**S-101PT10-07.6**

**Paper for Consideration by S-101PT**

**New data model for the feature Bridge**

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| ***Submitted by:*** | France |
| ***Executive Summary:*** | Due to inconsistent values for the attribute category of bridge,it is proposed to review the data model for the feature Bridge |
| ***Related Documents:*** | S-101FC, S-101DCEG, S-401. |
| ***Related Projects:*** | S-101, S-401. |

## Introduction / Background

1. In S-101 Edition 1.1.0, **category of bridge** is an Enumerate attribute with a multiplicity (0,1) (or (1,1) when the bridge is over navigable water). It allows the same 12 possible values than S-57 attribute CATBRG). Yet, these values are inconsistent as they provide information of different natures.
2. This paper proposes to review the data model to remove inconsistencies in attribute **category of bridge**.

## Analysis/Discussion

3. It must be noted that the (0,1) or (1,1) multiplicity in S-101 ed. 1.1.0 for attribute **category of bridge** is not consistent with attribute CATBRG in S-57, which is of type List (multiplicity: (0,*). The direct consequence is that multiple values populated for CATBRG (ex. 2, 4, 9) cannot at this stage be fully transferred into S-101 Feature **Bridge**.
4. To better understand the issue which is the object of this paper, it seems useful to have a look at the various types of bridge (with their current IHO registry definition) that can be encountered.

   Value *1* (Fixed bridge) and *2* (Opening bridge): these attributes values are important to distinguish between the two types of bridges in terms of navigation, but do not describe the proper bridge.

   Value *3* (Swing bridge): "*A movable bridge (or span thereof) which rotates in a horizontal plane about a vertical pivot to allow the passage of vessels.*"

*Swing bridge*

   Value *4* (Lifting bridge): "*A movable bridge (or span thereof) which is capable of being lifted vertically to allow vessels to pass beneath.*"


*Lifting bridge*

Value 5 (Bascule bridge): "*A counterpoise bridge rotated in a vertical plane about an axis at one or both ends.*"

*Bascule bridge*

Value 6 (Pontoon bridge): "*A fixed floating bridge supported by pontoons.*"
After contact with members oft he Inland ENC Harmonization Group, it is suggested to amend the definition to read: "*An opening floating bridge supported by pontoons.*" A pontoon bridge could be a swing bridge or a retractable bridge.

*Pontoon bridge*

Value 7 (Drawbridge): "*A general name for bridges of which part or the entire span of the bridge may be raised or drawn aside to allow ships to pass through.*"
This enumeration value is only used for retractable bridges in IENCs. The retractable bridge is defined in the Encoding Guide for Inland ENCs: "*A retractable bridge is a type of movable bridge in which the deck can be rolled or slid backwards to open a gap for crossing traffic, usually a ship on a waterway*."
This type is sometimes referred to as a thrust bridge. The bridge deck of a thrust bridge is retracted to one side.
The problem with the current definition in S-100 is that it has a big overlap with bascule bridge, lifting bridge and swing bridge. This could either be solved by reviewing the current definition as follows: "A *type of movable bridge in which the deck can be moved aside or backwards to open a gap to allow ships to pass through".*

*Drawbridge*

Value 8 (Transporter bridge): "*Consists of towers on each side of the watercourse connected by a system of girders on which a carriage runs.*"
A transporter bridge is to be considered as a fixed bridge (refer to Decision ENCWG7/42), as the gondola is not supposed to be activated when a ship is passing under the bridge, and thus not to be considered for the vertical clearance.

*Transporter bridge*

Value 9 (Footbridge), 10 (Viaduct) and 11(Aqueduct): these values describe the function of the bridge.

Value 12 (Suspension bridge) describes the type of construction for the bridge.

**Conclusions**
It is proposed to review the data model an amend the DCEG as follows:

## 6.5 Bridge

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| IHO Definition: **BRIDGE**. A structure erected over a depression or an obstacle such as a body of water, railroad, etc., to provide a roadway for vehicles or pedestrians. (IHO Dictionary – S-32). | | | | |
| **S-101 Geo Feature: Bridge (BRIDGE)** | | | | |
| **Primitives: Curve, Surface, None** | | | | |
| *Real World* | *Paper Chart Symbol* | *ECDIS Symbol* | | |
| **S-101 Attribute** | **S-57 Acronym** | **Allowable Encoding Value** | **Type** | **Multiplicity** |
| bridge construction | *(CATBRG)* | 1 : arch<br>2 : viaduct<br>3 : pontoon bridge<br>4 : suspension bridge<br>5 : transporter bridge | EN | 0,1 |
| bridge function | *(CATBRG)* | 1 : vehicular<br>2 : rail<br>3 : pedestrian<br>4 : aqueduct | EN | 0,* |

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|---|---|---|---|---|
| category of opening bridge | (CATBRG) | ~~1 : fixed bridge~~<br>~~2 : opening bridge~~<br>3 : swing bridge<br>4 : lifting bridge<br>5 : bascule bridge<br>6 : pontoon bridge<br>7 : drawbridge<br>~~8 : transporter bridge~~<br>~~9 : footbridge~~<br>~~10 : viaduct~~<br>~~11 : aqueduct~~<br>~~12 : suspension bridge~~ | EN | 0,1 † |
| colour | (COLOUR) | 1 : white<br>2 : black<br>3 : red<br>4 : green<br>5 : blue<br>6 : yellow<br>7 : grey<br>8 : brown<br>9 : amber<br>10 : violet<br>11 : orange<br>12 : magenta<br>13 : pink | EN | 0,* (ordered) |
| colour pattern | (COLPAT) | 1 : horizontal stripes<br>2 : vertical stripes<br>3 : diagonal stripes<br>4 : squared<br>5 : stripes (direction unknown)<br>6 : border stripe | EN | 0,1 † |
| condition | (CONDTN) | 1 : under construction<br>2 : ruined<br>5 : planned construction | EN | 0,1 |
| feature name | | | C | 0,* |
| display name | | | (S) BO | 0,1 |
| language | | ISO 639-2/T | (S) TE | 0,1 |
| name | *(OBJNAM)*<br>*(NOBJNM)* | | (S) TE | 1,1 |
| fixed date range | | See clause 2.4.8 | C | 0,1 |
| date end | (DATEND) | | (S) TD | 0,1 † |
| date start | (DATSTA) | | (S) TD | 0,1 † |
| height | (HEIGHT) | | RE | 0,1 |
| nature of construction | (NATCON) | 1 : masonry<br>2 : concreted<br>6 : wooden<br>7 : metal<br>11 : latticed | EN | 0,* |
| opening bridge | *(CATBRG)* | | BO | 0,1 † |
| radar conspicuous | (CONRAD) | | BO | 0,1 |
| reported date | *(SORDAT)* | See clause 2.4.8 | TD | 0,1 |
| status | (STATUS) | 1 : permanent<br>2 : occasional<br>4 : not in use<br>5 : periodic/intermittent<br>7 : temporary | EN | 0,* |

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| | | 12 : illuminated | | |
| visual prominence | (CONVIS) | 1 : visually conspicuous<br>2 : not visually conspicuous<br>3 : prominent | EN | 0,1 |
| scale minimum | (SCAMIN) | See clause 2.5.9 | IN | 0,1 |
| information | | See clause 2.4.6 | C | 0,* |
| file locator | | | (S) TE | 0,1 |
| file reference | *(TXTDSC)*<br>*(NTXTDS)* | | (S) TE | 0,1 † |
| headline | | | (S) TE | 0,1 |
| language | | ISO 639-2/T | (S) TE | 0,1 |
| text | *(INFORM)*<br>*(NINFOM)* | | (S) TE | 0,1 † |
| pictorial representation | (PICREP) | See clause 2.4.12.2 | TE | 0,1 |

† For bridges encoded over navigable water, the attribute **opening bridge** is mandatory.

The attribute **category of opening bridge** is mandatory if **opening bridge** = *True*.

The sub-attribute **colour pattern** is mandatory for bridges that have more than one value populated for the sub-attribute **colour**.

For each instance of **fixed date range**, at least one of the sub-attributes **date end** or **date start** must be populated.

For each instance of **information**, at least one of the sub-attributes **file reference** or **text** must be populated.

INT 1 Reference: D 20-24

### 6.5.1 Bridges (see S4 – B-381)

If it is required to encode a bridge, it should be done using the feature **Bridge**. Bridges may be encoded over water that is navigable or non-navigable at the maximum display scale of the ENC data. Where the bridge is encoded over navigable water, the spans and pylons of the bridge must be associated with the feature **Bridge** using the association **Bridge Aggregation** (see clause 25.4) (that is, the **Bridge** feature has geometry of type curve or surface, or has no geometry). Where the bridge is encoded over non-navigable water, then it must be encoded, where required, using a **Bridge** feature having no component features (that is, the **Bridge** feature has geometry of type curve or surface); or as a **Landmark** feature (see clause 7.2) if the bridge has geometry of type point.

The value of the vertical clearance between (high) water level and any fixed overhead obstruction must always be given, where known, on the largest maximum display scale ENC data intended for navigation under the obstruction, and for detailed passage planning. The datum above which clearances are given must be a high water level, preferably Highest Astronomical Tide (HAT), where the tide is appreciable. The value for the vertical clearance must be encoded using the features **Span Fixed** or **Span Opening** (see clauses 6.6 and 6.7), with the clearance(s) populated using the complex attributes **vertical clearance fixed**, **vertical clearance closed** and/or **vertical clearance open**, and sub-attributes populated relevant to the span. In areas where the tidal range is not appreciable the datum above which clearances are given should be Mean Sea Level (MSL).

Remarks:

- If it is required to encode the name of a bridge over navigable water, the **Bridge** should be encoded using geometry of type curve or surface, associated with all relevant components of the bridge using the association **Bridge Aggregation**. The extent of the geometry of the **Bridge** should utilise the geometry of all the components of the bridge so as to cover its full extent.
- If it is required to encode the extent of an unnamed bridge over navigable water, this may be done using a **Bridge** feature having no geometry, associated with all relevant components of the bridge using the association **Bridge Aggregation**.
- Water under a bridge must be encoded using the features **Depth Area**, **Dredged Area** or **Unsurveyed Area** (and appropriate **Depth Contour** and **Sounding** features) if the waterway is navigable at the maximum display scale for the ENC data, or using the features **Land Area** if the waterway is not navigable

at the maximum display scale for the ENC data.

- When there is a fixed vertical clearance, closed vertical clearance, or open vertical clearance given for a bridge, it should be applied only to the portion of the bridge to which the clearance refers, using the features **Span Fixed** or **Span Opening** (see clauses 6.6 and 6.7). All encoded bridge spans must be associated with the **Bridge** feature using the association **Bridge Aggregation** (see clause 25.4). See examples in the Figures below. If there are no vertical clearances given for a bridge and it is over water that is navigable at the maximum display scale of the ENC data, a single **Span Fixed** or **Span Opening** feature must be encoded covering the area of the bridge, having mandatory vertical clearance attributes populated with an empty (null) value.
- The attribute **height** is used, where required, to encode the height of the highest point on the bridge structure (see clause 2.5.7).
- If it is required to encode a ~~sliding~~ bridge for which part or the entire span is moved aside or backwards, it must be done using a **Bridge** feature, with attributes **opening bridge** = *True* and **category of opening bridge** = *7* (drawbridge).
- If it is required to encode a pontoon bridge where a pontoon section may be temporarily be removed or rotated so as to allow the passage of vessels, this must be done using a **Bridge** feature, with attributes **bridge construction** = *3* (pontoon bridge), **opening bridge** = *True* and **category of opening bridge** = Empty (null).
- If it is required to encode a distance mark that is included on or associated with a bridge, this must be done using the feature **Distance Mark** (see clause 8.9).
- In navigable water, bridge supports must be encoded, where possible, using a **Pylon/Bridge Support** feature (see clause 6.11), with attribute **category of pylon** = *4* (bridge/pylon tower) or *5* (bridge pier).
- It is not mandatory to encode roads or railways on bridges.

### 6.5.2 Examples of Encoding Common Bridge Types

**OPENING BRIDGE**

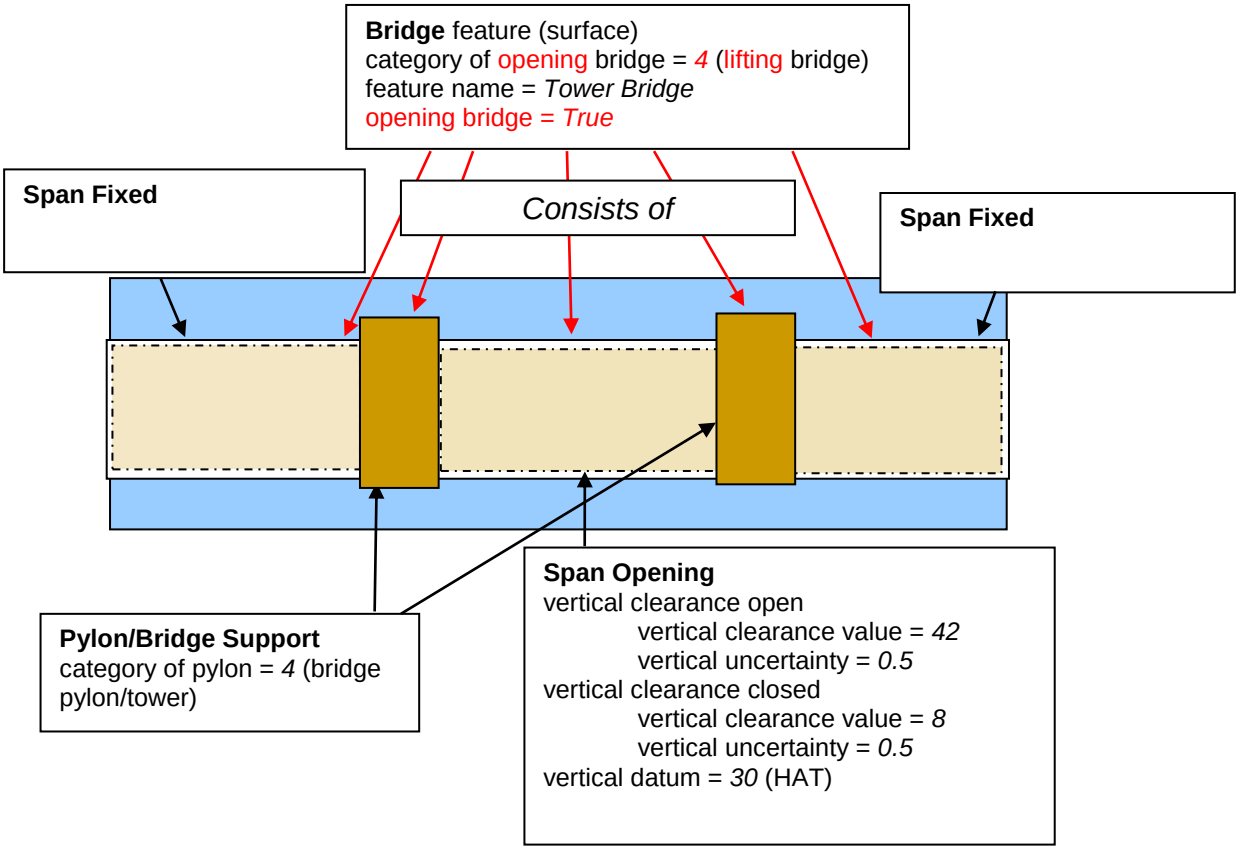


***Figure 6.2 - Opening bridge - Example***

Distinction: Pipeline Overhead; Pylon/Bridge Support; Span Fixed; Span Opening.

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| **Feature/Feature associations:** | **Bridge Aggregation**; **Structure/Equipment**; **Aids to Navigation Association**; **Updated Information**; **Text Association** |
| **Feature/Information associations:** | **Additional Information** |
| **Spatial/Information association:** | **Spatial Association** |

**Recommendations**

It is recommended to:

- Review the S-101 Ed. 1.2.0 DCEG as shown above;
- Align the S-101 Feature Catalogue accordingly.

**Action Required of S-101PT**

The S-101PT is invited to:

a. Discuss this paper

b. Agree with the recommendations