MINISTRY OF TRANSPORT
THE REPUBLIC OF TAJIKISTAN

THE PREPARATORY SURVEY REPORT ON THE PROJECT FOR IMPROVEMENT OF DUSHANBE INTERNATIONAL AIRPORT IN THE REPUBLIC OF TAJIKISTAN

AUGUST 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
JAPAN AIRPORT CONSULTANTS, INC.
DAIKEN SEKKEI, INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to the Consortium consist of Nippon Koei Co., Ltd., Japan Airport Consultants, Inc. and Daiken Sekkei, Inc.

The survey team held a series of discussions with the concerned officials of the Government of the Republic of Tajikistan, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I express my sincere appreciation to the officials concerned of the Government of the Republic of Tajikistan for their close cooperation extended to the survey team.

August, 2014

Mr. Akira NAKAMURA
Director General,
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

SUMMARY

1. Outline of the Country

(1) National Land and Nature

The Republic of Tajikistan (hereinafter referred to as "Tajikistan") has a population of 7.99 million. It is a landlocked country surrounded by four countries, namely, Kyrgyz, China, Afghanistan, and Uzbekistan. Tajikistan's land area is 142,600 km^2, and 93% of the land is mountainous. At the Ferugana Basin in the northern part, the Uzbekistan and Kyrgyz border faces complicatedly. China's border in the southeastern area is part of the Pamir Mountains. The highest peak above sea level is more than 7,000 m. The capital is Dushanbe, which is located in the western area. It has 10% of the country's population, and is the center of economy, social activities and administration. Dushanbe International Airport (hereinafter referred to as "DIA"), which is a target of this project, is located 6 km south of the center of Dushanbe City.

Source: JICA Study Team

Figure 1 Tajikistan Country Map

(2) National Economy

Tajikistan's gross domestic product (GDP) is US$759,000. Its GDP per capita is US$953.3 (IMF 2012). The breakdown by industry group is: 24.7% for primary industries, 39.4% for secondary industries, and 35.9% for tertiary industries (World Development Indicators Online 2013). Major sources of income are the aluminum industry, cotton growing, and remittances from migrant workers.

Remittances from migrant workers mainly in Russia occupies more than 36% of the total GDP. It is an important source of income for Tajikistan, which has a lot of poor segments of the population. Main export items are non-noble metals such as aluminum, cotton and cotton products, minerals, and planting products. Main import items are bauxite, transportation machines, carriages, equipment, chemical products, planting products, non-noble metals, and food products. The amount of trade is an excess of imports over exports: US$1.36 million for exports, and US$3.778 million for imports. After the global financial crisis in October 2008, Tajikistan has been affected by Russia and Kazakhstan, which have a close economical relation, and remittances from immigrant workers has decreased and the growth of GDP dulled. However, Tajikistan maintains around 7% GDP growth in recent years.

2. Background and Outline of the Project

(1) Overall Goals and Project Objective

The government of Tajikistan considered necessity of enhancement of aviation services in "Living Standard Improvement Strategy" in 2013 which is a strategy on medium range 2013-2015 in Tajikistan. In addition, developments of airport facility and air navigation system were evaluated as a core task which will able to secure economic growth of Tajikistan in "National Target Development Strategy for Transport Sector of the Republic of Tajikistan to the Year 2025" in 2011. The socio economic infrastructure development is stipulated as an important sector in a Country Assistance Plan for Tajikistan formulated by the government of Japan. And also "Transportation and Small Scale Electric Power Supply" are stipulated as important issues in the "JICA Country Analysis Paper", so the Project is in accord with those strategies.

This Project aims to upgrade aircraft departure/landing safety and efficiency, and air cargo handling efficiency at Dushanbe International Airport (DIA), which is the core of air transportation in the Republic of Tajikistan.

(2) Current Condition and Problem Related to the Project

1) ILS

Because there is only one instrument landing system (ILS) in the west side of the runway, flight cancellation and delay often occurs at DIA due to the frequent occurrence of dense fog. It is an urgent issue to install the necessary air navigation system for safe flight operations.

2) International Cargo Terminal building and Cargo Terminal Equipment

DIA's cargo facilities have been used since 1964 therefore aging of equipment is obvious. Lists of equipment which are operational in the cargo building are two cargo x-ray machines and weight scale, however, there are no facilities or equipment which can handle temperature control or large-scale cargo. Because of the limited volume and items which the cargo building can handle, transport in Tajikistan is forced to road traffic. This causes increase in import and export costs and become a barrier of economic activities.

This project aims to upgrade the air traffic safety and cargo handling capacity in order to contribute to the realization of a smooth cargo transportation by modernizing the air navigation facilities and implementing the cargo facility at DIA, the capital airport of Tajikistan.

3. Outline of the Survey/Contents of the Project

(1) Period of Dispatch

Study team was dispatched to Site survey from 4th December 2013 to 27th December. And from 1st January to 6th January, Study team presented draft report.

(2) Requested Item and Studied Item

Tajikistan's initial request was as listed below.

Table 1 Requested item by Tajikistan

Request	item
Cargo Terminal Building	Export / Import warehouse, Refrigerator etc
ILS system	Runway 27 side
PALS system	Runway 27 side
[redacted]	[redacted]
Equipment for Cargo Handling	Weight scale, forklift, Toeing Tractor ,etc

Source: JICA Study Team

The result of discussion with Tajikistan at site, the scope of the project is as following below

1) ILS and PALS

ILS and PALS is as following below.

Table 2 List of Major Equipment for ILS

Place	Name of Equipment	Q'ty	Remarks
Localizer site	Localizer Equipment	1 set	2-frequency type, hot-standby
	Localizer Antenna	1 set	12 or 20 elements
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
GP/DME site	GP Equipment	1 set	2-frequency type, hot-standby
	GP Antenna	1 set	3 elements
	DME Equipment	1 set	100W, hot-standby
	DME Antenna	1 set	
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
Monitor building 09GP site	ILS Remote Maintenance Monitoring System (RMMS)	1 set	
	ILS Remote Control Status Unit (RCSU)	2 set	Including for 09 ILS
	Localizer interlock system	1 set	
	Wireless system (radio link)	2 sets	
Control Tower	ILS Status Unit	1 set	

Source: JICA Study Team

Table.3 List of Major Equipment for ILS

Place	Name of Equipment	Q'ty	Remarks
Runway 27 side	Precision Approach Lighting System	1 set	
	Runway Threshold Light	1 set	
New Substation (east side)	PALS Control Panel	1 set	
	Constant Current Regulator	2 sets	30kVA x 2
	Engine Generator	1 set	100kVA
Existing Substation	AGL Control & Monitor Panel	1 set	PC type
Control Tower	AGL Control Panel	1 set	PC type

Source: JICA Study Team

2) International Cargo Terminal building

International Cargo Terminal building is as following below.

Table 4 Total Area List of International Cargo Terminal Building

(Unit: m^2)

Block			Area
Freight handling block (Steel structure)	Freight handling area	Build-up / break-down space, storage for exports, storage for imports and X-ray inspection area	2,404.1
Office block (RC structure)		Cold storages	
	Special cargo facilities	Dangerous goods space, valuable goods storage and animal storage	106.4
	Offices area	Cargo office and staff rooms	1,203.3
Total			3,713.8

Source: JICA Study Team

3) Cargo handling equipment

Cargo handling equipment are as following below

Table 5 Cargo handling Equipment

No.	Equipment	Main Use	Purpose/ Design ground	No.s	Beak Down
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2-2	Pit Scale（10 Feet）	Built up ULD Weight measure	ULD weight measure	1	Export1
2-3	Engine powered Folk lift Track (15 ton)	Handle Large, heavy cargo. Transport to storage and loading to Trucks.	To handle large or heavy cargo	1	Export・Import
2-4	Battery Powered Ramp Equipment Tractor Battery Powered Ramp Equipment Tractor	Transportation of dolly or cart	Add shortage number.	4	Ramp 3 Warehouse 1
2-5	Lower Deck Container Turntable Dolly	To transport ULD	Necessary to ULD handling	8	4 for 1 aircraft 4 for congesting condition
2-6	Pallet Dolly	To transport Pallet ULD	Add shortage number	16	For 1 aircraft
2-7	Baggage/Cargo Cart	To transport bulk	Add shortage number	4	Bulk for A320
2-8	Platform Scale (1 ton)	Weight measure for export cargo	Weight measure of bulk baggage	1	Mainly for export

No.	Equipment	Main Use	Purpose/ Design ground	No.s	Beak Down
2-9	Platform Scale (500kg)	Weight measure for import cargo	Weight measure of very small baggage	1	Mainly for import
2-10	Battery Powered Forklift Track 1.5ton	For raising and traversing baggage in warehouse	Necessary for raising and traversing baggage in warehouse	4	Import 2 Export 2
2-11	Battery Powered Forklift Track 2.5ton	For loading, raising and traversing baggage	Necessary for loading, raising and traversing baggage from trucks	8	Import 3 Export 2 Truck yard 3
2-12	Battery Powered Reach Forklift Track 1.5ton	For raising and traversing baggage in cold storages	Standard forklifts are so hard to move in small cold storages that small forklifts are necessary	1	Cold storages
2-13	Manual Pallet Jack 1.5ton	For raising and traversing baggage in valuable goods storage, animal storage and inspection desk	Standard forklifts are so hard to raise and traverse such baggage as animals, valuables and very small baggage. Additionally many workers are supposed to work near its point of use. For working efficiency and safety of workers, small equipments are necessary.	2	Inspection desk and valuable goods storage 1 The other purpose 1
2-14	Nesting Lack	To keep baggage in warehouse for efficient handling	Shelves for keeping baggage should not be fixed so that layout of shelves in warehouse is changeable not only for import but also for export. Additionally they can take a role as plastic pallet for bulk baggage.	112	2 level stacked Mainly for import
2-15	Nesting Lack for cold storage	To keep baggage in cold storages for efficient handling	For saving space with 2 stacked shelves	28	Cold storage (+5~+2°C) 14 Cold storage (-20~-5°C) 14
2-16	Plastic Pallet	To keep bulk baggage in warehouse	To collect bulk baggage for handling by forklifts and manual pallet jacks	50	Export 50
2-17	Roll Box Pallet	To keep very small baggage in warehouse	Movable shelf for keeping only separated or very small baggage to save space.	5	To be separated based on last number of B/L number (0 to 9)
2-18	Working Table	For working in inspection desk	Use for working table in inspection desk	1	Inspection desk 1
2-19	Safety Belt	To keep safety of workers when ULD break down	For safety of workers	8	Each ULD position
2-20	Working Stand	To keep safety of workers when ULD break down and reduce damage of baggage	For safety of workers and keeping quality of baggage	2	For break-down import
2-21	ULD Container Rack	To keep empty ULD containers	Use for keeping empty containers before break-down and after build-up	1	
2-22	ULD Pallet Rack	To keep unused ULD pallets	Use for keeping unused pallets before break-down and after build-up	2	
2-23	Battery Powered Aerial Work Platform	For maintenance of ceiling of warehouse	Use for changing lights and maintenance of ceiling of warehouse	1	Use in warehouse

Source: JICA Study Team

(3) Position of this project

To accomplish the Project targets that the project aims to upgrade the air traffic safety and cargo handling capacity in order to contribute to the realization of a smooth cargo transportation by modernizing the air navigation facilities and implementing the cargo facility at DIA, the capital airport of Tajikistan, a high level of aircraft operation will be realized by providing adequate equipment that meet International Civil Aviation Organization (ICAO) standards. From this it is expected that aircraft departure/landing safety and efficiency would be enhanced. Also, this Project aims to upgrade the airport's cargo handling capacity by improving the existing cargo building, which is aged and not suited for modern cargo handling. The scope of the Project includes procurement of air navigation safety equipment, construction of the international cargo terminal building, and procurement of cargo terminal building equipment.

1) Basic Design Policy for Air Navigation Safety Equipment

The objectives of procurement of air navigation safety equipment under the Project are to enhance safety and efficiency of air traffic and to enhance stable and punctual aircraft operations at Dushanbe International Airport (DIA). In order to achieve such objectives, the design of the equipment is to be carried out based on the following basic considerations:

- Specifications of instrument landing system (ILS) shall be so prepared that the equipment shall meet relevant requirements of ICAO Annex 10 in terms of facility requirements, performance requirements, and electrical specifications.
- Precision approach lighting system (PALS) shall be so prepared that the configuration of lights shall meet the requirements of ICAO Annex 14.
- These types of air navigation safety equipment are being manufactured domestically by Toshiba, NEC and Toshiba Light-tech, and internationally by Indra Nav (Norway), SELEX (Italy), ADB (Belgium), Thorn (France), etc. These manufacturers are competing with each other in terms of performance and price. In this study, it has been intended that the best total equipment system, especially those of easy operation and maintenance, shall be formulated taking into account the proposed equipment systems by Japanese and international manufacturers.
- The requests from the Tajikistan side described in the minutes of discussion have been confirmed during the site survey through the technical memorandum, and the design policy proposed in this study shall be carried out accordingly.

2) Basic Design Policy for International Cargo terminal building and Cargo handling equipment

The facilities and equipment are designed in accordance with the demand forecast with consideration to maintenance, finance, and other general capabilities of Tajikistan. The basic policy of the design is as follows:

- Comply with the International Air Transport Association (IATA) requirements
- Facility and equipment plan in accordance with demand forecast
- Facility and equipment plan in accordance with Tajikistan's cargo handling capability

4. Construction Period and Cost Estimation of the Project

Necessary periods for implementation of the Project are eight months for detailed design, 15.5 months for Air Navigation safety equipment's product, inspection, transport and installation. 15month for International Cargo Terminal building, 12 month for Cargo handling equipment's product, inspection, transport and installation. Required period for construction and procurement is 25 months in total.

5. Evaluation of the Project

In view of the above, it is judged that the project is appropriate for technical assistance project, by using Japanese grant aid.

(1) Relevance

1) Object Suitability

This project aims to upgrade aircraft safety by improving air navigation and providing an efficient cargo handling system through the construction of an international cargo terminal building and procurement of cargo terminal equipment.

The improvement of air navigation has high suitability in view of safety upgrade. The construction of international cargo building also has high suitability because it will contribute highly in the efficiency of cargo handling.

2) Benefit target

DIA is a capital airport and the only international airport in Tajikistan. The economic impacts of air navigation upgrade and international cargo terminal construction provide benefits to all 7.99 million Tajikistan nationals both directly and indirectly.

3) Purpose of the project

Because there is only one instrument landing system (ILS) in the west side of the runway, flight cancellation and delay often occurs at DIA due to the frequent occurrence of dense fog. It is an urgent issue to install the necessary air navigation system for safe flight operations.

DIA's cargo facilities have been used since 1964 therefore aging of equipment is obvious. Lists of equipment which are operational in the cargo building are two cargo x-ray machines and weight scale; however, there are no facilities or equipment which can handle temperature control or large-scale cargo. Because of the limited volume and items which the cargo building can handle, transport in Tajikistan is forced to road traffic. This causes increase in import and export costs and become a barrier of economic activities.

This project aims to upgrade the air traffic safety and cargo handling capacity in order to contribute to the realization of smooth cargo transportation by modernizing the air navigation facilities and implementing the cargo facility at DIA, the capital airport of Tajikistan.

4) Mid- and Long-term Policies to Tajikistan

The Tajikistan government supports the necessity to strengthen air transportation in the mid-term action strategy entitled "Living Standard Improvement Strategy" (formulated in 2013). In addition to the strategy of the transport sector "National Target Development Strategy for Transport Sector of the Republic of Tajikistan to the Year 2025" (formulated 2011), the government policy targets for the implementation of airport facilities and air navigation system because it is expected that the development of the transport sector including the aviation sector would ensure Tajikistan's

economic development in the future. This project corresponds to these policies.

The "Country Assistant Policy to Tajikistan" decides that the implementation of economic infrastructure is a priority. The "JICA Country Analysis Paper to Tajikistan Republic" also analyses that "implementation of transportation and small-sized electric infrastructure at the node of Central and South Asia" is a priority. This project corresponds to the analysis and policies.

(2) Effectiveness

1) Quantitative Effect Indicators

The quantitative effect indicators' target year is settled in 2019; three years after the completion of the project in 2016. By the social, economic, and technical results of this survey, the quantitative effect indicators are shown in Table 6.

Table 6 Quantitative Effect Indicators

Indicator	Basis (year 2013)	Target (year 2019) [3 years after project completion]
Percentage of aircraft making an approach or landing at DIA using ILS system	80 %	100 %
International cargo handling volume at DIA	3,258 ton	8,700 ton

Source: JICA Study Team

2) Qualitative Effect Indicators

The qualitative effect indicator of the project is shown below:

- ✈ Air traffic safety and reliability are to be upgraded by modernizing the air navigation system.

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Abbreviations

ACC	Area Control Center
AGL	Aeronautical Ground Lights
A/P	Authorization to Pay
ATIS	Automatic Terminal Information System
AVR	Automatic Voltage Regulator
B/A	Banking Arrangement
BOD	Biochemical oxygen demand
CAA	Civil Aviation Authority
CEP	Committee for Environmental Protection
CIS	Commonwealth of Independent States
COTS	Cost Of The Shelf
DAC	Development Assistance Committee
DD	Detail Design
DH	Decision Height
DIA	Dushanbe International Airport
DME	Distance Measuring Equipment
EA	Environmental Approval
EE	Ecological Expertise
EF	Committee for Environmental Protection
EMP	Ecological Management Plan
E/N	Exchange of Note
FAA	Federal Aviation Authority
G/A	Grant Agreement
GDP	Gross National Product
GOST	GOsudarstvennyy STandart
GP	Glide Path
GPS	Global Positioning System
GSE	Ground Support Equipment
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IEC	The International Electro technical Commission
ILS	Instrument Landing System
IMF	The International Monetary Fund
ITV	Industrial Television
JCS	The Japan Electric Wire & Cable Makers' Association
ICEA	The Insulated Cable Engineers Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
KHz	Kilo Hertz
LAN	Local Area Network
LLZ	Localizer
M/D	Minutes of Discussion
MHz	Mega Hertz

MM	Middle Marker
MOT	Ministry of Transport
MTBF	Mean Time Between Failures
NAV	Navigation
NDB	Non directional Radio Beacon
ODA	Official Development Assistance
OJT	On the Job Training
OM	Outer Marker
PALS	Precision Approach Lighting System
PAPI	Precision Approach Path Indicator
PEE	Public Ecological Expertise
PC	Personal Computer
PSR	Primary Surveillance Radar
RCSU	Remote Control Status Unit
RMMS	Remote Maintenance Monitoring System
RTHL	Runway Threshold Lights
RVR	Runway Visual Range
R/W	Runway
SEE	State Ecological Expertise
SSR	Secondary surveillance Radar
TAN	Tajik earonavigation
TCH	Touchdown Crossing Height
T/M	Technical Memorandum
ULD	Unit Load Device
UPS	Uninterruptible Power Supply System
USSR	Union of Soviet Socialist Republics
VAT	Value Added Tax
VFR	Visual Flight Rule
VIP	Very Important Person
VHF	Very High Frequency
VOR	VHF Omni-directional Range
WAM	Wide Area Multi-lateration

CHAPTER 1
Background of the Project

Chapter 1 Background of the Project

1-1 Background of Request for Grant Aid

As described in Section 1.1.1, because there is only one ILS in the west side of the runway, flight cancellation and delay often occurs at DIA due to the frequent occurrence of dense fog. It is urgent issue to install the necessary air navigation system for safe flight operations.

Also the cargo terminal facility has existed for 50 years since its construction. Handling item and volume is limited because the facility is not able to handle unit load devices (ULD) which is the standard for international cargo handling.

Under such conditions, the Tajikistan government requested Japan for grant aid to procure air navigation system and cargo equipment, and for the construction of an international cargo terminal. The request items are shown in Table 1.2.1.

Table 1-1.1 Requested Items

Category	Facility and Equipment	Volume
International Cargo Terminal	International Cargo Terminal	Floor area of approx. 3,000 m^2
Air Navigation	Instrument Landing System (ILS)	1 set
	Precision Approach Lighting System (PALS)	1 set
X-ray Inspection Machine for Cargo	X-ray Machine for Checking Cargo	1 set
Equipment for Cargo Terminal	Equipment for Cargo Terminal	1 set

Source: JICA Study Team

1-2 Natural Conditions

(1) Topographical Survey and Geotechnical Investigation

1) Survey

The JICA Study Team conducted topographical survey of the international cargo terminal area and the LLZ, GP and PALS area. Furthermore, they conducted geotechnical investigation in the international cargo terminal area.

Figure 1-2.1 Location of Topographical Survey and Geotechnical Investigation

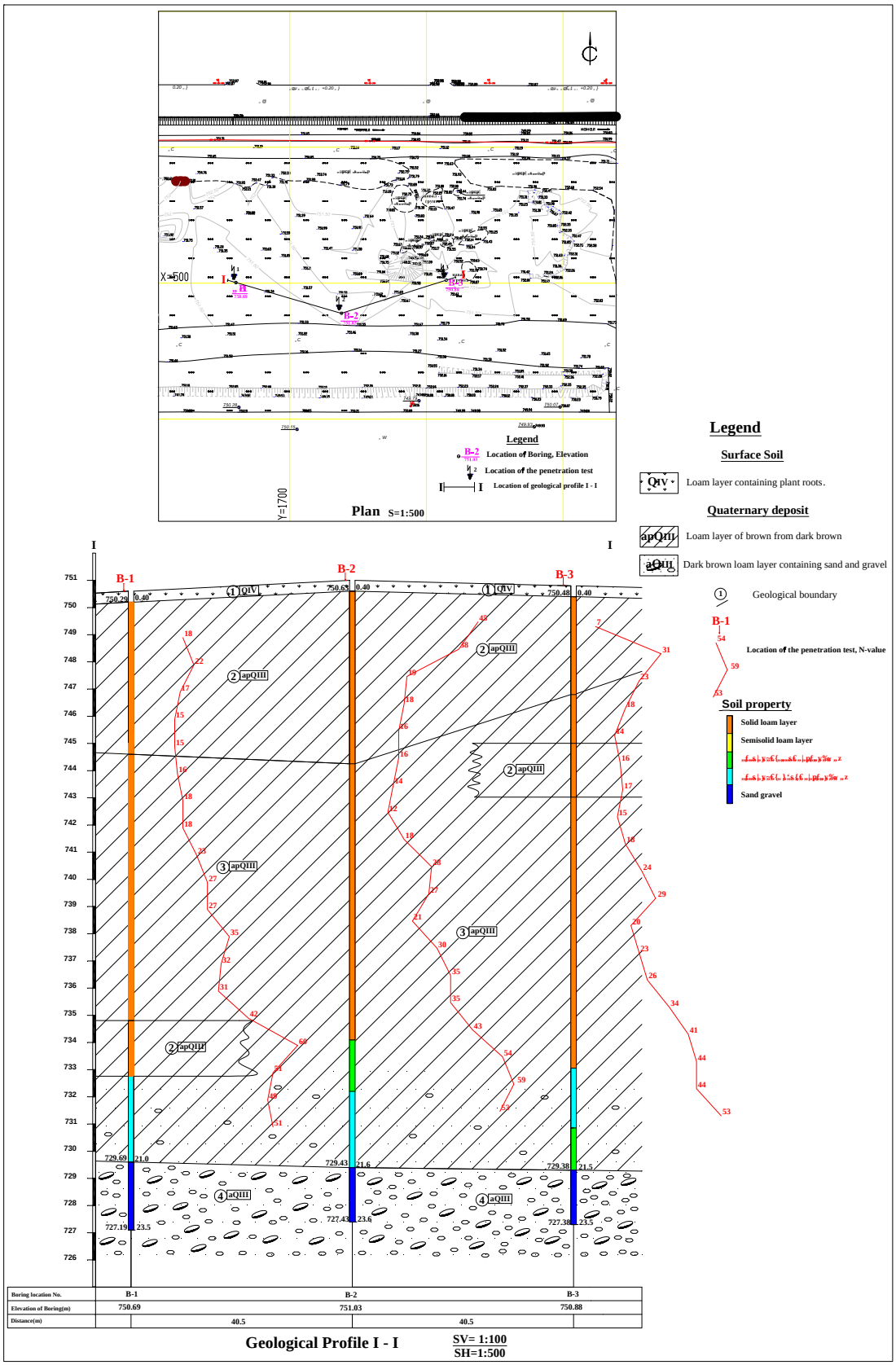
2) Results of Geotechnical Investigation in the International Cargo Terminal Area

The results of the three borings at the international cargo terminal area are shown in Table 1.3.1. There is 0.4 m of topsoil under the surface. Below it there continues approximately 13 m to 14 m of hard clay. Below 14 m, it is sandy gravel. Around 21 m depth there is a firm gravel layer. No underground water was found up to 21 m of depth. The results of standard penetration test are as follows: from 8 m to 9 m the N value is more than 10; from 9 m of depth the N value is more than 20; and below 13 m of depth the N value is more than 30. The load bearing layer, which has an N value of more than 50, starts from 18 m of depth. The results of the laboratory test of the three boring are shown in Table 1.3.1. The soil distribution at the three points is almost the same.

Table 1-2.1 Results of Laboratory Test

Boring No.	Depth	Soil property	Specific gravity	Field density	Wet density	Soil Porosity	Natural water content	Liquid limit	Plastic limit	Plasticity index
	(m)		Gs	ρ (t/m^3)	ρ_s (t/m^3)	n (%)	W (%)	W_L (%)	W_p (%)	J_p
B-1	1	Loam	2.68	1.56	1.85	49.3	14.8	26.0	18.3	7.7
	3	Loam	2.68	1.66	1.92	45.5	13.5	26.1	18.6	7.5
	5	Loam	2.68	1.72	1.93	44.8	16.4	26.4	18.8	7.6
	7	Loam	2.68	1.62	1.85	49.3	19.0	28.6	20.7	7.9
	9	Loam	2.68	1.55	1.82	51.5	19.3	28.0	20.4	7.6
	11	Loam	2.68	1.70	1.88	47.4	20.9	28.4	21.2	7.2
	13	Loam	2.68	1.67	1.87	48.1	20.1	28.4	21.1	7.3
	15	Loam	2.68	1.61	1.83	50.4	20.9	28.2	21.0	7.2
	17	Sandy loam	2.67	1.66	1.88	47.2	17.7	22.7	17.9	4.8
	19	Sandy loam	2.68	1.70	1.84	50.0	26.8	29.6	22.6	7.0
B-2	2	Loam	2.68	1.54	1.88	41.8	10.3	26.1	18.5	7.6
	4	Loam	2.68	1.58	1.86	48.9	15.5	26.9	19.8	7.1
	6	Loam	2.68	1.63	1.88	47.8	16.7	26.5	19.0	7.5
	8	Loam	2.68	1.58	1.82	51.1	20.6	28.3	21.0	7.3
	10	Loam	2.68	1.61	1.85	49.6	19.0	27.9	20.0	7.9
	12	Loam	2.68	1.68	1.87	48.1	20.6	28.3	21.0	7.3
	14	Sandy loam	2.68	1.70	1.89	47.0	19.5	27.0	20.0	7.0
	16	Sandy loam	2.67	1.66	1.87	48.1	19.6	26.3	20.0	6.3
	18	Loam	2.68	1.77	1.88	47.4	25.4	29.0	22.1	7.2
	20	Loam	2.68	1.70	1.85	49.6	26.1	29.5	22.4	7.1
B-3	1	Loam	2.68	1.57	1.89	47.0	10.6	26.1	18.5	7.6
	3	Loam	2.68	1.61	1.88	47.4	14.2	26.5	19.1	7.4
	5	Loam	2.68	1.58	1.83	50.4	19.0	27.1	19.8	7.3
	7	Loam	2.67	1.68	1.88	47.6	18.9	27.5	19.9	7.6
	9	Loam	2.68	1.58	1.82	51.1	20.4	28.6	21.1	7.5
	11	Loam	2.68	1.74	1.91	45.7	19.8	27.7	20.1	7.6
	13	Loam	2.68	1.63	1.83	50.4	22.6	29.9	22.7	7.2
	15	Loam	2.68	1.69	1.88	47.4	20.0	28.4	21.0	7.4
	17	Loam	2.68	1.68	1.86	48.9	23.0	30.0	23.0	7.0
	19	Loam	2.68	1.68	1.83	50.4	26.4	29.5	22.3	7.2
	21	Loam	2.68	1.73	1.87	48.1	24.6	29.9	22.7	7.2

Source: JICA Study Team



Source: JICA Study Team

Figure 1-2.2 Result of Boring Test at the International Cargo Terminal Area

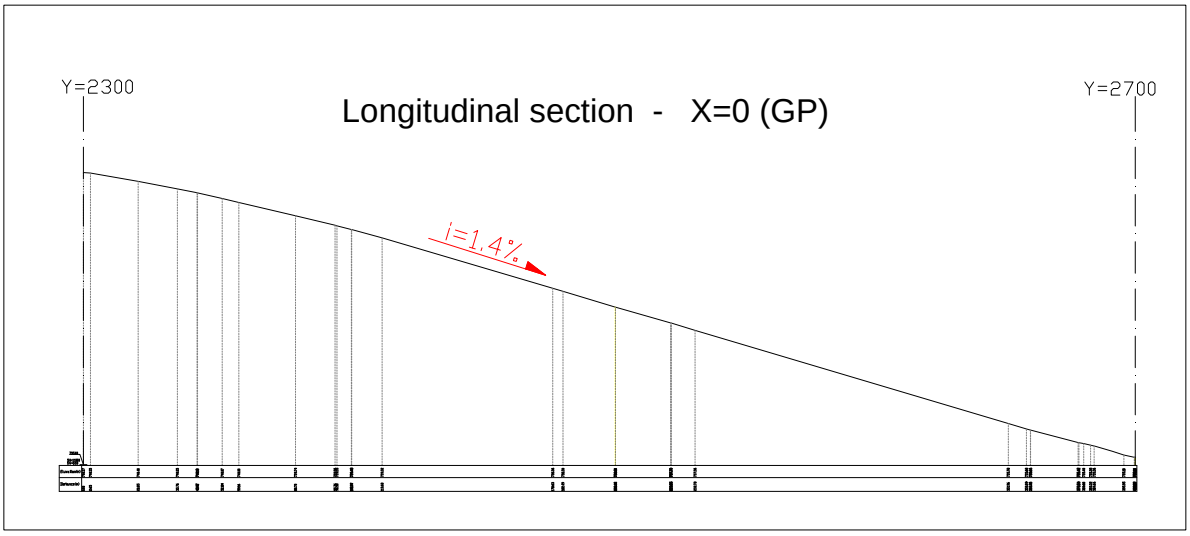
3) Results of Topological Survey of the Air Navigation Facility Area

The plan of the topological survey of the air navigation facility area is shown in Figure 1.3.3. According to the results of the survey, it was found out that the longitudinal slope of the runway near the glide path is 1.4%. Such value is steeper than International Civil Aviation Organization (ICAO) regulation. However, because the renovation of the runway is not included in this project, air navigation installation will be installed in accordance with the existing slope. The altitude of the RWY 09 side GP foundation, which was surveyed by GPS, was applied to the altitude of this survey

Table 1-2.2 Longitudinal Slope of the Runway

Length of the Runway	Maximum Longitudinal Slope of the Runway	
	① 1/4 Length from the Runway end	Other part of ①
More than1,800 m	0.8%	1.25%

Source: ICAO ANNEX 14



Source: JICA Study Team

Figure 1-2.3 Longitudinal Slope of the Runway Based on Survey Results

1-3 Environmental Society Consideration

Environmental society consideration is mandatory before new project commencement. It is regulated that "Ecological Expertise (April 2012 No.684)" (hereinafter referred to as "EE") is a law which covers environmental impact assessment (hereinafter referred to as "EIA"). The final target is to obtain an environmental approval (hereinafter referred to as "EA"). The administrative agency is the Committee for Environmental Protection under the Tajikistan government.

This project is not new airport construction, but is a renovation of airport facilities. The process of EIA is mandated by DIA before tender announcement for construction.

EE is the most important law before the commencement of a new project. There are other related laws and regulations which control the environment in Tajikistan. Tables 1.4.1 and 1.4.2 are the list of laws related to environmental control.

DIA is requested to have EA before the tender announcement.

Table 1-3.1 Environmental Conservation Laws in Tajikistan

Part I		Part II	
No.	Title	No.	Title
1	On Environmental Protection	1	On Ecological Expertise
2	On Ecological Monitoring	2	On Generation and Reuse of Waste
3	On Ecological Information	3	On Protection of Air Atmosphere
4	On Ecological Education of Population	4	On Security of Biology
5	On Approval System	5	On Radiation Safety
6	On Permission for Some Types of Activities	6	On Ecological Audit
7	On Another Obligator Paying to Budget	7	On Fishing
8	On Administrative Violation	8	On Energy
9	On Conservation and Use of Flora	9	Water Code
10	On Animal Conservation	10	Forest Code
11	On Mineral Wealth	11	Land Code
12	On Production and Cautions Attitude with Pesticide and Agricultural Chemistry	12	On Public Service
13	On Special Protection within the Nature		

Source: JICA Study Team

Table 1-3.2 Laws of Environmental Control in Tajikistan

No.	Title
1	Law on Air
2	Law on Approval of Regulation on State Ecological Expertise
3	Law on Procedure for Licensing Activities in the Field of Ecological Expertise
4	Law on Fauna Protection and Use
5	Law on Flora Protection and Use
6	Law on Hydrometeorology Activity
7	Law on Biosafety

Source: JICA Study Team

CHAPTER 2
Contents of the Project

Chapter 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) Overall Goals and Project Objectives

The government of Tajikistan considered necessity of enhancement of aviation services in "Living Standard Improvement Strategy" in 2013 which is a strategy on medium range 2013-2015 in Tajikistan in addition, developments of airport facility and air navigation system were evaluated as a core task which will able to secure economic growth of Tajikistan in "National Target Development Strategy for Transport Sector of the Republic of Tajikistan to the Year 2025" in 2011. The socio economic infrastructure development is stipulated as an important sector in a Country Assistance Plan for Tajikistan formulated by the government of Japan. And also "Transportation and Small Scale Electric Power Supply" are stipulated as important issues in the "JICA Country Analysis Paper", so the Project is in accord with those strategies.

This Project aims to upgrade aircraft departure/landing safety and efficiency, and air cargo handling efficiency at Dushanbe International Airport (DIA), which is the core of air transportation in the Republic of Tajikistan.

(2) Basic Concept of the Project

To accomplish the Project targets, a high level of aircraft operation will be realized by providing adequate equipment that meet International Civil Aviation Organization (ICAO) standards. From this it is expected that aircraft departure/landing safety and efficiency would be enhanced.

Also, this Project aims to upgrade the airport's cargo handling capacity by improving the existing cargo building, which is aged and not suited for modern cargo handling.

The scope of the Project includes procurement of air navigation safety equipment, construction of the international cargo terminal building, and procurement of cargo terminal building equipment.

The locations of project related facilities are as shown the Figure 2-1.1.

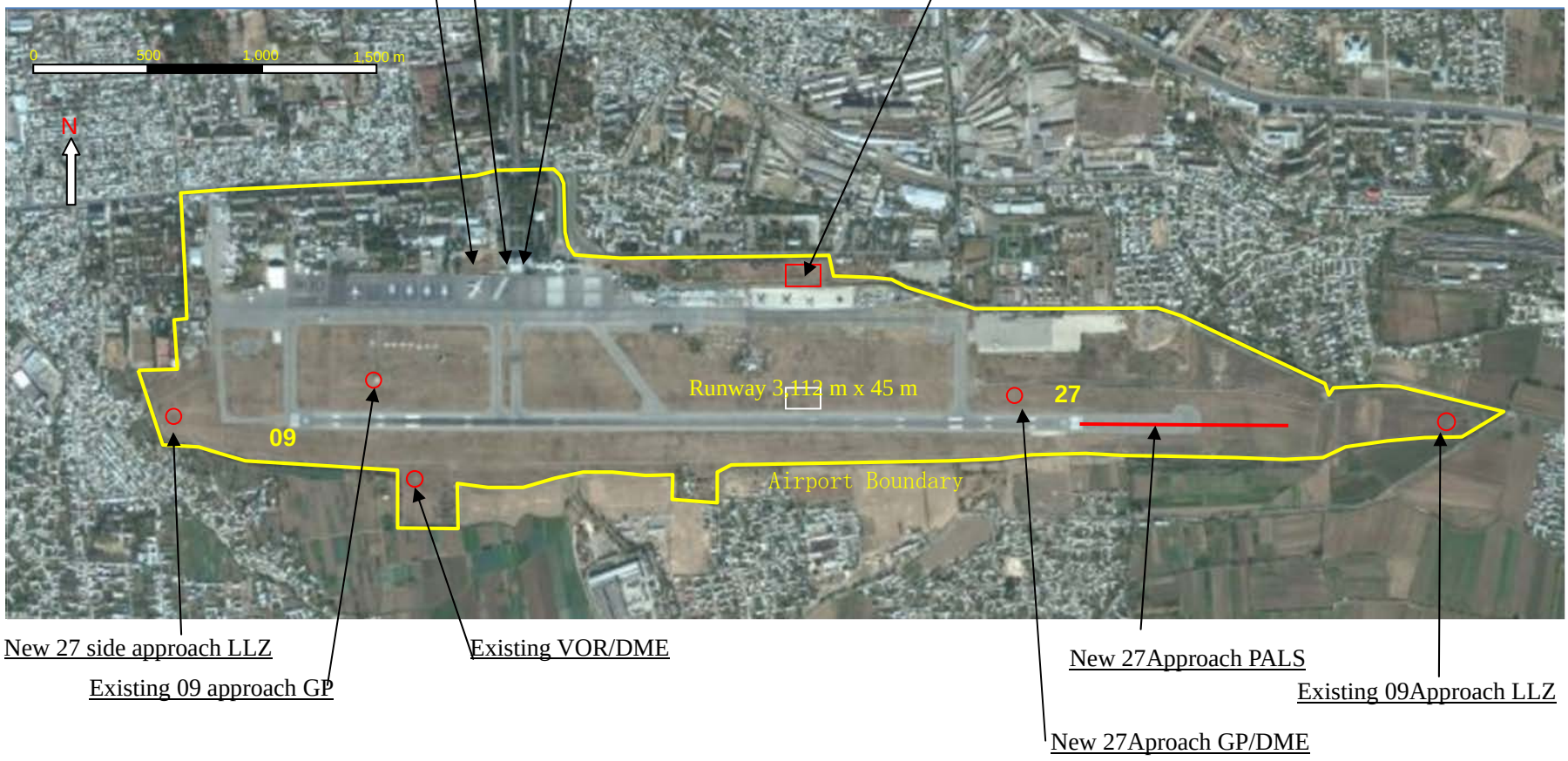


Figure 2-1.1 Locations of project related facilities

2-2 Outline Design of Japanese Assistance

2-2-1 Design Policy

(1) Air Navigation Safety Equipment

1) Basic Consideration

The objectives of procurement of air navigation safety equipment under the Project are to enhance safety and efficiency of air traffic and to enhance stable and punctual aircraft operations at Dushanbe International Airport (DIA). In order to achieve such objectives, the design of the equipment is to be carried out based on the following basic considerations:

- ✈ Specifications of instrument landing system (ILS) shall be so prepared that the equipment shall meet relevant requirements of ICAO Annex 10 in terms of facility requirements, performance requirements, and electrical specifications.
- ✈ Precision approach lighting system (PALS) shall be so prepared that the configuration of lights shall meet the requirements of ICAO Annex 14.
- ✈ These types of air navigation safety equipment are being manufactured domestically by Toshiba, NEC and Toshiba Light-tech, and internationally by Indra Nav (Norway), SELEX (Italy), ADB (Belgium), Thorn (France), etc. These manufacturers are competing with each other in terms of performance and price. In this study, it has been intended that the best total equipment system, especially those of easy operation and maintenance, shall be formulated taking into account the proposed equipment systems by Japanese and international manufacturers.
- ✈ The requests from the Tajikistan side described in the minutes of discussion have been confirmed during the site survey through the technical memorandum, and the design policy proposed in this study shall be carried out accordingly.

2) Design Policy for the Natural Environment

Design for air navigation safety equipment should be carried out according to the architectural design standards established in Tajikistan and considering natural environmental conditions such as earthquake (vibration), heavy wind (wind force), and weather (atmospheric temperature and humidity). In the case of design of commercial off-the-shelf products, the manufacturing company's design criteria are used.

3) Design Policy for Social and Economic Conditions

There are no points to be specially considered on the design for air navigation safety equipment such as country lifestyle, historical and culture, religious, architectural style and economic condition.

4) Design Policy for Business Environment on Construction/Procurement

Air navigation safety equipment are critical aviation infrastructure that is common around the world. The equipment specifications to be provided under the Project shall meet the technical requirements specified in ICAO standards.

5) Design Policy for Local Consultants and Contractors

Since the installation of equipment provided for the Project requires unskilled labor, skilled labor, and electrical engineers, it was decided to use a local electrical contractor. However, a local electrical contractor with specialization on air navigation safety equipment does not exist in

Tajikistan. But, field works for this Project comprises mainly general construction such as foundation work, steel frame construction, equipment installation, and wiring. It was planned that the local contractor shall be under the supervision of engineers dispatched from Japan.

6) Design Policy for Operation and Maintenance

The types of air navigation safety equipment to be procured under the Project are principally the same ones being currently operated and maintained in Tajikistan. At DIA, the existing air navigation safety equipment is operated and maintained on a day-to-day basis without any problems. The operation and maintenance personnel are being subjected to refresher training as well as operational and technical training scheduled every year for the enhancement of their knowledge and maintaining their technical capability of international standards. They also learn how to accommodate technical problems and to repair any deficiencies through on-the-job training (OJT). Considering these facts, it can be concluded that the current operation and maintenance personnel possess sufficient technical capability.

However, since the operation and maintenance of the new equipment will differ from the existing equipment, they shall plan an advisory for the initial operation of engineers that shall be dispatched from the manufacturing companies.

7) Design Policy of Equipment Grade

The equipment that will be procured for this Project shall be based on the specifications set by the ICAO standards. With regard to standards related to quality and the environment, the specifications given by the architectural design standards established in Tajikistan will be applied. For quality in particular, any commercial off-the-shelf product should be utilized to reduce maintenance cost after the commencement of operations as it is a worldwide trend in air navigation safety equipment.

8) Method of Construction/Procurement and Work Scheduling

Careful consideration should be given when formulating the method of construction and work scheduling so that adverse impacts on airport operations and services by installation of ILS and PALS are lessened.

The critical path of the Project should be decided based on the period of manufacture, transportation, adjustment, and testing. Delivery time of each system to the site should be adjusted as the work on site is not crowded, and the procurement period is shortened.

(2) International Cargo Terminal Building and Equipment

1) Basic Consideration

The facilities and equipment are designed in accordance with the demand forecast with consideration to maintenance, finance, and other general capabilities of Tajikistan. The basic policy of the design is as follows:

- ✈ Comply with the International Air Transport Association (IATA) requirements
- ✈ Facility and equipment plan in accordance with demand forecast
- ✈ Facility and equipment plan in accordance with Tajikistan’s cargo handling capability

2) Design Policy for the Natural Environment

The climate in Dushanbe is considered for the design of the cargo terminal building and equipment.

3) Design Policy for Social and Economic Condition

Lifestyle, history, cultural tradition, religion, architecture and economic conditions are considered for the design of the cargo terminal building and equipment.

4) Design Policy for Business Environment on Construction/Procurement

The third country manufacturers, such as in Japan or Europe, are included for the requested cargo terminal equipment procurement since there is no manufacturer for such in Tajikistan.

5) Design Policy for Local Consultants and Contractors

There is no agent that deals with the cargo terminal's new equipment in Tajikistan. These equipment will be taken care of by the agents in surrounding countries of Tajikistan because higher capabilities are expected to be required for maintenance.

6) Design Policy for Operation and Maintenance

In order to maintain government-sponsored enterprise (GSE) equipment which are properly procured by this Project, the following trainings are executed. Technical documents, and operation and maintenance manuals are required and prepared for maintenance. These operation manuals are translated into Russian because there are a few staff who understand English.

- ✈ Equipment summary, operation protocol, and operation checklist
- ✈ Periodical maintenance method such as cleaning, alignment, and repair of minor damages

7) Design Policy of Equipment Grade

The specifications of the equipment which are procured by the Project shall comply with IATA requirements. All equipment shall have a specification which fits each usage purpose.

8) Method of Construction/Procurement and Work Scheduling

The construction site of the cargo terminal building is located in the existing airport. It faces the low usage apron. There are no particular items on construction that might give any impact around the site. The construction schedule shall be decided with consideration of minimal influence to airport operations.

The period for the manufacturing of cargo terminal equipment, including transportation, installation and test runs shall be decided considering the Project's critical path in order to minimize the period of supervision at the site.

2-2-2 Basic Plan (Construction Plan / Equipment Plan)

(1) Whole Plan for Air Navigation Safety Equipment

1) ILS

(a) Operational Category

ILS would enable approach and landing of aircrafts under low visibility conditions by providing aircraft navigational guidance with high accuracy. ILS operational categories for

approach and landing are defined in the "ICAO MANUAL OF ALL WEATHER OPERATIONS" as shown below.

Table 2-2.1 ILS Operational Category

Category	Level of Precision Approach
Category I	A precision instrument approach and landing with a decision height (DH[1]) not lower than 60 M (200 ft) and with either a visibility not less than 800 M, or a runway visual range (RVR[2]) not less than 550 M.
Category II	A precision instrument approach and landing with a DH lower than 60 M (200 ft) but not lower than 30 M (100 ft), and a RVR not less than 350 M.
Category III A	A precision instrument approach and landing with: A DH lower than 30 M (100 ft), or no DH; and b) A RVR not less than 200 M
Category III B	A precision instrument approach and landing with: A DH lower than 15 M (50 ft), or no DH; and b) A RVR less than 200 M but not less than 50 M
Category III C	A precision instrument approach and landing with no DH and no RVR limitation.

Source: ICAO Manual of All Weather Operations

According to weather data at DIA, foggy conditions frequently occur in the winter season from November to February, and low visibility conditions (less or equal to 600 m) occur in December (7.3%) and February (0.8%). In other words, the low visibility condition occurs for about 54 hours in total in December and 5 hours in total in February.

Although there is no exact weather data for establishing the ILS category such as runway visual range (RVR) 550 m (Category I) and RVR 350 m (Category II), introduction of ILS Category I is appropriate under the consideration of weather trends by Met Airport Report (METAR) and Terminal Airport Forecast (TAF) from November to December 2014. The weather trend around the airport is that the low visibility condition (less than 550 m: below Category I) does not continue for long hours but for several hours instead.

(b) Equipment Configuration

ILS normally consists of a localizer (LLZ for providing azimuth guidance) and a glide path (GP for providing vertical guidance) as well as a set of marker beacons or a distance measuring equipment (DME for providing distance information). It is common practice around the world to utilize DME instead of a marker beacon due to economic, operational and maintenance reasons. The Tajikistan side requested in its letter, a grant aide to procure a marker beacon, however it has been agreed upon with the Tajikistan side during the site visit that DME instead of a beacon should be chosen as a component for providing distance information.

(c) Location for Installation of Equipment

Location of the localizer should be within the allowable range specified in ICAO Annex 10 and by relevant aviation authorities. Discussion with the Tajikistan side has been held taking into account the current airport property, topography and the existing structures such as approach lights. The location has been decided at 415 m from end of RWY 09 on the extended runway center line.

[1] DH (Decision Height): A specified height at which a missed approach must be initiated during a precision approach if the required visual reference to continue the approach to land has not been established.

[2] RVR (Runway Visual Range) : In respect of a runway, means the maximum horizontal distance, as measured by an automated visual landing distance system and reported by an air traffic control unit for the direction of takeoff or landing, at which the runway, or the lights or markers delineating it, can be seen from a point above its center line at a height corresponding to the average eye of pilots at touchdown.

The location of the glide path is to be decided based on the following formula as specified in ICAO Annex 10:

$$D = \frac{TCH}{(\tan\theta \pm S)}$$

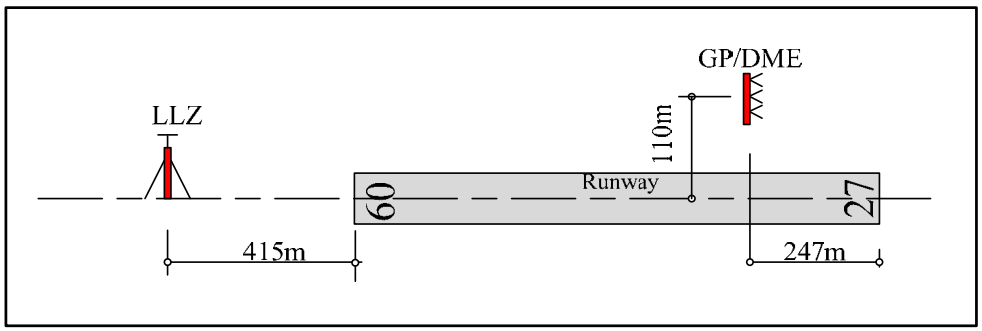
Where, TCH : Touchdown crossing height (ILS reference datum: 15 m + 3 m)
θ : Glide path angle
S : longitudinal slope of the glide path reflection plane
– : up slope,
+ : down slope

The location of the glide path has been calculated as 247 m inside, from the runway threshold based on the following conditions:

- ✈ Runway longitudinal slope of 1.45% downward (according to topographic survey data);
- ✈ ILS reference height from the runway threshold: 16.5 m (average of 18 m and 15 m);
- ✈ Final approach slope of 3 degrees.

The distance of the glide path perpendicular to the runway center line should be 110 m to the north of the runway considering the following:

- ✈ Should be more than specified in the ICAO document;
- ✈ To avoid perimeter road and fence provided to the south of the runway (PAPI side), DME should be collocated with the glide path.



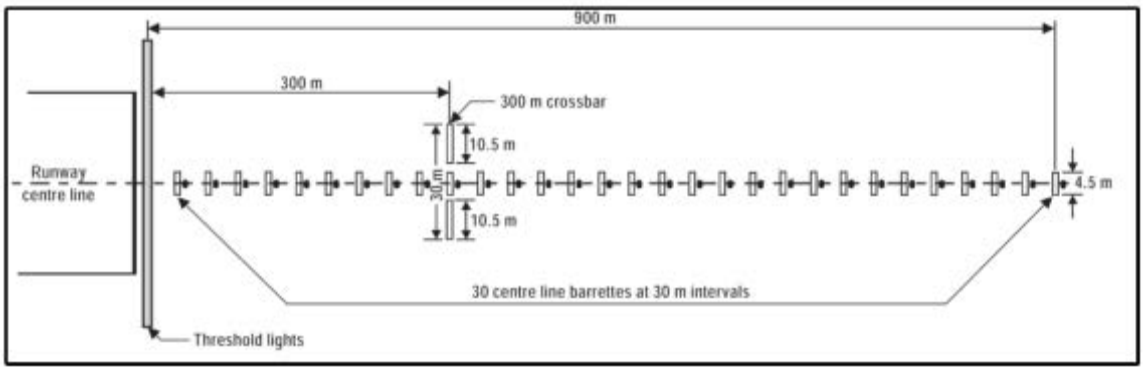
Source: JICA Study Team

Figure 2-2.1 Location of ILS facility

2) Precision Approach lighting System (PALS)

PALS Category I should be provided in accordance with ICAO Annex 14. ICAO specifies two types of PALS; namely, the DISTANCE CODE CENTER LINE and BARRETTE CENTER LINE. The BARRETTE CENTER LINE type with 300 m cross bar, which is the same type as the existing PALS for RWY 09, has been chosen from economic, workability, and maintenance viewpoints through discussions with the Tajikistan side.

It should be noted that there is an obstacle, a limitation requirement to ensure visibility from pilots to PALS, specifically light planes. Nothing except for navigational aids should be allowed to protrude the light plane. Figure xxx shows the layout of the light fixtures of PALS.



Source: JICA Study Team

Figure 2-2.2 layout of light fixtures of PALS

(2) Equipment Design for Air Navigation Safety Equipment

1) ILS

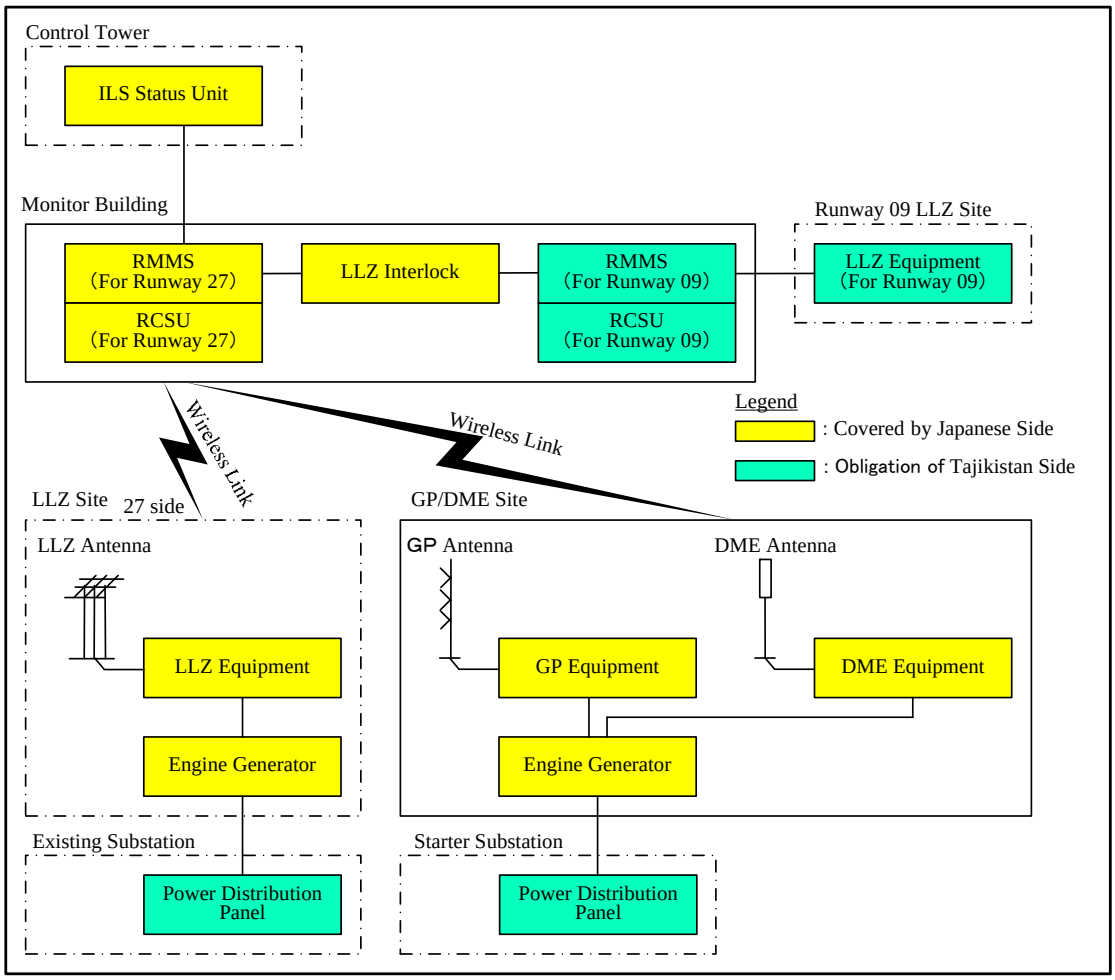
Major equipment configuration and installation placing for ILS are described below.

Table 2-2.2 List of Major Equipment for ILS

Place	Name of Equipment	Q'ty	Remarks
Localizer site	Localizer Equipment	1 set	2-frequency type, hot-standby
	Localizer Antenna	1 set	12 or 20 elements
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
GP/DME site	GP Equipment	1 set	2-frequency type, hot-standby
	GP Antenna	1 set	3 elements
	DME Equipment	1 set	100W, hot-standby
	DME Antenna	1 set	
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
Monitor building 09GP site	ILS Remote Maintenance Monitoring System (RMMS)	1 set	
	ILS Remote Control Status Unit (RCSU)	2 set	Including for 09 ILS
	Localizer interlock system	1 set	
	Wireless system (radio link)	2 sets	
Control Tower	ILS Status Unit	1 set	

Source: JICA Study Team

The outline of ILS system diagram is as shown below,



Source: JICA Study Team

Figure 2-2.3 ILS System Diagram

Attention should be paid to the following design and installation requirements:

- The power supply of ILS should be the responsibility of the Tajikistan side. Standby generators (approximate capacity of 10 kVA) should be provided to each ILS equipment for emergency purposes. Power cables for LLZ and GP/DME will be drawn from the existing substations for the airfield lighting, and from the power room of RWY 27 starter control building, respectively. Careful coordination should be made with the Tajikistan side for proper installation of cables.
- ILS remote maintenance and monitoring system, remote control and status unit, as well as LLZ interlocking system will be installed in the monitor room at the RWY 09 glide path site. As the spaces for the equipment and the power supply are to be undertaken by the Tajikistan side, careful coordination is required.
- ILS status unit will be installed in the control tower. The space for the equipment and the power supply as well as communication cables are to be undertaken by the Tajikistan side with careful coordination.
- The foundation structure of the LLZ antenna is to be constructed where the existing RWY 09 PALS is located. Its construction work should be conducted with due attention to the existing cable location.

Major equipment specifications of ILS are shown below.

1. System Configuration:
   (1) The configuration of Instrument Landing System (ILS) is as follows.
   (2) Localizer (LLZ) - Category I : 1 set
   (3) Glide Path (GP) - Category I : 1 set
   (4) Distance Measuring Equipment (DME) : 1 set
   (5) Remote Control & Monitoring System : 1 set
   (6) Remote Control Wireless System : 2 pairs

2. Specifications:
   The ILS complies with ICAO Annex 10. Facility performance is category I.
   (1) LLZ
      1) Transmitter : Dual configuration (Two frequency system)
         Frequency : 110.3 MHz
      2) Monitor : Dual configuration
      3) Remote control interface : RS232 or Ethernet
         DC power supply : Redundant configuration with battery
      4) Automatic Voltage Regulator : 5kVA or more
      5) Uninterruptible power supply : Operable for over 3 hours, DC 24V lead-acid battery
   (2) Glide Path
      1) Transmitter : Dual configuration (Two frequency system)
         Frequency : 335.0 MHz
      2) Monitor : Dual configuration
      3) Remote control interface : RS232 or Ethernet
      4) DC power supply : Redundant configuration with battery
      5) Automatic Voltage Regulator : 5kVA or more
      6) Uninterruptible power supply : Operable for over 3 hours, DC 24V lead-acid battery
   (3) DME
      1) Transponder : Dual configuration
         : Output Power 100W
         : Channel : 40X
      2) Monitor : Dual configuration
      3) Remote control interface : RS232 or Ethernet
      4) DC power supply : Redundant configuration with battery
   (4) Remote Control & Status Unit (RCSU)
      1) Monitoring functions
         (a) Transmitter ON/OFF status
         (b) Remote Control line alarm
         (c) Total monitor alarm status
         (d) Buzzer stop status
         (e) AC commercial power failure
         (f) Power ON/OFF status
         (g) Battery voltage alarm
         (h) Others
      2) Control functions
         (a) Transmitter ON/OFF
         (b) Buzzer stop
         (c) Power ON/OFF
         (d) Others
   (5) Remote Control Wireless System
      1) Frequency : 5 GHz band or proposed
      2) Channel Spacing : Configurable on 5 MHz increments or proposed
      3) Interface : Ethernet 10/100 Base T or RS232
      4) Max. range : Base unit 5 km

Source: JICA Study Team

2) PALS

Major equipment configuration and installation placement for PALS are described below.

Table 2-2.3 List of Major Equipment for PALS

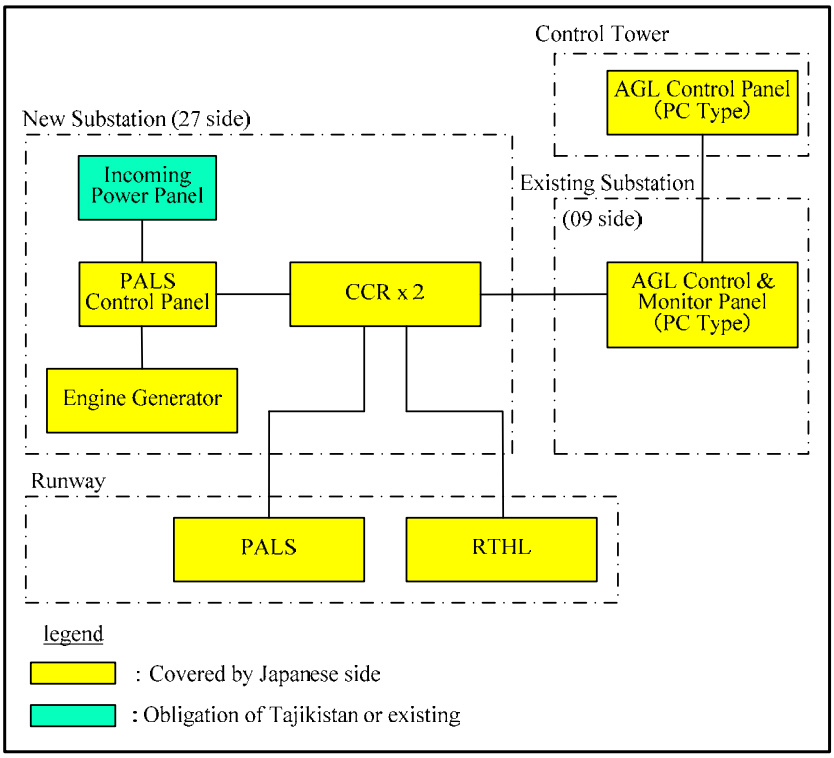
Place	Name of Equipment	Q'ty	Remarks
Runway 27 side	Precision Approach Lighting System	1 set	
	Runway Threshold Light	1 set	
New Substation (east side)	PALS Control Panel	1 set	
	Constant Current Regulator	2 sets	30kVA x 2
	Engine Generator	1 set	100kVA
Existing Substation	AGL Control & Monitor Panel	1 set	PC type
Control Tower	AGL Control Panel	1 set	PC type

Source: JICA Study Team

The outline of PALS system diagram is as shown below.

- A new substation for the power supply of the aeronautical ground lights (AGL) will be constructed within the airport property, on the side of RWY 27 by the Tajikistan side. Power distribution panel and cables will also be installed by the Tajikistan side. The construction and installation schedule should be coordinated.
- Standby generator of 100 kVA should be provided in the new power substation for emergency.
- RWY 27 threshold is being displaced by 407 m and surface-type, approach light fixtures should be provided in this paved area, while elevated-type light fixtures are to be provided in the other green area.
- A lighting control and monitor panel will be installed in the existing power substation for AGL. Space and power supply therefore should be the responsibility of the Tajikistan side. A lighting control panel is installed in the control tower and its space and power supply should be the responsibility of the Tajikistan side. Careful coordination is required.
- Lighting control and monitoring cable (approximate distance of 4.5 km) will be installed between the new power substation and the existing substation for AGL. When deciding the cable route, careful coordination is required to confirm any existing underground structures.
- After the Tajikistan side removes the existing simplified approach lighting system (SALS) from RWY 27 threshold, the new PALS will be installed. Therefore construction and installation schedule should be coordinated with the Tajikistan side.

Major equipment specification of PALS is shown below; Attention should be paid to the following design and installation requirements:



Source: JICA Study Team

Figure 2-2.4 PALS System Diagram

1. System Configuration:
Precision Approach Lighting System (PALS) is as follows.

PALS	:	1 set
Runway Threshold Light (RTHL)	:	1 set
AGL Control & Monitoring Panel	:	1 set
Cable	:	1 set

2. Specifications

(1) PALS

1) Power Supply
The approach lights shall be supplied with power from the Power Substation by means of interleaved two circuits system operating on a constant current, high voltage series loop circuit of 6.6 amperes at 100% brilliance.

2) Lighting System
The Approach Lighting System shall be high intensity system with Barrette Center Line.
The Precision Approach Lighting System shall comprise elevated type unidirectional light fittings and surface type unidirectional light fittings within the pavement.

3) Light Fittings
Each high intensity light fitting shall be of the unidirectional type with light distribution of an intensity of Category I as shown in Appendix 2, Figure 2.1 of ICAO Annex-14. Elevated light fittings shall employ a single tungsten halogen lamp 6.6 amperes 150 watt and surface light fittings shall employ a single tungsten halogen lamp 6.6 amperes 300 watt.
Elevated light fittings shall be subjected to thermal shock test in accordance with ICAO aerodrome design manual.

4) Isolating Transformer
All isolating transformers shall be suitable for use on series circuits with a current of 6.6 amperes.

5) CCR Total Efficiency The total efficiency of the regulator shall be not less than 90% at the rated output where 100% of the power factor of the load

(2) RTHL

1) Power Supply
The runway threshold lights shall be interleaved into the PALS's series circuits.

2) Lighting System
Runway threshold lights for Runway 27 shall comprise high intensity unidirectional surface type fittings for threshold lights.
All fittings shall be equipped with aviation green filters to show green in the direction of the approach to the runway.

3) Light Fittings
Each high intensity light fitting shall be of the unidirectional type with light distribution of an intensity of Category I as shown in Appendix 2, Figure 2.3 of ICAO Annex -14, and elevated light fitting shall employ a tungsten halogen lamp, 6.6 amperes 150W and surface light fittings shall employ a single tungsten halogen lamp 6.6 amperes 200 watt.

4) Isolating Transformer
All isolating transformers shall be suitable for use on series circuits with a current of 6.6 amperes.

5) Protective Devices
The adequate protective devices shall be provided for the load opened, the load grounded, over current and the load circuit problem.

(3) AGL Control & Monitoring Panel
System Requirements of the Control and Monitoring System shall comply with the ICAO Aerodrome Design Manual Part 4 and Part 5, ICAO Annex 14 Aerodromes (Fourth Edition) Attachment A, 15 Intensity Control of Approach and Runway Lights and ICAO Airport Services Manual Part 9.

(4) Cable
All power cables of parallel circuit, as well as all control cables to be used in the Works shall be manufactured and tested in accordance with the following Standards:

IEC	:	International Electro technical Commission
JIS	:	Japan Industrial Standard
JCS	:	Japanese Cable Makers Association Standards
ICEA	:	Insulated Cable Engineers Association, U.S.A.

(3) Air Cargo Demand Forecast

1) Air Cargo Handling

(a) Cargo handling volume

Cargo handling volume in DIA is 2,400ton（2013） The volume is increasing those years. Import volume is form twice to four times of export volume.

(b) Types of Cargo

a) Exports

The amount of fresh products accounts for high rate of exports. They are fruits and vegetables produced in Tajikistan and exported to large cities such as Moscow. The amount of such products is changing every year but continuous since the Soviet era. Cherry, peach, pomegranate, watermelon, strawberry and lemon are the main items that are recently exported to Middle Eastern countries. Other items for export are textile products, cotton products and miscellaneous goods that are mainly exported to Russian principal cities such as Moscow and St. Petersburg.

b) Imports

A wide variety of items are imported such as machine components, medicinal chemicals, and blood products. Machine components include maintenance equipment for hydroelectric turbine and they are transported by a large chartered freighter. In addition, DIA is a major transit point of relief supplies from all over the world dealt by non-governmental organizations (NGOs), and religious organizations.

(c) Operation of Freighters

In DIA, chartered aircrafts are in service for transportation of items, whether it be seasonal or urgent requirements. Russian IL76 (maximum tonnage is 50 t) and AN12 (maximum tonnage is 20 t) are in service. The existing cargo terminal building cannot handle cargo transported by charter aircrafts, and such cargo is usually delivered to the parking apron. Thus, cargo delivered to the parking apron is not consistent in terms of amount. No data is recorded about such cargo but a considerable amount is anticipated to be transported to DIA.

On the other hand, Turkish Airlines is in service for passenger aircrafts at present. Turkish Airlines was also planning operations of freighters (A330; maximum tonnage is 50 t, one flight a week) from Istanbul since September 2013. They got approval to operate from the Tajikistan aviation authorities, but the start of the plan was postponed due to insufficiency of cargo handling capacity in DIA. In addition, Turkish Airlines is in service of operations for A330 passenger aircrafts in Manas International Airport in Bishkek, Kyrgyz, which is a country beside Tajikistan. They stated that the amount of cargo dealt within DIA is sufficient enough to operate freighters. This shows that a new terminal building can result in the significant increase of the amount of freighters handled in DIA.

2) Socioeconomic Conditions in Tajikistan

(a) Economic Conditions

The economy of Tajikistan has been growing since the end of the civil war. Agriculture is the main industry, and fruits, cotton flowers and live stock are the main products. Mining

(antimony, gold, silver, copper, mercury, molybdenum and uranium), hydroelectric power generation businesses, and remittances from emigrant workers are also the main sources of national income. In addition, by utilizing its abundance of electrical power, the textile industry and the aluminum industry has also developed. The gross domestic product (GDP) of Tajikistan USD 7.59 billion (according to the International Monetary Fund (IMF)), and its real economic growth rate is 7.5% in 2012.

(b) GDP

Real GDP transition of Tajikistan as shown in Table 2-2.4. In recent years, the economy of Tajikistan has steadily grown, and the GDP growth rate has increased from 6% to 7%.

The future prospect of GDP growth rate written on Article 4 of the IMF's consulting report is 5.0% from 2012 to 2030.

Table 2-2.4 Transition of Real GDP of Tajikistan

(Unit 1 billion Somoni in 2000)

Year	Real GDP	Growth rate year-on-year
2000	1.787	8.3%
2001	1.969	10.2%
2002	2.182	10.8%
2003	2.422	11.0%
2004	2.671	10.3%
2005	2.850	6.7%
2006	3.050	7.0%
2007	3.294	8.0%
2008	3.557	8.0%
2009	3.682	3.5%
2010	3.921	6.5%
2011	4.211	7.4%
2012	4.527	7.5%

Source: World Bank, World Development Indicators

3) Future Forecast of Cargo Amount

(a) Demand Forecast of Cargo Transported by Passenger Aircrafts

Cargo demand forecast can be conducted by making use of the close relationship between the amount of cargo and GDP in Tajikistan, as follows:

$$\mathrm{CGO} = 10^{1.7353} \cdot \mathrm{GDP}^{2.6257}$$
$$r^2 = 0.80915$$

Where, CGO : The amount of cargo dealt in DIA (t/year)
GDP : Real gross domestic product of Tajikistan (Unit: TJS 1 billion in 2000)
r : a correlation coefficient

With the use of the above formula, the demand forecast of cargo transported by passenger aircrafts is clarified, as shown in Table 2-2.5. In addition, the 5% average GDP growth rate according to IMF is applied as the future GDP growth rate.

In addition, the international cargo terminal building should be planned so that it can accept the demand of cargo in 2021 (five years later).

Table 2-2.5 Demand Forecast of Cargo in DIA (Passenger Aircraft)

(Unit：t / year)

	Actual （2013）	2016	2021
Amount of Cargo (Passenger aircraft)	2,369	4,784	9,160

Source: JICA Study Team

(b) Demand Forecast of Cargo Transported by Freighters

The achievement of cargo handling does not include the amount of cargo transported by freighters in DIA. In addition, Turkish Airlines is eager to start operations of freighters in DIA. The plan has not started due to insufficiency in handling capacity of the cargo terminal building. Turkish Airlines states that the amount of cargo dealt in DIA is sufficient enough to operate freighters. Accordingly, the demand forecast of cargo transported by freighters (A330, maximum tonnage of 50 t) is conducted based on the plan of Turkish Airlines. Based on the hearing, it is assumed that freighters are used only for only and that one freighter with 32.5 t cargo (65% load factor) is arriving at the airport in a week.

In addition, one flight in a week as mentioned above is the same as frequency planned by Turkish Airlines. It is possible that the amount of cargo increases in the future, therefore one flight in a week is applied to the demand forecast as a smaller frequency in this case.

Table 2-2.6 Demand Forecast of Cargo in DIA (Freighter)

(Unit：t / year)

	Actual （2012）	2016	2021
Amount of Cargo （Freighter）	－*	1,690	1,690

Source: JICA Study Team

*: Charter freighters are in service in Dushanbe International Airport but the amount of cargo is unclear due to no data.

(c) Transition of Cargo Amount in DIA

Demand forecast of cargo transported by passengers aircraft and freighters is conducted as shown in Table 2-2.7.

Table 2-2.7 Transition of Cargo Amount in DIA

Category	year	Amount (ton)	Average growth rate
Achievement	2009	1,536	2009-2012 21.9 %
	2010	1,954	
	2011	2,068	
	2012	2,304	
Demand forecast	2016	6,747	2012-2021 14.5 %
	2021	10,850	

Source: JICA Study Team

4) Evaluation for Demand Forecast

(a) Correspondence between the Number of Passengers and the Amount of Cargo

Presently, the international passenger terminal is under construction in DIA with the support of France. It is planned under the assumption that the number of passengers in 2025 will be 500 million. The future forecast of the number of passengers and the amount of cargo is shown in Table 2-2.8 in comparison with the achievements.

Table 2-2.8 Growth Rate of Number of Passengers and the Amount of Cargo in DIA

Category	Achievement	Demand forecast
Growth Rate of Number of Passengers	10.9% (2009-2012)	10.9% (2012-2025 年)
Growth Rate of Cargo	21.9% (2009-2012)	12.4% (2012-2021)Not include freighters 14.5% （2012-2021）Include freighters

Source: JICA Study Team

As a result of Table 2-2.8, there is no significant difference between the growth rate of the number of passengers and growth rate of cargo. Therefore, the construction plan of the international cargo terminal building is correspondent to that of the international passenger terminal building as supported by France on the issue of demand forecast in the field of aviation.

(b) Comparison with Cargo Handling Volume of Bishkek Airport in Kyrgyz

Both Tajikistan and Kyrgyz are landlocked countries and their economic volumes are also similar to each other. Table 2-2.9 shows a comparison of aviation demand between DIA and Bishkek Airport.

Cargo volume handled in DIA is 1/7 of Bishkek Airport, while the number of passengers is 80% of Bishkek Airport.

Passenger handling volume per year of DIA is 80% as much as that of Bishkek Airport. But cargo handling volume in DIA is only 1/7 as much as that in Bishkek Airport and very small. Like this, cargo handling in DIA is quite undeveloped. However, if the new cargo terminal building is developed, cargo handling volume is supposed to increase to a level that corresponds to the size of the economy.

It should be noted that, according to interviews with a cargo carrier in Dushanbe City conducted by the study team, imported cargo is partly transported by road from Manas Airport (MIA) since the cargo handling capacity of DIA is not sufficient. The fact is also confirmed by an interview with the operating company at Bishkek Airport conducted by the study team. If the new cargo terminal building is improved, such cargo is expected to be transported to DIA directly without going through Bishkek Airport.

Table 2-2.9 Comparison of Cargo Handling Volume between MIA and DIA

	Tajikistan	Kyrgyz
Population (thousand)	8,009	5,582
GDP per capita	870 USD	1,160USD
GDP (million)	6,972	6,475
Capital Airport	Dushanbe airport	Bishkek airport
Passenger (2013)	1,299,233	1,375,795
Cargo volume (2013)	2,370 t	22,305t
Cargo terminal building For ULD operation	Not developed	In operation
Freighters operation	Charter flight only	Regular flight

Note: Population, GDP and volumes: achievement in 2012
Source: Population and GDP: World Bank, Volume: Airport company

(c) Contribution to the Commercialization of Agriculture

Currently, imported cargo accounts for 56% of air cargo dealt in DIA, but approximately 200 to 300 t of vegetables and fruits are exported to Middle Eastern countries and Russia every year. The Tajikistan government has aimed to expand the market and increase production of agricultural products such as fruits and high value-added fresh food as a major policy of the government. Fruit producers, the Chamber of Commerce and Industry, the

Ministry of Transport, the Department of Economics, and DIA are focusing on total consistent improvement of production, distribution and sales.

World Bank intends to conduct the "Agricultural Commercialization Project" in five years from 2014 and to support the implementation of Tajikistan's governmental policies. In this project, it is intended to promote fruit production with high commercial value, to carry out the development of refrigerated warehouse, and to form the cold chain for three model districts around Dushanbe.

The development of the cargo terminal building in DIA is corresponding to such a policy of Tajikistan's government. Currently, it is hard to apply the project to the cargo demand forecast; it seems to be certain that cargo handling volume increases in harmony with such a movement.

(d) Level of Cargo Handling Fee in DIA

The regular handling fee of cargo in general (indoor only) in DIA is USD 400 per ton. However, a 50% to 60% discount is applied by the airline company, therefore USD 150 to 200 per t is usually collected. In neighboring countries, Almaty Airport in Kazakhstan charges USD 140 per t, and Bishkek Airport in Kyrgyz charges. It shows that the cargo handling fee in Tajikistan is not very expensive compared to that of neighboring countries.

It does not mean that the use of air cargo has not progressed due to the handling fee. Increase of cargo handling volume is expected after the improvement of cargo handling capacity, but it is important to keep the level of cargo handling fee competitive against neighboring countries.

(4) International Cargo Terminal

1) Site and Building Plan

The international cargo terminal building is to be planned based on the following conditions:

- The handling capacity is equal to 32 unit load devices (ULDs) (which is also equal to the cargo capacity of an A330 freighter and three times as much as that of an A320 freighter),
- The number of ULDs on build-up/break-down positions is eight in total,
- In addition to build up/break down space, storage for imports and exports, cold storage (-20 to -5 °C, and +5 to +20 °C), valuable goods storage, animal storage and dangerous goods storage are provided in the cargo terminal building.

The cargo terminal building consists of a freight handling block and a two-story office block. The office block has a cargo office, staff rooms on the first floor, and offices for customs, quarantine, and post on the second floor.

2) Schematic Planning

Area estimation of the international cargo terminal building is conducted based on the following policies:

- Annual capacity of the freight handling area is 5.0 t/m^2 according to IATA Reference Manual (O2.6),
- The total area of the office space is half as large as that of the freight handling area by reference to the "Airport Facility Planning Reference" published by the Ministry of Land, Infrastructure and Transport of Japan.

The area of the freight handling area, as shown in Table 2-2.10, is estimated based on the demand forecast which shows the amount of cargo handled by DIA in 2021 (approximately 11,100 t).

Table 2-2.10 Area Estimation for Freight Handling Area of Cargo Terminal Building

	Type of storage/ Capacity	Total tonnage	Average storage period	Annual capacity	Area (m2)
Build-up / break-down space	8 positions				1110.4
X-ray inspection area	2 facilities				172.5
Storage for exports	Nesting racks stacked three high Total 168 units	0.2 t x 168 units Total 33.6 t	2 days	6,023 t	937.9
Storage for imports	Palette placed flat Total 50 units	0.2 t x 50 units Total 10 t	1 day	3,650 t	
Cold storages	Nesting racks stacked two high Total 56 units	T x 56 units Total 5.6 t	1 day	2,044 t	183.3
Total in Warehouse				11,717 t	2404.1
Capacity per square meter				4.9 t /m^2	
(Reference) IATA Reference Manual (O2.6) Low Automation Mostly Manual				5.0 t / m^2	

Source: JICA Study Team

As shown in Table 2-2.11, the total area of the office area is estimated at about 1,200 m^2 (2,401.1 × 1/2). As for the area of valuable goods storage, animal storage and dangerous goods space, the total area of the international cargo terminal building is estimated as shown in Table 2-2.11.

Table 2-2.11 Total Area List of Cargo Terminal Building

Block			Area (m^2)
Freight handling block (Steel structure)	Freight handling area	Build-up / break-down space, storage for exports, storage for imports and X-ray inspection area	2,404.1
		Cold storages	
Office block (RC structure)	Special cargo facilities	Dangerous goods space, valuable goods storage and animal storage	106.4
	Offices area	Cargo office and staff rooms	1,203.3
Total			3,713.8

Source: JICA Study Team

(a) Plan

For planning, the handling capacity of the international cargo terminal building shall be equal to 32 ULDs, which is also equal to cargo capacity of A330 freighter.

a) Freight handling area and special cargo facilities

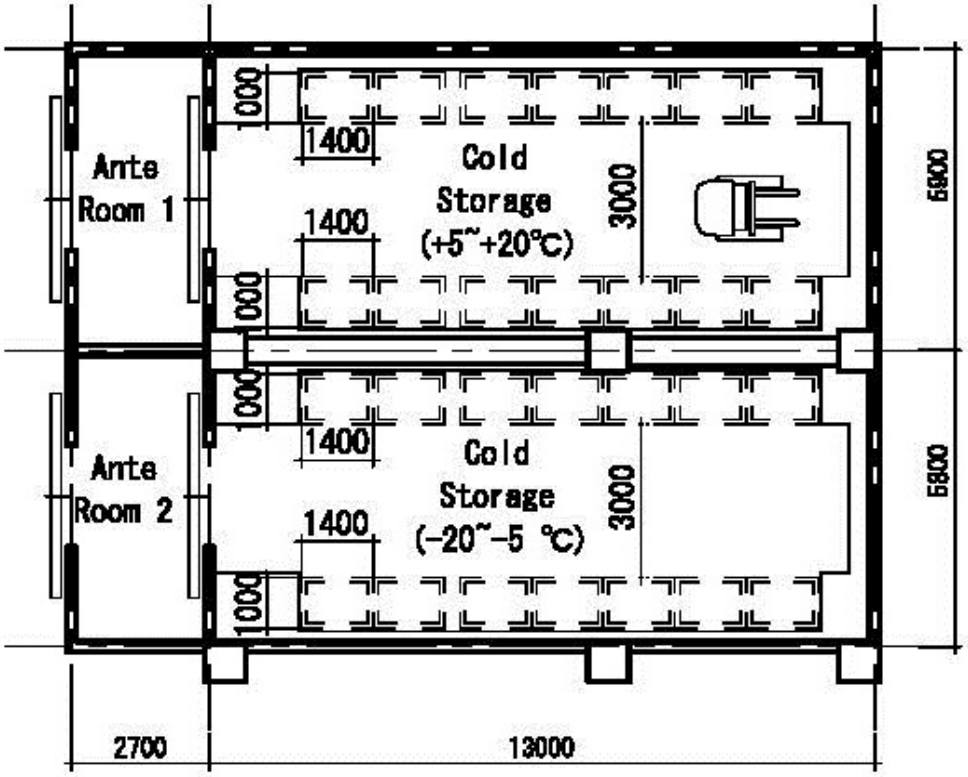
a. Eight positions for build-up/break-down ULDs

It takes one hour to load cargo onto an A330 freighter and to unload from it respectively. In one hour, 32 ULDs should be loaded/unloaded. On the other hand, it is assumed that it takes 15 minutes to build-up/break-down one ULD. Therefore four ULDs are built up/broken down in one hour. Thus in order to deal with 32 ULDs in one hour, eight build-up/break-down positions are necessary.

The area for the build-up/break-down is determined by the dimensions of a dory (3.4 m × 3.0 m). Additionally, the approach area (1 to 1.25 m wide) shall be ensured around a dory and 5.5 m × 5.5 m area is required for each position. With a width of 4 m, an approach way for forklifts shall be provided around the positions.

c. Cold storage (-20 to -5 °C and +5 to +20 °C)

A capacity of 2.8 t is required for each cold storage. In the storages, goods are stored on upside down nesting rack (1.4 m × 1.0 m). By stacking two levels high, 28 nesting rack should be provided in each storage. In addition, 3 m wide approach ways for reach forklift should be provided.

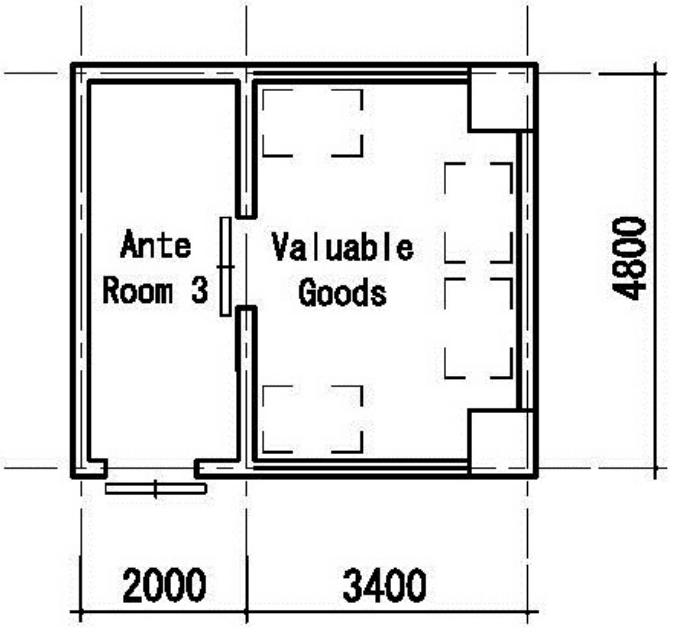


Source: JICA Study Team

Figure 2-2.6 Plan of Cold Storages

d. Valuable goods storage

Because the size and weight of valuable goods vary, they are supposed to be placed flat. Space of 3.4 m × 4.8 m is required to fit four palettes.

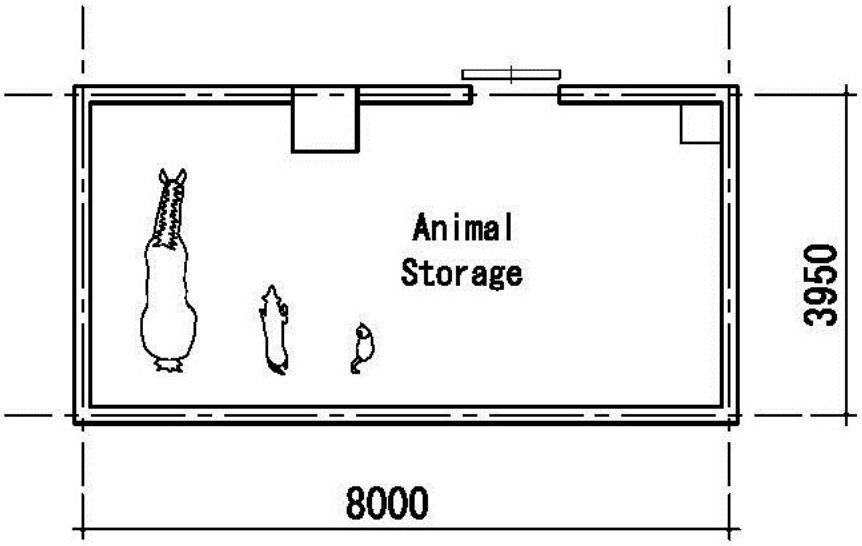


Source: JICA Study Team

Figure 2-2.7 Plan of Valuable Goods Storage

e. Animal storage

In order to store animals such as dogs, cats, horses and birds, an animal storage should be provided. Air conditioning system is required to maintain the environment for animals.



Source: JICA Study Team

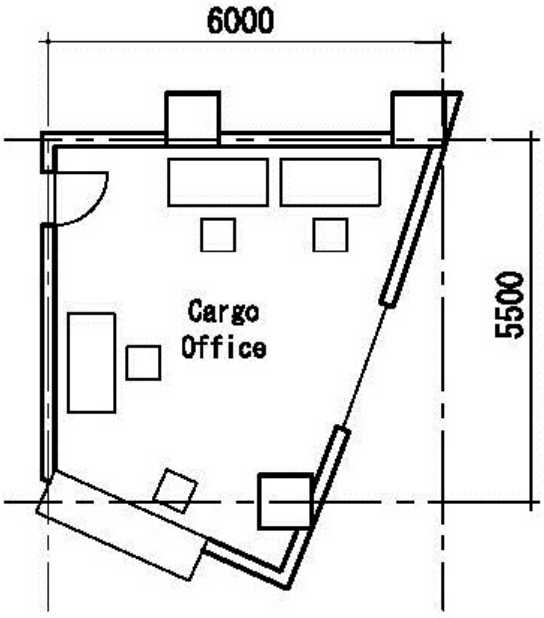
Figure 2-2.8 Plan of Animal Storage

[redacted]

b) Office

a. Cargo office

A cargo office is required for the staff in charge of administrative work in the cargo terminal building. A staff of 3 people will stay in the cargo office.

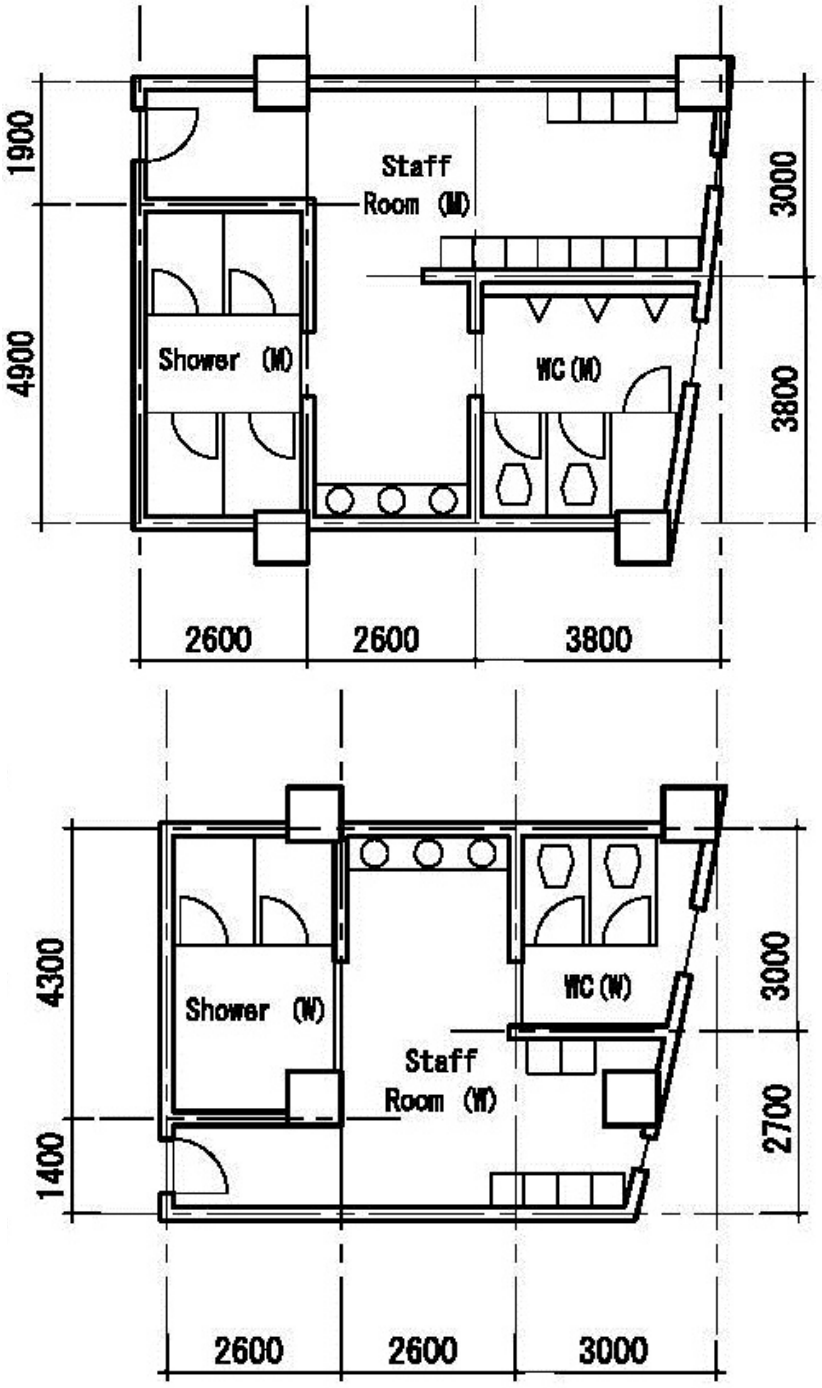


Source: JICA Study Team

Figure 2-2.10 Plan of Cargo Office

b. Staff rooms

Staff rooms for men and women should be provided. The capacity of the staff room for men is 24 people (8 people × 3 time shifts), and that for women is 12 people (8 people × 3 time shifts). Each staff room contains lockers, showers and water closets.



Source: JICA Study Team

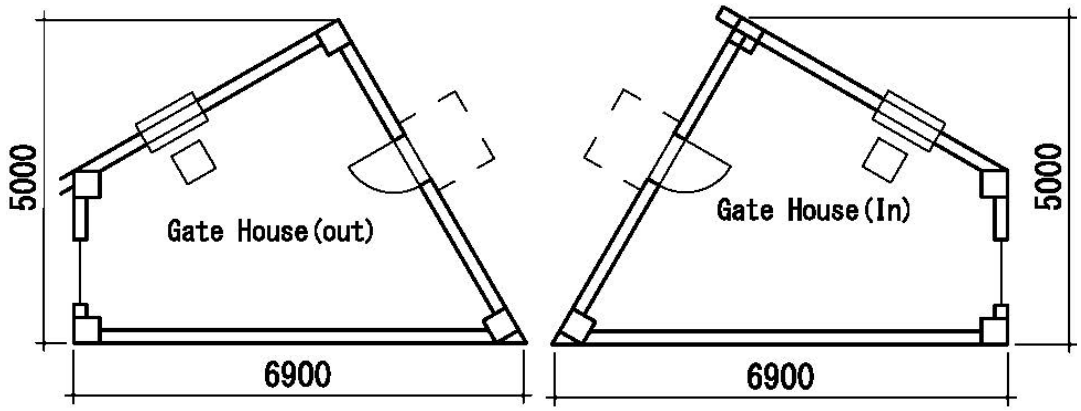
Figure 2-2.11 Plan of Staff Rooms

[redacted]

c) Other Rooms

a. Gate Houses

For management of trucks, gates for entering and exiting should be provided respectively. In addition, the gate houses should be provided near each gate for guard staff.

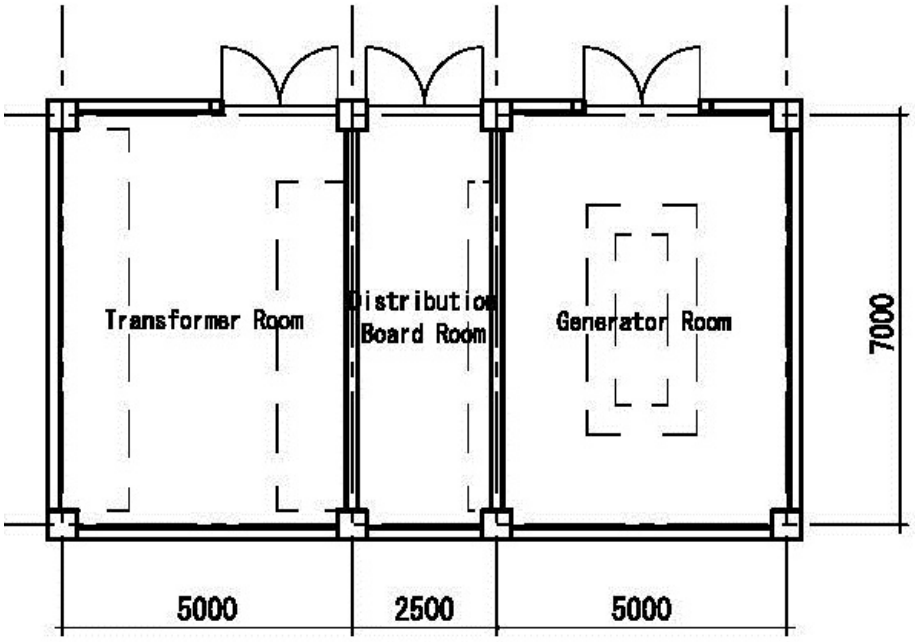


Source: JICA Study Team

Figure 2-2.13 Plan of Gate Houses

b. Transformer & Generator House

A house for storing a secondary transformer installed by the Japanese side, and a generator should be provided.



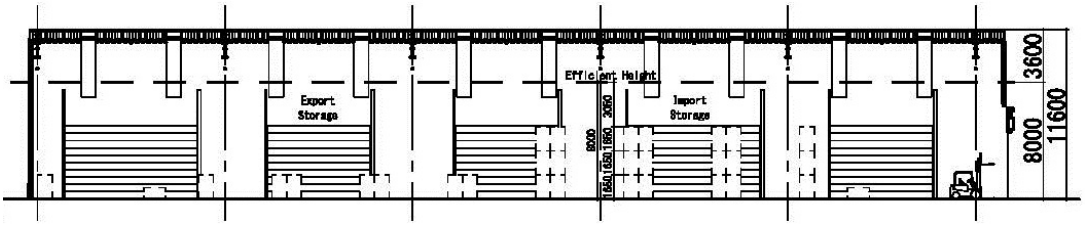
Source: JICA Study Team

Figure 2-2.14 Plan of Transformer & Generator House

(b) Section

a) Freight Handling Block

The height of nesting rack stacked three levels high is 4.95 m (1.65 m × 3). In order to ensure a 3 m clearance above it, more than 8 m ceiling height should be ensured.

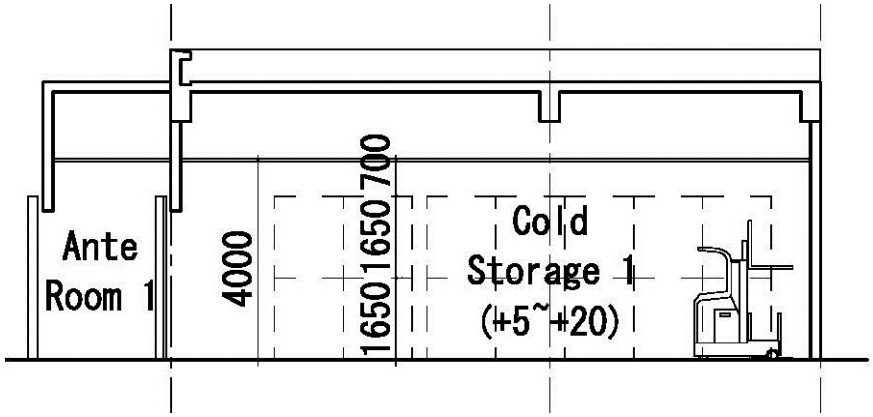


Source: JICA Study Team

Figure 2-2.15 Warehouse

b) Cold Storages

The height of upside down nesting rack stacked two levels high is 3.30 m (1.65 m × 2). In order to ensure 0.7 m clearance above it, 4 m ceiling height should be ensured.



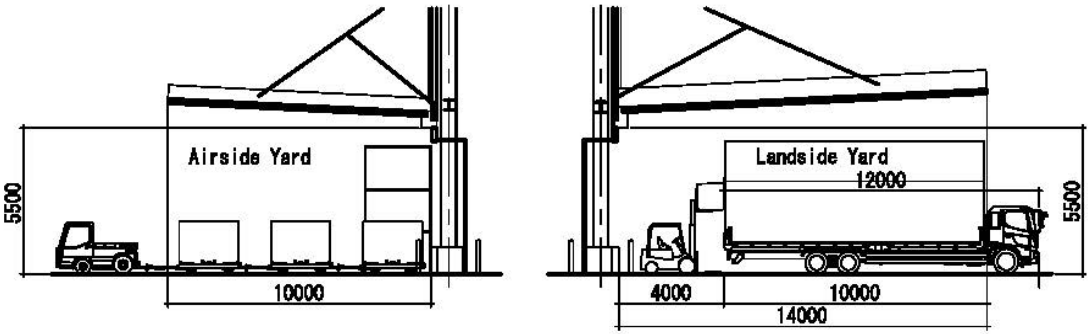
Source: JICA Study Team

Figure 2-2.16 Section of Cold Storages

c) Canopies in the Airside and the Landside

The depth of the canopy in the airside should be over 10 m in order to be able to store three linked palette dories. In addition, the ceiling height should be more than 5.5 m to store palette racks stacked three levels high.

The depth of the canopy in the land side should be over 14 m to ensure an approach way for forklifts (4 m) and store carrier part of trucks (10 m). In addition, the ceiling height should be more than 5.5 m so that gull wing type trucks can enter to load and unload goods.



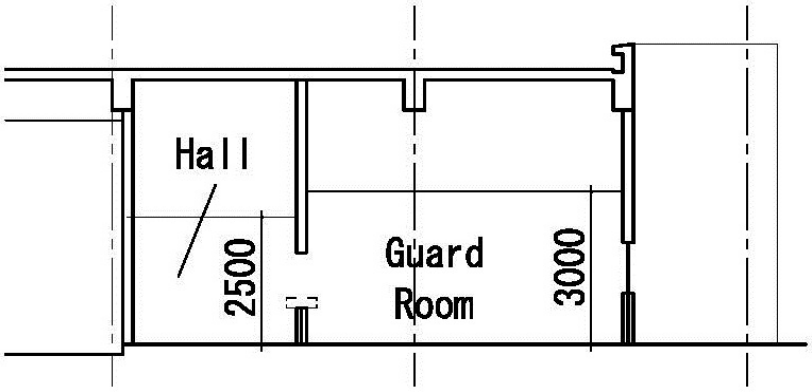
Source: JICA Study Team

Figure 2-2.17 Section of Canopies in Air-side / Land-side

d) Office Area

To ensure comfort, the ceiling height of offices should be more than 3.0 m, and ceiling height of the hall between rooms should be more than 2.5 m.

A pit space for the drainage piping should be provided partly under the offices. A part of the pit space is to be used as a firefighting water tank.



Source: JICA Study Team

Figure 2-2.18 Section of Office Area

3) Structural Design

(a) Types and Materials of the Main Structures

a) Superstructure

In order to secure flexibility, a large column free space (inside the building and canopies) is needed for handling cargo in the freight handling area, the main frame will be built using structural steel, which will be fabricated in Japan. To reduce the transportation cost, size and to minimize the use of brackets, the outer dimensions and projected areas of the structural steel will be kept as small as possible.

The buildings of the office area will employ the kinds of materials and methods that are widely used in Tajikistan. The main frames will be composed of reinforced concrete pillars and beams; exterior walls will be built with bricks because of their heat insulating properties, and interior walls will use concrete blocks and a light gauge steel structure for the wall framework.

b) Substructure

The geological survey revealed that loamy soil dominates the middle stratum while gravel stratum is presently found at depths of 21.0 m to 21.6 m below the ground level. Accordingly, the foundations of the main buildings will use the gravel stratum as a bearing stratum, into which piles will be driven. The auxiliary facilities will be built on a spread foundation. The first floor of the buildings in the freight handling area and office areas will have a slab-on-grade structure.

Table 2-2.12 Materials and Structures of Main Structural Members

Building	Structural Member	Structural Material	Type of Structure	Remarks
Freight handling area	Foundation	Earth drilling pile	Pile foundation	
	1st-floor floor	Reinforced concrete	Slab-on-grade	
	Roof	Folded plate	-	
	Exterior wall	Folded plate	-	
	Main frame	Steel construction	Rigid frame	
Office area	Foundation	Earth drilling pile	Pile foundation	
	1st-floor floor	Reinforced concrete	Slab-on-grade	
	2nd-floor floor, roofs	Reinforced concrete	Slab structure	
	Exterior wall	Brick work	-	
	Interior wall	Concrete blocks / Light gauge steel structure for wall framework	-	
	Main frame	Reinforced concrete	Rigid frame	
Gate house	Foundation	Reinforced concrete	Spread foundation	
	1st-floor floor	Reinforced concrete	Slab-on-grade	
	Roof	Reinforced concrete	Slab structure	
	Exterior wall	Brick work	-	
	Main frame	Reinforced concrete	Rigid frame	
Transformer & generator house	Foundation	Reinforced concrete	Wall footing	
	1st-floor floor	Reinforced concrete	Slab-on-grade	
	Roof	Reinforced concrete	Slab structure	
	Exterior / interior wall	Concrete blocks	-	
	Main frame	Reinforced concrete	Rigid frame	

Source: JICA Study Team

(b) Design Loads

a) Live Loads

In Tajikistan, live loads are designed in accordance with the Russian standards "Loads and Actions: Snip 2.01.07-85", which are also applied to this Project with necessary modifications. Since the said standards do not provide load requirements for girders, pillars, or foundations, the live loads for girders and other supporting structures are set by referring to the floors and joists.

Table 2-2.13 Live Load

(Unit: kN/m^2)

Location / Structure	Floor / beam	Girder / pillar / foundation	Seismic load
Freight handling area	25.0	—	—
Roof	0.70	←	0.35
Office	2.00	←	1.00

Source: JICA Study Team

b) Seismic Force

Tajikistan located near the boundary of the Eurasian Plate and Indo-Australian Plate, where magnitude 7.0 or larger earthquakes frequently occur. The country has established the Earthquake Engineering Design Standards 2007, according to which the seismic properties of the Project site are set as follows:

- ✈ Seismic intensity area: 9 (Dushanbe)
- ✈ Building use coefficient: 0.4 (airport facility)
- ✈ Ground category: II

c) Snow Loads

Dushanbe belongs to Snow Region II according to the Russian standards "Loads and Actions: Snip 2.01.07-85". In this region, snow load of 0.70 kN/m^2 is applied.

d) Wind Loads

Dushanbe belongs to Wind Region III according to the Russian standards "Loads and Actions: Snip 2.01.07-85". In this region, wind pressure of 0.38 kN/m^2 is applied. However, as the maximum wind velocity recorded in Dushanbe between 2000 and 2012 was 26 m/s according to the city's weather data, the design wind velocity is set at 30 m/s, based on the wind load (average wind pressure: 1.72 kN/m^2), which is set in accordance with the Japanese Building Standard Act.

(c) Main Structural Materials

Listed below are the main structural materials.

Table 2-2.14 Main Structural Materials

Material	Applicable standard, location of use, etc.	Strength, etc.
Pile	Earth drilling pile	800φ: Ra=1600 kN 1000φ: Ra=2200 kN
Cement	Ordinary Portland cement	—
Concrete	Freight handling area, Gate house, Generator room	Design strength: Fc21
	Office area and piles	Design strength: Fc24
Rebar	D16 or smaller: JIS G3112 SD295 or GOST A-II (A300) equivalent D18 or larger: JIS G3112 SD395 or GOST A-III (A400) equivalent	fy = 295 N / mm^2 fy = 390 N / mm^2
Structural steel	JIS: G3101 (rolled steel for general structure) SS400 JIS: G3106 (rolled steel for welded structure) SM490	F = 235 N / mm^2 F = 325 N / mm^2

Source: JICA Study Team

4) Mechanical Equipment Plan

(a) Plumbing Equipment Plan

a) Water Supply Equipment

The Tajikistan side will undertake the installation of an 80 mm water main up to the valve near the boundary of the Project site. From there, it is the responsibility of the Japanese side.

Water supply pipes to be installed under the Project will be vinyl pipes in consideration of hygiene and workability. As the pressure of the water main is 1.6 kg/cm, direct water supply method will be employed. Taking into account pipe friction resistance and other factors, the diameters of the pipes inside the facilities will be 65 mm or larger in order to maintain an adequate flow rate during simultaneous use of various appliances. The rooms, in which water supply fixtures will be installed, are as follows:

Table 2-2.15 Living Space Installed with Water Supply Equipment

Room	Fixtures
Water closet	Toilet stool, urinal, wash-basin
Staff room	Toilet stool, urinal, wash-basins, shower
Inspection desk and dispatcher room	Office sink
Guard room	Wash-basin
Kitchen	Kitchen sink
Truck yard, etc.	Ground wash basin

Source: JICA Study Team

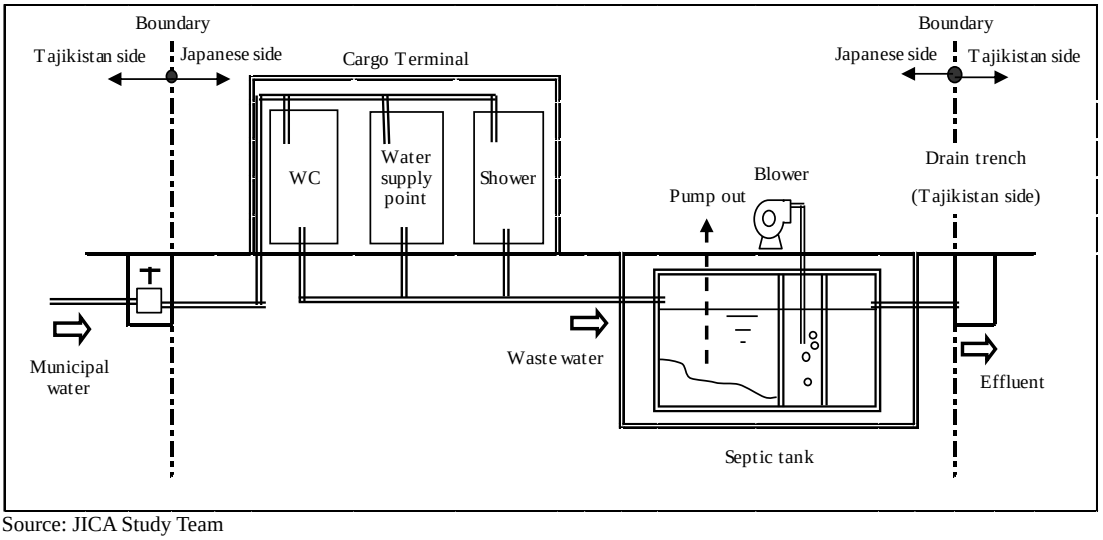
b) Sewage Equipment

Liquid sanitary waste and graywater will be collected and discharged through separate indoor pipes that merge outside the buildings. Sewage is treated in a combined septic tank, which will be installed inside the Project site, and the effluent is discharged into a drain ditch, which will be constructed by the Tajikistan side. The septic tank will discharge 8.0 m3 per day of effluent as per the table below, and will have a treatment capacity to meet the standard at BOD 20 mg/L. A schematic of the water supply and a sewage systems are shown in Figure 2-2.19.

Table 2-2.16 Estimation of Municipal Water Use

	Users	Number of persons 【N】	Average water use (q) per day per person 【L/(d・N)】	Water use per day Qd = N・q 【L/d】	Average time of use per day 【h】	Estimated average water supply per hour 【L/h】
Municipal Water	Warehouse operators	30	100	3,000	8	375
	Office workers	46	100	4,600	24	192
	Total volume			7,600→8,000		

Source: JICA Study Team



Source: JICA Study Team

Figure 2-2.19 Schematic of Water Supply/Sewage System

c) Water Heaters

To supply hot water to washbasins, showers, and kitchen sinks, electric water heaters will be installed because the use of propane gas heaters in airports is not allowed for security reasons. The specifications and quantities of electric water heaters are shown below.

Table 2-2.17 Specifications and Quantities of Electric Hot Water Heaters

Room	Hot water supply	Specification				Qty.	Operating condition
		Tank capacity	Max. boiling temp.	Water temp.	Power source		
Staff room	Shower	322 L	80˚C	-	3-phase 380V15kW	3	8 persons use 60˚C / 50L each every 6 hours
WC, etc.	Wash-hand	12 L	75˚C	37˚C	1-phase 220V1.1kW	6	50 persons use 37˚C / 0.5L each continuously.
		6 L	75˚C	37˚C	1-phase 220V1.1kW	3	
Kitchen	Kitchen	30 L	75˚C	37˚C	1-phase 220V1.5kW	1	37˚C / 60L is used continuously.

Source: JICA Study Team

d) Sanitary Fixtures

Sanitary fixtures will be selected from those that are locally available in consideration of maintenance.

Table 2-2.18 Specifications of Sanitary Facilities

Fixture	Specification	Remarks
Toilet stool	Low tank type	-
Urinal	Attached with flush valve	-
Lavatory and wash basin table	-	Faucets are part of mechanical equipment works.
Wash-hand basin	Counter type	-
Utility basin	-	-
Showerhead	Attached with thermostat	-

Source: JICA Study Team

e) Fire Fighting Equipment

As a general rule, the office area will be equipped with indoor firefighting fixtures in accordance with mutatis mutandis with Japanese regulations.

The storage tank that supplies water to the indoor fire hydrants will be placed in a pit in the office area. Since the construction site is situated in a cold region, where water inside the elevated service tank could freeze during winter, booster pump method will be adopted to maintain adequate water pressure. The indoor fire hydrants will be with a coverage radius of 20 m.

A 4.0 kg ABC fire extinguisher will be placed every 20 m or less. A fire extinguisher box will be mounted where it is needed as part of the building construction works.

(b) Heating, Ventilation, and Air Conditioning (HVAC) System and Freezer/Refrigeration Equipment Plan

a) Air-conditioning Equipment

Air source heat pumps and air-conditioning units will be installed in office rooms and other spaces, as shown in the table below. To reduce cost for installing outdoor units, indoor units of rooms on the first floor will be connected to multi type outdoor units. Air conditioners on the second floor office rooms, which will be rented out to tenants, will be of a package type having a one-to-one combination of indoor unit and outdoor unit. Each air conditioner will be connected to a wired remote controller mounted on the wall of each room. As a general rule, air-conditioning equipment will be procured from sources in Tajikistan except for the multi type units for the first floor rooms, which will be procured from Japan.

Table 2-2.19 Rooms Requiring Air Conditioning and Temperature Settings

	Summer (temp / humidity)	Winter (temp / humidity)
Estimated outdoor temperature/humidity	38.2 / 23.2	-7.1 / 77.5
Animal storage	22.0 / -	22.0 / -
Office rooms on 1st & 2nd floors	26.0 / -	22.0 / -

Source: JICA Study Team

b) Ventilation Equipment

Water closets, office rooms, and other spaces that generate heat, odors, steam, etc. will be equipped with ventilation units that comply with the specifications provided below. The ventilation equipment will be of Type 3 that uses a door louver for air intake and an exhaust fan (small multi-wing type) to expel air.

Table 2-2.20 Ventilation

Room	Ventilation method	Ventilation rate (no. of air changes per hour)
Office	Type 3*	To be calculated based on no. of persons (20m3/h・person)
WC	Type 3	10 – 15
Animal storage	Type 3	15
Other	Type 3	2 – 5

Source: JICA Study Team

*Type 3 is a ventilation method that uses mechanical force only for expelling air.

c) Freezer and Refrigeration Equipment

A freezer and refrigerator storage will be equipped in the office area, and the inside temperature of the freezer storage will be set between -20.0 ˚C and -5.0 ˚C; the refrigerator storage between 5.0 ˚C and 15 ˚C. Four indoor units will be installed and properly distributed in each freezer and refrigerator storage to maintain temperature uniformity. The freezer will be placed on the floor next to the freezer and refrigerator storages, and the condensers will be mounted on the rooftop of the one-story buildings in the office area. In addition, anterooms will be attached to prevent outside air from flowing into the freezer/refrigerator storages when opening and closing the doors. The anterooms will be connected to the HVAC system to keep the temperature at around 22.0 ˚C and equipped with floor heaters to prevent condensation. The freezer units, as a general rule, will be procured from Japan, as they require specialized installation techniques.

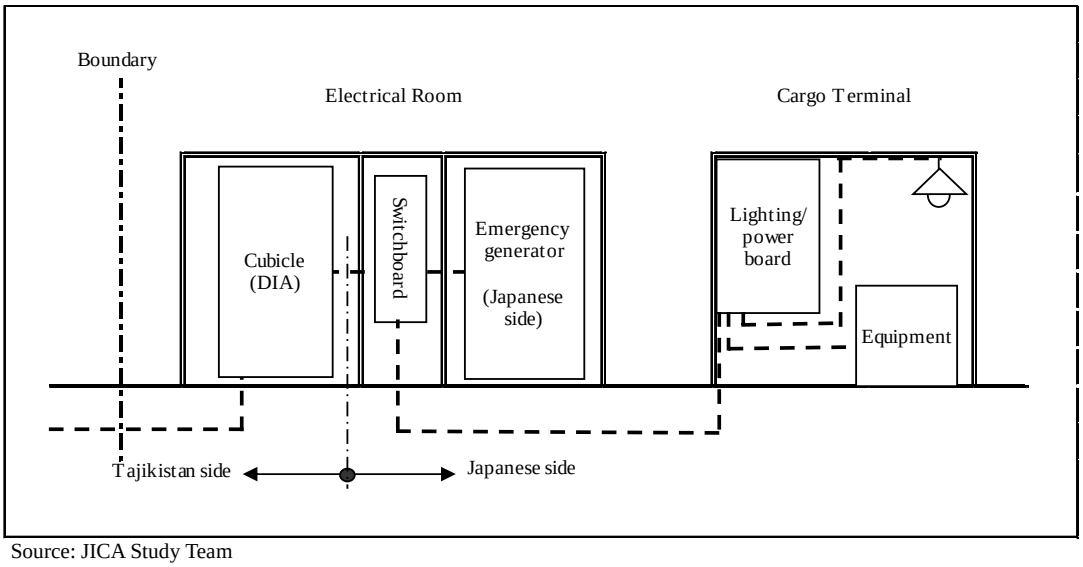
5) Electrical Equipment Plan

(a) Substation, Mains, and Power Equipment Plan

The Japanese side will lay low voltage electrical cables (3 phase / 4 wire 380 / 220 V) from the secondary side of the substation, which will be built by the Tajikistan side (DIA), to the cargo terminal buildings through an underground conduit to supply electricity to the distribution board inside each building.

Since the freezer and refrigerator equipment, and some lighting fixtures need to continue operating during power outages, an emergency power generator will be installed by the Japanese side. The generator will be selected with consideration of local availability of the replacement parts that may be necessary for maintenance. Generator circuits will be installed in the distribution boards, to which electric devices requiring emergency power supply will be connected.

The schematic of the substation system is provided below.



Source: JICA Study Team

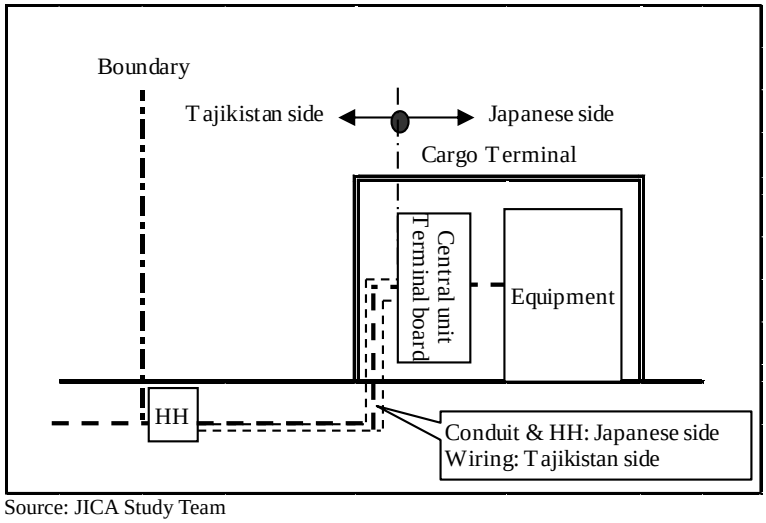
Figure 2-2.20 Schematic of Substation Facility

The power board will be installed near the electrical equipment for maintenance purposes. Dedicated power outlets will be installed near the X-ray units to supply power to the equipment.

(b) Lighting and Electrical Equipment

To supply power to lighting and electrical equipment, the Tajikistan side will install a service line to the terminal board inside the facilities. Other electrical installation works from the central unit will be performed by the Japanese side.

- ✈ Outdoor conduits will be buried underground.
- ✈ Electrical mains will be laid basically through cable trays and pipes.
- ✈ Cables in the freight handling area will be laid basically through pipes, cable trays, and raceways.
- ✈ Cables in the office area will be laid basically through ceilings and walls.
- ✈ Equipment requiring grounding will be grounded in accordance with Japanese standards.
- ✈ Distribution board enclosures will be procured from Japan while circuit breakers and other equipment will be procured from Tajikistan.
- ✈ Circuit breakers will be selected from those having sufficient capacities to ensure protection of electrical equipment and cables.
- ✈ Conduits, cables, and other wiring devices will be procured from Tajikistan.
- ✈ Telephone, local area network (LAN), security, and public address (PA) equipment will be procured from Tajikistan.
- ✈ The division of work between Japan and Tajikistan for the installation of the telephone, LAN, security, auto fire alarm, and PA systems is shown in the figure below. The Japanese side will be responsible for laying empty conduits from the underground pipe, which is protruding from the ground on the site boundary, to the terminal board of the central unit, as well as for the installation of equipment inside the cargo terminal buildings. The Tajikistan side will undertake the piping and wiring works from the main equipment of the airport to the site boundary, as well as the wiring work from the site boundary to the terminal boards of the central unit inside the cargo terminal buildings.



Source: JICA Study Team

Figure 2-2.21 Division of Work for Electrical Installation

(c) Lighting Fixtures and Power Outlets Plan

a) Lighting Fixtures

Appropriate lighting fixtures will be procured based on the floor illumination standards of 150 lux, and 400 lux (around 80% of JIS) for the freight handling area, and office rooms, respectively.

For the truck yard and airside handling area, outdoor lamps will be installed in places that will not interfere with vehicle traffic to provide night time illumination and security. Lighting fixtures will be chosen from those that are widely available in Tajikistan for maintenance reasons. However, indoor emergency exit lights will be designed according to Japanese standards and procured from Japan.

b) Power Outlets

General type power outlets will be installed in places that need them. In addition, dedicated power outlets will be installed for the equipment units listed in the table below.

Table 2-2.21 Specifications of Dedicated Power Outlets

Location	Equipment	Capacity / Voltage	Remarks
Freight handling area	X-RAY	1.5kVA / 220V	Generator circuit
	Pit-type scale	200VA / 220V	Generator circuit
	Handling equipment battery charger	96kVA / 380V	For forklift
Mechanical Room	Fire fighting pump	101.9kW / 380V	Generator circuit

Source: JICA Study Team

(d) Communications Equipment Plan

a) Telephone System

The Tajikistan side will be responsible for laying the telephone line in the Project site. From there, underground conduits will be installed to the buildings by the Japanese side.

A telephone switchboard will be installed in the guard room, and a terminal board will be installed inside the office area. Secondary side wiring and outlets will be installed in the places that need them, such as the office rooms, gate houses, and freight handling area.

b) LAN System

For the LAN system, an L3 switch will be installed in the guard room, and outlets will be placed in locations inside the buildings. The Japanese side will undertake the installation of the LAN system from the outlets to the L3 switch, while the Tajikistan side will install a service line, as is the case with the telephone system.

(e) PA System

PA system equipment will be installed in the freight handling area, outdoor handling area, and office rooms. The amplifier will be installed in the guard room.

(f) Automatic Fire Alarm System

The fire alarm system will be configured in accordance with Japanese fire regulations with necessary modifications. The receiver will be installed in the guard room.

(g) Lightening Protection Equipment

Lightening conductors will be procured from Japan and mounted on the rooftops in accordance with JIS.

(h) Entry and Exit Control System

Authentication devices will be installed along the security lines on the airside and in the truck yard to control the entry and exit of people.

(i) ITV Equipment

Surveillance cameras will be installed in places where the freight handling area and security lines can be monitored. The main monitor will be placed in the guard room.

(5) Material selection for construction

Material for Cargo terminal roof is double folding sandwich sheet with insulation board in consideration to heat insulation performance. The wall is steel sheet in consideration to cost. Floor material of warehouse is surface hardening paint floor. For office area vinyl sheet is use for floor. The area where water resistance is required such as toilet and kitchen, will use tiling for floor finish. The area where heavy traffic is expected, such as entrance, hallway floor is furnished by tiling. Internal wall in warehouse is material surface finish. For working area is paint finish. Office wall is finished by wall paper. The ceiling in office, acoustic sound board is used in consideration to sound absorbs. Other area plaster board with paint is applied to ceiling. For window material, resin frame is used because of its heat performance. The windows between warehouse and office are used aluminum because of fire regulation requirement.

Table 2-2.22 External finish table

Building	Wall	Windows	Roof	Note
Cargo Terminal	Steel sheet Paint on RC	Resin frame sash double layer glass. Aluminum sash (partially)	Sandwich steel sheet with insulation board RC with waterproof	Building signage
Guard house	Paint on Mortar	Resin frame sash double layer glass.	Water proofing Insulation	Gate door, Building name board.
Transformer generator house	Paint on Mortar	Resin frame sash double layer glass.	Water proofing Insulation	

Table 2-2.23 Interior finish

Building	Room	Floor	wall	Ceiling	Note
Cargo terminal	Warehouse	Floor Surface hardener	Paint	Material surface	Over slider door （w=7,000/6000、H=5,000）
	Refrigerator	Floor Surface hardener	Paint	Paint	SUS auto door
	Dangerous goods	Floor Surface hardener	Paint	-	Floor marking
	Valuable storage	Floor Surface hardener	Paint	Paint	Steel sliding door
	Inspection Desk	Floor Surface hardener	Paint	Paint	
	Animal Storage	Floor Surface hardener	Paint	Acoustic board	Steel sliding door
	Dispatcher room	Vinyl sheet	Paint	Acoustic board	Counter, counter window
	Entrance	Ceramic Tiling	Paint	Acoustic board	
	Hallway	Ceramic Tiling	Paint	Acoustic board	
	Staff room	Vinyl sheet	Wall paper	Acoustic board	
	Guard room	Vinyl sheet	Wall paper	Acoustic board	Counter
	Cargo Office	Vinyl sheet	Wall paper	Acoustic board	Counter, Counter window
	Entrance Hall	Ceramic Tiling	Ceramic Tiling	Acoustic board	
	WC	Ceramic Tiling	Ceramic Tiling	Paint on cement board	Toilet partition, Wash basin, mirror
	Shower room	Ceramic Tiling	Ceramic Tiling	Paint on cement board	Shower partition
	Pump room	Ceramic Tiling	Paint	Paint	
	Stairs	Ceramic Tiling	Paint	Acoustic board	
	Office	Vinyl sheet	Wall paper	Acoustic board	
	Kitchen	Ceramic Tiling	Tiling/ Wall paper	Acoustic board	Kitchen sink, cup board
	Mechanical room	Epoxy hardener	Paint	Sound insulation	
Guard House	-	Ceramic Tiling	Paint	Acoustic board	Counter
Transformer Generator	-	Epoxy hardener	Paint	Paint	

(6) Cargo handling equipment

1) Outline of the Cargo handling equipment

DIA handles cargo by bulk at old cargo terminal building which was built in 1994. It is inefficient conditions. While ULD (Unit Load Device) is generalize, DIA's cargo handling remains bulk handling only because DIA does not have necessary facility and equipment. This fact disturbs Tajikistan's air transport activation.

Because new cargo terminal is designed for ULD handling, equipment is also designed in accordance with cargo terminal building concept. It is a policy to procure minimum equipment. The procurement item is as shown in below.

2) Policy for procurement

Procurement policy is that necessary equipment to operate in International Cargo terminal building is to be procured by this project. Equipment which are use for aircraft loading such as

High lift loader and Belt loader are not to be procured by the project. Instead DIA will utilize existing equipment.

3) Policy for selection

The equipment which is listed in IATA airport handling manual will be selected from the standard. Respecting to current manual handling, select equipment which is easy to use to shift new operation smoothly. Because there is existing maintenance workshop in DIA, new equipment is selected on the assumption that equipment maintenance will be given by existing workshop. The main use and purpose of the equipment for the new international terminal is as shown in the Table 2-2.24.

Table 2-2.24 Cargo handling Equipment

No.	Equipment	Main Use	Purpose/ Design ground	No.s	Beak Down
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2-2	Pit Scale（10 Feet）	Built up ULD Weight measure	ULD weight measure	1	Export1
2-3	Engine powered Folk lift Track (15 ton)	Handle Large, heavy cargo. Transport to storage and loading to Trucks.	To handle large or heavy cargo	1	Export・Import
2-4	Battery Powered Ramp Equipment Tractor Battery Powered Ramp Equipment Tractor	Transportation of dolly or cart	Add shortage number.	4	Ramp 3 Warehouse 1
2-5	Lower Deck Container Turntable Dolly	To transport ULD	Necessary to ULD handling	8	4 for 1 aircraft 4 for congesting condition
2-6	Pallet Dolly	To transport Pallet ULD	Add shortage number	16	For 1 aircraft
2-7	Baggage/Cargo Cart	To transport bulk	Add shortage number	4	Bulk for A320
2-8	Platform Scale (1 ton)	Weight measure for export cargo	Weight measure of bulk baggage	1	Mainly for export
2-9	Platform Scale (500kg)	Weight measure for import cargo	Weight measure of very small baggage	1	Mainly for import
2-10	Battery Powered Forklift Track 1.5ton	For raising and traversing baggage in warehouse	Necessary for raising and traversing baggage in warehouse	4	Import 2 Export 2
2-11	Battery Powered Forklift Track 2.5ton	For loading, raising and traversing baggage	Necessary for loading, raising and traversing baggage from trucks	8	Import 3 Export 2 Truck yard 3
2-12	Battery Powered Reach Forklift Track 1.5ton	For raising and traversing baggage in cold storages	Standard forklifts are so hard to move in small cold storages that small forklifts are necessary	1	Cold storages
2-13	Manual Pallet Jack 1.5ton	For raising and traversing baggage in valuable goods storage, animal storage and inspection desk	Standard forklifts are so hard to raise and traverse such baggage as animals, valuables and very small baggage. Additionally many workers are supposed to work near its point of use. For working efficiency and safety of workers, small equipments are necessary.	2	Inspection desk and valuable goods storage 1 The other purpose1

No.	Equipment	Main Use	Purpose/ Design ground	No.s	Beak Down
2-14	Nesting rack	To keep baggage in warehouse for efficient handling	Shelves for keeping baggage should not be fixed so that layout of shelves in warehouse is changeable not only for import but also for export. Additionally they can take a role as plastic pallet for bulk baggage.	112	level stacked Mainly for import
2-15	Nesting rack for cold storage	To keep baggage in cold storages for efficient handling	For saving space with 2 stacked shelves	28	Cold storage (+5~+20℃) 14 Cold storage (-20~-5℃) 14
2-16	Plastic Pallet	To keep bulk baggage in warehouse	To collect bulk baggage for handling by forklifts and manual pallet jacks	50	Export 50
2-17	Roll Box Pallet	To keep very small baggage in warehouse	Movable shelf for keeping only separated or very small baggage to save space.	5	To be separated based on last number of B/L number (0 to 9)
2-18	Working Table	For working in inspection desk	Use for working table in inspection desk	1	Inspection desk 1
2-19	Safety Belt	To keep safety of workers when ULD break down	For safety of workers	8	Each ULD position
2-20	Working Stand	To keep safety of workers when ULD break down and reduce damage of baggage	For safety of workers and keeping quality of baggage	2	For break-down import
2-21	ULD Container Rack	To keep empty ULD containers	Use for keeping empty containers before break-down and after build-up	1	
2-22	ULD Pallet Rack	To keep unused ULD pallets	Use for keeping unused pallets before break-down and after build-up	2	
2-23	Battery Powered Aerial Work Platform	For maintenance of ceiling of warehouse	Use for changing lights and maintenance of ceiling of warehouse	1	Use in warehouse

Source：JICA study team

Main equipments are shown in Table below.

Table 2-2.25 Specifications of Main Equipments

No.	Name	Country of procurement/product	Specification	No.s
1-1	Instrument landing system (ILS)	Norway	Localizer (LLZ) 1, Glide Path (GP) 1, Distance Measuring Equipment (DME) 1, Remote Control & Monitoring System 1, Remote Control Wireless System 1	1
1-1-1	Localizer	Norway	Localizer Antenna：1 Localizer Equipment：1 Shelter：1	1
1-1-2	Glide path	Norway	Glide Path Antenna：1 Glide Path Equipment：1 Shelter：1	1
1-1-3	Dimension measuring equipment	Norway	DME Antenna：1 DME Equipment：1	1
1-1-4	Remote Control & Monitoring System	Norway	Remote Control & Status Unit （RCSU）：1 LLZ Interlock System：1 ILS Status Unit：1	1
1-1-5	Remote Control	Norway	Frequency: 5 GHz band or proposed	2

No.	Name	Country of procurement/product	Specification	No.s
	Wireless System		Channel Spacing: Configurable on 5 MHz increments Interface: Ethernet 10/100 Base T Max. range: Base unit 5km	
1-2	Precision Approach Lighting System (Aeronautical Ground Lights [AGL])	Belgium	Precision Approach Lighting System（PALS）: 1 Runway Threshold Lights（RTHL）: 1 AGL Panel：1 式, Cable: 1 Engine Generator for ILS：2 Engine Generator for AGL：1	1
1-2-1	Precision Approach Lighting System (PALS)	Belgium	Lighting Fixture (Inset Type)： 68 Lighting Fixture (Elevated Type)：68 Isolating Transformer 300W：68 Isolating Transformer 150W：68 Constant Current Regulator：2	1
1-2-2	Runway Threshold Lights (RTHL)	Belgium	Lighting Fixture (Inset Type)：20 Lighting Fixture (Elevated Type)：2 Isolating Transformer 200W：20 Isolating Transformer 150W：2	1
1-2-3	AGL Panel	Belgium	AGL Control & Monitoring Panel：1 No AGL Control Panel ：1 No	1
1-2-4	Cable	Belgium	AGL Power Cable（1st order）:7,000m AGL Power Cable（2nd order）:7,900m AGL Control Cable：4,500m	1
1-2-5	Engine Generator for ILS	Belgium	Engine Generator (Outdoor Type)：(10kVA)	1
1-2-6	Engine Generator for AGL	Belgium	Engine Generator (Outdoor Type)：(100kVA)	1
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2-2	Pit Scale (10 feet)	Japan	Scale Range: 15,000kg Indication: Minimum 5.0kg Size(L×W)：Minimum 3,000×2,700mm Usage: for ULD on Dolly. Certificate Record required.	1
2-3	Engine Powered Forklift Track (15ton)	Japan	Based on ITA (Industrial Truck Association, USA), FEM (European Federation of Materials Handling, EU), JIVA (Japan Industrial Vehicles Association, Japan) and so on as Manufacture's Origin. Handling Capacity: up to 15,000kg Power：Diesel Engine powered Length of Folk：minimum 2,600mm	1
2-4	Battery Powered Ramp Equipment Tractor	Germany	Based on IATA AHM 968 Refer to AHM 910, 913, 915, 916, 918 Towing/ Stopping capacity: up to 49 tons.	4
2-5	Lower Deck Container Turntable Dolly	Netherland	Based on IATA AHM 965 Refer to AHM 909, 910, 911, 913, 916 Roller platform height: 508mm (20 in) (top of rollers) from ground.	8
2-6	Pallet Dolly	Japan	Based on IATA AHM 966 Refer to AHM 909, 910, 911, 913, 916 Side Towing required. Roller platform height: 508mm(20 in) (top of rollers) from ground.	16
2-7	Baggage/Cargo Cart	Netherland	Based on IATA AHM 963 Refer to AHM 910, 913, 916 Load capacity: 1,500kg(3,300 lb) Height of platform: max 60cm (24 in) from ground.	4

No.	Name	Country of procurement/product	Specification	No.s
2-8	Platform Scale (1 ton)	Japan	Scale Range: 1,000kg Usage: for export baggage. Certificate Record required. Battery operated indicator required.	1
2-9	Platform Scale (500kg)	Japan	Scale Range: 500kg Usage: for export baggage. Certificate Record required. Battery powered Indicator required.	1
2-10	Battery Powered Forklift Track (1.5ton)	Japan	Based on ITA (Industrial Truck Association, USA), FEM (European Federation of Materials Handling, EU), JIVA (Japan Industrial Vehicles Association, Japan) and so on as Manufacture's Origin. Handling Capacity: up to 1,500kg Power：Battery(Electrically powered) Length of Folk：1,220mm(nominal) High Must Type required.	4
2-11	Battery Powered Forklift Track (2.5ton)	Japan	Based on ITA (Industrial Truck Association, USA), FEM (European Federation of Materials Handling, EU), JIVA (Japan Industrial Vehicles Association, Japan) and so on as Manufacture's Origin. Handling Capacity: up to 2,500kg Power：Battery(Electrically powered) Length of Folk：Minimum 2,000mm	8
2-12	Battery Powered Reach Forklift Track (1.5ton)	Japan	Based on ITA (Industrial Truck Association, USA), FEM (European Federation of Materials Handling, EU), JIVA(Japan Industrial Vehicles Association, Japan) and so on as Manufacture's Origin. Handling Capacity: up to 1,500kg Power：Battery(Electrically powered) Length of Folk：1,220mm(nominal) High Must Type required.	1
2-13	Manual Pallet Jack (1.5ton)	Germany	Based on ITA (Industrial Truck Association, USA), FEM (European Federation of Materials Handling, EU), JIVA (Japan Industrial Vehicles Association, Japan) and so on as Manufacture's Origin. Handling Capacity: up to 1,500kg Power：no power system required. Length of Folk：minimum 1,219mm(48in) Width of Folk: 685mm(27in)	2
2-14	Nesting rack	Japan	Floorboard and Guard bar (detachable) required Load Capacity: Up to 1,000 kg External Dimensions (W×L×H, Reference): 1,570×1,200×1,400mm Internal Dimensions (W×L×H, Reference): 1,450×1,150×1,200mm	112
2-15	Nesting rack for cold storage	Japan	Floorboard and Guard bar (detachable) required Load Capacity: Up to 1,000 kg External Dimensions (W×L×H, Reference):1,820×1,200×1,550mm Internal Dimensions (W×L×H, Reference): 1,550×1,150×1,500mm	28
2-16	Plastic Pallet	Turkey	Refer to AHM912 as Folk Lift Pocket. One Side Pallet required. Load Capacity (dynamic): 1,000 kg Load Capacity (static): 2,000 kg	50
2-17	Roll Box Pallet	Japan	Folding Type required. 4 casters (fixed×free with lock×2) required. Steel Floor Board required. Load Capacity: Maximum 500 kg External Dimensions (W×D×H, Reference): 1,100×800×1,700mm	5

No.	Name	Country of procurement/product	Specification	No.s
			Internal Dimensions (W×D×H, Reference): 1,040×745×1,457mm	
2-18	Working Table	Japan	Polyester Upper Board (or equivalent) required. Load Capacity (reference): 250～500 kg Dimensions (W×L×H, reference): 1,800×900×740mm With caster type required.	1
2-19	Safety Belt	Japan	Main unit：1 Safety block：1	8
2-20	Working Stand	Japan	Floor Size(W×D, reference) : 550mm×1400mm Floor Height: adjustable from 550 to 900mm Load Capacity: minimum150kg 4 Castor with Lock required Safety Guard required except forward.	2
2-21	ULD Container Rack	Japan	Over all Lack Size W×D×H, Maximum): ,000×2,000×4,000mm Storage Container size: (LD3:1,930×1,400×1,550),(LD6:4,020×1,600×1,430) Total storage No(sample): LD3×20、or LD6×10. Each compartment store LD3×２、or LD6×1. Total storage weight (Maximum): 2,000 kg	1
2-22	ULD Pallet Rack	Japan	Over all Lack Size(W×D×H, reference): 3,800×2,350×3,300mm Storage for ULD Pallet (125×96in) On the order of total storage: 40 Pallets Total storage weight (Maximum): 4,000 kg	2
2-23	Battery Powered Aerial Work Platform	U.K.	Minimum Basket Floor Height: up to 13.5m (nominal) Minimum Capacity: Minimum 200kg Power：Battery powered. Wheel Type required. On Board Charger required.	1

Source：JICA study team

2-2-3 Outline Design Drawing

(1) Air Navigation Safety Equipment

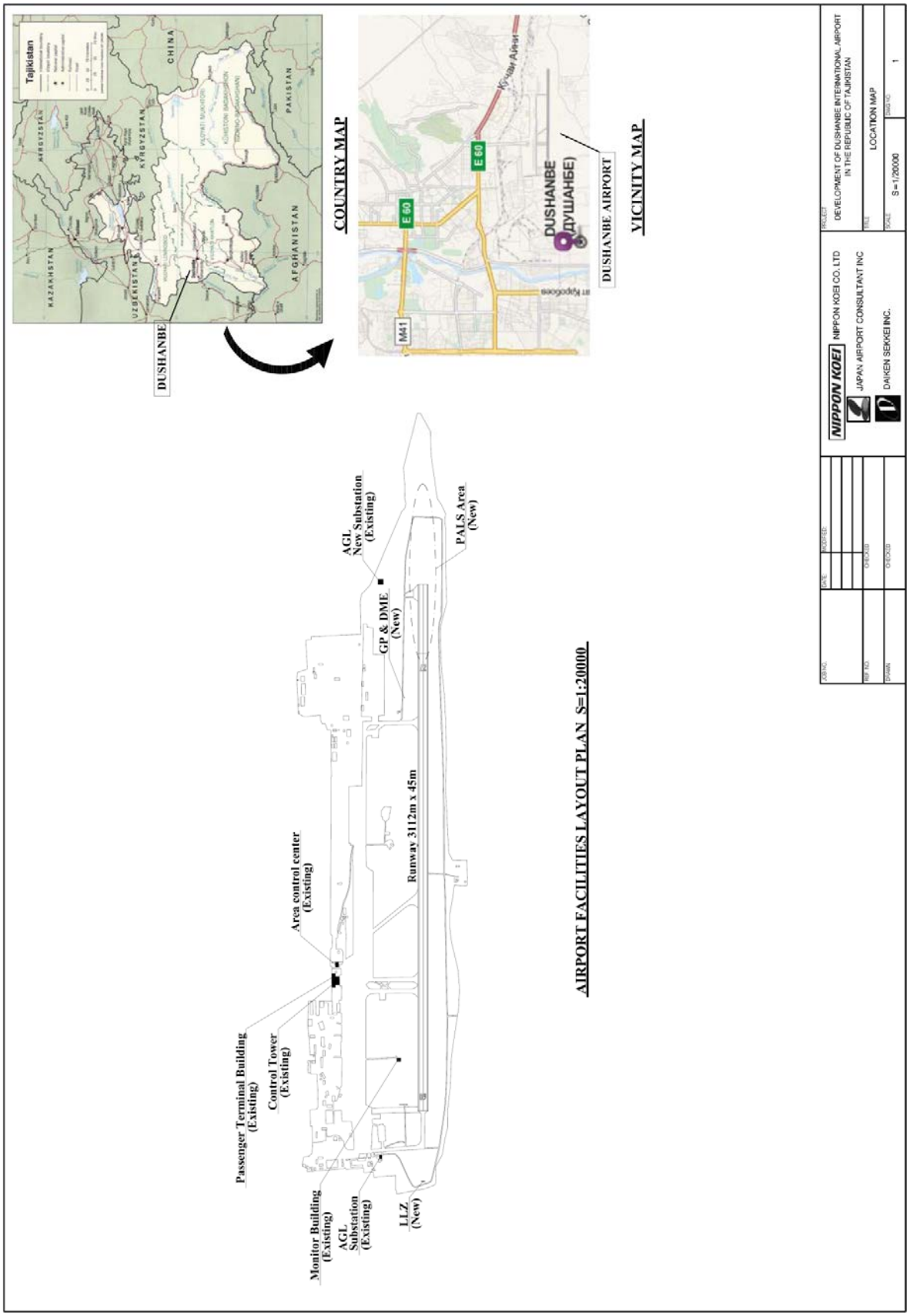
The design drawings of air navigation safety equipment are as shown in Table 2-2.26, and Figure 2-2.22 to Figure 2-2.35.

Table 2-2.26 Design drawings of Air Navigation Safety Equipment

No.	Sheet Contents
1	Location Map
2	ILS Schematic Diagram
3	LLZ Facility Layout Plan
4	LLZ Equipment Layout Plan
5	LLZ Antenna Layout Plan
6	GP and DME Facilities Layout Plan
7	GP and DME Equipment Layout Plan
8	GP and DME Antenna Layout Plan
9	RCSU and RMMS Equipment Layout Plan
10	ILS Status Monitor and AGL Panel Layout Plan

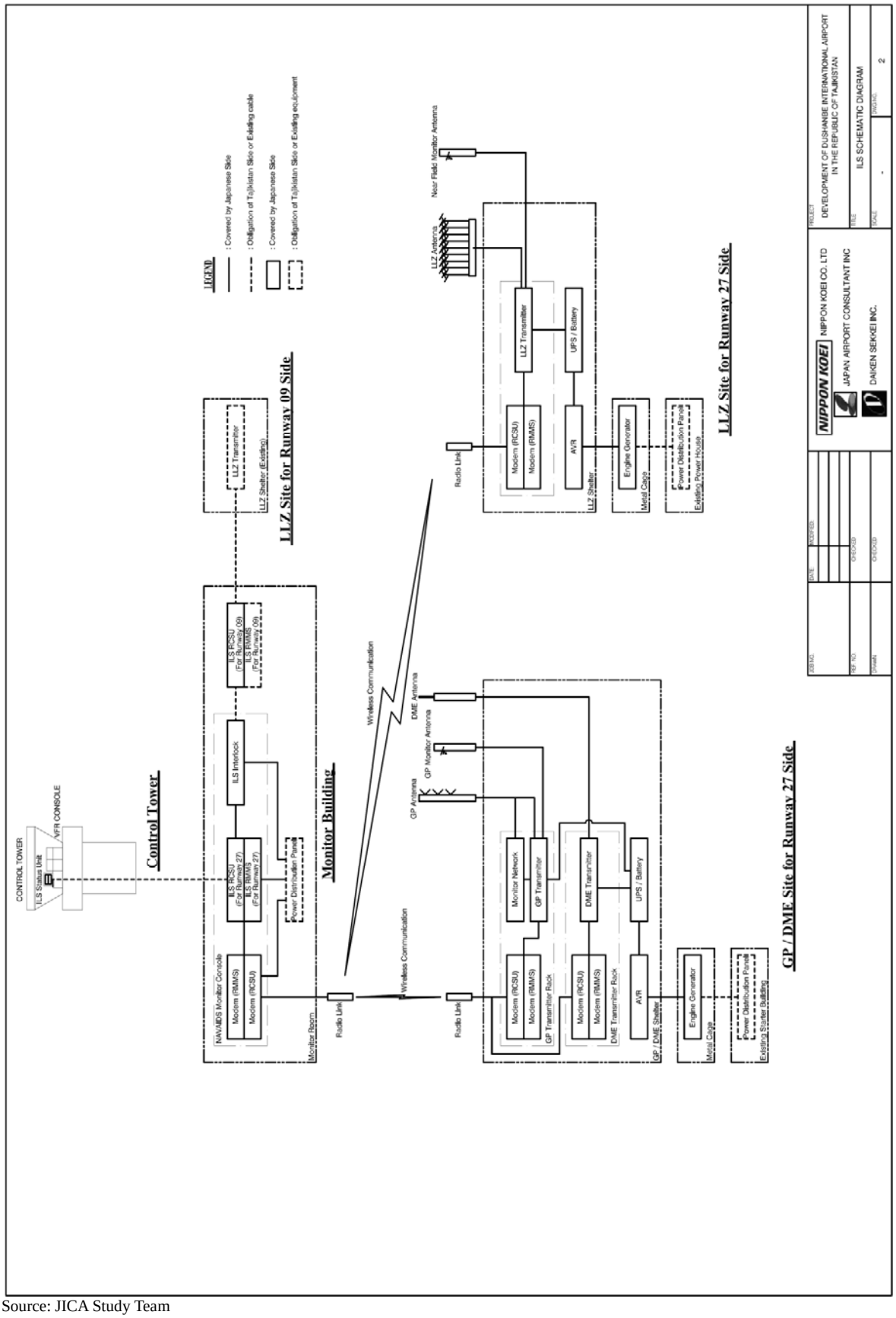
No.	Sheet Contents
11	PALS and RTHL Facilities Layout Plan
12	PALS and RTHL System Schematic Diagram
13	PALS and RTHL Wiring Diagram
14	Cable Duct Layout Plan

Source: JICA Study Team



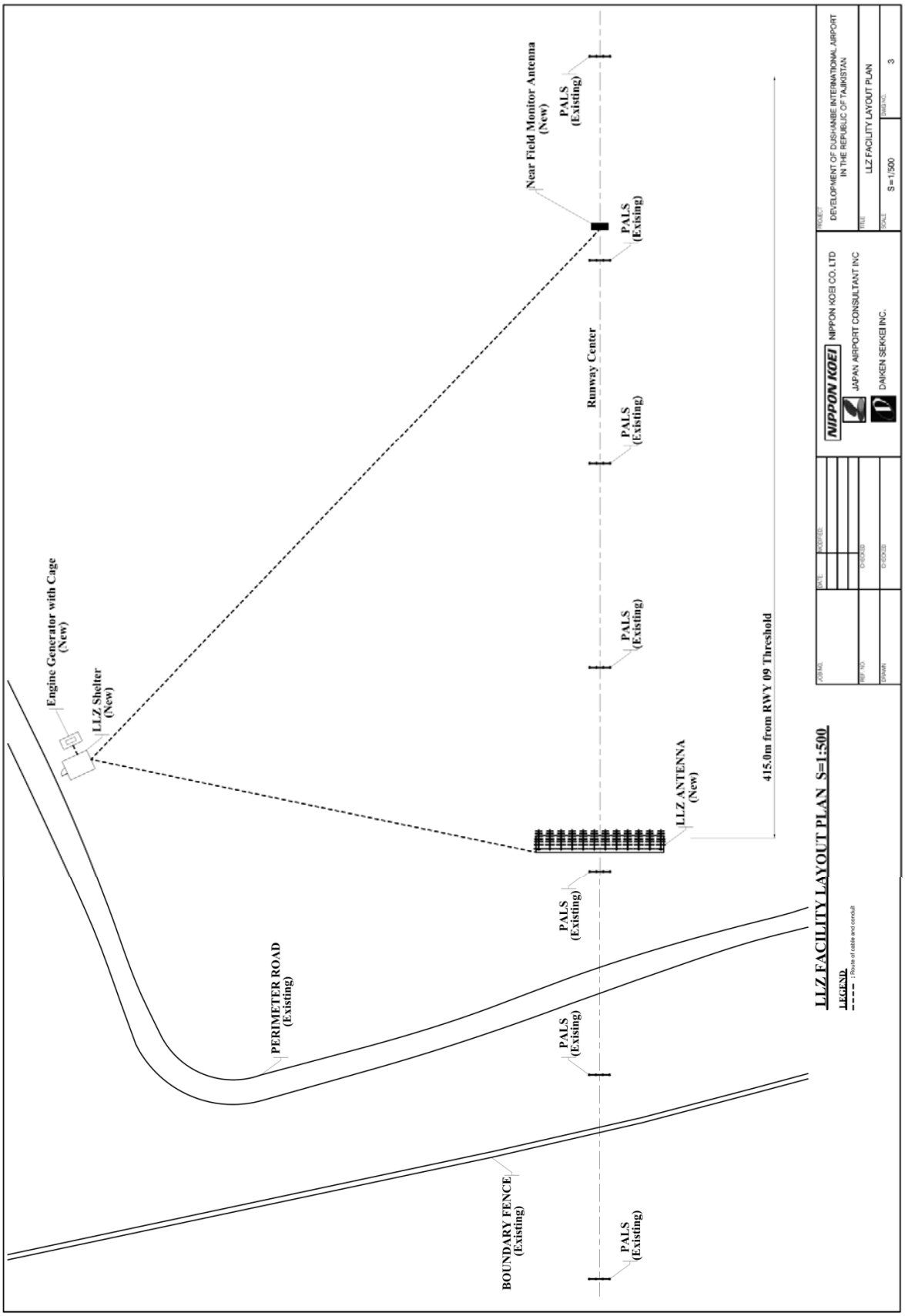
Source: JICA Study Team

Figure 2-2.22 Location Map



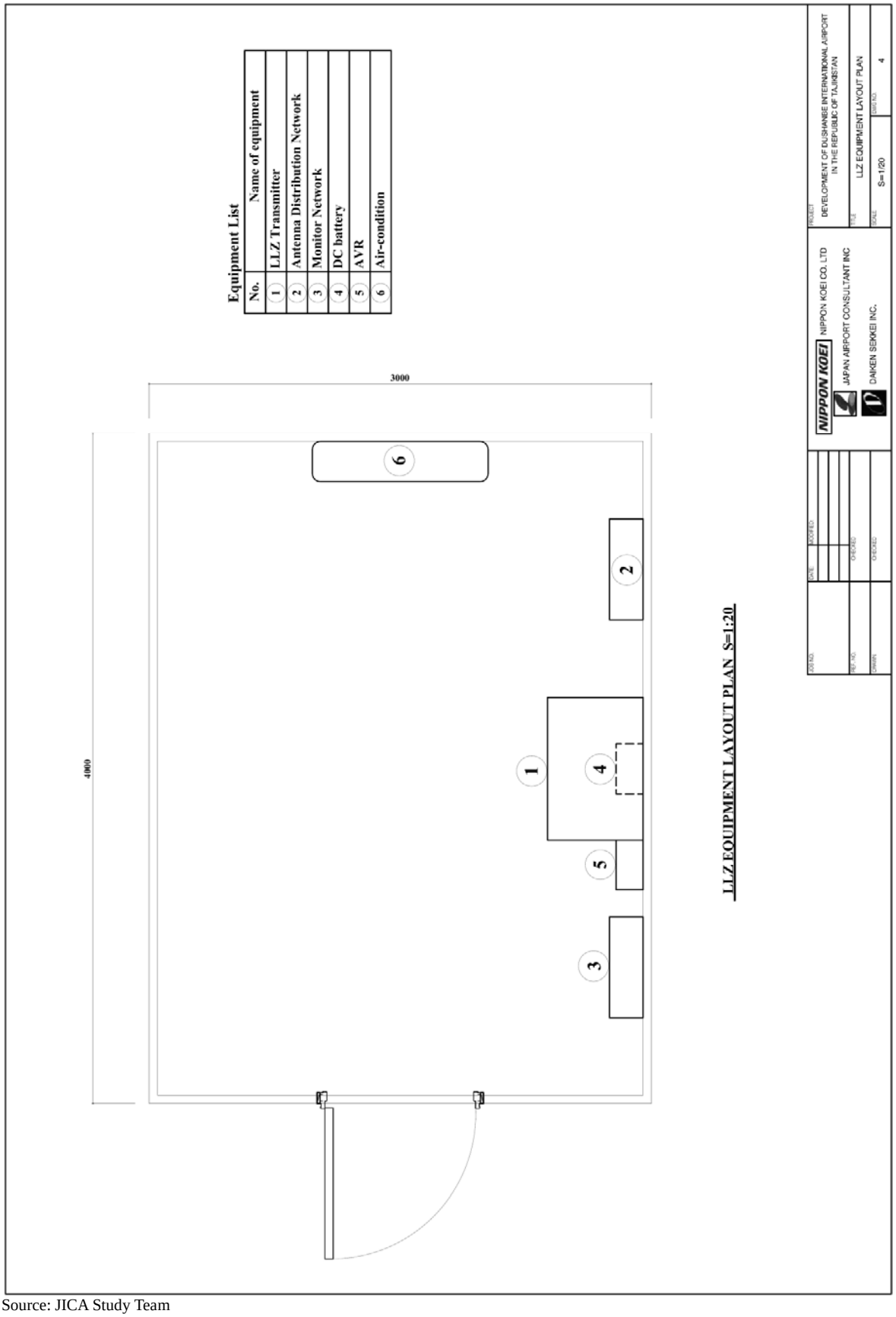
Source: JICA Study Team

Figure 2-2.23 ILS Schematic Diagram



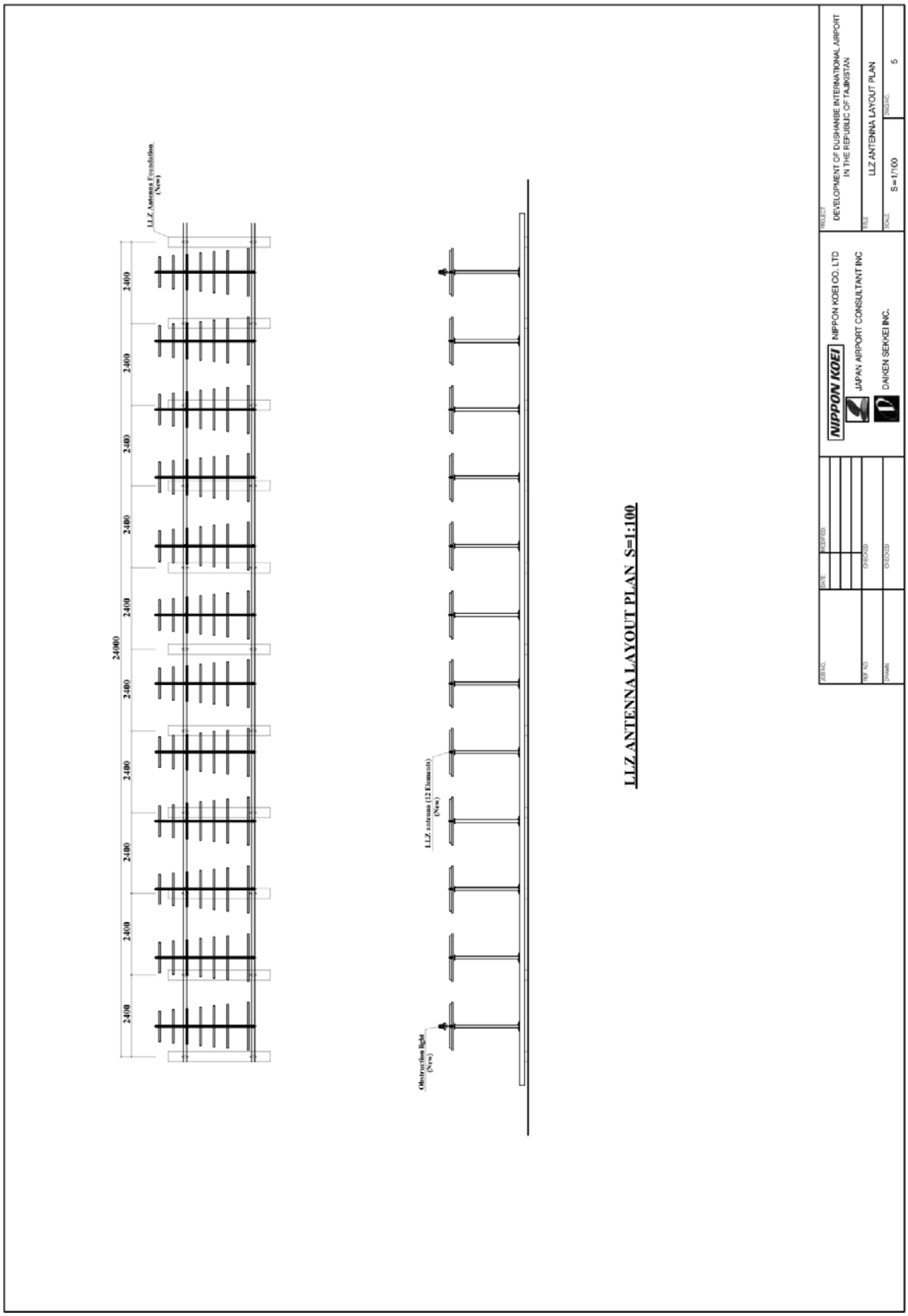
Source: JICA Study Team

Figure 2-2.24 LLZ Facility Layout Plan



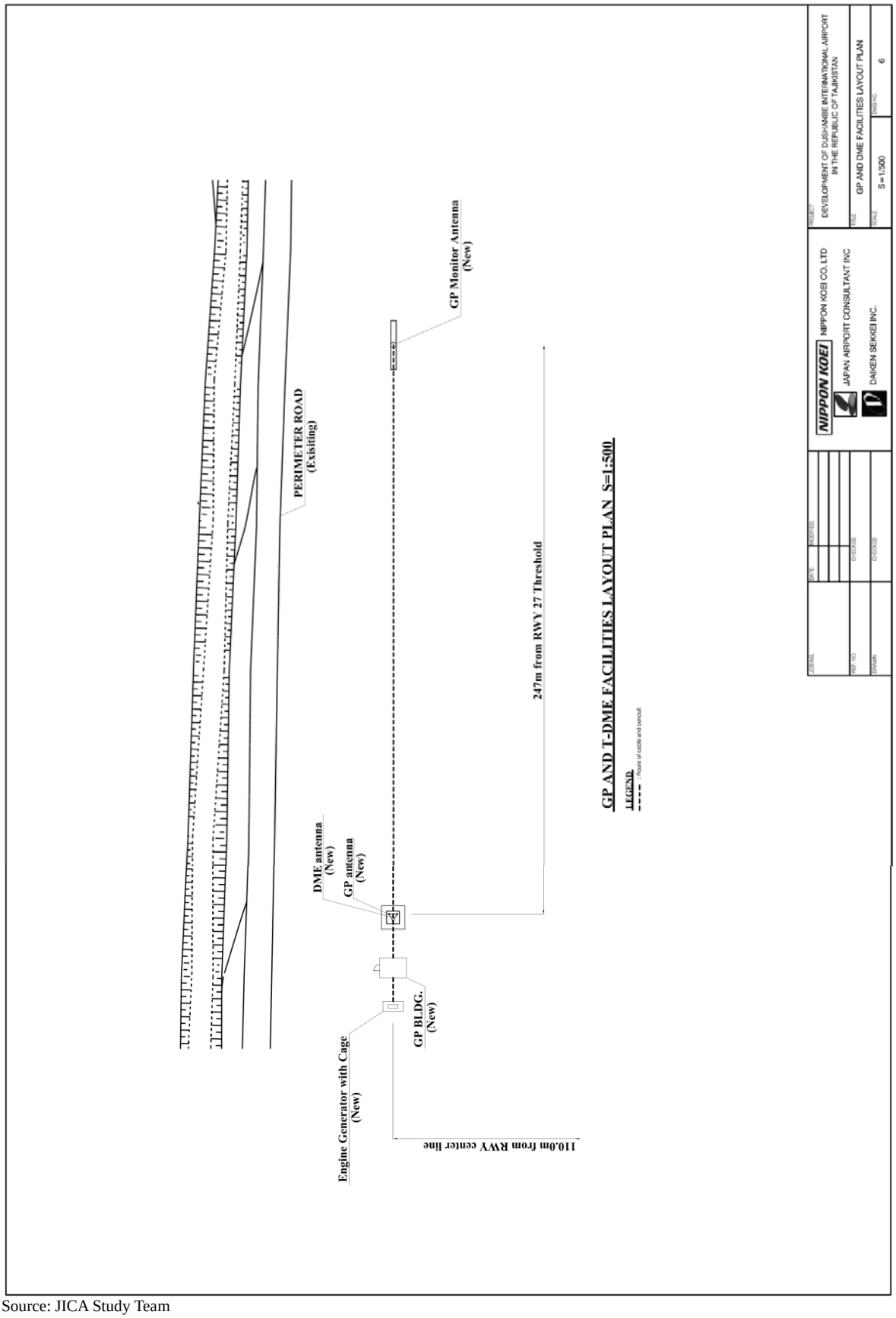
Source: JICA Study Team

Figure 2-2.25 LLZ Equipment Layout Plan



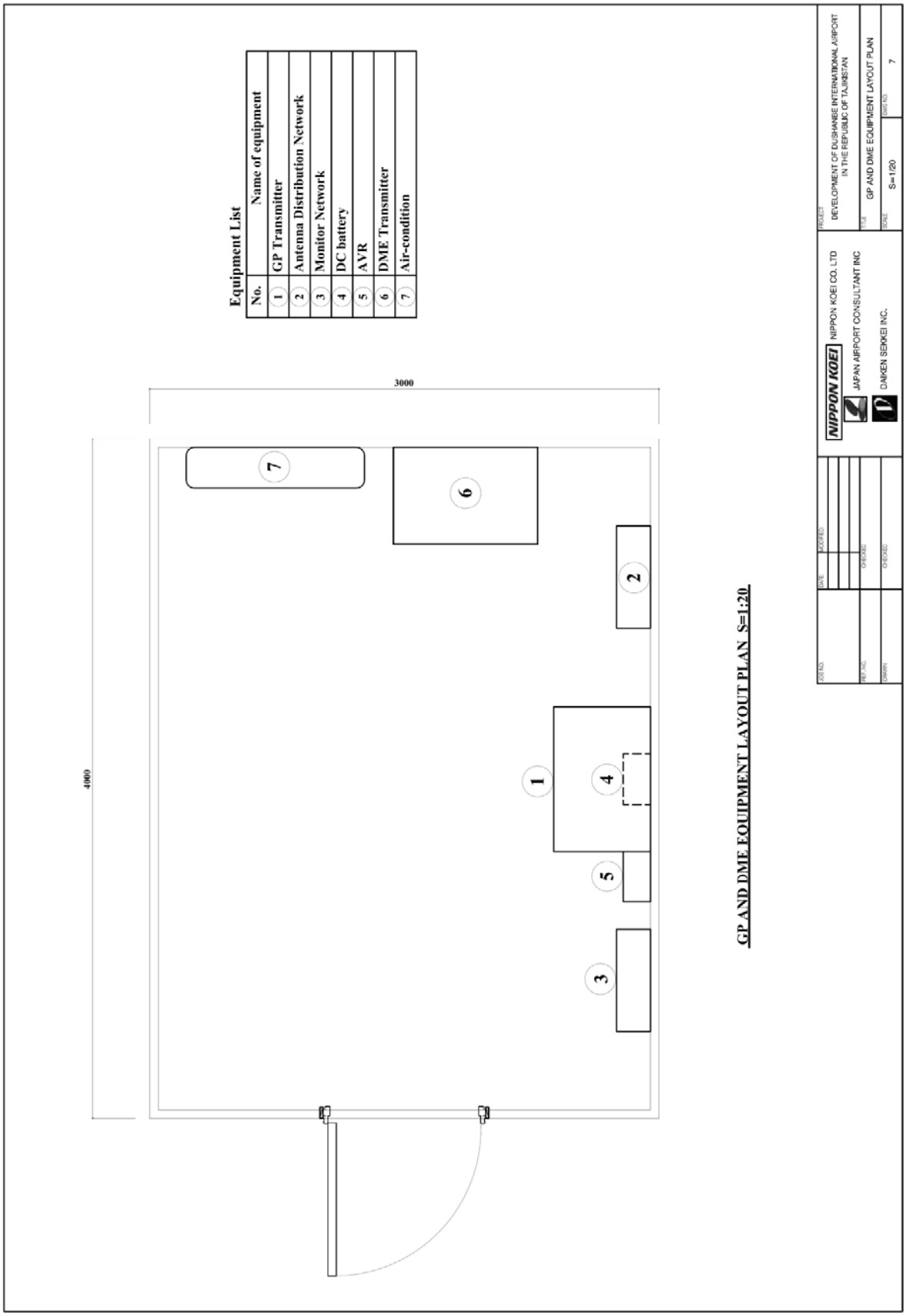
Source: JICA Study Team

Figure 2-2.26 LLZ Antenna Layout Plan



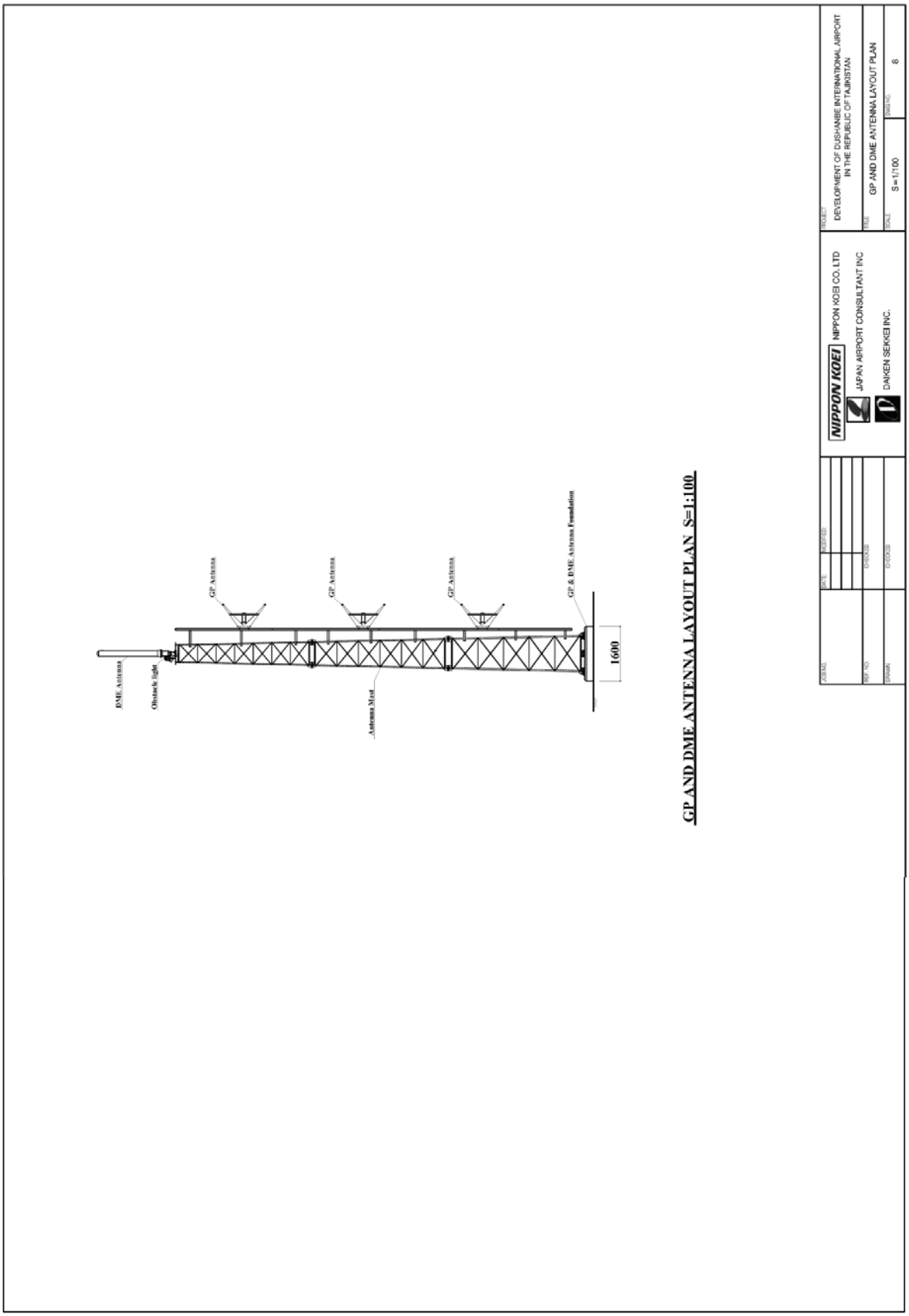
Source: JICA Study Team

Figure 2-2.27 GP and DME Facilities Layout Plan



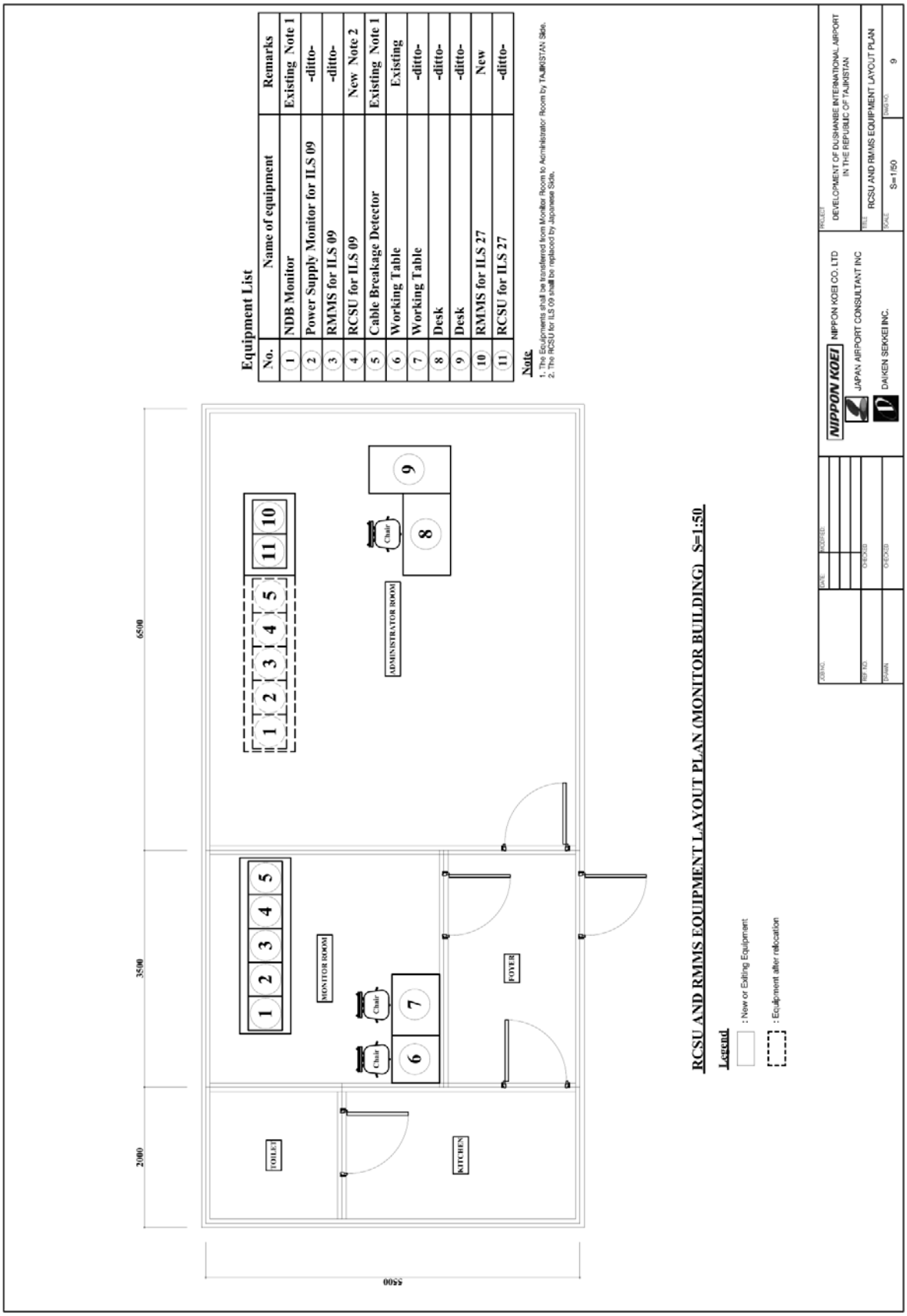
Source: JICA Study Team

Figure 2-2.28 GP and DME Equipment Layout Plan



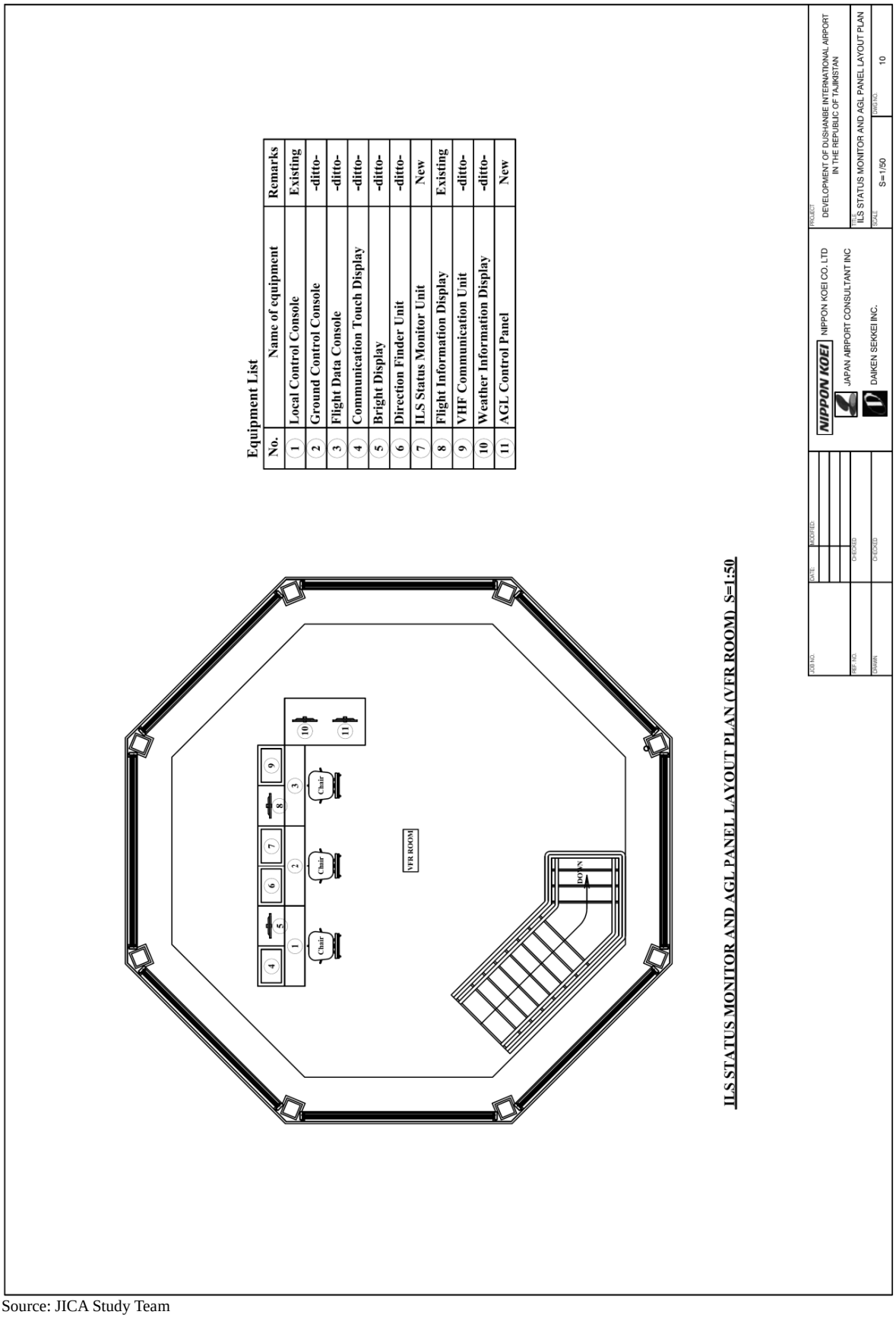
Source: JICA Study Team

Figure 2-2.29 GP and DME Antenna Layout Plan



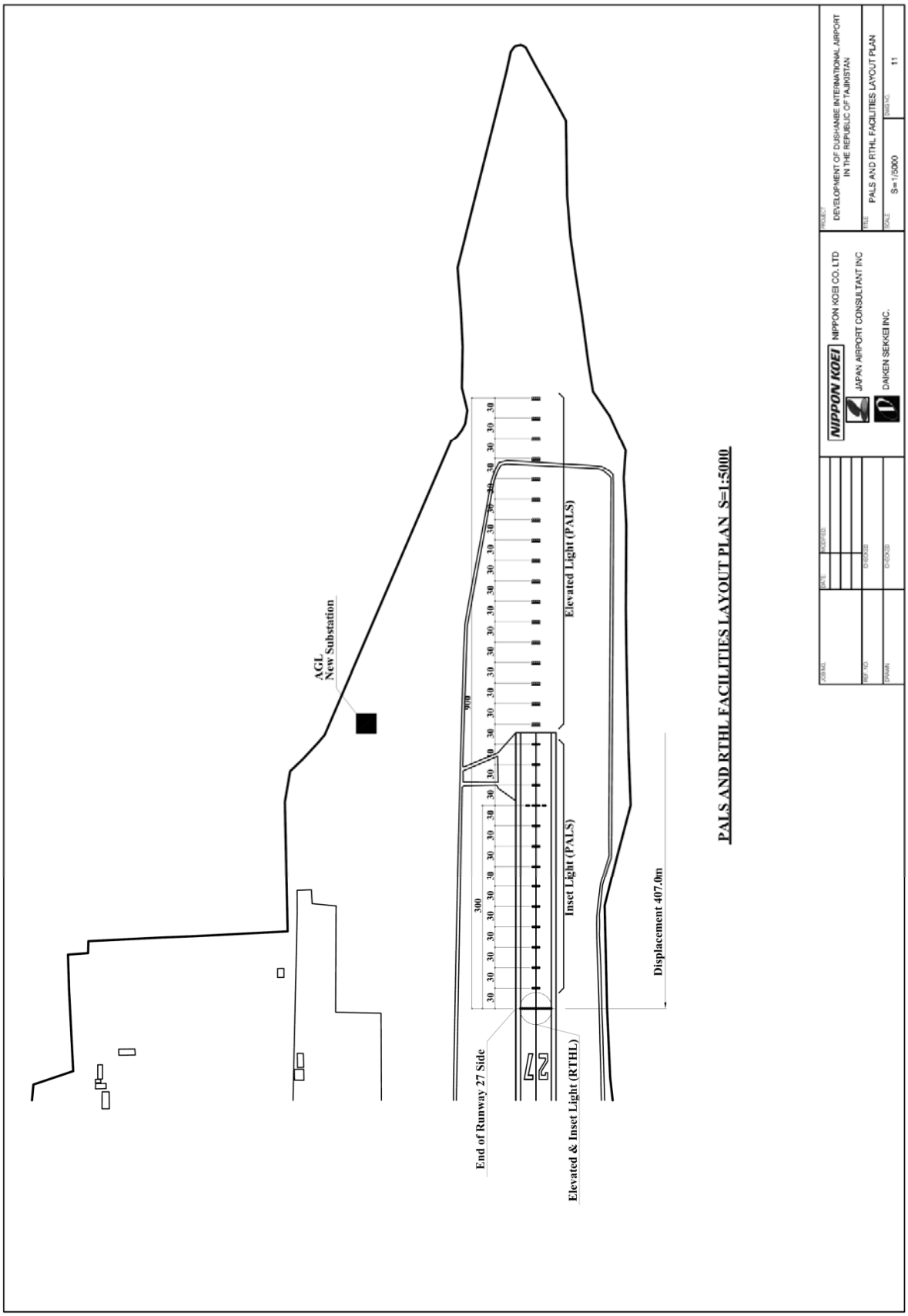
Source: JICA Study Team

Figure 2-2.30 RCSU and RMMS Equipment Layout Plan



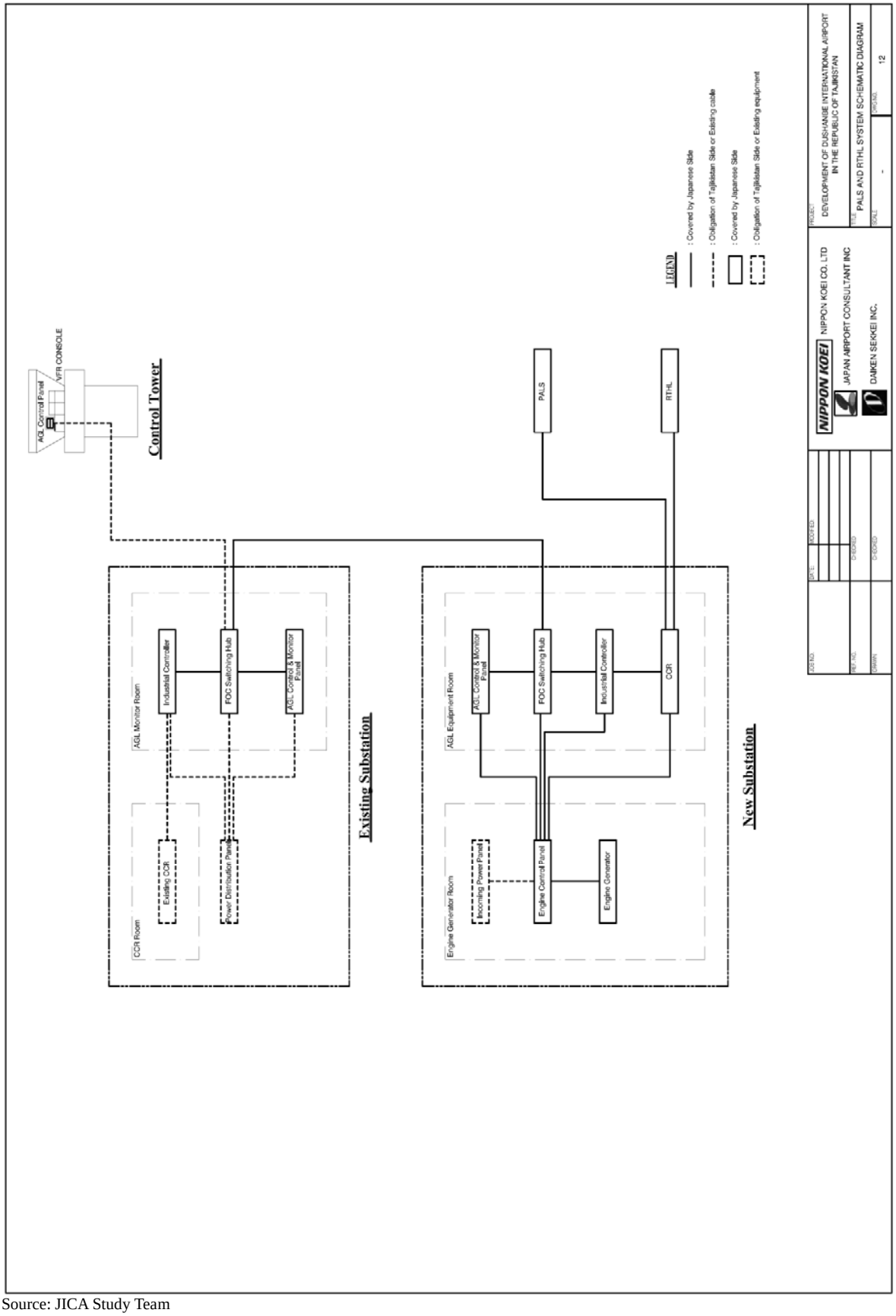
Source: JICA Study Team

Figure 2-2.31 ILS Status Monitor and AGL Panel Layout Plan



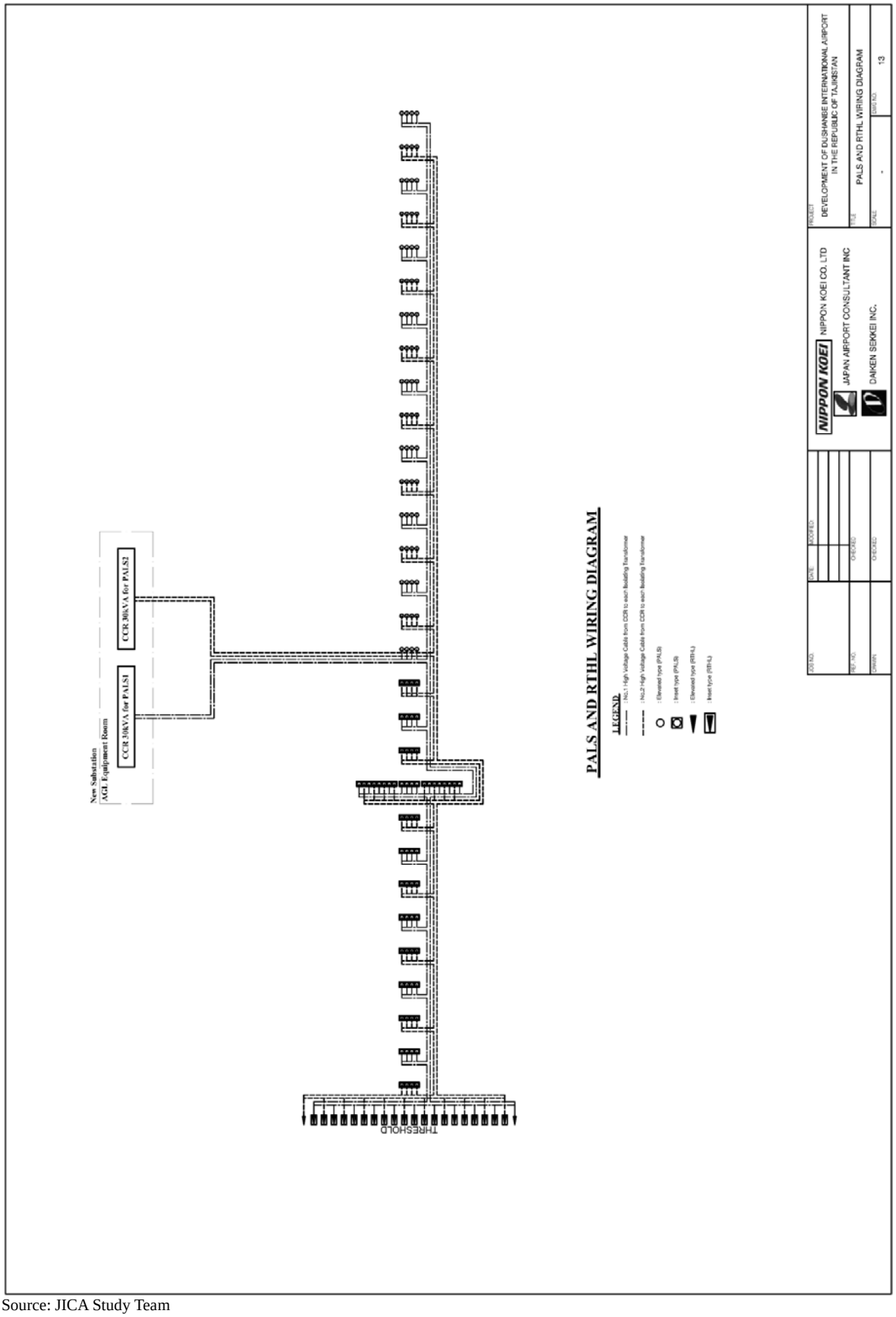
Source: JICA Study Team

Figure 2-2.32 PALS and RTHL Facilities Layout Plan



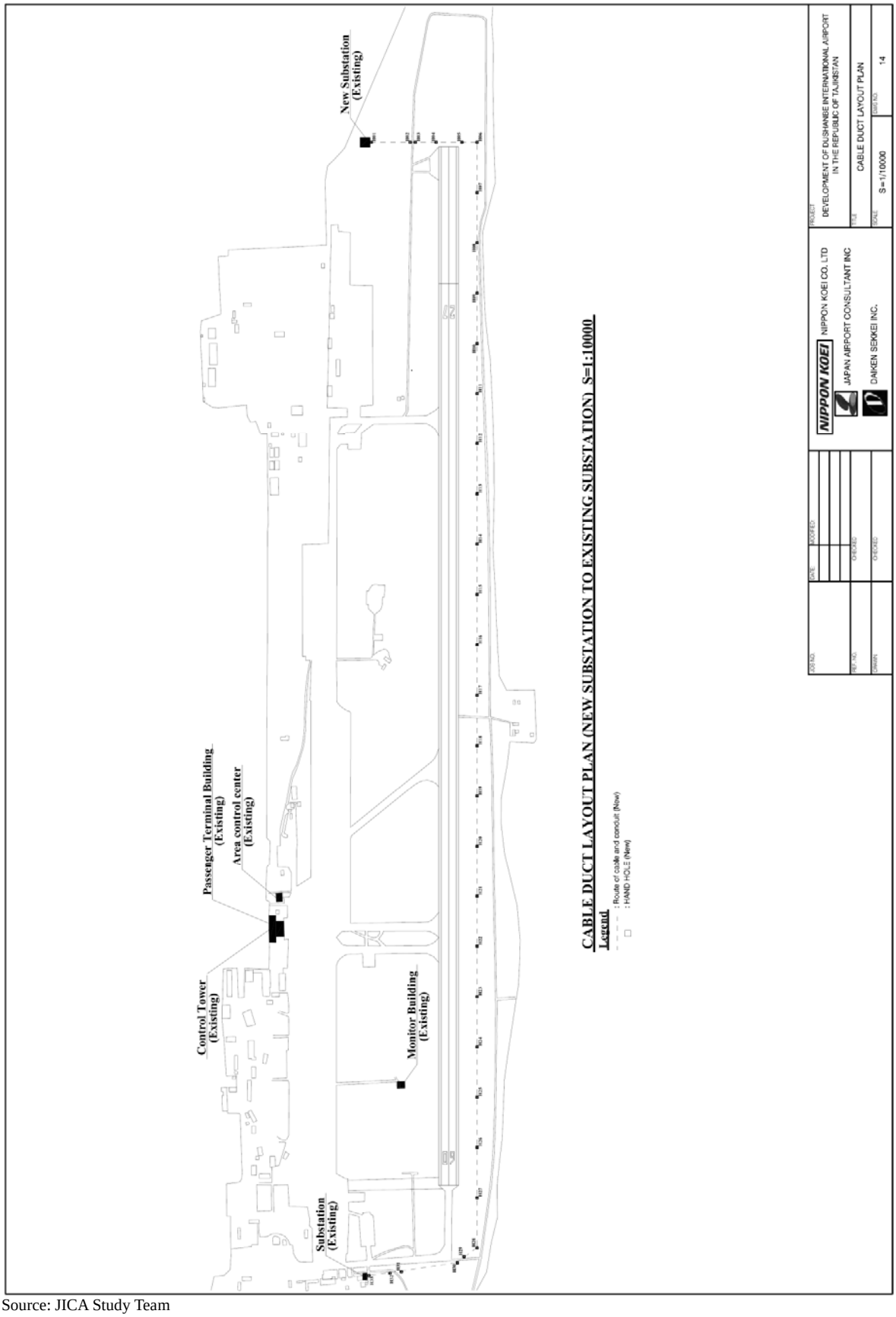
Source: JICA Study Team

Figure 2-2.33 PALS and RTHL System Schematic Diagram



Source: JICA Study Team

Figure 2-2.34 ALS and RTHL Wiring Diagram



Source: JICA Study Team

Figure 2-2.35 Cable Duct Layout Plan

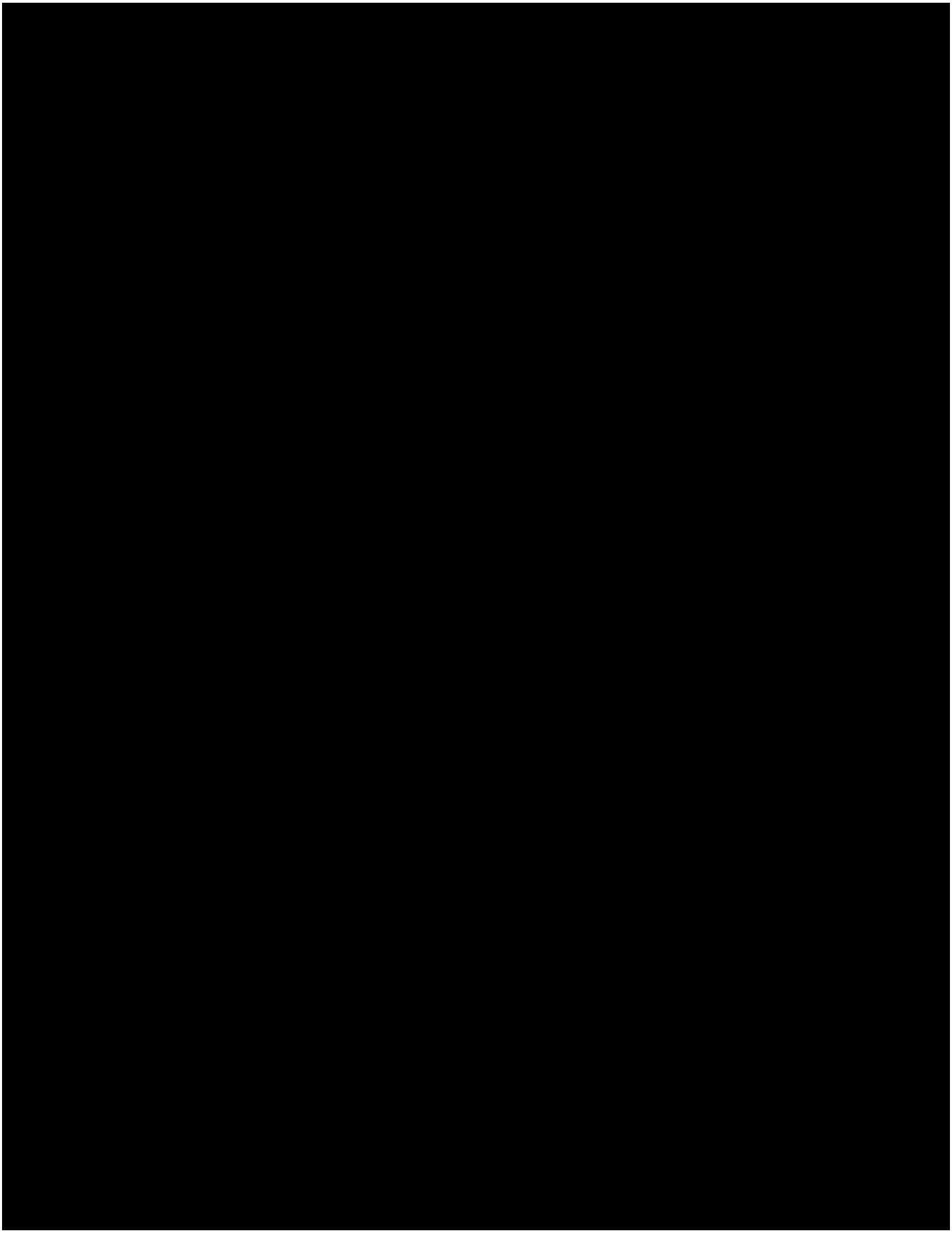
(2) International Cargo Building

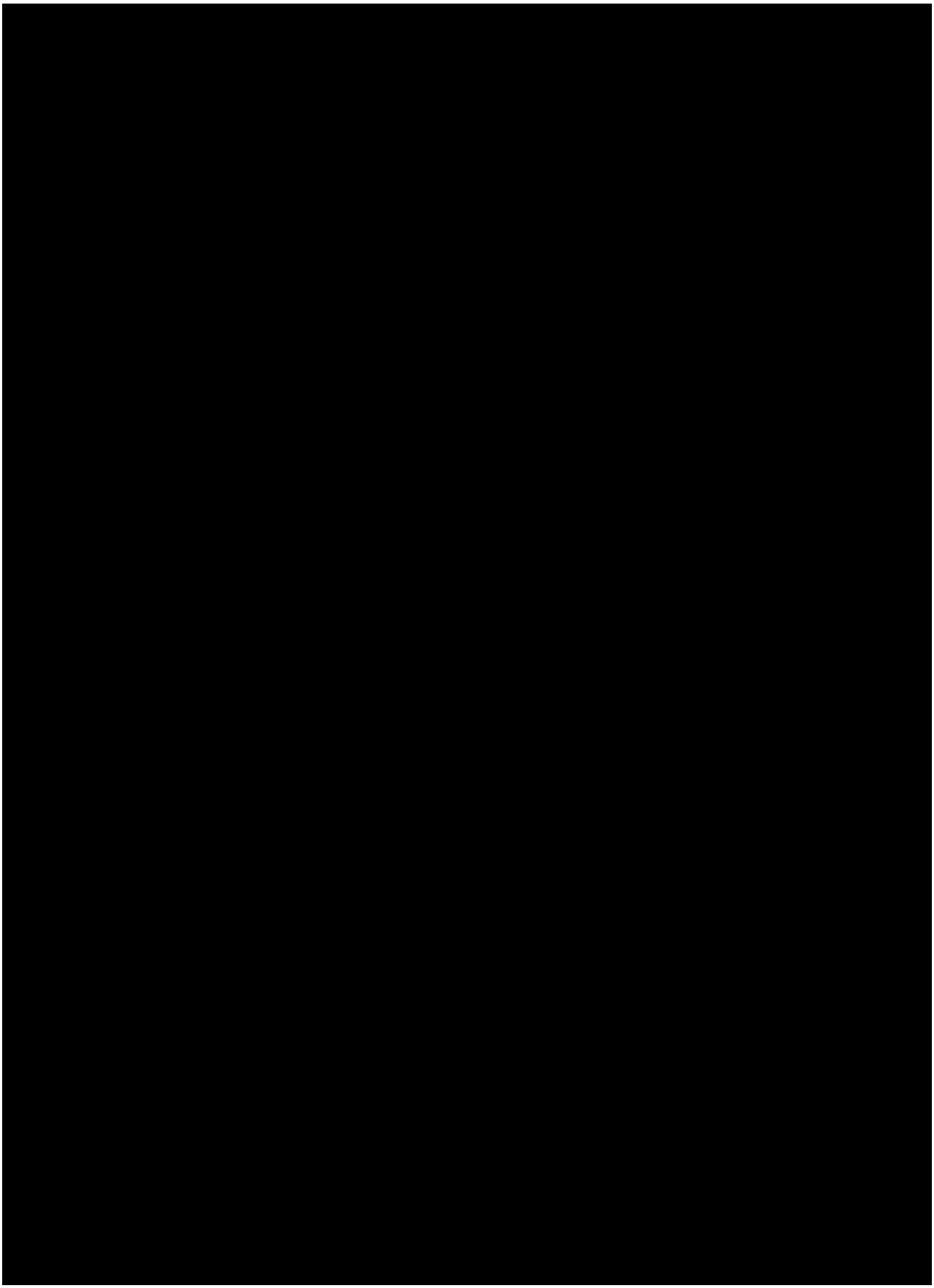
Design drawings of the international cargo terminal are as shown in Table 2-2.27.

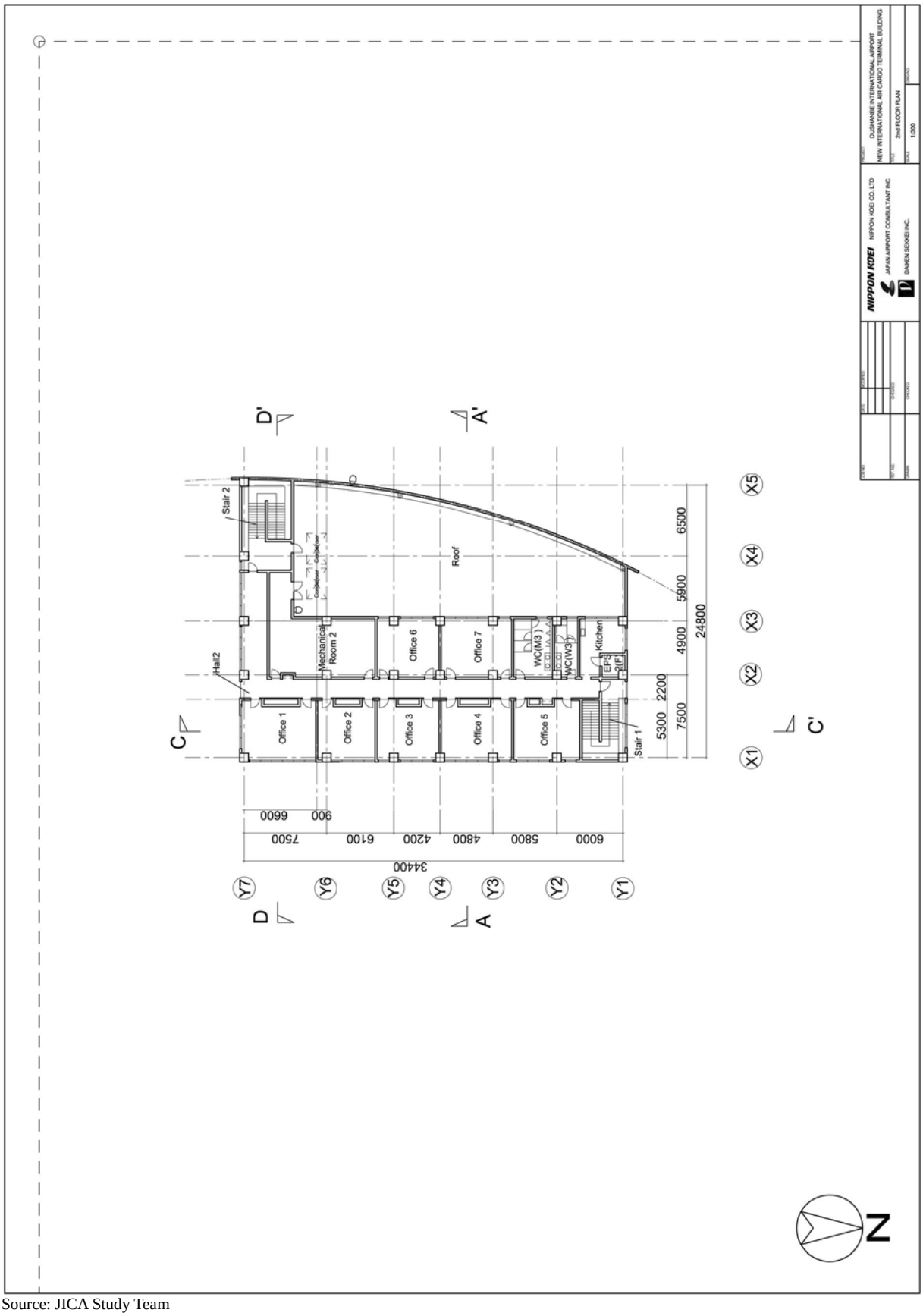
Table 2-2.27 Design drawings of International Cargo Terminal

No.	Title
1	Site Layout Plan
2	1st Floor Plan
3	2nd Floor Plan
4	Roof Plan
5	Elevation (North and East)
6	Elevation (South and West)
7	Section 1
8	Section 2

Source: JICA Study Team

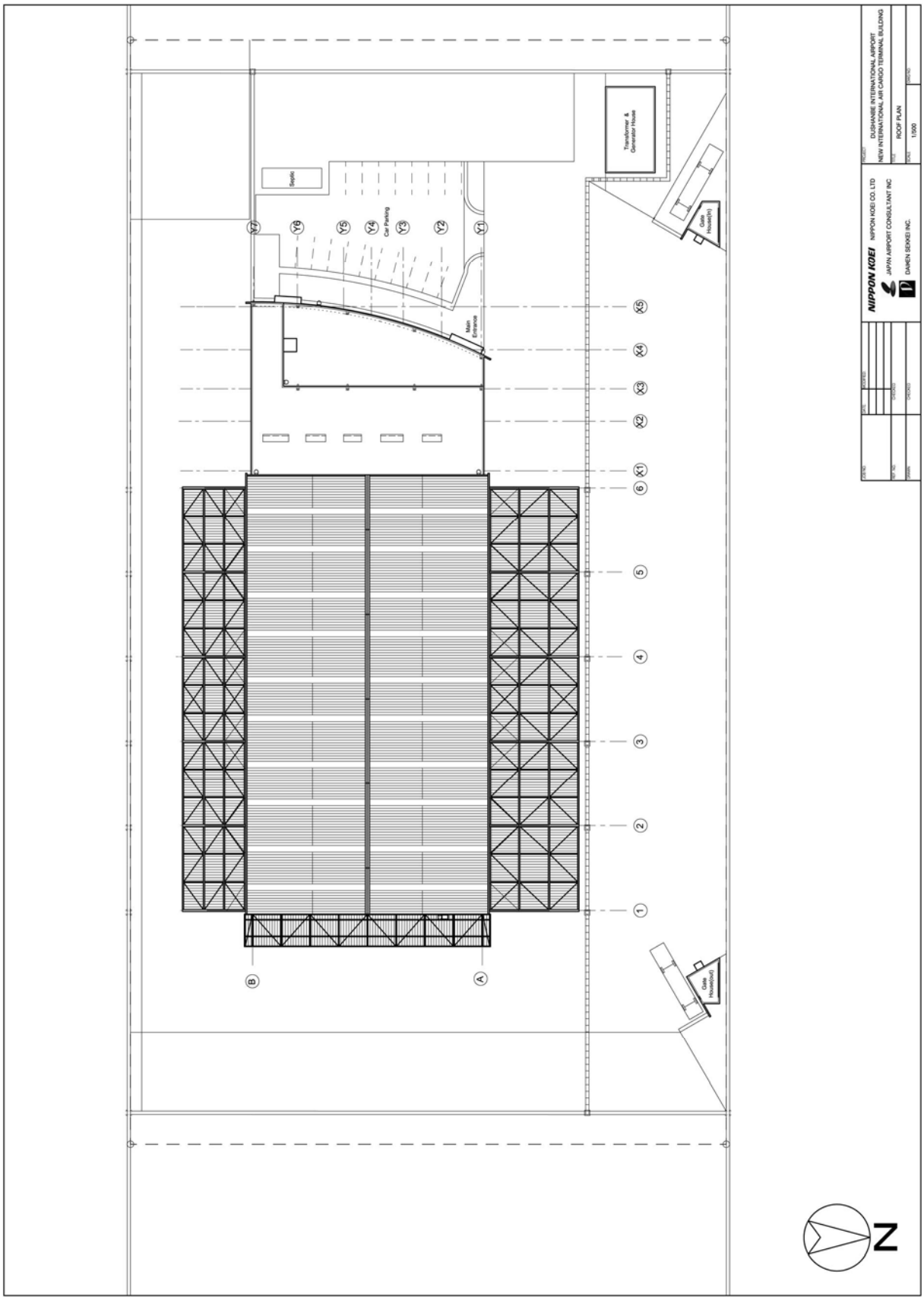






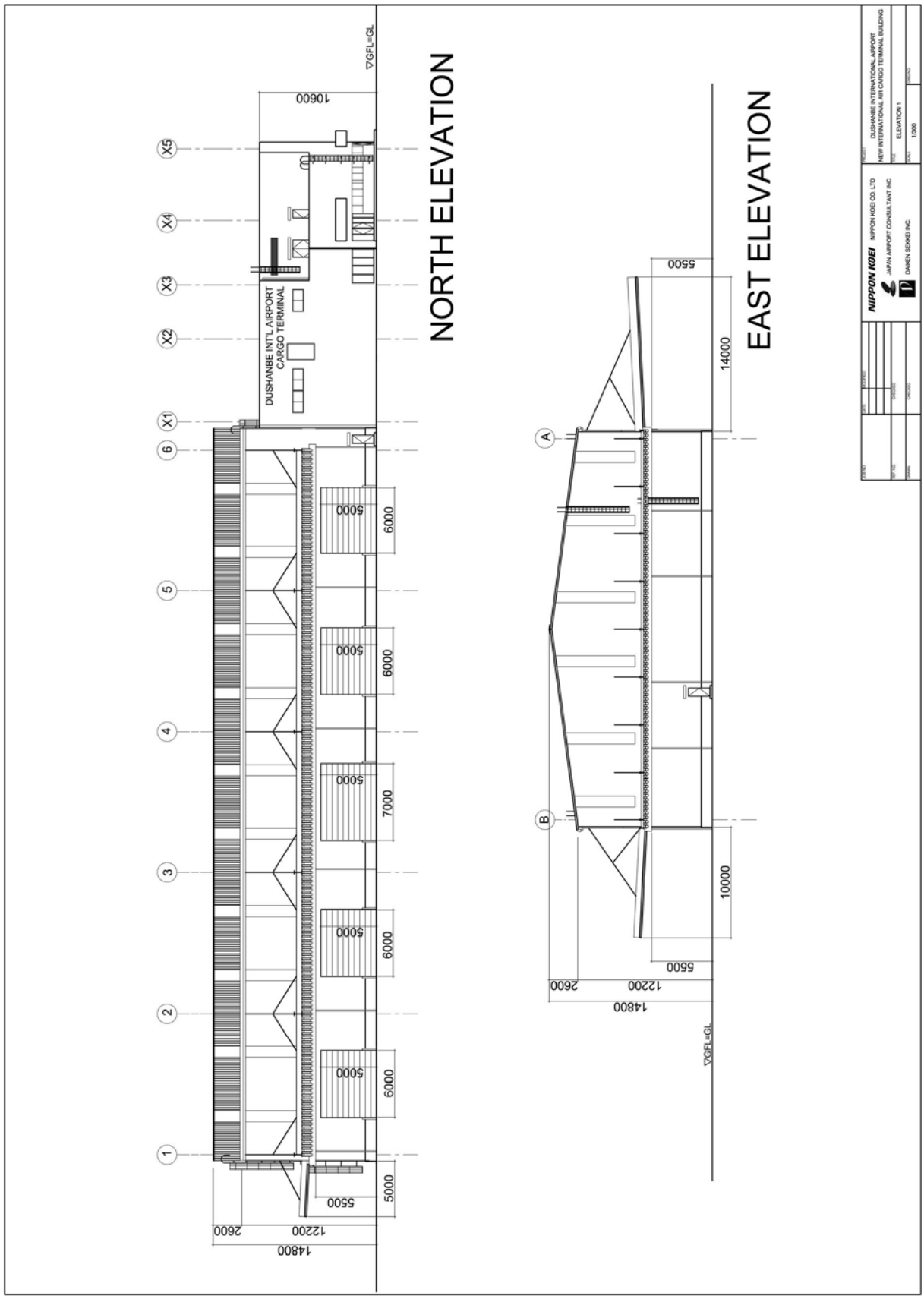
Source: JICA Study Team

Figure 2-2.38 2nd Floor Plan



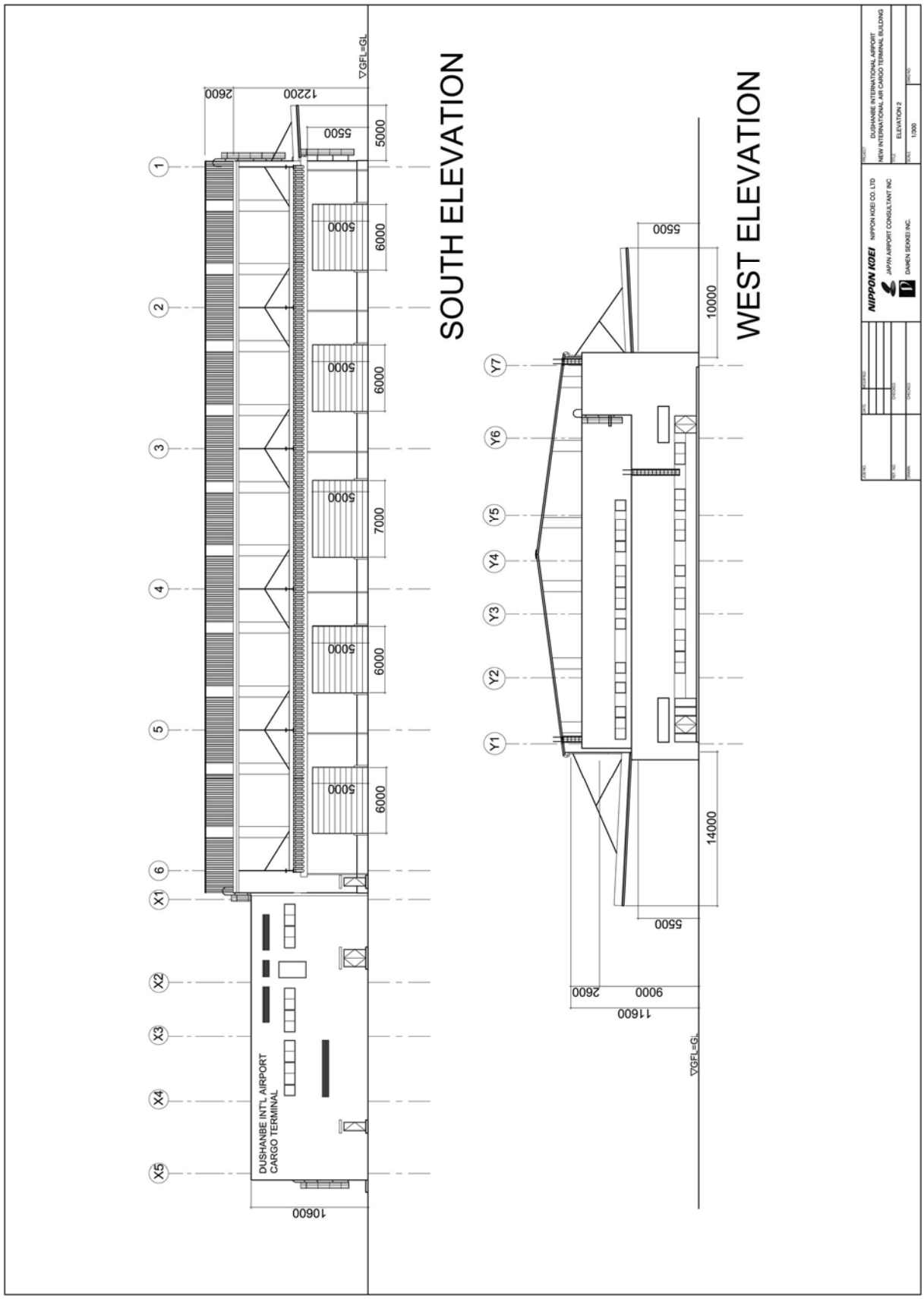
Source: JICA Study Team

Figure 2-2.39 Roof Plan



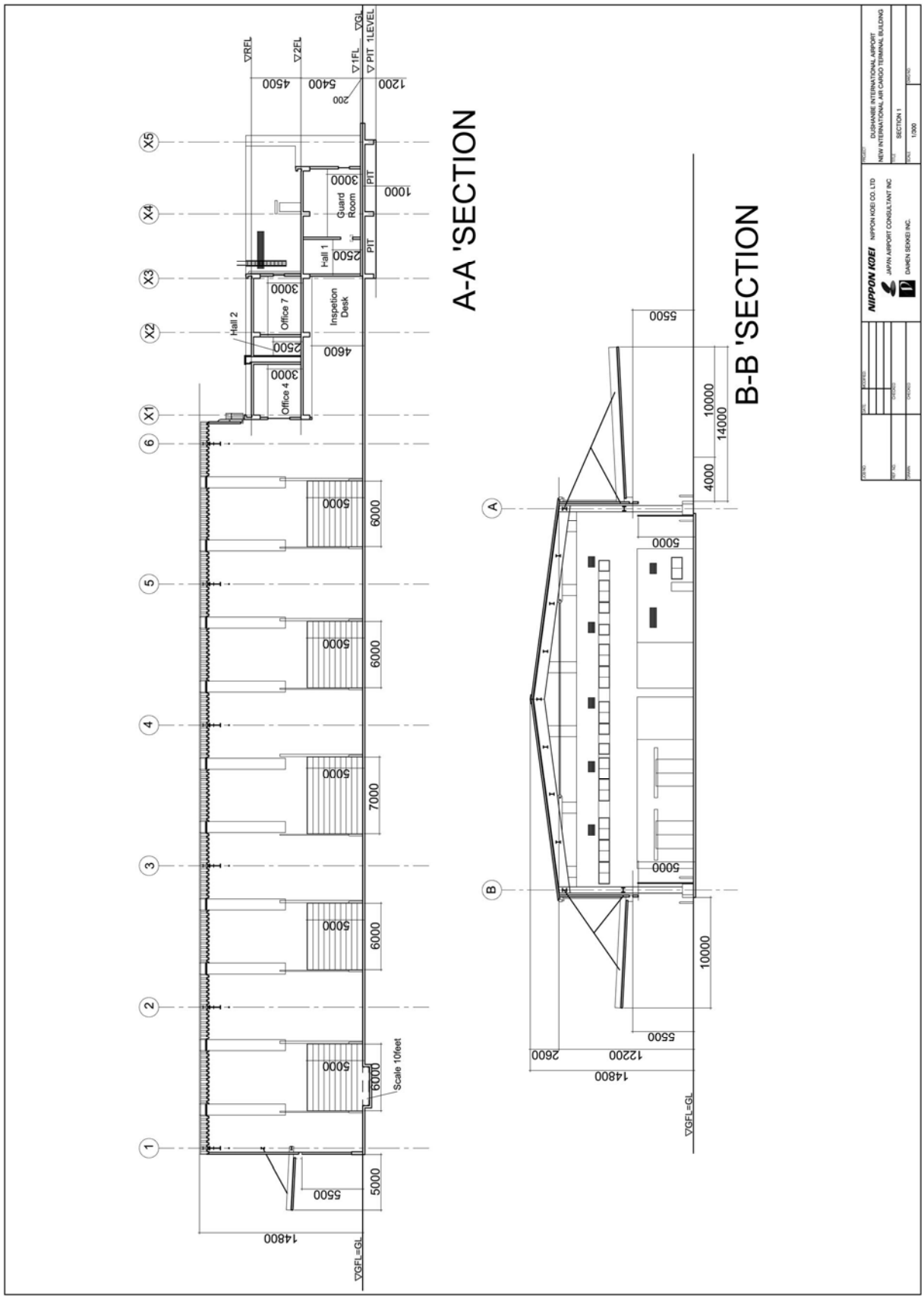
Source: JICA Study Team

Figure 2-2.40 Elevation (South and West)



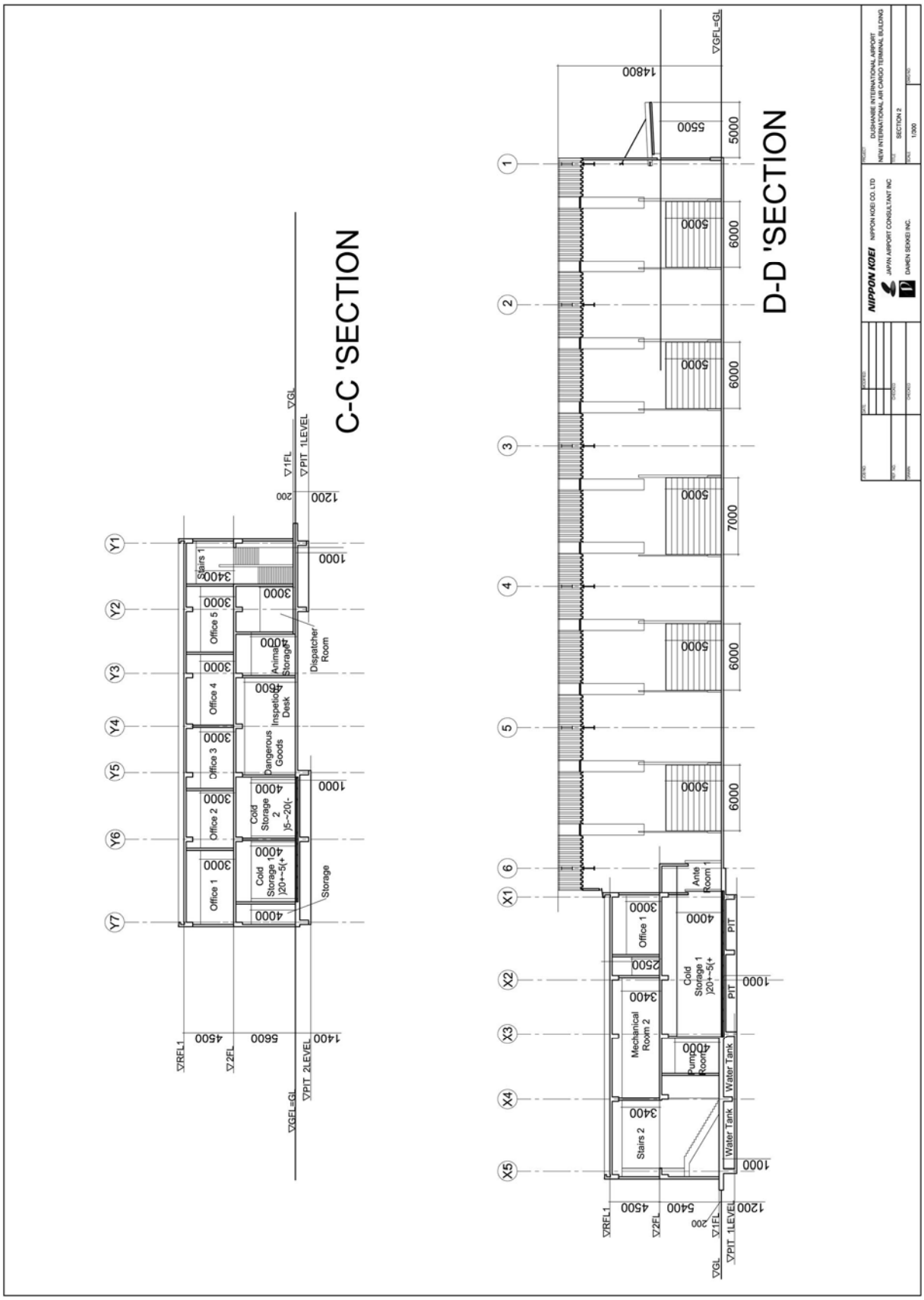
Source: JICA Study Team

Figure 2-2.41 Elevation (South and West)



Source: JICA Study Team

Figure 2-2.42 Section 1



Source: JICA Study Team

Figure 2-2.43 Section 2

2-2-4 Implementation Plan

(1) Implementation Policy

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between GOJ and Tajikistan to make a pledge for assistance, which is followed by the conclusion of the Grant Agreement (hereinafter referred to as "the G/A") between JICA and Tajikistan to define the necessary articles to implement the Project, such as payment conditions, responsibility of Tajikistan, and procurement conditions. After the signing of the G/A, Tajikistan will conclude a consulting services agreement for the Project with the. consultant in Japan which conducted the Survey, and the consultant will start the detailed design and preparation of tender documents for the Project. Upon completion of tender documents, tender procedure will take place for selection of a construction contractor and an equipment supplier, who are Japanese juridical persons.

The respective contractors will execute construction of facilities and procurement and installation of equipment.

The Agreement with the consultant and the contracts with the construction contractor and the equipment supplier shall be verified by JICA in order to fulfill accountability to Japanese taxpayers.

After the construction is commenced, supervising organization is set up among Tajikistan implementation agency, consultant, contractor and Equipment supplier.

1) Implementation Organization

The responsible organization of Tajikistan for the Project is DIA, who will be a signatory of agreement and contracts. DIA, who is going to make use of the facilities/equipment, will be in charge of overall coordination of the Project.

2) Consultant

After the signing of the E/N and the G/A, DIA will conclude a consulting services agreement for detailed design and supervision of the Project with a consultant in Japan and obtain verification of JICA in accordance with Japan's Grand Aid Scheme. The consultant will prepare detailed design documents and tender documents based on the Preparatory Survey Report (hereinafter referred to as "the Report"), and obtain consent of DIA

In implementing tenders and construction works, the consultant is to assist tendering procedure of facilities and to supervise the construction works based on the tender documents. Also in the equipment works, the consultant is to assist tendering procedure and supervise procurement, installation and operation training works based on the tender documents

(a) Detail design

The services are to design facilities in detail and to review equipment plan based on the Report, and prepare tender documents including drawings, specifications, instructions to renderers and draft contracts for construction works and equipment works.

(b) Assistance of Tendering

The services are to assist tendering by the implementing agency to select a construction contractor and an equipment supplier and conclude the contracts, and to assist reporting the result to the DIA and JICA

(c) Supervision

The services are to confirm whether or not the construction contractor and the equipment supplier are carrying out their respective works in accordance with the provision of the relevant contracts, respectively, and to ensure that the contracted obligations are properly fulfilled. In addition, the consultant is to give the construction contractor and the equipment supplier instructions and advices and to coordinate their works for smooth implementation of the Project from the stand point of fairness. Details of supervision services are as follows,

- ✈ Examining and confirming implementation plan, shop drawings, specifications of equipment and the other relevant documents submitted by the contractor and the supplier.
- ✈ Examining and confirming construction materials and quality and performance of the equipment delivered
- ✈ Examining building equipment and other equipment for delivery, ' installation and instruction for operation.
- ✈ Observing the progress of the construction works and the equipment works
- ✈ Inspecting the completed facilities and the installed equipment

In addition to the services mentioned above, the consultant is to report the progress of the Project, procedure of payment, handover after completion, etc. to the relevant agencies of Tajikistan and JICA.

3) The Construction Contractor and the Equipment Supplier

The construction contractor and the equipment supplier are to be selected by the open tender intended for Japanese firms. DIA will conclude a construction works contract and the equipment works contract separately with the lowest renderer, as a general rule of the Japan's Grand Aid Scheme.

The construction contractor and the equipment supplier are to construct facilities, procure and install equipment and provide operation training of equipment to the Tajikistan side in accordance with each contract.

4) JICA

JICA provides necessary services for execution of the Project as the implementing agency of Government of Japan for the Grant Aid in accordance with the Japan's Grant Aid Scheme.

5) Local Construction Companies

It is assumed that Local leading construction companies have acceptable capability and manpower, and are expected to work on the Project as subcontractors of the Japanese construction company

- ✈ Not to disturb airport operation during construction execution.
- ✈ In Tajikistan, there is no specific contractor capable of installing air navigation safety equipment; hence, appropriate engineers/specialists from the equipment manufacturer in Japan or from a third country should be dispatched to carry out equipment installation, adjustment, testing as well as OJT for equipment operations.
- ✈ Engineers/specialists dispatched from the equipment manufacturers should utilize and supervise local communication work subcontractors for wiring and fixing equipment so that the local economy would be fostered, employment opportunities enhanced, and technology transferred.
- ✈ Basic working time is to be form 8to17.Except the case when delay is expected by rain etc, no night work is planned in schedule.

6) Procurement Plan

- ✈ The contractor for the Project is to be selected through a competitive bidding procedure among qualified Japanese companies. The bidder that will submit the lowest priced bid will in principle be selected as the successful bidder, and after negotiations, the contract for the Project is to be concluded between the selected bidder and the Tajikistan side.
- ✈ The equipment under the Project will not be manufactured in Tajikistan and therefore only Japanese products should be procured in principle. However in case procurement of Japanese products is not practicable, procurement from a third country may be considered.
- ✈ The contractor for the Project shall supply, transport and install the equipment and provide training for equipment operation as well as repair and maintenance to the personnel of the Tajikistan side in accordance with the contract. The contractor shall also ensure that the equipment manufacturers and local agents would be able to supply spare parts and consumables necessary for continuous operation of the equipment after completion of the Project. The contractor shall also ensure that the obligation of the contractor during the warranty period of the Project will be fulfilled and the maintenance and repair services after completion of the Project should be available.

(2) Implementation Conditions

1) Construction condition

Tajikistan's construction industry is still developing stage. Number of skilled worker is less compare to usual labors. The companies which are organized as general contractor are few in Tajikistan. But some large construction firm from Turkish or China exists in Tajikistan.

Domestic workers are concentrated in Dushanbe. The workers or skilled workers who are not hired in Tajikistan tend to be emigrant worker of Russia, Turkish or Middle East.

2) Considerations for construction

(a) Schedule control

It has 560mm rain per year and in winter season; temperature is below zero in winter season in Dushanbe. But construction is possible, since those rain or snow may not disturb the construction.

(b) Safety control

The site is in the airport area where passenger may come in. There is no residence nearby. But security check is required. During construction, entrance control shall be discussed with DIA. The construction schedule shall have commonly with DIA not to disturb airport operations.

(c) Compliance with Labor Law

The contractor shall ensure compliance with the labor law and other relevant laws and regulations upon employment of local laborers, and should observe appropriate working conditions and local customs so that any disputes are avoided and a safe working environment can be maintained.

(d) Convenient Access for Contractor's Personnel and Vehicles to the Site

Convenient access for the contractor's personnel and vehicles to the site should be ensured. The contractor's personnel who should have access to the site should always hold their appropriate identification (ID) issued by DIA, and the contractor's equipment should be identified by adhesive labels with the logo of Japanese ODA.

3) Consideration for Equipment Procurement

It is extremely important to transfer the appropriate methods of equipment operation as well as repair and maintenance services to the relevant personnel of the executing agencies so that the equipment can be properly and continuously operated and safety and security conditions of the airport can be enhanced. Accordingly, the contractor should appoint qualified engineers for the equipment installation who will provide training for the equipment operation, repair and maintenance, and testing to the operation/maintenance personnel of the executing agencies. The qualified engineers from the contractor should ensure that the operation/maintenance personnel have achieved an appropriate level of understanding thereof.

4) Points of Concern to the Construction

Followings are the points of concern to the project execution.

(a) Respect Labor Law

To ensure the safety and to prevent a labor dispute, when a contractor hires labors, he shall respect Labor Law of Tajikistan, adequate work condition or customs.

(b) Work staff and Vehicle's Right to Access to the Construction Site.

To ensure the work staff's and materials access during the construction, make work staff possessed ID card issued by the DIA and stick an ODA symbol on the work vehicles.

5) Consideration for Procurement

It is very important to give recipients instructions about the equipment handling and maintenance. Nominate experienced installation engineers and give enough time to explain operation such as operation technique, minor repairing or checking. Recipients' understanding shall be confirmed carefully when engineer gives instructions.

(3) Scope of Works

1) Scope of Works

Table 2-2.28 shows the demarcation of the Project scope between the Japanese side and Tajik side on procurement and installation under the Project.

Table 2-2.28 Demarcation of the Scope of Works

Japanese scope	Tajikistan's scope
1. Construction of International Cargo terminal Building	1) Provide construction site 2) Removal of concrete debris in the site 3) Construction of access way which connect the public road to the site road 4) Bear of the commission fee for architectural design expertise. 5) Provide rain water disposal point. 6) Preparation of temporally electricity and water supply for the construction. 7) Preparation of permanent water supply. 8) Preparation of permanent high voltage electricity.
2. Air Navigation Safety Equipment procurement, Installation/Adjustment for Equipment ILS PALS Maintenance Education & Training for Equipment Marin and Inland Transportation for Equipment	2. Air Navigation Safety Equipment (1) Site Preparation, Design and Construction of Building 1) Preparation of power lines for ILS 2) Installation space and power for ILS remote control equipment 3) Preparation of power for PALS 4) Construction of sub-station, which has the room for CCR of PALS 5) Installation space and power for PALS remote control equipment 6) Dismantle and replacement of existing equipment, installation of power & communication lines for new equipment, etc. (2) Coordination, application formalities with relevant organization 1) Tax exemption and customs clearance of the Equipment 2) Application formalities for establishment of radio station (3) Transportation, storage, recycle and disposal of dismantled equipment (4) Allocation of counterpart personnel (5) Participation of equipment installation and equipment calibration including trial operation and site acceptance test
3. Procurement and Installation of Cargo X-ray equipment.	(1) Application and documentation for the Authorities 1) Tax exemption and custom clearance (2) Transportation, storage, reuse or disposal of old equipment. (3) Allocate of the counterpart.
4. Procurement and Installation of International Cargo terminal.	(1) Application and documentation for the Authorities 1) Tax exemption and custom clearance (2) Transportation, storage, reuse or disposal of old equipment. (3) Allocate of the counterpart

Source: JICA Study Team

2) Demarcation of procurement and installation

Japanese side execute following works concerning to the consulting service related to procurement and installation of the project.

(a) Consulting Services

- ✈ Preparation of detailed design documents and tender documents of the facilities / equipment.
- ✈ Assistance for selection and contracting with a construction contractor and equipment supplier.
- ✈ Supervision of construction of facilities, and procurement, installation and initial operation and maintenance training of equipment.

(b) Construction of facilities and Procurement and Installation of Equipment

- ✈ Construction of the facilities
- ✈ Procurement, transportation to the Project sites and installation of equipment.
- ✈ Trial operation s and adjustment of Equipment.

Explanation and initial training of operation and maintenance equipment.

Tajikistan responsible to the followings such as the removal of existing equipment and tax exemption.

- ✈ Removable of existing equipment or secure storages for new equipment.
- ✈ Procurement of equipment which Tajikistan side shall purchase.
- ✈ Prompt custom clearance and facilitation for domestic transport process to the items which are imported by certified contract.
- ✈ To accord Japanese physical persons whose services may be necessary for their entry into Tajikistan.
- ✈ All cost burden other than Japanese cost.

(4) Consultant Supervision

1) Supervision Plan

(a) Scope of Consultant Supervision

Following verification of the construction contract by the Japanese government, the consultant will issue a notice to proceed to the contractor and will commence its supervision services. The consultant will, as a part of the supervision services, monitor the progress of the contractor's work and report it to the executing agencies of the Tajikistan side as well as JICA. The consultant will carry out managerial and technical services related to project scheduling, quality, and safety issues as well as payment to the contractor, as well as make recommendations for improvements. The consultant will also report to the Embassy of Japan in Tajikistan as required and as appropriate. One year after the final inspection of equipment and takeover from the contractor to the Tajikistan side, the service inspection of the warranty period is to be conducted, followed by completion of the consulting services.

The main scope of supervision services by the consultant is as follows:

a) Review and approval of equipment specifications and work execution plans

The contractor shall submit equipment specifications and drawings to the consultant prior to the start of manufacturing. The contractor shall also submit working drawings as well

as work execution plans and schedules, etc., to the consultant. The consultant will approve or reject the drawings/plans in accordance with the contract.

b) Testing and inspection of the manufactured equipment

The consultant will inspect that the equipment has been manufactured by the contractor in accordance with the contract by witnessing factory testing or inspecting test reports and other related documents submitted by the contractor after the manufactured equipment is completed.

c) Prior confirmation and coordination for the equipment storage yard

The consultant will confirm the status of each site and coordinate with the Tajikistan government on the preparations done for an equipment/material storage yard. Before the procured equipment arrives in the site, the consultant shall secure the equipment/material storage yard.

d) Installation supervision

The consultant will supervise the contractor's quality, safety, schedule, and control of the equipment installation works including transportation.

e) Testing and inspection of equipment installation

The consultant will witness tests and approve the conditions of equipment installation of the manufacturer, and will conduct the inspection of test data.

f) Inspection tests on completion and issuance of the taking-over certificate

The consultant will witness and inspect the tests upon completion to be carried out by the contractor in order to approve or reject the works in accordance with the contract. When all of the works have been completed and have satisfactorily passed any tests, the taking-over certificate will be issued by the consultant. The consultant will also coordinate with DIA for the due process to take over the equipment from the contractor to DIA, which is the implementing agency of the Tajikistan side.

2) Implementation Structure

Construction supervisor stay at the site on site basis. The supervisors execute both control Quality and schedule and coordination between Tajikistan side and contractor. Followings are role of engineers on construction stage.

a) International Cargo Terminal

Table 2-2.29 Implementation Structure of International Cargo Terminal

Assignment	Period	Role
Japanese engineer		
Supervisor (International Cargo Terminal)	Resident (On site)	・ Control quality and schedule ・ Coordination between Tajikistan side and contractor
Procurement supervision (Equipment for International	Temporary on site as required	・ Completion check and approval of Procure Equipment(International Cargo Terminal)

Assignment	Period	Role
Cargo Equipment)	(On site)	・ Supervision of equipment installation and testing, quality and schedule control
Local engineer		
Assistant Supervisor (International Cargo Terminal)	Resident (On site)	・ Assistant of Control quality and schedule ・ Assistant of Coordination between Tajikistan side and contractor
Assistant Procurement supervision (Equipment for International Cargo Equipment)	Temporary on site as required (On site)	・ Assistant of Completion check and approval of Procure Equipment(International Cargo Terminal) ・ Assistant of Supervision of equipment installation and testing, quality and schedule control

Source: JICA Study Team

b) Air Navigation Safety Equipment

Table 2-2.30 Implementation Structure of Air Navigation Safety Equipment

Assignment	Period	Role
Japanese Staff		
Procurement Supervision Engineer (Test on completion and taking-over)	Temporary onsite as required	・ Supervision for test on completion and taking-over
Procurement Supervision Engineer for ILS	Temporary onsite as required	・ Overall supervision of project quality and schedule ・ Adjustment of the Tajikistan side and contractor ・ Supervision for installation, adjustment and testing ・ Completion check of the whole system and handover ・ Evaluation and approval of ILS equipment specification for manufacturing ・ Supervision of equipment installation and testing, quality and schedule control
Procurement Supervision Engineer for PALS	Temporary onsite as required	・ Overall supervision of project quality and schedule ・ Adjustment of the Tajikistan side and contractor ・ Supervision for installation, adjustment and testing ・ Completion check of the whole system and handover ・ Evaluation and approval of PALS equipment specification for manufacturing ・ Supervision of equipment installation and testing, quality and schedule control
Inspector (Inspection)	Temporary in Japan	・ Observe testing at manufacturing at factory
Local Staff		
Air-Nav Engineer	Temporary onsite as required	・ coordination between scope of Tajikistan side and Japanese side ・ Supervision of equipment installation and testing, quality and schedule control
Air field Lighting Engineer	Temporary onsite as required	

Source: JICA Study Team

3) Procurement Supervision Plan

Based on the policy of the Grant aid of Japanese Government, Consultant executes the detail design based on the basic design by organizing consistent team. Followings are the procurement supervising policy for the project.

- ✈ Aiming to complete procurement without any delay by keeping close cooperation with related authorities both Japan and Tajikistan.
- ✈ Give adequate and quick instruction and advice to the supplier and related people.
- ✈ Give adequate and quick instruction and advice for correct equipment placement and coordination with other equipment.
- ✈ The consultant work will be completed after confirmation of all works completed in accordance with contract, witness handover and get approval of Tajikistan side.

(5) Quality Control Plan

1) Quality control Plan for the construction

Japanese control and examination standard shall be referred for the quality control since there are no standards in ICAO or FAA recommendations. Followings are the quality control item, examination method and frequencies.

Table 2-2.31 Item of Quality control (Tentative)

Item			Method	Frequency
Concrete	Material	Cement	Quality certificate, Result of chemical and physical test.	By Material
		Water	Result of component test	By Material
		Admixture	Quality certificate, Contents analysis	By Material
		Sand	Bone-dry weight	By Material
			Corse grained range、Fines Modulus	
			Clay Lump and soft dust ratio	
		Gravel	Bone-dry weight	By Material
			Contents of sliced gravel	
			Corse grained range	
			Sodium sulfide(Lost weight)	
	Mixing		Bending strength test (28days JIS A 1106,1115,1132)	By Mixture
	Casting		Slump	1times/day
			Temperature	1times/day
	Strength		Compressive strength test (28 days JIS A 1106,1115,1132)	1times/day or every 150m^3

Source: JICA Study Team

2) Quality Control for Equipment

ICAO standards and other international standards shall be referred to control quality. The consultant confirms the consistency with a contract at the pre inspection before shipment. And the third-party inspection agency's inspection to the shipping items and packing conditions is executed at the same time.

3) Air Navigation Equipment

(a) Compliance with ICAO Standards

Specifications and functions of the system and equipment shall comply in principle with applicable ICAO standards.

(b) Approval of shop Drawings for the Equipment Manufacturer

The contractor will be required to prepare and submit equipment specifications, work schedule and execution plan, and the consultant will review and ensure that equipment performance and installation will comply with the contract documents.

(c) Factory Inspection

The consultant will conduct factory inspections to review and confirm that the major systems and equipment manufactured by the contractor complies with the contract requirements. Alternatively, the consultant may require the contractor to submit the test data for review and confirmation of the compliance with the contract requirements. The major systems and equipment will only be approved for transportation and shipment to the sites after the consultant's confirmation.

(d) Quantity Inspection Prior to Packing

Prior to packing the procured items, the consultant together with the contractor will carry out an inspection of the packaging factory of the manufacturers to confirm that quantities of such items are in compliance with the contract.

(e) Quantity Inspection Prior to Shipping

A third party organization entrusted by the consultant will carry out inspection together with the contractor to confirm that the quantities subjected to shipment are in compliance with the contract.

(f) Final Inspection

The consultant together with the contractor will carry out final inspection of equipment or a group of equipment for which adjustment to an individual or a group of equipment after connection is completed. During the final inspection, engineers dispatched from the manufacturers will operate the equipment in order to collect testing data for final acceptance as well as to confirm the quantity and performance of the equipment.

(g) Flight Check

The consultant together with authorized representatives of DIA will entrust a qualified organization to carry out flight checks to confirm that the procured systems meet the performance requirements stipulated in the contract.

(h) Tests on Completion and Takeover

After completion of installation and adjustment of the systems and equipment as well as the initial training for equipment operation and maintenance by the contractor, the consultant and the contractor, including authorized representatives of DIA will conduct a joint final inspection on the results of the tests on completion and any other test results as applicable; and

if found out satisfactory, all of the equipment and systems procured and installed under the Project will be accepted by DIA, and a taking-over certificate will be issued by the consultant.

(6) Procurement Plan

1) Construction materials

Most of materials for the construction can be procured in Tajikistan. Materials which is not available in Tajikistan will be imported from Japan.

Table 2-2.32 Procurement source of Major materials

Item	Source of procurement			Note
	Tajikistan	Japan	Third country	
Concrete/ Steel bar	○			
Steel structure		○		
Block, Brick	○			
Water proofing	○			
Steel sheet roofing		○		
Trowel material	○			
Door & windows	○	○		
Electrical material	○	○		
Plumbing materials	○	○		
Air conditioning materials	○	○		

Source: JICA Study Team

2) Equipment Procurement

Materials for the Air Navigation safety equipment and International Cargo terminal equipment shall be procured from Japan, Tajikistan and Third countries which are member of DAC in consideration of the procurement cost, adequate specification and ease of procurement. Import Material from Japan or the third countries are disembark at Mersin port in southern Turkish being faced to Mediterranean Sea, then transport to Dushanbe international airport by surface transportation. Distance between Mersin port and Dushanbe international airport is 4,200 km. It takes 2 month by the route going thorough Armenia, Iran, Turkmenistan and Uzbekistan

Table 2-2.33 Source of Procurement

Item	Source of procurement			Note
	Tajikistan	Japan	Third country	
1. Air Navigation safety equipment				
Localizer (LLZ)			○	Norway
Glide Path(GP)、Distant Measuring Equipment (DME)			○	Norway
Precision Approach Lighting System(PALS)			○	Belgium
2. Cargo terminal Equipment				
[redacted]			[redacted]	[redacted]
Pit Scale(1 0ft)		○		
Engine powered Forklift (15ton)		○		
Battery Powered Ramp Equipment Tractor			○	
Lower deck Container turntable Dolly			○	Holland
Pallet Dolly			○	
Baggage Cart			○	Holland
Platform Scale(1ton)		○		
Platform Scale(500kg)		○		
Battery Powered Forklift(1.5ton)		○		
Battery Powered Forklift(2.5ton)		○		
Battery Powered Reach Forklift(1.5ton)		○		
Manual Pallet Jack(1500kg)			○	Germany
Nesting rack(120x80cm)		○		
Nesting rack for cold storage(for Refrigerator)		○		
Plastic Pallet(120x80cm)		○		
Roll Box Pallet		○		
Working Table		○		
Safety belt		○		
Working Stand		○		
ULD Container Lack		○		
ULD Pallet Lack		○		
Battery Powered Aerial Work Platform			○	England

Source：JICA Study Team

3) Procurement Lot

The tender will be executed by Following Lot division.

Table 2-2.34 Lot Division

Lot	Item
1	Construction of International Cargo Terminal
2	Air Navigation safety Equipment Cargo terminal Equipment

Source：JICA Study Team

(7) Operational Guidance Plan

1) Air Navigation Safety Equipment

The procured equipment has in principle the same functions as the existing equipment, however initial training for the equipment operation/maintenance/repair, as well as new functions specific to the new systems is essential for DIA personnel. The initial training will be provided by engineers, who will have conducted the adjustment of the system and equipment, dispatched from the equipment/system manufacturers in Japan or from its origin. The training will be in the form of OJT of DIA personnel for several days.

2) Cargo terminal equipment

To maintain the equipment adequately equipment supplier provides trainings as shown in Table 2-2.35. Technical, operation and maintenance manuals are provided to those equipment which are required to have maintenance. Parts of Manuals are translated into Tajikistanf it is necessary.

- ✈ Operation method (Summary of the material, procedure, confirmation)
- ✈ Periodical Maintenance method (Cleaning etc)

Table 2-2.35 Instruction to operation and maintenance

Item	Instruction	Instructor	Period of the instruction
Cargo terminal equipment	Explanation by Manufacturer	Manufacturer Engineer	7 day after Procured
Security equipment	Explanation by Manufacture	Manufacturer Engineer	4 days after Procured

Source: JICA Study Team

(8) Soft Component (Technical Assistance) Plan

1) Background of Soft Component Plan

In this grant aid, procurement of equipment and construction of the terminal building capable of handling ULD (Unit Load Device) such as containers, pallets, etc. are requested from Tajikistan. The handling capacity of air cargo is expected to be improved dramatically by equipment procurement and the construction of facilities in Dushanbe International Airport, where only bulk cargo is handled so far. However, the workers dealing with air cargo have only experience of handling of bulk cargo and they do not have enough knowledge and experience about the handling of the ULD. Thus, educational training of handle method of ULDs in the new cargo terminal is required. Therefore, the soft component provides educational training of handling

ULD for cargo terminal operators with equipment and new cargo terminal building procured in the Project.

2) Objective of Soft Component

The objective of soft component is to build basis of continuous service for handling ULD in Tajikistan after the grant aid by implementation of training for operating method of new cargo terminal building. More specifically, as well as implementation of lecture of handling method of ULD, operation method of cargo terminal including ULD handling and use of equipment, creating the freight handling manual shall be supported.

3) Effects of Soft Component

Fundamental knowledge of handling ULDs can be acquired.

Freight Handling Manual, consisting handling method of ULDs, operation method of the new cargo terminal building and use of equipments, can be created.

4) Confirmation of Effects of Soft Component

The evaluation examinations which relate to lecture subject in written test and interviews are carried out after lectures and practices to confirm understanding level of fundamental knowledge.

The freight Handling Manual is completed and started to be used for the operation of new cargo terminal building.

5) Activities (Inputs) of Soft Component

The contents and the scale of activities by Japanese and Tajikistan side are planned as shown in Table 2-2.36

Table 2-2.36 Activities of Soft Component

Items	Japanese side	Tajikistan side
1. Activities A. Necessary technical skill and category	Lecture for ULD handling method as a fundamental operation skill with introduction of examples in Japan. Training shall be conducted with prepared curriculum and textbook.	Cargo terminal operators (About 10 persons)
B. Current level of technical skill and required level		Current : dealing with only bulk cargo Plan : acquiring skill for handling ULD international air cargo
C. Target group		Cargo terminal operators
2. Method of Implementation	Implementation of lecture and practice, support of creation of freight handling manual	Creating freight handling manual
3. Resource	2 Japanese consultants with experience of operation of terminal building, 2 translators (2.0M/M per person, total 8.0M/M)	Providing training facility and office room for creating the manual.
4. Output		Freight handling manual

Source: JICA Study Team

6) Procurement of Resource for Implementation of Soft Component

It will be the first experience for Tajikistan to operate the cargo terminal building handling ULDs. In addition, cargo terminal operation is a specialized field in the aviation. Number of companies with experience of operating cargo terminal and ability of training are limited in Japan as well, but Japanese staff with experience of training of handling ULDs shall be dispatched as instructors and the implementation of the plan is conducted by "Consultant's-direct-support based method."

7) Implementation schedule of Soft Component

Implementation schedule of soft component included in the Project is as shown in Table 2-2.37.

Table 2-2.37 Implementation Schedule of Soft Component

Month	1	2	3	4
Construction of Cargo Terminal Building			▲Completion and provision	
Installation of Equipment			▲Completion of installation	
Soft Component Lecture (0.5 month)				
Practice (0.5 month)				
Creating manual (1.0 month)				
Completion report (Total 2.0 months)				▲

Source: JICA study team

The lecture is divided into 2 parts, (1) Introduction of operation example of cargo terminal building and (2) Knowledge for operation of cargo terminal building. Trainee's confirmation is evaluated by examinations. On the other hand, in practice training, trainees are intended to acquire operation method of cargo terminal with using equipment and fake cargo made from cardboard and take evaluation examination in written test and interviews after practice.

In addition, creating freight handling manual is intended to be implemented by 2 groups of trainees and instructor, one is import/export group and the other is management group. The freight handling manual shall be created with support for review of Japanese existing manual and adjustment of condition in Tajikistan.

Training schedule and instructor dispatching schedule (M/M) is as shown in Table 2-2.38 and training schedule is as shown in the table below.

Table 2-2.38 Training Schedule and Instructor Dispatching Schedule (M/M)

Item / Month	1	2	Instructor	Translator	M/M
Lecture (0.5 month)			2	2	2.0
Practice (0.5 month)			2	2	2.0
Creation of Manual (1.0 month)			2	2	4.0
Dispatching Period (2.0 months)			2	2	8.0

Source: JICA Study Team

(9) Implementation Schedule

1) Consultation

After conclusion of the exchange of notes (E/N) and the grant agreement (G/A) for the Project, consulting services for detailed design, assistance in bidding and installation supervision will be concluded between the Tajikistan side and the consultant. The consultant will commence the detailed design works immediately. The consultant will first collect information on installation and cost estimation for the detailed design, and then will prepare the detailed design and bidding documents in Japan accordingly. The period for detailed design including the site survey will be two months.

After completion of the detailed design, the services for assistance in bidding and evaluation of the bids will be completed by the consultant within about 3.5 months. Such services will include preparation for the bid announcement and public announcement, preparation of bid evaluation report for selection of the successful bidder and assistance in concluding the construction/installation contract. Following the bidding process, the successful bidder will conclude the construction/installation contract with the Tajikistan side. The contractor will commence the works following the issuance of the notice to proceed by the consultant.

2) Air Navigation Safety Equipment

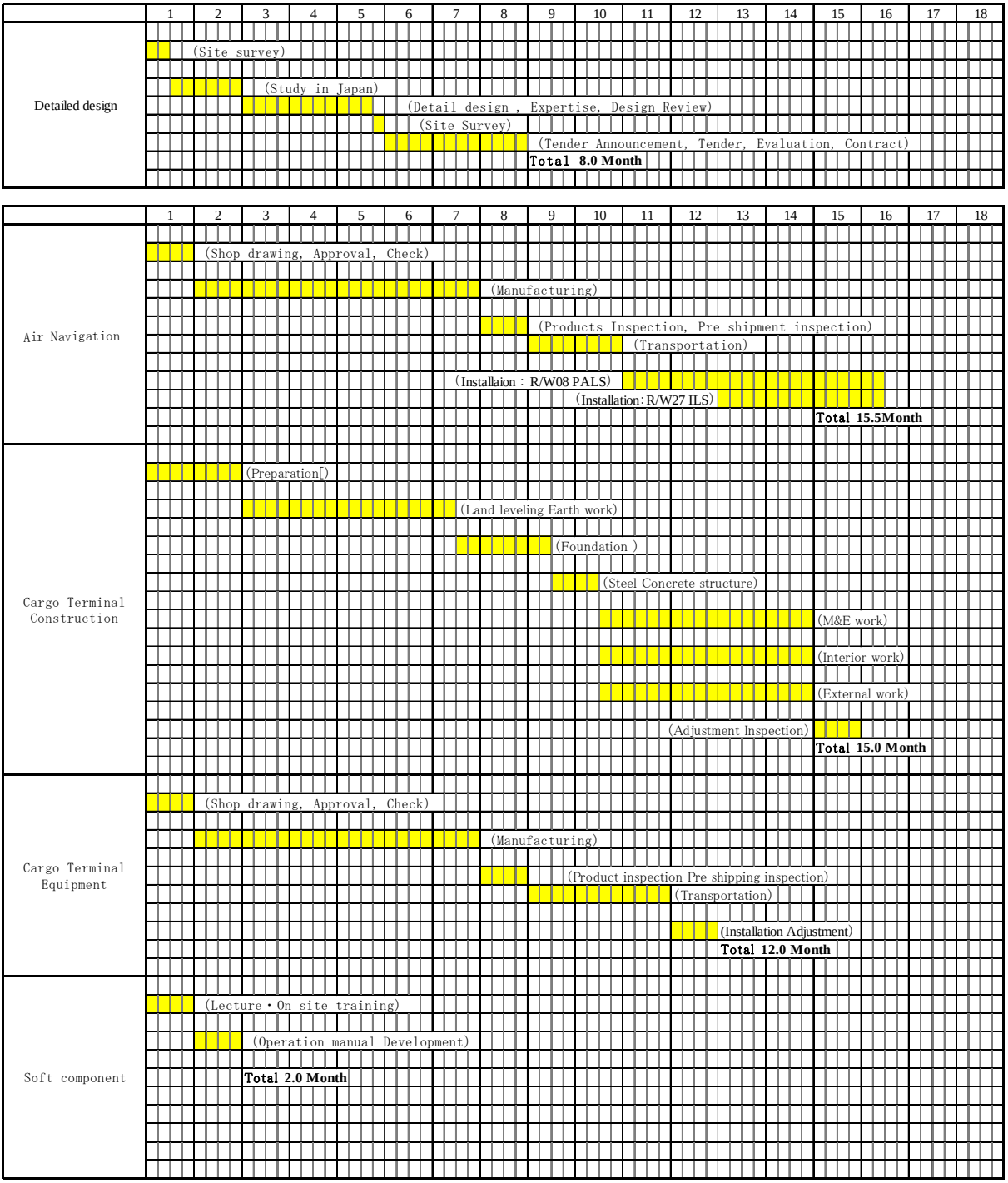
It will take 17 months for procurement and installation of the air navigation safety equipment, including nine months for preparation of necessary drawings and manufacturing, two months for testing and transportation, and six months for installation, adjustment, trial operation, training of operation/maintenance personnel as well as the commissioning test and handing over of the equipment to the Tajikistan side.

3) International Cargo Terminal

Construction term of the International Cargo terminal is expected from 24 to 26 month. Procurement of the Motored equipment requires 8 month. Pre Inspection and shipping needs 3month. Installation and adjustment needs 1month. Therefore 12 month is expected to be required for procurement in total.

That implementation schedule is shown in Table 2-2.39.

Table 2-2.39 Implementation Schedule



Source: JICA Study Team

2-3 Obligation of Recipient Country

2-3-1 General

For the implementation of grant aid, general matters of implementation borne by recipient country are as follows;

- ✈ Provision of data and information necessary for the implementation of the plan.
- ✈ Site necessary for the implementation of the plan (Working site and the site for equipment storage).
- ✈ Land leveling of each construction site before the start of construction.
- ✈ Recipient country shall open the Japanese bank account under the name to Tajikistan and issue Authorization to Pay.
- ✈ Recipient country shall implement rapid loading/unloading on the drop point of Tajikistan, exemption of taxes and duties of custom.
- ✈ With respect to the approved contract, recipient country shall conduct exemption of taxes levied in Tajikistan, such as domestic taxes and other taxes regarding the provision of product and service, for Japanese person and cooperation related to the project .
- ✈ With respect to the approved contract, recipient country shall give entry and working permission and other permission regarding provision of services for Japanese person.
- ✈ Recipient country shall give permission required upon implementation of the project and the other authority.
- ✈ Recipient country shall maintain, manage and repair the facilities constructed in the project appropriately and effectively.
- ✈ Recipient country shall bear the expense of the project, excluding the expense borne by Japan Grant Aid.

2-3-2 Special Items

(1) Banking Arrangement (B/A) and Authorization to Pay (A/P)・Payment of Commission

The Government of Tajikistan needs to promptly draw up an arrangement with a bank in Japan to open a special account into which the funds granted by the Government of Japan will be deposited, and from which payments will be made to the Japanese contractor. The Government of Tajikistan also needs to issue an authorization to pay (A/P), which will be needed by the Japanese contractor to receive the payments. The Government of Tajikistan shall bear commissions to the Japanese bank for banking services based on the B/A.

(2) Exemption of taxes and duties on imported equipment and materials

The Government of Tajikistan shall ensure that the customs, duties and taxes which may be imposed with respect to the import of equipment and products be exempted.

(3) Entrance to the site and construction permits

Dushanbe International Airport (DIA) shall obtain entrance and construction permits for the contractor to execute the works.

(4) Removal of existing equipment for installation of new equipment

The Tajikistan side shall remove the existing equipment to secure space necessary for installation of the new equipment.

(5) Taxes and fiscal levies for procurement of materials and services

The Government of Tajikistan shall bear the internal taxes and other fiscal levies which may be imposed with respect to the purchase of the products and services without using the grant.

(6) Temporary yard

The Tajikistan side shall provide, at its own expense, adequate space at the sites for the contractor to temporarily store materials and equipment.

(7) Securing commercial power on site

The Tajikistan side shall provide commercial power at each site which is required for the operation after handing over the equipment.

(8) Provision of existing main power distribution network

The Tajikistan side shall provide the power distribution system and line to the sites at its own expense.

2-3-3 Responsibility of the Works to be implemented by the Tajikistan Side

Lists of the specific obligations of the Tajikistan side are shown below.

Table 2-3.1 Specific Obligations of Tajikistan Side

Site	Equipment	Obligations of Tajikistan Side
1. Air Navigation and Safety Equipment		
ILS site	ILS Equipment	Provision of power supply
PALS site	PALS Equipment	Construction of new sub-station and provide with power distribution panel, and provide with installation space for engine generator system Dismantle of existing SALS
09 GP site Monitor Building	ILS Remote Control and Monitoring System	Temporarily replace the equipment as necessary to allow spaces for new equipment installation. Provision of commercial power supply available for new equipment
Control Tower	ILS Status Unit AGL Control Panel	Temporarily replace the equipment as necessary to allow spaces for new equipment installation. Provision of commercial power supply and communication line available for new equipment.
Existing AGL sub-station	AGL Control & Monitor Panel	Provision of installation space and commercial power supply available for new equipment.
New sub-station		
2. International Cargo Terminal		
Construction site		Removable of debris in the site
Access road		Construction of access road to the site and two connections with public road.
Water Gutter		Two rain water gutters along airside and landside of the site.
Electricity		Both temporary and permanent power intake up to DIA side transformer. Procurement and installation of DIA transformer.
Water supply		Water supply both temporary and permanent into the site
Telephone LAN		Telephone and LAN intake and connection to the building.
Design Expertise		Cost for the design expertise

Source: JICA Study Team

2-4 Project Operation Plan

Dushanbe International Airport (DIA) is responsible for operation and maintenance of the airport facilities. Some of the facilities and equipment are being maintained and repaired by DIA directly while other maintenance/repair services are contracted out. Some of the maintenance/repair services are regularly conducted every year while some are conducted every several years. The following issues should be properly taken into account:

2-4-1 Maintenance Organization

(1) Air Navigation Safety Equipment

Air navigation safety equipment in DIA is operated and maintained by two organizations, namely, the Airport Corporation, and the Tajikistan Aero-Navigation (TAN). ILS, NDB and AGL are owned by the Airport Corporation and operated/maintained/repaired by DIA. VOR, DME and weather observation equipment are owned and operated/maintained/repaired by TAN. TAN is also providing air traffic control services for DIA as well as enroute air traffic control (ATC) services to aircraft flying within the Tajikistan's flight information region (FIR), and is responsible for installation/operation/maintenance of ATC equipment.

For the purpose of operation, maintenance and repair of the equipment, relevant personnel from DIA are available as shown in Table 2-4.1.

Table 2-4.1 Operation and Maintenance Staff

Category	Chief engineer	Inspection chief engineer	Deputy engineer	Engineer	Technician	Chief operator	Operator	Technician others	Shift per day
Navigation (ILS, NDB)	1	-	-	1	6	-	-	-	2 (day & night)
Communication Building facility	1	-	3	6	23	-	-	-	-
AGL & Power Supply	1	1	-	4	-	1	4	16	2 (day & night)

Source: JICA Study Team

The operation/maintenance/repair service personnel are required in principle to be graduates of technical colleges or universities. Several staff are employed every year. After being employed as a technical staff and subjected to special training courses provided by DIA, they are stationed at the airport or ATC facilities.

The technical staffs are categorized according to their years of experience, and results of qualification examinations.

As air navigation safety equipment and AGL need to be operational 24 hours a day, the relevant personnel have to work in day and night shifts.

Operation and maintenance staff have been trained by refresher training as well as operation and technical training periodically every year, so as to further enhance their skills and experiences, and to maintain international standard skills. Furthermore, on-the-job training (OJT) is being provided for operation and maintenance staff at the actual sites. It can be concluded that the staff have already possessed basic technical capability necessary to maintain and repair these systems.

The Project will instal ILS and PALS in the RWY 27 side, which are the same equipment installed in the RWY 09 side as per international standard. The ILS has to be operated on only one side even if it were installed for both runway directions. At present, a simplified approach lighting system (SAL) was installed in the RWY 27 side. The installation of PALS is an upgrade of the approach lighting system in the RWY 27 side. In this regard, the existing staff for operation/maintenance/repair services should suffice, even if there is an increase in equipment.

(2) International Cargo Terminal

International cargo terminal is under the jurisdiction of the department of commercial terminal, DIA. It is operated by 4-shift system. Each team has 8 workers and totally 32.

International cargo terminal is conducting component exchange and regular inspection based on the maintenance manual. Equipments in the cargo terminal are maintained by the department of commercial terminal.

(3) Equipment for Cargo Terminal

There is no special equipment in the existing cargo terminal building except X-ray inspection machine. Vehicle operation for cargo handling is under jurisdiction of the department of ground handling, DIA. The department of ground handling owns and tractor, belt loader, bulk cart, etc and operates them for 24 hours by 4-shift system.

The department has a repair team and it is conducting vehicle maintenance 8 to 17, Monday to Friday. Maintenance/repair of all equipment is conducted there and it has sufficient skills for vehicle maintenance/repair.

2-4-2 Operation/Maintenance/Repair

(1) Air Navigation Safety Equipment

The operation and maintenance manual of individual equipment for air navigation safety equipment is to be supplied by the manufacturer, and maintenance repair works have been conducted based on such manuals, as follows:

- ✈ System Operation Procedure Including Measures in Case of Emergency
- ✈ Equipment Testing Method and Checklist
- ✈ Standard Repair Procedure
- ✈ Standard Method for Testing
- ✈ Standard Procedure for Test Data Recording

Based on the above procedures, maintenance services have been carried out through six steps of periodical maintenance services following international standards. Suitable time intervals for maintenance services are shown in Table 2-4.2.

Table 2-4.2 Schedule of Maintenance Services

Period	Maintenance Services
Daily	Cleaning, observation of equipment parameters and adjustment, if necessary.
Weekly	Cleaning, observation of equipment parameters and adjustment, if necessary.
Monthly	Check parameters of each equipment and adjust them to its standard parameters.
3 months	Check parameters of each equipment and adjust them to its standard parameters.
6 months	Check parameters of each equipment and adjust them to its standard parameters.
Annually	Check parameters of each equipment and adjust them to the standard parameters by flight calibration and field inspection.

Source: JICA Study Team

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Condition of Cost Estimate

- ✈ Cost Estimation Time: December, 2013
- ✈ Exchange Rate:
  TJS 1 = JPY 20.76
  USD 1 = JPY 99.99
  EUR 1 = JPY 135.09
- ✈ The average exchange rate was applied for a period of three months, from September 1, 2013 to November 30, 2013. Local currency: TJS (Somoni)
- ✈ Construction period and procurement period: 15 months as shown in Table 2-2.39

(2) Cost to be borne by Tajikistan

Table 2-5.1 Cost be Born by Tajikistan under the Project

Tajikistan work	Contents	Estimation cost (Unit：Million Somoni)
ILS & PALS	Power station and Power unit for ILS & PALS	0.30
Cargo Terminal	Electricity and water supply	0.05
	Installation of rain water gutter	0.19
	Fence and Gate installation	0.18
	Charge for Design Expertise	0.05
Bank Commission	Bank Commission （Bank Arrangement(B/A) Authorization to Pay(A/P)）	0.10
Total		0.87

Source: JICA Study Team

2-5-2 Operation and Maintenance Cost

(1) Air Navigation Safety Equipment

Table 2-5.2 shows estimated amounts of the annual budget necessary for maintenance and repair of the air navigation safety equipment under the Project, including salaries, maintenance and repair costs, spare parts costs, and consumable costs as well as flight checks

Table 2-5.2 Annual Cost for Equipment Maintenance and Repair for Air Navigation Safety

Item	Cost(US$)		Note
Air Navigation safety Equipment (ILS, PALS)	Personnel expense	202,800	Navigation 8people PALS／Electric 27
	Maintenance and Repair Cost	6,500	
	Spare parts, consumable parts cost	8,000	
	Flight inspection cost	160,000	
	Total	377,300	Same as current

Source: JICA Study Team

(2) International Cargo Terminal and related equipment

Table2-5.3 shows estimated amounts of the annual budget necessary for maintenance and repair of International cargo Terminal and related equipment under the Project, including salaries, maintenance and repair costs, spare parts costs, and consumable costs as well as fuel cost.

Table 2-5.4 Annual Cost for Equipment Maintenance and Repair for Air Navigation Safety

Item	Cost (US$)		Note
International Cargo terminal and related Equipment	Personnel expense	294,000	Manager 1person Clark 2 person x 4shift Guard3person x4shift Dispatcher 1person x 4shift Worker 8person x 4shift
	Maintenance and Repair Cost	7,000	
	Spare parts, consumable parts cost	10,000	
	Fuel cost	90,000	
	Total	401,000	Additional cost in total 212,600

Source: JICA Study Team

(3) Secure operation and maintenance cost

It is estimated that annual budget for Air Navigation Safety Equipment is US$377,300, for International cargo terminal and related equipment is US$401,000. Total cost is estimated US$778,300. Within this cost, new expense by this project is additional cost in Maintenance and Repair Cost, Spare parts, consumable parts cost and fuel cost of International cargo terminal. This amount is US$212,600.

Annual profit of DIA is approximately US$1,460,000. The additional cost which will occur in International Cargo Terminal is 15% of this profit. Therefore, it is expected that all facility and equipment implemented by the project will be operated and maintained in the future.

CHAPTER 3
Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

To implement this project, the following activities will be executed by Dushanbe International Airport (DIA).

- ✈ Prior to the construction commencement, prepare the international cargo terminal construction area (90 m x167 m).
- ✈ Construct a road in front of the construction site and a ramp road connected to the public road.
- ✈ Run a water supply and draw electricity to the construction site.
- ✈ Obtain necessary permission before tender announcement, discuss with environment expert about the Ecological Expertise (EE) Law.
- ✈ Obtain construction permit before tender announcement, discuss with Dushanbe City and building expert.
- ✈ Install air navigation facilities and execute necessary work on the site.
- ✈ Carry out the procedure of tax exemption and import clearance for the items procured by this project.

3-2 Necessary Inputs by Recipient Country

To produce an effect and able to maintain it, the following activities are to be executed by DIA.

- ✈ Within one month before the construction completion, select staff so they can relate with the new international cargo building and confirm who receive the soft component training.
- ✈ Allocate counterpart staff who will be in charge of the air navigation facilities.

3-3 Important Assumptions

To produce an effect and able to maintain it, external conditions are shown below.

- ✈ DIA would continuously make necessary funding and human resources available, and counterpart personnel of the project would be involved in upgrading aviation safety.
- ✈ DIA would continuously improve its air navigation safety equipment based on its future plan.
- ✈ Airlines would continue to improve their aviation safety under the oversight of the Civil Aviation Agency (CAA).
- ✈ Personnel involved in aviation safety would continue to improve the airport security and safety situation.

3-4 Project Evaluation

3-4-1 Relevance

In view of the above, it is judged that the project is appropriate for technical assistance project, by using Japanese grant aid.

(1) Object suitability

This project aims to upgrade aircraft safety by improving air navigation and providing an efficient cargo handling system through the construction of an international cargo terminal building and procurement of cargo terminal equipment.

The improvement of air navigation has high suitability in view of safety upgrade. The construction of international cargo building also has high suitability because it will contribute highly in the efficiency of cargo handling.

(2) Benefit target

DIA is a capital airport and the only international airport in Tajikistan. The economic impacts of air navigation upgrade and international cargo terminal construction provide benefits to all 7.99 million Tajikistan nationals both directly and indirectly.

(3) Purpose of the project

Because there is only one instrument landing system (ILS) in the west side of the runway, flight cancellation and delay often occurs at DIA due to the frequent occurrence of dense fog. It is an urgent issue to install the necessary air navigation system for safe flight operations.

DIA's cargo facilities have been used since 1964 therefore aging of equipment is obvious. Lists of equipment which are operational in the cargo building are two cargo x-ray machines and weight scale, however, there are no facilities or equipment which can handle temperature control or large-scale cargo. Because of the limited volume and items which the cargo building can handle, transport in Tajikistan is forced to road traffic. This causes increase in import and export costs and become a barrier of economic activities.

This project aims to upgrade the air traffic safety and cargo handling capacity in order to contribute to the realization of a smooth cargo transportation by modernizing the air navigation facilities and implementing the cargo facility at DIA, the capital airport of Tajikistan.

(4) Mid- and Long-term Policies to Tajikistan

The Tajikistan government supports the necessity to strengthen air transportation in the mid-term action strategy entitled "Living Standard Improvement Strategy" (formulated in 2013). In addition to the strategy of the transport sector "National Target Development Strategy for Transport Sector of the Republic of Tajikistan to the Year 2025" (formulated 2011), the government policy targets for the implementation of airport facilities and air navigation system because it is expected that the development of the transport sector including the aviation sector would ensure Tajikistan's economic development in the future. This project corresponds to these policies.

The "Country Assistant Policy to Tajikistan" decides that the implementation of economic infrastructure is a priority. The "JICA Country Analysis Paper to Tajikistan Republic" also analyses that "implementation of transportation and small-sized electric infrastructure at the node of Central and South Asia" is a priority. This project corresponds to the analysis and policies.

3-4-2 Effectiveness

(1) Quantitative Effect Indicators

The quantitative effect indicators' target year is settled in 2019; three years after the completion of the project in 2016. By the social, economic, and technical results of this survey, the quantitative effect indicators are shown in Table 3-4.1.

Table 3-4.1 Quantitative Effect Indicators

Indicator	Base (2013)	Target (2019) (3 years after project completion)
Percentage of aircraft making an approach or landing at DIA using ILS system (%)	80	100
International cargo handling volume at DIA (ton)	3,258	8,700

(2) Qualitative Effect Indicators

The qualitative effect indicator of the project is shown below:
Upgrade air traffic safety and reliability by modernizing the air navigation system.

Appendices

A-1 Member List of the Study Team

A-2 Study Schedule

A-3 List of Parties Concerned in the Recipient Country

A-4 Minutes of Discussions 1

A-5 Technical Memorandum

A-6 Minutes of Discussions 2

A-7 Soft Component Plan

A-1 Member List of the Study Team

(1)	Mr. Hiroyuki UEDA	:	Leader (JICA Advisor)
(2)	Ms. Aya Shimada	:	Coordinator (JICA)
(3)	Mr. Hajime USUKURA	:	Coordinator (JICA)
(4)	Mr. Satoshi HATAYAMA	:	Team Leader of the Consultants (Nippon Koei Co., Ltd)
(5)	Mr. Yoshifumi HOSHIAI	:	Deputy Team Leader / Building (Nippon Koei Co., Ltd)
(6)	Mr. Toshihiko SUZUKI	:	Building Structure (Daiken Sekkei, Inc.)
(7)	Mr. Takeshi SAKAMAKI	:	Equipment for Building (Daiken Sekkei, Inc.)
(8)	Mr. Yukimi TAJIMA	:	Equipment for Air Navigation (Japan Airport Consultants, Inc)
(9)	Mr. Norihito FUKUHARA	:	Airfield Lighting (Japan Airport Consultants, Inc)
(10)	Mr. Michiaki SHIMIZU	:	Construction/Installation/Procurement/ Cost Estimation (Daiken Sekkei, Inc.)
(12)	Mr. Kazuyasu FUKUMOTO	:	Distribution / Cargo Demand Forecast (Nippon Koei Co., Ltd)
(12)	Mr. Seiji NAKAZATO	:	Natural Condition Survey (Nippon Koei Co., Ltd)
(13)	Mr. Shinsuke SATO	:	Environment and Social Consideration (Nippon Koei Co., Ltd)
(14)	Ms. Hiromi Watanabe	:	Interpreter

A-2 Study Schedule

Table A-2-1 Schedule of the First Site Survey

Accumulated Day	December 2013	Week	Leader (JICA)	Coordinator (JICA)	Team Leader of the Consultants	Deputy Team Leader	Building Structure	Equipment for Building	Equipment for Air Navigation	Airfield Lighting	Construction/ Installation/ Procurement/ Cost	Distribution/ Cargo Demand forecast	Natural Condition Survey	Environment and Social Consideration
			Mr. Hiroyuki UEDA	Ms. Aya SHIMADA	Mr. Satoshi HATAYAMA	Mr. Yoshifumi HOSHIAI	Mr. Toshihiko SUZUKI	Mr. Takeshi SAKAMAKI	Mr. Yukimi TAJIMA	Mr. Norihito FUKUHARA	Mr. Michiaki SHIMIZU	Mr. Kazuyasu FUKUMOTO	Mr. Seiji NAKAZATO	Mr. Shinsuke SATO
1	4	Wed	Narita → Istanbul → Dushanbe						Narita → Istanbul → Dushanbe					
2	5	Thu	Arrive Dushanbe /Discussion of Inception Report						Arrive Dushanbe /Discussion of Inception Report					
3	6	Fri	Discussion of Inception Report／Discussion with DIA						Discussion of Inception Report／Discussion with DIA					
4	7	Sat	Site Survey						Site Survey					
5	8	Sun	Data collection and analysis						Data collection and analysis					
6	9	Mon	Discussion						Discussion		Site Survey	Site Survey	Site Survey	Site Survey
7	10	Tue	Discussion Preparation of MoD						Discussion					
8	11	Wed	MoD Signing						MOD Signing					
9	12	Thu	Dushanbe→Narfita		Equipment & Facility Survey				Site Survey					
10	13	Fri	Arrive Narita		Equipment & Facility Survey				Site Survey					
11	14	Sat			Equipment & Facility Survey				Site Survey					
12	15	Sun			Data collection and analysis		Narita → Istanbul → Dushanbe		Data collection and analysis					
13	16	Mon			Equipment & Facility Survey						Site Data Collection	Survey		
14	17	Tue			Equipment & Facility Survey									
15	18	Wed			Equipment & Facility Survey									
16	19	Thu			Equipment & Facility Survey				Dushanbe→ Narita			Dushanbe→ Narita		
17	20	Fri			Equipment & Facility Survey／Technical Memorandum				Arrive Narita			Arrive Narita		
18	21	Sat			Equipment & Facility Survey									
19	22	Sun			Data collection and analysis						Finalize report		Data collection and analysis	
20	23	Mon			Finalize report						Finalize report		Finalize report	
21	24	Tue			Finalize report						Finalize report			
22	25	Wed			Finalize report						Finalize report		Finalize report	
23	26	Thu			Dushanbe→Narita						Dushanbe→Narita		Dushanbe→Narita	
24	27	Fri			Arrive Narita						Narita		Arrive Narita	

Source: JICA Study Team

Table A-2-2 Schedule of the Second Site Survey

Accumulated Day	2014	Week	Leader (JICA)	Coordinator (JICA)	Team Leader of the Consultants	Deputy Team Leader of the Consultants	Equipment for Air Navigation
			Mr. Hiroyuki UEDA	Mr. Hajime USUKURA	Mr. Satoshi HATAYAMA	Mr. Yoshifumi HOSHIAI	Mr. Yukimi TAJIMA
1	6/1	Sat.	Bishkek → Dushanbe				
2	2	Sun.	Finalize report				
3	3	Mon.	Explanation and Discussion of Draft Final Report				
4	4	Tue.	Explanation and Discussion of Draft Final Report				
5	5	Wed.	M/D Signing				
6	6	Thu.	Dushanbe → Istanbul → Narita				
7	6/1	Sat.	Arrive Narita				

A-3 List of Parties Concerned in the Recipient Country

Table A-3 List of Parties Concerned in the Recipient Country

Occupation	Title	Name
Ministry of Transport (MOT)	First Deputy Minister	Mr. Zukhrov Jumakhon
Civil Aviation Authority (CAA)	General Director	Mr. Jobirov Ibragim
Dushanbe International Airport (DIA)	Deputy General Director	Mr. Aziz Ibragimov
	Director of Aero Navigation	Mr. Salomov Abdurakhmon
	Director of Ground Handling Service	Mr. Mizrobov Noyobsho
	Deputy Director of Ground Handling Service	Mr. Tabar Khasanovich
	Director of Cargo Handling Service	Mr. Khodjoiev Tojiddin
	Deputy Director of Cargo Handling Service	Mr. Manon
	Aerodrome Weather Center	Ms. Novikova Anna
	Economic Division	Mr. Vokhidov Shavkat
	Director of Heating & sanitation Technical Supply	Mr. Izatulloev Nusratullo
	Engineer of Heating & sanitation Technical Supply	Mr. Amirov Gafur
	Engineer of Heating & sanitation Technical Supply	Mr. Valeliy Sergeevich
	Fire Fighting Division	Mr. Davlatov
	Building Division	Ms. Natasha
	New Passenger Terminal Building	Mr. Boboev Odil
	Coordinator	Mr. Rakhmonali Komiyu
	Electrical Division	Mr. Aziz Ibragimov
National Building Expertise Committee	Chairman	Mr. Negmatov Temur
Tajikistan National Statistic Bureau	Staff	Ms. Makhtsleda
Scientific Technical Institute	Junior Researcher	Mr. Sodikov Umed
SOMON AIR	Chief Executive	Mr. Lloyd Paxton
	Commercial Director	Mr. Ejaz Khan
DHL	Country Manager	Mr. Masudbeg Jumonkulov
	Commercial Manager	Mr. Rizoev Jamshed
EAST AIR	CEO	Mr. Anatoly Galnov
	Commercial Director	Ms. Irina Bilyukova
TAJIK AIR	CEO	Mr. HAMROEV Firuz
European Bank for Reconstruction and Development (EBRD)	Associate Banker Dushanbe Resident Office	Mr. Sobir Aliev
World Bank Tajikistan Country Office	Senior Country Economist	Ms. Marina G Bakanova
International Finance Corporation (IFC) (World Bank Group)	IFC Country Officer Program Manager	Mr. Christopher D. Miller
	Investment Officer	Ms. Manija Mamadnabieva
French Embassy	Ambassador	Mr. Didier Leroy

A-4 Minutes of Discussions 1

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT FOR DEVELOPMENT OF DUSHANBE INTERNATIONAL AIRPORT
IN THE REPUBLIC OF TAJIKISTAN

In response to a request from the Government of the Republic of Tajikistan (hereinafter referred to as "Tajikistan"), Japan International Cooperation Agency (hereinafter referred to as "JICA") in consultation with the Government of Japan decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Development of Dushanbe International Airport (hereinafter referred to as "the Project").

JICA sent a Preparatory Survey Team (hereinafter referred to as "the Team") to Tajikistan, headed by Mr. Hiroyuki UEDA, Senior Advisor of JICA, and was scheduled to stay in the country from December 5th to December 12th, 2013.

The Team held a series of discussions with officials concerned of the Government of Tajikistan and conducted a field survey in the study area.

In the course of discussions and field survey, both Japanese and Tajikistan sides confirmed the main items described in the attached sheets.

Dushanbe, December 11th, 2013

Jumakhon ZUKHUROV
Fisrt Deputy Minister
Ministry of Transport
the Republic of Tajikistan

Hiroyuki UEDA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

ATTACHMENT

1. Objective of the Project

   Both Japanese and Tajikistan sides confirmed that the objective of the Project is to improve the safety and efficiency of taking-off and landing and to promote greater efficiency in freight-handling operations at Dushanbe International Airport.

2. Project Site

   Both sides confirmed that the site of the Project is shown in Annex-1.

3. Objective of the Survey

   Both sides confirmed the objective of the Survey as follows:

   3-1. To understand the background and objective of the Project and examine its impacts and appropriateness.

   3-2. To consider the components, outline design and cost estimation of the Project based on the data and information collected through the Survey and the results of meetings between the Japanese and the Tajikistan sides.

   3-3. To study the issues of environmental and social considerations through the Survey.

4. Responsible and Implementing Organizations

   Both sides confirmed the responsible and implementing organizations as follows:

   4-1. The responsible organization is Ministry of Transport (MOT).

   4-2. The implementing organization is Dushanbe International Airport (DIA).

   4-3. The organization chart of MOT is as shown in Annex-2.

   4-4. The organization chart of DIA is as shown in Annex-3.

5. Items Requested by the Government of Tajikistan

   5-1. As a result of discussions, both sides confirmed that the items finally requested by the Government of Tajikistan are as follows:

   (1) Construction of the International Cargo Terminal at Dushanbe International Airport

   Both sides confirmed that basic requirements of the requested cargo terminal as follows:

   - The cargo terminal will have a capacity to handle air cargo demand anticipated in the year after five years of its completion.
   - The Project will provide equipment necessary for the cargo terminal including X-ray machines for checking cargoes
   - The Project will provide Ground Support Equipment (GSE) for handling of Unit Load Devices (ULD).

   The Tajikistan side agreed that the DIA would undertake the following preparatory work for the construction of the cargo terminal at its own expenses.

   - Clearing and leveling the planned construction site
   - Provision of electric power supply and water supply for the planned construction site
   - Construction of an access road with security fence connecting the cargo terminal and

A.M.

the road around the airport

(2) Procurement of Instrument Landing System (ILS) and Precision Approach Lighting System (PALS) for Runway 27 of Dushanbe International Airport

Both sides confirmed that basic requirements of the requested ILS and PALS as follows:

- ILS and PALS will enable category-I precision approach as defined by International Civil Aviation Organization (ICAO) for the runway 27.

The Tajikistan side agreed that the DIA would undertake the following work for installation of ILS and PALS at its own expenses.

- Provision of electric power supply for the equipment

(3) Soft Component

The Tajikistan side requested that an appropriate training of staff as Soft Component for cargo handling be considered in the Project. Japanese side took note of it and will evaluate its necessity and effects of such activity.

5-2. JICA will assess the appropriateness of the request and will report the findings to the Government of Japan. The final specifications and quantities of the facilities and equipment shall be decided by the Japanese side and be described in the draft Preparatory Survey Report, which will be prepared around June 2014, in consideration of necessity, technical viability, sustainability, cost-effectiveness, and budget availability. The Tajikistan side understood that all the requested items, therefore, may not be accepted as final components of the Project.

6. Japan's Grant Aid Scheme

6-1. The Tajikistan side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-4.

6-2. The Tajikistan side will take the necessary measures, as described in Annex-5, to facilitate the smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented, according to the existing agreement between the Government of Japan and the Government of Tajikistan.

7. Schedule of the Study

Both sides confirmed the schedule of the Survey as follows:

7-1. The Team will continue the field survey in Tajikistan until December 26th, 2013.

7-2. JICA will prepare the draft Preparatory Survey Report in English and explain its contents including the final components and cost estimation of the Project to the Tajikistan side around June 2014.

7-3. JICA will complete the final report and send it to the Government of Tajikistan around September 2014.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

The Team explained outline of JICA Guidelines for Environmental and Social Considerations

(hereinafter referred to as "the JICA Guideline") to the Tajikistan side. The Tajikistan side understands the concept of the JICA Guideline and agreed on carrying out Initial Environmental Examination (IEE) in accordance with the Tajikistan laws and regulations, if necessary.

9. Other Relevant Issues

9-1. The Tajikistan side understands the principle of the Japan's Official Development Assistance (ODA) Charter, which stresses that ODA must not be utilized for military purposes or promoting international conflicts, and agrees to ensure that the International Cargo Terminal to be constructed and the equipment and facilities to be procured in the Project shall never be utilized for any military purposes.

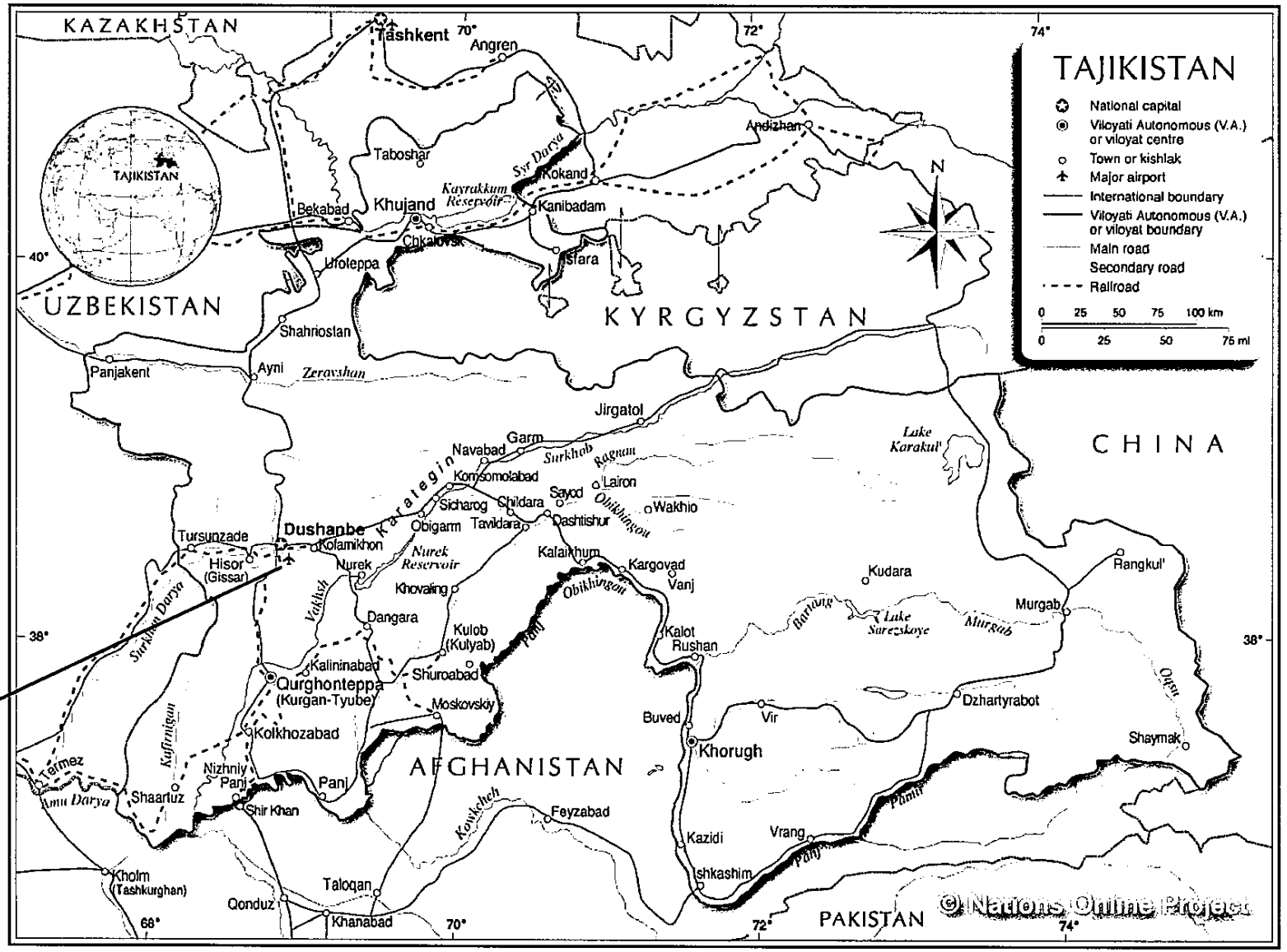
9-2. The Tajikistan side agreed that Dushanbe International Airport shall secure enough budget and personnel necessary for operation and maintenance of the facilities constructed and equipment procured by the Project.

9-3. The Tajikistan side shall provide security measures for all concerned Japanese nationals working for the Project, if deemed necessary.

Annex-1: Project Site
Annex-2: Organization Chart of MOT
Annex-3: Organization Chart of DIA
Annex-4: Japan's Grant Aid Scheme
Annex-5: Major Undertakings to be Taken by Each Government

Annex-1

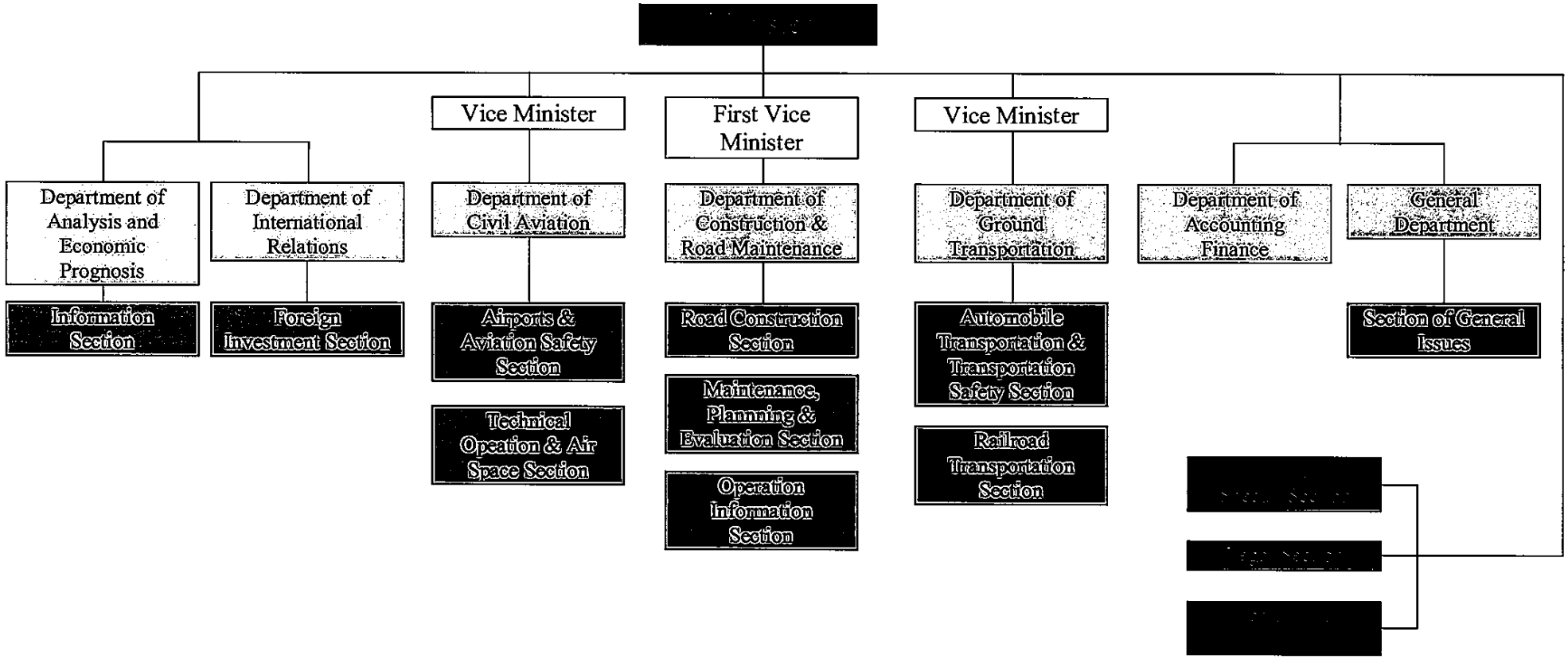
PROJECT SITE



Dushanbe International Airport

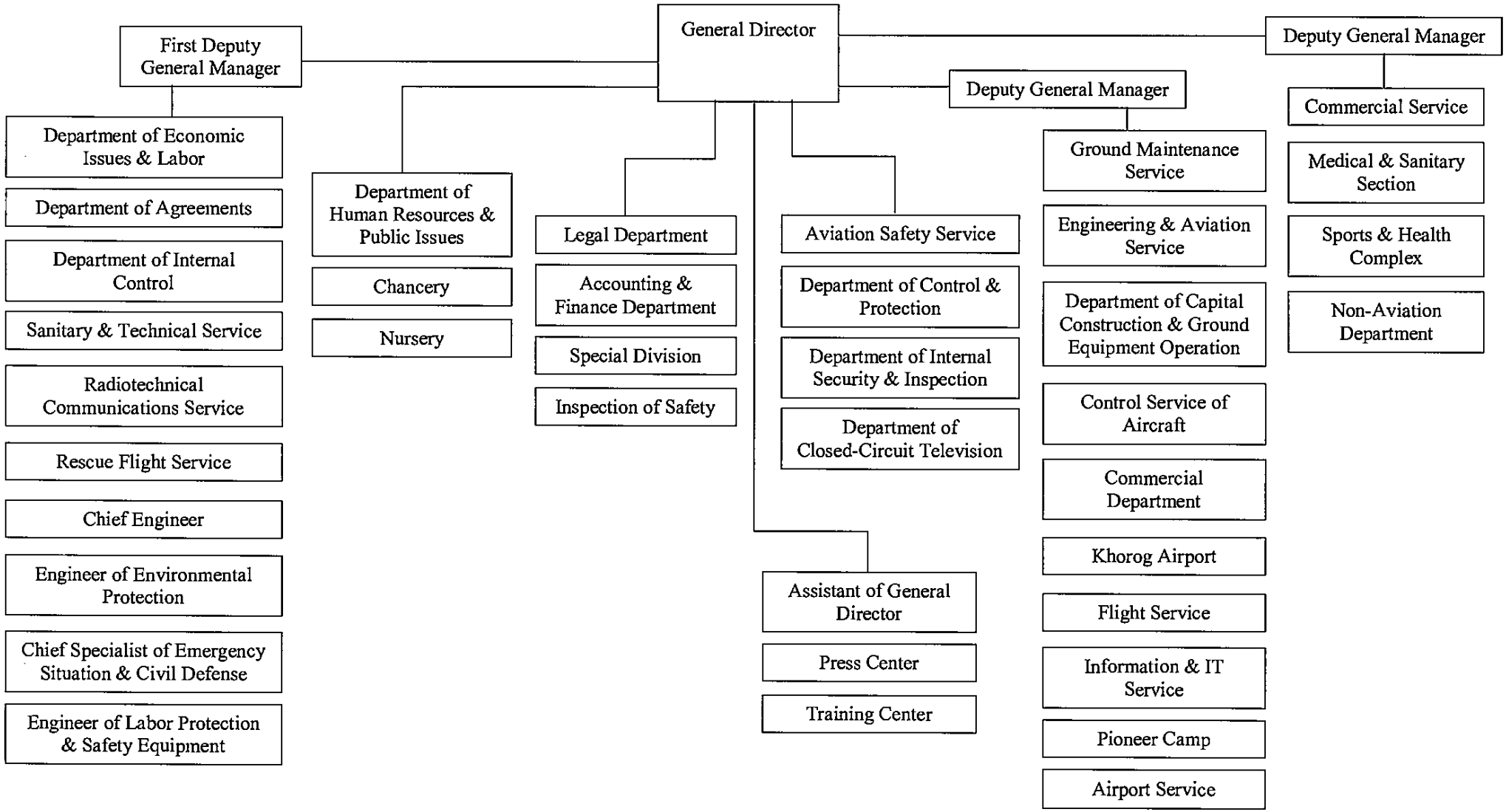
Annex-2

ORGANIZATION CHART OF MOT



Annex-3

ORGANIZATION CHART OF DIA



JAPAN'S GRANT AID SCHEME

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - -Agreement concluded between JICA and a recipient country
- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.

- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-5.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

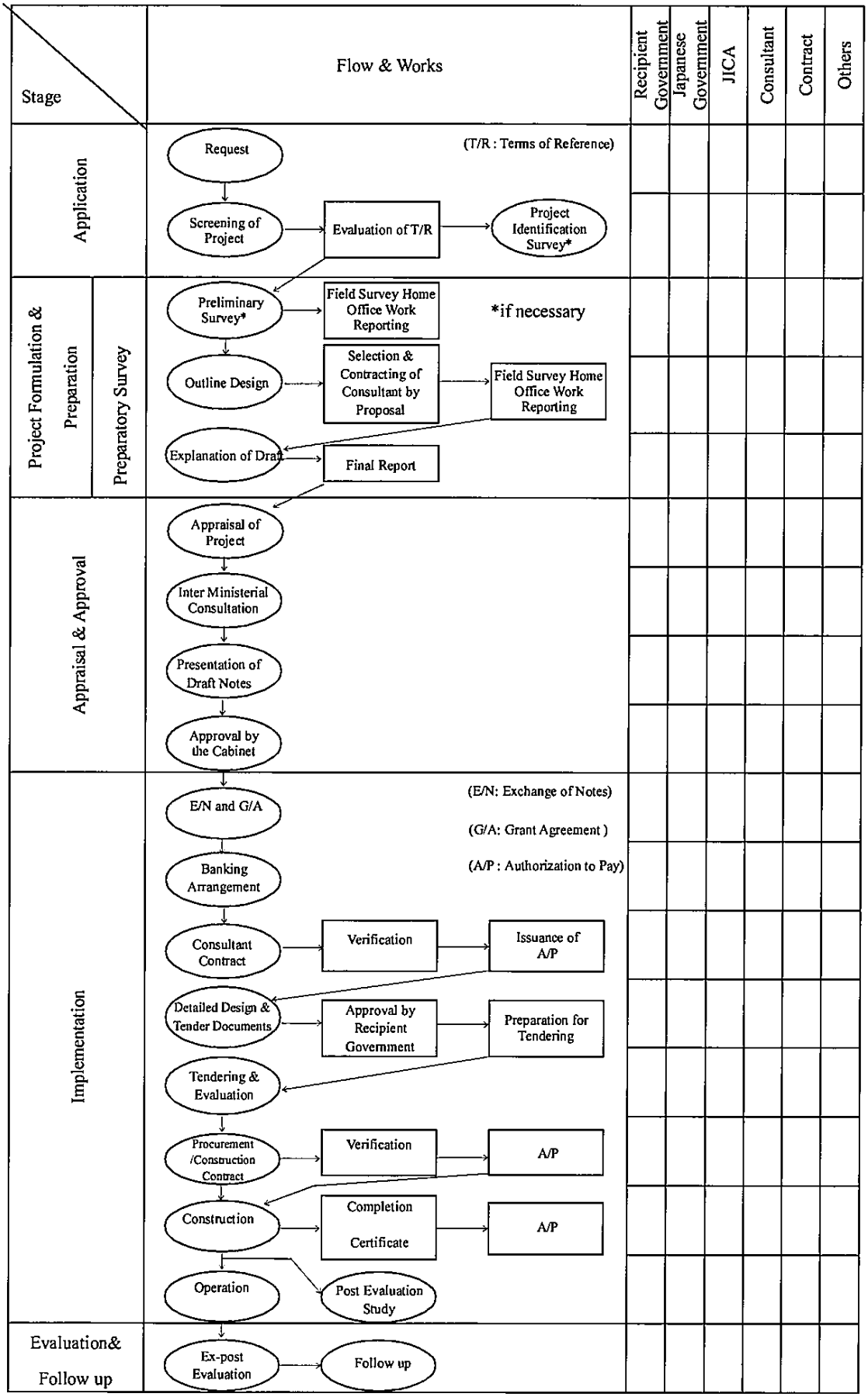
The Government of the recipient country should bear an advising commission of an Authorization

to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



MAJOR UNDERTAKINGS TO BE TAKEN BY EACH GOVERNMENT

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure lots of land necessary for the implementation of the Project and to clear the sites;		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	5) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To undertake transportation and to ensure prompt customs clearance of the products of the project		
	1) Transportation of the products from Japan to the recipient country	●	
	2) Custom clearance of the products		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		●
6	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

(B/A : Banking Arrangement, A/P : Authorization to pay)

A-5 Technical Memorandum

TECHNICAL MEMORANDUM
ON THE PREPARATORY SURVEY
ON THE PROJECT FOR
DEVELOPMENT OF DUSHANBE INTERNATIONAL AIRPORT
IN THE REPUBLIC OF TAJIKISTAN

Following the signing of Minutes of Discussion on the Project for Development of Dushanbe International Airport (the Project) on December 11, 2013 by Mr. Jumakhon ZUKHUROV, the First Deputy Minister, Ministry of Transport, the Republic of Tajikistan and Mr. Hiroyuki UEDA, Leader of Preparatory Survey Team (the Survey Team) of Japan International Cooperation Agency (JICA), the consultant members of the Survey Team continued the field survey and held a series of technical discussions on the Project with officials concerned of Civil Aviation Authority (CAA) and Dushanbe International Airport (DIA).

As a result of the technical discussions and field survey of the Project, both Japanese and Tajikistan sides confirmed the main items described in the attached sheets. It is noted that the result of discussions between the consultant members of the Survey Team and Tajikistan side is not final and binding, and that issues stated in this Technical Memorandum will be brought to Japan for further examination by Japanese side.

Dushanbe, December 25, 2013

JOBIROV IBRAGIM
Authority of Civil Aviation
Ministry of Transport of the Republic of Tajikistan

AZIZ IBRAGIMOV
Deputy General Director
Dushanbe International Airport

SATOSHI HATAYAMA
Leader of the Consultants
JICA Preparatory Survey Team

ATTACHMENT

I. Air Navigation Safety Equipment

1. Basic Technical Requirements of the Systems

The detailed system configuration of each project component will be considered following basic technical requirements:

- The system equipment characteristics will follow and conform to any relevant ICAO Standards and Recommendations including Annex/SARPs, and other related national or international regulations and agreements.
- The designs for the system will take into account human engineering considerations, for example, the Human-Machine Interface (HMI) of the operational and technical position should be of window type, multi-color and user-friendly graphical environment.
- The hardware of ILS and PALS systems should be as much as practicable Commercial Off-The-Shelf (COTS) products with state-of-the-art technology.

2. Equipment Configuration of the Systems

System equipment configuration for each system based on the basic technical requirements is shown in the table below;

Note: Further analysis for equipment configuration of each system will be implemented during the works for preparation of draft final report & equipment specification by the Survey Team.

1) Instrument Landing System (ILS)

Table I-1 ILS Equipment Configuration

Place	Name of Equipment	Q'ty	Remarks
Localizer site	Localizer Equipment	1 set	2-frequency type, hot-standby
	Localizer Antenna	1 set	12 or 20 elements
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
GP/DME site	GP Equipment	1 set	2-frequency type, hot-standby
	GP Antenna	1 set	3 elements
	DME Equipment	1 set	100W, hot-standby
	DME Antenna	1 set	
	Wireless system (radio link)	1 set	
	DC Power supply equipment	1 set	
	Automatic Voltage Regulator	1 set	5kVA
	Shelter (metallic shelter)	1 set	With air conditioner
	Engine Generator	1 set	10kVA
Monitor building 09GP site	ILS Remote Maintenance Monitoring System (RMMS)	1 set	
	ILS Remote Control Status Unit	1 set	

	(RCSU)		
	Localizer interlock system	1 set	
	Wireless system (radio link)	2 sets	
Control Tower	ILS Status Unit	1 set	

Outline of each system diagram is as shown below:

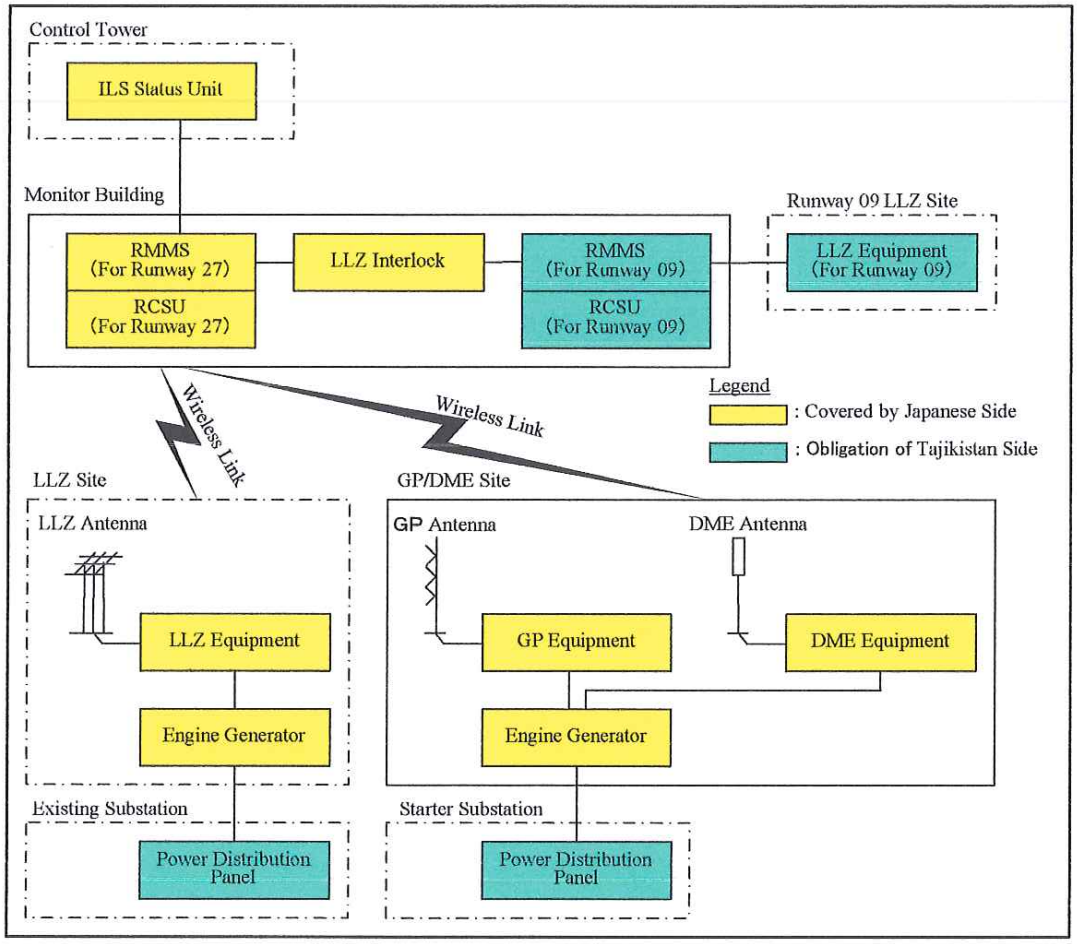


Figure I-1 ILS System Diagram

2) Precision Approach Lighting System (PALS)

Table I-2 PALS/RTHL Equipment Configuration

Place	Name of Equipment	Q'ty	Remarks
Runway 27 side	Precision Approach Lighting System	1 set	
	Runway Threshold Light	1 set	
New Substation (east side)	PALS Control Panel	1 set	
	Constant Current Regulator	2 sets	30kVA x 2
	Engine Generator	1 set	100kVA
Existing Substation	AGL Control & Monitor Panel	1 set	PC type
Control Tower	AGL Control Panel	1 set	PC type

Outline of the system diagram is as shown below:

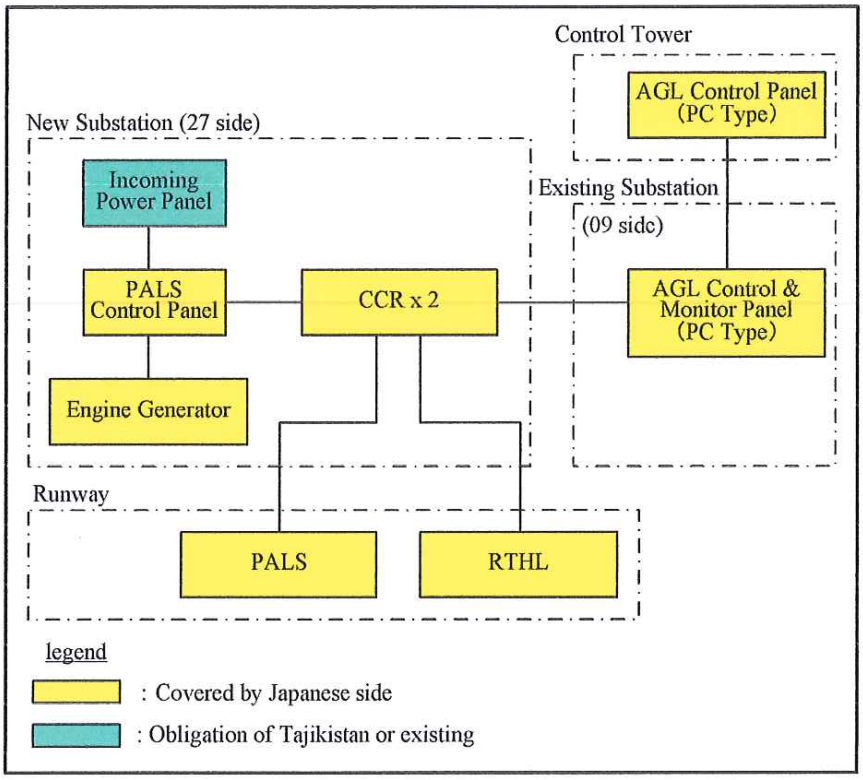


Figure I- 2 PALS/RTHL System Diagram

3. **Responsibility of the works to be covered by Tajikistan side and by Japanese Grant Aid, and technical confirmation**

- Provision of electric power supply for the ILS and PALS by DIA.
- ILS will consist of Localizer, Glide Path and DME instead of two Markers.
- Power capacity for Localizer and Glide Path/DME is 10kVA each, and PALS is 60kVA.
- 10 kVA engine generators with automatic function will be provided for Localizer and Glide Path/DME respectively. The engine generator will be covered by lockable metal cage.
- Remote control system for ILS will be installed at monitor room located Runway 09 GP site.
- ILS monitor panel will be installed in the Control Tower. That cable for monitor panel will be provided by DIA.
- Remote control for ILS, which will be installed by Japanese side, will be done by wireless system.
- Installation of the following cable will be covered by Japanese Grant Aid;
  - Existing substation to Runway 27 Localizer – power cable
  - Existing substation vicinity of Starter to Runway 27 Glide Path – power cable
- Substation for PALS to be located Runway 27 side including incoming switchgear panel as well as incoming power cable will be constructed and installed by DIA.
- Two sets of Constant Current Regulator (CCR) will be installed in the Runway 27 PALS substation.

- Installation of 100kVA Engine Generator and automatic transfer switching devices with power panel for CCR in the Runway 27 PALS substation will be covered by Japanese Grant Aid.
- Runway threshold light (RTHL, green lights) will be integrated into the circuit of PALS.
- Installation of power cable for PALS/RTHL from Runway 27 PALS substation will be covered by Japanese Grant Aid.
- AGL control & monitor panel (PC type) will be installed at control room in the present substation located Runway 09 side by Japanese side. The power supply for such PC will be provided by DIA.
- Installation of modem cable between AGL control & monitor panel (PC type) in the control room and CCR in the Runway 27 PALS substation will be covered by Japanese Grant Aid.
- Installation of AGL control panel (PC type) in the Control Tower will be covered by Japanese Grant Aid. However, remote cable for such PC will be provided by DIA. The power supply for such PC will be provided by DIA.
- Removal of existing SALS will be implemented by DIA.

II. International Cargo Terminal

1. International Cargo Terminal Building

1) Cargo demand forecast

The design target year of the cargo terminal building is year 2021, five (5) years after the completion of the construction of the terminal in 2016. Using elastic demand forecast on the future GDP growth rate of 5% per year estimated by IMF, the annual cargo volume is estimated to be approximately 10,000 ton in 2021.

2) Handling volume during peak hours

During peak hours, the following conditions are estimated as handling capacity of the cargo terminal building.

a) Handling 32 LD3ULD units from one A330 freighter aircraft, which Turkish Airlines planned to operate at Dushanbe International Airport, or

b) Handling two passenger aircraft, each of which can carry 7-11 LD3ULD.

Turn-around time of the aircraft is assumed as two hours.

3) Necessary ULD Build-up/Break down positions

To handle above cargo volume during peak hours, four build up potions for export and five break-down positions for import will be required for new cargo terminal building.

4) Handling of special cargo

The following storage will be prepared in the cargo terminal building.

- +5℃ to +20℃ cold storage for perishable goods.
- -15℃ to -20℃ cold storage for mainly vaccine import demand.

- A valuable storage for cash or gold ingot temporary storage.
- Dangerous goods store placed in accordance to IATA standard.
- Animal storage to keep live animals during quarantine documentation.

5) Construction site

The construction site will be the area as shown in the drawing Attachment 1. DIA agree to issue official letter to JICA regarding to the Land use of the cargo terminal building.

6) Land clearance.

DIA will remove the concrete debris in the site.

7) Road and bridge construction

DIA will execute both design and construction of access ways, which connect from the public road to the site road. The specification of the road and bridge should have enough capacity to bear 12 m long or 40 ton heavy truck traffic and should not disturb public traffics of the public road.

8) Cargo terminal plan

The cargo terminal planning will be developed based on the drawing as per Attached-YY

9) Procedure and commission fee for the design expertise.

DIA will execute an application for the design commencement permission to the Dushanbe city government. DIA will pay the commission fee for the architectural expertise.

10) Rainwater drainage

DIA will install gutter along the access road out of the cargo site.

DIA will install gutter along the apron besides the cargo site.

Japanese side will pave or finish the surface up to those gutters.

11) Electricity and water supply for construction

DIA will prepare temporary electricity and water supply for construction.

12) Water supply

Drawing of water supply to the western edge of the construction site will be done by DIA. Installation of the water meter of water supply will not be covered by Japanese Grant Aid.

13) Drainage

Sewage water from the cargo terminal will be treated to comply with Tajikistan or Japanese standard quality. Treated water will be disposed to storm water drainage.

14) High voltage facility

High voltage lead-in and construction of a sub substation will be done by DIA. Wiring from the secondary side of the switchboard breaker of the sub substation will be covered by Japanese Grant Aid.

Installation of Emergency generator will be covered by Japanese Grant Aid if necessary.

Installation of Emergency generator will be covered by Japanese Grant Aid if necessary.

15) Low voltage facility

Design and installation of the following electrical facilities in the cargo terminal will be covered by Japanese Grant Aid. Those systems will be completed only within the cargo terminal building. If connection with outside of the cargo terminal building is required, those works will be undertaken by DIA. In case any miss coordination may occur between DIA system and Japanese side system, those should be solved by DIA. Empty conduit will be covered by Japanese Grant Aid.

- Telephone
- LAN
- Fire alarm
- Security System
- ITV system
- Alarm for electrical and mechanical equipment

16) Fumigation

Fumigation system installation will be in consideration for the future study.

17) Soft component

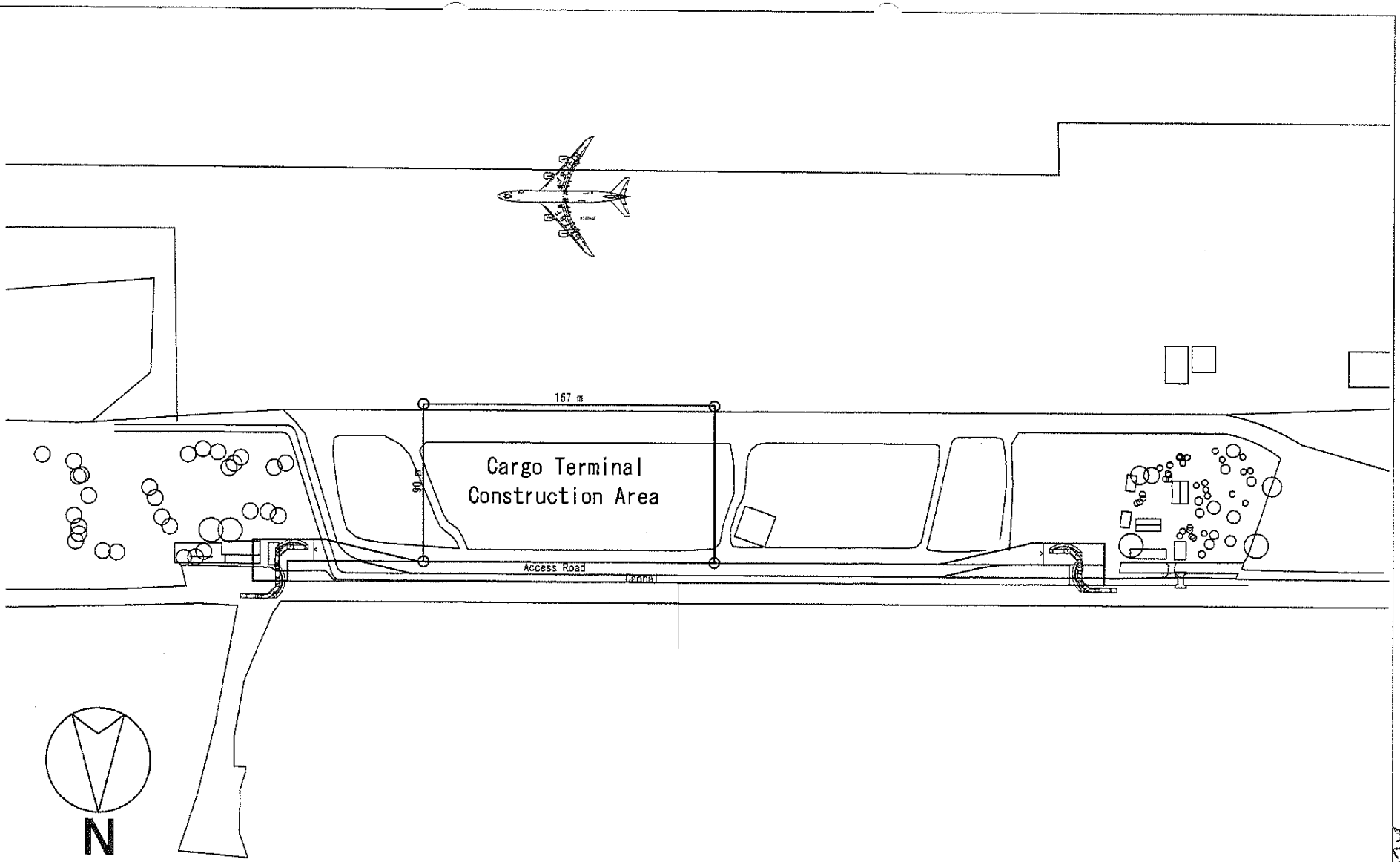
Soft component for new cargo operation will be in consideration for the future study.

2. Equipment for Cargo Terminal

1) Item to be in consideration for the study

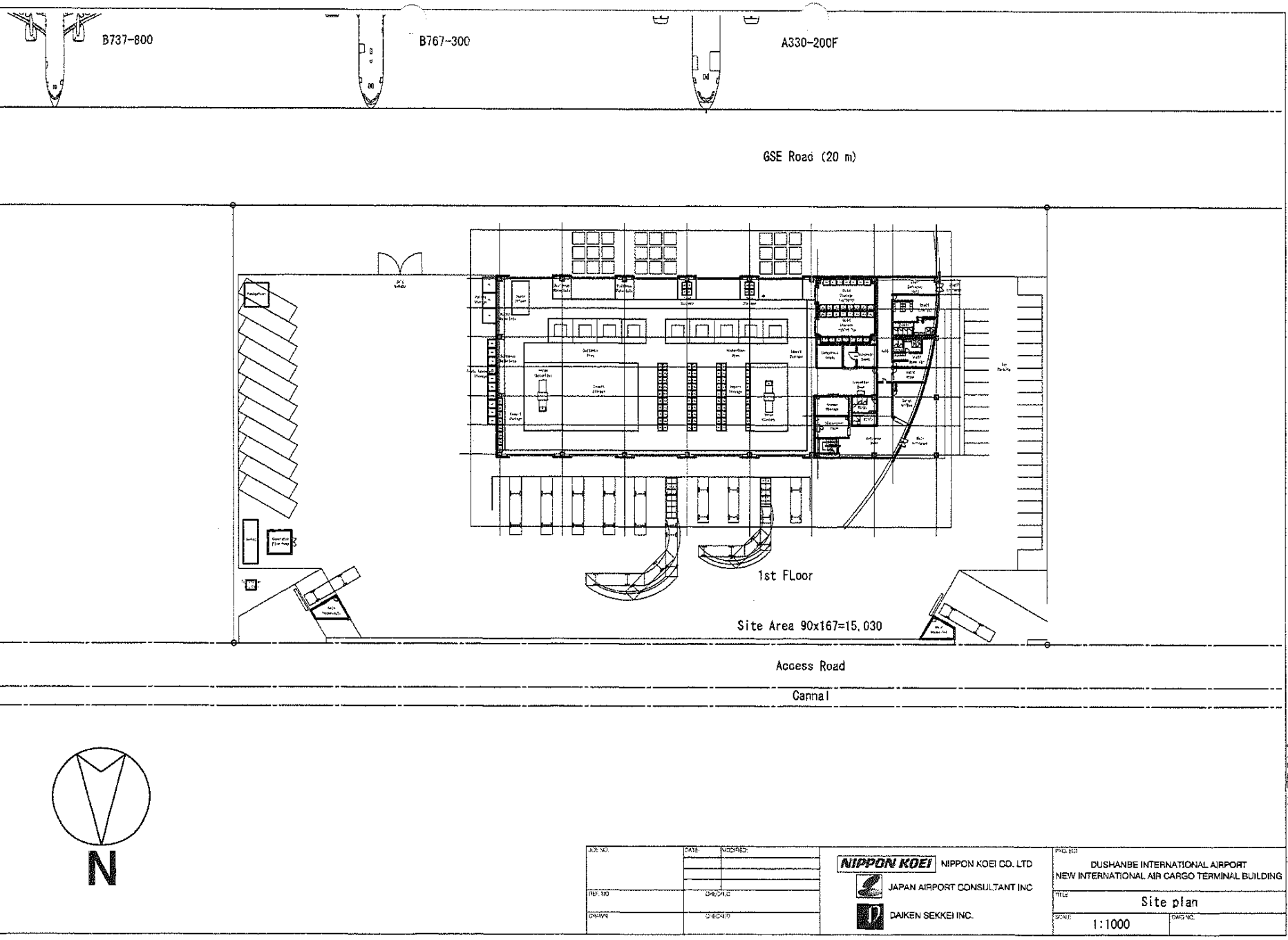
Following items will be in consideration as the scope of the Project:

	Equipment
1	Forklift (1.5 ton)
2	Forklift (2 ton)
3	Diesel Engine Forklift (15 ton)
4	Electrical Reach Forklift (1.5 ton)
5	Hand Lift (1.5 ton)
6	Pit Scale (20 feet)
7	Weight Scale (1 ton)
8	Weight Scale (0.5 ton)
9	Movable Rack for 1.2m x 0.8m Size Skid
10	Movable Rack for Cold Storage
11	Plastic Skid for 1.2m x 0.8m
12	High Lift Loader
13	Main Deck Loader
14	Container Dolly
15	Pallet Dolly
16	Bulk Cart
17	Toeing Tractor
18	Transporter (20 feet)
19	Role Pallet
20	Inspection desk



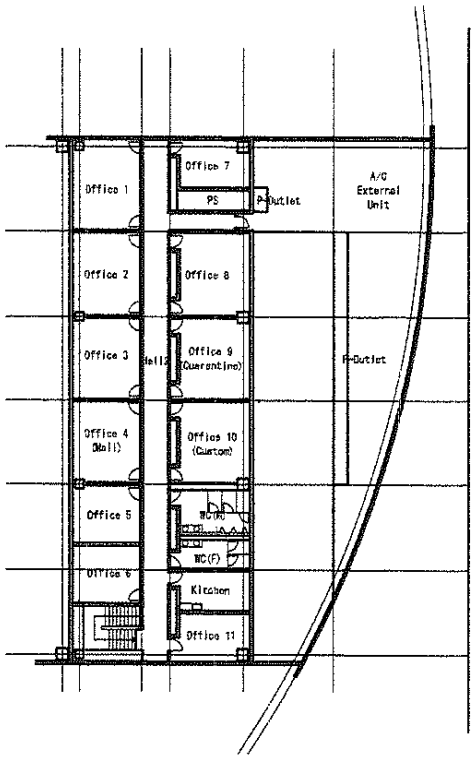
JOB NO.	DATE	SCALE	NIPPON KOEI NIPPON KOEI CO. LTD JAPAN AIRPORT CONSULTANT INC DAIKEN SEKKEI INC.
DRAWN	CHECKED		PROJECT: DUSHANBE INTERNATIONAL AIRPORT NEW INTERNATIONAL AIR CARGO TERMINAL BUILDING
			TITLE: Area Access
			SCALE: 1:3000

Attachment 1



JOB NO.	DATE / MODIFIED	NIPPON KOEI CO. LTD	PROJECT: DUSHANBE INTERNATIONAL AIRPORT NEW INTERNATIONAL AIR CARGO TERMINAL BUILDING
REF. NO	CHECKED	JAPAN AIRPORT CONSULTANT INC	TITLE: Site plan
DRAWN	CHECKED	DAIKEN SEKKEI INC.	SCALE: 1:1000 / DWG NO.

Attachment 2-1



N

2nd FLoor

JOB NO.	DATE / MODIFIED	NIPPON KOEI CO. LTD	PROJECT	DUSHANBE INTERNATIONAL AIRPORT NEW INTERNATIONAL AIR CARGO TERMINAL BUILDING
		JAPAN AIRPORT CONSULTANT INC	TITLE	2F Plan
PDF NO.	CHECKED	DAIKEN SEKKEI INC.	SCALE	1:500
DRAWN	CHECKED		DWG NO.	

Attachment 2-2

A-6 Minutes of Discussions 2

MINUTES OF DISCUSSION ON
THE PREPARATORY STUDY FOR
THE PROJECT FOR IMOPROVEMENT OF DUSHANBE INTERNATIONAL AIRPORT
IN THE REPUBLIC OF TAJIKISTAN
(EXPLANATION OF THE DRAFT PREPARATORY SURVEY REPORT)

On the basis of the field study in the Republic of Tajikistan in December 2013 and the technical examination in Japan, Japan International Cooperation Agency (hereinafter referred to as 'JICA') prepared the Draft Preparatory Survey Report (hereinafter referred to as the 'Report') on the Project for Improvement of Dushanbe International Airport (hereinafter referred to as the 'Project').

JICA's Preparatory Survey Team (hereinafter referred to as the 'Team') headed by Mr. Hiroyuki Ueda, Senior Advisor of JICA, stayed in Dushanbe from June 1st to 5th, 2014. The Team explained to and consulted with the officials concerned of the Government of the Republic of Tajikistan about the Report.

As a result of discussions, both Japanese and Tajikistan sides confirmed the items in the attachment.

It should be noted that implementation of the Preparatory Survey does not imply any decision or commitment by JICA to extend its grant for the project at this stage.

Dushanbe, June 4th, 2014

Sherali Gandjalzoda
First Deputy Minister
Ministry of Transport
Republic of Tajikistan

Hiroyuki Ueda
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Rustam Khalikov
General Director
Dushanbe International Airport

ATTACHMENT

1. Project Title

Both sides agreed that the Project title was changed as follows from the Minutes of Discussions signed between JICA and the Ministry of Transport (hereinafter referred to as the 'MOT') on December 11th, 2013.

Old: Project for Development of Dushanbe International Airport
New: Project for Improvement of Dushanbe International Airport

2. Executing Agency

Both sides confirmed that Dushanbe International Airport (hereinafter referred to as 'DIA') will be the Executing Agency for the implementation of the Project.

3. Contents of the Report

The Tajikistan side agreed and accepted in principle the contents of the Report and draft technical specifications of the equipment. The list of the facility to be constructed and equipment to be procured is shown in Annex 1.

4. Confidentiality of the Cost Estimation and Specifications

Both sides agreed that the project cost estimation attached in Annex 2 and technical specifications of the equipment in the Report should never be disclosed to any third parties until all the contracts of the Project are concluded.

5. Undertaking by the Government of Japan

The Japanese side will take the undertakings shown in Annex 5 of the Minutes of Discussions signed between JICA and the MOT on December 11th, 2013.

6. Undertaking by the Tajikistan Side

6-1. Preparatory Works at DIA

The Tajikistan side will undertake the following preparatory work for the Project at its expenses before starting the facility construction and equipment installation works.

6-1-1. Instrument Landing System (ILS) and Precision Approach Lighting System (PALS)

- To provide power supply and remote control lines for ILS equipment of Runway 27;
- To construct new sub-station and to provide it with power distribution panel;
- To provide installation space for engine generator system in the new sub-station;
- To dismantle existing SALS equipment;
- To temporarily replace the equipment as necessary to allow spaces for new

equipment installation for ILS remote control and monitoring system in the existing monitor building of Runway 09 GP site;

- To provide commercial power supply available for new equipment for ILS remote control and monitoring system in the existing monitor building of Runway 09 GP site;
- To temporarily replace the equipment as necessary to allow spaces for the installation of new equipment (ILS Status Unit and AGL Control Panel) in the control tower;
- To provide commercial power supply and communication line for the new equipment in the control tower; and
- To provide installation space and commercial power supply for AGL Control & Monitor Panel in the existing AGL sub-station and the new sub-station.

6-1-2. New International Cargo Building

- To construct guard fence around the new international cargo building;
- To construct new drainage in front of the new international cargo building; and
- To provide commercial power supply, water supply, communication line for the new international cargo building.

6-2. Administrative Undertakings

The Tajikistan side will take the undertakings in Annex 5 of the Minutes of Discussions signed between JICA and the MOT on December 11th, 2013 for smooth implementation of the Project at its own expenses.

7. Operation and Maintenance of the Facility and Equipment

The Tajikistan side will secure sufficient personnel and budget necessary for proper operation and maintenance of the facility constructed and equipment procured by the Project. The estimated costs are indicated in the Report.

8. Soft Component

The Tajikistan side understood the contents of the soft component described in the Report, and confirmed that it would provide necessary number of trainee.

9. Japan's Grant Aid Scheme

The Tajikistan side fully understood the scheme of the Japan's Grant Aid and the necessary measures to be undertaken by the Tajikistan side, which was explained by the Team and described in Annexes 4 and 5 of the Minutes of Discussions signed between JICA and the MOT on December 11th, 2013.

10. Environment and Social Consideration

10-1. Both sides confirmed the information on environmental and social considerations including major impacts and relevant mitigation measures for the Project are summarized in the Environmental Checklist (hereinafter referred to as the 'Checklist') attached as Annex 3. The Tajikistan side confirmed that they will inform JICA of any major changes which may affect environmental and social considerations made for the Project by revising the Checklist in a timely manner.

10-2. Both sides confirmed that when an environmental impact assessment (EIA) is decided to be required for the Project, the Tajikistan side will obtain the necessary environmental approval within five months from the date of the Contract with the Consultant for the Project.

10-3. Both sides confirmed that environmental monitoring will be implemented by the Tajikistan side in accordance with the Monitoring Plan in the Report.

10-4. Both sides confirmed that the result of the monitoring will be provided to JICA as a part of project status report by filling in the Environmental Monitoring Form attached as Annex 4 during the construction.

10-5. In case JICA finds that there is a need for improvement in a situation with respect to environmental considerations during the Project implementation period, JICA may request to extend the period of monitoring and reporting until JICA confirms that the issues have been properly addressed in accordance with the agreement between both sides.

11. Building Permission

Both sides confirmed that the Tajikistan side will obtain the building permission for the New International Cargo Building within five months from the date of the Contract with the Consultant for the Project.

12. Schedule of the Survey

JICA will complete the final report in English in accordance with the confirmed items and send it to the Tajikistan side around September 2014. The schedule is tentative and subject to change.

13. Disclosure of Information

Both sides confirmed that the survey results, excluding the project cost estimation, the details of the facility, and the technical specifications of equipment, will be disclosed to the public after the completion of the Preparatory Survey. All the survey results, including the

project cost estimation, the details of the facility, and the technical specifications of the equipment, will be disclosed to the public after all the contracts of the Project are concluded.

Annex 1: List of the Facilities and Equipment to be Procured
Annex 2: Cost Estimation
Annex 3: Environmental Checklist
Annex 4: Environmental Monitoring Form

Annex 1: List of Facilities and Equipment to be Procured

Items	Qty.
1. Construction of the New International Cargo Building (Floor Area 3,700 m^2)	1
2. Equipment for Instrument Landing System (ILS)	
(1) Localizer site	
1) Localizer Equipment	1
2) Localizer Antenna	1
3) Wireless System (radio link)	1
4) DC Power Supply Equipment	1
5) Automatic Voltage Regulator	1
6) Equipment Shelter (metallic shelter)	1
7) Engine Generator	1
(2) Glide Path/DME site	
1) GP Equipment	1
2) GP Antenna with monitor antenna	1
3) DME Equipment	1
4) DME Antenna	1
5) Wireless System (radio link)	1
6) DC Power Supply Equipment with batteries	1
7) Automatic Voltage Regulator	1
8) Equipment Shelter (metallic shelter)	1
9) Engine Generator	1
(3) Monitor Building Runway 09 GP site	
1) ILS Remote Maintenance Monitoring System	1
2) Remote Control Status Unit (RCSU)	2
3) Localizer Interlock System	1
4) Wireless System (radio link)	2
(4) Control Tower	
1) ILS Status Unit	1
3. Equipment for Precision Approach Lighting System (PALS)	
(1) Runway 27 side	
1) PALS	1
2) Runway Threshold Light	1
(2) New Substation	

1) PALS Control Panel	1
2) Constant Current Regulator	2
3) Engine Generator	1
(3) Existing Substation	
1) AGL Control & Monitor Panel	1
(4) Control Tower	
1) AGL Control Panel	1
4. Equipment for International Cargo Building	
[redacted]	
2) Pit Scale (10 feet)	1
3) Engine Powered Forklift Track 15 ton	1
4) Battery Powered Ramp Equipment Tractor	4
5) Lower Deck Container Turntable Dolly	8
6) Pallet Dolly	16
7) Baggage/Cargo Cart	4
8) Platform Scale (1.0 ton)	1
9) Platform Scale (500 kg)	1
10) Battery Powered Forklift Track (1.5 ton)	4
11) Battery Powered Forklift Track (2.5 ton)	8
12) Battery Powered Reach Forklift Track (1.5 ton)	1
13) Manual Pallet Jack (1.5 ton)	2
14) Nesting Lack (120 x 80 cm)	112
15) Nesting Lack for cold storage	28
16) Plastic Pallet (120 x 80 x 15 cm)	50
17) Roll Box Pallet (110 x 80 x 170 cm)	5
18) Working Table (180 x 90 x 74 cm)	1
19) Safety Belt	8
20) Working Stand (55 x 140 x 50 to 95 cm)	2
21) ULD Container Lack (200 x 400 x 2,240 cm)	1
22) ULD Pallet Lack (380 x 235 x 330 cm)	2
23) Battery Powered Aerial Work Platform (Floor Height 14 m Max)	1

Annex 2: Cost Estimation (Confidential)

This Page is closed due to the confidentiality.

Annex 3: Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N (d) N/A (N/A: Not applicable)	(a) EIA reports are required after the determination of detailed design according to the Tajikistan's classification criteria of Project classification. So EIA reports are not required at this point. (b), (c), (d) After detailed design of the Project, the EIA reports will be prepared and submitted to the Committee for Environmental protection (CEP) of Tajikistan. The CEP appraises the reports, and then approves them.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) N/A (b) N/A	(a) The Project doesn't influence local environment as the Project site is inside of the premises of existing airport. (b) Not required
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) N	(a) There are no alternative plans for the Project. ILS and PALS are designed based on the ICAO's specification.
2. Pollution Control	(1) Water Quality	(a) Do pollutants, such as Suspended Solids (SS), and oils contained in effluents comply with the country's effluent standards (BOD, COD etc)? Is there a possibility that the effluents from the project will cause areas not to comply with the country's ambient water quality standards?	(a) N/A	(a) Wastewater generated in the new cargo terminal should be treated properly to meet the effluent standards of Tajikistan. Although Tajikistan has effluent standards, these standards have not been obtained within the period of this study. Effluent standards should be checked. (According to the Tajikistan authority, effluent standards follow the GOST of former Soviet Union.)
	(2) Wastes	(a) Are wastes generated from the airports and other project facilities properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) All the wastes generated from the Project will be properly treated and disposed by the existing waste treatment system.
	(3) Noise and Vibration	(a) Does noise from aircraft comply with the country's standards? (b) Is there a possibility that noise and vibrations from various sources, such as airport users' vehicles and vehicles for airport operations will adversely affect ambient noise levels? If impacts are anticipated, are adequate noise mitigation measures considered?	(a) Y (b) N	(a), (b) At present, noise level in and around the airport complies with the Tajikistan's standards. There is no major impact of noise increased by the Project.
	(4) Soil Contamination	(a) Has the soil in the project site been contaminated in the past? Are adequate measures taken to prevent soil contamination by leakage of fuels?	(a) N	(a) The site has not been used for other purposes in the past.

	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) There is no plan to extract large volume of groundwater in the Project.
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a) There are no odor sources.
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The Project site is inside the existing premises of DIA
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N (d) N	(a) No (b) No (C) No (d) No
	(3) Hydrology	(a) Is there any possibility that alteration of drainage system due to the constructions of airports and related facilities will adversely affect surface water and groundwater flows? (b) Do the facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	(a) N (b) N	(a) No (b) No
	(4) Topography and Geology	(a) Does the project require the large scale change of topographic/geographic features? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff? (d) In the case of offshore projects, is there any possibility that the project will erode natural beaches?	(a) N (b) N (c) N (d) N	(a) The Project does not require the large scale change of topographic/geographic features. (b) There is no large cut and fill by the Project. (c) There is no possibility that soil runoff will result from the civil works. (d) The Project facilities are not constructed on/by the seas.

4. Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (I) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (I) N/A (j) N/A	(a) There is no involuntary resettlement caused by the Project. (b) Not applicable (c) Not applicable (d) Not applicable (e) Not applicable (f) Not applicable (g) Not applicable (h) Not applicable (i) Not applicable (j) Not applicable
	(2) Living and Livelihood	(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is sufficient infrastructure (e.g., roads) available for the project implementation? If the existing infrastructure is insufficient, is a plan developed to construct new infrastructure or improve the existing infrastructure? (e) Is there any possibility that the airports and other project structures will cause a sun shading and radio interference?	(a) N (b) N (c) N (d) Y (e) N	(a) There is no possibility that the Project will affect the living conditions of inhabitants because the Project site is inside of the airport. (b) There is no possibility that the Project causes the change of land uses. (C) There is no possibility that diseases will be brought due to immigration of workers associated with the Project. (d) Although sufficient infrastructure is available for the Project implementation, two connection roads to the outside public road will be constructed inside the airport. (e) There is no possibility that the airports and other project structure will cause a sun shading and radio interference.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There is no possibility that the Project will damage the local archeological, historical, cultural, and religious heritage.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is no possibility that the Project will adversely affect the local landscape.

4. Social Environment	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) No impacts on the culture and lifestyle of ethnic minorities and indigenous peoples are envisaged. (b) Not applicable
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) No (b) Safety measures during construction will be included in the term of reference of the contractor. (C) Safety and health measures will be included in the terms of reference of the contractor. (d) Local laws will be respected.
5. Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) N/A (c) N	(a) Adequate measures will be considered to reduce impacts during construction. (b) No construction activities will adversely affect the natural environment (ecosystem). (c) No construction activities will adversely affect the social environment.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) N (b) N/A (c) N/A (d) N/A	(a) There are no items needs to be monitored. (b) Not applicable (c) Not applicable (d) Not applicable
6. Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways, and Bridges checklist should also be checked (e.g., projects including large areas of deforestation). (b) If the airport is constructed on the sea, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities). (c) Where necessary, pertinent items described in the Forestry Projects	(a) N/A (b) N/A (c) N/A	(a) Not necessary (b) No (c) Not necessary

		checklist should also be checked (e.g., projects including large areas of deforestation).		
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) Not necessary

A-7 Soft Component Plan

1. Background of Soft Component Plan

In this grant aid, procurement of equipment and construction of the terminal building capable of handling ULD (Unit Load Device) such as containers, pallets, etc. are requested from Tajikistan. The handling capacity of air cargo is expected to be improved dramatically by equipment procurement and the construction of facilities in Dushanbe International Airport, where only bulk cargo is handled so far. However, the workers dealing with air cargo have only experience of handling of bulk cargo and they do not have enough knowledge and experience about the handling of the ULD. Thus, educational training of handle method of ULDs in the new cargo terminal is required. Therefore, the soft component provides educational training of handling ULD for cargo terminal operators with equipment and new cargo terminal building procured in the Project.

2. Objective of Soft Component

The objective of soft component is to build basis of continuous service for handling ULD in Tajikistan after the grant aid by implementation of training for operating method of new cargo terminal building. More specifically, as well as implementation of lecture of handling method ofULD, operation method of cargo terminal including ULD handling and use of equipment, creating the freight handling manual shall be supported.

3. Effects of Soft Component

- ✈ Fundamental knowledge of handling ULDs can be acquired.
- ✈ Freight Handling Manual, consisting handling method of ULDs, operation method of the new cargo terminal building and use of equipments, can be created.

4. Confirmation of Effects of Soft Component

- ✈ The evaluation examinations which relate to lecture subject in written test and interviews are carried out after lectures and practices to confirm understanding level of fundamental knowledge.
- ✈ The freight Handling Manual is completed and started to be used for the operation of new cargo terminal building.

5. Activities (Inputs) of Soft Component

The contents and the scale of activities by Japanese and Tajikistan side are planned as shown in Table A-7-1.

Table A-7-1 Activities of Soft Component

Items	Japanese side	Tajikistan side
1. Activities A. Necessary technical skill and category	Lecture for ULD handling method as a fundamental operation skill with introduction of examples in Japan. Training shall be conducted with prepared curriculum and textbook.	Cargo terminal operators (About 10 persons)
B. Current level of technical skill and required level		Current：dealing with only bulk cargo Plan：acquiring skill for handling ULD international air cargo
C. Target group		Cargo terminal operators
2. Method of Implementation	Implementation of lecture and practice, support of creation of freight handling manual	Creating freight handling manual
3. Resource	2 Japanese consultants with experience of operation of terminal building, 2 translators (2.0M/M per person, total 8.0M/M)	Providing training facility and office room for creating the manual.
4. Output		Freight handling manual

Source: JICA Study Team

6. Procurement of Resource for Implementation of Soft Component

It will be the first experience for Tajikistan to operate the cargo terminal building handling ULDs. In addition, cargo terminal operation is a specialized field in the aviation. Number of companies with experience of operating cargo terminal and ability of training are limited in Japan as well, but Japanese staff with experience of training of handling ULDs shall be dispatched as instructors and the implementation of the plan is conducted by "Consultant's-direct-support based method."

7. Implementation schedule of Soft Component

Implementation schedule of soft component included in the Project is as shown in Table A-7-2.

Table A-7-2 Implementation Schedule of Soft Component

Month	1	2	3	4
Construction of Cargo Terminal Building			▲Completion and provision	
Installation of Equipment				▲Completion of installation
Soft Component Lecture (0.5 month)				
Practice (0.5 month)				
Creating manual (1.0 month)				
Completion report (Total 2.0 months)				▲

Source: JICA study team

The lecture is divided into 2 parts, (1) Introduction of operation example of cargo terminal building and (2) Knowledge for operation of cargo terminal building. Trainee's confirmation is evaluated by examinations. On the other hand, in practice training, trainees are intended to acquire operation method of cargo terminal with using equipment and fake cargo made from cardboard and take

evaluation examination in written test and interviews after practice.

In addition, creating freight handling manual is intended to be implemented by 2 groups of trainees and instructor, one is import/export group and the other is management group. The freight handling manual shall be created with support for review of Japanese existing manual and adjustment of condition in Tajikistan.

Training schedule and instructor dispatching schedule (M/M) is as shown in Table A-7-3 and training schedule is as shown in Table A-7-4.

Table A-7-3 Training Schedule and Instructor Dispatching Schedule (M/M)

Item / Month	1	2	Instructor	Translator	M/M
Lecture (0.5 month)			2	2	2.0
Practice (0.5 month)			2	2	2.0
Creation of Manual (1.0 month)			2	2	4.0
Dispatching Period (2.0 months)			2	2	8.0

Source: JICA Study Team

Table A-7-4 Training Schedule

Day	Content	Remarks
Lecture		
1-2	Move from Japan to Dushanbe	
3	Meeting, confirmation of training place	
4	Introduction of operation example of cargo terminal building	
5	Introduction of operation example of cargo terminal building Evaluation examination (Written and interview)	
6	Knowledge for operation of cargo terminal building	
7	Summarization of the result of practice	
8	Preparation of training	
9	Knowledge for operation of cargo terminal building	
10	Knowledge for operation of cargo terminal building Evaluation examination (Written and interview)	
11-12	Operation method of cargo terminal building	
13	Operation method of cargo terminal building Evaluation examination (Written and interview)	
14	Summarization of the result of practice	
15	Preparation of training	
Practice		
16	Preparation of training	
17-19	Operation method of cargo terminal building (Management)	
20	Operation method of cargo terminal building (Management) Evaluation examination (Written and interview)	
21-23	Operation method of cargo terminal building (Export)	
24	Operation method of cargo terminal building (Export) Evaluation examination (Written and interview)	
25-27	Operation method of cargo terminal building (Import)	
28	Operation method of cargo terminal building (Import) Evaluation examination (Written and interview)	
29	Summarization of the result of practice	
30	Summarization of the result of the training (lecture and practice)	

Day	Content		Remarks
Creating Freight Handling Manual			
	Import/export group	Management group	
31-33	Introduction and analysis of example of manual		
34-35	Setting items and objective of manual		
36-40	Creating manual (Export)	Creating manual (Ledger sheet)	
41-45	Creating manual (Import)	Creating manual (Labor service)	
45-50	Creating manual (Custom clearance)	Creating manual (Accounting)	
51-53	Review of manual		
54-56	Finalization of manual		
57-58	Practice on site based on the manual		
59	Return to Japan		
60	Arrive in Japan		

Source: JICA Study Team

8. Output of Soft Component

Output of soft component will be as follows:

(1) Submission to Client

- ✈ Freight Handling Manual for the New International Cargo Terminal
- ✈ Final Report of Soft Component (technical assistance) (English or Russian language)

(2) Submission to JICA

a. Soft Component Implementation Status Report

- ✈ Initial Objective and Output
- ✈ Implementation Status of Activities as Initial establishment
- ✈ Output at Present (Test Result)
- ✈ Comment from the Client

b. Soft Component Completion Report

- ✈ Summary of the Project (Name of the Project, Date of E/N, Limit of the Project cost by E/N, Consultant Contract Cost)
- ✈ Summary of the Soft Component (Cost, Background, Planed Objective, Planed Output, Planed Activities, Engaged Personnel, Participants of the Client, Implementation Schedule (Period and M/M), Actual Activities, Status of the Output Result)
- ✈ Issues and Recommendations for achieving objective and continuous & developing effectiveness)
- ✈ Attached Document (Implementation Schedule, List of Participants of the Client, Log of Participants, List of Output (Name of Output Document, Name of Producer, Summary)
- ✈ Appendices (Output: Completion Report to the Client, produced manual. text, test result, others: Photos, news articles, etc.)

9. Outline Cost of Soft Component

The outline cost of the soft component is as shown is Table A-7-5.

Table A-7-5 Outline Cost of Soft Component

This table is closed due to the confidentiality.

10. Obligation of Recipient Country

In order to achieve the objective of the soft component, it is required for Tajikistan to build management the budget and personnel with making use of provided freight handling manual. Furthermore, setting fee which stimulates demand for air cargo, attracting airlines, and increasing the size of the equipment of the existing route, are also required as a background of the Project for the responsibility of the recipient country.