# Streamlining operations related to the maintenance and preservation of airport facilities

# 1. Outline of Studies and Activities

FY			Event	Research Results, etc.											
AD Heisei Reiwa		Reiwa	Event	[Research 1] Airport			n 1] Airport Facility CALS System	[Research 2] Airport Pavement Patrol				[Research 3] Airport Civil Engineering Construction Estimation System			
2001	13		MLIT CALS/EC Action Program formulated				_								
2002	14 15			Pro syst data data Dev mar	vis terr aba aba velo nag	sion n, ao use f use s opeo gem			syste	Consideration of system introduc				Expansion of computer program functions	
2004	10		Enactment of the Public Works Quality Assurance Law MLIT CALS/EC Action Program 2005 established.	CALS system management and operation guidelines Airport facility CALS system begins operation Airport facility CALS system portal site is opened Airport facility CALS system management and operation guidelines are revised				m development				system improv	totalization function and multiple unit price table batch correction function, Improvement of unit price list function, addition of overhead cost basis display function, unit price type estimation function, etc.		
2006	18						Established an anjoir technical support station to support revised electronic delivery guidelines, CAD drafting standards, and digital photo management standards.	System deve	/elopment		ement	Improvement of labor unit price correction function, addition of automatic backup function, etc.			
2007	19			Syste			Addition of search function for airport technical support stations, improvement of drawing management system, etc.							Improved survey labor correction, construction summary screen, and print option functions	
2008	20		Formulation of MLIT CALS/EC Action Program 2008			m improv	Addition of a facility information registration subsystem and integration of the airport technical database system into the technical station	LI T LI F	itrodu okyo I iternat ukuok	ction of airport system international, Osaka tional, Shin-Chitose, a, Naha	Improvement of flaggin section editing function, location information input function, etc.	20		Improvement of construction selection screen function, addition of merger estimation output function, support for revision of unit price type estimation standard, etc.	
2009	21					ement.	Upgraded GIS engine version, revised electronic delivery guidelines, CAD drafting standards, and digital photo management standards			-	Addition of damage tracking function, improvement of automatic photo- attachment function.			Correspondence to the revision of the unit price type estimation standard, etc.	
2010	22			$\overline{}$	Inspection management system improvement, program and data migration, operation verification, etc.			Introduction of airport system Hakodate Airport		iction of airport_ ate Airport_	Inspection data search and display function, addition of past damage layer, etc.			Support for new estimating system and rates for design work, etc.	
2011	23			Comprehensive system improvement (CALS system library [integration of portal sites and technical support stations], addition of a large- capacity data transfer system, etc.)				<u>h</u> <u>s</u> <u>s</u>	Introduction of airport system Sendai			Comprehensive system improvement (construction of a new system that integrates the port contract work estimating system with the core system)			
2012	24				Improvement of airport facility CALS site, inspection management system, tabulation tool, library information registration search function, etc.			- Updating of drawing data					External input of premium wage ratios, basic data management system, improvement of estimation management system, etc.		
2013	25		Publicizing of the maintenance and renewal of facilities at the airport				Improvement of airport facility CALS site, consolidation of drawing management system, facility information registration subsystem, etc.		itrodu iigata, ao, Mi okushi	ction of airport system , Hiroshima, Komatsu, iho, Iwakuni, ima, Kochi	Updating of drawing data			Addition of construction package type estimating function, support for 8% consumption tax, etc.	
2014	26		Enactment of three "Bearers" laws (revision of the Public Works Quality Assurance Law) Formulation of MLIT infrastructure longevity				Improvement of airport facility CALS site, electronic deliverables registration, editing, and deletion functions, inspection information editing functions, etc.	Introduction of airport system Okadama, Wakkanai, Kushiro, Takamatsu, Matsuvama, Kitakvushu, Nagasaki, Oita, Kumamoto, Miyazaki, Kagoshima		<u>ction of airport system</u> na, Wakkanai, o, Takamatsu, ama, Kitakyushu, <u>ki, Oita, Kumamoto,</u> <u>ki, Kagoshima</u>	Updating of drawing data			Improvement of the function for processing cost estimate calculations using the previous year's standards, addition of a function for modifying the unit price of the construction package, etc.	
2015	27		pian		oyarom	Svstem	-				-		system	Improvement of time constraint correction function, construction package estimation fraction processing, step generation update function, etc.	
2016	28		First year of the productivity revolution (Promotion of i- Construction Promotion)			improven	Construction of an airport facility information management system (CALS for regional airports), support for revision of electronic delivery guidelines, etc.				Updating of drawing data		improve	Addition of new special registration function for construction package type estimation, improvement of overtime labor correction function, etc.	
2017	29					ien†	Improvement of functions for registering and viewing inspection information, registering and viewing electronic deliverables, and registering maintenance and renewal plans, etc.				Improvement of inspection information retrieval system, updating of drawing data, etc.		ment	Introduction of the total value contract unit price agreement method, rounding of steps, etc., and improvement of processing of surveying business expenses, etc.	
2018	30						Maintenance and renewal plan registration function, inspection information registration function, improved tally function, added site search function, etc.	tion c.			Improvement of location information input function and GPS ) communication function, etc.			Support for multiple years of estimation, addition of functions for editing estimation reference data, correction of large cities, etc.	
2019	31	1	Enactment of three new "Bearer" laws enacted (revision of the Public Works Quality Assurance Law and promotion of work style reform)				Improvement of access tally function, change of inspection information registration format, addition of browse- only function, etc.	, .e-			Improvements due to changes in geographic information and spreadsheet software			Improvement of output function of merger estimation form, addition of construction period setting support system and correction function of unit price for weekends, etc.	
2020		2	Establishment of MLIT DX promotion headquarters for infrastructure sector	7			Addition of function for registering information on structures with historical and scenic value, changes to the operating environment (HTML5), etc.				_			Addition of heat stroke prevention site management cost correction and automatic construction tree creation functions, improved weekday off unit price correction function, etc.	

#### Research 1. Study on the establishment of an airport facility CALS system (2003-)

- [Background/Issues] Since FY1995, construction CALS/EC has been promoted as an effort to realize efficient execution of public works projects, reduce construction costs, and ensure and improve the quality of public facilities. The CALS/EC Action Program of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) was formulated in FY2001, and it became necessary to establish a system to ensure the quality of public works projects, improve productivity, and increase the efficiency of project execution by digitizing information that had previously been exchanged on paper and utilizing networks to share and effectively utilize information across project divisions.
- [Research Outline and Results Implementation] The airport facility CALS system was established to ensure transparency, reduce costs, improve quality, and increase the efficiency of operations in order to coordinate and share information on the entire life cycle of airport facilities across project fields and entities, and to exchange and utilize information on airport development projects and maintenance and management operations. In FY2005, the airport facility CALS system portal site was established and operation of the system started. In FY2011, the system was fully improved by creating a CALS system library that allows each system to be launched from a menu screen. In FY2020, the airport facility CALS system was accessed about 35,000 times, confirming that many workers are utilizing the system.

#### Research 2: Research on the construction of an airport pavement inspection system (2001-)

- [Background/Issues] Airport pavement, such as for runways, is required to be appropriately and efficiently maintained and managed because once its functions are impaired, the operation of the entire airport may be severely affected. However, from the viewpoint of ensuring the safety and punctuality of aircraft operations, there is a growing need to shift to preventive maintenance and management, and establish a system to accurately assess the current status of airport pavement and to realize efficient maintenance and management.
- [Research Outline and Results Implementation] As a tool to accurately grasp the current status of airport pavement and to realize efficient maintenance and preservation, we developed an airport pavement inspection system consisting of a DGPS receiver and a mobile PC, based on the following conditions: ① the inspection area is extensive, ② the inspection must be conducted within a limited time during the night when no aircraft are operating, and ③ appropriate measures must be determined immediately after the inspection. The system was introduced at Tokyo International Airport, Osaka International Airport, New Chitose Airport, Fukuoka Airport, and Naha Airport in FY2008, and by FY2014, the system had been installed at all 26 airports (government-managed airports). Even after the system was introduced, functional improvements and data updates were continuously implemented.

### Research 3. Study on the construction of an airport civil engineering construction estimation system (2001-)

- [Background/Issues] The airport civil engineering cost estimation standards must accurately reflect the constraints within the restricted areas of airports, the actual conditions of construction in the field, and changes in socioeconomic conditions, so that quality construction work and appropriate profit for the contractor can be ensured. The cost estimation system, which aims to optimize and streamline estimation work, is required to accurately reflect the latest revisions of the airport civil engineering cost estimation standards and labor unit prices, and to improve its functions to provide enhanced operability and convenience for the system users, such as regional development bureaus.
- [Research Outline and Results Implementation] The Civil Aviation Bureau of MLIT commenced development of the airport civil engineering cost estimation system in FY1997, and the system was put into operation in FY1999. Later, with the establishment of NILIM, the Civil Aviation Bureau took over the overall system operations, including maintenance and management, and improved the system functions, such as computerization and expansion of the program functions. In

FY2011, a new improved system that integrated the core system with the port construction cost estimation system was established. After the transition to the new system, we continued to improve the functions in accordance with the revision of the cost estimation standards and to provide enhanced convenience for the system users.

#### 2. Main Research Results

## Research 1: Research results on the construction of an airport facility CALS system

- The airport facility CALS system consists of common information and information by job category (civil engineering, construction, and machinery). Information by job category (Construction): maintenance ledgers, building inspection manuals, and electronic deliverables; Information by job category (Machinery): design guidelines, cost estimation standards, common specifications, vehicle information, and electronic deliverables.
- Electronic deliverables are the most frequently used part of the system, as they allow users to select the type of survey, design, or construction, the target airport, and the year of implementation, as well as registering and viewing survey and design reports, special specifications for construction, and as-built drawings.

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💡 空港要素技術集	🔶 CALS支援センター	からのお知らせ		一覧表示	
◎ 研修情報	2020年03月17日 サイト内検担 クス作成エラ	8時に一部検索されないファイル 5−のお知らせ」をご覧ください	があります。詳しくは、「CALS情報 ・	1」⇒「事務連絡」⇒「インデッ ∧	:
アクセスカウンター	1 新若情報			一覧表示	Notices & News
あなたは 264506人間の利用者です。	2021年03月10日 空港エンジ	ニア・ニュース 第225号 (令和)	9年3月)を「AEニュース」にアッフ	ロードしました。	

Initial screen of airport facility CALS system

#### Research 2: Research results on the construction of an airport pavement patrol and inspection system

- The airport pavement inspection system consists of a DGPS receiver and a mobile PC, and is equipped with the following functions: ① identifying and registering the location of abnormal areas, ② determining whether or not action is required for abnormal pavement conditions, ③ multiple-screen management function using GIS, ④ supporting the creation of inspection register books, and ⑤ tracking past damage.
- The DGPS receiver should have relatively high accuracy (measurement error of 1 m or less), be economical (radio wave information for error correction is free of charge), and be highly portable and easy to use, considering that it is used for inspection on foot.
- By inputting the pavement type, pavement condition, and form and scale of the abnormality, the function for determining whether or not to take measures for abnormal pavement conditions automatically displays appropriate measures based on a decision flow that reflect the experience of engineers who are familiar with inspections.



Conceptual diagram of location information acquisition



Photo Mobile PC screen

Research 3: Research results on the construction of an estimation system for airport civil engineering works

- The airport civil engineering cost estimation system was constructed to have basic functions such as creation of construction trees, unit price tables, cost breakdown tables, and summaries, printing and saving of cost sheets, a merger cost estimation, cost sheet database, and unit price table comparison. Improvements were implemented to optimize the functions in accordance with the revised estimation standards and to provide enhanced convenience for the system users.
- The above-mentioned functional improvements include the construction package type estimation method, the total value contract unit price agreement method, correction of site management costs related to heat stroke prevention, and correction of the unit price for two days off per week, etc.
- Improvements to provide enhanced convenience for the system users include a function that imports the construction types, design quantities, and standards entered in the prescribed form



Automatic construction tree creation function



Criteria Tree Search Function

of the construction quantity summary into the estimation system and automatically reflects them in the construction type system tree (see above), and a function that allows code and similarity searches when searching the standards tree (see below).

## 3. List of Related Reports and Technical Documents

- Airport Facility CALS System Operations Manual (April 2017)<sup>\*1</sup>
- Airport Facility CALS System Operation Manual [User's Edition] (February 2020)\*1
- · Airport Facility CALS System Operation Manual [Administrator's Edition] (March 2019)\*1
- Airport Civil Engineering Facility Ledger Registration and Browsing Operation Manual (February 2014)<sup>\*1</sup>
- Electronic Deliverable Registration and Viewing Operation Manual (February 2014)\*1
- Airport Pavement Maintenance Manual (Draft) (April 2020)<sup>\*1</sup>
- Airport Pavement Patrol and Other Inspection Systems User Manual (March 2017)<sup>\*2</sup>
- Airport Civil Engineering Estimation System Operation Manual (March 2021)<sup>\*2</sup>
- Airport Civil Engineering Estimation System Installation Instructions (December 2020)<sup>\*2</sup>
- Airport Civil Engineering Estimation System Estimated Quantity Registration Auxiliary System Operation Manual [For Client] (December 2020)<sup>\*2</sup>
- Airport Civil Engineering Estimation System Estimated Quantity Registration Assistance System Operation Manual [For Personnel in Charge of Estimated Quantity Registration] (March 2021)<sup>\*2</sup>
- \*1: Airport Engineering Division, Aviation Network Department, Civil Aviation Bureau of MLIT
- \*2: Airport Construction Systems Division, Airport Department, NILIM

#### 4. Future Outlook

MLIT is promoting DX (digital transformation) in the infrastructure field, including efforts to apply BIM/CIM in principle to

all public works projects except small-scale ones by FY2023 (R5) and to streamline infrastructure inspections through the introduction of innovative technologies such as AI. In the future, the following studies should be promoted as efforts to improve the efficiency of operations related to the development and maintenance of airport facilities.

- · Research for introducing BIM/CIM into the maintenance and preservation (inspection and management) of airport facilities
- Study on applying AI to airport pavement patrol inspections