Paper for Consideration by TSMAD and DIPWG

# S-101 Data Quality Section

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|---|---|
| *Submitted by:* | S-101 Work Item Leader |
| *Executive Summary:* | This paper seeks define guidance on S-101 for the Data Quality Working Group |
| *Related Documents:* | S-101 Product Specification |
| *Related Projects:* | N/A |

## Introduction / Background

1. At TSMAD 21 the chair expressed concern regarding the slow place of the DQWG in relation to Data Quality in S-101. One of the issues is that TSMAD/DIPWG has not provided enough guidance to DQWG. DQWG has prepared a survey for mariners in regards to data quality indicators used in both paper and electronic charts. It is hoped that the results of this survey will help shape the data quality section in S-101. The survey is contained in Annex A.

2. This paper seeks to define the scope of Data Quality for S-101.

## Analysis/Discussion

3. Data Quality is normally defined as:
    a. Data Quality refers to the degree of excellence exhibited by the data in relation to the portrayal of the actual scenario.
    b. The state of completeness, validity, consistency, timeliness and accuracy that makes data appropriate for a specific use – Government of British Columbia.
    c. RTCA/DO-200A defines data quality by the following criteria:

        - Accuracy – The degree of conformance between the estimated or measured value and its true value.
        - Resolution – The smallest difference between two adjacent values that can be represented in a data storage, display, or transfer system.
        - Assurance Level – Quantifiable value that communicates clearly what level of trust a user can place on the assessed data.
        - Traceability – The degree to which a system or a data product can provide a record of the changes made to that product and thereby enable an audit trail to be followed from the end-user to the data originator.
        - Timeliness – The degree of confidence that the data is applicable to the period of its intended use.
        - Completeness – The degree of confidence that all of the data, needed to support the intended use, has been provided.
        - Format – The process of translating, arranging, packaging, and compressing a selected set of data for distribution to a specific target system. A result of this process is a data structure that fulfills the characteristics of data quality.

4. One of the major issues regarding data quality is that the scope for S-101 has not been adequately defined. There has been discussion regarding the visualization of M_QUAL and the usefulness of M_QUAL on small scale ENCs, in fact, it is generally accepted that with the change in definitions to S-57 in supplement 2, M_QUAL covers bathymetry fairly well. However, there has not been substantial discussion as to what other data quality indicators are needed for an S-101 ENC.

5. Currently, S-101 has utilized the S-57 Use of the Object Catalogue sections on Data Quality as a placeholder for S-101. This includes guidance on M_SREL and M_QUAL. According to S-100 the data quality section for a product specification shall use the following guidance:

The data product specification shall identify the data quality requirements for each scope within the data product in accordance with S-100 Part 3. For every data quality scope it is necessary to list all the data quality elements and data quality sub-elements defined in S-100 Part 3, even if only to state that a specific data quality element or data quality sub-element is not applicable for this data quality scope.

Each product specification shall describe the data quality requirements. One aspect is the "data quality overview element" which should allow a user to decide whether this dataset is the one they want. The other aspect is the metadata allowed for specific feature collections, features and attributes within the dataset.

The data quality overview element should include at least the intended purpose and statement of quality or lineage. Other data quality elements cover: completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy, and anything specifically required for the product being specified.

The product specification should comment on which of these are to be used and how, including a description of (or reference to) conformance tests. For example, should data only be published if it passes a particular test, or is it allowable to publish the data with a quality statement which indicates non-conformance? The product specification shall describe how each quality element is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

The application schema shall indicate how the data quality elements will be related to the data items, for example whether a particular dataset should have homogeneous quality, or whether quality elements can be related to feature collections, individual feature objects or attributes.

Finally, the encoding description (clause 15) shall indicate how the quality elements will be encoded.

6. In addition, S-100 states that the following must be included in the product specification for data quality.

| | Item name | Definition | Obligation | Maximum occurrence | Data type | Domain |
|---|---|---|---|---|---|---|
| 1 | dataQuality | required level of data quality | M | N | DQ_DataQuality | see ISO 19115 |
| 2 | role: qualityScope | scope for the quality information | M | 1 | DPS_ScopeInformation | see Annex D |

7. Another factor to consider when defining the scope of data quality is the interoperability between existing S-57 elements and S-101. Hydrographic Offices have only just begun to take M_QUAL seriously and populate CATZOC with meaningful values. There is concern that this data would be lost in the transition from S-57 to S-101.
8. Lastly, the biggest complaint regards to data quality is that the portrayal on an ECDIS does not provide meaningful information. At the last stakeholders meeting there was some preliminary discussion regarding how to better portrayal this information.
    a. Potential Idea's were the following for route monitoring:
        i. Eliminate the existing portrayal and utilize a source diagram approach in the margins of the monitor that is colour coded red, yellow, green.
        ii. Have the ECDIS utilize the underling meta information and provide a colour coded track line (red, yellow, green).

## Conclusions

9. Considering all the factors listed above there are several levels of data quality and they can be expressed in different parts of the product specification. For example:
    a. Discovery Metadata can contain data quality indicators
    b. There can be data quality indicators within the dataset such as M_QUAL and M_SREL
    c. Portrayal of Data Quality information

10. TSMAD and DIPWG need to decide what the scope is for data quality and convey that to the DQWG. For example, is the scope to use the existing S-57 information in M_SREL and M_QUAL and then work on better visualization for the mariner.

## Recommendations

1. That TSMAD discuss the scope of data quality and provide a way forward for DQWG. Potential recommendations:
    a. Utilize the existing S-57 M_QUAL feature and concentrate on better portrayal for the mariner
    b. TSMAD handles the data quality for everything other than bathymetric information
        i. That would mean for ENC's TSMAD would handle data quality for all other information contained within the ENC.
    c. Establish the scope of data quality for S-101 – for example data quality is needed for bathymetry, navigational aids, regulations, routing etc…
    d. The results of this discussion are captured in a paper for the DQWG meeting in June.

## Action Required of TSMAD and DIPWG

The TSMAD and DIPWG is invited to:

a. discuss the intended scope of Data Quality for S-101 to provide a way forward for DQWG

# Data Quality Questionnaire

## Section A, About You

**1. Post or Role held?**

**2. Number of years served?**

- ☐ 0 – 5
- ☐ 5 – 10
- ☐ 10 – 15
- ☐ 15 +

**3. What navigation qualifications do you hold?**

**4. Which of the following best describes the type of shipping you are involved in?**

*You may tick more than one.*

- ☐ Local/coastal
- ☐ Domestic
- ☐ Trans Oceanic
- ☐ Other. Please state:

**5. Which sector do you operate in?**

*You may tick more than one.*

- ☐ Military
- ☐ Merchant Navy
- ☐ Commercial
- ☐ Ferry
- ☐ Oil and Gas (support)
- ☐ Renewables (support)
- ☐ Leisure (yacht)
- ☐ Day boat
- ☐ Cruise liner
- ☐ Fishing
- ☐ Pilotage
- ☐ Survey
- ☐ Other. Please state:

**6. Do you or your company navigate using:**

*You may tick more than one.*

- ☐ Paper Charts
- ☐ ENCs

- ☐ Raster Charts
- ☐ Proprietary Vector Charts
- Other

**7. Is your vessel equipped with an echo-sounder (depth sounder)?**

If Yes, When do you have this running at sea (tick all that apply):

- ☐ Always.
- ☐ In Ports and rivers
- ☐ In the Approaches to the Port
- ☐ In Coastal waters
- ☐ On the continental shelf (Depths 200m and less)
- ☐ In the vicinity of charted PA dangers etc.
- ☐ When indications of shoals are seen (discoloured water, breakers, land) visually or on Radar
- ☐ Never
- Other

If No please move to the next question.

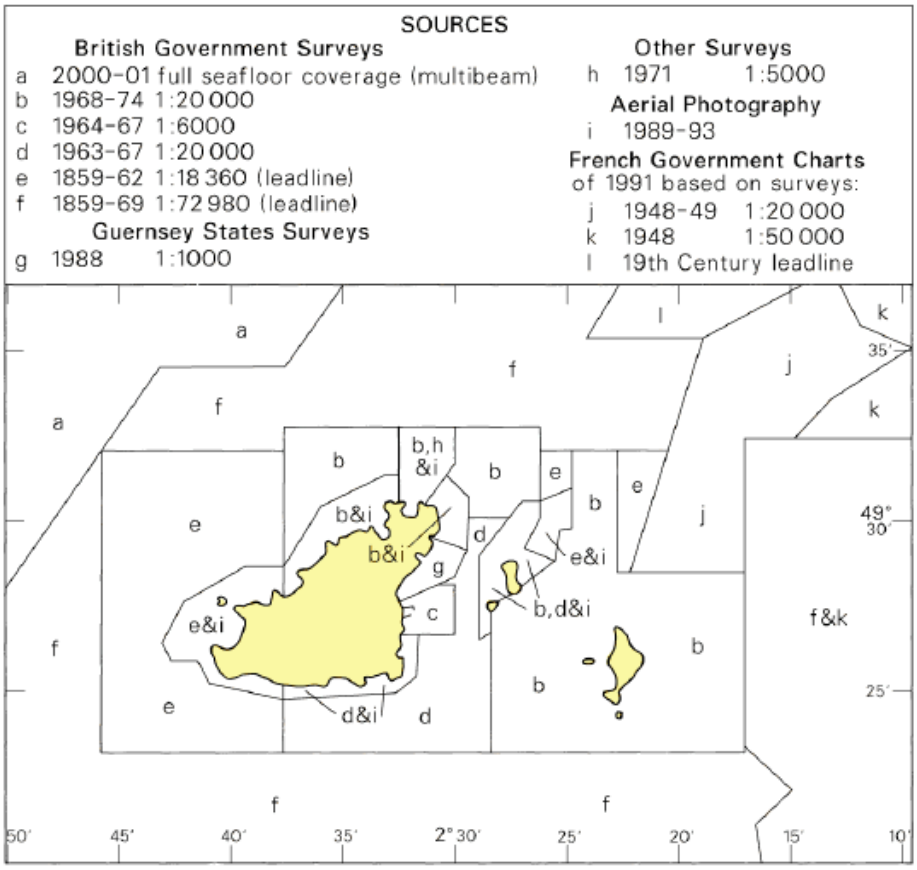
# Section 2, Your Perception and Awareness of Current Methods of Representing Data Quality

Paper charts and ENCs depict quality in many different, and sometimes subtle, ways. These are set out below and it would be useful if you would answer the questions relating to each one that applies to you. The questions are not intended to be an 'exam' so please do not look up the answer so as to get a good score. The questions are intended to discover what data quality items are not used or not understood and to use this information to design a better method of depicting quality. It may also allow a course, or module in a course, to be developed to educate mariners in these important points.

## Paper Charts

**8. Do the charts you use have a source diagram?**

**e.g.**




Yes ☐
No ☐ Go to question 9.

Do you take note of the information in the Source Diagram?
Yes ☐

If Yes; Do you plan routes which stay in better surveyed areas?
Yes ☐ No ☐

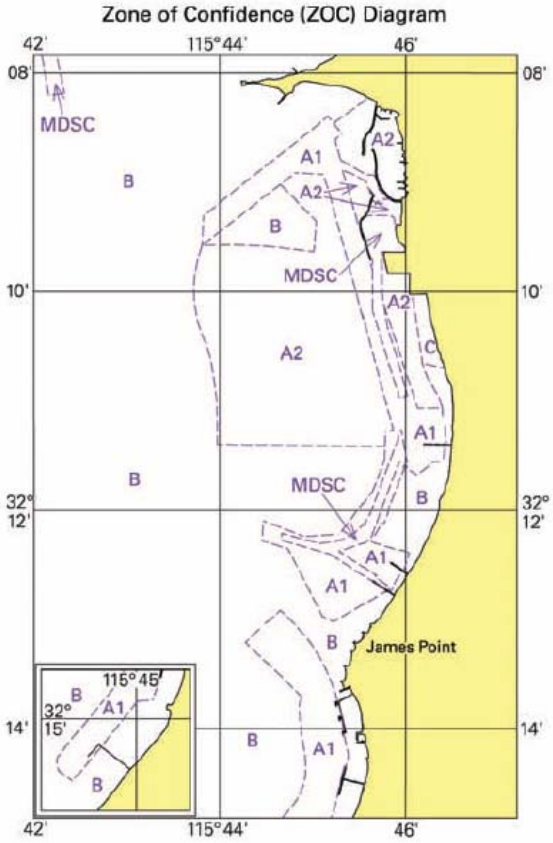
Do you operate revised procedures for areas with different qualities of survey e.g. slow down etc? (Please state what)

Other (please state)

No ☐

If No, why? Charts I use do not have one ☐
I have no control over the route I take ☐
I have used the same route many times before ☐
Other (please state)

**9. Do the charts you use have a ZOC diagram?**
**e.g.**




ZOC CATEGORIES
(For details see Australian Notice to Mariners No 25)

| ZOC | POSITION ACCURACY | DEPTH ACCURACY | SEAFLOOR COVERAGE |
|---|---|---|---|
| A1 | ±5m | =0·50m + 1%d | All significant seafloor features detected. |
| A2 | ±20m | =1·00m + 2%d | All significant seafloor features detected. |
| B | ±50m | =1·00m + 2%d | Uncharted features hazardous to surface navigation are not expected but may exist. |
| C | ±500m | =2·00m + 5%d | Depth anomalies may be expected. |
| D | Worse than ZOC C | Worse than ZOC C | Large depth anomalies may be expected. |
| U | Unassessed - The quality of the bathymetric data has yet to be assessed. | | |
| MDSC | Maintained Depth See Chart | | |

Yes ☐
No ☐ Go to question 10.

Do you take note of the information in the ZOC Diagram?
Yes ☐

If Yes; Do you plan routes which stay in better surveyed areas?
Yes ☐ No ☐
Do you operate revised procedures for areas with different qualities of survey e.g. slow down etc? (Please state what)

Other (please state)

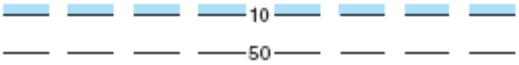
No ☐

If No, why? Charts I use do not have one ☐
I have no control over the route I take ☐
I have used the same route many times before ☐
Other (please state)

**Charts have several quality indicators as illustrated below. Please state if you are aware of the meaning of the indicator and also how you take note of these when navigating and/or route planning.**

**10. Broken depth contours**

**e.g.**




What is your understanding of broken depth contours?

Do not know ☐ (Go to question 11)

What do broken depth contours indicate?
How does the existence of broken depth contours alter the way that you navigate / plan routes?

**11. Broken coastline**

**e.g.**

What is your understanding of broken coastline?

Do not know ☐ (Go to question 12)

What does a broken coastline indicate?
How does the existence of a broken coastline alter the way that you navigate / plan routes?

**12. Dotted danger lines**

**e.g.**

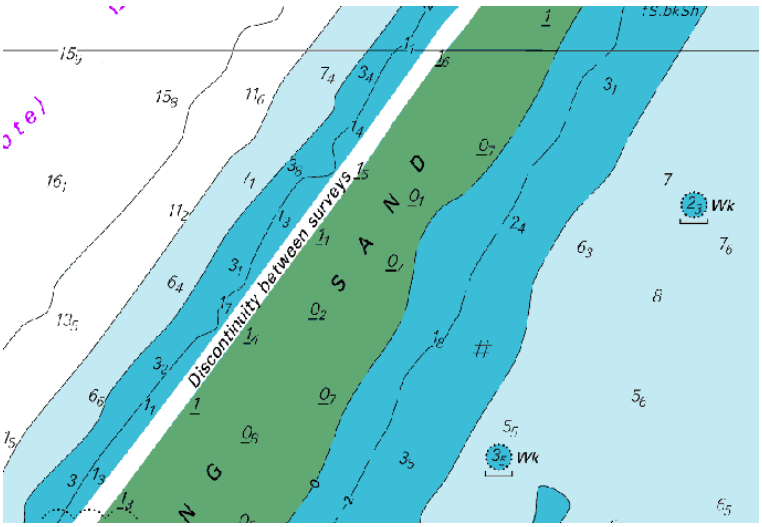
What is your understanding of Dotted Danger Lines?

Do not know ☐ (Go to question 13)

What does a Dotted Danger Line indicate?
How does the existence of a Dotted danger line alter the way that you navigate / plan routes?

## 13. Discontinuity between surveys

**e.g.**




What is your understanding of Discontinuities between surveys?
Do not know ☐ (Go to question 14)

What does a discontinuity between surveys indicate?
How does the existence of a discontinuity between surveys alter the way that you navigate / plan routes?

## 14. Notes relating to lack of survey

**e.g.**


V

Do not know ☐ (Go to question 15)

What does the ‘Unsurveyed’ note mean?
What does the ‘Depths’ note mean?

How does the existence of a ‘Unsurveyed’ and ‘Depths’ notes alter the way that you navigate / plan routes?

## 15. PA, PD, ED and SD abbreviations

**e.g.**

PA PD ED SD

What is your understanding of the PA, PD, ED and SD abbreviations when applied to a feature or sounding?
Do not know ☐ (Go to question 16)

What does the abbreviation PA mean?
What does the abbreviation PD mean?
What does the abbreviation ED mean?
What does the abbreviation SD mean?

How does the existence of a 'PA, PD, ED or SD abbreviation against a feature or sounding alter the way that you navigate / plan routes?

PA
PD
ED
SD

## 16. Upright (hairline) sounding

**e.g.** 


**Upright font** **Normal font for soundings**

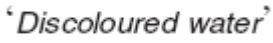
What is your understanding of a sounding written in an upright font?
Do not know ☐ (Go to question 17)

What do you understand from a sounding written in an upright font?

How does the existence of a, or more than one, sounding in an upright font alter the way that you navigate / plan routes?

## 17. Discoloured water legend

**e.g.**




What is your understanding of 'Discoloured water' legend?
Do not know ☐ (Go to question 18)

What do you understand from the Discoloured water legend?

How does the existence of a 'Discoloured water' legend alter the way that you navigate / plan routes?

## 18. Sand wave symbol

**e.g.**

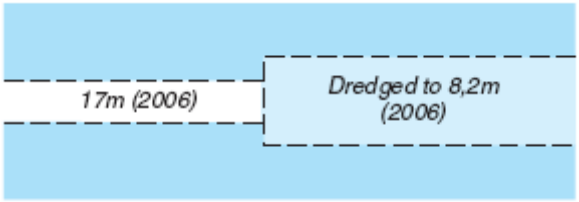
What is your understanding of the Sand wave symbol?
Do not know ☐ (Go to question 19)

What do you understand from the Sand wave symbol?

How does the existence of a sand wave symbol alter the way that you navigate / plan routes?

## 19. Dredged to … legend

**e.g.**




What is your understanding of the Dredged to legend?
Do not know ☐ (Go to question 20)

What do you understand from the 'Dredged to…' legend?

How does the existence of a 'Dredged…' to legend alter the way that you navigate / plan routes?

## 20. Potentially Dangerous Wreck

**e.g.**

What is your understanding of the Potentially Dangerous Wreck symbol?
Do not know ☐ (Go to question 21)

What do you understand from the Potentially Dangerous Wreck symbol?

How does the existence of a Potentially Dangerous Wreck alter the way that you navigate / plan routes?

## 21. Bar above a Dangerous wreck symbol

**e.g.**


Note: the wire swept symbol is a bar below the feature with up turned ends as shown to the right.



What is your understanding of the bar above the dangerous wreck symbol?
Do not know ☐ (Go to question 22)

What is the meaning of the bar above the dangerous wreck symbol?

How does the existence of a bar above a dangerous wreck symbol alter the way that you navigate / plan routes?

**22. Works in progress legend**

**e.g.**


What is your understanding of the various works in progress legends?
Do not know ☐ (Go to question 23)

What is the meaning of the various works in progress legends?

How does the existence of a works in progress legend alter the way that you navigate / plan routes?

## ENCs

**23. Do you use ENCs?**
Yes ☐
No ☐ Go to question 39

**When using the ENCs:**

**24. Do you take note of the information in the CATZOC?**
Yes ☐
If Yes; Do you plan routes which stay in better surveyed areas?
Yes ☐ No ☐
Do you operate revised procedures for areas with different qualities of survey e.g. slow down, maintain a sonar watch etc? (Please state what)

Other (please state)
Go to question 25

No ☐ Go to Question 35

**In addition to CATZOC, ENCs have several quality indicators as illustrated below. Please indicate if you are aware of the meaning of the indicator and also whether you take note of these when navigating and/or route planning.**

**25. HORACC – Horizontal accuracy**

What is your understanding of HORACC?
Do not know ☐ (Go to question 26)

What does HORACC indicate?
How does HORACC alter the way that you navigate / plan routes?

**26. POSACC – Positional accuracy**

What is your understanding of POSACC?
Do not know ☐ (Go to question 27)

What does POSACC indicate?
How does POSACC alter the way that you navigate / plan routes?

**27. SOUACC – Sounding accuracy**

What is your understanding of SOUACC?
Do not know ☐ (Go to question 28)

What does SOUACC indicate?
How does SOUACC alter the way that you navigate / plan routes?

**28. VERACC – Vertical Accuracy**

What is your understanding of VERACC?
Do not know ☐ (Go to question 29)

What does VERACC indicate?
How does VERACC alter the way that you navigate / plan routes?

**29. SURATH – Survey Authority**

What is your understanding of SURATH?
Do not know ☐ (Go to question 30)

What does SURATH indicate?
How does SURATH alter the way that you navigate / plan routes?

**30. SURSTA – Survey Start**

What is your understanding of SURSTA?
Do not know ☐ (Go to question 31)

What does SURSTA indicate?
How does SURSTA alter the way that you navigate / plan routes?

**31. SUREND – Survey End**

What is your understanding of HORACC?
Do not know ☐ (Go to question 32)

What does SUREND indicate?
How does SUREND alter the way that you navigate / plan routes?

**32. TECSOU – Technique of Sounding**

What is your understanding of TECSOU?
Do not know ☐ (Go to question 33)

What does TECSOU indicate?
How does TECSOU alter the way that you navigate / plan routes?

**33. QUASOU – Quality of Sounding**

What is your understanding of QUASOU?
Do not know ☐ (Go to question 34)

What does QUASOU indicate?
How does QUASOU alter the way that you navigate / plan routes?

**34. QUAPOS – Quality of Position**

What is your understanding of QUAPOS?
Do not know ☐ (Go to question 35)

What does QUAPOS indicate?
How does QUAPOS alter the way that you navigate / plan routes?

Other. Please state what and how you use it:

Go to Question 'Further Comments'.

**35. Do you consider the quality of the data that was used to compile the chart/ENC you use to be relevant to you?**

☐ Yes (go to question 38)
☐ No (continue to question 36)

**36. Would you take note of data quality information if it were explained to you / was available in the charts you use?**

☐ Yes (go to question 38)
☐ No (continue to question 37)

**37. Why would you not take note of data quality information?**

*You may tick more than one (then go to question 40)*

☐ Routes are planned centrally and I have no/little control over them
☐ Policy is governed by the company/organisation
☐ The route I use has no alternatives so I can not alter it.
☐ The route I use has been travelled many times before so I know it is OK.
☐ I trust that the HO producing the chart has done a good job and that the chart depicts the seafloor accurately.
☐ I am not aware of what data quality information is available.
☐ I do not know the relevance of the data quality information
☐ The charts / ENCs I use do not contain any data quality information or its use is so sporadic that it is effectively useless.

Other. Please state:

**38. Who would you expect training on data quality to be provided by?**

☐ Local/national maritime colleges
☐ IHO/Local Hydrographic Offices
Other:

# Section 3, Future Developments

**39. If you currently use data quality indicators do you think the existing methods (Source diagram, CATZOC etc) are adequate?**

☐ Yes
☐ No

**40. All existing methods of data quality only relate to charted parameters. Would you like any new system to take into account your vessel parameters, e.g. draught, length, beam, under-keel clearance etc? (such parameters would need to be entered into the system by you).**

☐ Yes
☐ No

Please state why:

**41. If you answered No to question 39, please say why and, if you can, detail how you would like the data quality information to be presented? E.g. It has been proposed to indicate data quality as a colour wash (red can not go, amber beware, green safe to go) on ENCs based on the ship parameters (draught etc) charted depth, estimated uncertainty of the charted depth etc.**

# Further Comments

If you have any further comments that you feel would be useful to the work of the data quality working group, please use the space below.

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# **Contact Details** (Optional)

If you give permission for the Data Quality Working Group to contact you regarding our study, please fill out the form below.

Name:

Email:

Address:

Contact telephone number: