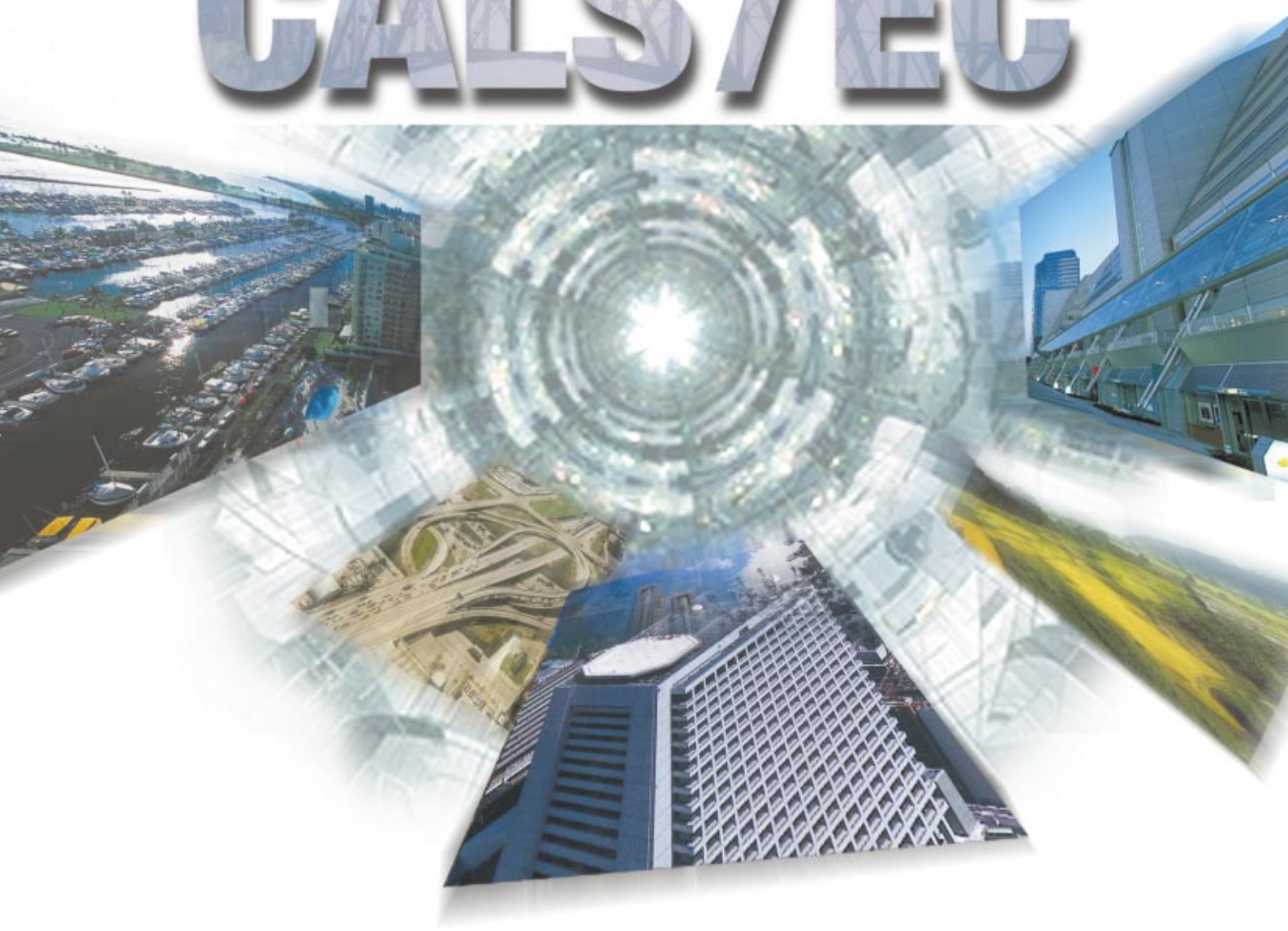
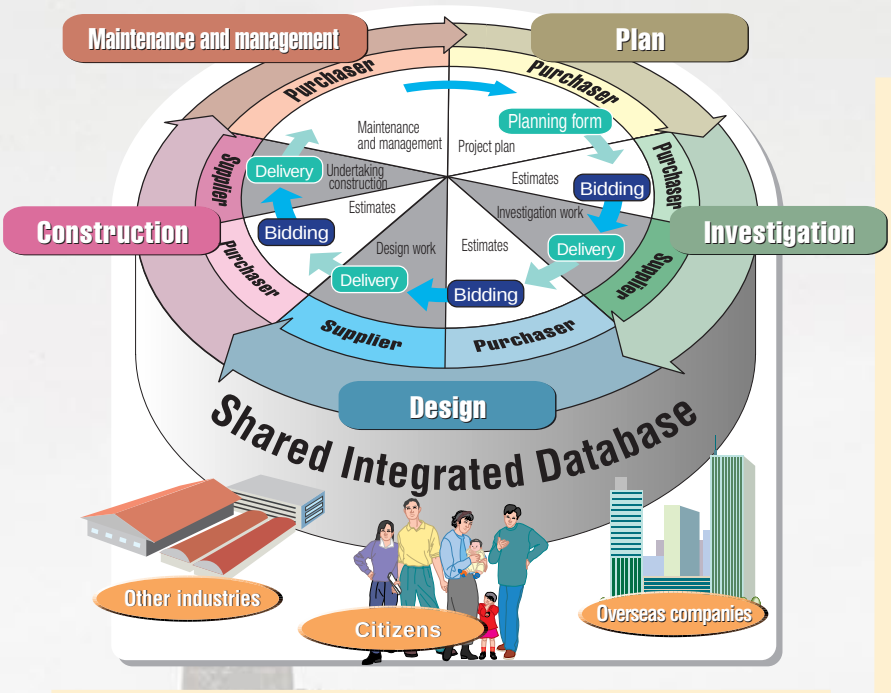
Reform of Public Works by IT

CALS/EC



Ministry of Land,
Infrastructure and Transport



Life-cycle Support

As already described, CALS/EC is an effort to fully rationalize services throughout the life-cycle of public works. Processes in public works will undergo from plan, investigation, design, construction, maintenance and management, as well as renewal. In each process, various information is exchanged between the related parties.

The following are efforts on CALS/EC for each corresponding service:

- **Electronic bidding**
- **Information sharing between purchaser and supplier while implementing work**
- **Electronic delivery**

These are expected to be integrated in the future, into:

- **Shared integrated database**

Shared Integrated Database

"Shared Integrated Database" integrates all information from the planning stage to maintenance and management in one (virtual) database for sharing information with citizens as well as between related parties. Through this database, existing information is mutually linked and used effectively through the entire project life-cycle.

CALS/EC Action Program

Since 1995, Construction CALS/EC (Ministry of Construction), Port CALS and Airport Facilities CALS (Ministry of Transport) have been promoted as activities to realize efficient execution of public works as well as to decrease construction costs and ensure and improve the quality of public facilities.

The Ministry of Land, Infrastructure and Transport (hereinafter, referred to as MLIT), established in January 2001, decided to integrate these three schemes and position them as CALS/EC, then, it decided to introduce CALS/EC into every process of public works administrated by MLIT by fiscal year 2004. Furthermore, the "Local Promotion Action Program" was declared in June 2001, targeting the complete realization of CALS/EC for all public purchasers, including local government agencies by fiscal year 2010.

Schedule Outline	Phase 1 FY 1996 to 1998 (FY 1996 to 1999)	Phase 2 FY 1999 to 2001 (FY 2000 to 2002)	Phase 3 FY 2002 to 2004 (FY 2003 to 2004)	By FY 2010
Construction CALS/EC	• Preparing a PC environment for all staff to make use of the Internet • Start of verification test	• Implementation of Electronic Procurement System in small number of construction works projects • Start of Electronic Delivery of results	• Implementation of CALS/EC for all public works projects administrated by MLIT	Implementation of CALS/EC in all public purchasers including local government agencies
Port CALS	• Preparing a Port CALS environment • Start of model project	• Construction of Integrated Database System • Establishment of framework for installing the Electronic Procurement System		
Airport Facilities CALS	• Settling Airport Facilities CALS Grand Design • Start of model project	• Construction of Integrated Database System	• Application of Airport Facilities CALS in public works projects administrated by MLIT	

Fiscal years for Airport Facilities CALS are shown in ( )

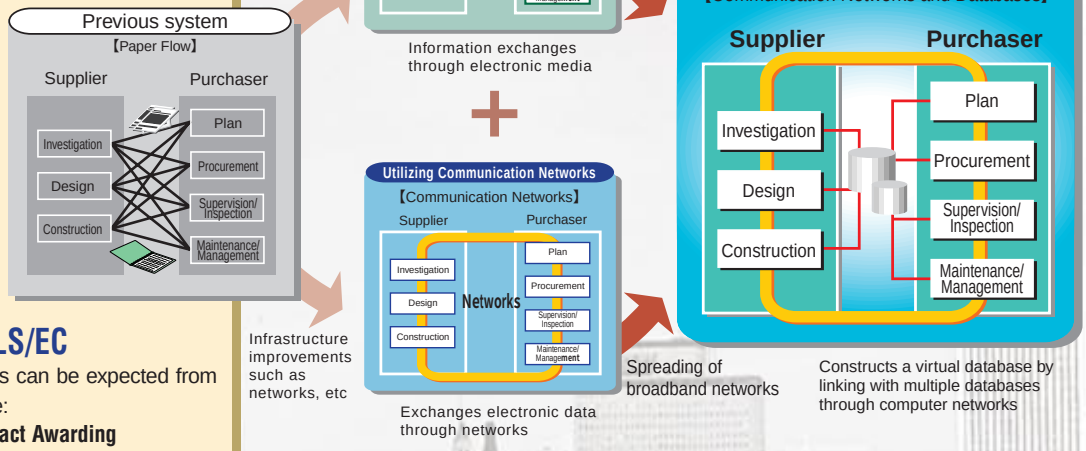
CALS/EC by Ministry of Land, Infrastructure and Transport

The Ministry of Land, Infrastructure and Transport's CALS*1/EC*2 started up fully with the launch of Electronic Bidding and Electronic Delivery in 2001. CALS/EC stands for "Public Works Support Integrated Information System." This is a mechanism using electronic information and computerization, instead of paper-based information exchange. It also uses the Internet to create an environment allowing linkage of many public works databases.

Overview of CALS/EC

CALS/EC is comprised of the three elements as shown in the Figure on the right:

"Using Electronic Information"
"Utilizing Communication Networks"
"Sharing Information"



Effects of CALS/EC

The following effects can be expected from the elements above:

- **Transparent Contract Awarding Procedures for Public Works**
- **Higher Efficiency**
- **More Interaction Between Citizens and Administration**
- **Improvement of Work Process at Construction Site**

Information Standardization

Standardizing information is indispensable for creating and exchanging electronic information. If the computerization of information proceeds without standardization, huge amounts of data that cannot be read with each other will be created, thus it leads to more confusion in work. In addition, it will require the installation of various terminals that have no interoperability, which results in rising costs. Standardization cannot be avoided to promote CALS/EC.

1. Transparent Contract Awarding Procedures for Public Works

Bidding procedures for public works have been criticized as not very clear. By changing the procedures to those that use the Internet, the procedures will become more transparent to people.

2. Higher Efficiency

Changing result printed on paper to electronic data enables data work to be more efficient by preventing duplicate input of the data, etc.

3. More Interaction Between Citizens and Administration

A system will be built whereby each citizen and executers of public works can directly engage in conversation by combining Internet home pages and electronic mail.

4. Improvement of Work Process at Construction Site

Public works construction sites have been looked upon as places where hard work is performed and that are dirty and dangerous. Work sites will greatly improved by IT.

*1 **CALS (Continuous Acquisition and Life-cycle Support):** A concept or an activity to reduce product development time, costs, and to improve productivity by transferring product or entire life-cycle information from design to manufacturing, distribution and maintenance between departments, corporations electronically and to enable data exchanges and data sharing, etc. for technology and transaction information through computer networks.

*2 **EC (Electronic Commerce):** Electronic commercial transactions performed on the networks. In the construction field, the use of EC technology for procurement of public works (bidding and contracts) and online trades between companies are attracting attention.

Procurement Stage

Electronic Bidding

Transparent Public Works Contract Awarding Procedures

"Public Works Procurement Information Service," for disclosing procurement information on the Internet started from April 2001 and "Electronic Bidding," using the Internet, started from October 2001 for public works projects administrated by the MLIT.

Public works Procurement Information service (PPI)

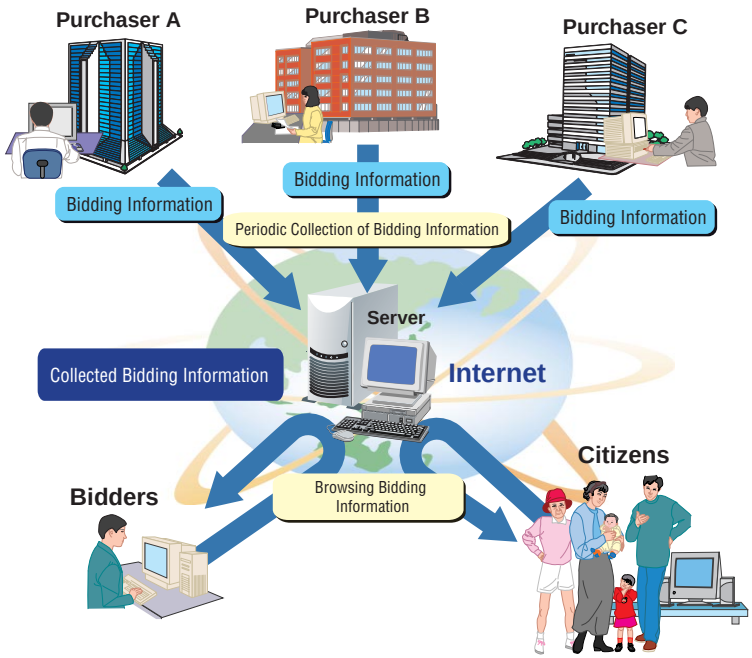
PPI provides ordering schedule information, ordering information, bidding results, that previously publicized by each regional development bureau or construction office on bulletin boards or for browsing (some utilized homepages on the Internet) on one Internet homepage.
Bidders and other citizens can obtain and search centralized procurement information using this service.
http://www.ppi.go.jp/ <Japanese only>

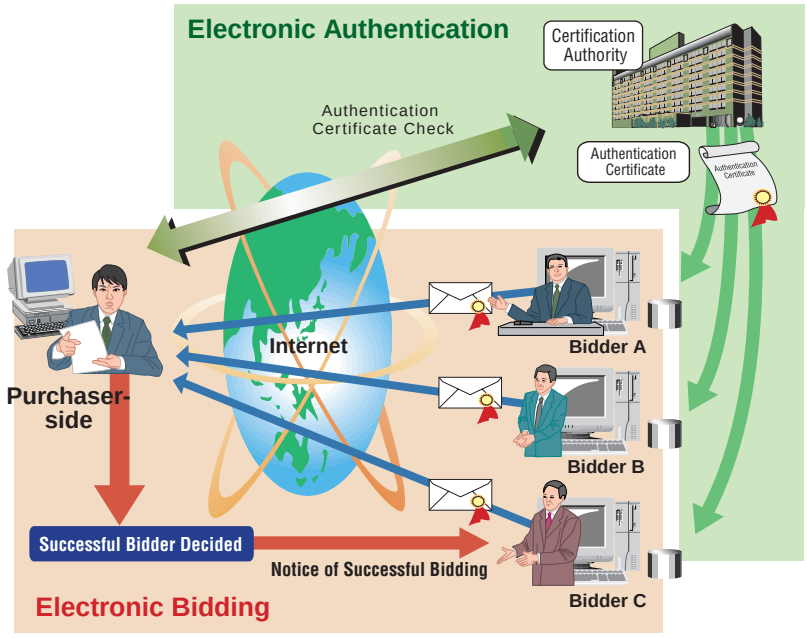
Electronic Bidding

This system allows bidders to enter bids merely through data processing on the Internet. Bidders can participate in tenders while remaining in their offices, so simplifying bidding work and inducing more bid applicants to participate in tenders. Expectations are high that contracts will be awarded at more rational prices through the principles of competition.
Electronic authentication*3 is used for implementing transactions on the Internet safely.
Implementation started for some public works projects administrated by the MLIT from October 2001, while many purchasers are preparing for support.
http://www.e-bisc.go.jp/ <Japanese only>

Standardization Efforts

If as many as 3,000 purchasers for public works introduce a unique system, this will result in purchasers wasting money on development costs and bidders having to introduce multiple systems, meaning that an incredible amount of money and time to learn these systems is required. Under such circumstances, can the efficiency of computerization be improved? And from a societal viewpoint, there is a question of whether such a bidding system is actually inefficient.
For these reasons, in July 2001, the Electronic Bidding Core System Development Consortium*4 was established as a way to standardize the Electronic Bidding System.
http://www.cals.jacic.or.jp/english/coreconso/





*3 Electronic authentication: A service paired with electronic bidding. Its target is to ensure security in implementing bidding on the Internet. The electronic certification authority issues an electronic certificate in advance and provides a system to identify that the electronic signature attached to the bid form is of the said person. It started with electronic bidding in October 2001.

*4 Electronic Bidding Core System Development Consortium: A consortium established by JACIC and SCOPE to support the smooth introduction of the electronic bidding system into public purchasers. Duplicate government investment and confusion of the users can be avoided if most public purchasers use the core system.

Work Implementation Stage

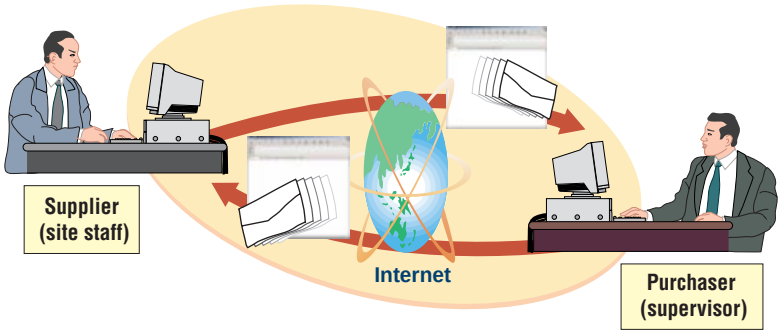
Information Sharing

Work Quality is Dramatically Improved

Public works are performed by many related parties. By sharing information such as the latest design or schedule among them, accidents or retrogradation in the construction work can be prevented.

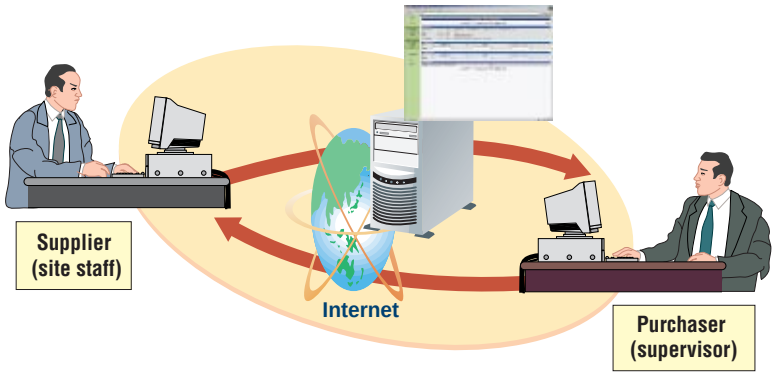
E-mail

The first step for information sharing is utilizing e-mails. If the contents to be discussed are simple, this can be accomplished by inquiring or proposing by e-mail and receiving a reply, instead of face-to-face discussions. Different from telephones that cannot leave a log, the e-mail is useful for decreasing the mistakes due to misunderstandings or miscommunication because inquiry and reply can be saved. The latest progress in the construction work can be shared by sending the same mail to multiple related parties at once.



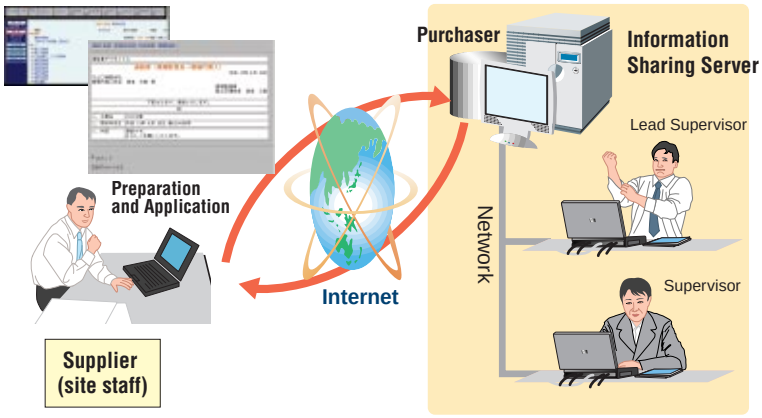
Information Sharing Server

E-mail is a very effective method, however, it is difficult to manage all the documents when the work grows beyond a certain scale and the number of persons involved increases because it becomes unclear what the latest information is, within the documents saved by each individual. To solve this problem, an information sharing server is often used. This server clears up where information is and what information is the latest.
Information sharing servers are classified into two types: servers utilizing the server owned by a purchaser and servers utilizing outsourcing services using iDC*6 which are called ASP*5.



Construction Process Documents Management System

An example of the Port System utilizing the information sharing server owned by a purchaser. Work quality and efficiency will be raised by electronically creating, applying with and certifying work related documents exchanged between the purchaser and supplier from construction work contracts to completion.
On the supplier side, by creating and applying with electronic forms on the Internet, transfer time and costs for providing these documents that were needed up to now can be reduced. On the other hand, purchasers make settlements for the electronic forms which were applied to from the supplier on the Internet using the network in the office.



*5 ASP (Application Service Provider): A business that prepares and manages application functions and various related services on the data center such as iDC, and provides them to multiple users through a broadband network (such as the Internet).

*6 iDC (Internet Data Center): A facility that manages and operates servers and other equipment for companies that conduct business using the Internet. Generally, it possesses a duplicated high-capacity, high-speed backbone line, high-level security and a solid facility and provides services 24-hours a day, 365-days.

Delivery Stage

Electronic Delivery

Operate Information in an Optimum Format

From fiscal year 2001, the "Electronic Delivery" service for the delivery of electronic files containing final results of each work process such as investigation, design and construction started for public works projects administrated by the MLIT.

Procedures and Standards

To appropriately manage the products, standardization of format is required. Standardization allows multiple information to be handled together and the contents to be easily understood, even if it is new information.
In addition, electronically-delivered data can be managed centrally by utilizing an information sharing server, etc., thus both purchaser and supplier can pick out required information whenever needed.
As rules for standardization, procedures and standards shown in the table are settled to enable electronic delivery for public works projects administrated by the MLIT from fiscal year 2001. These documents can be obtained from the following home page of the National Institute for Land and Infrastructure Management.
http://www.nilim.go.jp/japanese/denshi/calsec.htm
<Japanese only>

As a current measure for staff in the MLIT to support electronic delivery, the "Guideline for Electronic Delivery Operations (draft)" has been settled. In addition, to show the items and policies to be discussed at the start of construction for smooth implementation of the electronic delivery, the "Guideline for Prior Consultations on Electronic Delivery at Work Sites (draft)" has been settled.

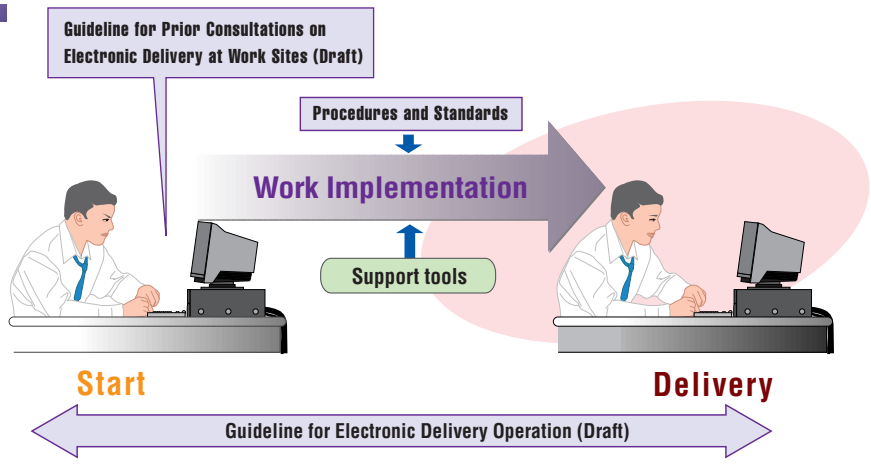
Computerization of Work Result Information

Procedures and Standards	Adopted/Revised
Standard for Digital Photo Control Information (Draft)	Adopted in Mar. 1999
Procedures for Electronic Delivery of Civil Engineering Design Work (Draft)	Revised in Aug. 2001
Procedures for Electronic Delivery of Documents Upon Completion of Works (Draft)	Revised in Aug. 2001
CAD*7 Drafting Standard (Draft)	Revised in Aug. 2001
Procedures for Geological Survey Data Sorting (Draft)	Revised in Aug. 2001
Guidelines	**Adopted**
Guideline for Electronic Delivery Operation (Draft)	Adopted in Mar. 2001
Guideline for Prior Consultations on Electronic Delivery at Work Sites (Draft)	Adopted in Mar. 2001

(as of January 2002)

Procedures for Electronic Delivery

When implementing a work, a full understanding of procedures and standards as well as discussions between supplier and purchaser enables smooth electronic delivery after implementing the work. Labor savings are also realized through effort to computerization of documents during the construction. Various tools for supporting the electronic delivery are also available.



*7 CAD (Computer-Aided Design, and indicates computerized design-support systems): A large variety of software is used in Japan, but data standards vary. The CAD Data Exchange Standards Development Consortium (SCADEC) which was set up between March 1999 and August 2000 developed SXF exchange standard based on ISO standard STEP/AP202, enabling data exchanges between different CAD software. SXF is going to be used in electronic delivery.
http://www.cad.jacic.or.jp/en/scadec_e.htm

Maintenance and Management Stage

Risk Management

High Level Utilization of the Collected Information

Efficient maintenance and management is required to support maintenance and management cost increases and inquiries from residents. Protecting lives and properties from disasters are also important missions.

Improving Maintenance and Management Efficiency

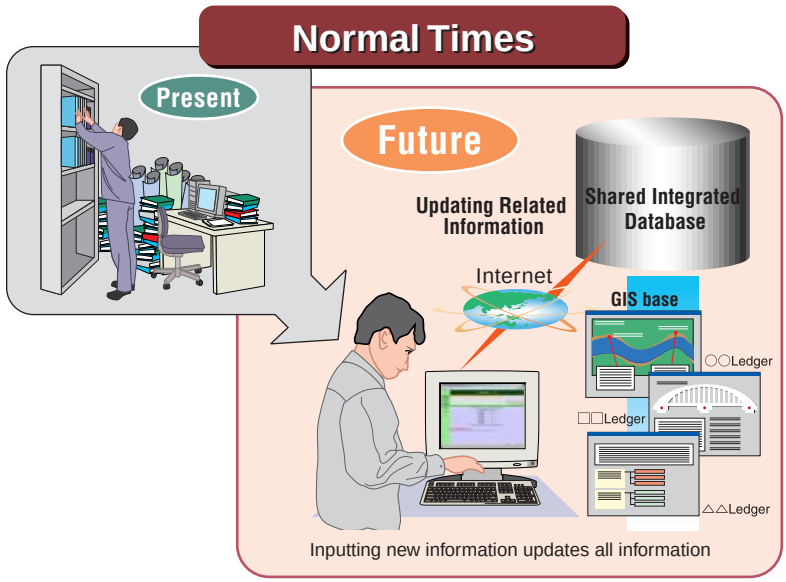
Efficient maintenance and management is required to maintain functions at equipped public facilities. At present, information on public facilities are managed by periodically replacing ledgers in which information to be processed is limited. In the future, if the “Shared Integrated Database” (electronic ledger) based on GIS*8 is constructed, and registration and updates are automatically enabled, the latest conditions and repair history can be easily searched for which makes normal, everyday services such as repair planning, more efficient.

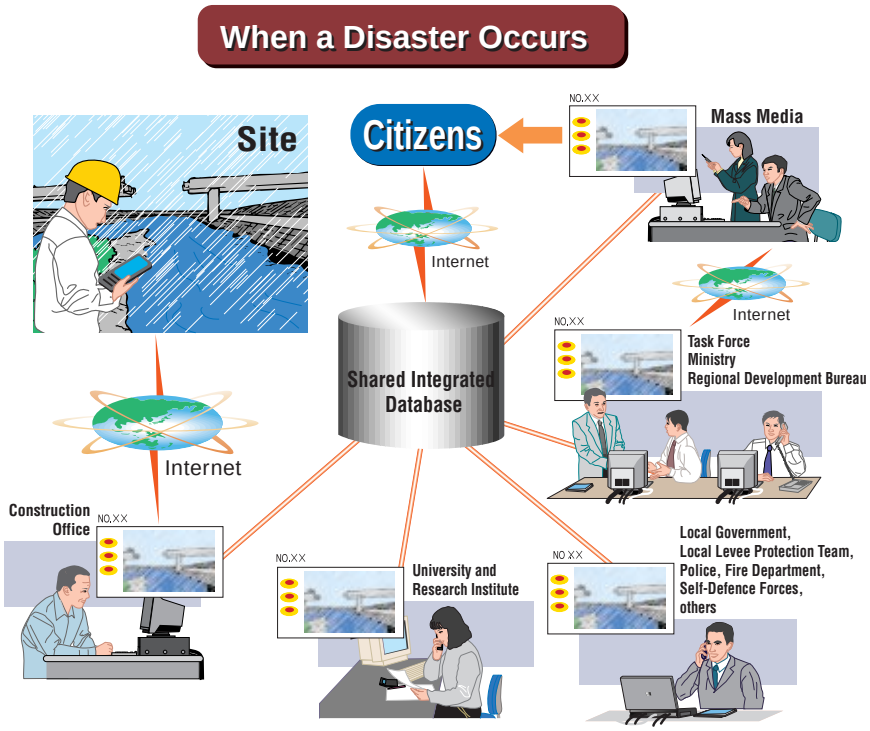
Responding to Inquiries

At present, responses to inquiries from residents are made by searching for information from the ledger. In the future, if the “Shared Integrated Database” can be used, residents themselves can search for related information directly resulting in a more rapid and accurate response.

Protecting Lives and Properties

More rapid and accurate information is required when a disaster strikes. At present, the situation at a disaster site is recorded on paper and reported over the telephone. In the future, if the site situation data sent from mobile equipment*9, is automatically registered on the “Shared Integrated Database,” more accurate information communications can be performed by information sharing among related departments. In addition, linking with universities and research institutes realizes more secure measures against disasters, by simulating the disaster and so forth.

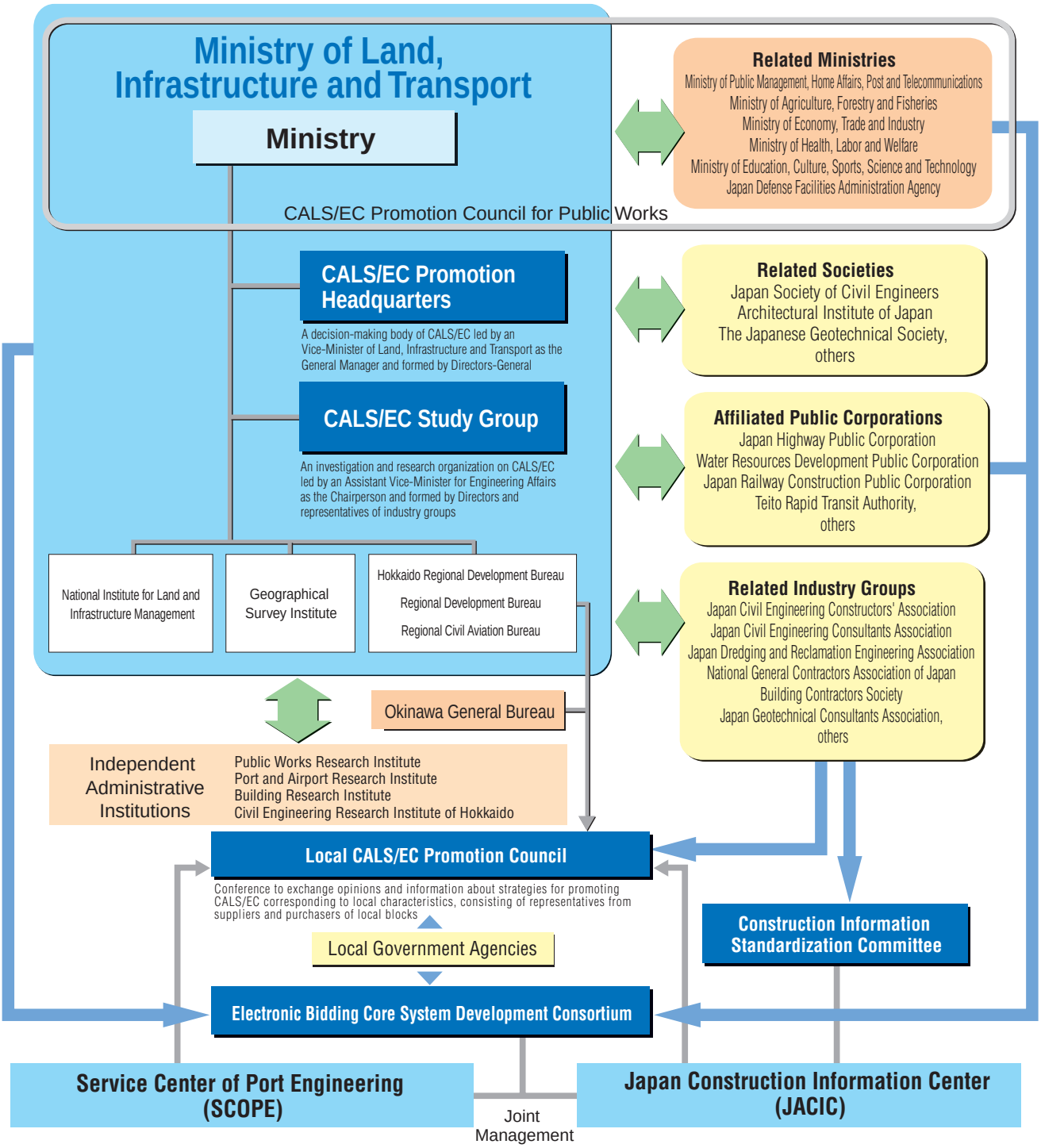




*8 GIS (Geographical Information System): A system to manage and operate information, such as ledger, statistics and images, indispensable for public works, in relation to maps that use computers. It improves processing speed, and simplifies analysis, conversion and multi-purpose uses of geographic information.

*9 Mobile Equipment: Portable information equipment including cellphones, portable digital assistants (PDAs) and compact personal computers. The rapid miniaturization and high added-value of mobile equipment have increased the number of users of mobile equipment recently. In Japan, about 60 million subscription contracts have been made for cellphones and PHSs (Personal Handy-phone System, simple cellphone system). PDAs are now joining communication functions and mobile equipment is being integrated.

CALS/EC Implementation Organization



For Further Information, Contact:

Minister's Secretariat, Ministry of Land, Infrastructure and Transport
(Engineering Affairs Division, Public Works Planning and Research Office)
URL http://www.mlit.go.jp/english/

1st Research Department,
Institute of Construction Management,
Service Center of Port Engineering (SCOPE)
URL http://www.scopenet.or.jp/main/english/

CALS/EC Department,
Construction Information Research Institute,
Japan Construction Information Center (JACIC)
URL http://www.cals.jacic.or.jp/english/

As of Jan. 2002