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3rd Asia Construction IT Round-Table Meeting, Tokyo, Japan

Abstract

Committee on Civil Engineering Information Processing,
Japan Society of Civil Engineers

Japan Construction Information Center

3rd Asia Construction IT Round-Table Meeting Abstruct

Contents

The informatization of Chinese building industry: current state of the art and challeges

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ABSTRACT

The major components of building industry are design firms and construction firms. It seems that the informatization of the firms has not gone well in China. What is the current state of the art? What are the challenges? The answer to these questions is not only wanted by the design firms and construction firms, but also by the relevant software vendors and research institutes.

The purpose of the research is to grasp the current state of the art of the informatization of design firms and construction firms generally and systematically and then to point out the challenges that the design firms, construction firms, the relevant software vendors and the relevant research institutes have to face.

The basic methodology adopted in the research is to analyze the relevant published papers. This approach is better than the commonly used approaches. Compared with the approach of by experience, the contents in this approach are new and positive, since the publishers normally manage to ensure that before the papers are published. Compared with the approach of by questionnaire, the contents in this approach tends to be in depth and accurate. Compared with the approach of by field investigation, the contents in this approach are easy to obtain within limited budget, because it is easier to find the paper in a library than to carry out the field investigation.

An online database called China Network Knowledge Infrastructure was used to obtain the full text papers. More than 1000 papers of various kinds were identified respectively for design firms and construction firms. By discarding the irrelevant papers, such as notices and interviews, 370 papers were determined for design firms and 459 papers were determined for construction firms for analysis.

The analysis reveals that tremendous progress has been made in the informatization of design firms and construction firms. With the government's emphasis on the informatization of the building industry in the eleventh five-year plan, it is the right time now for the firms, both large or middle scaled firms and small scaled firms to implement informatization in order to improve their competitiveness. The design firms and construction firms need to put into practice with the current knowledge and practice as references. The software vendors need to deepen their development of information systems to cope with the various levels of needs of the firms. The research institutes need to dig into the requirement of the informatization of small scaled design firms and construction firms and develop suitable information systems.

Construction IT in Hong Kong, Past, Present and Future

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Keywords: Virtual prototyping, productivity improvement, BIM

1 INTRODUCTION

Although a comprehensive survey indicates that there has been an increasing trend of IT take-up in the construction industry in Hong Kong and evidence has been found that IT can bring efficiency gain in conducting certain construction tasks, it seems IT has not brought in any productivity improvement to the industry. A comparison of productivity variations between manufacturing and construction industries across several countries confirms that the construction industry is lagging back. It is argued that there are three major reasons which may explain the inferior performance of the construction industry. The first reason is that the construction industry does not have a fixed production line in which the productivity is recorded and dominated by machines. Without the production line, construction personnel, from the operatives up to the project managers, have to negotiate their ways to collaborate in order to get tasks done. Second, the construction industry does not have an effective platform to capture and reuse knowledge and know-how occurred during the project delivery process. In current practice, designers start design at a blank sheet of paper, and construction process requires formation of new contracts, and teams. When the project is completed, little knowledge is captured and documented. As a result, similar mistakes may recur in future projects. Third, the construction industry lacks a capacity 'to try before build'. Unlike the car industry or the aerospace industry, where products are designed, assembled and tested in a computer environment, before actual production starts, a construction project starts with insufficient design information, little reliable planning information and literally no means to allow project managers to predict problems and risks before the commencement of the project.

It is then argued that Virtual Prototyping (VP) technology provides a solution to overcome these problems. Through a case study of the IsE project in Hong Kong, the use of VP is demonstrated and its role and impact examined. Specifically, the case study argues that a BIM model of design is the basis of applying the VP technology. And it indicates that a new profession, which we termed as process modeller, is needed to bridge the gap between BIM design and construction process. Once the BIM design is completed, the process modeller comes in to 'disintegrate' the BIM model into various formats required by contractors and consultants, at the same time, the modeller accepts information, such as primitive planning, shop drawings of temporarily structures, and integrate them into the BIM model in order to facilitate simulation of construction processes. Through working interactively with contractors and consultants, the modeller can virtually experiment different scenarios of construction methods and identify the optimal construction process. The case study further indicates that through the use of VP technology, contractors do not have to go through a real-life learning curve on site which is costly and risky. As a result, considerable time and cost savings are archived in the case study.

In summary, the IT survey and related research activities enable us to conclude the followings:

- Current IT investment has been mainly focused on assisting design, information gathering, sharing and exchange, not directly helping the production process.
- Traditional planning is 'blind chessing'. VP puts back the chess board.
- VP is needed in certain projects, or certain aspects of a construction process.
- VP brings cost saving at the expense of huge data input (BIM).
- The procurement process needs change so that all participants can share the benefits brought by VP.
- VP trims down managerialism, but creates a new profession (process modeler).
- The VP technology, as a tool, is not ready for practitioners to take over and use.

In particular, in order to speed up the adoption of VP technology in the construciton industry, it is necessary to clarify the ownership and payment for developing the BIM model as the model is potentially useful and beneficial to the entire project lifecycle. It is also important to rethink and revise the current procurement process so that all participants can share the benefits brought by the VP technology.

In summary, it is generally agreed that the digital practice is the fure of the construction industry, and all stakeholders including the government, researchers and practitioners should work together to lead the development of this new technology. Only through such a collaborative effort, the construciton industry may be bale to reverse the decreasing productivity trend and face ahead a positive improvement.

ACKNOWLEDGEMENT

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IT and Geographic Information Development in Hong Kong

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Keywords: IT, geographic information, construction.

1 21 DIGITAL IT STRAEGY

HONG KONG SAR GOVERNMENT PROPOSED THE PROGRAM FOR

- Promoting advanced technology and innovation
- Developing Hong Kong as a hub for technological cooperation and trade
- Enabling the next generation of public services
- Building an inclusive, knowledge-base society

Currently, the IT development is very encouraging:

- Mobile penetration: 125%
- Broadband penetration: 66%
  - Broadband can be reached by all commercial and residential buildings
- Household PC penetration: 70%
- PC penetration in business: 60%
- Internet penetration in business: 55%
- Over 50% of business adopted some form of e-business.
- Four 3G Mobile Service Operators

Key technological Areas:

- Communication Technologies
- Digital Content
- Sensor and identification technologies
- Software development and packaging
- Next-generation Internet
-

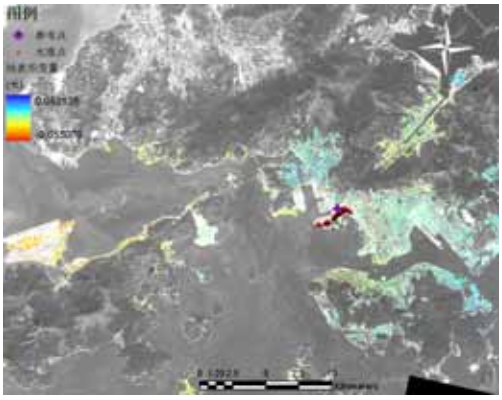
For example, the GovHK: One-Stop e-Government Services

2 GEOGRAPHIC INFORMATION

Government: Hong Kong Government Land Information Centre takes active role in giving professional advice to Government Departments and assisting them to establish Geographical Information Systems (GIS). For examples, the Land Information Centre provides GIS advisory and support services to the Census and Statistics Department, Government Property Agency, Fire Services Department, Registration and Electoral Office, Civil Engineering Department, Buildings Department, Planning Department, etc. Geographic information has also been used for important slope management task in Hong Kong.

Universities:

1) Satellite remote sensing station has been built up in the Chinese University of Hong Kong for research programs on environmental monitoring and disaster management.
2) Virtual geographic environments (VGE) has be introduced to the research agenda as a new platform evolved from maps and GIS.
3) Geographic information has been used for construction related programs such as urban planning, construction design, and construction environmental assessment, including noise, light, and air quality.



Industrial and Business Sectors:

Construction companies have better relationship now with research teams in universities than 10 years ago. Geographic information has been used by industrial and business sector including real estate management.

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Activity Report of the "Construction-IT" Committee, Japan Society of Civil Engineers

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1 ROLES OF CIVIL ENGINEERS ON IT APPLICATION

There are two phases for IT application and its development in civil engineering. One of those is the phase inside the civil engineering business. In this phase, civil engineers are expected to improve effectiveness, and to contribute to offer new services through management of infrastructure. The other phase is one out of the civil engineering business, where the engineers are required to create new services by sharing information produced in the civil engineering business with organizations in other business fields

Expected roles of civil engineers on IT application are summarized as follows:

- Information management on the bases of long-term scope.
- A wide variety of flexible activities for improvement of service level
- Design and planning of organization, mechanism to acquire, collect, accumulate, and share information

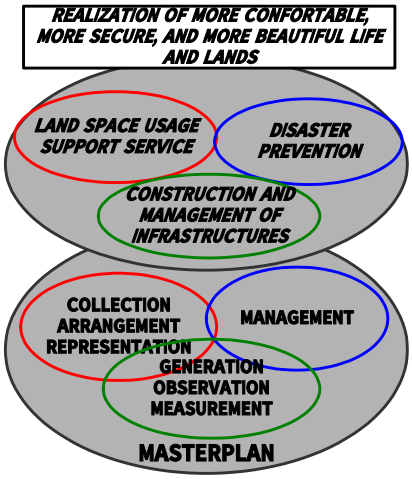

Figure 1 Roles of Civil Enginees in IT-applications

2 MISSION AND ORGANIZATION OF THE COMMITTEE

Since Japan Society of Civil Engineers consists of the engineers and researchers in the filed of civil engineering, I can list up two main missions of the Construction-IT Committee as follows:

- To research and study on various kinds of subjects about information processing technologies dealt with in civil engineering field
- To promote efficient utilization of information technologies in civil engineering industry.

The Committee on Computer Utilization was founded in 1974, because some influential members were keen to separate the computer section from the Construction Management Committee of JSCE. In the year, the first symposium on computer utilization in civil engineering was held and has been held once a year until this year. The name of the committee changed twice; the first change in 1938 to Committee on Civil Engineering Information Processing System, and the second change in 2004 to Committee on Civil Engineering Information Processing. The twice renaames must have met the needs from the viewpoint of what is required from the civil engineering communities. Also, the committee has issued the Journal including almost 500 technical papers once a year.

Figure 2 shows the organization of the committees.

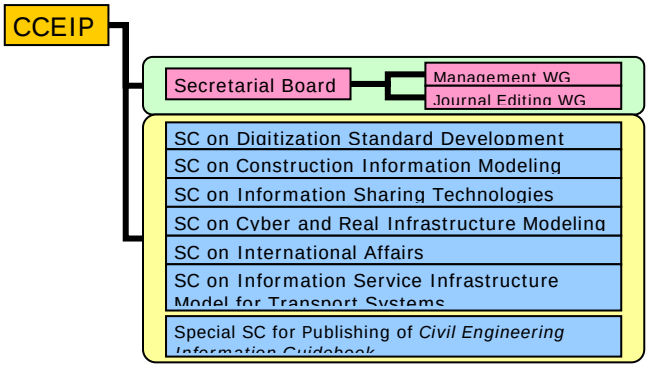

Figure 2 Organization of the Committee of JSCE

3 RECENT ACTIVITIES OF SUB-COMMITTEES

The sub committee (hereafter called SC) on Digitization Standard Development has been carriying out demonstration experiments by extracting attribute items of drawings required in operation and maintenance phases and conducting some research on drawing methodologies using SXF's* function of attribute investment.

*SXF: Scadec Data Exchange Format. Scadec: Standard for CAD data Exchange in. japanese Construction field

SC on Construction Information Modeling has been conducting some research on design information modeling required for the lifecycle management of civil engineering structures. Also, this SC hosted the Civil Engineering Information Modeling Seminar on 4-dimensional CAD and Virtual Reality in March 2006.

SC on Information Sharing Technologies is operating, editing and improving *JSCE.jp* in collaboration with other committees of JSCE. The SC has also been carrying out research and study on new technologies for information sharing. Recently, they are trying to develop a dictionary of civil engineering terminology on the "*Wikipedia*", experimentally.SC on Cyber and Real Infrastructure Modelling has been conducting some research and development on creation and utilization of an innovative model integrating information infrastructure in cyberspace and infrastructure in real world as shown in Figure 3. The SC has also been promoting some international collaborations with JACIC, IAI Japan, CSTB of France, etc.

SC on International Affairs is hosting this meeting in collaboration with JACIC. The SC also hosted the past Asia Construction IT Round Table Meetings.

SC on Information Service Infrastructure Model on Traffic Successfully carried out an experiment of road information providing and gathering with resident participation in Toyota City, Aichi. The SC also carried out an experiment of parking for cargo work in Toyota City, Aichi. and is conducting some research on "Smart Interchange" for application of Service Area as shown in Figure 4.

Special SC for Publishing of Civil Engineering Information Guidebook published "the Civil Engineering Information Guidebook" in 2005. The main topic in this guidebook was standardization of electronic data or information related to Construction. Now we are ready to publish the guidebook Volume2 in 2007 (see Figure 5). In this volume, information management and utilization is going to be dealt as the most important target subject.

4 TOWARD FUTURE ACHIEVEMENT OF THE FINAL GOAL

Ministry of Land, Infrastructure and Transport published Innovation 2007 in which the following issues were brought:

1）Realization of the society where anybody can access any useful information anywhere anytime
2）Construction of safe society against disasters
3）Advanced technology for highly secured society against terrorism
4）Improvement of efficiency and safety of product supply networks
5）Realization of the safest road traffic in the world by using ITS
6）Realization of the east Asian common IC tickets.

Research Institute of Construction and Economy conducted the investigation on the contribution of IT investment for profit improvement and concluded that.

- IT investment does not contribute for profit improvement sufficiently because Poor connection of IT strategy and management strategy.
- Methodology to estimate of the profit by IT investment is not established.
- IT should be introduced with organization and business process reformation.

IT strategy should be established to contribute for profit improvement. and should be firmly connected with business management strategy and its reformation. Development of standard platforms for the distribution, sharing and utilization of construction information must be one of the most influential tasks for IT adavancement in construction businesses.

ACKNOWLEDGEMENTS

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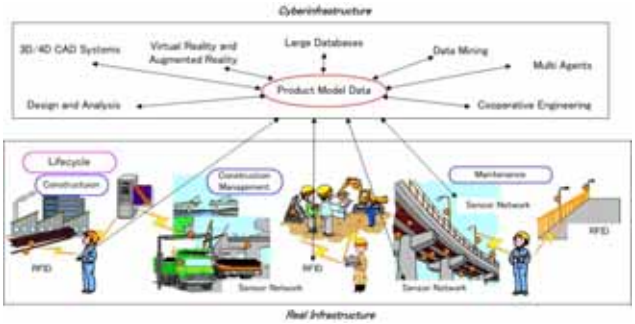

Figure 3 Integration of Cyberspace and Real World

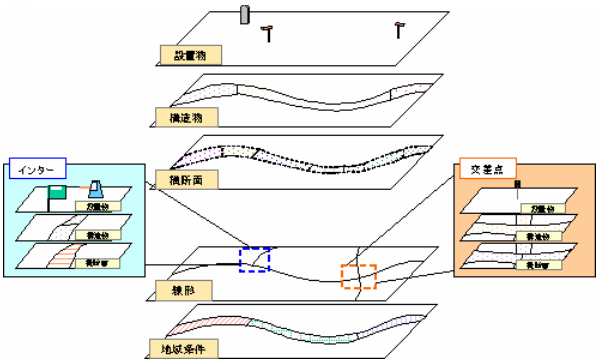

Figure 4 Research on "Smart Interchange"

Figure 5 Civil Engineering Information 2007

Activities in the Sub-Committee on Cyber and Real Infrastructure Model

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Keywords: Cyber-Infrastructure, civil infrastructure, product model, sensor, RFID, middleware, network.

1 INTRODUCTION

The Sub-Committee (SC) on Cyber and Real Infrastructure Model is one of the seven SCs of the Construction IT Committee in the Japan Society of Civil Engineers (JSCE). This sub-committee started from September 2006 and the expected working period is two years, which may be extended. It consists of fourteen members from universities, general contractors, design consultants, and governmental agencies, including its leader and sub-leader. Regular meetings are held every two months and occasional special meetings may be held.

2 OBJECTIVES

Development and progress in computers and information technology have made a "Cyber World," e.g., "Second Life." In Cyber World, the user can create natural and urban spaces and civil infrastructures and perform various simulations. Cyber World is expected to enhance the efficiency of plan, design, construction, and O&M of civil infrastructure systems. Public agencies may call upon open discussions with users, stakeholders and opinion leaders in Cyber World. It may become information and communication infrastructure for users and stakeholders to get support from it as well as to provide their information to it for better mutual understanding with the owners. This can be called Cyber-Infrastructure.

At the same time, we have to realize that civil infrastructures are actual things in the Real World, i.e., Real Infrastructure. Indulging in Cyber Infrastructure and separating Cyber and Real Infrastructures may be meaningless. Thus, linking, integrating, and fusing these two infrastructures by surveying, sensor networks, RFID, etc., is essential. Further, if Cyber Infrastructure can provide people and various equipment in Real Infrastructure with information, guide, and support, it will enable us to reach safe and secure societies and better quality of life. Integration of Cyber and Real Infrastructure will help us to create new values.

The SC on Cyber and Real Infrastructure Model (CaRIM) has been investigating the following:

- Information Infrastructure Model needed to create Cyber Infrastructure
- Sensors and related technologies in Real Infrastructure
- Technologies needed to link and integrate Cyber and Real Infrastructures.

The goal of the SC on CaRIM is to propose and suggest the visions, importance, roles, benefits, values, methods, and issues of the new proposed model CaRIM (Figure 1) not only to JSCE but also to the world by publishing reports, papers to conferences and journals.

3 CURRENT ACTIVITIES

Our current activities include:

- Collecting information related with CaRIM
- Developing the model and vision of CaRIM
- Developing a prototype of a sample CaRIM
- Demonstrate the methodology
- Suggesting creation and enhancement of values by CaRIM

Some of the information collected and presented by the members include but not limited to:

- Representation of 3D world by using Sketchup and Ruby.
- Developing IFC-BRIDGE with IAI Japan and CSTB (Sophia Antipolis) of France.
- 3D models and advanced sensor technologies in movies and dramas.
- Developing a shield tunnel product model with JACIC and IAI Japan.
- Developing 3D models by using digital images obtained from satellites.
- George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) of the US and E-Defense Grid (EDgrid) of Japan.
- Business Continuity Plan (BCP) after severe disasters.
- Application of cellular phones, GPS, digital cameras to probing person technology.
- 3D data by using LiDAR and Laser Profile Scanner.
- Utilization of 3D models in actual civil engineering practices

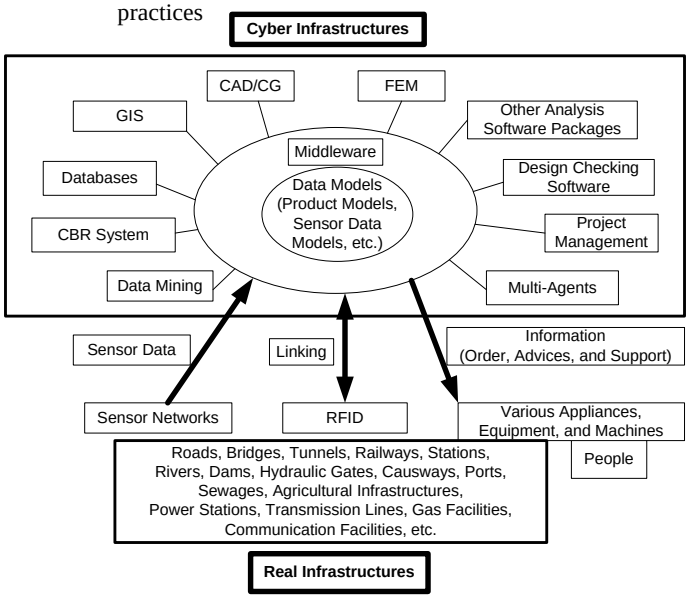

Figure 1: Cyber and Real Infrastructure Model.

New Legislation on NSDI in Japan: "Basic Law for the Advancement of Utilizing Geospatial Information"

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Keywords: Geospatial Information, Geospatial Framework Data, GIS, PNT, Basic Law, and Action Program.

1 INTRODUCTION

May 2007 saw a significant progress in the development of National Spatial Data Infrastructure (NSDI) in Japan with a new bill being enacted at the National Diet. The new legislation, "Basic law for the advancement of utilizing geospatial information (NSDI Law; provisional translation)," is considered to provide an overarching legal framework on how geospatial information should be developed, distributed and utilized in the country by taking advantage of Geographic Information System (GIS) and Space-Based Positioning, Navigation and Timing (PNT) technologies. This extended abstract summarizes the background and the outline of this new law as well as some initial preparatory work that is necessary before making the law into effect on 29 August 2007.

2 PAST MEASURES OF THE GOVERNMENT FOR NSDI

The Government of Japan initiated its attempts to promote the use of geographic information system (GIS) by setting up a Liaison Committee on GIS in the Government in 1995. This initiative was triggered by the Kobe earthquake, which took place in January 1995 and claimed more than 6,000 people's lives. Having learned the potential of using GIS for prompt emergency responses immediately after and quick recovery from such devastation, and having being informed of the US initiative of developing an NSDI under the leadership of the Clinton Administration, it was a natural consequence for the Government to take necessary measures to develop a new information infrastructure to promote GIS.

The Government first compiled its long-term plan for the development of the country's NSDI, though their initial understanding of NSDI was a geographic database with some emphasis on common framework data, not an infrastructure that enables the people to find, access, and use necessary geospatial information in a sustainable manner. Consequently, when the Government first set a standard on its NSDI in 1999, it defined the information items of the framework data and geographical data exchange standards based on ISO/TC211 standard documents [1].

This initial attempt of the Government for NSDI, however, made some progress in digitizing base paper maps, particularly 1:2,500-scale maps that were prepared by local governments for urban planning. The Geographical Survey Institute (GSI), the national mapping organization of the Government, digitized major features of these maps and distributed it in CD-ROMs to the public. Due to the limited fund that was made available to GSI for the project, detailed geospatial features including outlines of individual houses and road edges were not digitized. However, the low-cost and relatively straightforward data policy for commercial uses attracted many small businesses to get started with geospatial businesses.

GSI also completed digitizing its 1:25,000-scale topographic maps, the national base maps, for the whole country in 2001 and made the data of major features available to the general public.

The Government also introduced data standards (Japanese Standards for Geographic Information; JSGI) by designating a set of international standards on geographic information developed by ISO/TC211. Because of the generic nature of these standards, GSI developed a profile of JGSI, i.e. Japan Profile for Geographic Information Standards (JPGIS) by extracting parts of the JGSI that are applicable and essential to the country [2].

In response to concerns raised by government offices that are facing new challenges of legal issues including privacy, security and copyright in distributing their digital geospatial data, the Government issued a guidebook on policies of geospatial data and posted it on the Internet.

In light of growing demand from the private sector for geospatial data prepared and maintained in the local governments, the Interior Ministry, starting from 1999, took an initiative of promoting GIS in local governments with financial support for those that share the same base geospatial data among different sections.

3 BACKGROUND OF THE NEW LEGISLATION ON NSDI

While the aforementioned measures of the Government have made significant progress in the development of NSDI, the dissemination of GIS in and distribution of updated and detailed geospatial information from local governments have not still been measuring up to the expectation of the private sector. In light of the perspective that geospatial information businesses will grow very rapidly in the near future, some map compilation companies have independently digitized existing maps prepared by local governments, updated the digitized data on their own and sell them for a variety of applications including car navigation and residence maps that depict individual houses and apartments with each household name that is posted on their gates or mail boxes in urban areas.

Since these different types of geospatial base data do not spatially align with each other, the geospatial contents companies have been facing a daunting task of preparing and maintaining different sets of contents data geospatially adjusted for each of the different base data.

In addition, the cadastre mapping coverage in Japan is still only 47 % of the whole land with only a few % in some metropolitan areas. It is estimated to take several scores of years before the coverage is completed, particularly in urban areas. Given that accurate cadastre map data will not be available soon, there needs an innovative way to develop a common geospatial framework database for the nation without relying on cadastre data.

Another vital driving force for the new legislation has been the wide-spread use of PNT, particularly GPS, in the people's lives and businesses in Japan. The applications of GPS range from precision surveying to personal navigation with a GPS receiver embedded in growing number of cell phones. Despite the fact that we can no longer do without these critical applications, the GPS services totally depend on the US, and Japan has little control over the stability and sustainability of the system. In addition, GPS provides only limited coverage in both metropolitan areas and highly ragged terrain in terms of positioning capability.

Consequently, the Government saw urgent need of developing an augmentation and supplementary system for GPS to enhance the capability and availability of PNT services in Japan, which would support existing and emerging PNT applications as well as establish much closer liaison with PNT service providers, particularly the US.

Given that the synergetic integration of Government policies on these two technologies could enhance efficiency in government offices as well as create new industries with sophisticated services, some members of the National Diet took an initiative of submitting a bill for a basic law on geospatial information in June 2006. The bill was discussed and enacted in May 2007 during the regular Diet session and named as Basic Law for the Advancement of Utilizing Geospatial Information (NSDI Law; provisional translation).

4 OUTLINE OF NEW LEGISLATION ON NSDI

Basic laws in Japan normally lay out basic principles that the nation should follow as new policies for the purpose of leading the nation to new and advanced stages or coping with new challenges. The Government develops an action program with specific measures to implement appropriate policies in accordance with the basic principles in the laws. The NSDI Law is no exception and requires the Government to develop an action program, make it available to the public on the Internet and regularly review the program to monitor the progress.

Some of the basic principles prescribed in the NSDI Law are listed below:

- Develop an infrastructure that enables the maximum use of geospatial information,
- Take comprehensive measures to enhance the synergy between GIS and PNT,
- Ensure stable and reliable PNT services,
- Improve efficiency and enhance functionality of administrative management of governments with the use of geospatial information, and
- Pay due attention to the national security and personal information on geospatial information.

In addition to these principles, the NSDI Law also specifies the following policies for the Government to implement through an action program:

- Capacity building and enhanced use of GIS in governments,
- Development, timely update, and distribution of geospatial framework data by State and local government offices,
- Use of geospatial framework data in preparing maps that are mandated to governments, and
- Liaison and coordination with organizations that operate global PNT systems.

The Law requires the Government to define the information items and quality requirements of the geospatial framework data referred to in the above policies as well as to develop technical standards for its development in such a way to enhance its interoperability. GSI has the responsibility of finalizing the drafts for the definition and technical standards by 29 August 2007 when the Law is put into effect. Comments are currently requested from the public on these drafts at the time of writing this abstract. The outline of the draft definition and technical standards is as follows:

[Draft Definition of Geospatial Framework Data]

1. Information items: Thirteen items including geodetic control points, coastlines, boundaries of public facilities, administrative boundaries, road edge lines, building outlines and street block outlines.
2. Quality requirements: Data must be prepared by GSI or through public surveying and mapping with positional accuracies better than or equal to 2.5m (horizontal) and 1.0m (vertical) for the designated areas of urban planning, and 25m (horizontal) and 5.0m (vertical) for the outside.

[Draft Technical Standards]

1. Procedures on how existing geospatial framework data is to be used when developing or updating another and on how existing geospatial framework data are to be seamlessly connected to adjacent ones.
2. Applicable ISO-19100 series standards for data distribution.

5 IMPLEMENTATION OF NEW LEGISLATION

The NSDI Law has provided the geospatial community with a high-level legal framework to develop an infrastructure for enhanced use of geospatial information. The Law leaves the details of its implementation to an action program of the Government with specific measures and priorities. Much attention has to be paid to the measures related to the way the Geospatial Framework Data are developed and updated, as most geospatial information that should be included in the Geospatial Framework Data is collected and maintained in the local governments while they are not mandated by the Law to develop their action program or they are not likely to be supported by the Government with additional funding due to the Government's budget reduction policy.

Consequently, even after the law enforcement, there seems to be not much obligation or incentive for the local governments to participate in developing and updating of Geospatial Framework Data unless they see the benefit of having a common geospatial database to improve the efficiency and effectiveness of their government administration as well as to reduce their expenditures for duplicated geospatial data development. Strong leadership of the Government, particularly of GSI, in encouraging the local governments to shift from the traditional working habit that is based on paper maps to the geospatially-enabled governments that take advantage of GIS in information sharing using a common geospatial database, would be a key component of the successful implementation of the Law.

ACKNOWLEDGEMENTS

The author thanks to GSI colleagues who tirelessly and successfully worked for the development of draft definition of and technical standards for geospatial framework data.

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Railway GIS
- Google Earth & Railway -
Application of Google Earth in JR East

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Keywords: GIS, railway, management system, digitizing, alignment plan, satellite image, 3D

1 INTRODUCTION

Various drawings used in the railway operation had been digitized in each work process. However, there still was a need for paper drawings when they were to be interchanged between processes. "Railway GIS" was set up to eradicate paper drawings and to build the seamless data flow.

2 RAILWAY GIS

"Railway GIS" was developed for railway companies to add a variety of technical functions to GIS (Figure 1). Alignment plan (1/2500) and station plan (1/500) have basic railway information such as kilometerage, track center, location of the station and other railway facilities, as the attributive information.

Alignment plans, maintenance ledger database and assets database are assimilated in this system, which contributes for making the whole business process data-based and improving the productivity of the whole company.

The crucial process on applying GIS to railway management was digitization of paper-based alignment plans. We devised GIS data specifications for railway without being constrained by traditional surveying technique, and made digital map for Tokyo - Takao section of Chuo Line experimentally in 2002. After examining the result, we built "Railway GIS" covering 800km of metropolitan area and 800km of Shinkansen with 1/10 of digitizing cost compared to the conventional method. In 2004, we finally completed digital maps of JR East's whole lines (7,500km) from paper-based alignment plans and station plans which had been inherited from Japanese National Railways (Figure 2). In the following year, a new management system based on digital information such as alignment plans, maintenance ledger database and assets database was introduced into all the maintenance sections. The above system has been utilized for maintenance and management of railway facilities, construction ordering, anti-earthquake measures and preventive measures against noise.

We are currently working on digitizing JR Kyusyu's whole line (2,100km) of alignment plans, station plans and property plans.

For medium-sized or small-sized railway companies, we provide the Web GIS service, "Assets Keeper", which incorporated an asset management support system in "Railway GIS". "Assets Keeper" can be used on the Internet and can promote the efficiency of maintenance works.

Figure 1. Railway GIS

3 GOOGLE EARTH & RAILWAY

3-1 From 2D to 3D

Although "Railway GIS" was successfully brought in, we determined that two-dimensional maps could not supply enough information for disaster prevention measures and re-development planning in railway station vicinities. We verified the efficacy of three-dimensional topography information, aerial photograph and satellite image, and eventually constructed "Google Earth & Railway".

3-2 Functional overview of Google Earth & Railway

"Google Earth & Railway" is equipped with three-dimensional topography data and railway map information in "Google Earth" provided by Google Inc., which offers satellite images around the world on the Internet. Ikonos satellite images with 1 meter definition which are offered by Japan Space Imaging Corporation are adopted as high-resolution satellite images. 3D building models, alignment plans and facilities around the rail can be displayed on top of satellite images in this system. Furthermore, those images can be zoomed in or out, turned and outlined freely.

We introduced high-resolution satellite images mainly around JR East's business area by April 2007. It is intended to be expanded to the whole country by October 2007.

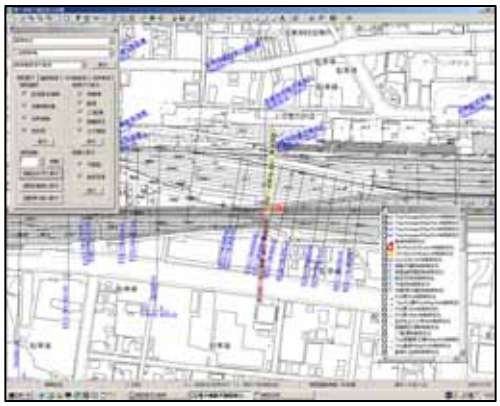

Figure 2. Digitized Alignment Plan

There should be only Internet connection to use “Google Earth & Railway”. The usage fee is relatively inexpensive; around 100,000 yen per month.

3-3 Utilization of Google Earth & Railway

In comparison with 2D-image systems, “Google Earth & Railway” enables to collect more accurate information more expeditiously, as it provides timely information visually. “Google Earth & Railway” is expected to support a broad range of services from disaster prevention planning, drawing up urban development plans, trade area analysis to travellers’ guide. JR East is currently developing the following practical usage of "Google Earth & Railway" to perform administration of business in more efficient way;

1) Disaster prevention planning

Disaster prevention planning by superimposing basic information (specifications and position) of civil engineering structure (railway, tunnel, bridge, etc.) on weather information, geographical features, topography, aviation, satellite image or map information (Figure 3,4)

2) Drawing up urban development plans, etc.

- Development and re-development planning in urban regions surrounded with high-rise buildings (Figure 5)
- Drafting of multistoried station building plan
- Marketing

3) Travellers’ guide

Utilization as travel guide by superimposing information of sightseeing spots on a railway map (Figure 6)

“Google Earth & Railway” is useful not only for railway companies, but also for various fields of businesses by combining digital maps of those fields.

4 Conclusion and Future Work

The advantages of digitized railway information are not confined in railway management. Combined with road information, it can contribute for establishing new comprehensive transport services. Also, it can develop 3D city information as urban infrastructure. Thus, it will exploit new application in a wide range of businesses.

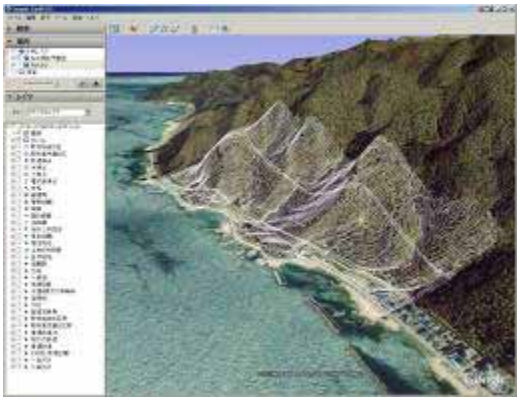

Figure 3. Superimposed Image on the Digitized Alignment Plan

Figure 5. Superimposing 3D Building Image

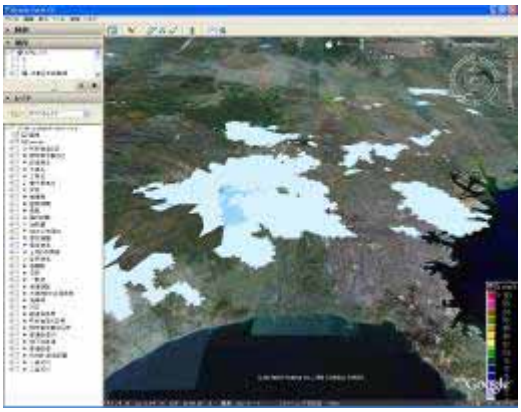

Figure 4. Superimposing Weather Information

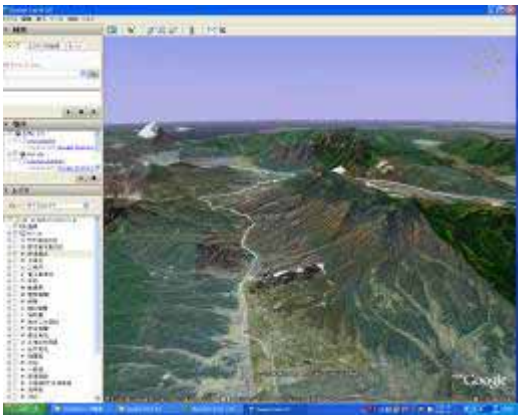

Figure 6. Koumi-Line and Mt. Yatsugatake

Ubiquitous Computing and Spatial Information: Toward a Ubiquitous Spatial Information Society

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Keywords: ubiquitous computing, spatial information, location-aware information services, universal information infrastructures

1 Introduction

Owing to recent advances in information and communication technologies, computers have been getting faster and smaller, and become indispensable to people's daily lives. One of the most intensively discussed topics in computer science and technologies these days is *ubiquitous computing* or *ubiquitous networking*, which aims to create a society where computers are installed in everything and everywhere, and everyone can get access to information whenever and wherever they want it. The essence of ubiquitous computing is automatic identification of real-world objects and situations (e.g., What is this? Who is in this room? Where is this machine located? Is it raining now?). In other words, in ubiquitous networking, computers are connected through a network and support human activities by recognizing specific real-world situations or contexts. This presentation focuses on applications of ubiquitous networking technologies to the field of spatial information, and briefly discusses empirical testing of location-aware spatial information services that has been conducted in several cities of Japan by Dr. Ken Sakamura's research team at the University of Tokyo and the YRP Ubiquitous Networking Laboratory.

2 Ubiquitous ID Architecture

As the basis of ubiquitous networking, objects need to be uniquely identified, and for that purpose, a network-based identification architecture, called the *ucode* system, has been developed. Ucodes are unique identifiers of objects, and any information about the objects can be attached to them. The information is accessed through the Internet, by way of information servers called *ucode resolution servers*, which store the locations (network addresses) of the information.

Ucodes can be used to identify and store information about objects, places, concepts, and the relations between them. For example, one can install a ucode tag in a product (e.g., a cabbage, strawberry, medicine), and record and trace information generated at the stages of production, distribution, and consumption. Also, one can install a ucode tag (e.g., an RFID tag or an infrared beacon) at a particular place, and link any information about the place to that ucode (e.g., a street lamp in a city).

Mobile devices used to get information from ucode tags are called *ubiquitous communicators*. They are multi-protocol communication interfaces, and enjoy rich multimedia functions (e.g., JPEG, MPEG4, MP3) and high security. There are various types of ubiquitous communicators, including PDAs, cell phones, and wrist watches.

3 Ubiquitous Spatial Information Systems

Based on these ubiquitous computing technologies, a variety of place information systems with location- and context-aware information services have been developed and tested in a nation-wide project called the *Autonomous Movement Support Project*, supported by the Ministry of Land, Infrastructure and Transport [1]. In this project, many active tags, sensor networks, and RFIDs have been installed across Japan, and the systems are empirically tested in cities such as Sapporo, Aomori, Tokyo, and Kobe. In these "ubiquitous cities," people can get information about objects and places at any time from these tags, for example, information about stores, commercial goods, sightseeing spots, and historic places.

A famous example of these empirical implementations is the *Tokyo Ubiquitous Technology Project in Ginza*, conducted in collaboration with the Ministry of Land, Infrastructure and Transport and the Tokyo Metropolitan Government [2]. In the Ginza area, thousands of ubiquitous ID tags are installed, both on the ground and underground, and various kinds of information services are provided, for example, for pedestrian navigation, train operation and transfer information, locations of bathrooms, barrier-free routes, stores, goods, sightseeing, and government information. Importantly, these information services are provided in multiple languages (Japanese, English, Chinese, Korean, etc.) and in context-aware manners (suitable for the user's age, gender, disabilities, etc., and for a specific weather condition or season).

For example, in the pedestrian navigation service, people can get information about the current position and a route to a destination, in the forms of maps, speech, 3-D panoramic views, and movies. They can also get navigation information in an optimal way, suitable for specific situations; for example, they are directed to the nearest bathroom, instructed to take an underground route when it rains, or shown pedestrian zones on Sundays. The ucodes that people accessed while walking are recorded, and they can review the places they visited when they get home (a service called a *personal homepage*).

4 Conclusion and Future Work

This presentation discussed ubiquitous computing and spatial information, and reported on information infrastructures for ubiquitous place information systems that have been developed and tested in many cities of Japan. Continued empirical testing of these place systems is under way, aiming for universal, ubiquitous information infrastructures suitable and usable for any people in any situation.

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[2] http://www.tokyo-ubinavi.jp/

eTendering International standards Development

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Keywords: e-Business, e-Tendering, UN/CEFACT, ebXML, International standard, EDIFACT

1 INTRODUCTION

In the case of the procurement by the government, it is very clear that the EDI relating to the procurement should be based on the international standards. According to the WTO TBT agreement, members shall use relevant international standards as a basis for their Technical Regulations. There are several massages relating to the Tendering in EDIFACT.

The EDIFACT is still international standard of EDI. But, it is a standard before internet. This was a main reason why did we decide to develop new standard using new technology. It was very few to develop new international standards led by Japanese delegation.

2 STANDARD DEVELOPMENT

There is a MoU on electronic business between IEC, ISO, ITU, and UN/ECE. Then, we chose UN/CEFACT as a stage to develop standards. This means we also chose standardization methodology (ebXML). ebXML (Electronic Business using eXtensible Markup Language) is a family of XML based standards sponsored by OASIS and UN/CEFACT whose mission is to provide an open, XML-based infrastructure that enables the global use of electronic business information in an interoperable, secure, and consistent manner by all trading partners.

Figure 1 shows the organization of UN/CEFACT. TGB (International Trade and Business Processes Group) is a largest group in the UN/CEFACT forum and responsible for business and governmental business requirements and content. TGB is composed of 19 industry domain groups (TGB1-TGB19). Our project team named "eTendering ebXML standards project" has been hosted by TBG6 (AEC). The participants of the project are France, UK, US, Sweden, Germany, Czech Republic, Korea, India and Japan.

Because this project was proposed by Japanese delegation, we proposed first draft of standard documents. And I have been a project leader of this project. The objectives of the project is Standardization of business processes transactions and core components in the field of electronic tendering/bidding across industries.

The scope of the project is defined by "scope of tendering subject" and "scope of tendering method".

Tendering subjects are "Works", "Services" and "Goods".

Tendering methods are "Open tender" and "Selective tender".

The project started at Geneva meeting on September 2002.

Because UN/CEFACT was newly established organization, workflow to get UN stamp was unstable at that time.

The Japanese construction delegation proposed a first draft (using UMM methodology) describing the business processes and the first electronic flows. This document is called BRS (Business Requirement Specification). The other standard document is called RSM (Requirement Specification Mapping).

The data models in each business document are described in the RSM. Every data component (BIEs) must be written in BIE table with definition, object class term, representation term, occurrence, and so on. This BIE table must be submitted to TBG17 for harmonizing. TBG17 is a special group for harmonizing. TBG17 is to be responsible for consistency and harmonisation of business process models and core components across business domains and sectors. After harmonizing of BIEs which is submitted by each domain group, TBG17 publishes Core Component Library. The harmonization is a very tuff job. According to RSM and CCL, we can generate XML schemas by using "Naming and Design Rule".

UN/CEFACT Plenary approved the BRSv1 (Works) in June 2005. TBG6 approved the BRSv2 (Works, Services, Goods) and the project team has revised it according to CCL06B. The RSMv2 and XML schema are waiting for ICG audit.

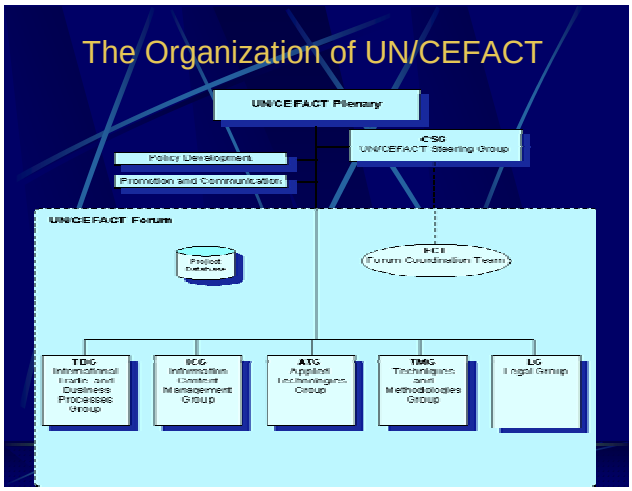

Figure 1: UN/CEFACT

3 CONCLUSION AND FUTURE WORK

The international standards of eTendering have been developed through this project.

ACKNOWLEDGEMENTS

This project was partially supported by Japan Construction Information Center.

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Life Cycle Data Management for Japanese construction
- Research Reports on Registry in US -

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Keywords: metadata registry, LCDM, IT infrastructure, XML, standardization

1 LCDM Overview

LCDM (Life Cycle Data Management) is a general concept of data sharing and system collaboration all through the construction lifecycle, not only execution process, but also maintenance process of completed objects.

The goals of LCDM are to develop specification of data standards and information infrastructure, on which standardized data are registered, updated, and made effective use of, in order to promote data standards and make information investment efficient.

1.1. Background

In the background, we propose to study and realize thc concept, there is the fact that the Japanese construction IT environment is filled with non-consistent standards and systems for diverse fields, so that we can not cope with the increase of needs for data sharing and reuse, all through the lifecycle of social infrastructures.

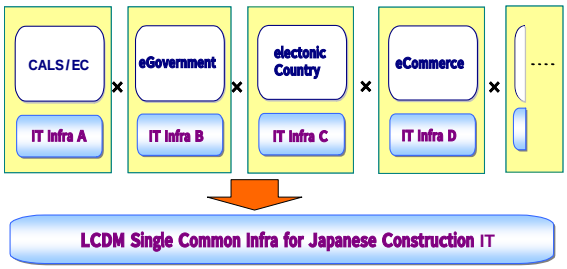

Figure 1: Background of LCDM

1.2. Activities on LCDM Forum

LCDM Forum, non-profit task force led by private companies, was established in Feb.2005 composed of members from construction industry, IT industry and public sectors, total 38 members.

The Forum finished two years term and dissolved on Feb.2007 as planned on the first, and published several specifications as deliverables.

You can download more than 600 pages from the following site. http://www.lcdm-forum.jp/ (in Japanese)

MLIT announced ‘Innovation 25’ a new IT Policy on 25th May, 2007 in which the concept of LCDM was adopted .

1.3. Concept of LCDM System

LCDM System is composed of 3 conponents, as follows.

LCDM Registry will be developed to make visible who, what, and where about data specifications. Only a single LCDM Registry may be allowed in construction field, and registration to the registry may go through human examination, to secure data interoperability.

LCDM Portals may be developed to provide data to users who will search and retrieve raw data from data providing systems through these portals.

LCDM Adapters may be developed and work as interface to transform non-standard data such as legacy data into LCDM-standard XML data.

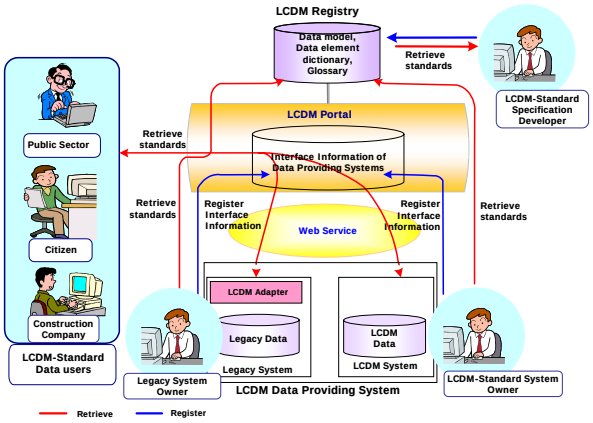

Figure 2: Concept of LCDM system

2 Research on US Main Registries

JACIC (Japan Construction Information Center) sent a delegation composed of officers of MLIT, members from LCDM Forum and JACIC November, 2006 to research US 5 main registries. Such as,

FAA：Federal Aviation Administration
http://fdr.gov/fdr/Home.jsp

USHIK：United States Health Information Knowledgebase
http://www.ushik.org/registry/x/

VHA：Veterans Health Administration
http://www1.va.gov/health/

NCI：National Cancer Institute
http://ncicb.nci.nih.gov/
EPA：Environmental Protection Agency
http://www.epa.gov/sor/

2.1. Summary of the Research

The delegation could get real information that would not be found from open announcement such as websites, by direct interview to those key men.

They developed Registries to realize Business Process Re-engineering and improvement of public service and also to manage data more efficiently, finally to realize cost-down of application system development.

Technically, all of them said that they developed Registries based on ISO/IEC 11179, but really, those were based on it not exactly but rather flexibly.

They developed not always their registry systems themselves, but there were use cases of commercial off the shelf products such as FAA, and were another case that VHA imported and re-used from EPA systems.

We observed through the research that the US Governmental Policy may be to build Registries as social infrastructures by public budget and to be operated by official agencies to secure neutrality and liability.

On real operation of their registries, we got such information as follows. These will be useful for our future registry implementation.

- Quality and status control of posted specifications is processed through human procedures
- In some cases, incentive is given by controlling budget for system development depended on usage of registries
- Even these advanced registries are not yet completed, and are still on the way of development

2.2. Abstract of the typical 3 Registries

FAA, EPA, NCI (Details are in the presentation)

3 METADATA OPEN FORUM IN NEW YORK '07

The 10th Open Forum on Metadata Registries was held in New York and presented on the LCDM activities. The abstract of the Forum is as follows.

Place; New York City, NY USA
Date; 9 - 11 July 2007
Participants; About 100 people
USA, Canada, UK, Iceland, China,
Korea, Australia, Japan etc.
Organization Fields;
Aeronautics, Science, Environment,
Engineering, Sales, Construction,
Medical-care, Manufacturing etc.

The presentations of the Forum can download from the following site.

http://metadataopenforum.org/index.php?index

Here I would like to introduce a part of informations I got at the Forum, the list of organizations operating Registries;

US, Canada

- EPA: Environmental Protection Agency
- NCI: National Cancer Institute
- USHIK: United States Health Information Knowledgebase
- FAA: Federal Aviation Administration
- VHA: Veterans Health Administration
- US Census Bureau
- DoD: Department of Defense
- STC: Statistics Canada

EU

- EEA EIONET: European Environmental Agency Data Dictionary
- ITS Registry: United Kingdom Highways Agency
- Icelandic Cancer Center

Others

- METeOR: Australian Institute of Health and Welfare Metadata Online Registry

Standardization Activity of JACIC in Construction IT Fields in Japan The 3rd 3-year Plan

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Keywords: construction information, standardization, CALS/EC, e-delivery, CAD data exchange format, SXF, DM-SXF conversion, JCCS

1. Introduction

In order to improve productivity and quality of public works, the Ministry of Land, Infrastructure and transport (MLIT) has executed CALS/EC initiative since 1996. CALS/EC aims to promote sharing and reusing construction information throughout lifecycle and among related organizations.

JACIC established the Construction Information Standardization Committee in 2000 to support CALS/EC initiative and has developed several standards to enable smooth circulation of digital construction data and realize integrated use of them.

The committee has developed standards under the 3-year plans. The 1st plan was made in 2001, 2nd in 2004 and the 3rd plan has just made in June 2007, which describes themes and targets of standardization by June 2010.

2. Results of standardization by the 2nd plan

The committee has consisted of four sub-committees in the 1st and 2nd plan period. They were SC for use of e-delivered data, SC for DM and construction information, SC for CAD data exchange and SC for common codes and JCCS.

SC for use of e-delivered data has developed e-delivery manual which is employed by MLIT and some of other public works responsible ministries and local governments for e-delivery in CALS/EC initiative. By using the manuals, MLIT insists all contractors to deliver all documents and figures derived from all construction work and engineering work in digital form. Therefore, huge amount of digital information concerning public works has been accumulated and increased year by year. However, such e-delivered information has not yet been utilized in the following phases properly as expected.

SC for DM and construction information determined a rule to describe location of work in e-delivery so that construction information can be retrieved easily from digital map or GIS. SC also developed a specification of file conversion from extended DM format to SXF format so that topographic map data can be used in design and construction phases as CAD data.

SC for CAD data exchange developed standard CAD exchange format SXF conform to ISO 10303. SXF is employed by MLIT and some of other public works responsible organizations as standard CAD format in e-delivery. More than 100 CAD softwares are applicable to SXF. Two dimensional SXF specifications have completely been developed by the end of the 2nd plan period.

SC for common codes and JCCS has studied on semantic information interchange through JCCS (Construction information Classification System in Japan). SC developed JCCS ver.2.0 by 2nd plan period and collected and classified more than 10,000 basic terms used in construction industry. However, there need much more terms to be collected to cover whole construction field, JCCS-Wiki system was developed to let outside expert participate in editing JCCS terms.

3. The 3rd 3-year standardization plan

The 3rd plan expands standardization activities toward 3 directions. One is along time direction from single phase interchange to lifecycle long interchange. The next is spatial direction from inner project data exchange to whole construction industry data sharing. The last is depth direction from value level to semantic level.

In order to promote standardization along the above mentioned directions, the plan reorganized the committee into three sub-committees. They are SC for use of e-delivered data, SC for chart and model data exchange, and SC for net-centric environment.

Construction By-products Resource Information System (COBRIS)

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Keywords: construction by-products, construction waste, recycling, information exchange

1. Introduction

Construction work requires plenty of materials as concrete, soil/sand, woods, metal, etc. On the other hand, during construction process, they also generate plenty of waste which consists of the same materials. Therefore, if waste can be reused as resources, it contributes saving materials and reducing waste.

Since "Basic Law to establish Recycle-based Society" was enacted in 2000, "Construction Material Recycling Act" and other rules and guidelines have promoted to exchange and recycle construction by-products.

In this regard, JACIC started COBRIS (Construction By-products Resource Information System) to provide place to exchange information on demand and supply of construction by-products and disposal facilities so that parties concerned can exchange construction by-products easily on market basis.

2. Situation of construction waste

According to a survey by the Ministry of Environment in 2003, out of whole 464 million tons (Mt) of waste, industrial waste shares 89%. And out of 412Mt of industrial waste, 75Mt (18%) are construction waste.

Survey by the Ministry of Land, Infrastructure and Transport in 2006 also tells that total amount of construction waste decreased from 99.1Mt in 1995 to 77.0Mt in 2005. More remarkably, recycling rate increased from 58% in 1995 to 92% in 2005.

3. COBRIS concept

Fig.1 shows relation between COBRIS and its users. COBRIS provides place for information exchange among contract donor, contractor and recycling service providers.

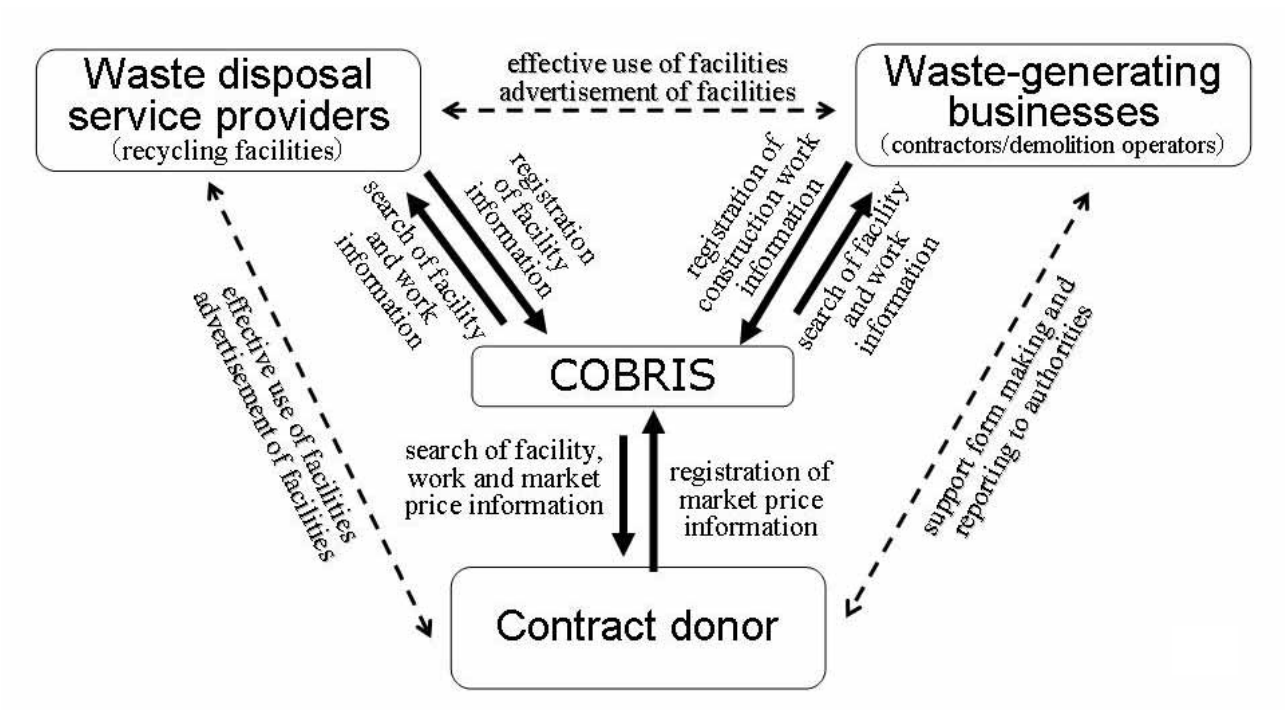

Fig.1 Relation between COBRIS and users

Contract donors register surveyed market price information into COBRIS. Waste generating businesses as contractors or demolition operators register plans for and implementation of construction by-products, as well as use of recycled resources. Waste disposal service providers register recycling facility information. Thus COBRIS stores such information for retrieval from users. Contract donors may find recycling facility information nearby the project site. Contractors may find if necessary material will be generated from other project site nearby.

3. COBRIS details

3.1 Information contents

As for construction work information, 6 items of construction materials such as concrete, reinforced concrete, woods building materials, bituminous mixture, soil/sand and crushed stone, and 11 items of construction by-products such as concrete waste, woods waste (woods building materials turned into waste), asphalt waste, woods waste (deforestation trees, etc.), construction sludge, mixed construction waste, metal waste, asbestos (of scattering nature) are to be registered.

Surveyed market price information consists of name and address of facility, acceptance charge and operational status. Facility information consists of the same information as surveyed market price information as well as offered price.

3.2 Annual service charge

Table-1 shows annual service charge.

Table-1 Annual service charge for the system (tax included)

System type	User	Contract unit	Annual charge
On-line system	National government, Public corporation	Per head office	¥157,500
	Prefecture, Mega city	Per office	¥31,500
	City, town, village, special ward	Per municipality	¥8,400
	Waste generating body	Per branch office	¥8,400
	Waste disposal service provider	—	free
Agent system	Waste generating body	Per branch office	¥15,750
	Waste disposal service provider	—	free

3.2 Membership of COBRIS

Table-2 shows number of users as of May, 2007.

Table-2 Membership of COBRIS (May, 2007)

User	Number
National government organization	309
Public corporation	9
Local government	282
Private utility corporation	6
Waste generating body	15,464
Waste disposal service provider	1,932
Total	18,002

Construction Terminologies and Language Independent Definitions in East Asia

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Keywords: Code Checking, Terminology, Building Codes

1 INTRODUCTION

East Asian countries, especially China, Japan and Korea commonly use Chinese characters as a written language and mutually understandable. Nowadays, e-Commerce and e-Business in construction IT is expanding. To facilitate these activities, it is necessary for consistent and stable terminology mapping and translation of English terminologies.

Also language neutral definition is important issue for the future oriented common terminology dictionary. One object can have several names in the same language. On the other hand, one name can refer to several objects. Therefore, it is necessary to describe objects from what they are, independent of use and time, and not from what they are named or classified as.

Structured documents with tagged intelligent objects are demanding recently. There have been notable development activities of language independent construction libraries based on ISO 12006-3, such as Lexicon, IFD and Barbie.

There are various possible applicable areas of these language independent libraries.

Currently, IFC and STEP are used as neutral construction data specification model. Based on these standard models, the following systems are under development stages;

-Construction/Building codes and regulation checking systems

-E-submission and code checking

-Object oriented classification system

2 DEVELOPING CONSTRUCTION TERMINOLOGY DICTIONARY

The terminology should be interoperable with international standards and should be operated across national boundaries. The work level of this project is recommended as follows;

-Establish terminology list for each country with corresponding English terminology

-Combine terminology list for each country into a single set

-define level and aspects of terminologies (taxonomy, specification and modelling)

The expected work procedure is as follows;

1. Start with Construction IT related terminologies
2. Expand to general construction terminologies
3. Expand terminology list to language neutral dictionary(to be used with system such as object oriented classification system and structured documents)

Establish This project should be supported by each governmental body to be formally accepted by each

Table 1: Level and Aspects of a terminology Table

I.D/ Reference KS	Terminology/ Definition	corresponding			Level	Related Resource	Types	
		English Word	Chinese Word	Japanese Word	-Taxonomy -Specification -Modelling	-Data Modeling -Catalogue -GIS -Internet -etc.	Construction IT	General Construction

3 BENEFITS AND FUTURE PERSPECTIVES

The following foreseeable benefits can be obtained.

-Keep same semantics with corresponding words to minimize misunderstanding

-Establish terminology standards for e-commerce

-Have language neutral definitions

Populate each country to establish national construction IT terminology standards

-Be applicable to future digital construction/building projects, such as classification system, codes and regulations checking systems.

To be used in the industry, the terminology system should have a flexible structure which supports intelligent tagging information.

4 CONCLUSION

As the needs of standardized terminology dictionary and language independent definitions are getting bigger, the international project team among east Asian countries should be established and applicable projects(automated code checking, classification system, or e-catalogue) to carry in parallel with this project.

By developing construction terminology dictionary, construction IT e-commerce can be facilitated significantly in Asia.