

DEVELOPMENT AND OPERATION OF JACIC/LCDM REGISTRY

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ABSTRACT: The Ministry of Land, Infrastructure, Transport and Tourism of Japan has led the CALS/EC initiative to introduce ICT in public works since 1996. In line with the CALS/EC initiative, documents, plans and data associated with public works are to be delivered in digital form which is called as 'e-delivery'. Therefore huge amount of infrastructure related information has been accumulated in each governmental/public organization. In order to highly utilize the information in various ways, it is necessary to know data specification in detail. However, it is not always easy because data specification is not necessarily standardized and varies time by time and by organization. In this regard, we JACIC created a Web site named 'JACIC/LCDM registry' in 2008 to register and retrieve data specification so that those who intends to develop new specification can refer existing specification easily, and who intends to develop application software to use such information can grasp data specification in detail. The paper introduces basic idea of JACIC/LCDM registry and present status as well as future prospects.

Keywords: *Metadata Registry, Data Specification, Infrastructure Information, Standardization*

INTRODUCTION

1.1 BACKGROUND

The Japan Construction Information Center (JACIC) established the Infrastructure Information Standardization Committee in 2000 consists of administrators, private sectors and academia. The committee aims to develop and coordinate standards for information exchanged throughout the public works process, which shall contribute to realize smooth exchange and comprehensive utilization of such information.

Information exchange in public works construction process has many difficulties because there exist so many players concerned, range of information is wide and diverse, the process is quite long and interoperability shall be kept throughout the facility lifetime.

Therefore, strict standardization in construction information is not only difficult to get consensus but may insist on inconvenient restriction for each applications of various users. In fact, there are various systems and databases currently in operation in public works process,

and their data specification differs widely depends on when and how they were developed.

Therefore, it is necessary to permit certain allowance in implementation of standards and to prepare infrastructure mechanism to assist smooth data circulation and utilization under mixed data specification circumstances, besides strict standardization.

In this regard, JACIC decided to study on metadata registry as a mechanism to enhance smooth data circulation through easy access to information about data standards as data scheme, data definition and data format.

Moreover, reuse of well-formed data standards can be promoted through referring the registry, which may lead voluntary unification of data specification to higher quality standards.

JACIC developed a prototype registry in July 2009 with 10 specifications. Then, more specifications mainly on public works e-delivery standards have been registered year by year to 510 specifications. The system has been improved upon user's request as well.

As for a case study to utilize the registry, e-delivery manuals currently in use in various local governments in Japan were compared and analyzed.

1.2 METADATA REGISTRY

Metadata registry is a server to store data specification information based on ISO/IEC 11179, so that system developers and architects can access to such information and make it easier to develop new data specification or application system to use data.

Data circulation infrastructure with metadata registries have been established in late 90's in US and Europe as a mechanism to find necessary information efficiently out of huge amount of data flood in Internet. This mechanism contributes to promote integrated data utilization throughout different organizations and different fields. In the USA, the Environmental Data Registry of the Environmental Protection Agency was open in 1996 as the first practical metadata registry system in the world which was reformed as the System of Registries. Then, XML registry was established in the Department of Defense in 1999 which was reformed to DoDMDR in 2003. The Federal Aviation Agency established FAA registry in early

2000's. Besides, health and medical field, traffic and transportation field, national security field have introduced the mechanism to promote smooth circulation and integrated use of data resources.

1.3 LCDM FORUM

Stimulated by US and European actions intending to use data values as much as possible, some private companies of engineering consultants and ICT system integrators gathered to form a non-profit task force named LCDM Forum (Life Cycle Data Management Forum) [1] to study on data circulation infrastructure with metadata registry in 2005 and closed in 2010. The task force developed several LCDM information infrastructure specifications, as well as promotion materials and study reports. Fig. 1 shows the concept of LCDM.

JACIC participated in the LCDM Forum as a principal member and also supported from fringe activities such as theoretical study at the standardization committee, visiting survey of US organizations and experimental development of a registry system.

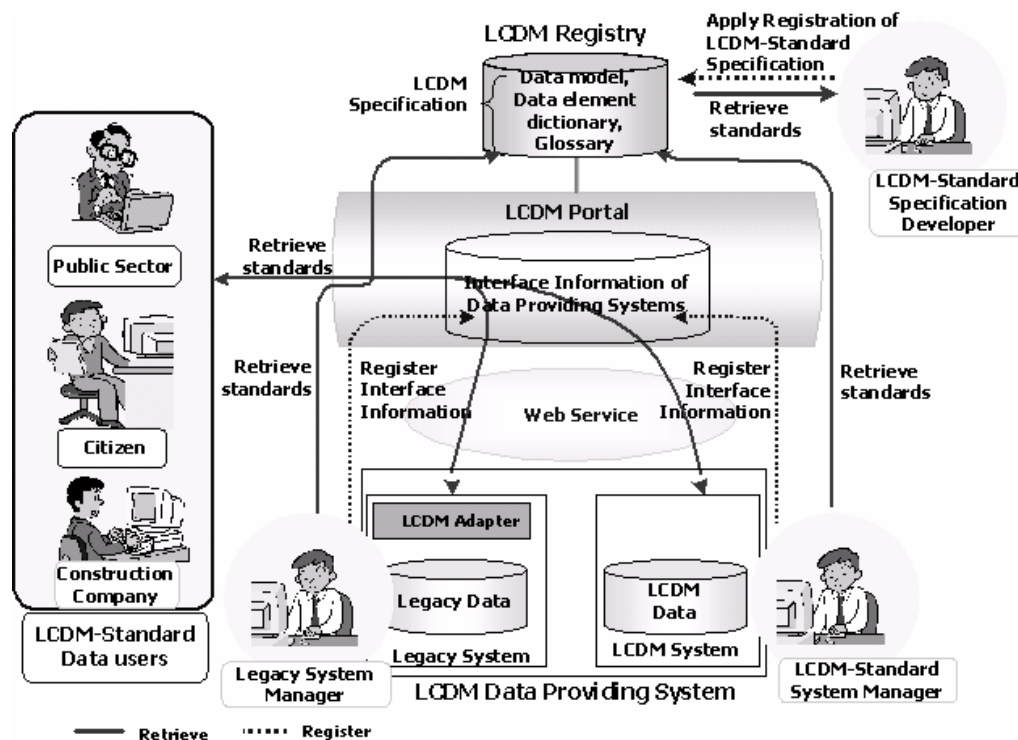


Fig. 1 Concept of LCDM information infrastructure (Copyright © LCDM Forum)

2. DEVELOPMENT OF JACIC/LCDM REGISTRY

In order to increase productivity and quality of public works, the Ministry of Land, Infrastructure, Transport and Tourism has promoted CALS/EC initiative which aims to introduce ICT as much as possible in public works process since 1996. Along with the initiative, whole documents, reports and plans as results of public works are to be delivered in digital form. Therefore, huge amount of digital information about social infrastructure facilities have been accumulated year by year which is expected to be very useful in various fields.

However, integrated use of multiple data in different systems is not easy because application software shall be customized to each data specification which is not necessarily standardized. Moreover, it is sometimes difficult even to get information where we can get linkage with such data and how we can use such data. Therefore, it is beneficial to prepare a mechanism consists of clearing house to serve data location information, Web GIS service to support map based retrieval, geocode dictionary to transform geographic names into geographic coordinates, thesaurus to serve information about synonyms and antonyms, metadata registry server to manage, update and retrieve data specification information, as well as one stop portal to enable easy access to whole related information.

In this regard, JACIC started to develop a prototype registry mainly for CALS/EC e-delivery manuals and related specifications in collaboration with LCDM Forum in 2008 as the first step to establish such information circulation mechanism. Then JACIC/LCDM registry was open in July 2009 with 10 specifications. We gradually increase the number of specifications registered to 510 in April 2011, while some of the specifications is remained unopened until receiving the permission from copyright holders of the specification. Each specification consists of separate files. Current number of files registered is more than 2,000.

Since those who need information about data specification is limited to specification designers or system developers, site access of JACIC/LCDM registry is rather low, however, it is expected that the better transparency of data specification may encourage the more integrated use of

data and promote the more active circulation of public works information.

3. JACIC/LCDM REGISTRY

3.1 Outline

JACIC/LCDM registry is available in Japanese language, open to anyone for retrieval, while free user pre-registration is required. Fig. 2 shows the top page of the registry [2].

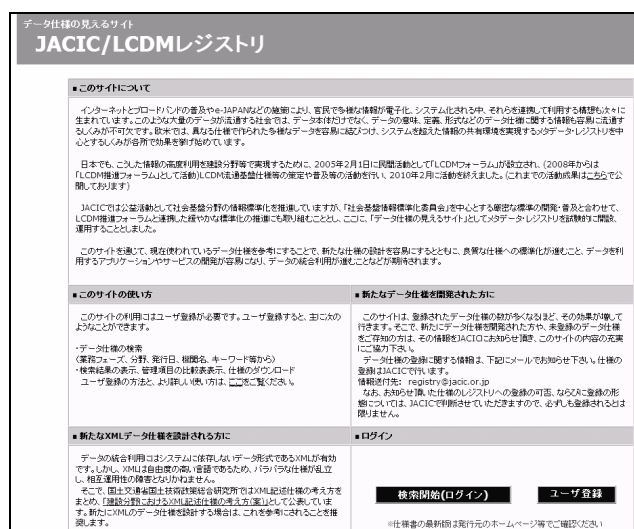


Fig. 2 JACIC/LCDM registry top page

Specifications and detailed files are retrievable by designated metadata or keywords. Retrieved results are displayed as list of candidate specification, or comparison table of multiple specifications with their metadata. Real files of found specification can be downloaded.

3.2 Retrieve Function

There are two ways of retrieval information. One is to retrieve a set of specification from metadata of the specification (conditional search). The other way is to retrieve each file of specification which includes a given keyword (keyword search).

3.2.1 Conditional Search

Metadata items to be used in conditional search are as follows.

- (1) Public works stage as survey, design, construction, maintenance.
- (2) Civil engineering field as road works, river works, rail way, port, etc.
- (3) Date when the specification enacted.
- (4) Organization which developed the specification.
- (5) Keyword in specification descriptive document.
- (6) Keyword in specification name

Fig. 3 shows the conditional search page.



Fig. 3 Conditional search top page

After set the search condition, specifications which meet the condition are retrieved and listed up as Fig. 4.



Fig. 4 Conditional Search Result

The target specification is selected from the list, and then detailed metadata of the specification is displayed as Fig. 5.



Fig. 5 Detailed description of specification

3.2.2 Keyword Search

In keyword search, full text search is executed for all files registered include the keyword. Fig. 6 shows the keyword search page.



Fig. 6 Keyword search top page

Fig. 7 shows the result list of specifications which include the keyword in text of files. The target specification can be selected from the list as same as condition search result.

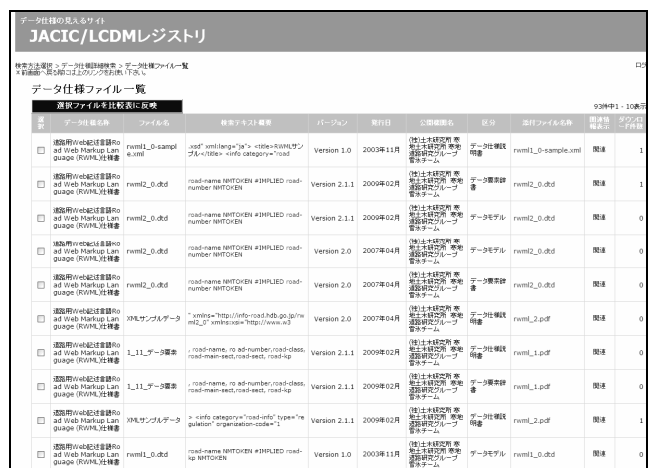


Fig. 7 Keyword Search Result

Files are downloadable either one by one or whole files together as a compressed package file.

4. COMPARISON OF E-DELIVERY MANUALS

As a case study of using the registry, differences among e-delivery manuals of prefectures were compared and analyzed. Out of 47 prefectures, manuals of 17 prefectures were compared.

4.1 E-Delivery Manual

The Ministry of Land, Infrastructure, Transport and Tourism initiated the CALS/EC program since 1996, and promote the initiative to local governments as well. In this regard, information results of public works are to be delivered in standard digital form. The ministry's e-delivery manual defines the rules and standards for e-delivery. Each local government is likely to imitate the manual for their e-delivery, however, there exist a slight variation among prefectures, which may cause some confusion to contractors. Since this variation comes from each prefecture's local requirement, it shall be respected, however, uncontrolled variation shall be avoided. In other words, if there are common requirement among many prefectures, amendment of the ministry's manual to meet the requirement can be unified among them.

4.2 COMPARISON RESULT

4.2.1 Type of Public Works subject to e-Delivery

The ministry started to apply e-delivery for all public works which cost exceeds 300 million yen in 2001, and gradually expanded the range to all public works since 2004. Likewise, each prefecture started e-delivery with limited works and then expanded. Therefore, there exist variations among prefectures now. Besides, some prefectures exclude maintenance work or small size work.

4.2.2 Items to be Delivered

Photographs, CAD data and facility specification data are compulsory e-delivered items in the ministry's manual. On the other hand, many prefectures exclude facility

specification data, and drawings are to be delivered either CAD data or paper drawings.

4.2.3 CAD data format

In order to assure interoperability of CAD data, standard CAD data exchange format SXF was developed and maintained in the Standardization Committee along with CALS/EC initiative. There are two types of format in SXF as 'P21' and 'sfc'. P21 format conform to ISO10303 AP202, while sfc is a simplified format mostly convertible to P21.

The ministry's manual specified P21, while many prefectures allow sfc as well.

4.3 Effect of registry

E-delivery manuals are open to the public through Web site of each prefecture. However, it is not easy to find out the location of such manuals one by one. In this case study, it is confirmed that registry is quite useful in case we intend to compare several specifications developed by different organizations.

5. ACKNOWLEDGEMENT

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