# Implementation of Data Alignment Measures for the Alignment of Planning, Lands and Public Works Data

## Final Report (Volume 2H)
## Maintenance of Metadata

March 2004

<table>
<tr><td colspan="6" align="center"><h1>Amendment History</h1></td></tr>
</table>

| Change Number | Revision Description | Pages Affected on Respective Version | Revision/ Version Number | Date | Approval Reference |
|---|---|---|---|---|---|
| 0 | Initial Release | | 1.0 | 4 Mar 2004 | |

# Volume 2H – Maintenance of Metadata

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# 1 Introduction

## 1.1 Purpose

1.1.1 This document would be the draft version of the Practice Note which advises on the requirements in

(a) Administration of Digital Geographic Data, including the responsibility of GIS Managers/ Administrators;

(b) Documentation Requirements of Digital Geographic Data in the various Geographical Information Systems (GIS) in the departments of the Works Branch of the ETWB, HPLB and FSTB; and

(c) Maintenance of Inventory of Metadata Tools.

1.1.2 This Practice Note shall be read in conjunction with HPLB TC No. xx/xx and ETWB TC No. xx/xx.

## 1.2 Definition

1.2.1 *"Digital Geographic Data"* shall be as defined in PELB TC 3/96 or WB TC 20/96, i.e. **Digital Geographic Data** shall be the same as **Digital Geospatial Data** used in the ASTM standards.

1.2.2 **Metadata** is the data about the data, and covers the content, quality, condition, and other characteristics of data.

1.2.3 **Content of digital geospatial metadata** shall be the information content of metadata for a set of digital geographic data.

1.2.4 **Catalogue of Geographical Information Systems** shall be a catalogue containing high-level information pertinent to the particular GIS.

1.2.5 *"DAS"* shall mean Data Alignment Strategy which is an initiative of HPLB to improve the efficiency and effectiveness in the exchange of planning, lands and works (PLW) data. It comprises two components: DAM and DAF.

1.2.6 *"DAM"* and *"DAF"* shall mean Data Alignment Measures and Data Alignment Framework respectively. While DAM refers to the short term measures which are implementable within a reasonable short timeframe, DAF

refers to the long term solution for the exchange of Planning, Lands and Works (PLW) data. These two components form the DAS.

1.2.7    "*Planning, Lands and Public Works Data*" or "PLW Data" shall mean the geospatial data currently exchanged among the participating departments for planning, lands and works purposes. These data include, but not limited to, the data generated from the GIS system or from CAD system, for drawings, spatial analysis and other applications relating to buildings, developments, lands, land administration, planning and works projects.

1.2.8    "*CSWP*" shall mean the CAD Standards for Works Projects promulgated in ETWB TC(Works) 38/2002. All CAD exclusive data shall be CSWP compliant.

# 2      Administration of Digital Geographic Data

## 2.1     Policy

2.1.1     Departments who have implemented GISs should appoint one GIS Manager to oversee the various GIS within the department, and one GIS Administrator for each GIS.  The GIS Manager should be responsible for coordinating the development of GISs at departmental level and GIS Administrators for managing the planning, implementation, operation and maintenance of the system.

2.1.2     Departments should advise LIC, LandsD of the particulars of the GIS Manager and GIS Administrators, whenever the appointment is newly made, or there is any change to the existing appointment.

2.1.3     As per Volume 2 I recommendation, in the context of CSU data, unless otherwise instructed by the PDs, the GIS Managers of the respective PDs will represent the department (in the capacity of Data Agent/Data Owner/Data User) to attend all issues relevant to the discharge of the duties.

2.1.4     The responsibilities for GIS Managers and GIS Administrators are set out in details in Appendix A.

# 3        Documentation Requirements for Digital Geographic Data

## 3.1      Metadata Documentation

3.1.1    The requirements shall consist of a catalogue as per Appendix B and the metadata documentation conforming to Federal Geographic Data Committee (FGDC) Standard[1] – the American Society for Testing and Materials (**ASTM**) Specification, "**Content of Digital Geospatial Metadata**".

## 3.2      Policy

3.2.1    All GISs in Participating departments in DAM shall be complete with the proper documentation to facilitate sharing and re-use of digital geographic data.  This policy is amplified by the following procedures that all GIS:-

   (a)       which are acquired after 1 August 1996, shall be complete with a set of metadata documentation prepared as per ASTM Section D5714-95, "**Content of Digital Geospatial Metadata**".

   (b)       which were acquired in W-PELB departments before 1 August 1996, shall be complete with the covering metadata documentation two years after the promulgation of this Practice Note.

   (c)       shall be complete with the Catalogue of Geographical Information System as per Appendix B to this Practice Note.

3.2.2    The GIS Manager shall be responsible for preparation of the metadata documentation and the Catalogue of Geographical Information System for the GISs under his control, and shall deposit the same at Land Information Centre (LIC) of Lands Department.  The documentation shall be made available on demand to W-PELB departments, private sector organisations and individuals interested in further use of the data unless the system contains data which is sensitive and confidential in nature.  In such cases, the Code on Access to Information shall be relevant.

3.2.3    All documentation for Digital Geographic Data in departments should be reviewed and updated no less than every 6 months or upon major amendments so as to ensure that it is as current as possible.

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[1] Please refer to Appendix C for details of the FGDC Standard.

3.2.4    A review on the requirements covered in this Circular will be conducted one year after the promulgation of this Circular or upon completion of the first set of the documentation whichever the sooner.

# 4 Inventory of Metadata Tools

## 4.1 Present Status of PDs

4.1.1   A survey was conducted on metadata tools currently adopted amongst the 13 participating departments (PDs). Table 1 illustrates the PDs, who are grouped into 3 categories:

(a)   *Cate*gory A Non-GIS PD – PD who does not possess any GIS software for the handling of geospatial data.

(b)   Category B Minor GIS PD – PD who purchased standard GIS product mainly for viewing, spatial query and simple manipulation of geospatial data. The PD does not have a customised GIS application.

(c)   Category C GIS PD – PD who owns customized GIS solution(s) for the creation, updating and maintenance of geospatial data to meet the business need of the PD.

| PDs | Category A<br><br>Non GIS PD | Category B<br><br>Minor GIS PD | Category C<br><br>GIS PD |
|---|---|---|---|
| ArchSD | ✔ | | |
| BD | ✔ 2 | | |
| LR | ✔ | | |
| TDD | | ✔ | |
| EMSD | | ✔ 3 | |
| C&SD | | | ✔ 4 |
| DSD | | | ✔ 5 |

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2 BD will become Cat C on implementation of BDGIS scheduled in 2004.

3 EMSD launched a pilot GIS application system and will become Cat C on its full implementation

4 Yet to maintain metadata

5 Yet to maintain metadata

| PDs | Category A<br><br>Non GIS PD | Category B<br><br>Minor GIS PD | Category C<br><br>GIS PD |
|---|---|---|---|
| RVD | | | ✔ 6 |
| CED | | | ✔ |
| HyD | | | ✔ |
| LandsD | | | ✔ |
| PlanD | | | ✔ |
| WSD | | | ✔ |

*Table 1 Categorization of PDs*

4.1.2    Metadata is not available from the Non GIS PDs nor from Minor GIS PDs.  EMSD launched its pilot GIS and the manipulated data are mainly for trial and pilot purpose.  For TDD, they procured a standard product for simple data manipulation. Though the products come with metadata production tools, they might not have a genuine need to maintain metadata for this purpose at this stage.

| PDs | System Name | Geospatial Data | Tools |
|---|---|---|---|
| EMSD | Pilot GIS | Footbridges and subways | ArcCatalog |
| TDD | Arc/Info | Base map | ArcCatalog |

*Table 2 Minor GIS PDs*

4.1.3    While most PDs are maintaining their metatdata, RVD and C&SD are yet to maintain their own set due to resource constraint. DSD currently does not have their own set of metadata, but they will have plan to generate their metadata.

4.1.4    Table 3 summarises the metadata status of GIS PDs:

| PDs | Metadata ID | System Name | Geospatial Data | Equipped with Metadata Tools | Method of Production | FGDC Compliant |
|---|---|---|---|---|---|---|
| | | | | | | |

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6 Yet to maintain metadata

| PDs | Metadata ID | System Name | Geospatial Data | Equipped with Metadata Tools | Method of Production | FGDC Compliant |
|---|---|---|---|---|---|---|
| C&SD | CSD-01 | Digital Mapping System (DMS) | Buildings and Temporary Structures | Yes ArcCatalog | N/A | N/A |
| DSD | DSD-01 | AM/FM | Drainage Network Data | Yes | N/A | N/A |
| RVD | RVD-01 | Property Master System (PMS) | Property Data for tenement and valuation | Yes ArcCatalog | N/A | N/A |
| CED | CED-01 | Slope Information System | Man-made slope Features | Yes ArcCatalog | Automated | Yes |
| | CED-02 | Geological Modeling System | Geological data | Yes ArcCatalog | Automated | Yes |
| | CED-03 | Computerised Slope Registration and Location Plan System | Man-made slope Features | N | Manual | Yes |
| HyD | HYD-01 | Road Data Maintenance System (RDMS) | Road Related Data | Yes ArcCatalog | Automated | Yes |
| LandsD | LND-01 | Computerised Land Information System (CLIS) | B1000, B5000, B10000, B20000 Base Maps & C1000 digital land record | Yes ArcCatalog | Automated | Yes |
| PlanD | PLN-01 | Town Planning Information System (TPIS)[7] | 1. Outline Zoning Plans 2. TPU 3. SB | Yes ArcCatalog | Automated | Yes |

[7] According to LandsD, the metadata documentation of TPIS is deposited in LandsD, but PlanD requests that the documentation cannot be placed in LandsD's Metadata Catalog System for searching.

| PDs | Metadata ID | System Name | Geospatial Data | Equipped with Metadata Tools | Method of Production | FGDC Compliant |
|---|---|---|---|---|---|---|
| WSD | WSD-01 | Digital Mapping System (DMS) | Water Mains Records Plan | Yes ArcCatalog | Automated | Yes |

*Table 3 Inventory of GIS PDs*

4.1.5    CED chooses to do it manually for the Computerised Slope Registration and Location Plan System because the manual effort required is very minimum.

## 4.2      Inventory of Department based metadata Tools

4.2.1    The tools adopted by PDs are mostly ArcCatalog running under Windows NT 4.0, Windows 2000 and different Unix environment, and a variety of GIS software versions. For PDs' reference, Appendix C.3 provides a list of tools and utilities available for the generation of metadata conforming to the FGDC standard.

4.2.2    An inventory of the metadata tools adopted by the GIS PDs is summarised in Table 4. It shows the PD's systems, environment, software and geospatial datasets, including information of the last updated date, updating frequency, and manual processing effort involved in each production of metadata for their datasets.

## 4.3      Inventory of CSU based metadata tools

4.3.1    For TPU/SB CSU, the same metadata production tool of the system Town Planning Information System (TPIS) will be used to generate the metadata of TPU/SB CSU.

4.3.2    For Slope CSU, the same metadata production tools of the system Slope Information System (SIS) will be used to generate the metadata of Slope CSU.

| Depart- ment | System Name | Operating System | GIS Software | Spatial Data Format | Textual Data Format | Description of metadata | Metadata Tool | Manual Effort[8] - First Preparation | Last Update Date | Freq [9] | Manual Effort[10]- Mainten- ance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CED | Slope Information System | WinNT 4.0 | Microstation J | DGN | Oracle | Metadata documentation is available. | ArcCatalog [11] | PTO(G): 3 | 1998 | A-Y | PTO(G): 2 |
| | Modeling System | WinNT 4.0 | ArcGIS 8.X | DGN | dbf | Metadata documentation is available. | ArcCatalog | - | - | N/A | STO/TO:1 |
| Geological Computerised | Slope Registration and Location Plan System | WinNT 4.0 | Microstation J + Geographics | DGN | Oracle | The CSRLP system maintains a digital map database as an up-to-date registrar of all registered slope features in the Hong Kong Territories . | - | - | Jun 2003 | A-Y | 1 hour |

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[8] Manpower resources required in the first preparation of metadata generation are shown in terms of number of man-days & rank.

[9] Updating Frequency is expressed in terms of Occurrence and Duration, i.e., How often the metadata is generated within a specified duration, where, Occurrence: "O" = On an on-going basis, "A" = On an ad-hoc basis; Duration: "Y" = Year, "H" = Half Year, "Q" = Quarter.

[10] Manpower resources required in subsequent maintenance for each metadata update are shown in terms of number of man-days & rank.

[11] CED has access to an Arc/Info software, and would make use of the available ArcCatalog tool for future generation and maintenance.

| Depart ment | System Name | Operating System | GIS Software | Spatial Data Format | Textual Data Format | Description of metadata | Metadata Tool | Manual Effort[8] - First Preparation | Last Update Date | Freq [9] | Manual Effort[10]- Mainten-ance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HyD | Road Data Maintenance System (RDMS) | Window 2000 (SP2) | ArcInfo/ ArcSDE v8.1.2 | ArcSDE | Oracle | Please see http://www.info.gov.hk/landsd/mapping/eng/lic/metadata.htm | ArcCatalog | SO: 4 | Feb 2003 | A-Y | SO:2 |
| LandsD | Computerized Land Information System (CLIS) | Solaris v2.6 | Arc/Info v6.x | Arc/Info Coverage | Info | Metadata documentation for B1000, B5000 digital topographic maps (Basic Mapping System) are available. Please see http://www.info.gov.hk/landsd/mapping/eng/lic/metadata.htm | ArcCatalog | LS:1 PTO/STO: 1.75  TO: 3.5 | Jun 2003 | O-Q[12] | LS:0.3  PTO/STO: 0.8  TO: 1.5 |
|  |  | Solaris v2.6 | Arc/Info v6.x | Arc/Info Coverage | Info | Metadata documentation for C1000 digital land record (Cadastral Information System) is available Jan 2004. Please see http://www.info.gov.hk/landsd/mapping/eng/lic/me | ArcCatalog | LS:1 PTO/STO: 1.75  TO: 3.5 | Jan 2004 | O-Q | LS:0.3  PTO/STO: 0.8  TO: 1.5 |

[12] The update frequency of metadata for B1000, B5000 digital topographic maps and C1000 digital land record would be at half-yearly interval initially, and later at quarterly interval.

| Depart ment | System Name | Operating System | GIS Software | Spatial Data Format | Textual Data Format | Description of metadata | Metadata Tool | Manual Effort[8] - First Preparation | Last Update Date | Freq [9] | Manual Effort[10]- Mainten-ance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | tadata.htm | | | | | |
| | | Windows NT | Microstation | DGN/ Arc/Info | Access | Metadata documentation for B10000, B20000 (Small Scale Mapping System) is available at http://www.info.gov.hk/landsd/mapping/eng/lic/metadata.htm | ArcCatalog | LS:1 PTO/STO: 1.75  TO: 3.5 | Jun 2003 | O-H | LS:0.3  PTO/STO: 0.8  TO: 1.5 |
| PlanD | Town Planning Information System (TPIS) | Solaris v2.6 | Arc/Info v 7.2.1 | Arc/Info Coverage | Info | Metadata documentation for TPU and SB metadata are available. | ArcCatalog | TO:2  STO:1 | May 2003 | A-Y | TO:2  STO:1 |
| WSD | Digital Mapping System (DMS) | SGI IRIX 6.5 | Arc/Info 8.0  SDE 3.2 | | Oracle and Info | Metadata documentation for Water Mains Record Plan is available at http://www.info.gov.hk/landsd/mapping/eng/lic/metadata.htm | ArcCatalog | - | Feb 2001 | - | - |

*Table 4 An Overview of Metadata Generated within GIS PDs*

# 5      Suggestions For Improvement

## 5.1      Improve Metadata Quality

5.1.1      Metadata tools are "tools" to help PD document the data about the "geospatial data".  The tools would help improve the efficiency in the metadata production process, but the effectiveness of the metadata would very much depend on how the data is described.   The followings are suggestion which PD could consider in the preparation of metadata:

(a)      Define the right scope of geospatial dataset – some metadata could be too broadly defined.  They are generated from a large dataset of different spatial data features to form a single metadata record. On the contrary, some metadata could be too finely defined. Whilst it may not be possible to document every data table and resource, providing too much information, or over-generalising the dataset is not a good practice and may not be helpful to the Data user. PDs are recommended to consider how the data resource is used first, and determine how the metadata should be organized and produced.

(b)      Input the right information – sometimes the departments are confused with the definition, e.g.  "Currentness Reference" and "Publication Date". Some users are confused between the two: the former refers to the time currency of content, i.e. a particular date/ time when the data is captured, whereas the latter refers to the date the information when the metadata was officially recorded or published.

(c)      Complete data entry -  A complete metadata should provide information about the quality and condition of data. It is noted that some optional fields are sometimes not provided, such as the data accuracy, and how the data is verified etc.   It is suggested that PDs should complete the following information in the preparation of metadata:

(i)      Attribute Accuracy Report – should describe how 'true' the attribute values may be e.g. field checks are carried out, but this does not refer to the positional accuracy of the value.

(ii)      Logical Consistency Report  - this includes topological checks and routine checks conducted on the attributes, e.g. check if values are between '0' and '100';

(iii)      Completeness Report – should explain cases where data can be omitted or excluded;

(iv)     Positional Accuracy – should tell the accuracy, and how information are obtained – via digitizing (where digitizing error can be introduced), survey techniques, image processing methods etc.

(v)      Precision – should tell how data is recorded – say, in single or double precision. The precision does not imply higher degree of data accuracy though.

(d)     Maintenance of Metadata – metadata should be recorded during the entire lifecycle of the dataset, from planning (entities and attributes), to digitizing (resolution), to analysis, through publication. It is noted that some PDs have not updated their metadata for a few years. PDs are recommended to develop operational procedures that-

(i)      Institutionalize metadata production and maintenance;

(ii)     Make metadata a key component of their data development and management process.

(e)     Creation of Metadata – some PDs are yet to produce the metadata for their newly implemented GIS systems. PD might have to pay a price for not compiling metadata, as there could be loss of information due to staff movements and misapplications. Sometimes management might not be able to make a quality decision based on poorly documented data.

## 5.2     Enforcement

5.2.1    The generation of metadata and its submission to LandsD for central hosting will be a mandatory requirement and need to be enforced. Currently, only a few departments submit their metadata to LandsD as required by the PELB and Works Branch TCs.

5.2.2    Although LandsD could follow up with reminders to ask PDs to submit metadata, such effort is not constructive. PDs should be encouraged to commit resources to prepare their first set of metadata and its subsequent maintenance.

# Appendix A - Responsibility of GIS Managers/Administrators

## A.1     GIS Manager

A.1.1   The responsibilities for the GIS Manager are as follows-

(a)     To formulate and implement the departmental strategy for developing GIS.  Such strategy should cover-

      (i)     capturing and refining geographic data cost-effectively through the implementation of data standards to facilitate data sharing and re-use;

      (ii)    establishing necessary standard on data infrastructure including data modelling, data definitions etc.  As far as is practicable, standardising hardware and software platform for proposed GISs to optimise the investment in hardware, software and training; and

      (iii)   instituting departmental procedures and guidelines to ensure, in so far as possible, the interoperability among various GISs.

(b)     To coordinate the production and maintenance of documentation for Digital Geographic Data in accordance with PELB TC 3/96 or WB TC 20/96 for the department's GISs; and

(c)     To oversee and coordinate the work of the GIS Administrators in the department

(d)     In the context of CSU data, unless otherwise instructed by the PDs, the GIS Managers of the respective PDs will represent the department (in the capacity of Data Agent/Data Owner/Data User) to attend all issues relevant to the discharge of the duties.

## A.2     GIS Administrator

A.2.1   The proposed responsibilities for the GIS Administrator are as follows-

(a)     To formulate proposals for development of GIS in accordance with the departmental GIS strategy developed by the GIS Manager;

(b)     To manage the implementation, operation and maintenance of GISs; and

(c)     To produce and maintain documentation for Digital Geographic Data for GIS in accordance with PELB TC 3/96 or WB TC 20/96.

# Appendix B – Format for Catalog of GIS

| Owner | Institution/Department/Company |
|---|---|
| Item Name | Short GIS name, *e.g. Computerised Land Information System (CLIS)* |
| Descriptions | Function of the GIS, *e.g. to maintain information of 1:1000 scale topographical map* |
| GIS Manager | Post: address, telephone, fax number, e-mail address, *e.g. CLS/LIC, Room 1501, 15/F, Murray Building, Hong Kong, Tel. 2848 6136, Fax. 28778520* |
| GIS Administrator | Post: address, telephone, fax number, e-mail address |
| Sources | source(s) of the data in the GIS system, *e.g. 1:1000 survey sheets, field survey* |
| System Platform | technology description, information of hardware, software and operation system |
| Item Identifier(s) | list the objects/identifiers in the dataset(s), *e.g. address, lot ID* |
| GIS Coverage | extent of data, state boundaries, *e.g. whole territory* |
| Users | Primary User, e.g. *LandsD* <br><br> Secondary Users, *e.g. Other government departments, utilities* |
| Availability | Restrictions and constraints to the use of the GIS data; i.e. contains confidential data items. |
| Symbology | Set of Symbols used in GIS to identify items of data; *e.g. HK Government Engineering Survey Offices; 1:200 and 1:500 Survey and Drafting Specifications* |
| Metadata | Name of the metadata database |
| Data Dictionary | Name of Data Dictionary, *e.g. BMS and CIS Dictionaries* |

*Table 5 Format for Catalogue of GIS*

# Appendix C - Metadata and Tools

## C.1 Federal Geographic Data Committee (FGDC) Standard

C.1.1  The Federal Geographic Data Committee (FGDC) initiated work on the first version of this standard in June 1992, through a forum on geospatial metadata. The committee accepted the offer of American Society for Testing and Materials Section D18.01.05 "Standard Specification for Content of Digital Geospatial Metadata" (D5714-95) to develop a draft information content standard. Extensive comments were received from the public with additional drafts produced. The refined drafts were offered for review and testing in January and March 1994. The first version was approved June 8, 1994.

C.1.2  Since the implementation of FGDC's Content Standard for Digital Geospatial Metadata (CSDGM, FGDC Metadata Standard), the Standard has been adopted by Federal, state, and local agencies, companies, and groups in the US. It has also been used by other nations as they develop their own national metadata standards. As a result of this international exposure and the feedbacks received from agencies, the FGDC updated the Metadata Standard and re-published in June 1998.

C.1.3  The objective of the FGDC metadata standard is to provide a common set of terminology and definitions for the documentation of digital geospatial data that can be made compatible with current requirements and good practices now being adopted by the various user groups within the US and other countries. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.

C.1.4  The metadata standard will serve to provide a common set of terminology and definitions for concepts related to the metadata. It should be independent of software and hardware platforms and should cover the four roles played by the metadata as below:-

   (a)  *Availability* – Information required to determine the sets of data that exist for a geographic location;

   (b)  Fitness for use – Information required to determine if a set of data meets a specific need;

   (c)  Access – Information required to acquire an identified set of data; and

   (d)  Transfer – Information required to process and use a set of data.

C.1.5  The scope of this standard is intended to support the collection and processing of geospatial metadata. The standard is not intended to reflect an implementation

design. An implementation design requires adapting the structure and form of the standard to meet application requirements. In addition, the standard does not specify the means by which this information is organized in a computer system or in a data transfer, nor the means by which this information is transmitted, communicated, or presented to the user.

C.1.6    The standard specifies the elements that are required to support three major uses of metadata: (1) to maintain an organization's internal investment in geospatial data, (2) to provide information to data clearinghouses and catalogs, and (3) to provide information needed to process and interpret data transferred from another organisation.

C.1.7    The FGDC Metadata Standard includes elements relating to:

   (a)      Identification;

   (b)      Data Quality;

   (c)      Spatial Data Organization;

   (d)      Spatial Reference;

   (e)      Entity and Attribute;

   (f)      Distribution;

   (g)      Metadata Reference;

   (h)      Contact;

   (i)      Time Period;

   (j)      Citation.

C.1.8    The standard also specifies the elements, which are mandatory (must be provided), mandatory if applicable (must be provided if the data set exhibits the defined characteristic), and optional (provided at the discretion of the producer of the data set). More information can be found at: http://www.fgdc.gov/metadata/meta_workbook.html.

C.1.9    There are 334 different elements in the FGDC standard, 119 of which exist only to contain other elements. These compound elements are important because they describe the relationships among other elements. For example, a bibliographic reference is described by an element called Citation_Information which contains both a Title and a Publication_Date. Agencies might need to know *which* publication date belongs to a particular title; the hierarchical relationship described by Citation_Information will make this clear.

# An Image Map of the
# Content Standard for Digital Geospatial Metadata
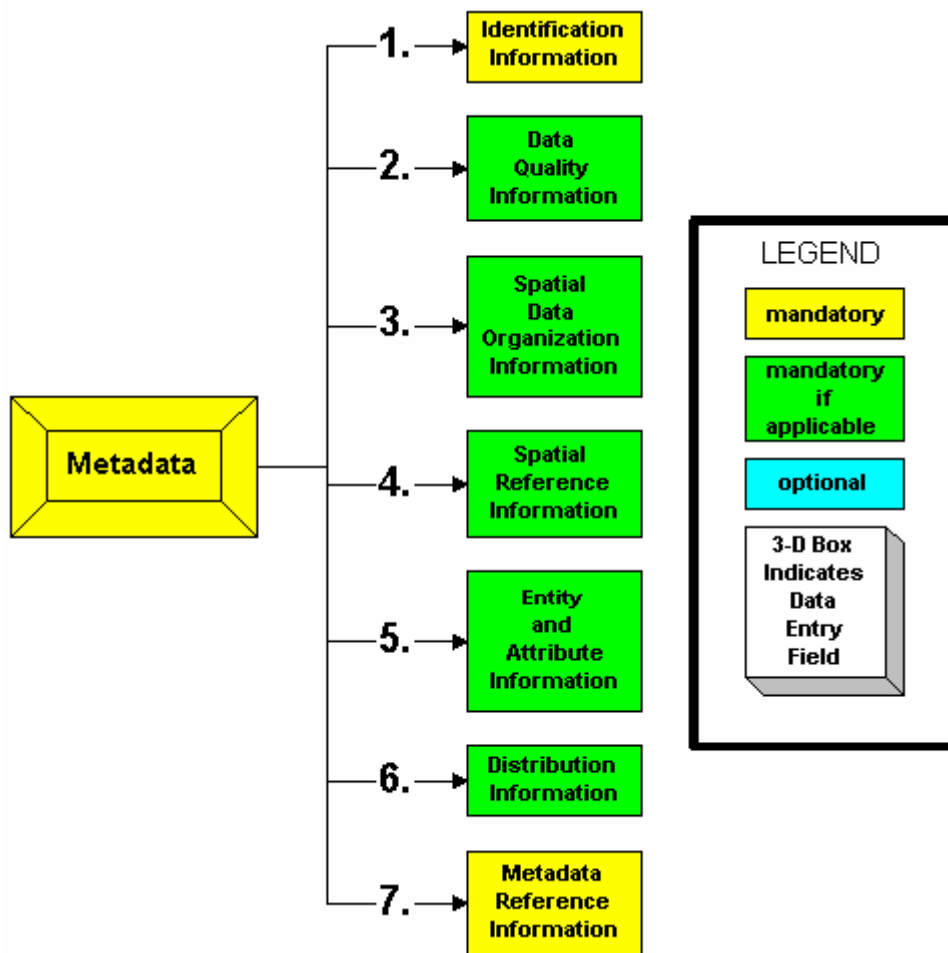Version 2 - 1998 (FGDC-STD-001 June 1998)



*Figure 1 An Image Map of the Content Standard for Digital Geospatial Metadata*

## C.2    Metadata Format

C.2.1    Metadata can be saved in a variety of formats as ASCII or Standardized
         Generalized Mark-Up Language (SGML).

C.2.2    It will be necessary to identify and evaluate software tools to address the
         automation of production of metadata.

C.2.3    Metadata production tools usually come with the GIS package, but these tools
         might need to be customized to meet the data management procedures of each PD
         and the metadata requirement.

C.2.4    GIS Administrators or Managers should manage to create metadata for their data. Creating correct metadata is like library cataloging, except that the GIS Administrators or Managers would need to reply on input from the users.

C.2.5    It is often assumed that GIS users and data producers should be motivated to generate their own metadata. For PDs who produce one or two data sets per year, general users might not want to spend time to learn the FGDC standard. One possible alternative is that they could be asked to provide information on a designed form or template that would be processed to generate the required metadata.

## C.3      Metadata Tools and Utilities

C.3.1    There are quite a number of metadata tools available in the market. This number of tools presents an array of choices which users could select to suit their own working environment.

C.3.2    Editors and utilities, such as cns, mp and tkme13 are examples of some popular tools.  Table 6 below illustrates some of the most common GIS working environments and the available tools which are used to produce metadata conforming to the 1998 CSDGM.

| Tool ID | Environment | Metadata Editor | Utilities |
|---------|-------------|-----------------|-----------|
| A-01 | ArcGIS 8.0+, ArcView 8.1+ | ArcCatalog (FGDC Metadata Editor) | cns and mp may be useful to prepare outside metadata for import into ArcCatalog. mp may be preferred to produce HTML output over ArcCatalog because it can be customized. Confident metadata editors may find that using tkme to edit the ArcCatalog XML files affords advantage for certain editing operations. |
| A-02 | ArcInfo < 8.0 | tkme  (or xtme with UNIX platform ArcInfo) | Use FGDCMETA (AML) to extract ArcInfo dataset 'property' information, then import that into tkme. Use mp to validate metadata and convert it to output forms including XML, SGML and HTML. |
| A-03 | ArcInfo < 8.0, Arcview 3.x | SMMS | cns and mp may be useful to prepare outside metadata for import into SMMS. mp may be preferred to produce HTML output over |

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13 cns, mp and tkme are freeware software utilities that are FGDC compliant

| Tool ID | Environment | Metadata Editor | Utilities |
|---------|-------------|-----------------|-----------|
|         |             |                 | SMMS because it can be customized. |
| A-04 | ArcView 3.x | tkme | DBFmeta should be used to create Entity and Attribute metadata snippet. Use mp to validate metadata and convert it to output forms including XML, SGML and HTML. |
| A-05 | Geomedia | SMMS for Geomedia | - |
| A-06 | Other GIS environments | Tkme or SMMS | Both of these tools can operate independent of any particular GIS software. Use mp to validate metadata and format it for output |

*Table 6 Metadata Tools and Utilities*