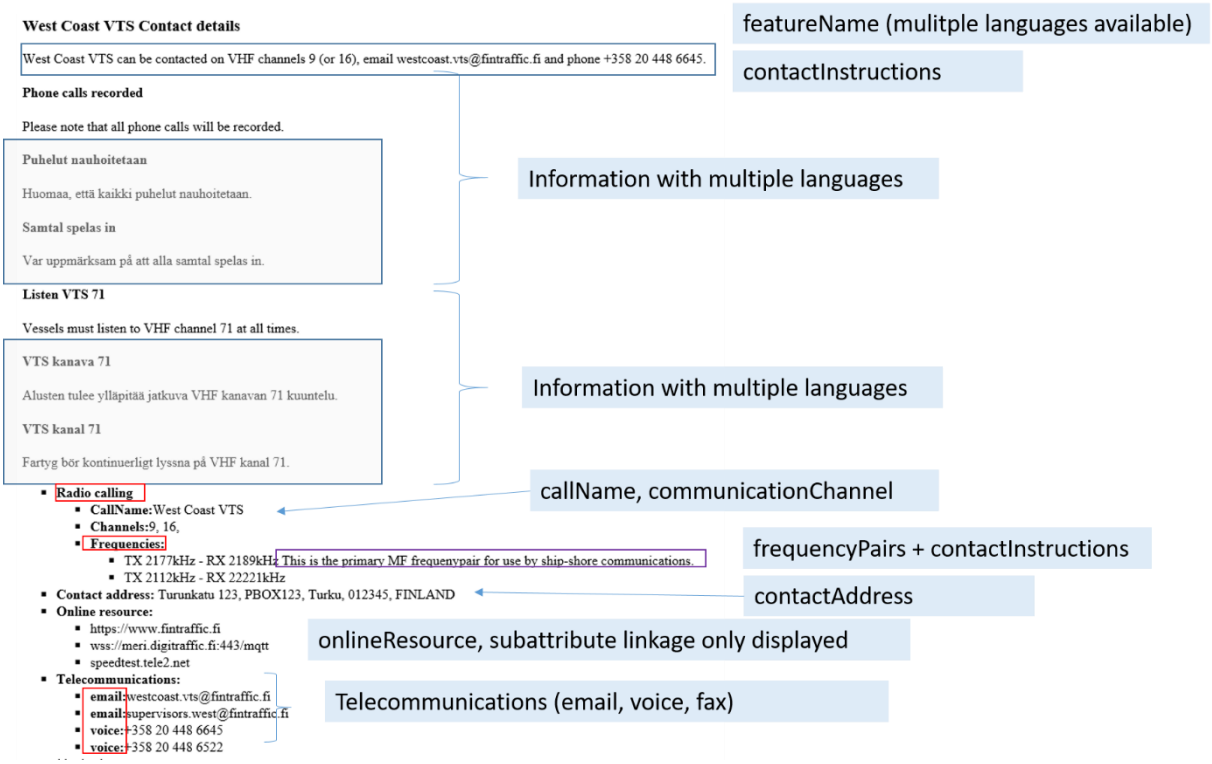


Figure 5 A slightly formatted sample of structured Contact details, including multiple languages and some custom grouping / formatting. Language specific content should be filtered based on language selection, in a final output.

Notes on the above figure;

- ContactDetails are grouped into main logical groups;

    1. RadioCalling (VHF and MF/HF frequencies)
    2. Contact address
    3. Online resources
    4. Telecommunications

- Contact details contain language-specific and common narrative content;
    - featureName and information support multiple languages
    - contactInstructions does not support multiple languages
    - Language-dependent content should be filtered by context parameter
- Of Online resource structure, only subattribute "linkage" is displayed
    - The third entry (speedtest.tele2.net) is encoded as an FTP-server for file upload, which is not clear by the displayed data only.
    - Possible need to filter data for ECDIS pick report, to only display some online resources (such as entries supporting "browsing").
- Some of the sub-headers used for the grouping of the sample (red boxes) are hardcoded into the sample, or retrieved from enumeration-values within the dataset.
    - There might be no language-specific translations available for these.

- telecommunications
  - categoryOfCommPref = preferred calling
  - telecommunicationIdentifier = +358 20 448 6645
  - telecommunicationService = voice
  - scheduleByDayOfWeek
    - categoryOfSchedule = normal operation
    - timeIntervalsByDayOfWeek
      - dayOfWeek = Sunday
      - dayOfWeek = Saturday
      - dayOfWeekIsRange = true
      - timeOfDayStart = 00:00
      - timeOfDayEnd = 24:00
- telecommunications
  - categoryOfCommPref = alternate calling
  - telecommunicationIdentifier = +358 20 448 6522
  - telecommunicationService = voice
  - scheduleByDayOfWeek
    - categoryOfSchedule = normal operation
    - timeIntervalsByDayOfWeek
      - dayOfWeek = Monday
      - dayOfWeek = Friday
      - dayOfWeekIsRange = true
      - timeOfDayStart = 08:00
      - timeOfDayEnd = 16:00

Figure 6 Telecommunications portrayal is further complicated by the fact, that each telecommunications- object can be given a preference and a scheduleByDayOfWeek. The figure above displays the preferred calling option, available 24/7 and a alternative option available during office hours only.

Within Contact details, each telecommunications can display preference and a separate schedule. Seasonal changes in the contact details, such as shown in the Canadian sample above, would most probably be encoded as (seasonal) ServiceHours of separate Authority-features.

3.8.3.11 NORDREG Report Delivery

NORDREG reports shall be sent to:

Iqaluit MCTS Centre

Operational from approximately mid-May to late December.

Telephone: 867-979-5724
Facsimile: 867-979-4264

Telex (Telefax): 063-15529
Telegraphic Identifier: NORDREG CDA

Email: IQANORDREG@INNAV.GC.CA

Prescott MCTS Centre

Operational from approximately late December to mid-May.

Telephone: 613-925-4471
Facsimile: 613-925-4519

Email: IQANORDREG@INNAV.GC.CA

Figure 7 Sample showing that one report is sent to different Authorities based on season.

- **Telecommunications:**
  - **email:**westcoast.vts@fintraffic.fi (preferred working)
  - **email:**supervisors.west@fintraffic.fi (alternate working)
  - **voice:**+358 20 448 6645 (preferred calling)
    - normal operationSunday to Saturday , 00:00 to 24:00
  - **voice:**+358 20 448 6522 (alternate calling)
    - normal operationMonday to Friday , 08:00 to 16:00

Figure 8 The above sample with additional formatting to display preference and schedule.

Comparing the above samples of contact details to the samples used in existing nautical publications, it seems that additional formatting and structuring of the data to support readability would be needed.

textContent / information / featureName

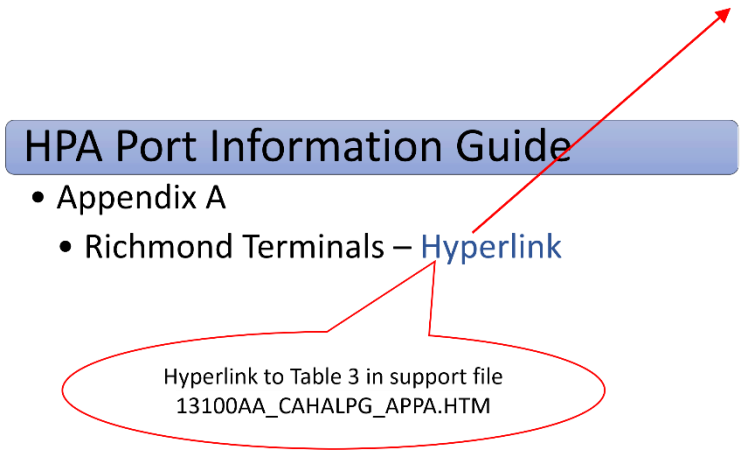
Sailing directions may provide information in structured form (tables, bulleted or numbered lists, etc.), which may be taken as guidance for online display of the S-131 equivalents, since mariners may be familiar with the structure of similar information in printed or digital publications. (*Source S-131*)

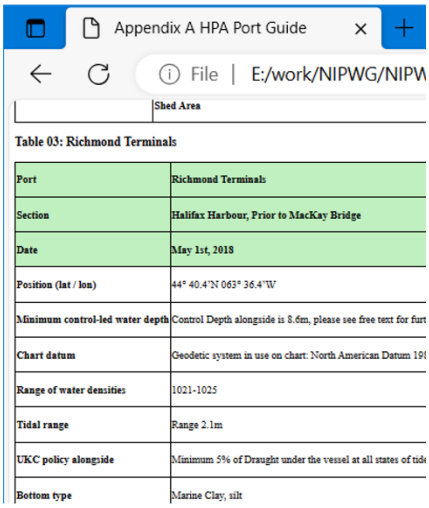
Sample of portraying S-131 textContent with referenced support file. TextContent contains an information structure, which can contain file-references and language specific content. Also featureName contains language specific information. S-131 states that the attribute *language* is intended to allow the portrayal implementation to select instances of information types or complex attributes according to the user's preferred language.

SignalStationTraffic
featureName:
displayName: true /displayName:
language: deu
name: Deichbrücke
textContent:
information:
fileReference: support/BrueckenSperrwerksSchleusensignaleAbschn19SeeSchStrO.png
headline: bridge, flood barrage and lock signals
language: eng
text: request lock operation
categoryOfSignalStationTraffic: traffic control light
status: permanent

Figure 9 Sample data showing language specific information.

```
<S131:textContent>
    <S131:information>
     <S131:fileLocator>table03</S131:fileLocator>
     <S131:fileReference>file:/13100AA_CAHALPG_APPA.HTM</S131:fileReference>
     <S131:headline>HPA Port Information Guide</S131:headline>
     <S131:headline>Appendix A</S131:headline>
     <S131:headline>Richmond Terminals</S131:headline>
    </S131:information>
</S131:textContent>
```

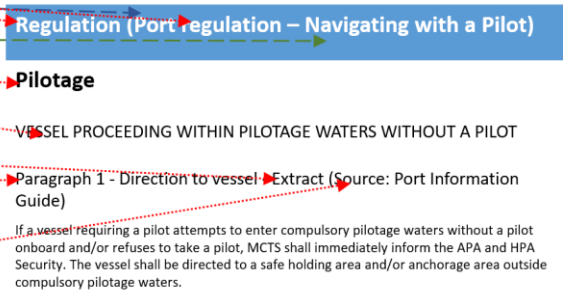




Regulations (also Recommendations, Restrictions etc.)

Sample of portrayal Regulations in S-131.

```
<S131:Regulations gml:id="AA.CAHAL.Regulations.11.3.12.1">
   <S131:categoryOfAuthority code="4">Port</S131:categoryOfAuthority>
   <S131:rxNCode>
    <S131:actionOrActivity code="1">Navigating With a Pilot</S131:actionOrActivity>
    <S131:headline>Pilotage</S131:headline>
    <S131:headline>VESSEL PROCEEDING WITHIN PILOTAGE WATERS WITHOUT A
PILOT</S131:headline>
   </S131:rxNCode>
   <S131:textContent>
    <S131:categoryOfText code="2">Extract</S131:categoryOfText>
    <S131:information>
     <S131:headline>Paragraph 1 - Direction to vessel</S131:headline>
     <S131:text>If a vessel requiring a pilot attempts to enter compulsory pilotage waters
without a pilot onboard and/or refuses to take a pilot, MCTS shall immediately inform the APA
and HPA Security. The vessel shall be directed to a safe holding area and/or anchorage area
outside compulsory pilotage waters.</S131:text>
    </S131:information>
    <S131:source>Port Information Guide</S131:source>
    <S131:sourceType code="9">Industry Publications and Reports</S131:sourceType>
   </S131:textContent>
  </S131:Regulations>
```



Applicability association

The information type **Applicability** may be displayed in either text or tabular form. Further description is available in S-131. Ship particulars etc. are needed as context parameters to support filtering of data.

<table>
<tr><td>When ALL conditions satisfied</td><td>Vessel type: other: all types including tug and tow
<table><tr><th>Dimension</th><th>compared to</th><th>Limiting value</th></tr><tr><td>length overall</td><td>greater than or equal to</td><td>50 metre</td></tr><tr><td>length overall</td><td>less than</td><td>90 metre</td></tr><tr><td>draught</td><td>greater than or equal to</td><td>6 metre</td></tr></table></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>When ALL conditions satisfied</td><td>Vessel type: other: all types including tug and tow
<table><tr><th>Dimension</th><th>compared to</th><th>Limiting value</th></tr><tr><td>length overall</td><td>greater than or equal to</td><td>50 metre</td></tr><tr><td>draught</td><td>greater than or equal to</td><td>4 metre</td></tr></table>
Miscellaneous conditions: When restricted visibility exists</td></tr>
</table>

Figure 10 Sample table display of applicability.