


Streamlining operations related to the maintenance and preservation of port facilities

1. Outline of Studies and Activities

Government actions related to digitization and public works	Improvement of efficiency of operations related to port facility maintenance and preservation (Promotion of port CALS, enhancement of cost estimation methods)
1996 MLIT Basic Concept for Construction CALS Development <ul style="list-style-type: none"> • Establishment of PC environment for all employees • Introduction of CALS 2000 Act for Promoting Proper Tendering and Contracting for Public Works	1996 Development and operation of a cost estimation information system 1997 Commentary on New Civil Engineering Cost Estimation System 1999 CAD Drawing Preparation Guidelines (Draft) <div>2001 Establishment of NILIM</div>
2001 Guidelines for Measures to Promote Proper Tendering and Contracting for Public Works 2001 New Action Plan on Measures to Reduce Public Works Costs 2001 e-Japan Strategy 2001 MLIT CALS/EC Local Development Action Program 2004 e-Government Construction Plan 2005 Act for Promoting Quality Assurance in Public Works 2005 MLIT CALS/EC Action Program 2005 Bidding and contract information, information sharing, electronic delivery, etc. 2008 MLIT CALS/EC Action Program 2008 ; Bidding and contracting procedures, information between client and supplier, information-intensive construction, electronic delivery, etc. 2016 Promotion of i-Construction 2018 Promotion of Cyber Port 2019 Medium- and long-term policies for ports PORT 2030 2019 Declaration to be the World's Most Advanced IT Nation - Basic Plan for the Advancement of Public and Private Sector Data Utilization (2020 all changes) 2020 Promotion of digital transformation 2020 Revision and enforcement of the three new “Bearer” laws	2001-2003 Port CALS Introduction Study 2001 Guidelines for the Electronic Delivery of Deliverables (Draft) 2002 Electronic delivery of deliverables for all survey and design work 2002 Start of port and airport bidding information service 2003 Implementation of electronic bidding for all construction work and services 2003 Electronic delivery of deliverables for all construction work 2004 Use of construction form management system for all construction work * <u>Sequential operation of integrated database</u> 2006 Start of operation of new system for port engineering cost estimation * <u>Continuous revision of port engineering cost estimation standards, etc.</u> * <u>Improvement of port engineering cost estimation system</u> <div>  </div> 2016 Full-scale operation of maintenance management database 2020 LCC calculation program

Numerous efforts have been made by the Management and Coordination Department (Technical Information Section and Cost Estimation Support Section) from the time of NILIM's inception to the present to “promote port CALS” and “enhance cost estimation methods” as a means of improving the efficiency of operations related to the maintenance and preservation of port facilities.

At the time of the inauguration of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), there was a demand for continued steady progress in social infrastructure development under the still severe fiscal situation, and it was important to

promote new measures in addition to existing cost reduction measures, as well as reducing life cycle costs by optimizing the construction time cost and improving the quality of facilities. In March 2001, the “New Action Plan for Public Works Cost Reduction Measures” was formulated to address the need for comprehensive cost reduction. The plan called for the revision of cost estimation standards in response to technological developments and changes in construction methods, and the promotion of CALS/EC in public works.

In addition, the “Act for Promoting Proper Tendering and Contracting for Public Works” was promulgated in November 2000 to ensure public confidence in public works and to promote the sound development of the construction industry, which undertakes these contracts. Based on this Act, the “Guidelines for Measures to Ensure Proper Tendering and Contracting for Public Works” was approved by the Cabinet in March 2001. The Guidelines also stipulate thorough implementation of proper cost estimations and the promotion of IT for bidding and contracting.

(1) Promotion of the MLIT CALS/EC system (Public works support and integrated information system)

In parallel with the above-mentioned trends, the development and diffusion of information technology led to an IT revolution that has brought about major social changes, and in January 2001, the “e-Japan Strategy,” a government-wide strategic initiative to promote the IT revolution, was decided upon.

Against this background, the use of IT was taken up as an important pillar of public works reform, and with the inauguration of the MLIT, it was decided to promote the CALS/EC (Continuous Acquisition and Life-Cycle Support / Electronic Commerce) system (public works support and integrated information system), for construction, as well as for ports and airports, and to establish a promotion headquarters and action program.

Rather than simply integrating the various CALS into a single system, MLIT CALS/EC aims to establish a system that accurately responds to diverse projects by setting common goals, exchanging information, and promoting technology sharing. Specific initiatives include: ① expanding the introduction of electronic bidding and electronic delivery and computerization of contract procedures, ② sharing information among contractors and subcontractors during construction, ③ standardizing various information among related parties, and ④ building an integrated database covering the entire life cycle of a project. On the order side, the project team is working to reduce travel costs, expand opportunities to receive orders, and improve operational efficiency.

As part of MLIT’s CALS/EC system, NILIM (Technological Information Division, Administrative Coordination Department) has developed and operated various systems comprising the port CALS under the supervision of the Port and Harbor Bureau of MLIT.

(2) Toward the improvement of estimation methods in public works

In the field of construction cost estimation, the “Commentary on the New Civil Engineering Cost Estimation System,” which was published in FY1997, set forth the following four directions for the cost estimation system for public works: ① easy-to-understand estimation for clients and contractors, ② standardization of estimation, ③ consistency and uniformity in contract-related documents, and ④ clarification of construction objectives. In port civil engineering projects, it is necessary to improve the efficiency of cost estimation work while maintaining consistency with this commentary.

NILIM (Cost Estimation System Division, Administrative Coordination Department), under the supervision of the Port and Harbor Bureau of MLIT, reorganized the Port and Harbor Construction Type System and the Port and Harbor Civil Engineering Contract Work Estimation Standards. In addition, the Port Engineering Estimation System Division, Administrative Coordination Department, under the supervision of the Port and Harbor Bureau of MLIT, reorganized the Port Engineering

2. Major Research Results

(1) Building Port CALS

The Port CALS system digitizes information related to the life cycle of port development projects, such as surveys and studies, plans, designs, cost estimations, orders, construction management, and maintenance management, to improve the accumulation and reuse of information. The project also aims to realize the efficient use of high-quality social assets related to ports and harbors by computerizing the exchange of information between the recipient and the receiver of port development projects.

The Administrative Coordination Department (Technological Information Division), as part of MLIT's CALS/EC system, works in cooperation with other systems and under the supervision of the Port and Harbor Bureau of MLIT to implement the following systems related to port construction and operations. The Port CALS system is part of MLIT's CALS/EC system.

① Electronic procurement

As part of the Port CALS, the Port and Airports Related Bidding Information Service (Figure-1) was launched in 2002. This system provides “Order Outlook,” “Bidding Notices, etc.,” and “Bidding Results” for port- and airport-related construction and operations as bidding information for each regional development bureau and NILIM on its website.

In addition, in conjunction with Port CALS, an electronic bidding system was introduced in 2003 for all construction works and operations of MLIT. Electronic bidding over the Internet was made possible by having the bidding participants prepare electronic certificates and other documents. In 2014, the government began using the Government Electronic Procurement System (GEPS), which is common to all prefectural and municipal governments, for “goods and services” and “some public works” conducted by the government.

Figure-1 Port and airport bidding information (bidding advertisement search screen)

② Electronic delivery

Based on the “Guidelines for Electronic Delivery of Deliverables (Draft)” (March 2001, MLIT), the Port and Harbor Bureau of MLIT prepared the “Guidelines for the Electronic Delivery of Deliverables in the Projects of the Regional Development Bureau (Port and Airport Related)” and implemented electronic delivery of all survey and design work in 2002, and all construction work in 2003.

In 2004, NILIM developed an electronic delivery storage management system (Figure-2) to enable efficient registration, storage, retrieval, and downloading of electronic deliverables, as well as information sharing. In 2011, NILIM also developed an inspection support system that enables checking of e-deliverables in accordance with various guidelines and procedures.

③ Computerization of application documents, etc. between contractor and client

As part of Port CALS, a construction form management system (Figure-3) was developed to enable the application and reference of documents (mainly forms of the common specifications for port construction) generated during the construction period between the contractor and the client using communication lines such as the Internet. The system has been used for all construction works in 2004 and for all operations in 2021.



Figure-2 Electronic delivery storage management system (Menu screen)

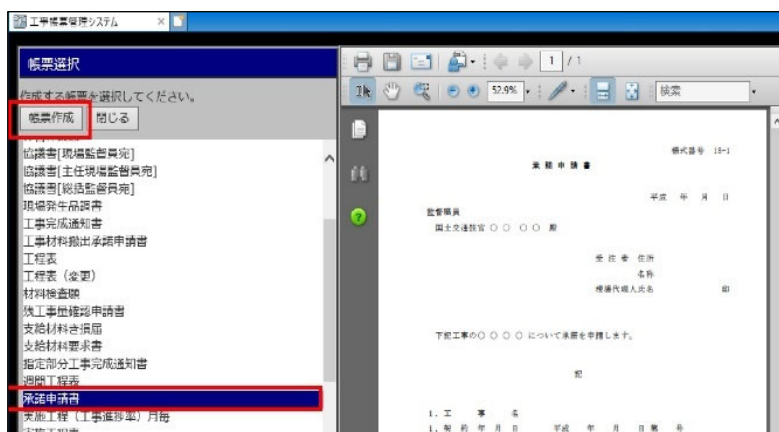


Figure-3 Construction form management system (form selection screen on the order-taking side)

④ Integrated database of port facilities

As part of Port CALS, an integrated database of port facilities (Figure-4) was established to electronically store a wide variety of information handled in port maintenance operations from survey and design to maintenance and management, and to centrally operate and share it throughout the entire port operations via a communication network. The full-text search function for operation manuals and literature materials was launched in 2002, and the contract management system used for integrated information management and contract management centered on construction/operations was launched in 2003.

The screenshot shows the '港湾施設統合データベース' (Port Facility Integrated Database) search interface. It includes a search condition selection area with a text input field and a search button. Below this is a section for selecting search results, with checkboxes for '基本情報' (Basic Information), '計画情報' (Planning Information), '運用情報' (Operation Information), '施設情報' (Facility Information), '連絡先' (Contact), and '電子納品物' (Electronic Delivery Materials). There are also buttons for 'ファイル作成状況確認' (Check File Creation Status), '画面・区スケーター' (Screen/Zoom), and '戻る' (Back). At the bottom, there are fields for '部署' (Department) and '業務所' (Business Office) with a 'すべて' (All) button.

Figure-4 Port integrated database (Search screen)

⑤ Port facility maintenance and management information database

As part of Port CALS, a database of port facility maintenance and management information (Figure-5) was developed to enable confirmation of facility inspection results over time, aiming to contribute to labor saving and efficiency improvement in maintenance and management operations such as facility inspection, diagnosis, and repair and improvement work. Full-scale operation started in FY2016. Data such as port facility ledgers from the Port Integrated Database were utilized for developing the database. In addition, the Port Research Department released a life cycle cost (LCC) calculation program (Figure-6) in FY2020. This program enables efficient estimation of the maintenance and management costs (LCC) required in the future based on the results of general periodic inspections and diagnoses conducted in accordance with the “Technical Manual for Maintenance and Management of Port Facilities” and other guidelines.

The screenshot shows the '維持管理情報データベース' (Maintenance Management Information Database) menu screen. It features a 'メニュー' (Menu) section with several options: '維持管理情報を検索・登録・確認する' (Search, Register, Confirm Maintenance Management Information), '実地監査状況を検索・登録・確認する' (Search, Register, Confirm On-site Audit Status), 'ライフサイクルコスト算定情報を検索・登録・確認する' (Search, Register, Confirm Life Cycle Cost Estimation Information), '予防保全計画管理シートを作成・登録・確認する' (Create, Register, Confirm Preventive Maintenance Plan Management Sheet), '立入検査情報を検索・登録・確認する' (Search, Register, Confirm Entry Inspection Information), '定型ファイルダウンロード' (Download Standard File), and 'パスワードの変更' (Change Password). Each option has a brief description. Below the menu is a 'データ保守メニュー' (Data Maintenance Menu) section with '一括修正シート取込' (Import Bulk Correction Sheet).

Figure-5 Maintenance management database (Menu screen)

The screenshot shows the 'LCC計算・性能評価集約等支援ツール' (LCC Calculation, Performance Evaluation Summary Support Tool) interface. It is divided into three main sections: 'LCC計算' (LCC Calculation), '性能評価' (Performance Evaluation), and '集約処理' (Summary Processing). The 'LCC計算' section includes '維持管理情報データベースCSVの取込' (Import CSV from Maintenance Management Information Database), 'LCC計算プログラムの実行' (Execute LCC Calculation Program), and 'LCC計算結果の集約表出力' (Output Summary Table of LCC Calculation Results). The '性能評価' section includes '性能評価結果の集約表出力' (Output Summary Table of Performance Evaluation Results). The '集約処理' section includes '集約処理の実行' (Execute Summary Processing). Each section has a brief description and a '参照' (Reference) button.

Figure-6 LCC calculation program

(2) Toward the improvement of estimation methods

The “Act for Promoting Quality Assurance in Public Works,” which went into effect in FY2005, stipulates that it is one of

the responsibilities of the client to properly determine the estimated price by accurately reflecting the actual conditions of the public works, etc. The White Paper on Land, Infrastructure, Transport, and Tourism publishes a yearly report on the enhancement of estimation methods for public works projects to improve construction management techniques as part of research and development, reminding us of the importance of continuously improving estimation methods as a national responsibility.

The Administrative Coordination Department (Cost Estimation System Division), under the supervision of the Port and Harbor Bureau of MLIT, collects and analyzes data on estimation methods related to port construction and operations in preparation for proposals for changes in various standards and procedures, etc. The division also designs, develops, tests, operates, and improves cost estimation systems, and responds to inquiries from all over Japan.

① Toward the revision of estimation standards for port and harbor engineering works

The Port and Harbor Bureau of MLIT has established the “Estimating Standards for Port and Harbor Contracts” in order to properly calculate the estimated cost of port and coastal works. In addition to the construction techniques required for general civil engineering works, port and coastal construction works are mainly carried out at sea or in the sea using work vessels, etc., and are easily affected by weather and sea conditions, etc. In addition, social conditions and the construction environment are changing day by day due to the increasing scale of construction and the shift of construction sites to offshore locations.

In order to respond promptly and appropriately to these changes in social conditions and the construction environment, NILIM has continuously surveyed and analyzed the actual conditions of construction and proposed revisions as necessary to ensure that the cost estimating standards are in line with the actual construction conditions.

② Support for port and harbor civil engineering cost estimation system

Major modifications of the port civil engineering estimation system each fiscal year are listed in Table-1. In FY2006, in addition to the integration of the current port civil engineering cost estimation system and the ship and machinery cost estimation system, a new standard for civil engineering cost estimation was introduced for port transportation facilities, etc., in order to unify and streamline the cost estimation process. In FY2008, the system was

Year	Major modifications to the totalization system
2001	Improved CALS-compliant database Green Purchasing Law compliance
2002	Improved CALS-compliant database Study of new estimation system
2003	Support for new construction type system Improvement of the output function of the cost estimate
2004	Support for system construction type compendiums Support for merged estimates of the same construction category
2005	Construction Category Information Setting Addition of detailed summary table display
2006	Integration of Port Engineering and Marine Machinery Construction Estimating Systems Compatible with the Standard Estimating Standards for Civil Engineering Works
2007	Function to create a price list for round trip costs, English navigation costs, etc. Addition of information on base price and fuel consumption, etc., and automatic calculation of navigation costs
2008	Improvement of outputting forms for public notice related to the outputting function of estimation reference materials Improved output function of forms related to common temporary construction costs
2009	Support for unit price type estimating method Improved input method for overhead conditions
2010	Addition of Estimating Function by the Total Price Contract Unit Price Agreement Method Correspondence to the Standard Estimating Standards for Civil Engineering Works "Metropolitan Area Correction"
2011	Improvement of cost estimation function using the total price contract unit price agreement method Stricter management of estimated price information (improved input/output restrictions)
2012	Support for merged calculations Improvements due to stricter management (user authentication and hide function improvements)
2013	Introduction of Construction Package Type Estimating Method Improvements related to the revision of consumption tax and local consumption tax rates
2014	Support for multi-year estimates Additional construction package features
2015	Improvement of the function for updating step generation Improvement of total price contract unit price agreement method function (selection of individual or lump-sum agreement)
2016	Improvement of Survey Base Price Calculation Data and Estimate Reference Data Forms Support for merger estimation of total value contract unit price agreement method
2017	Correspondence to the Revision of the Implementation Guideline for the Total Price Contract Unit Price Agreement Method Added information on the basis for outputting the construction quantity summary form and the disposal cost.
2018	Response to the Trial Implementation of the Holiday Assurance Evaluation Type Correspondence to the revision of the implementation guidelines for the total value contract unit price agreement method
2019	Support for ICT dredging Addition of an auxiliary function to the trial of the holiday-securing evaluation type
2020	Correspondence to correction of site management cost that contributes to measures against heat stroke Development of ICT-compliant steps (dredging, foundation, block installation) and addition of automatic calculation function
2021	Support for recording expenses related to measures to prevent the spread of infectious diseases Addition of criteria tree search function (code search, similarity search)

Table-1 Major modifications to the estimation system

upgraded in line with the revision of the “Estimation Standards for Port and Harbor Works” and functional improvements were made to optimize the environment for system users.

3. List of Related Reports and Technical Documents

- Bidding Information Service for Ports and Airports
- Guidelines for the Electronic Delivery of Deliverables in Port and Airport Projects of the Regional Development Bureau (Ports and Airports)
- Preconsultation Check Sheet
- Electronic Delivery Inspection Support System - Operation Manual
- Tutorial and Operation Manual for the Construction Form Management System
- Estimation Standards for Port and Harbor Contracts - Standards for Each Fiscal Year
- Standard for Calculating the Loss of Vessels, Machinery, and Equipment, etc.
- Port Contracting Estimation System, Operation Manuals, and Related Documents
- Maintenance Management Information Database Manual

4. Future Outlook

(1) Promotion of Cyber Port

Based on the Declaration to be the World’s Most Advanced IT Nation - Basic Plan for the Promotion of Public and Private Sector Data Utilization (Revised) (Extract) (Cabinet Decision on July 17, 2020), the Ministry of Land, Infrastructure and Transport and the Cabinet Secretariat are currently developing and operating a “Cyber Port” from three fields: port logistics, port management, and port infrastructure, with the aim of maximizing convenience and productivity through the utilization of information.

NILIM (Technical Information Division, Administrative Coordination Department), under the supervision of the Port and Harbor Bureau of MLIT, is responsible for the development of systems in the field of port infrastructure (Figure-7).

(2) Toward the improvement of estimation methods

In 2020, the three new “Bearer” laws were revised and enforced from the perspective of

Excerpts from the Declaration to be the World’s Most Advanced IT Nation - Basic Plan for the Promotion of Public and Private Sector Data Utilization (Revised) (Extract) (Cabinet Decision on July 17, 2020)

Ports and harbors play an important role in handling more than 99% of Japan’s trade (by weight), and the “port-related data collaboration infrastructure” is a public information infrastructure that will be promoted and developed at the national level, and will be used to optimize the individual informatization efforts that have been left to each port and entity up to now. Accelerate efforts to build a “Port-Related Data Interoperability Infrastructure” for social implementation by 2020. With the Port-Related Data Collaboration Infrastructure at the core, we will dramatically improve the productivity of Japan’s ports by realizing a “Cyber Port,” a business environment in which various information surrounding ports is organically connected. Improve the international competitiveness of Japan’s ports as a whole by promoting the use of cutting-edge AI technology, etc. and aggregated big data to enhance the productivity of port logistics, and to improve the efficiency of port administration and disaster response from the user’s perspective at each port.

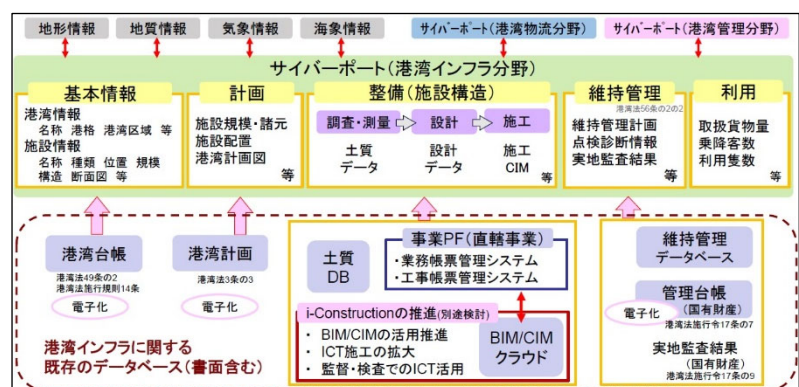


Figure-7 Overview of Cyber Port (Port infrastructure sector)

promoting work style reforms such as optimization of construction periods and enhancement of compensation at construction sites, improving productivity by streamlining regulations for engineers and utilizing ICT, etc., strengthening emergency response to disasters, and ensuring a sustainable business environment. In addition, as society undergoes dramatic changes, such as the response to COVID-19, acceptance of foreign skilled workers, and digital transformation, it is necessary to continue promoting the reform of work styles, development and securing of bearers, and improvement of productivity in port and airport construction. Therefore, the Port and Airport Construction Bureau of MLIT and the Civil Aviation Bureau and Port and Harbor Bureau of MLIT have established the “Study Group on Port and Airport Construction.”

Based on the deliberation results of the study group, NILIM (Cost Estimation System Division, Administrative Coordination Department), under the supervision of the Port and Harbor Bureau of MLIT, will conduct the necessary surveys and research and development to improve the estimation methods for port construction and operations.