TSMAD27-4.5.2A

Paper for Consideration by TSMAD

Changes to Sections 3.1, 3.5 and 3.8 of the S101_Data Classification and Encoding Guide

Submitted by:	Data Quality Working Group (DQWG)
Executive Summary:	DQWG would like TSMAD to consider the changes to section 3.1, 3.5 and 3.8 of the S101_Data Classification and Encoding Guide_TSMAD Review_2
Related Documents:	S-101
Related Projects:	S-101

Introduction / Background

The DQWG was tasked by the DCEG working group to review the sections that are relevant to Meta data objects in the DCEG that the DQWG are responsible for.

Analysis / Discussion

The sections involved are 3.1, 3.5 and 3.8 of the most recent version of the guide (S101_Data Classification and Encoding Guide_TSMAD Review_2). The objects involved are Quality of Non-bathymetric Data, Quality of Bathymetric Data and Quality of Survey. Sections are below with the changes from the most recent version by the DQWG in orange. Also included are two diagrams explaining how Quality of Bathymetric Data objects can overlap and how the general structure of these three objects work together.

Sections

3.1 Quality of non-bathymetric data

IHO Definition: **QUALITYOFNON-BATHYMETRICDATA**. An area within which the best estimate of the overall uncertainty of the data is uniform. The overall uncertainty takes into account for example the source accuracy, chart scale, digitizing accuracy etc. (Adopted from S-57 Edition3.1, Appendix A–Chapter 1, Page 1.208, November 2000).

S-101 Geo Feature: Quality of non-bathymetric data (M_ACCY)

Primitives: Surface

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Horizontal distance uncertainty	(HORACC)		RE	0,1
Orientation uncertainty			RE	0,1
Positional uncertainty	(POSACC)		RE	1,1
Survey date range			C	0,1
Date end	*(SUREND)*	ISO8601:1988	(S) DA	1,1
Datestart	*(SURSTA)*	ISO8601:1988	(S) DA	0,1
Vertical uncertainty	(VERACC)		(S) RE	0,1
Information			C	0,*
Language		ISO639-3	(S)TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S)TE	1,1
Textual description			C	0,*

File reference	*(TXTDSC)* *(NTXTDS)*		(S)TE	1,1
Language		ISO639-3	(S)TE	0,1

INT 1 Reference:

3.1.1 Quality of positions

The meta feature **QualityofNon-bathymetricData** may be used to provide an overall uncertainty of position for all non-bathymetric features.It must not be used to provide the uncertainty of bathymetric information.

The attributes **qualityofposition** and **positionaluncertainty** may be applied to any spatial type, in order to qualify the location of a feature.

Horizontaldistanceuncertainty, qualityofposition and **positionaluncertainty** must not be applied to the spatial type of any geo feature if they are identical to the **horizontaldistanceuncertainty, qualityofposition** and **positional uncertainty** values of the underlying meta feature.

Qualityofposition gives qualitative information, whereas **positionaluncertainty** gives quantitative information.

Positionaluncertainty on the **QualityofNon-bathymetricData** applies to non-bathymetric data situated within the area, while **qualityofposition** or **positionaluncertainty** on the associated spatial types qualifies the location of the **Qualityof Non-bathymetric Data** feature itself.

Meta features **Qualityof Non-bathymetric Data** and **QualityofBathymetricData** may overlap.

Remarks:
- No remarks.

3.1.2 Horizontal distance uncertainty

If it is required to encode the uncertainty of a horizontal clearance (complex attributes **horizontalclearancefixed** and **horizontalclearanceopen**), it must be done using the sub-attribute **horizontaldistanceuncertainty**.

Horizontaldistanceuncertainty applies only to **horizontalclearancefixed** and **horizontalclearanceopen**. There is no attribute to express the accuracy of the attributes **horizontallength** and **horizontalwidth**.

Remarks:
- No remarks.

3.1.3 Vertical uncertainty

If it is required to encode the uncertainty of a vertical clearance (complex attributes **verticalclearancefixed**, **verticalclearanceopen**, **verticalclearanceclosed** and **verticalclearancesafe**), it must be done using the sub-attribute **verticaluncertainty**.

If several vertical clearances are given for one feature, the uncertainty given must be that of the least accurate.

Remarks:
- No remarks.

Distinction: Quality of bathymetric data; quality of survey.

3.5 Quality of bathymetric data

IHO Definition: **QUALITYOFBATHYMETRICDATA**. An area within which a uniform assessment of the quality of the bathymetric data exists. (S-57 Edition 3.1, Appendix A–Chapter 1, Page 1.216, November 2000).

S-101 Geo Feature: Quality of Bathymetric Data (M_QUAL)

Primitives: Surface

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of temporal variation		1 : unassessed 2 : event 3 : likelyto change 4 : unlikelyto change	EN	1,1
Depth range maximum value	(DRVAL2)		RE	0,1
Depth range minimum value	(DRVAL1)		RE	0,1
Features detected			C	1,1
Least depth of detected features measured			(S)BO	0,1
Significant features detected			(S)BO	1,1
Size of features detected			(S) RE	0,1
Positional uncertainty	(POSACC)		RE	0,1
Full seafloor coverage			BO	1,1
Sounding uncertainty	(SOUACC)		RE	0,1
Survey date range			C	0,1
Date end	*(SUREND)*	ISO8601:1988	(S) DA	1,1
Datestart	*(SURSTA)*	ISO8601:1988	(S) DA	0,1
Technique of sounding measurement	(TECSOU)	1 : found by echo-sounder 2 : found by side scan sonar 3 : found by multi-beam 4 : found by diver 5 : found be lead-line 6 : swept by wire-drag 7 : found by laser 8 :swept by vertical acoustic system 9 : found by electromagnetic sensor 10 :photogrammetry 11 : satellite imagery 12 : found by leveling 13 : swept by side-scan sonar	EN	0,*
Information			C	0,*
Language		ISO639-3	(S)TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S)TE	1,1
Textual description			C	0,*

File reference	*(TXTDSC)* *(NTXTDS)*		(S)TE	1,1
Language		ISO639-3	(S)TE	0,1

INT 1 Reference:

3.5.1 Quality, reliability and accuracy of bathymetric data (see S-4–B-297)

Information about quality, reliability and uncertainty of bathymetric data is given using:

- the meta feature **QualityofBathymetricData** for an assessment of the quality of bathymetric data;
- the meta feature **QualityofSurvey** for additional information about individual surveys (see clause X.X);
- the attributes **qualityofsoundingmeasurement**, **soundinguncertainty** and **techniqueofsoundingmeasurement** on groups of soundings or individual features;
- the attributes **positionaluncertainty** and **qualityofposition** on the spatial types (see clause X.X).

For the mariner, **QualityofBathymetricData** provides the most useful information. Therefore, the use of **QualityofBathymetricData** is mandatory for areas containing depth data or bathymetry on ENC datasets at maximum display scale 1:700000 and larger.

More detailed information about a survey may be given using **QualityofSurvey** (see clause X.X). For example, in incompletely surveyed areas, lines of passage soundings may be indicated as such using a curve **QualityofSurvey** feature. This information is more difficult for the mariner to interpret. Therefore, the use of **QualityofSurvey** is optional.

For individual features (wrecks, obstructions etc), or small groups of soundings, **qualityofsoundingmeasurement**, **soundinguncertainty** and **techniqueofsoundingmeasurement** may be used to provide additional information about quality and uncertainty.

The meta feature **QualityofBathymetricData** defines areas within which uniform assessment exists for the quality of bathymetric data, and must be used to provide an assessment of the overall quality of bathymetric data to the mariner. Areas of a dataset containing depth data or bathymetry must be covered by one or more **QualityofBathymetricData**, which can overlap (see clause 3.5.X.X).

Remarks:

- To express completeness of bathymetric data, the complex attribute **featuresdetected** must be encoded. **Featuresdetected** indicates that a systematic method of exploring the seafloor or the water column to the **Depth range maximum value** was undertaken to detect significant features. The sub-attributes **sizeoffeaturesdetected** and **leastdepthofdetectedfeaturesmeasured** must not be encoded unless the sub-attribute **significantfeaturesdetected** is set to *True*.
- Wherever possible, meaningful and useful values for the attributes **categoryoftemporalvariation**, **full seafloorcoverage**, and the complex attribute **featuresdetected** must be used for areas of bathymetry. For areas of unstable seafloors, the complex attribute **surveydaterange** (**dateend**) must be used to indicate the date of the survey of the underlying bathymetric data.
- **Depthrangeminimumvalue** must only be used on a **QualityofBathymetricData** feature where a swept area occupies the entire **QualityofBathymetricData** surface.
- **Depthrangemaximumvalue** must only be used on a **QualityofBathymetricData** feature to specify the maximum depth to which all other attributes for the **QualityofBathymetricData** feature applies. When **depthrangemaximumvalue** is specified, values populated for all other attributes apply only to depths equal to or shoaler than **depthrangemaximumvalue**. No quality information is provided for depths deeper than **depthrangemaximumvalue**.
- **Positionaluncertainty** is used on a **QualityofBathymetricData** feature to specify the positional uncertainty of the depths covered by the surface. ~~When **depthrangeminimumvalue** is specified, **positionaluncertainty** must not be used there is no positional accuracy information provided for any underlying depths in this circumstance.~~
- **Soundinguncertainty** is used on a **QualityofBathymetricData** feature to specify the vertical uncertainty of the depths covered by the surface. When **depthrangemaximum and minimum values** are specified, **sounding uncertainty** refers only to the uncertainty of the swept depth defined by **depthrangemaximum and minimum values** ~~there is no depth accuracy information provided for any underlying depths in this circumstance.~~
- When the **QualityofBathymetricData** surface contains data from only one survey, the date of survey, if required, must be specified using the complex attribute **surveydaterange**, sub-attribute **dateend**. When the **QualityofBathymetricData** surface contains data from two or more surveys, the date of the most recent and the oldest survey, if required, must be specified using the complex attribute **surveydaterange**.
- Additional quality information may be given using the meta feature **QualityofSurvey**.
- **QualityofBathymetricData** must not be encoded of land areas. ~~Areas are encoded~~ over land, all mandatory attributes should be populated with an empty (null) value.

~~In a dataset, they should not overlap.~~

- ~~When both **QualityofBathymetricData** and **QualityofNon-bathymetricData** features are used in a dataset, the area covered by these features should equal the area of data coverage for the dataset.~~
- **Positionaluncertainty** on the **QualityofBathymetricData** applies to bathymetric data situated within the surface, while **qualityofposition** or **positionaluncertainty** on the associated spatial types qualifies the location of the **QualityofBathymetricData** feature itself.
- **QualityofBathymetricData** Meta feature objects may overlap only if **Depthrangemaximumvalue** is populated in one of feature objects and **Depthrangeminimumvalue** is populated on the overlapping feature object (see clause 3.5.X.X).
- When **QualityofBathymetricData** Meta feature objects overlap the **Depthrangemaximumvalue** of one object must be equal to **Depthrangeminimumvalue** of an overlapping object (see clause 3.5.X.X).

3.5.1.1 Feature detection

In the context of bathymetry, a feature is any object, whether man made or not, projecting above the seafloor, which may be considered to be a danger to surface navigation. Refer to S-44.

The ability to detect bathymetric features must be encoded using the complex attribute **featuresdetected**. The sub-attribute **significantfeaturesdetected** indicate whether the survey was capable of detecting features of a size indicated by the sub-attribute **sizeoffeaturesdetected**. The sub-attribute **leastdepthofdetectedfeaturesmeasured** indicates whether the least depth of detected features was found. For instance, if a wreck was found, but it is not certain that the least depth of that wreck was measured, **leastdepthofdetectedfeaturesmeasured** must be set to *False*.

3.5.1.2 Temporal variation

The changeability of the bathymetry must be encoded using **categoryoftemporalvariation**. In order for a time reference to be given for the expression of temporal variation, the relevant dates of the bathymetric data must be encoded using the complex attribute **surveydaterange** if the category is set to 3 (likely to change) or 2 (event).

3.5.1.3 Sounding Uncertainty

Sounding uncertainty is encoded using the attribute **soundinguncertainty** on **QualityofBathymetricData**. If it is required to encode additional sounding uncertainty information, it must be done using the attribute **soundinguncertainty** on individual geo features (e.g. **Sounding**).

The uncertainty of sounding must not be encoded using **soundinguncertainty** on the depth geo feature, unless it is different to the value of **soundinguncertainty** encoded on **QualityofBathymetricData**.

3.5.1.4 Technique of sounding measurement

If it is required to encode the technique of sounding measurement, it must be done using the attribute **Techniqueofsoundingmeasurement** on either **QualityofBathymetricData** or on individual geo features (e.g. **Sounding**).

The technique of sounding measurement must not be encoded using **techniqueofsoundingmeasurement** on the depth geo feature, unless it is different to the value of **techniqueofsoundingmeasurement** encoded on **QualityofBathymetricData**.

Distinction: Accuracy of data; quality of survey.

3.8 Quality of survey

IHO Definition: **QUALITYOFSURVEY**. An area within which a uniform assessment of the reliability of source survey information exists. (S-57 Edition 3.1, Appendix A – Chapter1, Page 1.218, November 2000).

S-101 Geo Feature: Quality of survey (M_SREL)

Primitives: Curve, Surface

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Features detected			C	0,1
Least depth of detected features measured			(S)BO	0,1
Significant features detected			(S)BO	1,1
Size of features detected			(S) RE	0,1
Full seafloor coverage			BO	1,1
Line spacing maximum	(SDISMX)		IN	0,1
Line spacing minimum	(SDISMN)		IN	0,1
Measurement distance maximum			RE	0,1
Measurement distance minimum			RE	0,1
Quality of position	(QUAPOS)	1 : surveyed 2 : unsurveyed 3 : inadequately surveyed 4 : approximate 5 : position doubtful 6 : unreliable 7 : reported (not surveyed) 8 : reported (not confirmed) 9 : estimated 10 : preciselyknown 11: calculated	EN	0,1
Quality of sounding measurement	(QUASOU)	1 : depth known 2 : depth or least depth unknown 3 : doubtful sounding 4 : unreliable sounding 6 : least depthknown 7 : least depth unknown, safe clearance at value shown 8 : value reported (not surveyed) 9 : value reported (not confirmed) 10 : maintained depth 11 : not regularly maintained	EN	0,*
Scale value maximum	(SCVAL1)	scale value maximum < scale value minimum	IN	0,1
Scale value minimum	(SCVAL2)	scale value minimum > scale value maximum	IN	0,1
Survey authority	(SURATH)		TE	1,1

Survey date range			C	0,1
Date end	*(SUREND)*	ISO8601:1988	(S) DA	1,1
Date start	*(SURSTA)*	ISO8601:1988	(S) DA	0,1
Survey type	(SURTYP)	1 : reconnaissance / sketch survey 2 : controlled survey 4 : examination survey 5 : passage survey 6 : remotely sensed 7 : full coverage 8 : systematic survey 9 : non-systematic survey 10: inadequately surveyed 11 : spot-sounding survey 12 : acoustically swept survey 13 : mechanically swept survey	EN	1,*
Information			C	0,*
Language		ISO639-3	(S)TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S)TE	1,1
Textual description			C	0,*
File reference	*(TXTDSC)* *(NTXTDS)*		(S)TE	1,1
Language		ISO639-3	(S)TE	0,1

INT 1 Reference:

3.8.1 Survey reliability and source of bathymetric data

The survey reliability and/or details of the source surveys used in compilation may be encoded using the meta feature **QualityofSurvey**.

Remarks:

- To express completeness of bathymetric data, the complex attribute **featuresdetected** should be encoded. **Featuresdetected** indicates that a systematic method of exploring the seafloor was undertaken to detect significant features. The sub-attributes **sizeoffeaturesdetected** and **leastdepthofdetectedfeaturesmeasured** must not be encoded unless the sub-attribute **significantfeaturesdetected** is set to *True*.
- If the attributes **soundinguncertainty** and **techniqueofsoundingmeasurement** are required, they must be encoded on either the meta feature **QualityofSurvey** or on individual geo features(e.g. **Sounding**).
- If the attribute **measurementdistancemaximum** is set to *0* (zero) for the full area of the survey, the attribute **fullseafloorcoverageachieved** should be set to *yes*.
- Where populated, the value for the attribute **measurementdistanceminimum** must not be larger than the value populated for **measurementdistancemaximum**.
- **Qualityofposition** on the **QualityofSurvey** applies to bathymetric data situated within the area, while **qualityofposition** or **positionaluncertainty** on the associated spatial types qualifies the location of the **QualityofSurvey** feature itself.

3.8.2 Quality of sounding

If it is required to encode the quality of sounding, it must be done using the attribute **qualityofsoundingmeasurement** on either the **QualityofSurvey** or on individual geo features (e.g. **Sounding**).

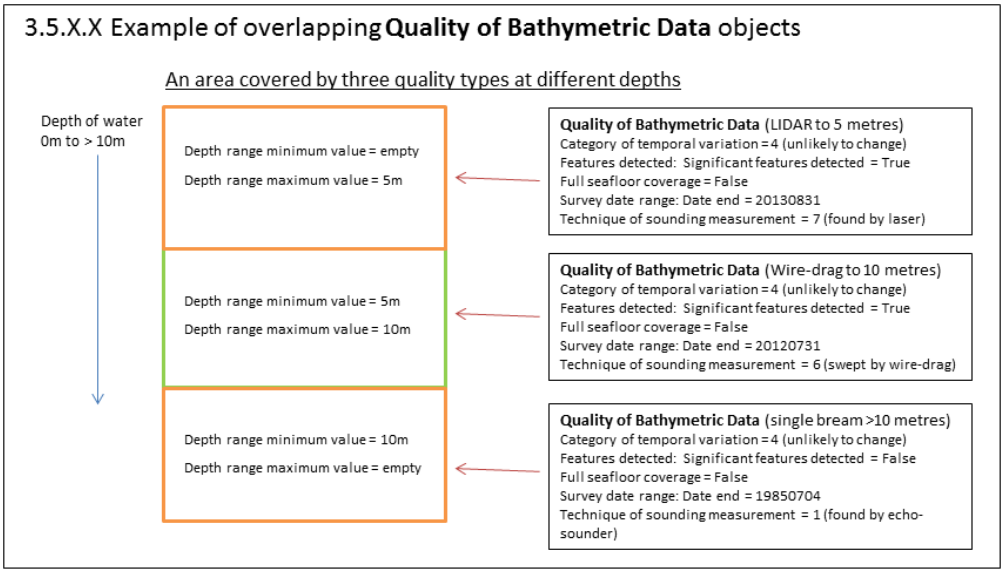
The quality of sounding must not be encoded using **qualityofsoundingmeasurement** on the depth geo feature, unless it is different to the value of **qualityofsoundingmeasurement** encoded on **Qualityof Survey** (see tables at clauses X.X and X.X).

~~Remarks:~~

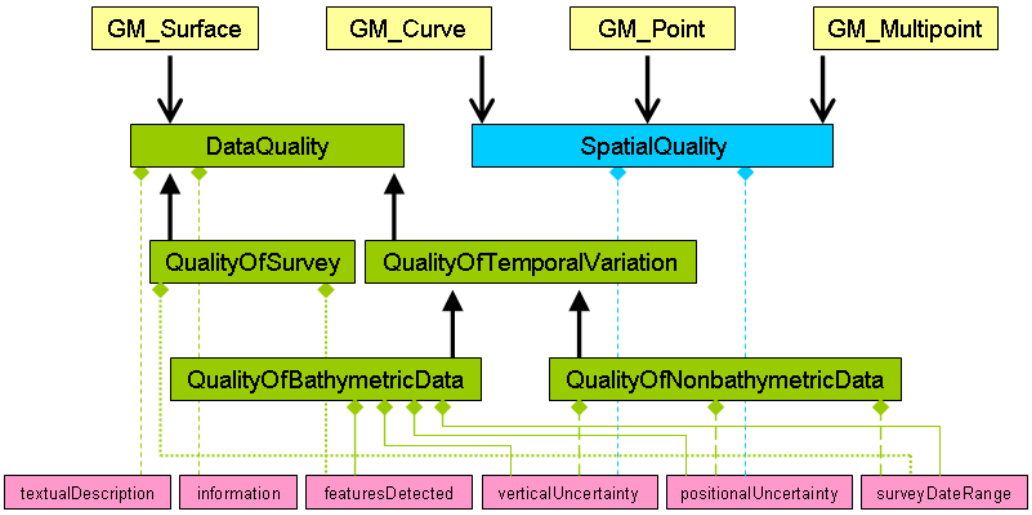
- ~~No remarks.~~

Distinction: Accuracy of data; quality of bathymetric data

Graphics



Simplified UML diagram of IHO DQWG
– based on Eivind Mong's full diagram of 15 August 2012
Leendert Dorst, 23 October 2013



Recommendations

The DQWG is recommending that TSMAD reconsider adopting the changes to the aforementioned sections of the DCEG or ask for more comments and input from the Data Quality Working Group.

Action Required of TSMAD

The TSMAD:

a. discuss the DQWG proposal

b. agree to changes and / or require more comments