Kyrgyz Republic
Kyrgyz Air Navigation

THE PREPARATORY SURVEY FOR THE PROJECT FOR THE IMPROVEMENT OF AIR TRAFFIC CONTROL FACILITIES AT INTERNATIONAL AIRPORTS IN THE KYRGYZ REPUBLIC

FINAL REPORT

March 2024

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.,
AZUSA SEKKEI CO., LTD.
JAPAN AIRPORT CONSULTANT, INC.
JAPAN RADIO AIR NAVIGATION SYSTEMS ASSOCIATION

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Consortium consist of Nippon Koei Co., Ltd. Azusa Sekkei Co., Ltd, Japan Airport Consultants, inc., and Japan Radio Air Navigation Systems Association.

The survey team held a series of discussions with the concerned officials of the Government of Kyrgyz Republic and conducted a field investigation. 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 wish to express my sincere appreciation to the officials concerned of the Government of Kyrgyz Republic for their close cooperation extended to the survey team.

March 2024

Tanaka Hiroo
Director General
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Summary

1. Background of the Project

Kyrgyz is mountainous and air transportation plays an important role. Osh International Airport is the second largest international airport in Kyrgyz and has been modernized in recent years to meet increasing demand. However, most of the air traffic control (ATC) facilities and systems, including those from the former Soviet Union, are aging, and there are problems with safety and continuity of operations. On the other hand, due to the ongoing situation in Ukraine, air routes that do not pass through Russia remain highly important, and new air routes have been opened and are expected to increase in the future. Therefore, the construction of a new control tower at Osh International Airport and the improvement of the ATC system to enhance the safety of aircraft operations will contribute to the development of the tourism industry and the importance of the Central Asian region as an air route hub. With the above background, this grant aid aims to improve the safety of air transportation and enhance its functions by rebuilding the control facilities, updating equipment, and upgrading the ATC system at Osh International Airport.

Figure 1 Map of Kyrgyz Republic and Target Airports locations

2. Contents of the Project

In response to the request from Government of Kyrgyz, the Government of Japan decided to conduct a preparatory study of the project. JICA dispatched a study team to the Kyrgyz from July 9 to August 1, 2023, August 14 to 31, 2023. The team confirmed the details of the request for this project, surveyed the construction situation, equipment procurement situation, and other donor support situation, conducted a field survey of the planned construction site, conducted a schematic design, and confirmed the schematic design onsite. After returning to Japan, the team analyzed the results of the field survey in Japan, updated the schematic design, and estimated the cost of the schematic project. Then, from February 5 to 9, 2024, a survey team was dispatched to the Kyrgyz again to explain the draft report of the preparatory survey, and the details of the plan were explained to KAN (Kyrgyzaeronavigatsia) officials.

To achieve the above goals, this project will rebuild the aging ATC facilities at Osh International Airport and upgrade the ATC systems at the three international airports, Manas, Osh and Issyk Kul International Airports. In addition, a soft component will be planned for KAN staff while the facilities

and equipment are being upgraded by the project.

The components determined as a result of the above are as follows, and Outline of the equipment included in the Project is shown in Table 1.

(1) Construction of control tower and Area Control Center (ACC)
(2) Updating the ATC systems at three international airports: Manas International Airport, Osh International Airport, and Issyk Kul International Airport
(3) Soft components for KAN staff

Table 1 List of Major Equipment to be Procured

No.	Item	Site	Q'ty
1	Multi-sensor Data Processing System	Bishkek ACC / Issyk-kul International Airport	1 set
2	ATC Training Simulator System	Bishkek ACC	1 set
3	Voice Communication Switching System		1 set
4	Multi-sensor Data Processing System	Osh ACC	1 set
5	Voice Communication Switching System		1 set
6	VHF Air-Ground Communication System		1 set

3. Project Implementation Schedule

Necessary periods for implementation of the facility construction of a new control tower and ACC and an installation of ATC equipment will be as follows, respectively.

(1) Control Tower and ACC:

- 8.0 months for detailed design and tender, 17.5 months for facility construction and commissioning in total

(2) ATC Equipment:

- 4.5 months for detailed design and tender; 24 months for equipment procurement, installation, and soft components in total

4. Project Evaluation

(1) Quantitative Effectiveness

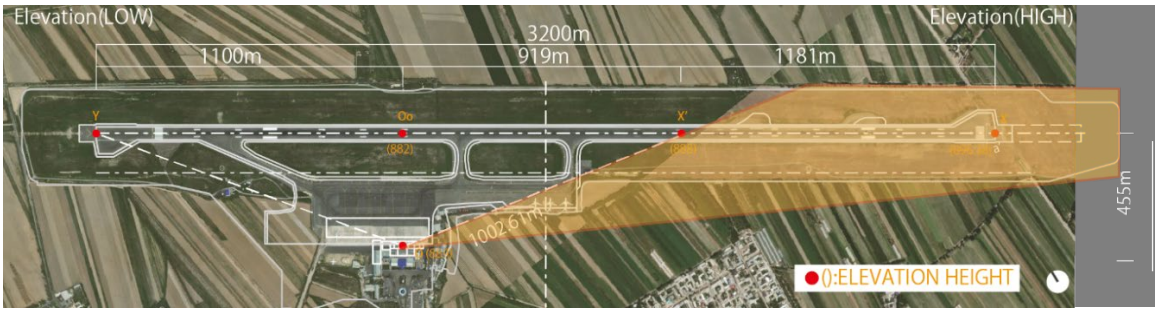
The quantitative evaluation of the construction of the control tower and the Installation of ATC Equipment was conducted as follows. The target value of the quantitative effect expected from the project implementation is after the completion of the project. Based on the technical studies conducted during this study, the quantitative effects of the project implementation are assumed as shown in Table 3.

Table 2 Expected Effects and Outcome Indicators

Input / Act	Expected Output	Expected Outcome
Construction of New Air Traffic Control Tower	Aerodrome control that meets ICAO standards.	It can ensure airport safety in line with ICAO standards.
Installation of ATC Equipment	Increase of Aircraft track capacity.	Safety of aircraft operations and aircraft track capacity will be improved to meet increased aviation demand.

Table 3 Quantitative Effectiveness

Indicator	Base Value (Before implementation)	Target Value (After implementation)
Percentage of runway sections visible at Osh Airport (%)	63.1	100
Number of aircraft that the ATC system can handle simultaneously.	400	2000



The orange area is the area where visibility is difficult. Percentage of runway length that is currently visible: (1,100 + 919) / 3,200 = 63.1%, Percentage of improvement due to construction of control tower : 100 - 63.1 = 36.9%

(Source: JICA study team)

Figure 2 Runway visibility range

(2) Qualitative Effectiveness

The qualitative evaluation of the implementation of this project is as follows.

- Improved visibility from the control tower at Osh International Airport and integration of the control tower and ACC will improve the safety of aircraft operations at Osh International Airport and the efficiency of ATC operations.
- Upgrading the ATC systems at Osh, Manas, and Issyk-Kul International Airports will improve the safety of aircraft operations and aircraft handling capacity over Kyrgyzstan.
- Improved safety of aircraft operations and aircraft handling capacity will enhance regional connectivity and stimulate human and logistical flows.

PREFACE
Summary

CONTENTS

Location Map/ Perspective

Figure List

Table List

Abbreviations (1/2)

Abbreviations	Meanings
A/P	Authorization to Pay
ACC	Area Control Center
ADS	Automatic Dependent Surveillance
AFTN	Aeronautical Fixed Telecommunication Network
APP	Approach
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATSEP	Air Traffic Safety Electronics Personnel
AWOS	Automated Weather Observing System
B/A	Banking Arrangement
BCP	Business Continuity Planning
CAT	Category
COTS	Commercial Off-the-Shelf
CVOR	Conventional VOR
DME	Distance Measuring Equipment
DVOR	Doppler VOR
EIA	Environmental Impact Assessment
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EPS	Electric Pipe Space / Electric Pipe Shaft
EUR	Euro
FAA	Federal Aviation Authority
FIR	Flight Information Region
GDP	Gross Domestic Product
GL	Ground Level
GOST	State Standard
GPS	Global Positioning System/ Satellite
GRG	Grievance Redress Group
HF	High Frequency
HMI	Human Machine Interface
IBAs	Important Bird and Biodiversity Areas
ICAO	International Civil Aviation Organization
IFC	International Finance Corporation
ILS	Instrument Landing System
JGS	Japanese Geotechnical Society
JIS	Japanese Industrial Standards

Abbreviations (2/2)

Abbreviations	Meanings
KAN	Kyrgyz Air Navigation
KR	Kyrgyz Republic
LAN	Local Area Network
LLC	Limited Liability Company
MDF	Main Distributing Frame
MIA	Manas International Airport
MoEC	Ministry of Economy and Commerce
MSDPS	Multi Sensor Data Processing System
MSSR	Monopulse Secondary Surveillance Radar
NDB	Non-Directional (radio) Beacon
OJT	On the Job Training
PSR	Primary Surveillance Radar
PTB	Passenger Terminal Building
RASP	Regional Aviation Safety Plan
RCAG	Remote Center Air-Ground Communication
SAEPF	State Agency of Environment Protection and Forest
SCAA	State Civil Aviation Agency
SE	State Enterprise
SNiP	Building Regulations
SSR	Secondary Surveillance Radar
TWR	Tower
VCSS	Voice Communication Control System
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omnidirectional radio Range
VPN	Virtual Private Network
VVIP	Very Very Important Person
WAM	Wide Area Multilateration
WB	World Bank
WC	Water Closet
WFP	World Food Programme
WGS	World Geodetic System

1 BASIC CONCEPT OF THE PROJECT

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1.1 Background of Request for Grand Aid

Kyrgyz is a mountainous country where air transport plays a significant role. Osh International Airport is the second largest international airport in the country, and modernization is underway to cope with the increasing demand in recent years. However, most of the ATC facilities and systems are outdated, including those from the Soviet era, and there are problems with safety and business continuity. On the other hand, the importance of air routes that do not pass through Russia remains high due to the continuation of the situation in Ukraine, and new air routes have been opened and are expected to increase in the future.

Therefore, improving the safety of aircraft operations by building a new control tower and improving the ATC system at Osh International Airport will contribute to the development of the tourism industry and the importance of the Central Asian region as a hub for air routes.

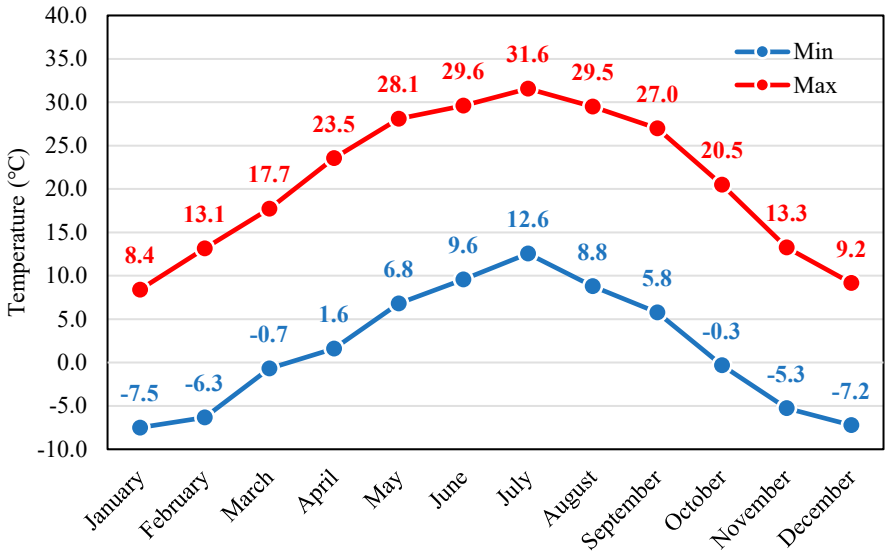
Under these circumstances, this grant aid aims to improve the safety and functionality of air transport by replacing the control facilities and equipment and updating the ATC system at Osh International Airport.

1.2 Natural Conditions

1.2.1 Climate

1) Temperature

Regarding the temperature, we analyzed the hourly temperature data received from meteorological department of KAN. In Osh state, summers are hot with dry conditions and mostly clear skies, while winters are extremely cold with heavy snowfall and occasional cloudiness. Throughout the year, the average temperature varies from -7.5°C to 32°C. It is rare for temperatures to fall below -11°C or exceed 35°C. Figure- 1.1 shows the monthly average temperatures (maximum and minimum) at Osh International Airport from 2018 to 2022 over a period of 5 years. The highest and lowest temperatures recorded during this 5-year period were 39.3°C and -13.6°C, respectively.



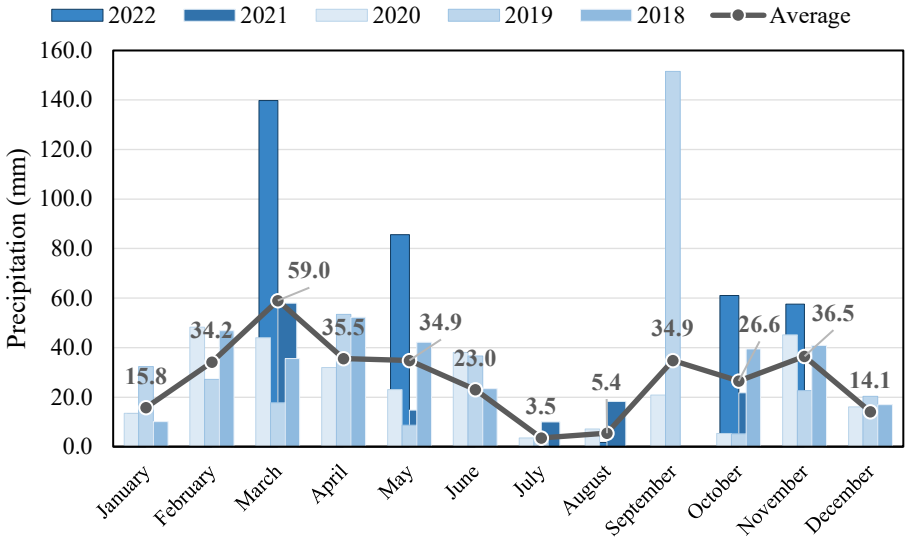
(Source: Created by JICA study team based on information provided by KAN)

Figure- 1.1 Monthly Average Temperature (°C) at Osh International Airport (2018-2022)

2) Precipitation and Snowfall

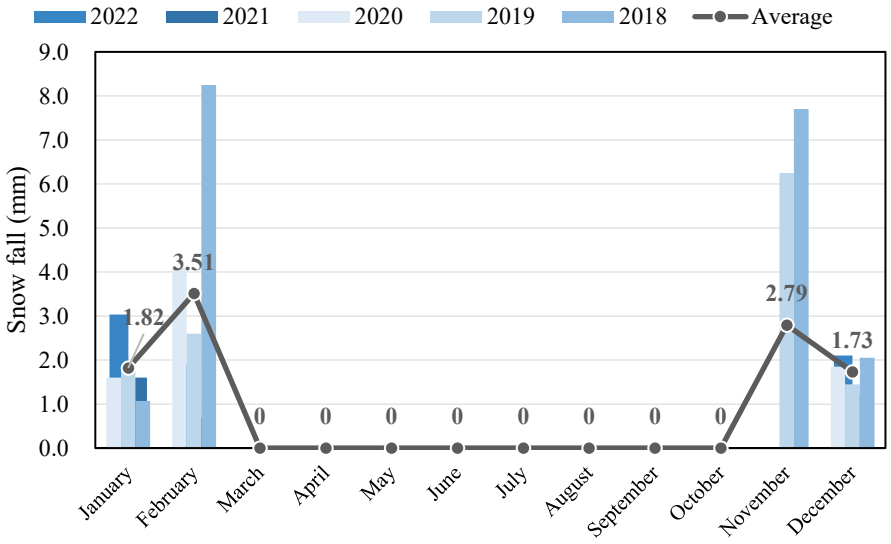
Regarding precipitation and snowfall, we analyzed the hourly precipitation and snowfall data received from meteorological department of KAN. Here, a day with precipitation is defined as a day with a total precipitation of 0.1mm or more. The period with the highest precipitation spans approximately 9 months from October to June. March has the highest number of precipitation days. The remaining 3 months from July to September are relatively dry, with August having the less precipitation days, averaging 0.7 days. Figure- 1.2 shows the monthly average precipitation from 2018 to 2022.

The snowfall period in Osh state lasts for about 4 months, from mid-November to early March. February has the highest snowfall at Osh International Airport, with an average snowfall of 3.5mm. Figure- 1.3 illustrates the monthly average snowfall from 2018 to 2022.



(Source: Created by JICA study team based on information provided by KAN)

Figure- 1.2 Monthly Average Precipitation (mm) at Osh International Airport (2018-2022)



(Source: Created by JICA study team based on information provided by KAN)

Figure- 1.3 Monthly Average Snowfall (mm) at Osh International Airport (2018-2022)

3) Freezing Depths

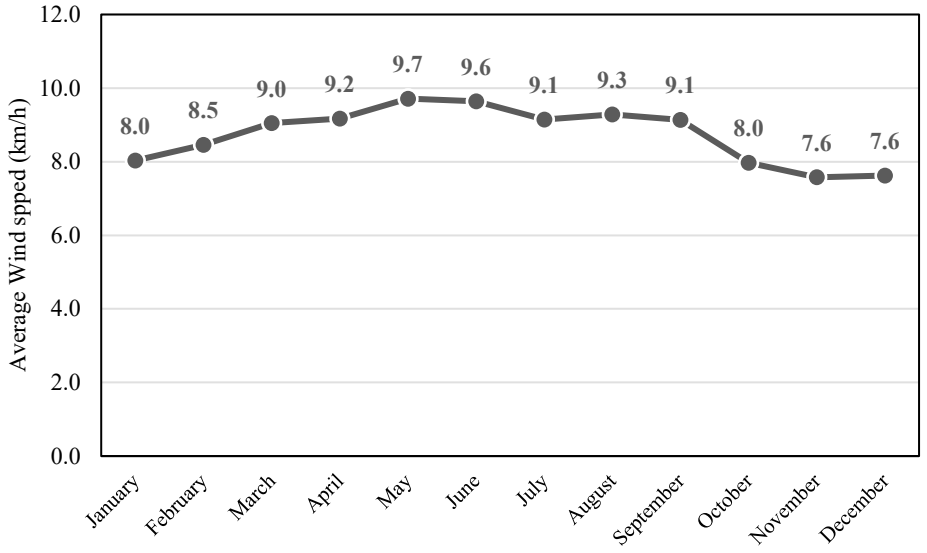
The values for the standard freezing depths of the ground in Osh state, obtained from the KAN meteorological department, are as follows:

- Freezing depth for clay and loam soils: 0.52m
- Freezing depth for loam and fine, dusty sand: 0.63m
- Freezing depth for gravel and sandy soils: 0.68m
- Freezing depth for coarse-grained soils: 0.77m

4) Wind Speed and Direction

a) Wind Speed

Regarding wind speed data, we obtained and analyzed five years of wind speed data at one-minute intervals from the KAN meteorological department. The period with strong winds throughout the year is approximately seven months from March to September, with an average wind speed exceeding 9.0 km/h. May is the month with the strongest winds at Osh Airport, with an average wind speed of 9.7 km/h. From October to March, winds are relatively calm over five months. December is the calmest month, with an average wind speed of 7.6 km/h. Additionally, the maximum wind speed in the last five years was 57.4 km/h (31 knots), and the minimum wind speed was 0 km/h (0 knots). Figure-1.4 shows the monthly average wind speed from 2018 to 2022.

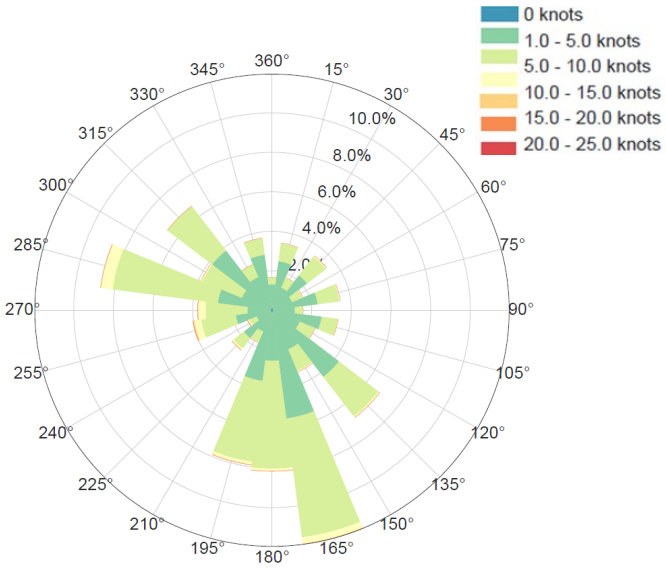


(Source: Created by JICA study team based on information provided by KAN)

Figure- 1.4 Monthly Average Wind speed (km/h) at Osh International Airport (2018-2022)

b) Wind Direction

Regarding wind direction data, we obtained and analyzed five years of wind direction data at one-minute intervals from the KAN meteorological department, spanning from 2018 to 2022. As a result, the average wind direction was found to be south-southeast. Figure-1.5 illustrates the wind rose diagram for Osh International Airport.



(Source: Created by JICA study team based on information provided by KAN)

Figure- 1.5 Wind rose at Osh International Airport (2018-2022)

1.2.2 Earthquake

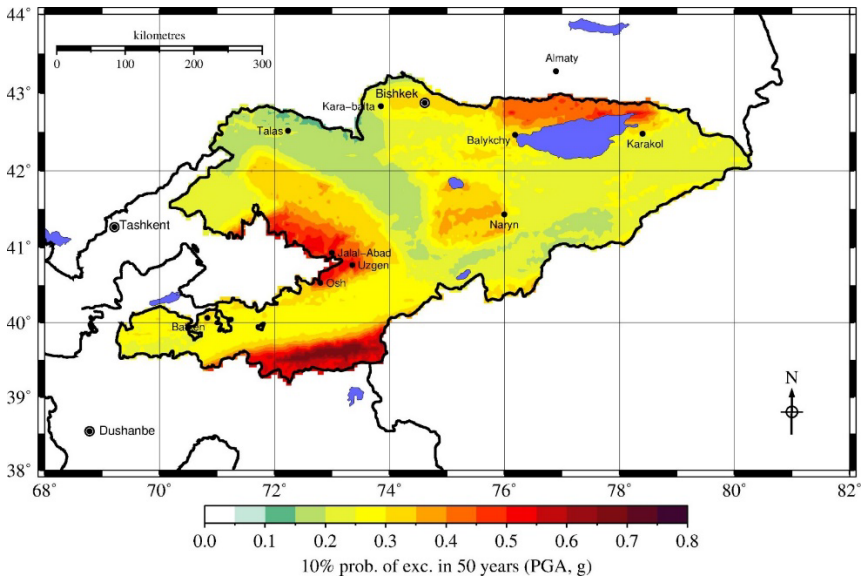
Given that most of the Kyrgyz's terrain is mountainous, there is minimal agricultural land (approximately 7% of the total area), with cultivated land primarily located in the Fergana Valley in the southwest, the Chu Valley in the north, and the Talas Valley. The mountainous terrain is a result of ongoing tectonic activity and mountain formation in the Central Asian region.

Due to its geography, tectonic regime, and topography, Kyrgyz is highly vulnerable to various natural disasters, including earthquakes, landslides, floods, wind and rainstorms, glacial lake outbursts, and droughts. Being mountainous, the country is particularly prone to landslides, mudflows, and floods, with the potential for rapid and severe flooding due to the breach of natural dams. Moreover, abandoned mine tailings and waste rock dumps contain radioactive substances, increasing vulnerability during floods and landslides.

From 1988 to 2007, the distribution of reported disasters in Kyrgyz included landslides at 27%, earthquakes at 18%, floods at 9%, and avalanches at 5%. Earthquakes with a moment magnitude (Mw) of Mw≥5 occurred at a frequency of about once a month, while potentially catastrophic earthquakes with Mw≥7 occurred every few decades. The level of earthquake hazard varies significantly within the country, with the highest hazard areas being the Fergana Valley near Osh and Jalalabad, the north shore of Lake Issyk-Kul near the border with Kazakhstan, and the southern part of the Alai Mountains near the border with Tajikistan. The rest of the country experiences moderate hazard levels.

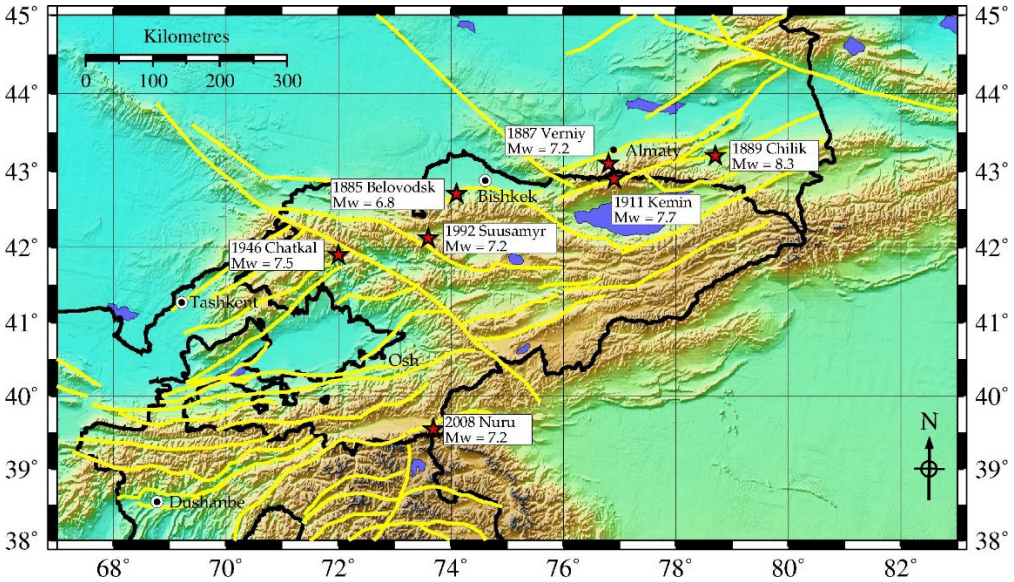
The initial earthquake occurrence rate in the control tower area is 9 points, according to the "Kyrgyzstan Earthquake Zoning Map." The top 10 meters of site lithology, as per SNiP KR 02:2009 Table 5.1, mainly consists of Type II soils related to seismic characteristics, such as cohesive, solid, and semi-solid soils. SNiP KR 02:2009 Table 5.1, Note 2, recommends a seismic activity score of 9 points based on geological and hydrogeological conditions. Appendix 1 of the "Kyrgyz Osh City Earthquake Zoning Map" indicates that if the score exceeds 9 points, residual deformation may occur. The calculated acceleration value (ag) is recommended as 0.440 for Type II soil conditions within the top 10 meters of site thickness for the nearest settlement, Osh, according to c.

A probabilistic seismic hazard analysis by the World Bank presents peak ground acceleration in the near-surface ground up to approximately 30 meters deep. These occurrence probabilities exceed 10% over a 50-year period.



(Source: World Bank, Measuring Seismic Risk in Kyrgyz Republic (240323_RR_RP001))

Figure- 1.6 Seismic Hazard Map



(Source：World Bank, Measuring Seismic Risk in Kyrgyz Republic (240323_RR_RP001))

Figure- 1.7 Large Earthquakes Occurred in the Last 150 Years

1.2.3 Topographical survey and geotechnical investigation

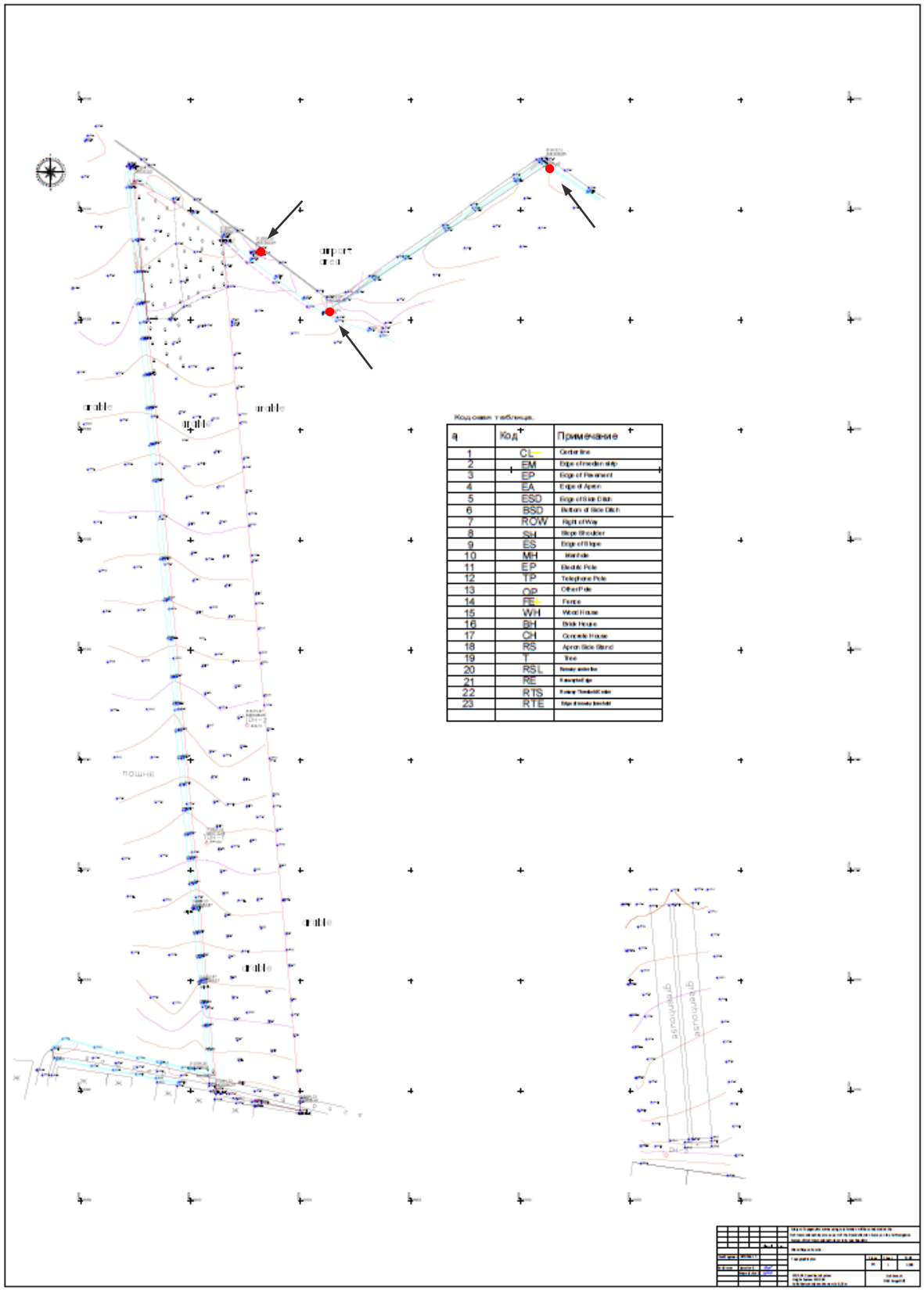
(1) Topography Survey

To understand the terrain conditions serving as the basis for the preliminary design of the control tower and ACC, a topography survey of approximately 40,000 m^2 was conducted in the vicinity of the proposed site for the control tower at Osh International Airport. The terrain was generally flat. Additionally, to comprehend the terrain around the airport, a topographic map with contour lines at intervals of 0.5m was created. As there were no reference points in the vicinity, new reference points were established. The coordinates of the new reference points are presented in Table- 1.1, and the results of the terrain survey are shown in Figure- 1.8.

Table- 1.1 Coordinate Information of the New Reference Points

No.	Benchmark Name	X	Y	Height H	Sign Type
		WGS-84			
1	Rp-A	313280.30	4497380.64	842.23	Metal
2	Rp-B	313312.07	4497354.33	842.53	Metal
3	Rp-C	313412.15	4497420.85	841.43	Metal

(Source: JICA study team)



(Source: JICA study team)

Figure- 1.8 Topographic Survey Results (40,000m^2)

(2) Geotechnical Investigation

To establish foundational data for the preliminary design of the control tower and ACC, core drilling, standard penetration tests, and indoor soil tests using disturbed samples were conducted. The details of the soil investigation are as follows:

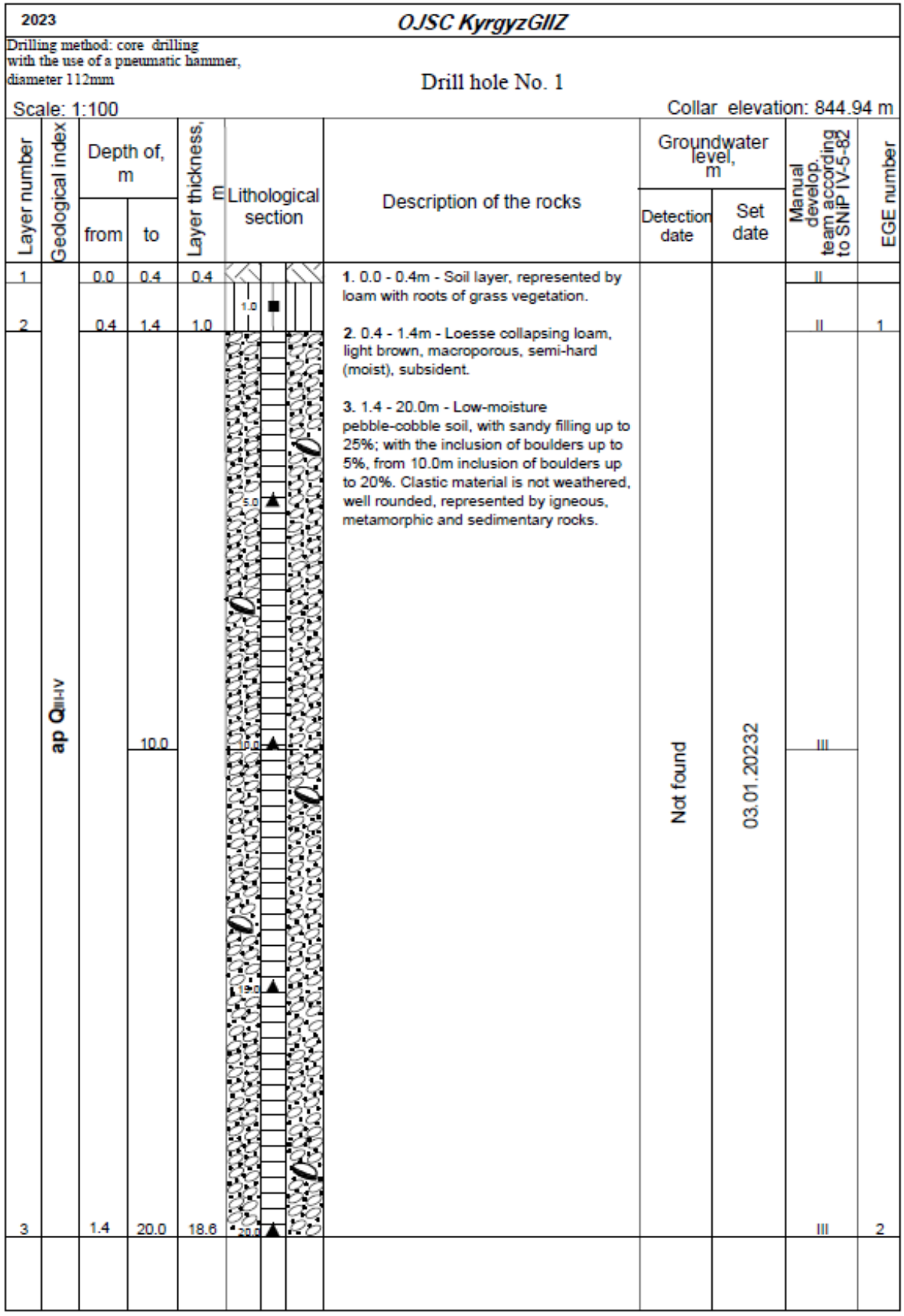
- Mechanical Boring Test: 60m (3 locations)
- Standard Penetration Tests: 20m (1 location), 10m (2 locations)
- Laboratory Test (including moisture content, liquid limit, plastic limit, particle size analysis, specific gravity): 40 samples
- Plate Load Test: 1 location
- Permeability Test: 1 location

1) Mechanical Boring Test

The boring investigation survey was conducted at three locations, as shown in Figure- 1.9. In the geological layers of the investigation areas at Boring Positions No.1 and No.2, the ground consisted of alternating deposits of loam and sand layers. From the surface to a depth of 1.4m, loam was deposited, while from 1.4m to 20.0m, sand layers were present. In the geological layers of the investigation area at Boring Position No.3, the ground also consisted of alternating deposits of loam and sand layers. Loam was deposited from the surface to a depth of 2.0m, and from 2.0m to 20.0m, sand layers were present. The borehole log based on boring and standard penetration tests are shown in Figure- 1.10 to Figure- 1.12.

(Source: JICA study team)

Figure- 1.9 Mechanical Boring Investigation Location



(Source: JICA Study Team)

Figure- 1.10 Borehole Log at Survey Location No.1

2023 **OJSC KyrgyzGIIZ**

Drilling method: core drilling with the use of a pneumatic hammer, diameter 112mm

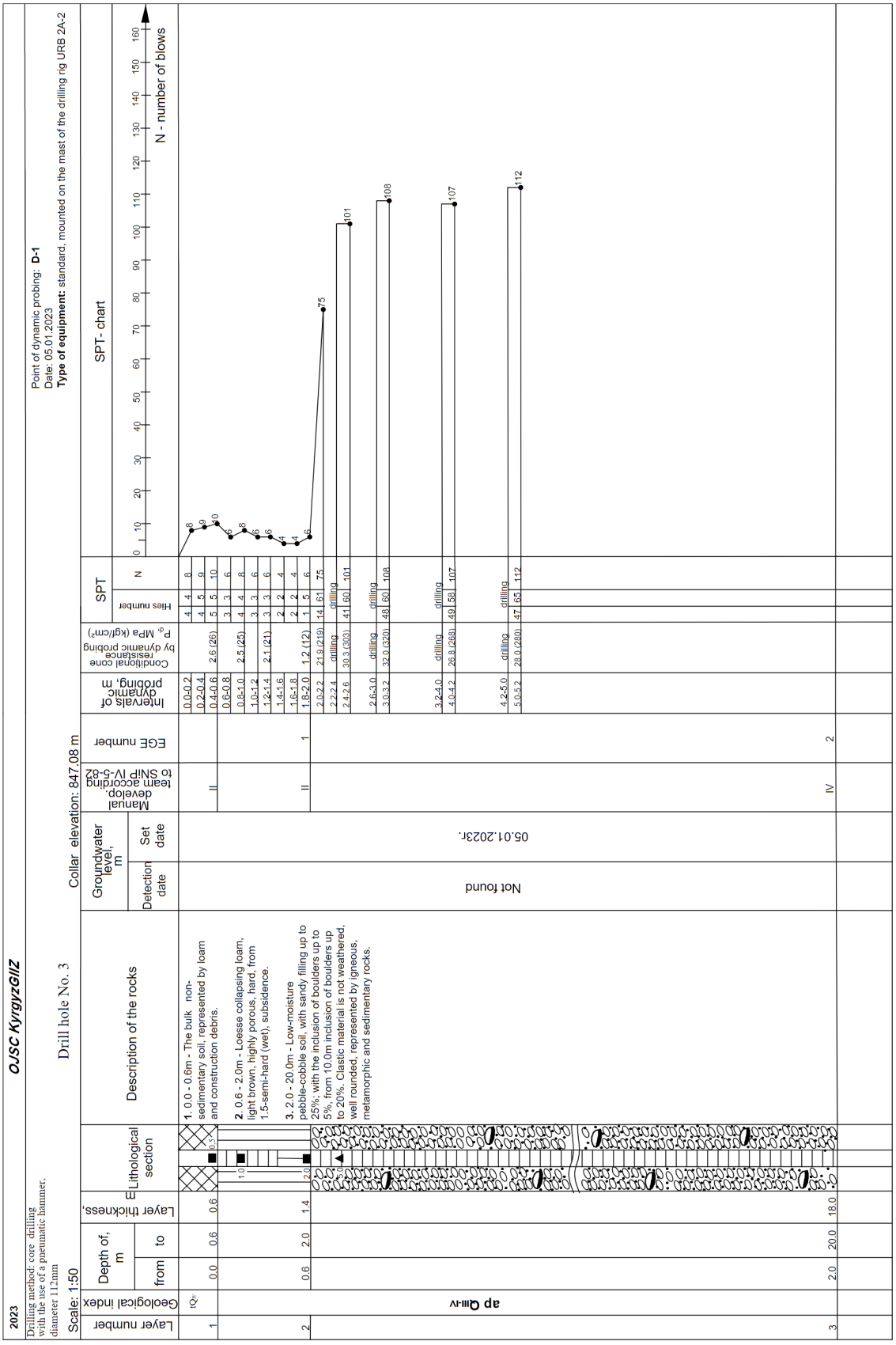
Drill hole No. 2

Scale: 1:100 Collar elevation: 844.10 m

Layer number	Geological index	Depth of, m: from	Depth of, m: to	Layer thickness, m	Lithological section	Description of the rocks	Groundwater level, m: Detection date	Groundwater level, m: Set date	Manual develop. team according to SNiP IV-5-82	EGE number
1		0.0	0.4	0.4		1. 0.0 - 0.4m - Soil layer, represented by loam with roots of grass vegetation.			II	
2		0.4	1.4	1.0	1.0	2. 0.4 - 1.4м - Loesse collapsing loam, light brown, highly porous, semi-hard (wet), subsident.			II	1
3	ap Q_{III-IV}	1.4	20.0	18.6	5.0 10.0 15.0 20.0	3. 1.4 - 20.0m - Low-moisture pebble-cobble soil, with sandy filling up to 25%; with the inclusion of boulders up to 5%, from 10.0m inclusion of boulders up to 20%. Clastic material is not weathered, well rounded, represented by igneous, metamorphic and sedimentary rocks.	Not found	03.01.2023	III	2

(Source: JICA Study Team)

Figure- 1.11 Borehole Log at Survey Location No.2



(Source: JICA Study Team)

Figure- 1.12 Borehole Log at Survey Location No.3

2) Plate Load Test

The plate load test is a test conducted to investigate the support characteristics of the ground, including deformation and strength up to a certain depth, by applying a load through a rigid loading plate to the natural ground. This test examines the relationship between the magnitude of the load and the settlement of the loading plate to determine the support characteristics of the ground, such as soil reaction coefficients and ultimate bearing capacity. It is performed for the purpose of designing structural foundations or confirming design conditions.

Plate Load Bearing Test Results

I. Relationship between Load and Settlement

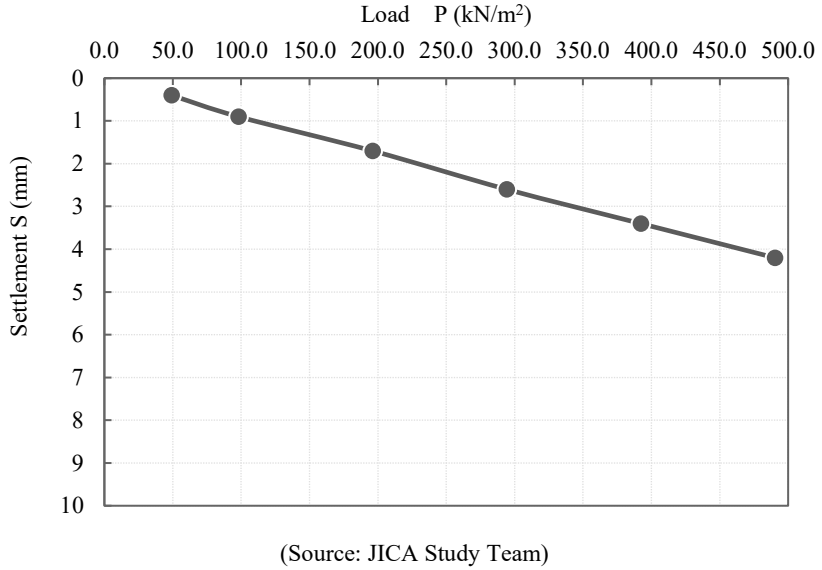
From the measurement results of the plate load bearing test, the values of load intensity and settlement at each load stage are presented in Table- 1.2.

Table- 1.2 Load and Settlement at Each Load Stage

Load Stage No.	Load Intensity (kN/m^2)	Settlement (mm)	Total Settlement (mm)
1	49.0	0.4	0.4
2	98.1	0.5	0.9
3	196.1	0.8	1.7
4	294.2	0.9	2.6
5	392.3	0.8	3.4
6	490.3	0.7	4.2

(Source: JICA Study Team)

Furthermore, the Load Intensity-Settlement Curve (P-S Curve) is presented in Figure- 1.13.



(Source: JICA Study Team)

Figure- 1.13 Relationship Between Load and Settlement (P-S Curve)

II. Determination of the Ultimate Bearing Capacity

The assessment of the ultimate bearing capacity is made in accordance with the Geotechnical Society of Japan Standards (JGS 1521-2003).

The judgment for the ultimate bearing capacity is made based on the following conditions:

i. Load at which the increase in the settlement become significant in the「P−S curve」and the settlement begins to increase linearly.
ii. Load at which the「logP−S curve」become nearly parallel to the settlement axis.
iii. Maximum test load (if either condition i or ii is difficult to ascertain)

However, this excludes cases where the settlement exceeds 30mm (ratio of settlement to the loading plate: 10%) or when it is become difficult to maintain loading or support due to ground failure.

III. Determination of Ultimate Bearing Capacity

In the test, at the 5th stage with a load of 490.5kN/m^2, the settlement to the loading plate did not exceed 4.2mm, and there was no ground failure observed. Additionally, in the obtained "P-S Curve," the settlement remained consistently linear and did not increase after the load application stage. Since the final settlement did not exceed 4.2mm, it was determined that the ultimate bearing capacity is equal to or greater than the maximum load confirmed in the test, which was 490.5kN/m^2.

Table- 1.3 Ultimate Bearing Capacity

Maximum Load Intensity (kN/m^2)	Maximum Settlement (mm)	Determination	Ultimate Bearing Capacity (kN/m^2)
490.5	4.2	Maximum Load Intensity does not exceed 30mm	490.5 Above

(Source: JICA Study Team)

IV. Calculation of Soil Reaction Coefficients

For the nth cycle of a stepwise repeated loading in the load intensity stage, the soil reaction coefficient k_v can be determined from the P-S Curve using the following equation:

$$\boldsymbol{k_{vn} = \frac{\Delta p}{\Delta S} = \frac{p_2' - p_1'}{S_2' - S_1'}} \quad (1)$$

k_{vn} : The soil reaction coefficient (MN/m^3)

p_1' : Principally, it is considered unloaded (zero load). However, if unloading is not performed until zero load, the minimum load intensity (kN/m²) for the targeted cycle is used.

p_2' : The maximum load intensity (kN/m²) at which the load intensity-settlement relationship can be considered approximately linear for the targeted cycle.

S_1', S_2' : The settlement values (mm) corresponding to each of the re-loading stages in the targeted cycle, represented asp_1', p_2'.

Table- 1.4 shows the results of the calculation of soil reaction coefficients.

Table- 1.4 Calculation Results of Soil Reaction Coefficients

p_1' (kN/m^2)	p_2' (kN/ m^2)	Δp (kN/ m^2)	S_1' (mm)	S_2' (mm)	ΔS (mm)	k_{vn} (MN/ m^3)
49.03	294.2	245.25	0	2.2	2.2	111.47

(Source: JICA Study Team)

(3) Laboratory Soil Tests

To understand the physical and mechanical properties of each soil layer distributed in the survey area, laboratory soil tests were conducted using soil samples collected during standard penetration tests in the borehole investigation. The detailed test results are attached at the end as the Laboratory Soil Test Results Data Sheet. Additionally, a summary of these results is provided in Table- 1.5.

Table- 1.5 Measurement Results of Representative Soil Properties

Soil Properties			Loam	Pebble
Physical test	General	Sample Collection Position GL-(m)	0-1.4	1.5-20
		Wet Density ρt(g/cm^3)	1.77	2.2
		Dry Density ρd(g/cm^3)	1.5	-
		Natural Water Content ratio ωn (%)	18	3.2
		Porosity n (%)	44.66	-
		Saturation Sr (%)	69.3	-
	Grain size	Gravel (%)	-	79.1
		Sand (%)	-	20.9
		Silt (%)	-	0
		Clay (%)	-	0
		Maximum Particle Size (mm)	-	200
Mechanical test		Adhesive Force c (kgf/cm^2)	-	0.235
		Internal Friction Angle φ (°)	-	37

(Source: JICA Study Team)

(4) Onsite Permeability Test

Onsite permeability testing was conducted at a single location, as indicated in Figure- 1.9, at Boring Position No.2. The on-site permeability test was performed using the Mariotte siphon method (constant head method). The investigation continued until a steady state was achieved. Considering the sedimentation of loam up to a depth of 1.4m from the ground surface, and from the perspective of soil replacement, the on-site permeability test was conducted at a depth of 1.5m, using the foundation as the reference plane. The permeability coefficient was confirmed to be 8.61×10^{-2} cm/s based on the results of the on-site permeability test.

1.3 Environmental and Social Considerations

1.3.1 Environmental and Social Considerations

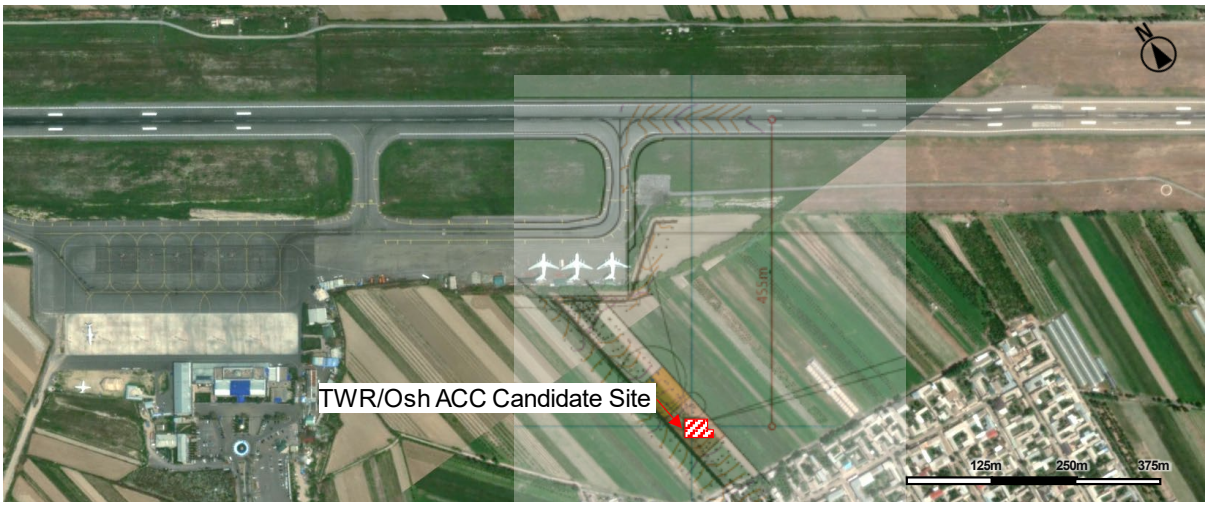
(1) Project Outline

An overview of the project is given in Table -1.1 and Figure 1.2. For more information on the project is shown in Chapter.2.2 Outline Design of the Japanese Assistance.

Table- 1.6 Project Scope

Technical Memorandum (Architecture, 2023.8.29)	Facilities
Osh International Airport Control Tower and ACC reconstruction	New 8-story control tower including VFR room and ACC

(Source: JICA Study Team)



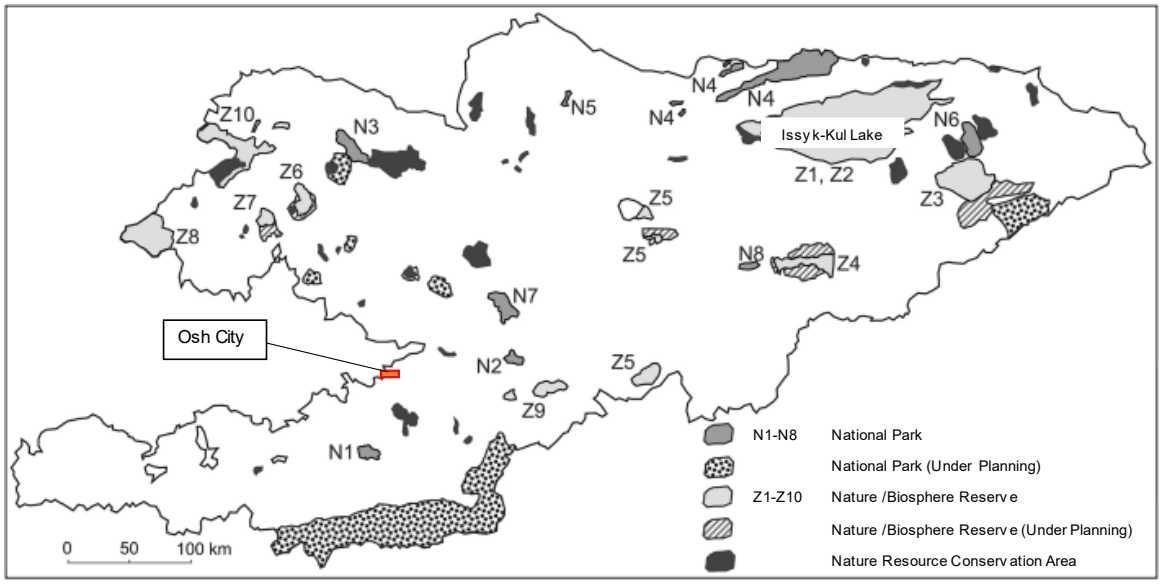
(Source: JICA Study Team)

Figure- 1.14 The Project Area

(2) Base environmental and social situations

1) Natural Conservation Area

Kyrgyz's national conservation area managed by the Department of Environmental Protection and Forestry, which has designated 86 (approximately 4.6% of the country's land area) under the Law on Nature Protection, 1991. The protected areas are divided into national parks, nature and biosphere reserves (Zapovednik) and natural resources conservation areas (Zakatnik). The status of the designations is shown in the diagram below. No protected areas have been designated in the area around the Osh City, which is the project implementation area.



(Source: Protected Natural Areas and Tourism Development in the Kyrgyz Republic, Geographical Review No 83 2008)

Figure- 1.15 Main and Planned Natural Conservation Areas

2) Ramsar Site

In Kyrgyz, three Ramsar wetlands have been designated, but all are located in the center or east of the country and not in the vicinity of the project implementation area.

(Source Ramsar Site: URL:https://www.ramsar.org/country-profile/kyrgyzstan)

Figure- 1.16 Location map of Ramsar wetlands in Kyrgyz

3) Important Bird and Biodiversity Areas: IBAs

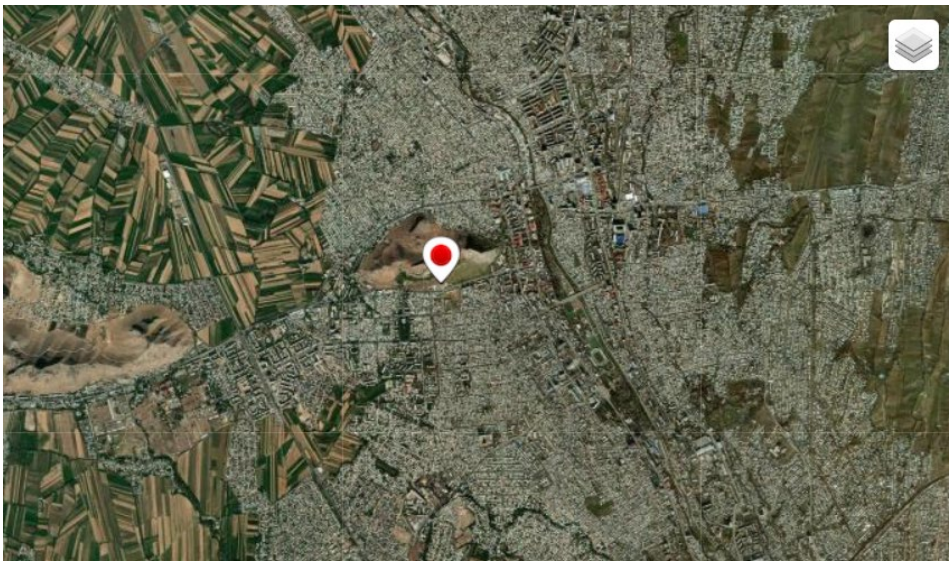
IBAs (Important Bird and Biodiversity Areas) is a programme that aims to select habitats important for birds according to common global criteria (IBA criteria) and to protect all habitats as a network globally. There are 11 IBAs in Kyrgyz, but none of them are located around Osh, the project area.

(Source: Bird Life International 'http://datazone.birdlife.org/country/kyrgyzstan/ibas')

Figure- 1.17 Location of IBAs in Kyrgyz

4) Cultural Heritage

Kyrgyz has a total of three UNESCO World Heritage Sites: two cultural sites, the Sacred Mountain Sulaiman-To and the Silk Road (Changan-Tianshan Corridor trade route network), and one natural site, the Xiantianshan. Of these, the 'Sacred Mountain Sulaiman-To' is located within the city of Osh, but more than 15 km from the project area.



(Source: UNESCO World Heritage Web site https://whc.unesco.org/en/list/1230/)

Figure- 1.18 Project Area Location of Sacred Mountain Sulaiman-To as World Heritage

5) Gender

Kyrgyz's latest gender gap index for 2023 is 0.700, ranking it 84th in the world. According to Kyrgyz's administrative statistics, there are no gender-related court records and there is almost no difference in education levels between men and women, indicating that there are no gender issues. On the other hand, in Kyrgyz, kidnapping and marriage of girls continues to take place in rural areas due to the shortage of labour, especially in rural areas, and a large wage gap (almost 70% of men's wages) has been noted.

Interviews with KAN, the implementing agency of the project, revealed that the gender ratio of KAN staff is 7:3, with very few women, especially in management positions.

6) Poverty Rate

Kyrgyz's economy is partly dependent on remittances from Russia by overseas workers, but according to the UN World Food Programme (WFP), remittances have been reduced following the Russian-Ukrainian war that started in 2022, and there are concerns that 10% of Kyrgyz workers abroad may lose their jobs and have to return home. Kyrgyz's economic growth has succeeded in reducing the poverty rate from around 40% in 2000 to 20% in 19 years, but the Corona disaster and war are expected to raise this figure to 38% by the end of 2010.

(3) Environmental and Social Considerations Systems and Organizations

1) Environmental and Social Considerations Schemes

The Law on Environmental Protection (1999) has been designated as the basis for environmental legislation in the Kyrgyz Republic. The Law determines the policy in nature management and environmental protection in the country and articulates the legal system. With regard to the EIA procedures relevant to the project, Section IV, paragraph 16 stipulates that an Environmental Impact Assessment (EIA) is to be carried out to prevent planned economic and other activities from having an adverse impact on the environment. The Law on Environmental Expertise (1999) also provides for matters relating to EIA. The Law requires business entities to submit documents for EIA review and to carry out planned activities in accordance with the approved documents. The Law and General Technical Regulation on Ensuring Environmental Safety (2009) designates projects subject to EIA, as shown in the table below, and The Project is '18. airports, airfields, testing stations, inland navigation ports and motor racing tracks". On the other hand, as the project does not involve the development of the airport itself, but only the construction of ancillary facilities, the Ministry of the Environment has been asked to determine whether the project falls under this criterion.

In addition, the 'Regulations on the Procedure for Conducting State Ecological Expertise' also sets out the EIA assessment procedure: article 4 provides for a list of documents to be submitted for EIA assessment, article 5 for the environmental assessment body and the assessment procedure. Article 7 stipulates that the assessment shall commence within two weeks of the submission of the documents required for the assessment and that the assessment period shall not exceed three months. The Regulation on the Procedure for Conducting Environmental Impact Assessment for the EIA Procedure (2015) provides a detailed scope of the EIA procedure.

Table- 1.7 Projects subject to EIA under Kyrgyzstan legislation

Type of Project	Type of Project
1. Energy facilities 2. Reservoirs 3. Petroleum refining, petroleum products and gas plants 4. Construction materials manufacturing (cement, asphalt, slate, asbestos cement pipes, etc.) 5. Agriculture and forestry 6. Mining industry 7. Metalworking industry 8. Glass industry 9. Manufacture of pharmaceuticals, biological products and protein products 10. Chemical products 11. Food industry 12. Textile, leather and paper manufacturing industry 13. Warehousing of hazardous, dangerous and radioactive materials	14. Wastewater treatment and waste gas facilities 15. Groundwater intake 16. Water supply systems, irrigation and drainage systems in densely populated areas 17. Road and rail construction 18. Airports, airfields, testing stations, inland navigation ports, motor racing tracks 19. Construction of recreational and tourist facilities 20. Industrial parks 21. Sewerage system 22. Mountain lifts, cable cars 23. Industrial and household waste recycling, treatment and disposal 24. Gas stations 25. Vehicle maintenance and pre-sale preparation facilities

(Source: Law and General Technical Regulation on Ensuring Environmental Safety)

2) Environmental Standards

Kyrgyz does not have its own environmental standards for air quality, noise, vibration, etc. According to interviews with the Ministry of Environment, the national organization "Kyrgyz Standard" recommends referring to Russian environmental standards, which are the prevailing standards.

3) Environmental and Social Consideration Organizations

The responsible agency for environmental administration in Kyrgyz is the State Agency of Environment Protection and Foresty (SAEPF), which is responsible for implementing policies and regulations in environmental protection and the use of natural resources, assessing natural resources, including forestry, preventing negative environmental impacts of business and economic activities through EIA assessments, prevention of negative environmental impacts of business and economic activities through EIAs, and international cooperation in environmental protection and nature management.

The Department of State Environmental Expertise (DEU) under SAEPF is responsible for EIA reviews. There is a regional office in each state, and EIA assessments are carried out at the main office in case of risk category I and at the regional office in case of risk categories II and III. Due to the size of the project and the nature of the project, the City of Osh was determined to be in risk category II or III after discussions with the SAEPF Osh Office,, the EIA review body is the SAEPF Osh office.

4) Gap Analysis between JICA Guidelines and Kyrgyz National legislation

Table- 1.8 Gap Analysis

Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
Basic Matter	1. Environmental and social impacts caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures must be examined, in order to avoid such impacts as much as possible, and to minimize, reduce or mitigate them when such avoidance is impossible. The result of the examinations must be reflected into the project plan. 2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis, and to be in a close harmony with the economic, financial, institutional, social, and technical analyses of projects. 3. The findings of the examination of environmental and social considerations, including alternatives and mitigation measures, must be documented as an independent document or as a part of other documents. Environmental assessment reports must be prepared for projects with potential significant impacts. 4. For projects which may have significant impacts in particular, or for controversial projects, a committee of experts may be formed so that projects may seek their opinions, in order to increase accountability.	- Environmental impact assessments are carried out before a decision is taken to implement a project. Article 2, Law on Environmental Expertise (1999)] - The basic principle of EIA requires the consideration of alternatives, including preventive measures and zero option. The EIA results must also include an environmental impact assessment of the alternatives and measures to avoid, minimise or compensate for negative impacts. [Articles 1.3-1.4, Regulation on the Procedure for Conducting Environmental Impact Assessments (2015)]	No significant gaps.
Consideration of Countermeasures	1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts by the project and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts. When this is not possible, minimization, reduction, and then mitigation of the impacts must be considered, in accordance with the mitigation hierarchy. Compensation measures must be examined only when significant impacts are still remain even with the aforementioned measures. 2. Appropriate plans and systems for measures, such as monitoring plans and environmental management plans, must be prepared. The costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. For projects with particularly significant impacts, detailed environmental management plans must be prepared.	- The basic principle of an EIA requires the consideration of alternatives, including prevention measures and zero options. The EIA results are also required to include an environmental impact assessment of the alternatives and measures to avoid, minimize or compensate for negative impacts. [Chapters 1.3-1.4, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)]. - Provides for the EIA implementer to prepare an environmental monitoring plan during the construction, operation and clearance of the project, with environmental monitoring to take place during the project implementation phase. - Provides for post-project verification of the EIA and verification and monitoring of the EIA results after the project is carried out by the project operator. The results of the post-project verification will be submitted to the operator and, where negative impacts are identified, additional measures required to mitigate them. [Articles 3.7, 3.13, Regulation on the Procedure for Conducting Environmental Impact Assessments (2015)].	No significant gaps.

Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
Impact Scope to be considered	1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water use, climate change, biodiversity, and ecosystem services, including trans-boundary or global scale impacts. These also include social considerations such as: Migration of population including involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor peoples and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. 3. In addition to the direct and immediate impacts of projects, derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects are also to be examined and assessed to a reasonable extent. It is also desirable to consider the impacts through a project life cycle.	- The requirements and assessment items for assessing the existing environmental status are as follows. - Environmental and other restrictions on land use (e.g. nature reserves, historic and cultural preservation areas) - Climatic/weather conditions - Existing levels of air pollution - Current status of surface water bodies - Geological and hydrogeological conditions - Land resources and soil cover - Soil contamination, flora and fauna, radioactive pollution - Socio-economic conditions (economic situation, social demography, public health, regional history) - demographics, public health, historical and cultural values of the area) - Socio-economic conditions (economic situation, socio-population dynamics, public health, historical and cultural values of the region) Attachment 5, Regulation on the Procedure for Conducting Environmental Impact Assessments (2015)].	There are no major gaps, but JICA's Environmental and Social Considerations Guidelines have more assessment items and more detailed natural environment and social items specifically.
Consistency with Laws, Standards, Plans, etc.	1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by host country governments, including local governments. Projects must also conform to the environmental and social consideration policies and plans of the host country governments. 2. In principle, Projects must be undertaken outside of areas that are specifically designated for conservation of nature or cultural heritages by the host country governments, unless the main purpose of the Projects is to promote or restore the protection of such areas. Also, projects shall not cause significant adverse impacts on such designated conservation areas.	- The EIA implementation rules of Legislative Decree No. 60 stipulate that. - In the case of risk category I, the EIA must be carried out on all items. - In the case of risk categories II and III, an EIA is carried out for some omitted items. - If the environmental impact is not significant, an environmental assessment declaration is prepared. 【Article 4.28-4.30, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)】	No significant gaps.
Social Consensus	1. Projects must be adequately coordinated so that they are accepted in a socially appropriate manner for the countries and areas where the projects are planned. For Projects with potentially significant environmental and social impacts, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans are examined. The outcome of such consultations must be incorporated into the project plans. 2. Appropriate considerations must be given to vulnerable social groups, such as women, children, elderly peoples, people in poverty, indigenous peoples, persons with disabilities, refugees, internally displaced persons, and minorities. Such vulnerable social groups are susceptible to	- In the EIA Implementation Regulations, local residents are included among the stakeholders in the implementation of EIAs. - It provides for residents to be informed about activities that may have a negative impact on the environment or public health when EIA implementation is required. 【Article 3.7,3.13, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)】	Although there are gaps, KAN has proposed stakeholder consultations in the project implementation areas.

Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
	environmental and social impacts and may have little access to decision-making processes within society.		
Climate Change	1. For projects that are expected to generate more than a certain amount of greenhouse gas emissions, the total amount of greenhouse gas emissions will be estimated and disclosed before the project implementation.	No specific provisions.	There is no provision for the publication of estimates of total greenhouse gas emissions.
Biodiversity	1. Projects must not involve significant conversion or significant degradation of critical habitats or critical forests. 2. Illegal logging of forests must be avoided. Project proponents need to obtain logging permits from regulatory agencies,and are encouraged to obtain forest certifications for forestry projects, in order to ensure the prevention of illegal logging.	There are no specific provisions, but the EIA assessment items cover nature reserves. Environmental and other restrictions on land use (e.g. nature reserves, historic and cultural preservation areas). 【Attachment 5, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)】	Although there are gaps, the project does not involve significant conversion or significant degradation of important natural habitats or important forests.
Involuntary Resettlement and Loss of Means of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time.	Detailed in Table 1. 10 Gap analysis between JICA's policy on land acquisition and Kyrgyz legislation.	There are many gaps in resettlement and land acquisition. In particular, the preparation of RAPs, stakeholder consultations, information disclosure, livelihood restoration support and consideration for vulnerable groups are not explicitly mentioned in Kyrgyz legislation. On the other hand, according to interviews with relevant institutions, it is assumed that

Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
	4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and support. In preparing the RAP, consultations must be held with the project affected people and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social Standard (ESS) 5 of the World Bank's environmental and social policies.		customary considerations are taken into account.
Involuntary Resettlement and Loss of Means of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and	- Provides for the EIA implementer to prepare an environmental monitoring plan during the construction, operation and clearance of the project, and environmental monitoring is carried out during the project implementation phase. - It provides for post-project verification of the EIA and verification and monitoring of the EIA results after the project is carried out by the project operator. The results of the post-project verification will be submitted to the operator and, where negative impacts are identified, additional measures required to mitigate them. 【Article 3.7,3.13, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)】	Gaps exist. Monitoring is mandatory, but disclosure of this information is not required. The project is not required by Kyrgyz law to conduct an EIA, but monitoring will be conducted in line with the EMP & EMoP proposed in this report. For information disclosure, a system will be established to make monitoring data available on the KAN website.

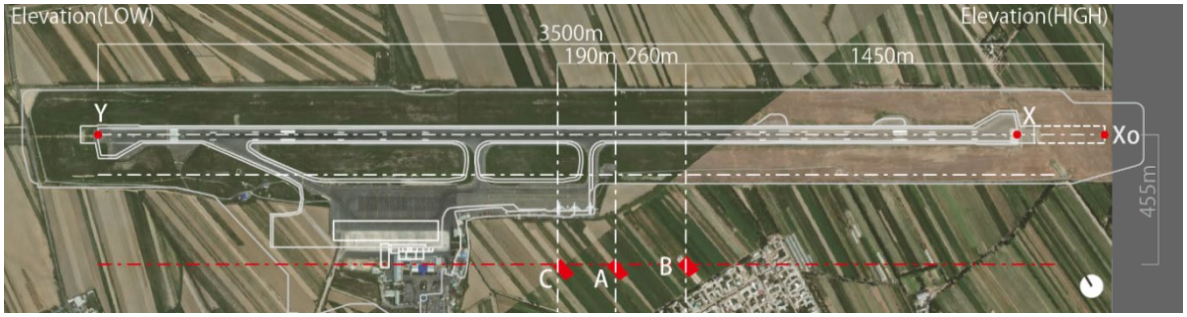
Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
	support. In preparing the RAP, consultations must be held with the project affected people and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social Standard (ESS) 5 of the World Bank's environmental and social policies.		
Involuntary Resettlement and Loss of Means of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and support. In preparing the RAP, consultations must be held with the project affected people and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social	There is no clearly defined grievance mechanism for EIAs.	Gaps exist. As there is no specific mention of a complaint's mechanism for EIAs, suggestions are made with reference to other cases.

Main Items	JICA Guidelines	Kyrgyz National legislation	Major Gaps
	Standard (ESS) 5 of the World Bank's environmental and social policies.		
Involuntary Resettlement and Loss of Means of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and support. In preparing the RAP, consultations must be held with the project affected people and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social Standard (ESS) 5 of the World Bank's environmental and social policies.	- Local residents are included among the stakeholders in the implementation of EIAs, as stipulated by EIA Implementation Regulation 3.7. - It provides for residents to be informed about activities that may have a negative impact on the environment or public health when EIA implementation is required. 【Article 3.7,3.13, Regulation on the Procedure for Conducting Environmental Impact Assessment (2015)】	Gaps exist. Monitoring is mandatory, but disclosure of this information is not required. The project is not required by Kyrgyz law to conduct an EIA, but monitoring will be conducted in line with the EMP & EMoP proposed in this report. As for information disclosure, This FS report on the project will be disclosed on the KAN website.

(Source: JICA Study Team)

(4) Alternatives

The project has examined potential sites for the control tower based on the tower height, visibility range, topographical conditions of the proposed site and land purchase conditions of the proposed installation site, and the results of this examination were used as the basis for the study of alternatives. If the project is not implemented, the demand for the future runway extension of the airport will not be met, and therefore the project was rated low. In terms of cost, Option-A and B were rated similarly. From a technical point of view, Option-A was judged to be the best option. From the environmental and land acquisition aspects, all alternatives were rated at the same level, but Option-A has a positive attitude of the owner of the land subject to land acquisition. Based on the above, Option-A was selected as the best option.



(Source: JICA Study Team)

Figure- 1.19 Study Map of Potential Sites for Control Towers

Table- 1.9 Alternatives

Evaluation Criteria	Option A Runway center if runway is extended	Option B Southeast side with higher elevation than Option A	Option C Center of current runway	Without project option the project is not implemented (continued use of existing control tower)
Cost	Same as Option B	Same as Option A	Higher than Option A, B	There are no construction costs, but maintenance costs are incurred. In addition, if it is extended in the future, it will not meet the demand, which will hinder the operation of the airport.
	3	3	2	1
Technical aspect	It will be the focal point of the future runway, providing optimum visibility of the runway and taxiway from the control tower.	Visibility concerns due to distance from runway end Y. Proximity to residential areas and security concerns.	The future runway end Xo will be further away and protrude about 4 m above the horizontal surface.	Insufficient field of view in case of future runway extension.
	4	2	2	1
Environmental aspect	Currently used as agricultural land, with minimal impact on the natural environment. Sufficient distance from residential areas.	Currently, the land is used as agricultural land and has little impact on the natural environment. Although it is closest to the residential area, due to the nature of the facility, no significant impact is of concern as it does not generate noise or vibration.	Currently used as agricultural land, with minimal impact on the natural environment. It is sufficiently distant from residential areas.	Status quo.
	3	3	3	4
Land acquisition	Land is being used as farmland and needs to be acquired. Landowner is willing to buy or sell.	The land is used as farmland and land acquisition will occur.	The land is used as farmland and land acquisition will occur.	Not happen.
	3	3	3	4
Total	13	11	10	10

(Source: JICA Study Team)

(5) Necessity of EIA for the Project

Since the Project will be implemented in the city of Osh, we conducted a hearing with the Osh City Office of the Ministry of Environment, and it was determined that EIA procedures are not required for the project. As the project progresses, it will be necessary to prepare a Technical Note (construction permit) indicating the detailed design and construction process, etc. As part of the Technical Note, a simplified environmental impact assessment, including a field survey, will need to be included.

(6) Scoping

Since the Project will be constructed on land that is already being used as a field, its impact on the natural environment will be very minor. On the other hand, the project will require acquisition of land, compensation to the three farmers who own the land, and impacts on the social environment such as the use of the surrounding roads during construction.

Table- 1.10 Scoping Results

	Impact Factor	Result of Scoping		
		BC/ CS	OP	The basin of Scoping Result
Pollution				
1	Air Quality	✓		DC: Temporary deterioration of air quality is anticipated during the operation of construction equipment and machinery. OP：No anticipated impacts are foreseen from the Project.
2	Water Quality	✓	✓	DC: The impact on water quality due to construction activities is anticipated. Additionally, there is a potential for water quality contamination from runoff, including discharge from the construction site, heavy machinery, and vehicles. OP: Domestic wastewater will be generated as a result of the operation of the control tower.
3	Waste/Hazardous Substances	✓		DC: Since there is a need to replace the soil on the construction site, the treatment of construction-generated soil will be necessary. Additionally, the generation of waste from debris and grass cutting is expected during construction. OP: The generation of waste that could impact the surrounding environment is not anticipated.
4	Soil contamination	✓		DC: There is potential for soil contamination due to construction oil spills etc. In addition, the soil (6,000 m3) on the construction site needs to be replaced and therefore disposed of appropriately. OP：No anticipated impacts are foreseen from the Project.
5	Noise/Vibration	✓		DC: It is anticipated that noise will be generated due to the operation of construction equipment and vehicles. OP: No anticipated impacts are foreseen from the Project.
6	Subsidence			DC/OP: No significant concerns are anticipated regarding the impacts of the Project.
7	Odor			DC/OP: No anticipated impacts are foreseen from the Project.
8	Sediment			DC/OP: No anticipated impacts are foreseen from the Project.
Natural Environment				
9	Protected area			DC/OP: The project site is agricultural land, and there is no protected area in the vicinity.
10	Ecosystems/flora and fauna/biodiversity			DC/OP: No anticipated impacts are foreseen from the Project.
11	Hydrography			DC/OP: No anticipated impacts are foreseen from the Project.
12	Topography and Geology	✓		DC: Soil improvement work is required for 4,000 m^2 of the planned project site, which will require the removal of existing soil and the bringing in of soil for land preparation. OP: As large-scale excavation or embankment is not planned, there is no expectation of significant impact on the topography or geology.
Social Environment				
13	Land acquisition/Resettlement	✓		BC: Acquisition of agricultural land, which is the planned project site, will be necessary. OP: There is no anticipation of additional land acquisition after the start of operations.
14	Poor			DC/OP: No anticipated impacts are foreseen from the Project.
15	Ethnic minorities/Indigenous peoples			DC/OP: The presence of ethnic minorities or indigenous peoples has not been confirmed in the project area or its vicinity.
16	Local economy, including employment and means of livelihood	✓		DC: The employment generated by the construction may increase the income of local workers, leading to temporary improvements in livelihoods. There is a concern about the impact on the income of landowners who are the subjects of land acquisition. OP: The operation of the control tower is managed by KAN Osh office, and there are no concerns about its impact on the local economy.
17	Land use and utilization of regional resources			DC/OP: While the Project involves modifying some agricultural land for the planned project area, there is no anticipation of significant impacts on land use or regional resource utilization.
18	Wate Use	✓		DC: If there is water usage in rivers or other water bodies near the project site, the impact of turbid water from construction activities (DC) is a consideration. OP: No anticipated impacts are foreseen from the Project.

	Impact Factor	Result of Scoping		
		BC/ CS	OP	The basin of Scoping Result
19	Existing Social Infrastructure and Social Services	✓	✓	DC: During construction, temporary traffic congestion caused by construction machinery and vehicles is anticipated on agricultural roads around the planned project site. OP: The project will enhance the capacity of the control tower operations at Osh Airport.
20	Social organizations and decision-making bodies at the local level.			DC/OP: No anticipated impacts are foreseen from the Project.
21	Disparities in losses and benefits			DC/OP: As the Project does not anticipate large-scale construction, no impact is expected on this item.
22	Conflicts of interest within the region			DC/OP: No anticipated impacts are foreseen from the Project.
23	Cultural Heritage	✓		DC/OP: The project area and its surroundings do not contain cultural heritage. However, according to the laws of Kyrgyzstan, it is necessary to conduct an investigation of buried cultural properties before construction. If cultural properties are discovered, it is necessary to consult with the Cultural Agency and take appropriate measures.
24	Landscape			DC/OP: No anticipated impacts are foreseen from the Project.
25	Gender	✓	✓	DC: As no large-scale construction works are envisaged, no specific negative impacts on gender are envisaged as a result of the project. On the other hand, the new control tower facilities to be constructed need to be designed in a gender-sensitive manner. In addition, there is a possibility of wage disparity in terms of employment conditions when operating as construction workers. OP: Facilities for the control tower will be designed with consideration for gender.
26	Children‘s right	✓		DC: There are concerns about the impact on the safety of commuting due to vehicle operations during construction. OP: No anticipated impacts are foreseen from the Project.
27	Community health, safety and security	✓		DC: No major impacts are of concern as no major works are envisaged, but safety considerations for the local community should be considered as there may be a temporary increase in construction workers during the construction period. OP: No anticipated impacts are foreseen from the Project.
28	Occupational safety and health	✓		DC: It is necessary to consider the working environment for construction workers. OP: No anticipated impacts are foreseen from the Project.
Other				
29	Accident	✓		DC: An increase in construction machinery and construction vehicle traffic during construction is anticipated, leading to the possibility of traffic accidents. OP: No activities that would anticipate accidents are planned during the operational phase.
30	Cross-border effects and climate change			DC/OP: No anticipated impacts are foreseen from the Project.

(Remark*The impact factors in this scoping proposal were selected with reference to JICA Guidelines and similar sources.)

BC: Before Construction, DC: During Construction, OP: Operation Phase

(Source: JICA Study Team)

(7) Results of Environmental and Social Considerations Survey

The results of the on-site investigation are as follows:

1) Air Quality

The area around the proposed project site is agricultural land and there are no facilities located there that would be a source of air pollutant emissions.

2) Water Quality

The area around the project site is predominantly agricultural land, with no rivers or water sources located nearby.

3) Ecosystem

The area is currently utilized as agricultural land, and no notable ecosystems have been identified.

4) Land Use

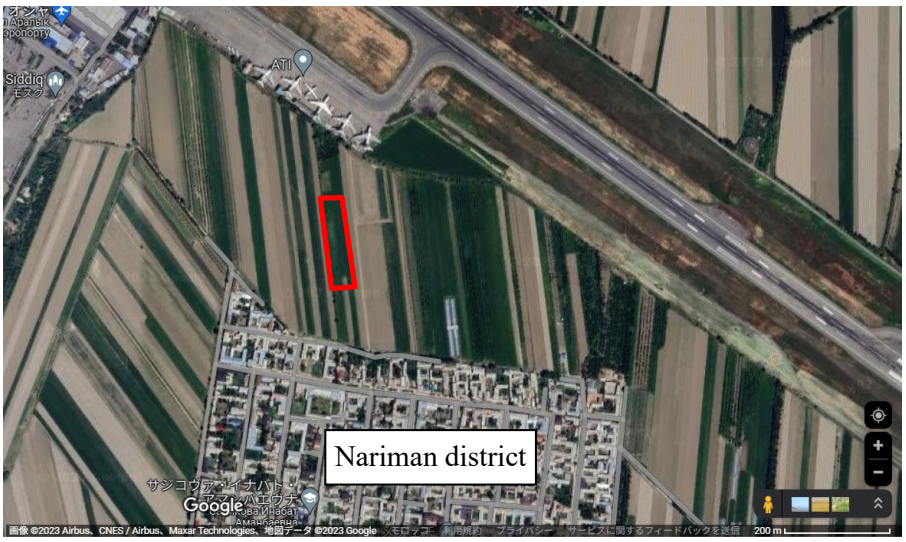
The project site is currently used for agriculture. There are three landowners in the project implementation area, and it was reported that during the summer, mainly corn for livestock feed is cultivated, while alfalfa is grown in the winter.


(Source: JICA Study Team)

Figure- 1.20 The condition of the project implementation area (As of August 2023)

5) Residential Areas

The project site is situated at the midpoint between the current Osh Airport runway and the Nariman district. It is more than 200 meters away from the edge of the residential area, and there are no concerns about its impact on the residential area.



(Photo: Google Earth)

Figure- 1.21 Location of The Project Area and Nariman district

6) Surrounding Infrastructure

On the northern edge of the Nariman district, there is an unpaved road accessible to general vehicles. During the construction of the Project, there is a high likelihood that this road will be utilized as a construction road. While the traffic volume is not high, as local farmers in the Nariman district use this road for accessing farmlands, it is essential to exercise ample caution to minimize the impact on this traffic when construction vehicles are in operation.

(Source: JICA Study Team)

Figure- 1.22 The Unpaved Road along the Project Site

(8) Evaluation of Impact Assessment

The results of the impact assessment are presented in the following table:

Table- 1.11 Evaluation of Impact Assessment

No	Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Basin of Evaluation
		BC/DC	OP	BC/DC	OP	
Pollution						
1	Air Quality	✓		D	D	DC: Due to the operation of construction equipment, a temporary deterioration of air quality is anticipated. However, as the project involves the construction of small buildings, the impact is expected to be minor. OP: No impacts are expected from the Project.
2	Water Quality	✓	✓	D	B-	DC: Since there are no water bodies around the project planning area, there will be no direct impact. However, contaminated water generated during construction will be treated appropriately before disposal, such as through storage tanks. OP: At the control tower, toilet and domestic wastewater will be treated using a septic tank, and the treated water will be disposed of by infiltration. There is no significant concern about the impact on the surroundings.
3	Waste/Hazardous Substances	✓		B-	D	DC: In the Project, approximately 4,000 square meters of soil needs to be replaced due to soil quality issues. For the treatment of this soil, if the soil quality is deemed acceptable, KAN Osh plans to transport it to an appropriate disposal site or mining location. In case the soil contains hazardous substances such as heavy metals, it will be disposed of in accordance with the legally regulated methods. OP: General waste will be generated from the operation of the control tower, but no waste is expected to be generated that would affect the surrounding environment.
4	Soil contamination	✓		B-	D	DC: The possibility of soil contamination due to construction oil spills etc. is considered, but appropriate disposal will be carried out during construction. In addition, as explained in section 3.3 Waste/Hazardous substances, the disposal of construction-generated soil will need to be addressed. Currently, the soil is used in field land and the potential for soil contamination is very low, so the soil will be converted to other agricultural land or used for other purposes if desired after temporary storage. OP: No impacts are expected from the Project.
5	Noise/Vibration	✓		D	D	DC: Construction equipment and vehicle operations are expected to generate noise, but since there is a distance from the settlement, no significant impact is anticipated. OP: No impacts are expected from the Project.
6	Subsidence			D	D	DC/OP: No impacts are expected from the Project.
7	Odor			D	D	DC/OP: No impacts are expected from the Project.
8	Sediment			D	D	DC/OP: No impacts are expected from the Project.
Natural Environment						
9	Protected area			D	D	DC/OP: No impacts are expected from the Project.
10	Ecosystems/flora and fauna/biodiversity			D	D	DC/OP: No impacts are expected from the Project.
11	Hydrography			D	D	DC/OP: No impacts are expected from the Project.
12	Topography and Geology	✓		B-	D	DC: 6,000 m^3 of soil will be removed from the planned p project area and soil will be improved. The soil will be brought in from plants in Osh (about 6 sites). OP: As no major cuts or embankments are planned, no topographical or geological impacts are envisaged.

No	Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Basin of Evaluation
		BC/DC	OP	BC/DC	OP	
Social Environment						
13	Land acquisition/Resettlement	✓		B-	D	BC: A small-scale land acquisition will occur as part of the land acquisition. The three landowners of the proposed project site (4,000 m^2) have already been discussed by KAN and have agreed to sell the land; KAN is considering the acquisition of temporary land (temporary yard), a site for an access road at KAN's expense and security measures, including the proposed project site (4,000 m^2), up to The project is considering the purchase of approximately 23,400 m^2 at most. In that case, two owners will be added to the current three, making a total of five owners. On the other hand, these plans of land acquisition in the surrounding area will be finalized once the implementation of the project has been decided, and concrete negotiations will take place after the project has been finalized. According to KAN, the proposed land price by KAN is above the market price and all owners are positive about the land acquisition as the profitability of the current land as agricultural land is low.
14	Poor			D	D	DC/OP: No impacts are expected from the Project.
15	Ethnic minorities/Indigenous peoples			D	D	DC/OP: The project is focused on urban areas, and there is no confirmation of the presence of ethnic minorities or indigenous peoples in the project area and its surroundings.
16	Local economy, including employment and means of livelihood	✓		B-/B+	D	DC: The employment generated by the construction may increase the income of local workers, leading to a temporary improvement in livelihoods. Concerns about the impact on the income of landowners, who are the subject of land acquisition, are raised. However, based on hearings, it is assumed that KAN has obtained agreement from residents through compensation, and significant negative impacts are not expected.
17	Land use and utilization of regional resources	✓		D	D	DC/OP: The project has selected some agricultural land as the project site. However, no impacts on land use or regional resource utilization are anticipated in the future.
18	Wate Use	✓		D	D	DC: There are no rivers around the project area, so no impacts are anticipated. OP: While general water usage will occur during the operation of the control tower, as it is not a facility with significant water consumption, no impacts on water usage are expected from the Project.
19	Existing Social Infrastructure and Social Services	✓	✓	B-	A^+	DC: Temporary traffic congestion caused by construction machinery and vehicles is anticipated on unpaved roads around the planned site during construction, but it will be a temporary impact. OP: The project will enhance the capacity of the control tower operations at Osh Airport.
20	Social organizations and decision-making bodies at the local level.			D	D	DC/OP: No impacts are expected from the Project.
21	Disparities in losses and benefits.			D	D	DC/OP: As the project does not envisage any major construction works, no impact on this item is envisaged.
22	Conflicts of interest within the region			D	D	DC/OP: No impacts are expected from the Project.
23	Cultural Heritage	✓		C	-	DC/OP: The project area and its surroundings do not contain cultural heritage. However, according to the laws of Kyrgyzstan, it is necessary to conduct an investigation of buried cultural properties before construction. The procedures for this will be carried out by KAN as the responsible authority after land acquisition.
24	Landscape			D	D	DC/OP: No impacts are expected from the Project.
25	Gender	✓	✓	B-	B＋	DC: No specific negative gender impacts are envisaged from the project, but the construction work will provide an opportunity for employment promotion for local residents, but may result in a wage gap in employment conditions for women seeking work. OP: the design of the control tower will be gender-sensitive, including the placement of women-only rooms and women's toilets.

No	Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Basin of Evaluation
		BC/DC	OP	BC/DC	OP	
26	Children ‘s right	✓		B-	D	DC: There is concern about the impact on safety during school commuting due to the operation of vehicles during construction. OP: No specific negative impacts on children's rights are envisaged as a result of the project.
27	Community health, safety and security	✓		D	D	DC: Safety considerations for the local community should be considered due to the possibility of a temporary increase in construction workers during the construction period. OP: No specific impact on infectious diseases is envisaged.
28	Occupational safety and health	✓		B-	D	DC: The working conditions of construction workers need to be taken into account, but the impact is limited as the work is not large-scale. On the other hand, in Kyrgyzstan, the Law on Protection of Workers (2009) sets out labor standards to protect workers. In addition, the SNiP (Standards, Norms and Rules) set by the government agency Gosstroi (State Construction Committee) regulates occupational health and safety management for the construction industry. Contractors need to comply with these laws, regulations and standards and create a good working environment. OP: No work is planned during the in-service phase that could have a negative impact on workers.
Other						
29	Accident	✓		B-	D	DC: The increase in construction machinery and construction vehicle traffic during construction is expected to lead to the occurrence of traffic accidents on surrounding roads. OP: No activities that would anticipate accidents are planned during the operational phase.
30	Cross-border effects and climate change			D	D	DC/OP: As the Project is not of a large scale, there is no anticipation of impacts related to cross-border effects or climate change.

(Remark*The impact factors in this scoping proposal were selected with reference to JICA Guidelines and similar sources.)

BC: Before Construction, DC: During Construction, OP: Operation Phase

(Source: JICA Study Team)

(9) Mitigation Measures and Costs for Implementation, Monitoring Plan

1) Mitigation and Monitoring Plan

The results of the mitigation measures are presented in the following table:

Table- 1.12 Mitigation Measures and Monitoring

No	Factor	Mitigation Measures	Monitoring Items	Responsible Section (Mitigation/ Monitoring)	Cost
2	Water Quality	DC: The consultant and contractor will utilize sedimentation treatment facilities or similar equipment to process runoff from the construction site before discharging it.	Installation of sedimentation treatment facilities: Monthly	Contractor/Contractor	Included in the construction cost
		OP: At the control tower, toilets and domestic wastewater are generated. These will be treated using a septic tank, and the treated water will be disposed of by infiltration.	Confirmation of septic tank installation: Once	KAN/KAN	KAN Budget
3	Waste/Hazardous Substances	DC: Regarding the treatment of construction-generated soil, if the soil quality is deemed acceptable, KAN Osh plans to transport it to an appropriate disposal site or former mining area. If residents in the vicinity express a desire, distribution will be considered. If, however, hazardous substances such as heavy metals are present, proper disposal methods regulated by law will be implemented.	Confirmation of soil treatment methods: Once	Contractor/Contractor	Included in the construction cost
4	Soil contamination	DC：The consultant and contractor will rigorously perform daily maintenance checks on construction machinery to ensure there are no leaks, including gasoline, and to prevent any environmental hazards.	Rigorous daily maintenance checks	Contractor/Contractor	Included in the construction cost
		OP： According to KAN, the disposal for the Project is anticipated to take place at a landfill site (former mining excavation area) managed by the city of Osh.	Confirmation of soil treatment methods: Once	KAN/KAN	KAN Budget
12	Topography and Geology	Same as above.	Same as above.	KAN/KAN	Same as above.
13	Land Acquisition and resettlement	BC： KAN will provide compensation to affected residents in accordance with the laws of Kyrgyzstan.	Confirmation of land handover: Once Verification of compensation-related documents: Once	KAN/KAN	KAN Budget
16	Local Economy, Including Employment and Livelihood Opportunities	DC：If there are preferences expressed by the neighboring residents, priority will be given to hiring them as workers.	Confirmation of employment status: Quarterly	Contractor/Contractor	Included in the construction cost
19	Existing Social Infrastructure and Social Services	During construction： The contractor will implement speed limits for construction vehicles and install signs, protective facilities, and other measures to prevent accidents.	Verification of complaints related to traffic congestion: Promptly upon receiving each complaint	Contractor/Contractor	Included in the construction cost

No	Factor	Mitigation Measures	Monitoring Items	Responsible Section (Mitigation/ Monitoring)	Cost
23	Cultural Heritage	DC/OP：According to the laws of Kyrgyzstan, it is necessary to conduct an investigation of buried cultural properties before construction. The procedures for this will be carried out by KAN as the responsible authority after land acquisition. If cultural properties are confirmed, consultations will be held with the Cultural Agency to undertake the necessary procedures.	Confirmation of the results of the buried cultural property survey: After the survey is conducted.	KAN/KAN	KAN Budget
25	Gender	DC: Ensure gender equality in unit labor costs OP: Ensure gender considerations in planned facilities	Regular monitoring of wage payment registers of prime contractors, subcontractors and sub-subcontractors: monthly Confirmation of gender considerations in controlled control towers	Contractor/Contractor	Included in the construction cost
26	Children‘s right	DC：Construction plan will be developed to ensure that construction vehicles do not pass through during school commuting and homecoming hours. Additionally, hazard anticipation activities, such as the installation of road signs, will be implemented.	Safety and health plan review: Monthly Accident reports: Promptly upon the occurrence of each accident	Contractor/Contractor	Included in the construction cost
27	Community health, safety and security	DC：Same as children’s right Provide health and safety training to construction workers	Health and safety training checks / monthly	Contractor/Contractor	Included in the construction cost
28	Occupational safety and health	DC：To prevent injuries and accidents among the workforce, the contractor mandates the use of work uniforms and helmets for the workers. The contractor conducts awareness campaigns on occupational health through morning briefings and training sessions. Additionally, an emergency response system is established to address incidents when they occur.	Verification of work attire and helmet usage: Daily Monitoring of awareness campaign implementation: Monthly Accident reporting: Promptly upon the occurrence of each accident	Contractor/Contractor	Included in the construction cost
29	Accident	DC：The contractor will implement safety measures to prevent and address accidents. This includes maintaining safety equipment for work at heights, stocking first aid supplies, deploying an adequate number of traffic controllers, implementing emergency response plans, conducting safety education, holding daily meetings, and engaging in hazard anticipation activities (such as installing road signs). Additionally, an environmental health and safety manager will be appointed to address hygiene and environmental issues, and to appropriately record and report construction-related accidents.	Safety and Health Plan Review: Monthly Accident Reports: Promptly upon the occurrence of each accident	Contractor/Contractor	Included in the construction cost

Remark： BC : Before Construction, DC : During Construction, OP : Operation Phase
(Source: JICA Study Team)

2) Monitoring form

A draft monitoring form is presented below for the monitoring items listed in Table 1.7 above.

a) Water Quality

Monitoring items (frequency)	Status during the reporting period.
Installation of turbid water treatment equipment (monthly)	
Check installation of septic tanks (once after service)	

b) Waste/ Hazardous Substances

Monitoring items (frequency)	Status during the reporting period.
Confirmation of soil treatment methods (once after implementation)	

c) Soil Contamination（Topography and Geology）

Monitoring items (frequency)	Status during the reporting period.
Thorough daily maintenance checks (daily)	
Check soil treatment methods (once after implementation)	

d) Land Acquisition/Resettlement

Monitoring items (frequency)	Status during the reporting period.
Confirmation of site handover/once	
Confirmation of documents relating to compensation/once	

e) Local Economy, Including Employment and Livelihood Opportunities

Monitoring items (frequency)	Status during the reporting period.
Employment status checks (quarterly)	

f) Existing Social Infrastructure and Social Services

Monitoring items (frequency)	Status during the reporting period.
Confirmation of the nature of the complaint due to the occurrence of road congestion (each time a complaint is accepted).	

g) Cultural Heritage

Monitoring items (frequency)	Status during the reporting period.
Confirmation of the results of the archaeological survey / after the survey has been carried out.	

h) Gender

Monitoring items (frequency)	Status during the reporting period.
Checking wage payment registers (monthly)	
Confirmation of gender considerations for new control towers (when in service)	

i) Children's right

Monitoring items (frequency)	Status during the reporting period.
Health and safety plan checks (monthly)	
Accident reporting (per accident)	

j) Community health, safety and security

Monitoring items (frequency)	Status during the reporting period.
Confirmation of the results of the archaeological survey / after the survey has been carried out.	

k) Occupational safety and health

Monitoring items (frequency)	Status during the reporting period.
Check on the wearing of work clothes and helmets (daily)	
Checks on the implementation of awareness-raising activities (monthly)	
Accident reporting (every accident)	

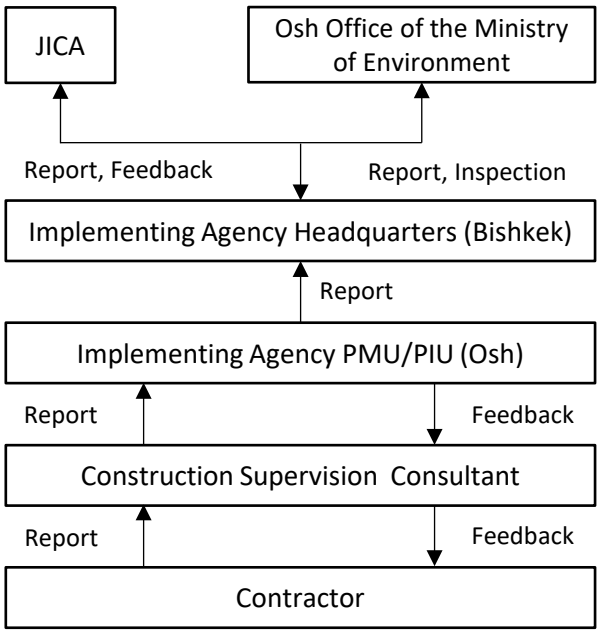
l) Accident

Monitoring items (frequency)	Status during the reporting period.
Accident reporting (per incident)	

(10) Implementation Framework

1) Under Construction

Following figure shows the implementation framework of EMP (Environmental Management Plan) and EMoP (Environmental Monitoring Plan) under construction phase.

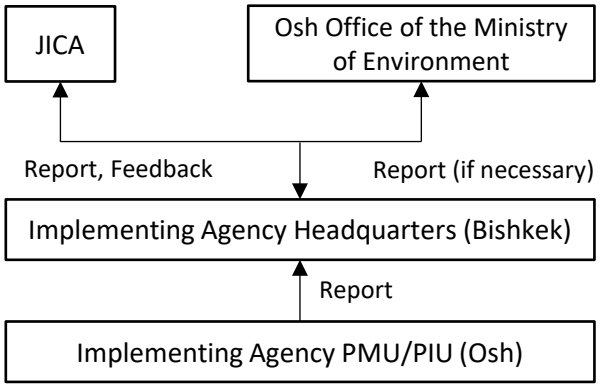


(Source: JICA Study Team)

Figure- 1.23 Implementation framework of EMP and EMoP (Under construction)

2) Operation Phase

Following figure shows the implementation framework of EMP and EMoP in service phase.



(Source: JICA Study Team)

Figure- 1.24 Implementation framework of EMP and EMoP (In Service)

(11) Consultation with Local Stakeholders

Regarding consultation with local stakeholders, KAN has been requested to conduct it. The Osh office is expected to take the lead in the future. Currently, discussions on land acquisition have commenced with three farmers who are the current owners of the project area, and agreements have been reached.

(12) Grievance Redress Mechanism

During the project implementation, a Local Grievance Redress Group (Local GRG) will be established to deal with any comments related to the implementation of the works, including representatives from Osh Municipality, Osh Municipal Office of Environment, KAN Osh Office, and the settlements. Grievances are first submitted to the Municipality of Osh, and if not resolved within three days, to the Local GRG, which assesses the situation, consults with those who have submitted opinions, and listens to the opinions of the KAN Osh Office (currently, a lawyer from the Osh Office is assumed to be in charge), representatives of affected residents and others to If the situation is not resolved within 15 days, the opinion will be submitted to the Central GRG, including KAN HQ, to decide on a response (timeframe is not fixed).

(13) Others (Cultural Heritage)

In response to a note from the Ministry of Infrastructure, it was mentioned that if the construction of a control tower around Osh Airport (currently used as farmland) is to take place, excavation of buried cultural property needs to be conducted before construction.

In light of this, a hearing was conducted with Zholdoshov Chynarbek, Chief Specialist of the Cultural Heritage Protection and Development Department, who responded that procedures in accordance with the Law of the Kyrgyz Republic on the Protection and Use of the Historical and Cultural Heritage are necessary. All procedures must be completed before project implementation, but excavation of buried cultural property may lead to redesign based on the results or a request for construction interruption. KAN, as the responsible authority, will undertake these procedures after the land acquisition is completed and handed over.

1.3.2 Land Acquisition and Resettlement

(1) Necessity Land Acquisition and Resettlement

In the Project, the project area will be the land adjacent to the current airport, which is currently used as a field. Resettlement will not occur, and land acquisition will be required.

(2) Legal Framework for Land Acquisition and Resettlement

1) Overview of the relevant national legal framework for land acquisition and resettlement

Land Acquisition and Resettlement in Kyrgyz are carried out in accordance with the Constitution of the Kyrgyz Republic (June 27, 2010), the Civil Code (No. 16 of May 8, 1996) and the Land Code (No. 45 of June 2, 1999). The following table shows the laws and regulations regarding land acquisition and involuntary resettlement in Ki Country and a summary of these laws and regulations.

Table- 1.13 Land Acquisition Laws and Regulations

Name	Year	Outline
Constitution of Kyrgyz Republic	2010	The diversity of land ownership, protection of land ownership rights, and the possibility of acquiring land for public purposes through fair and prior compensation are stipulated.
Land Code	1999	Land acquisition is conducted with the approval of the relevant authority and the consent of the current landowner (user). Compensation is based on market prices, considering the value of the land and losses incurred. Alternatively, it may involve providing equivalent land as compensation.
Civil Code	1996	The regulations define the types and amounts of losses to be compensated in the case of land acquisition and involuntary resettlement of residents.
Law on Grievances	2007	Provisions are in place to record and justly address complaints from the public related to activities such as land acquisition.

(Source: JICA Study Team)

2) JICA's policy on land acquisition

JICA's policy on land acquisition is shown in the table below. Note that the project does not include resettlement, so only items related to site acquisition (loss of livelihoods) were extracted.

Table- 1.14 JICA's Policy on Land Acquisition

The key principles of JICA policies on involuntary resettlement
1. Loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people who may lose their livelihoods by the project, must be provided sufficient compensations, and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible and provided in advance. Measures to achieve this may include Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the planning, implementation, and monitoring of measures against loss of livelihood.
Above principles are complemented by World Bank ESS5, since it is stated in JICA Guideline that "JICA confirms that environmental and social considerations of a project do not deviate significantly from the World Bank's environmental and social policies." Additional key principle based on World Bank ESS5 is as follows.
1. The Borrower will, as part of the environmental and social assessment, conduct a census to identify the persons who will be affected by the project, to establish an inventory of land and assets to be affected, to determine who will be eligible for compensation and assistance, and to discourage ineligible persons, such as opportunistic settlers, from claiming benefits. (ESS5 para20). 2. Affected persons may be classified as persons: (a) Who have formal legal rights to land or assets (b) Who do not have formal legal rights to land or assets, but have a claim to land or assets that is recognized or recognizable under national law; or (c) Who have no recognizable legal right or claim to the land or assets they occupy or use. (ESS5 para10) The Borrower will offer affected persons compensation at replacement cost, and other assistance as may be necessary to help them improve or at least restore their standards of living or livelihoods, subject to the provisions of paragraph 26 through 36 of this ESS. (ESS5 para 12) 3. Particular attention will be paid to gender aspects and the needs of the poor and the vulnerable. (ESS5 para26)
In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

(Source: JICA Study Team)

3) Gap analysis between JICA's policy on land acquisition and Kyrgyz Legislation

The gaps between the JICA guidelines and the Kyrgyz legal system for land acquisition are summarized in the table below. Note that the project does not include resettlement, so only items related to land acquisition (loss of livelihoods) were extracted.

Table- 1.15 Gap analysis between JICA's policy on land acquisition and Kyrgyz Legislation

No.	JICA Guidelines	Laws and Guidelines of the Kyrgyz Republic	Gaps with JICA Guidelines	Policy by the Project
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	The Constitution of the Kyrgyz Republic (2010), Land Code(1999), Civil Code(1996)	None	Same as JICA GL
2	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	The Constitution of the Kyrgyz Republic (2010), Land Code(1999), Civil Code(1996)	None	Same as JICA GL
3	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	The Valuation of properties is carried out according to market value and market price.	None	Same as JICA GL
4	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	The Constitution of the Kyrgyz Republic (2010), Land Code (1999), Civil Code (1996)	None	Same as JICA GL
5	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	Not specified.	Although there is no mention of the use of language, in practice negotiations are conducted using a common language.	Same as JICA GL
6	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	Law on Grievances (2007)	None	Same as JICA GL
7	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	Not specified.	Identification of affected people is not specified. In practice, land owners were identified at an early stage in this Project.	Same as JICA GL
8	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	The only PAPs who have formal right to property are eligible for compensation only. (Land Code)	PAPs without formal land ownership are not entitled to compensation.	This project is not applicable because the official identity of the landowner has been confirmed.
9	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Not specified about livelihood restoration.	No support for transition agencies is envisaged.	Additional cash compensation will be paid based on KAN proposal.
10	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	Not specified.	Special considerations for vulnerable groups are not specified.	This project is not applicable because landowners are not included in vulnerable groups.

(Source: JICA Study Team)

(3) Scale and Scope of Land Acquisition and Resettlement

The site subject to land acquisition is 4,000 m^2. It is currently used as a field and no buildings exist. Three owners of the subject site have been identified.

KAN is also in discussions with the landowners with a view to purchasing up to approximately 20,000 m^2 of land adjacent to the project site, including the planned project site (4,000 m^2), for temporary land acquisition (temporary yard), a site for an access road at KAN's expense and security measures, although not for the project site. In that case, two additional landowners will be added to the three landowners in the project area, bringing the total number of landowners to five. The table below shows the number of these five landowners and their family members, and the area of land covered by the project. (This area is the total area of the project area and its surroundings). The purchase plan will be finalized once the project is implemented, and specific negotiations on the area to be purchased will be carried out after the project is finalized, but according to KAN, the owner is willing to sell the land as the current land has low profitability as agricultural land.

Table- 1.16 Information of Landowners

No.	Landowners	Number of families	Area of Land Acquisition (ha)Noe1、Note2
1	Landowner Mr. K.I	7	0.56
2	Landowner Mr. A.A	10	0.36, 0.40
3	Landowner Mr. A.D	6	0.28
4	Landowner Mr. M.I	4	0.42
5	Landowner Mr. M.M	5	0.32
Total			2.34

(Source: JICA Study Team)

(Note 1: The above land acquisition area is based on information provided by KAN and is the sum of the area where the Project is implemented, and the area KAN is considering acquiring on its own.)

(Note 2: The subject site is agricultural land and no buildings or other facilities or trees are located there.)

(4) Specific Measures for Compensation and Support

1) Compensation for Loss

As of November 2023, KAN is negotiating with the landowners, but all three landowners want to be compensated in money. In addition, if agricultural crops were being grown on the land at the time of land acquisition, they will be compensated in accordance with Ki State legislation.

2) Livelihood Restoration

According to the KAN, landowners are highly interested in selling their land as the income from their current agricultural land is not significant. In addition, landowners have not requested assistance for reacquisition of alternative agricultural land to continue farming in the future. The land acquisition price includes consideration for livelihood restoration, and the landowners are satisfied with the posted price, which is several times the price of the implemented land price. In addition, as part of the environmental and social considerations mitigation measures, it is proposed that the landowners will be employed as construction workers on a priority basis if they so wish.

3) Entitlement Matrix for the Project

The entitlement matrix for land acquisition for the project is shown in the table below.

Table- 1.17 Entitlement Matrix

No.	Type of loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation issues/Guidelines	Responsible Organization
1	Loss of agricultural land	Legal owner(s) of land	i. Replacement value of land (Cash Compensation under Law), including support cost for livelihood restoration (cash) ii. Costs and taxes related to land sale and purchase procedures	i. Payment of Cash Compensation under Law	KAN
2	Loss of crop	Legal owner(s) of land	i. If some crop is grown on site at the time of the land sale, the cost of the Crop is covered.	i. Payment of Cash Compensation under Law	KAN
3	Loss of Livelihoods	Legal owner(s) of land	i. Cash compensation of land including support cost for livelihood restoration ii. Employment as a construction worker if requested by the landowner	i. Payment of Cash Compensation under Law ii. Provide working opportunity, if any	KAN/ Contractor

(Source: JICA Study Team)

(5) Implementation Structure (Identification of the agency responsible for resettlement and its responsibilities)

KAN is the responsible agency for land acquisition before the signing of the Exchange of Notes (E/N) between the Kyrgyz government and the Japanese government regarding grant assistance.

(6) Implementation Schedule (Physical relocation will begin after completion of compensation payment for lost assets)

As of December 2023, it has been confirmed that KAN is the responsible authority for various applications and compensations. Negotiations for land acquisition have been ongoing with landowners since early 2023, and compensation and land acquisition are scheduled to commence in 2024.

(7) Costs and Financial Resources

The cost of land acquisition is currently being negotiated by KAN with the landowner and will be estimated according to Kyrgyz legislation, but the cost includes (i) land price, (ii) costs required to change land ownership, (iii) taxes, and (iv) compensation costs as livelihood restoration support. The price of the land is currently under negotiation, but according to KAN, the price offered is several times the actual land price, including livelihood restoration assistance, and the landowner is currently satisfied with the amount offered. The actual land acquisition costs shall be borne by KAN, with formal budgetary measures to be taken in early 2024.

(8) Monitoring System and Monitoring Form by Implementing Agencies

KAN will monitor the landowner's living conditions after the land transfer and any complaints during the construction. The monitoring form is presented in the table below.

Table- 1.18 Monitoring Form (Land Acquisition)

No.	Monitoring Items	Period	Status during the reporting period.
1	Land transfer status (payment status)	After transfer of land	
2	Living conditions of landowners	Once during construction and once	
3	Complaint lodged regarding land acquisition		

(Source: JICA Study Team)

(9) Stakeholder Meeting

KAN is currently in negotiations with three landowners. According to KAN, agreements have already been reached regarding the transfer of land, and negotiations are ongoing concerning the land price and compensation.

The JICA survey team has requested KAN to conduct local stakeholder consultations for neighboring community. The stakeholder meetings will be conducted mainly by the KAN Osh office in the future. The report of this preparatory survey for cooperation will also be published on the website of the implementing agency, KAN.

Table- 1.19 Meeting Records between KANs and Landowners

No.	Date	Participants	Contents of meeting
1	12 January 2023	KAN, 2 landowners (Mr. K.I, Mr. A.A)	Confirms with the landowner the plans for the project and whether or not there is interest in acquiring the land for the project. Landowner expresses high interest in sale, but is willing to discuss details of compensation policy.
2	9 February 2023	Same as above	Confirmation of landowner's formal land ownership documentation by KAN.
3	24th March 2023	KAN, Mr. K.I	Discussion and confirmation of agreement with Mr. K.I. regarding field survey and soil investigation.
4	May 2023	KAN, Land owner 2 (Mr. K.I, Mr. A.A)	Confirmation of the existing irrigation facilities on the land to be acquired and discussion on the progress of the project.
5	May 12, 2023	KAN, Landowner 3 (Mr. K.I Mr. A.A, and Mr. A.D)	Discussed land acquisition and compensation policy with one new landowner. The landowner has almost agreed to sell the land. Discussions on the compensation policy will continue.
6	June 2023	KAN, Mr. K.I	Re-discussed with Mr. K.I. the timing of surveying and other site investigations. Agreed on the timing and location of the survey.
7	July 2023	Ditto	Continued discussions with the landowner.
8	23rd August 2023	KAN General Secretary, Mr. K.I	Discussions were held between KAN Director General and Mr K.I., the representative of the landowner, on the price for selling the land; the amount offered by KAN was agreed and the schedule for the future was shared.
9	4 October 2023	KAN, 5 landowners (Mr. K.I Mr. A.A, Mr. A.D, Mr. M.I, and Mr. M.M)	In consideration of the future acquisition of land in line with KAN's plans, including the project implementation area, discussions were held between KAN and five landowners, including two additional landowners from the surrounding area, in addition to the three owners of the project implementation area up to now. The two additional owners have also expressed a high level of interest in selling their land. Negotiations will start again with the owners of the surrounding land once the project has been decided in the future.

(Source: JICA Study Team)

2 CONTENTS OF THE PROJECT

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2.1 Basic Concept of the Project

2.1.1 Upper-Level Plan

In the "Civil Aviation Development Concept of the Kyrgyz Republic (2021-2025)", the State Civil Aviation Agency (SCAA) identifies the problems in the civil aviation sector in the Kyrgyz and presents an approach to solve them. The approach consists of nine items in order of priority, and the objectives and measures to achieve them are described. Among them, the development of airport infrastructure in the Kyrgyz is mentioned, and the setting of intermediate goals for the development of civil aviation in the Kyrgyz is listed as a task to be implemented. The nine items are as follows:

1) Improving the safety of domestic airlines
2) Administrative improvement of the State Civil Aviation Agency (SCAA)
3) The need to update the aircraft models
4) Establishment of a modern aircraft maintenance center
5) Improvement of the personnel system of civil aviation companies
6) Improvement of ATC services
7) Development of airport infrastructure in the Kyrgyz
8) Development of ultralight and light aviation in the Kyrgyz
9) Geographical expansion of flights In particular, regarding

1) and 2), the SCAA of Kyrgyz was pointed out in the ICAO audit in 2006 that it did not meet the ICAO standards and was listed on the EU blacklist. As a result, it was not possible to operate direct flights from Kyrgyz to the EU. Since the audit from 2016 to 2019, the key issues have been improved with the support of experts from the European Commission, and as a result, positive evaluations have been obtained from ICAO experts that the safety of flights in Kyrgyz is ensured. In addition, the European Regional Aviation Safety Plan (EUR RASP) in 2020 states that Kyrgyz is part of the European region and that the level of flight safety in Kyrgyz needs to be maintained at or above the level adopted in the European region.

2.1.2 Current Condition and Problem of the Sector

The Kyrgyz is a landlocked country in Central Asia, surrounded by four countries: Kazakhstan, Uzbekistan, Tajikistan, and China. More than 90% of its territory is mountainous. Osh city, located in the Fergana Valley in the south of Kyrgyz, is the second largest city in the country and is called the capital of the south. Osh International Airport, located near Osh city, is the second largest airport in Kyrgyz after Manas International Airport, and the passengers who use the airport account for about 40% of the total in the country. Osh International Airport has international flights connecting various cities in Russia, the capitals of Middle Eastern countries, and domestic flights to the capital Bishkek. For Kyrgyz, where most of the land is mountainous, air transport is an important means of transportation. Especially in Osh city, which is located in the basin, while the development of road networks such as trunk roads is progressing, air transport, which can be used as a safe means of transportation even in winter, is a crucial element that supports the socio-economic infrastructure in Osh city and the surrounding areas. The government of Kyrgyz, considering that the air demand at Osh International Airport is increasing steadily and that there is a high possibility of an increase in transit demand in the future due to geographical conditions, announced a modernization plan for Osh International Airport in 2015. As a result, runway extension was conducted in 2016, and expansion work of the passenger terminal building was conducted in 2017.

On the other hand, the control tower, which was built in 1974, is not only deteriorated, but also the visibility of the runway extension part on the southeast side due to the above-mentioned runway extension is difficult from the existing control tower, and it does not comply with the ICAO standards, and the controllers are not able to perform the airfield control duties sufficiently.

In addition, the ATC system used at the three international airports of Manas International Airport, Osh International Airport and Issyk-Kul International Airport has been in operation for about 15 years and has exceeded the manufacturer's warranty period. Therefore, there is a possibility that problems with reliability and efficiency may arise due to the aging of the system. In addition, if the ATC system stops due to a disaster or failure, not only will it not be able to receive manufacturer support, but there is also a risk that air route control will not be possible for an extended period of time, which may affect business continuity.

2.1.3 Purpose of the Project

The goal of this project is to improve the safety and handling capacity of aircraft operations at Osh International Airport, Manas International Airport, and Issyk-Kul International Airport in Kyrgyz by replacing the control tower and updating the ATC system at these airports, and to contribute to the strengthening of regional connectivity and the economic development of southern Kyrgyz by reducing the dependence on land transport via Russia or China and enhancing the functionality of the Kyrgyz aviation sector.

Figure- 2.1 Location map of the Airports in Kyrgyz

2.2 Outline Design of the Japanese Assistance

2.2.1 Design Policy

(1) Construction (Facilities)

1) Basic Policy

The control tower and ACC are fundamental components of the airport's ATC system, playing a crucial role in supporting the safe operation of aircraft. Their primary functions include issuing instructions related to aircraft takeoff, landing, and in-flight operations, as well as coordinating and monitoring air traffic. The primary goal is to enhance the safety of aircraft operations departing and arriving at the airport. To achieve this objective, the new facility should be designed based on the fundamental policies outlined below.

- Kyrgyz Republic adheres to the standards set by the International Civil Aviation Organization (ICAO) and has established domestic standards concerning the safe operation of aircraft. However, as ICAO's standards for control towers are expressed qualitatively, it is advisable to refer to quantifiable criteria such as those provided by the FAA when planning if specific national standards for Kyrgyz Republic 's control towers are not established. Additionally, at Osh International Airport, runway extensions were carried out around 2010 and 2016. However, the control tower, constructed as the independent tower on the rooftop of the existing passenger terminal building since its initial construction about 50 years ago, faces visibility issues.

- In addressing these issues, this proposed plan aims to establish the new control tower in compliance with FAA and ICAO standards. Simultaneously, efforts will be made to create a control tower and ACC that provides a comfortable working environment for staff, ultimately contributing to the safe operation of aircraft.

- To ensure compliance with international standards, meet safety requirements, and cater to the operational needs of Osh International Airport, the following considerations will be taken into consideration during the planning process:
  - Preventing Visibility Obstruction During Construction: Ensuring that construction activities do not cause visibility issues during the construction period.
  - User-Friendly Facilities for Staff: Designing a building that is user-friendly for staff, considering their comfort and convenience.
  - Comprehensive Cost Consideration: Considering the overall cost, including infrastructure, rather than focusing solely on construction expenses.
  - Security Considerations: Implementing security measures to ensure the safety and integrity of the facility.
  - Future Airport Planning: Considering future airport plans and developments in the design to accommodate long-term growth and changes.

The contents of ‘Minutes of Discussion’ for the request by Kyrgyz side established in the last field investigation were confirmed in the ‘Technical Memorandum’ based on the geographical survey. The design policy should be implemented based on these agreements.

2) Design Policy for the Natural Environment

The design of the control tower and ACC will be conducted in accordance with Kyrgyz Republic 's building standards, taking into account natural environmental conditions specific to the country, including seismic considerations (vibration), strong winds (wind force), and meteorological factors (ambient temperature, humidity, etc.).

3) Design Policy for the Social and Economic Condition

In the outline design (OD) phase, particular attention will be given to lifestyle, historical and cultural traditions, religion, and other societal factors. The design process will consider and accommodate these aspects to align with the local way of life and cultural context.

4) Design Policy for Business Environment on Construction/ Procurement

Kyrgyz has published a plan in January 2020 titled "Kyrgyz Republic's Construction Industry Development Strategy for 2020-2030" to promote the development of the construction industry. The plan proposes improvements that contribute to the development of the construction industry, including simplification of building permit application procedures. Due to this social background, the number of registered construction companies has increased in recent years, and construction is continuing in the suburbs of cities such as Bishkek and Osh. Construction companies are classified into three categories (Category 1-3) based on their comprehensive evaluation, such as order history. The construction work that can be ordered is limited by the following categories:

- Category-3: Buildings up to 5 floors
- Category-2: Buildings up to 12 floors
- Category-1: Buildings above 13 floors

Kyrgyz manufactures sand, cement, bricks, and other materials domestically, but mainly procures other construction materials from foreign countries such as Turkey and Kazakhstan. Foreign-made building materials are popular in the local market, and it is also possible to procure materials from foreign countries through local agents for products that require orders.

In Kyrgyz, the local currency (Kyrgyz som) is used for basic commerce. However, since imported goods are widely circulated in the market, the price of materials is sometimes quoted in US dollars, and payment is made in Kyrgyz som based on the exchange rate of the day.

5) Design Policy for Local Consultants and Contractors

In Kyrgyz, a local design consultant with a license is required to obtain a construction permit. Therefore, it is recommended to seek the cooperation of a local design consultant with a license during the implementation design stage. During the construction phase, it is assumed that Japanese construction contractors will subcontract to Kyrgyz construction companies or directly employ skilled workers and laborers.

6) Design Policy for Operation and Maintenance

KAN's Branch Osh operates a Radio Technical Support Center with 50 engineers specializing in aviation radio technology. However, there are no engineers dedicated to building repairs at this center. In Bishkek, there is a Chief Engineer responsible for construction and building, overseeing the management of company facilities throughout Kyrgyz Republic. Repair and construction activities are outsourced to external construction companies. All construction work is conducted under the supervision of the Chief Engineer for Construction and Building and the General Engineer, who assume full responsibility for the quality and timely completion of construction activities.

In this proposed plan, the operation and maintenance of the facility will adhere to the current maintenance personnel's technical capabilities. The facility content will be within the scope that can be technically managed by the existing maintenance staff. Additionally, the selection of equipment will prioritize those with low maintenance costs. The overall plan aims to reduce running costs.

7) Design Policy of Facility Grade

The control tower is a facility that passengers first encounter upon aircraft arrival and the last building they see when departing from the airport or the country. Responding to KAN's request to create a building representing the fusion of Japanese and Kyrgyz cultures, the control tower, with its unique tower structure, inherently becomes a symbol of the airport. However, as it is not a facility used by the general public like the passenger terminal, it is essential to plan it with considerations of cost, maintenance, and ease of construction, avoiding excessive extravagance.

In setting the grade, priority will be given to maintenance and ease of construction. The design aims to utilize materials from Japan and Kyrgyzstan to symbolize the airport, creating a simple, well-maintained, and aesthetically pleasing building that resists dirt. Additionally, to ensure passenger and aircraft safety and the continuity of aviation operations, the building will incorporate an appropriate Business Continuity Planning (BCP) as part of its airport facilities.

For the interior, given its status as a functional facility, efforts will be made to create a comfortable working environment for staff. With the exception of the control rooms, which requires sound absorption for voice communication, unit carpeting will be used, aiming for a grade similar to typical local office facilities.

8) Method of Construction/ Procurement and Work Scheduling

Construction and procurement shall be planned in a way to ensure safety and quality required for a grant aid project, while also considering methods of construction and procurement practiced in Kyrgyz. A construction period shall be scheduled to achieve the shortest possible term, taking into account of climate conditions, working conditions, and lifestyle in Kyrgyz.

(2) Air Traffic Control Equipment

1) Basic Policy

The ATC equipment being procured for this project is designed to upgrade the ATC systems at Manas, Osh, and Issyk-Kul International airports to enhance the safety of aircraft operations and aircraft handling capacity at these airports in line with the project objectives. In order to achieve these goals, the project will be designed in accordance with the following basic policies.

- Since no official design standards have been established for ATC data processing systems, the design standards for ATC systems specified in Japan and Euro-Control shall be used as the basis. In addition, for COTS (off-the-shelf products) such as PCs, the policy is to use the manufacturing company's design standards.

- There are several ATC equipment manufacturing companies both in Japan and overseas, and each company is competing on quality and price. For this reason, this project will take into consideration systems proposed by not only Japanese manufacturing companies but also overseas manufacturing companies and will develop the overall system to find the most suitable equipment system for Kyrgyz, especially considering the easiness of operation and maintenance.

- The requests from the Kyrgyz side described in the Minutes of Discussion have been confirmed during the site survey through a Technical Memorandum, and the design policy proposed in this study shall be conducted accordingly.

2) Design Policy for the Natural Environment

Design for ATC equipment should be conducted according to the architectural design standards established in Kyrgyz 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 the Social and Economic Condition

This project is to introduce new equipment for ATC facilities. Social and economic factors such as lifestyle, history, cultural tradition, religion, and architectural style were not considered in the design policy.

4) Design Policy for Business Environment on Construction/ Procurement

Since ATC equipment is a part of the global aviation infrastructure, the specifications of the procured equipment shall be based on the international standards of ICAO, the equipment specifications established by the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, and the equipment specifications proposed by Japanese manufacturers.

5) Design Policy for Local Consultants and Contractors

As the installation work for this project requires regular workers, special workers, and electricians, local construction companies and electrical contractors will be utilized. Although there are no electrical contractors specializing in ATC facilities in Kyrgyz, the on-site construction work for this project is mainly general work such as IT equipment installation and terminal wiring. Therefore, the construction will be conducted by local contractors under the supervision of specialized engineers dispatched from Japan or a third country.

6) Design Policy for Operation and Maintenance

The ATC equipment to be procured under this project is basically the same system as the

equipment currently being operated and maintained in Kyrgyz. At KAN, the operation and maintenance of existing equipment is conducted on a daily basis, and normal operations are being conducted without any hitch. In addition, KAN continues to train air traffic controller trainees and maintenance personnel from time to time. In addition, each operation and maintenance staff receive refresher training and operational/technical training on a regular basis every year to improve their knowledge and maintain technical standards at international standards. In the field, KAN's staff accumulate experience through OJT and learn how to deal with failures and repair methods. Based on these facts, we believe that the current operation and maintenance personnel have sufficient technical capabilities.

However, since the operation and maintenance methods for the procured equipment will differ between existing equipment and the latest equipment, initial operational guidance will be planned by engineers dispatched from the manufacturing company.

7) Design Policy of Equipment Grade

The functional specifications of the ATC equipment to be procured under the Project shall be in accordance with ICAO and Euro-Control standards. For equipment specifications and environmental standards, the manufacturer's equipment specifications will be taken into consideration. Regarding quality, in light of international trends in ATC equipment, commercial-off-the-shelf products (COTS) will be used as much as possible in order to reduce maintenance costs for counterpart country after this project is completed.

8) Method of Construction/ Procurement and Work Scheduling

Since this project will be implemented within the restricted and controlled areas of the three airports, construction methods and processes will be planned so as not to interfere with airport operations.

The period required for manufacturing, transportation, installation, adjustment, and commissioning of each equipment shall be determined based on the critical path of the entire project, and the timing of delivery of each system to the site shall be adjusted to minimize the period required for local procurement management and to avoid work congestion at the site.

2.2.2 Basic Plan (Construction Plan/Equipment Plan)

(1) Site and Facility Layout Plan

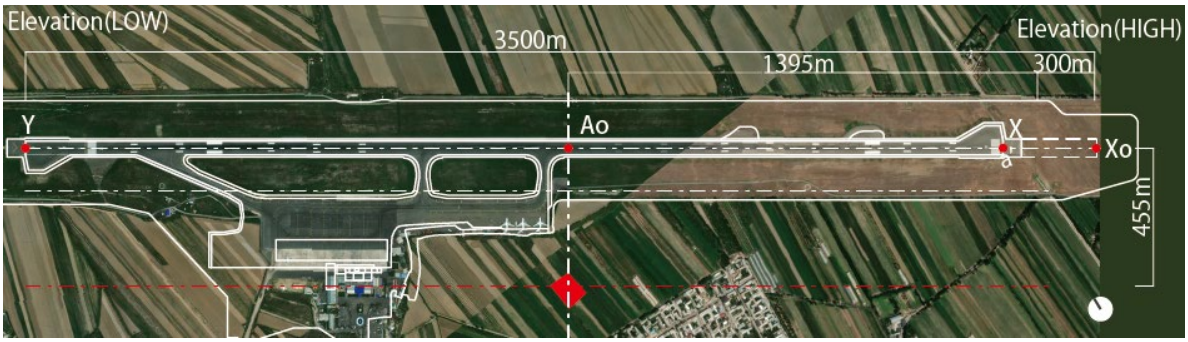
1) Control Tower Location

In accordance with the " Civil Aviation Bureau - ATC Tower Facility Design Standards -I. Control Tower Design Standards -3. Selection of Control Tower Position" (Edited by the Ministry of Land, Infrastructure, Transport, and Tourism of Japan, 2010), it is generally advantageous to position the control tower facing the longitudinally central part of the runway. Considering visibility range, orientation of the VFR room (Visual Flight Rules, indicating tower control room), and visibility from the VFR room, the control tower will be planned to align with the anticipated 300m eastward extension of the runway, approximately at the center of the totally extended runway to serve as the visual reference point for air traffic controllers.

Furthermore, considering the visual height according to FAA 6480.4B and ICAO's transitional and horizontal surfaces, the tower's location in Figure- 2.2 will provide the necessary visual height and fit within the height restrictions.

In selecting the site, alignment with KAN's preferences for land provision is crucial. To facilitate smooth land negotiations, the plan aims to secure the land owned by less than three landowners and plan for a site area of approximately 4,000m^2, excluding areas designated for roads and infrastructure.

As part of the surrounding conditions, a site along an agricultural waterway has been selected. The reason behind this choice is the potential to utilize the agricultural waterway and its adjacent land for rainwater drainage, thereby possibly avoiding the need for excessive land acquisition.



(Source: JICA Study Team)

Figure- 2.2 Site Location for Control Tower Planning

2) Site Layout Plan

The project site planned in 1) is diagonally positioned to the runway axis at 43 degrees. The building will be strategically positioned at the center of the site. An access road will be constructed on the city side (south side), facilitating vehicle access from the south. To accommodate this, a parking area is planned on the south side of the building. In compliance with Kyrgyz regulations, which require accessibility for firefighting vehicles around the perimeter of important facilities, gravel paving is planned for the outer perimeter.

To manage toilet drainage, a septic tank will be positioned on the north side to allow direct discharge to the north. Due to Kyrgyz regulations stipulating a 15-meter separation between buildings and small septic tanks, the plan considers this requirement and situates the septic tank to the northeast while maintaining the required separation. Power supply, as per information obtained from KAN, is anticipated to be drawn from the city side (south side), leading to the planning of a power station building on the west side.

(2) Facility / Architectural Plan

1) Section Plan

The verification of the line of sight (LoS) in the VFR room will be conducted according to FAA 6480.4B, as illustrated in Table- 2.1. The elevation of the site ground level is set to be determined by the planned height along the access road, considering the water slope from the south side road. As a result, the ground level is expected to be 1 to 1.5 meters higher than the surrounding farmland. Based on this condition, the planned eye level of the controller is set at 32.55 meters (> i = 32.29m).

Except for the VFR room, the building's structure is designed with a rational height of 4.3 meters for each floor, ensuring structural integrity, safety on stairs, and ease of construction. The new control tower and ACC are planned as an 8-story structure, including the VFR room.

Table- 2.1 Formula for Determining the Height of the Control Tower

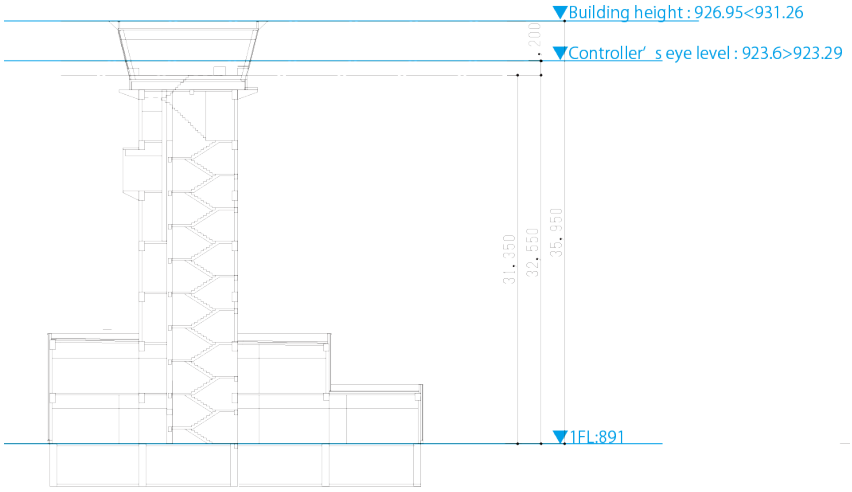
Groound Elevation of X	a	896.38	m(elevation)	survey data
Groound Elevation of Xo	b	898.78	m(elevation)	a+2.4m(300mxslope0.8%)
Ground Elevation of Ao	c	886.26	m(elevation)	survey data
Ground Elevation of A	d	891	m(elevation)	assumption

Minimum Control Tower Height Requirement (with regard to minimum Linf of Sight (LOS) angle to RWY30 Threshould)				
Distance Xo to Ao	e	1,695	m(distance)	
Distance A to Ao	f	455	m(distance)	
Distance Xo to A	g	1,755.01	m(distance)	g=squre(e^2+f^2)
Minumum Elevation of Controller's Eye level	h	923.29	m(elevation)	h=b+g x tan(0.8degree)
Minumum Hight of Controller's Eye level from Ground	i	32.29		i=h-d
Height between Controller's Eye Level and Top of Control Tower (including antenna on the roof)	j	6	m(height)	assumption
Minimum Tower Height	k	38.29	m(height)	k=i+j

Maximum Control Tower Height (with regard to Inner horizontal surface Restriction)				
Distance A to Ao	f	455	m(distance)	
Maximum Elevation of Tower at A due to Inner horizontal surface Restriction	l	931.26	m(elevation)	l=c+(f-140)/7
Maxium Tower Hight above ground	m	40.26	m(height)	m=l-d

Distance between Maxium and Minimum Tower height	n	1.97	m(height)	n=m-k

(Source: JICA Study Team)



(Source: JICA Study Team)

Figure- 2.3 Cross-Sectional Plan

2) Floor Plan

For the 8-story control tower, each floor's layout is meticulously planned, emphasizing operational efficiency and cost-effectiveness. The ground floor features an entrance and strategically grouped office spaces to maximize operational efficiency. The control tower is centrally located, ensuring structural rationality.

Considering the need for equipment updates in every 20 years in the radar control room and equipment room, a room facilitating easy updates is planned on the opposite side of the control tower area. The briefing room for controllers is positioned for convenient access to the control tower.

On the second floor, rooms for the Air Traffic Management (ATM) department, such as training rooms and break rooms, are main facilities, along with break rooms for the Engineering department and Machine rooms. The seventh floor is dedicated to the control equipment room, considering wiring efficiency, while the sixth floor is planned as a meeting room for controllers. The fifth floor accommodates the equipment room responsible for heating and cooling the control room, ensuring a rational plan to avoid the design of long duct lengths. The various rooms for the control tower and ACC are summarized in Table- 2.2.

Table- 2.2 List of Key Rooms Comprising Each Floor

Story	Tower	Area Control Center
8	Tower Control Room	—
7	Communication equipment room	—
6	Meeting room for Controller	—
5	Machine room for Tower control room	—
4	Maintenance storage room	—
3	Storage room	—
2	ATM Training room, Break room for ATM, Shower room	Rest room for engineering
1	Briefing room, Manager room for ATM	Radar control room, Radar equipment room, Navigation and communication equipment room, Control and Monitor Room, Recording and Analysis Room, Office for Engineering, Optical fiber Cable Network room, Meteorological Manager room, Meteorological Briefing room, Briefing room for pilot, Manager RM For Pilot management, Casher room, Signal Center, Kitchen, Medical room, Guard room, etc.

(Source: JICA Study Team)

3) Elevation Plan

The control tower, being a building visible to passengers during aircraft takeoff and landing, particularly during landings, is designed to be the first building observed by travelers. With its distinctive tower-shaped design, the elevation plan prioritizes simplicity, user-friendliness, and easy maintenance. Recognizing the challenges associated with maintaining tower-shaped structures, the exterior materials requiring minimal maintenance are utilized for the tower section, while the lower sections are planned using locally prevalent construction methods.

4) Scale Setting of Building

The proposed plan is the replacement of the current control tower. An assessment of the various rooms utilized in the existing tower was conducted to confirm the necessary rooms and their respective areas. While some rooms were deemed unnecessary, there is a need for additional accommodations, especially considering recent changes such as the increasing number of female staff and the demand for gender-sensitive facilities.

For new control equipment facilities, rooms like the radar control room are deemed satisfactory in size as per the existing setup. However, adjustments in room size are required for the control equipment room to align with the necessary area dictated by the control equipment.

Other factors influencing scale changes include alterations of the number of floors and equipment rooms. The current control tower, situated on the rooftop of the passenger terminal building, consists of three levels for both the ACC and control tower. The new plan envisions an 8-story structure. The tower section is strategically planned to be effective, serving purposes such as storage, machine rooms, and meeting rooms for controllers.

Additionally, the existing control tower shares several utility rooms, such as machine and electrical rooms, with the terminal building, resulting in an increase of the necessary area of utility rooms.

- The following measures have been taken to meet with the additional requirements:
- Addition of rooms for females
- Adjustments to the required size of control equipment rooms
- Increase in the total area due to the change from 3 to 8 floors, with the tower's unique shape leading to an augmented shared common area
- Addition of shared facilities like toilets

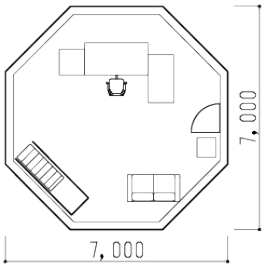
Table- 2.3 Area Comparison Table

Room name		Existing			PLAN(JAN)			PLAN(JUL)		
		W	D	m2	W	D	m2	W	D	m2
Tower Control Room	8*	6.5*	6.5*	35*	10.5	10.5	90	9	9	76
Communication equipment room	7*	3.25	3.25	10.56	3	3	9			19.5
Maintenance store RM	7*	3.25	3.25	10.56						
				56.13			99.00			95.50
Radar control room	1	10.5	7.7	80.85	11	8	88	11	7.6	83.6
Radar equipment room	1	3.5	7.7	26.95	8	5	40	5	7.6	38
Manager room for ATM	1	3.5	7.8	27.30	4	8	32	4	7.6	30.4
ATM Briefing room	1	3.5	7.8	27.30	8	6	48	8.4	6	50.4
ATM Rest room(M)	2	3.5	7.8	27.30	4	8	32	6.8	4.4	29.92
ATM Rest room(F)	2				4	6	24	6.4	3.2	20.48
Break room for ATM					4	6	24	6	5.4	32.4
ATM Shower room(M)	2				2	4	8	4	1.6	6.4
ATM Shower room(F)	2				2	4	8	4	1.6	6.4
ATM Training room	2				7.8	7.6	59.28	4	8	32
				224.70			398.28			365.00
Navigation and communication equipment room	1	3.5	4.8	16.80	5	7.6	38	8	5	40
Control and Monitor Room	1	3.5	7.8	27.30	5	7.6	38	8	5	40
Recording and Analysis Room	1	3.4	3.3	11.22	4	3	12	4	3	12
Office for Engineering	1	3.4	4.5	15.30			30.5	4	8	32
Manager RM for Engineering	1	3.5	7.8	27.30	4.2	5.6	23.52	4	4	16
Rest room for engineering		3.5	3	10.50			27	4	3	12
Optical fiber Cable Network room	1	3.3	6	19.80	4	4	16			17.2
		3.3	3.9	12.87			0			0
				176.09			220.02			204.20
Meteorological Manager room	1	3.3	7.8	25.74	4	8	32	4.2	7.6	31.92
Meteorological Briefing room	1	3.5	7.8	27.30	3	3	9	3.6	7.6	27.36
Briefing room for pilot	1	3.5	3.8	13.30	3	3	9	6.3	2.6	16.38
Administrator room	1	3.5	4	14.00						
Manager RM For Pilot management	1	3.5	6	21.00	3	3	9	6.3	2.6	16.38
Signal Center	1	3.7	7.7	28.49	4	6	24	3.6	7.6	27.36
Casher RM	1	3.4	7.7	26.18	3	3	9	3	3.8	11.4
				191.01			127.00			165.80
Kitchen	1	3.3	6	19.80	4	6	24	4.2	7.6	31.92
Medical RM	1	3.7	7.7	28.49	4	6	24	3.2	7.8	24.96
Locker RM(M)	1				4	6	24	3.9	5.4	21.06
Locker RM(F)	1				4	6	24	5.2	2.2	11.44
Guard room	1				4	4	16	4	4	16
Wind Breaker room(Security control)	1				4	4	16	4.4	4	17.6
Entrance Lobby, meeting area	1				8	8	64	8.4	6	50.4
Conference room							0			37.8
Store Room	1						0			125.5
				83.29			227.00			208.38
Sub total		731.22			1071.30			1038.88		
Mechanical room							100			93.6
Mechanical Panel room										8.4
Electrical room							90			81
WC							90			72.3
PS,EPS							90			30
Corridor, Stair, etc							300.00			600.00
				731.22			1741.30			1924.18

(Source: JICA Study Team)

5) Scale Setting of VFR (ATC) Room

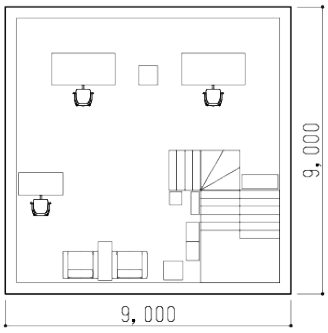
Osh International Airport is a single-runway airport. The existing ATC room at Osh International Airport is octagonal, encapsulated area of approximately 7.0m × 7.0m. It comprises of 1 control console, sofas, floor-standing air conditioning equipment, and a ladder-shaped staircase. The design, including a single control console, the absence of an administrator's desk, and the installation of a ladder-shaped staircase, allows for a minimal footprint.



(Source: JICA Study Team)

Figure- 2.4 Osh International Airport Control Room - Plan Imagery and Photographs

On the other hand, the control room at Manas International Airport, which is also a single-runway airport like Osh, has a larger scale with a square shape of approximately 9.0m × 9.0m. It consists of 2 control consoles, 1 monitoring seat, sofas, floor-standing air conditioning equipment, a water server, and a staircase. Redundancy is ensured during updates, providing a well-thought-out plan. Based on feedback obtained through interviews, KAN confirmed that there are no specific issues with the Manas International Airport control room.



(Source: JICA Study Team)

Figure- 2.5 Manas International Airport Control Room - Plan Imagery and Photographs

The new control room will be planned with a similar scale and layout, ensuring compatibility with KAN's usage, like the well-functioning Manas International Airport control room. The octagonal shape is commonly adopted for control rooms in consideration to its effectiveness in terms of column size, layout of control consoles, and overall floor space utilization. By adopting the same shape, the plan aims to maximize visibility. The scale will be set considering the rationality of window sashes.

6) Substation Building

The substation building is planned as a separate structure from the Air Traffic Control Tower and ACC. According to the SNiP regulations, the electrical room, with high-voltage power and transformers, is mandated to be located on the first floor or in the basement. Given that the first floor is fully utilized for operational purposes and expanding it further the further expansion is not desirable and considering the additional space such as staircase and ventilation requirements associated with planning in the basement, it is decided to plan the separate building. The power substation building will be a simple, single-story reinforced concrete structure.

In practice, it is common in Kyrgyz Republic to plan such rooms in the annex buildings or in container-like structures outside the main facility.

7) Finishing Plan

In accordance with the above policy, the following exterior and interior materials will be planned.

Table- 2.4 Exterior Finishing Schedule (Draft)

Element	Material
Roof	Asphalt waterproofing, Insulation layer, Topping concrete
Exterior wall	Lower section: Stone cladding (from Kyrgyzstan), Tower section: Fluorine-aluminum-zinc alloy-coated steel sheet
Door & Window	Anodized aluminum windows, aluminum doors, and steel doors

(Source: JICA Study Team)

Table- 2.5 Interior Finishing Schedule (Draft)

Room system	Material			
	Floor	Base	Wall	Ceiling
Entrance	Ceramic tile 600×600	Ceramic tile Vinyl baseboard	Emulsion paint on gypsum board	Emulsion paint on gypsum board
Tower control room, Rader control room	Tile carpet with Raised floor system(H=200 or 400)	Vinyl baseboard	Emulsion paint on gypsum board	Acoustic board (T-bar system)
Working place	Vinyl tile	Vinyl baseboard	Emulsion paint on gypsum board	Acoustic board (T-bar system)
Kitchen, Break room	Vinyl tile (Wood-grain patter)	Vinyl baseboard	Emulsion paint on gypsum board	Acoustic board (T-bar system)
Corridor, Stair	Vinyl sheet	Vinyl baseboard	Emulsion paint on gypsum board	Emulsion paint on gypsum board
WC, Shower	Ceramic tile 300 x 300	—	Ceramic tile 300 x 300	Emulsion paint on Waterproof gypsum board (Waterproof type)
Machine room, Storage room	Dust proof paint	Dust proof paint	Emulsion paint on gypsum board	—

(Source: JICA Study Team)

(3) Structural Plan

As a basic policy, the structural planning will be conducted based on the results of natural condition surveys and thorough analysis of the topography, geology, soil quality, hydrogeology, ground properties, weather, climate, etc. necessary for facility planning.

The new construction of the control tower and ACC is planned to be a reinforced concrete rigid frame structure with earthquake-resistant walls, with a top floor having a steel frame structure, and a direct foundation (Shallow foundation). It is assumed that locally available cement and concrete will be used, reinforcing bars will be procured from a local agency, and steel frames will be procured from the third country.

1) Building Scale

The control tower/ ACC building will have eight floors above ground, with the top floor being planned as a VFR room and the first and second floors as offices for the ACC.

2) Structure Type

The top 8th floor of the building will be of steel frame structure, the 1st to 7th floors will be of reinforced concrete structure, and the lower underground structure and direct foundation will also be of reinforced concrete structure.

3) Frame Type

It is planned to be a rigid frame structure with bearing walls.

4) Foundation Type

It is planned to be a direct foundation (Shallow foundation).

5) Design Loading

The wind speed will be determined by the "KAN Meteorological Department", and with reference to SNiP standards, the wind load will be calculated using a Japanese analysis method.

For the earthquake load, the seismic base shear coefficient is calculated from "SNiP KR 20-02: 2018" and using the Japanese standards and analysis method to calculate for the earthquake load.

6) Design Standards and Guidelines

Referring to Kyrgyz standards "SNiP KR 20-02: 2018 Seismic construction・Design Standards", "SNiP 2.01.07-85* Loads and Effects". Structural analysis will be based on Japanese Building Standards Law. In addition, it will be referred to equivalent US standards.

7) Materials Used

It is planned to adopt an appropriate standard of materials (or equivalent standards) that are commonly used in Kyrgyz.

- Concrete：The plan is to use concrete produced in Osh city, with a design standard strength of Fc 24N/mm2. Cement will also be procured locally.
- Rebar：The plan is to use deformed reinforcing bars GOST 5781-82 / GOST 34028-2016 or equivalent standards.
- Steel：The plan is to use a steel frame fabricated in Thailand or Vietnam and will be equivalent to Japan's JIS G 3101 SS400 and JIS G 3136 SN400B. The quality of the steel frame factories in Kyrgyz is poor, so the plan is to produce and import from the third country.

8) Foundation

According to the geological survey report, from existing GL-2.5m depth can secure the required soil bearing capacity, so direct foundations will be adopted.

(4) Utility Plan

1) Standard

Equipment planning will be carried out in accordance with the local standards of SNiP and Gostroy. In addition, items not listed in the local standards will be planned in accordance with the Japanese Building Standards Act, building equipment design standards, and the Building Facility Sanitation Act.

2) Electrical Equipment

a) Infrastructure development

The electrical line will be connected to the planned site by branching off from the utility pole southeast of the airport facility and will be carried out by Kyrgyz side using an overhead line. Power will be received from the south side of the site.

Regarding the communication cables in consideration to the security, it was discussed with KAN for them to prepare the infrastructure to run the cables from the north side of the site.

(Source: JICA Study Team)

Figure- 2.6 Location of existing high-voltage power receiving and power station buildings

(Source：JICA Study Team)

Figure- 2.7 Infrastructure development plan

b) Power Substation

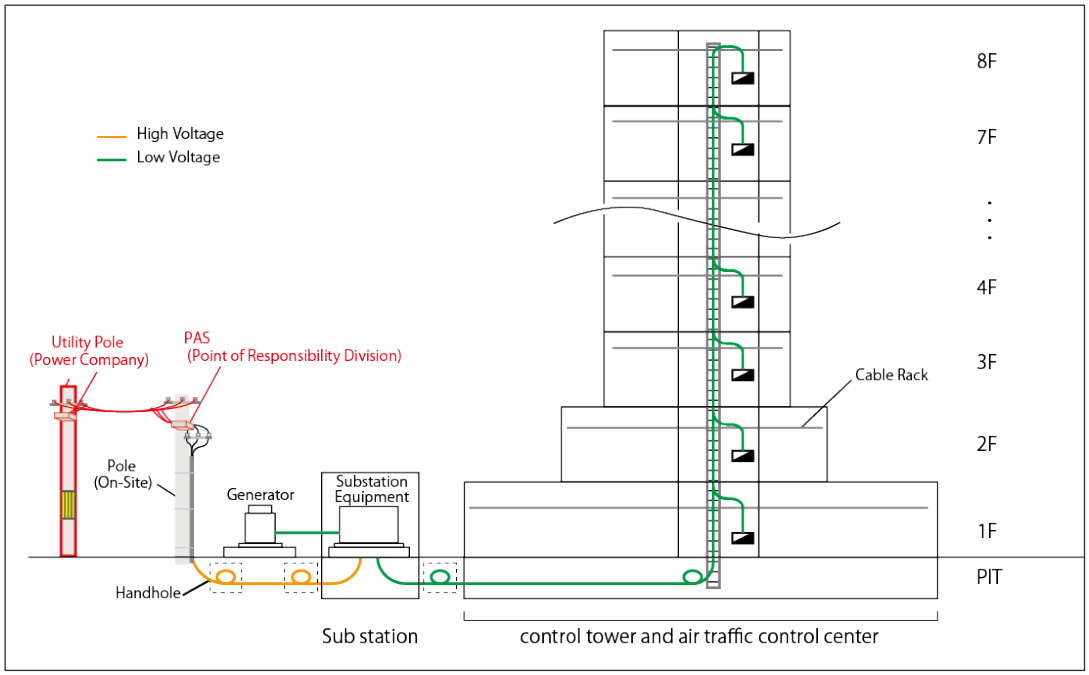
- The new two high-voltage lines (10kV) for the control tower will be withdrawn to the newly constructed power station building.
- A new transformer and switchboard will be installed in the new substation building to transform 3Φ4W 10kV down to 3Φ4W 380/220V and it will be supplied to the new control tower.

c) Emergency Power Generation System

- The emergency generator equipment, that can supply 100% of the equipment power within the facility for disaster prevention and security loads, will be provided.
- The engine and the fuel will be a diesel type, which is relatively easy to obtain locally and is the same fuel used for existing generators.
- The fuel tank will be planned to contain the enough fuel for delivering power for approximately 24 hours.

d) Main line equipment

- The piping and wiring from the substation equipment to the control panel and lighting distribution board will be provided.
- Electrical system: Power main line: 3-phase 4-wire 380V, lighting main line: 1-phase 3-wire 220V, 50Hz.
- The wiring method will be the conduit wiring or cable rack wiring. As for the type of pipe, the metal pipe or resin pipe will be adopted.



(Source: JICA Study Team)

Figure- 2.8 Main line system diagram

e) Lighting / Outlet Equipment

- The LED lighting will be adopted as a principle.
- The illuminance standards will be planned, based on the stricter standard of either JIS standards or local standards.
- The toilets will be equipped with 'motion sensors' that will automatically turn on and off lights to prevent unnecessary power consumption while no one is inside. (In consideration of on-site maintenance and updating of sensors, rooms using this 'motion sensor' control will be limited to toilets only.)
- Emergency lighting and guide lights will be provided in accordance with local regulations.
- The necessary number of outlets will be provided to ensure the functionality of each room.
- An OA panel will be provided in the raised floor room for OA equipment, and a harness joint box + OA tap will be installed.
- Pole lights and bracket lights (attached to the exterior wall of the building) will be provided as the exterior lighting.

Table- 2.6 Design illuminance (excerpt)

Room Name	Type of Instrument	Illuminance (lx)
Airfield Control Room	Recessed ceiling	500
Communication Equipment Room	Recessed ceiling	500
Manager Room	Recessed ceiling	500
Briefing Room	Recessed ceiling	500
Rest Rooms	Recessed ceiling	300
Shower Room	Downlight (moisture-proof type)	200
Toilets	Downlight	200
Machine Room・EPS	Ceiling-mounted type	200
Corridor・Warehouse	Ceiling-mounted type	100

(Source：JICA Study Team)

f) Power Equipment

- The power will be supplied to/controlled in the control panel and other devices.
- The alarm panel (with lamp display and buzzer) will be installed to monitor the working status of major equipment.

g) Lightning Protection Equipment

- Since this building is a high-rise building and the important facility, external lightning protection equipment should be provided.
- External lightning protection equipment will be installed based on IEC standards. (Protection by rotating sphere method)
- The internal lightning protection equipment, using SPD for external power lines, communication lines, grounding lines, etc. will be planned.
- An SPD for the grounding terminal board will be provided, to which the external grounding wire is connected between the grounding terminals.

h) Telephone/LAN Equipment

- MDF will be installed in the EPS on the first floor, and a lead-in conduit for communication lines will be planned. (The lead-in wiring will be constructed by Kyrgyz side)
- The settling of PBX, wiring, and outlets after MDF is included in the construction.
- The empty piping and power supply to enable the use of wireless Wi-Fi equipment will be provided.

i) Announcing Equipment

- The announcing equipment will be provided for the main rooms in the facility.
- The announcing equipment for emergency call should be installed in accordance with the local regulations.

j) Paging Equipment

- The intercom base unit will be provided in the security guard's room and a door phone unit will also be provided at the gate of the site entrance to deal with visitors.
- The intercom base unit facilities should also be provided in the medical room.

k) Common Television Equipment

- Since internet TV is commonly used in the region, the lead-in conduit will be planned.
- The outlet will be planned in the rest rooms.

l) Surveillance Camera Equipment

- Surveillance cameras will be installed to monitor the situation within the facility and for crime prevention.
- The image should be stored in the recorder and the recording capacity should be approximately for 2 weeks.

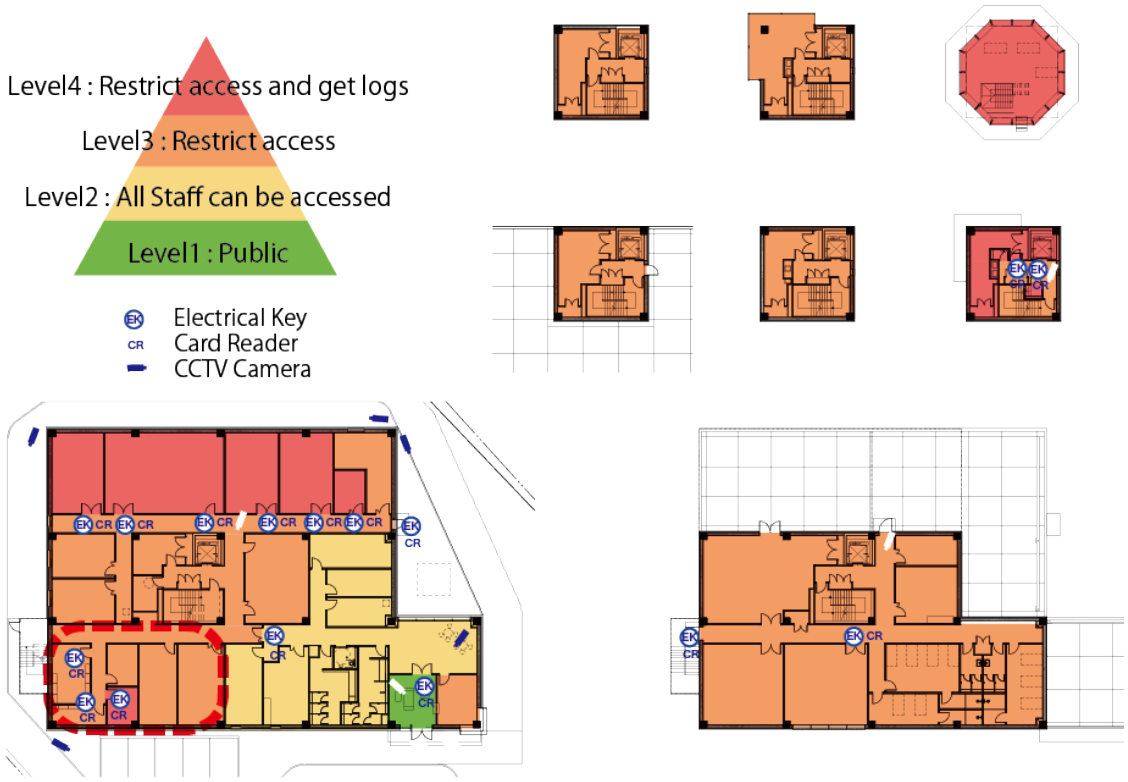
m) Access Control Equipment

i. Security Controls
The space to install X-Ray equipment should be kept at the entrance. The equipment will be provided by KAN, if necessary.

ii. Access Control Equipment
The electric lock system should be provided to control the entry and exit of staff. Electric locks will be the ‘card key’ type.

n) Automatic Fire Alarm Equipment

- The automatic fire alarm and closing equipment should be provided in accordance with the Fire Service Fighting Code and Building Standards Law.



(Source: JICA Study Team)

Figure- 2.9 Security Plan Diagram

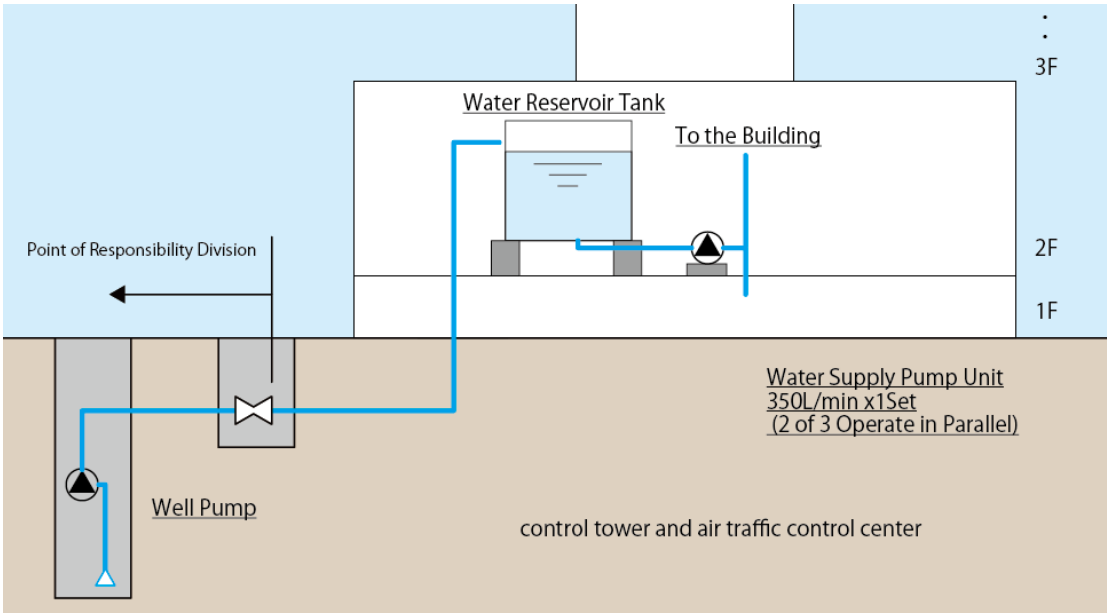
3) Water supply, Drainage, and Sanitary Equipment

a) Sanitary Fixtures and Fittings

- The locally available sanitary fixtures should be adopted.
- The toilet bowl will be the low tank type.
- The toilet shower (wall-mounted, hot water supply) should be provided in the toilet bowl.
- The 'push-button' flush valves should be provided on the urinals.
- The multi-functional toilet should be provided. (An ostomate waste disposal facility will not be provided.)
- The washbasin faucet shall be a lever-type manual faucet.
- The washbasins in both man's and women's restrooms will be 'counter-type' and will be equipped with a mirror in front of the washbasins. (Architectural work)
- In the women's restroom, a counter and mirror will be provided for women's' convenience. (Architectural work)
- Toilets will be equipped with emergency power sources against disasters.

b) Water Supply System

- The 'well' water should be supplied as the public water source.
- The 'well' water should be pumped up from point approximately 80m below the ground level. (To be borne by Kyrgyz side)
- Taking into consideration the size of the building and the purpose of the water supply, the water supply system will be a 'single' tap water system.
- The water supply system should be the water tank + pressurized pump system.
- The water tank should have the capacity to contain the water volume of 2 days' usage.
- Water supply pipes should be laid below the freezing depth (GL-0.77m).



(Source: JICA Study Team)

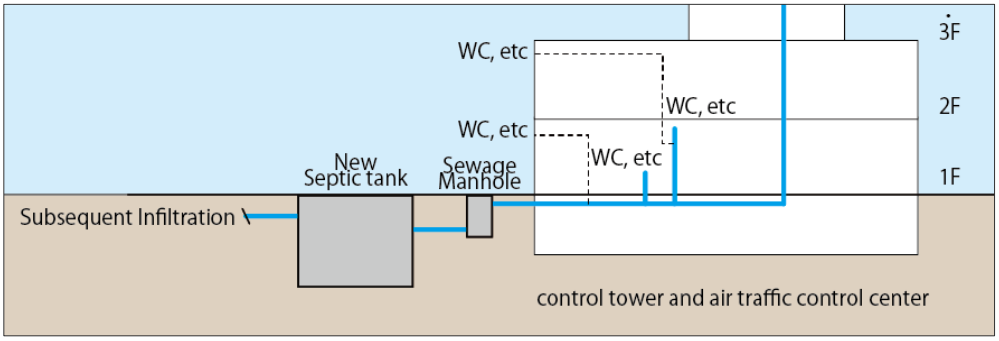
Figure- 2.10 Water supply image diagram

c) Hot Water Supply System

- The stable supply of hygienic hot water should be planned, with the control of temperature, amount, and pressure required for each appliance and device in the facility.
- As the hot water supply system, the independent hot water supply equipment should be adopted, by taking into consideration of cost, environmental friendliness, durability, ease of operation/maintenance, installation area, etc.
- The electric water boiler/tank (6L) will be installed around the water area in each room.
- The electric water boiler/tank (150L) will be installed for the shower and kitchen area.

d) Drainage System

- The drainage system will be the combined drain system from each sanitary fixtures in the facility and should be separated from the outdoor rainwater drainage.
- Sewage and miscellaneous wastewater will be collected into the new septic tank.
- Sewage in the septic tank should be treated with chlorine disinfection and collected by the sewerage company's pump truck.
- Drainage from the septic tank should be of the 'infiltration' type.
- The drainage hole should be provided on the floor of each toilet.
- Drainage facilities, including septic tank, will be included in the main construction work.
-



(Source: JICA Study Team)

Figure- 2.11 Drainage image diagram

e) Gas Equipment

- No gas equipment should be adopted for the safety.

4) Air Conditioning and Ventilation System

a) Air conditioning System

【Common Standards】

【General rooms (office, etc.)】

- Individual heat source package air conditioner + outside air processing package (type 2 ventilation).
- The heat source will be electricity, and the fixture should be designed against cold temperature.
- The 'starts-and-stops' switch should be the 'hand-operated' switch.
- The liquid R32, which has a zero 'ozone depletion potential' and a low 'global warming potential' should be adopted.
- The evaporative humidifier should be installed in the outside air treatment package machine.
- An air cut valve should be installed for drain drainage.
- The electric heater should be provided as a backup one. (for the winter indoor heat load only)

【Electricity room】

- Packaged air conditioner + first class ventilation system should be provided.
- The package air conditioner should be turned on/off according to the room temperature.

【Water areas such as WC, hot water supply room, vestibule of shower room, etc. 】

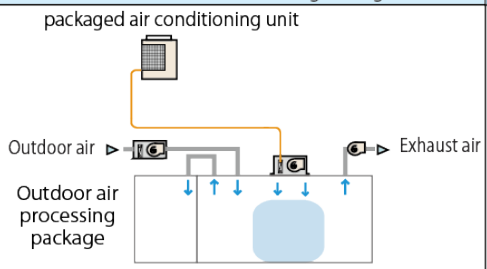
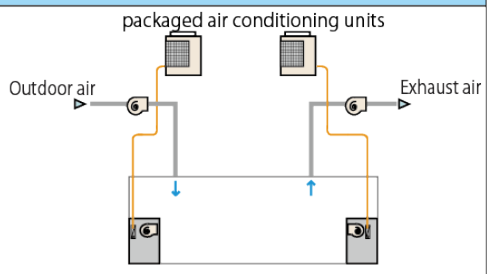
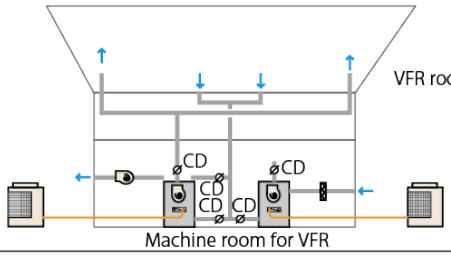
- The electric heater should be provided (set at 5°C) to prevent water piping from freezing.

【Windbreak room】

- The wall-mounted (corner type) electric heater should be provided close to the ceiling. (5°C setting)

【Other】

- Wiring work of remote control for air conditioning equipment will be carried out in this Project.

Method	1.Packaged Air Conditioning Unit + Outdoor Air Processing Package	2.Supply and Exhaust Fans
System Diagram		
Overview	**Air conditioning:** Air conditioning by packaged air conditioning unit **Ventilation:** Ventilation by outdoor air processing package	**Air conditioning:** Summer: Air conditioning by packaged air conditioning unit. Winter: Air conditioning by supply and exhaust fans. **Ventilation:** Ventilation by supply and exhaust fans. **Others:** Start/stop based on indoor temperature (Body Thermo).
Temperature and Humidity Conditions	Summer: 26° C, 50% Winter: 22° C, 40%	Summer: 26° C, 50%
Humidification Method	Evaporative humidifier (integrated into the outdoor air processing package)	-
Target Rooms	General rooms	Electrical room and Equipment room
Method	3.Packaged Air Conditioning Unit	4.Electric Heater
System Diagram		
Overview	**Air conditioning:** Air conditioning with Packaged Air Conditioning Unit **Ventilation:** Ventilation with Outdoor Air Processing Package	**Heating Method:** Heating with Electric Heater
Temperature and Humidity Conditions	Summer: 26° C, 50% Winter: 22° C, 40%	Winter Setting: 5° C
Humidification Method	Evaporative humidifier (integrated into the outdoor air processing package)	-
Target Rooms	Tower control room(VFR)	Sanitary Facilities Rooms

(Source: JICA Study Team)

Figure- 2.12 Conceptual diagram of air conditioning system

b) Ventilation System

- In general rooms, type 2 ventilation will be provided using an outside air treatment package unit.
- Class 1 ventilation should be provided for mechanical and electrical rooms.
- The filter should be installed in front of the outside air treatment package.
- The filters should be installed on the air supply fans for the electrical and mechanical related rooms.
- Exhaust fans will be installed in toilets, kettle rooms, warehouses, etc., and type 3 ventilation system should be provided.
- The thermometer should be installed in the water tank room to stop the air-supply fan, in case of freezing.

c) Smoke Exhaust Equipment

- The natural smoke exhaust should be adopted throughout the building.

d) Automatic Control Equipment

- No 'central disaster-monitoring device' will be provided.
- For the air-cooled heat pump package, the individual remote control will be provided in each room.

5) Fire Extinguishing Equipment

- The fire extinguishing equipment, such as indoor fire hydrants, connected water inlets, sprinkler equipment, and gas fire extinguishing equipment should be provided in accordance with the local firefighting standards.

(5) Equipment Plan

1) Surveillance Data Processing System

As the core of the surveillance system for ATC, this processor integrates and processes data from Secondary Surveillance Radars (SSR), Wide Area Multilateration (WAM), and direction-finding systems (DF) installed in Kyrgyz, displays aircraft targets on the surveillance information display system, and provides en-route control and approach control. As for other surveillance information, we will consider equipment specifications that can process and display information from automatic dependent surveillance systems (ADS-B) in this system. The system is planned to be called the Multi-Sensor Data Processing System (MSDPS).

This system will be installed at Bishkek ACC and Osh ACC. In the case of Issyk-Kul Airport, in consideration of the efficiency, economy, and maintenance of the system, it is planned that data processed at the Bishkek ACC will be transmitted via a dedicated line to perform Issyk-Kul aerodrome control operations.

2) Control Working Position, Surveillance Data Display and Flight Data Display

The number of controllers working position will be planned to take into consideration the number of aircraft to be managed at each airport in the future and the KAN's future plans.

The Bishkek ACC will have five sets of en-route and approach control positions (including the Issyk-Kul Airport approach control position), 1 flight information service position, 1 operational supervisor position, and 1 reserve operational position. The Osh ACC shall consist of two sets of enroute and approach control seats and one operational supervisor position.

For each display device, the surveillance data control positions shall be equipped with a HMI (Human Machine Interface) sized monitoring data display device (generally 28-inch or wide type), and the flight data control seats (coordination seats) shall be equipped with a flight data display device showing aircraft arrival and departure plans. In addition, in order to coordinate with approach and departure control, a surveillance data display and a flight data display are planned to be installed in each of the control tower for aerodrome control: one in the Manas airport control tower, one in the Osh airport control tower, and one in the Issyk-Kul airport control tower.

3) ATC Training Simulator System

In implementing enroute control and approach control operations, it is important to introduce training equipment for refresher training and skill improvement of air traffic controllers, as well as for rating (qualification). The aircraft configuration will consist of two sets of enroute control positions, 1 set of approach control position, 1 set of operational supervisor position, and 2 pseudo pilot positions (including instructor). This simulator system is designed as an independent training equipment, not as a system to be used for actual operations.

4) Voice Control Switching System

The voice control switching system is an essential piece of equipment for air-ground communication with aircraft and liaison and communication with each ATC function and department related to airport operations at the Bishkek ACC, Osh ACC, and the operation rooms of each airport control tower.

The channel capacity of the equipment shall cover the control communications of each ACC respectively, and shall have communication control functions (radio system, telephone system, voice recording system, and control clock) including enroute and approach control.

5) VHF Air-Ground Communication System

This equipment is to be installed in the new control tower at Osh Airport to plan for uninterrupted aerodrome control during the operational transition from the existing control tower to the new control tower. The VHF air-ground communication frequency will consist of the aerodrome control frequency and the search and rescue frequency.

(6) Equipment Plan by Each System

1) Bishkek Area Control Center and Issyk-Kul Airport

a) Multi-Sensor Data Processing System (MSDPS)

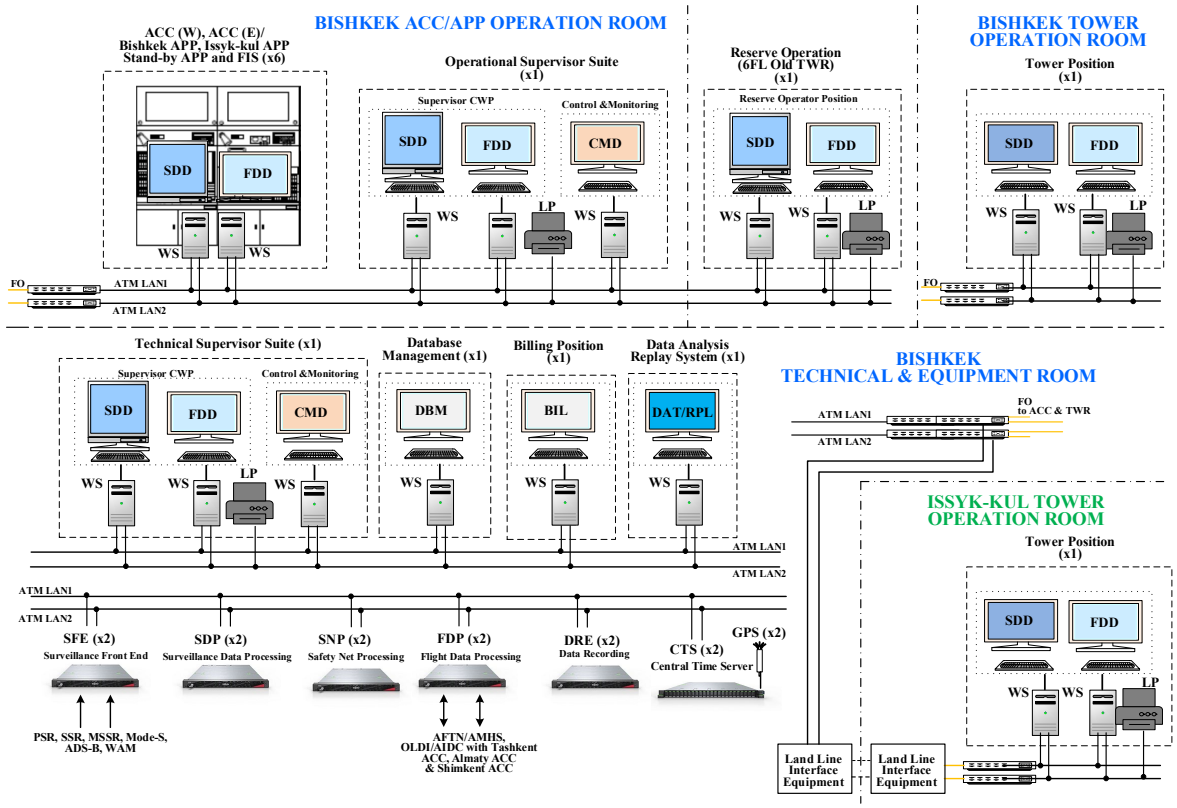
The major equipment configuration of MSDPS, which is installed at Bishkek ACC and Issyk-Kul airport, is shown in Table- 2.7.

Table- 2.7 MSDPS Major Equipment Configuration (Bishkek/Issyk-Kul)

No.	Equipment	Q'ty	Unit	Location
Bishkek				
1	Multi-Sensor Data Processing System (MSDPS)	1	Set	Technical & Equipment Room
1-1	Surveillance Front End Server	2	Sets	
1-2	Surveillance Data Processing Server	2	Sets	
1-3	Safety Net Processing Server	2	Sets	
1-4	Flight Data Processing Server	2	Sets	
1-5	Data Recording Server	2	Sets	
1-6	Central Time Server + GPS	2	Sets	
2	Database Management System	1	Set	
3	Billing System	1	Set	
4	Data Analysis/Replay System	1	Set	
5	Technical Supervisor Suite	1	Set	
5-1	Surveillance Data Display	1	Set	
5-2	Flight Data Display	1	Set	
5-3	Control & Monitoring Display	1	Set	
6	ACC West Position	1	Set	ACC/APP Operation Room
6-1	Surveillance Data Display (2k x 2k)	1	Set	
6-2	Flight Data Display	1	Set	
7	ACC East Position	1	Set	
7-1	Surveillance Data Display (2k x 2k)	1	Set	
7-2	Flight Data Display	1	Set	
8	Bishkek APP Position	1	Set	
8-1	Surveillance Data Display (2k x 2k)	1	Set	
8-2	Flight Data Display	1	Set	
9	Issyk-Kul APP Position	1	Set	
9-1	Surveillance Data Display (2k x 2k)	1	Set	
9-2	Flight Data Display	1	Set	
10	Stand-by APP Position	1	Set	
10-1	Surveillance Data Display (2k x 2k)	1	Set	
10-2	Flight Data Display	1	Set	
11	Operational Supervisor Suite	1	Set	
11-1	Surveillance Data Display	1	Set	
11-2	Flight Data Display	1	Set	
11-3	Control & Monitoring System	1	Set	
12	FIS Position	1	Set	
12-1	Surveillance Data Display (2k x 2k)	1	Set	
12-2	Flight Data Display	1	Set	
13	Reserve Operational Position	1	Set	6F Old Tower
13-1	Surveillance Data Display	1	Set	
13-2	Flight Data Display	1	Set	
14	Tower Position	1	Set	Tower Operation Room
14-1	Surveillance Data Display	1	Set	
14-2	Flight Data Display	1	Set	
15	Data Distribution Equipment (L/L Interface)	1	Set	Technical & Equipment Room
16	LAN Network Equipment	1	Set	
17	Power Distribution Box	1	Set	
Issyk-Kul				
1	Tower Position	1	Set	Tower Operation Room
1-1	Surveillance Data Display	1	Set	
1-2	Flight Data Display	1	Set	
2	Data Distribution Equipment (L/L Interface)	1	Set	Equipment Room
3	LAN Network Equipment	1	Set	

(Source: JICA Study Team)

The outline of the system diagram for MSDPS at Bishkek ACC and Issyk-Kul airport is shown in Figure- 2.13.



(Source: JICA Study Team)

Figure- 2.13 MSDPS Outline Diagram (Bishkek/Issyk-Kul)

b) ATC Training Simulator System (SIM)

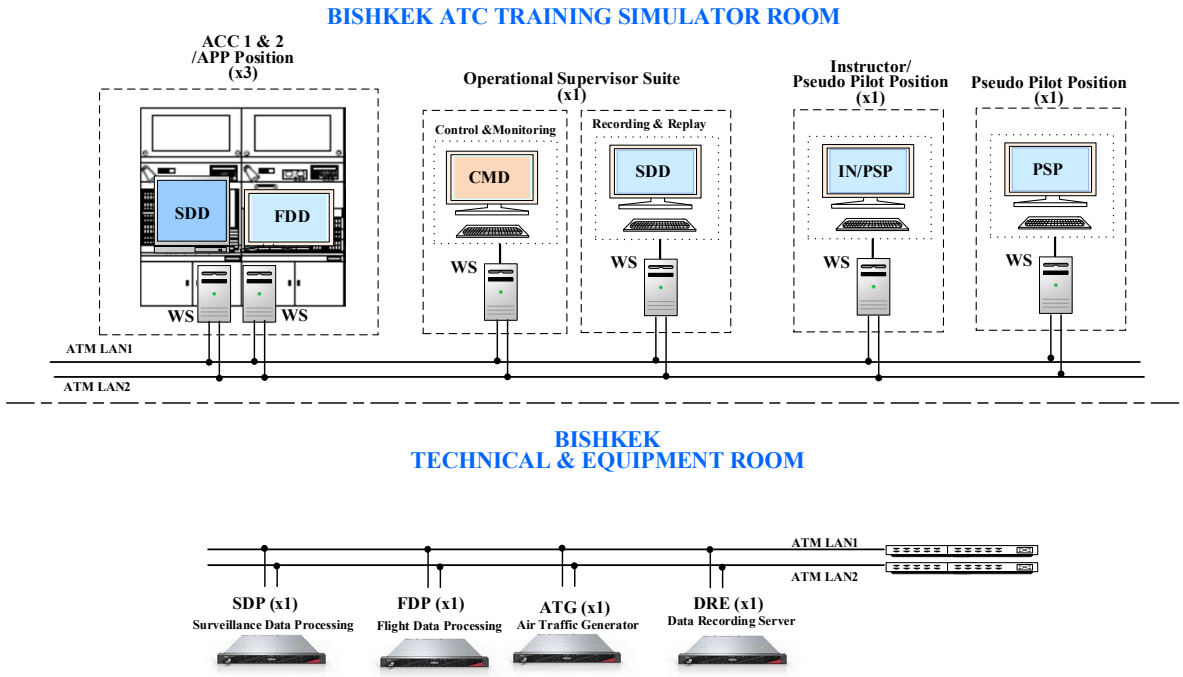
The major equipment configuration of ATC Training Simulator system, which is installed at Bishkek ACC, is shown in Table- 2.8.

Table- 2.8 SIM Major Equipment Configuration

No.	Equipment	Q'ty	Unit	Location
1	ATC Training Simulator System	1	Set	Technical & Equipment Room
1-1	Surveillance Data Processing Server	1	Set	
1-2	Flight Data Processing Server	1	Set	
1-3	Air Traffic Generator	1	Set	
1-4	Data Recording Server	1	Set	
2	ACC Position	2	Sets	Simulator Room
2-1	Surveillance Data Display (2k x 2k)	2	Sets	
2-2	Flight Data Display	2	Sets	
3	APP Position	1	Set	
3-1	Surveillance Data Display (2k x 2k)	1	Set	
3-2	Flight Data Display	1	Set	
4	Operational Supervisor Suite	1	Set	
4-1	Surveillance Data Display (REC & REP)	1	Set	
4-2	Control & Monitoring System	1	Set	
5	Instructor / Pseudo Pilot Position	1	Set	
6	Pseudo Pilot Position	1	Set	
7	LAN Network Equipment	1	Set	
8	Power Distribution Box	1	Set	

(Source: JICA Study Team)

The outline of the system diagram for SIM is shown in Figure- 2.14.



(Source: JICA Study Team)

Figure- 2.14 SIM Outline Diagram

c) Voice Communication Switching System (VCSS)

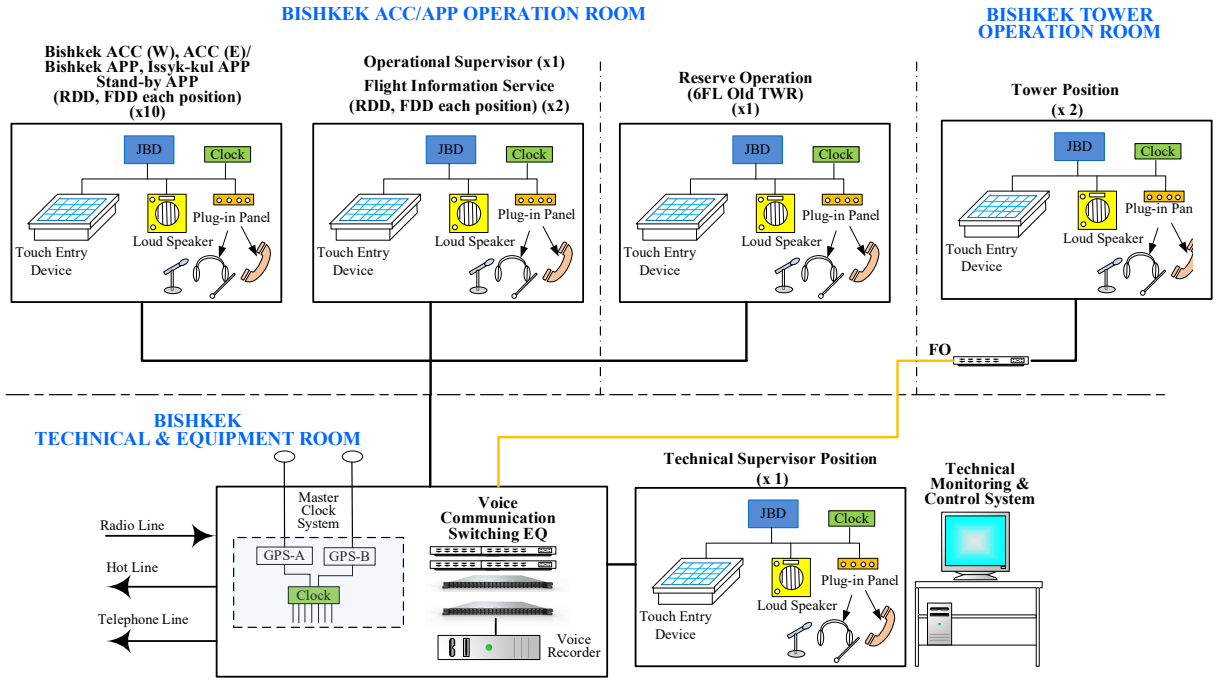
The major equipment configuration of VCSS, which is installed at Bishkek ACC, is shown in Table- 2.9.

Table- 2.9 VCSS Major Equipment Configuration (Bishkek)

No.	Equipment	Q'ty	Unit	Location
1	Voice Communication Switching Equipment	1	Set	Technical & Equipment Room, ACC/APP/TWR Operation Room
2	Controller Working Position	11	Sets	
2-1	Touch Entry Device	17	Sets	
2-2	Plug-In-Panel	17	Sets	
2-3	Loudspeaker	34	Sets	
2-4	Microphone	17	Sets	
3	Technical Monitoring & Control System	1	Set	
4	Master Clock System	1	Set	
4-1	Master Clock Unit	1	Set	
4-2	Desk Mount Slave Clock	17	Sets	
5	Voice Recorder	1	Set	
6	Accessary			
6-1	Headset	27	Sets	
6-2	Handset	17	Sets	

(Source: JICA Study Team)

The outline of the system diagram for VCSS at Bishkek ACC is shown in Figure- 2.15.



(Source: JICA Study Team)

Figure- 2.15 VCSS Outline Diagram (Bishkek)

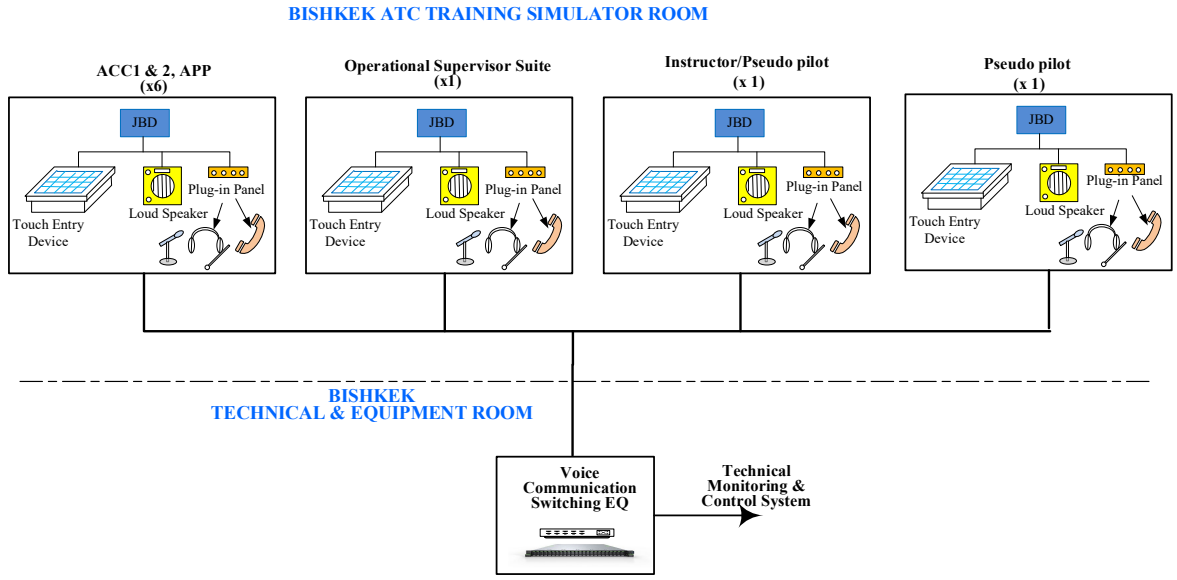
The major equipment configuration of VCSS, which is installed for ATC Training Simulator at Bishkek ACC, is shown in Table- 2.10.

Table- 2.10 VCSS for SIM Major Equipment Configuration

No.	Equipment	Q'ty	Unit	Location
1	Voice Communication Switching Equipment (Common with operational equipment)	1	Set	Technical & Equipment Room
2	Controller Working Position	6	Sets	Simulator Room
2-1	Touch Entry Device	9	Sets	
2-2	Plug-In-Panel	9	Sets	
2-3	Loudspeaker	18	Sets	
2-4	Microphone	9	Sets	
3	Technical Monitoring & Control System (Common with operational equipment)	1	Set	
4	Accessary			
4-1	Headset	12	Sets	

(Source: JICA Study Team)

The outline of the system diagram for VCSS of SIM is shown in Figure- 2.16.



(Source: JICA Study Team)

Figure- 2.16 VCSS Outline Diagram (SIM)

d) Installation Policy and Points for attention

The installation policy and points for attention at the Bishkek ACC and Issyk-Kul Airport are as follows.

- The power supply necessary for the requested equipment will be prepared by Kyrgyz side, but it is necessary to pay attention to the power capacity and power system types required for each system equipment (3-phase 4-wire system, single-phase 2-wire system).
- A new room for en-route control/approach control operation room is planned to be constructed adjacent to the existing operation room, but it is necessary to pay attention to the coordination with KAN before the start of equipment installation work regarding securing the route of the cable from the equipment room.
- The LAN network for the Multi-Sensor Data Processing System (MSDPS) will use the existing optical network between the existing control tower and the equipment room of the ACC, but since other systems (emergency telephone systems, NAV monitors, VHF air to ground communications, etc.) have also been using same lines in the optical network, so it is necessary to pay attention to the coordination of available lines.
- It should be noted that the transmission line to and from Issyk-Kul Airport should be a VPN with high connection speed and security.
- Items related to the input of existing radar information (aircraft target), multilateral target information, and direction finder aircraft azimuth information, as well as the setting of ATC communication lines with neighboring FIRs (Toshkent, Shymkent, and Almaty) should be noted in coordination with KAN.
- Currently, there is equipment that is not in operation in the ATC equipment room, so the Kyrgyz side will be responsible for removing and relocating equipment before installing the new equipment.
- As not only the requested equipment but also the equipment procured by KAN will be installed in the ATC operation room and equipment room, it is necessary to pay attention to the specific adjustment of the equipment installation location.

2) Osh Area Control Center

a) Multi-Sensor Data Processing System (MSDPS)

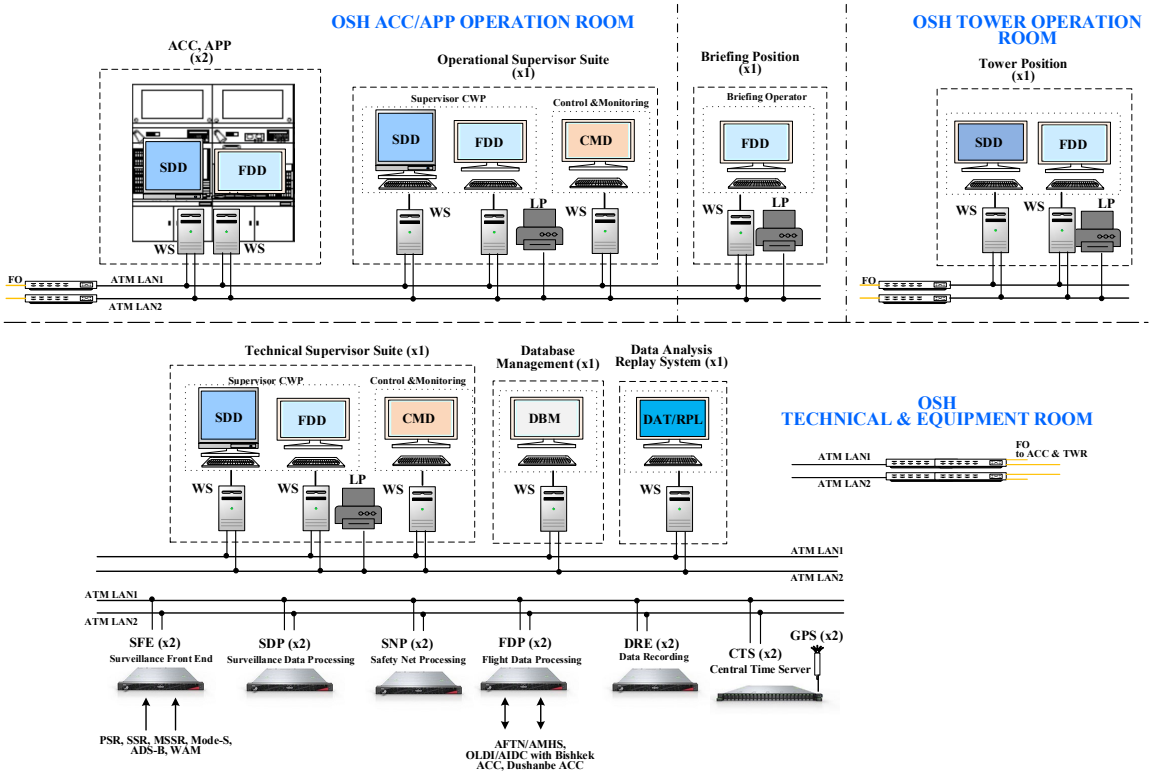
The major equipment configuration of MSDPS, which is installed at Osh ACC, is shown in Table-2.11.

Table- 2.11 MSDPS Major Equipment Configuration (Osh)

No.	Equipment	Q'ty	Unit	Location
Osh				
1	Multi-sensor Data Processing System (MSDPS)	1	Set	Technical & Equipment Room
1-1	Surveillance Front End Server	2	Sets	
1-2	Surveillance Data Processing Server	2	Sets	
1-3	Safety Net Processing Server	2	Sets	
1-4	Flight Data Processing Server	2	Sets	
1-5	Data Recording Server	2	Sets	
1-6	Central Time Server + GPS	2	Sets	
2	Database Management System	1	Set	
3	Data Analysis/Replay System	1	Set	
4	Technical Supervisor Suite	1	Set	
4-1	Surveillance Data Display	1	Set	
4-2	Flight Data Display	1	Set	
4-3	Control & Monitoring Display	1	Set	
5	ACC Position	1	Set	ACC/APP Operation Room
5-1	Surveillance Data Display (2k x 2k)	1	Set	
5-2	Flight Data Display	1	Set	
6	APP Position	1	Set	
6-1	Surveillance Data Display (2k x 2k)	1	Set	
6-2	Flight Data Display	1	Set	
7	Operational Supervisor Suite	1	Set	
7-1	Surveillance Data Display	1	Set	
7-2	Flight Data Display	1	Set	
7-3	Control & Monitoring Display	1	Set	
8	Briefing Position	1	Set	Briefing Room
8-1	Flight Data Display	1	Set	
9	Tower Position	1	Set	Tower Operation Room
9-1	Surveillance Data Display	1	Set	
9-2	Flight Data Display	1	Set	
10	Data Distribution Equipment (L/L Interface)	1	Set	Technical & Equipment Room
11	LAN Network Equipment	1	Set	
12	Power Distribution Box	1	Set	

(Source: JICA Study Team)

The outline of the system diagram for MSDPS at Osh ACC is shown in Figure- 2.17



(Source: JICA Study Team)

Figure- 2.17 MSDPS Outline Diagram (Osh)

b) Voice Control Switching System (VCSS)

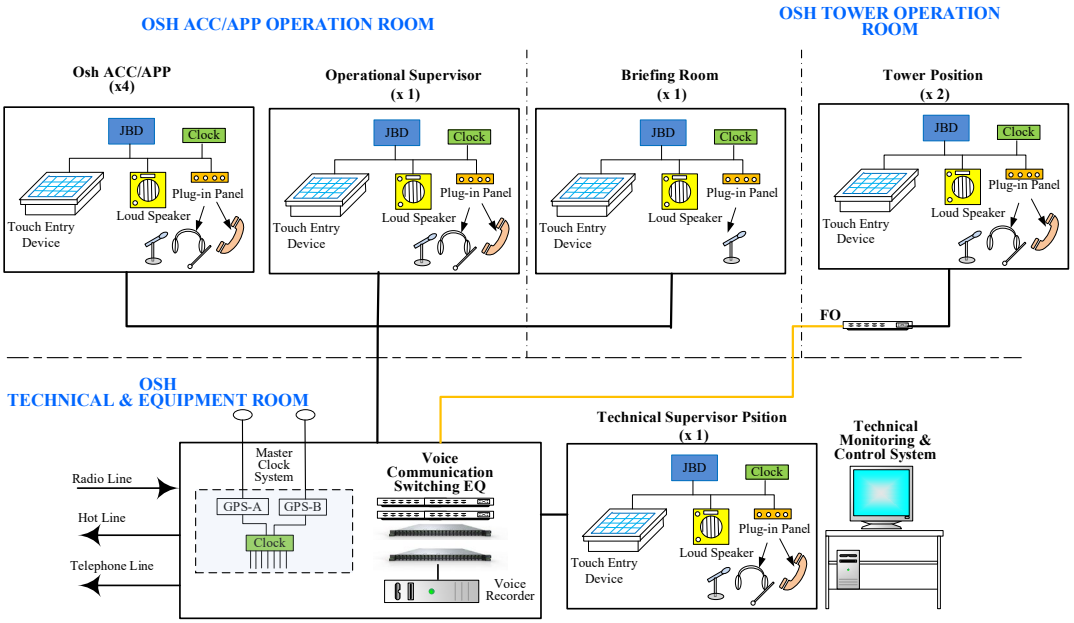
The major equipment configuration of VCSS, which is installed at Osh ACC, is shown in Table-2.12.

Table- 2.12 VCSS Major Equipment Configuration (Osh)

No.	Equipment	Q'ty	Unit	Location
1	Voice Communication Switching Equipment	1	Set	Technical & Equipment Room, ACC/APP/TWR Operation Room Briefing Room
2	Controller Working Position	7	Sets	
2-1	Touch Entry Device	9	Sets	
2-2	Plug-In-Panel	9	Sets	
2-3	Loudspeaker	18	Sets	
2-4	Microphone	9	Sets	
3	Technical Monitoring & Control System	1	Set	
4	Master Clock System	1	Set	
4-1	Master Clock Unit	1	Set	
4-2	Desk Mount Slave Clock	9	Sets	
5	Voice Recorder	1	Set	
6	Accessary			
6-1	Headset	14	Sets	
6-2	Handset	8	Sets	

(Source: JICA Study Team)

The outline of the system diagram for VCSS at Osh ACC is shown in Figure- 2.18.



(Source: JICA Study Team)

Figure- 2.18 VCSS Outline Diagram (Osh)

c) VHF Air-Ground Communication System

The major equipment configuration of VHF, which is installed at Osh New Control Tower, is shown in Table- 2.13.

Table- 2.13 VHF Major Equipment Configuration (Osh)

No.	Equipment	Q'ty	Unit	Location
1	VHF Air-Ground Transceiver (Main and Stand-by for 118.3MHz and 121.5 MHz)	2	Sets	TWR Operation Room
2	VHF Antenna	2	Sets	TWR rooftop

(Source: JICA Study Team)

d) Installation Policy and Points for attention

The installation policy and points for attention at the Osh ACC are as follows.

- The power supply necessary for the requested equipment will be prepared by Kyrgyz side, but it is necessary to pay attention to the power capacity and power system types required for each system equipment (3-phase 4-wire system, single-phase 2-wire system).
- With regard to the input of existing radar information (aircraft target), multilateral target information, and direction finder aircraft azimuth information into the Multi-Sensor Data Processing System (MSDPS), it is necessary to pay attention to coordination with KAN and the airport management company since this is done through the airport optical network system.
- It is necessary to pay attention to the coordination with KAN in setting up the ATC communication line with the neighboring FIR (Dushanbe).
- As not only the requested equipment but also the equipment procured by KAN will be installed in the ATC operation room and equipment room, it is necessary to pay attention to the specific adjustment of the equipment installation location.
- The VHF antenna for air-ground communication shall be installed on the rooftop of the control tower, and the coaxial cable shall be installed along the shortest route to minimize cable loss.

3) Equipment Specifications

The equipment to be procured, the major equipment configuration, and its equipment specification are shown below.

a) Multi-Sensor Data Processing System (MSDPS)

Table- 2.14 MSDPS Major Equipment Specification

Purposes

Multi-Sensor Data Processing System (MSDPS) provides en-route and terminal ATC environment for air situation awareness and safety enhancement for Bishkek, Osh, and Issyk-Kul ATC by processing track/plot data from MSSR, WAM and DF.

Equipment Configuration

Bishkek, Issyk-Kul Equipment List

No.	Equipment	BISHKEK			ISSYK-KUL	
		TECH EQ Room	ATC OPS Room	TWR	EQ Room	TWR
1	Multi-Sensor Data Processing System (MSDPS)	1				
1-1	Surveillance Front End Server	2				
1-2	Surveillance Data Processing Server	2				
1-3	Safety Net Processing Server	2				
1-4	Flight Data Processing Server	2				
1-5	Data Recording Server	2				
1-6	Central Time Server + GPS	2				
2	Database Management System	1				
3	Billing System	1				
4	Data Analysis/Replay Display	1				
5	Technical Supervisor Suite	1				
5-1	Surveillance Data Display	1				
5-2	Flight Data Display	1				
5-3	Control & Monitoring System	1				
6	ACC West Position		1			
6-1	Surveillance Data Display (2k x 2k)		1			
6-2	Flight Data Display		1			
7	ACC East Position		1			
7-1	Surveillance Data Display (2k x 2k)		1			
7-2	Flight Data Display		1			
8	Bishkek APP Position		1			
8-1	Surveillance Data Display (2k x 2k)		1			
8-2	Flight Data Display		1			
9	Issyk-Kul APP Position		1			
9-1	Surveillance Data Display (2k x 2k)		1			
9-2	Flight Data Display		1			
10	Stand-by APP Position		1			
10-1	Surveillance Data Display (2k x 2k)		1			
10-2	Flight Data Display		1			
11	Operational Supervisor Suite		1			
11-1	Surveillance Data Display		1			
11-2	Flight Data Display		1			
11-3	Control & Monitoring System		1			
12	FIS Position		1			
12-1	Surveillance Data Display (2k x 2k)		1			
12-2	Flight Data Display		1			
13	Reserve Operational Position			1		
13-1	Surveillance Data Display			1		

13-2	Flight Data Display			1		
14	Tower Position			1		1
14-1	Surveillance Data Display			1		1
14-2	Flight Data Display			1		1
15	Data Distribution Equipment (L/L Interface)	1			1	
16	LAN Network Equipment	1			1	
17	Power Distribution Box	1				

Osh Equipment List

No.	Equipment	OSH			
		TECH EQ Room	ATC OPS Room	TWR	ARO OP Room
1	Multi-Sensor Data Processing System (MSDPS)	1			
1-1	Surveillance Front End Server	2			
1-2	Surveillance Data Processing Server	2			
1-3	Safety Net Processing Server	2			
1-4	Flight Data Processing Server	2			
1-5	Data Recording Server	2			
1-6	Central Time Server + GPS	2			
2	Database Management System	1			
3	Data Analysis/Replay System	1			
4	Technical Supervisor Suite	1			
4-1	Surveillance Data Display	1			
4-2	Flight Data Display	1			
4-3	Control & Monitoring Display	1			
5	ACC Position		1		
5-1	Surveillance Data Display (2k x 2k)		1		
5-2	Flight Data Display		1		
6	APP Position		1		
6-1	Surveillance Data Display (2k x 2k)		1		
6-2	Flight Data Display		1		
7	Operational Supervisor Suite		1		
7-1	Surveillance Data Display		1		
7-2	Flight Data Display		1		
7-3	Control & Monitoring System		1		
8	Briefing Position				1
8-1	Flight Data Display				1
9	Tower Position			1	
9-1	Surveillance Data Display			1	
9-2	Flight Data Display			1	
10	Data Distribution Equipment (L/L Interface)	1			
11	LAN Network Equipment	1			
12	Power Distribution Box	1			

Specification 1. General Requirements 1.1 Environment Conditions MSDPS shall be designed to be operated under following environment conditions (except COTS). (1) Temperature : -0°C to +40°C (Indoor), -30°C to +50°C (Outdoor) (2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing 1.2 Power Requirements (1) Power Voltage : 220VAC single-phase, 220/380VAC three-phase (2) Frequency : 50Hz (3) Power Consumption : to be designed to minimize 1.3 Design criteria for the parts (1) Metal material, bolts and other metal parts of outdoor equipment shall be durable material for anti-corrosion. (2) The equipment shall be connected with connectors.
2. Function Requirements 2.1 General (1) MSDPS shall be installed at Bishkek ATC Center and Osh ATC Center and used for En-rout and terminal air traffic control. (2) MSDPS shall provide Mode S operation (supporting transponder level 2) and a capability for ELS (Elementary Surveillance) and EHS (Enhanced Surveillance). (3) MSDPS shall be able to receive the data in ASTERIX format (CAT1/2, 34/48, CAT8, CAT19, CAT 20, CAT 21 anKANT205). (4) Control and Monitoring of the MSDPS shall be performed at each ATC Center, respectively. (5) MSDPS is stipulated as the principal system of air situation awareness and ATC safety enhancement. The MSDPS shall be a state-of-art system designed for air traffic management tasks. (6) MSDPS shall be able to process track or plot data from surveillance radar such as MSSR and WAM. (7) Hardware components shall be commercial off-the-shelf (COTS) and field-proven commercially available products. Custom hardware components shall not be used in the system. (8) MSDPS shall be open architecture for future expandability or customization

(Source: JICA Study Team)

b) ATC Training Simulator System (SIM)

Table- 2.15 SIM Major Equipment Specification

Purposes

ATC Training Simulator System provides air traffic controller training environment for En-route control and Approach control using Surveillance Data Display and Flight Data Display.

Equipment Configuration

No.	Equipment	BISHKEK	
		TECH EQ Room	SIM Room
1	ATC Training Simulator System	1	
1-1	Surveillance Data Processing Server	1	
1-2	Flight Data Processing Server	1	
1-3	Air Traffic Generator	1	
1-4	Data Recording Server	1	
2	ACC Position		2
2-1	Surveillance Data Display (2k x 2k)		2
2-2	Flight Data Display		2
3	APP Position		1
3-1	Surveillance Data Display (2k x 2k)		1
3-2	Flight Data Display		1
4	Operational Supervisor Suite		1
4-1	Surveillance Data Display		1
4-2	Control & Monitoring System		1
5	Instructor / Pseudo Pilot Position		1
6	Pseudo Pilot Position		1
7	LAN Network Equipment		1
8	Power Distribution Box		1

Specification

1. General Requirements

1.1 Environment Conditions

SIM shall be designed to be operated under following environment conditions (except COTS).

(1) Temperature : -0°C to +40°C (Indoor), -30°C to +50°C (Outdoor)

(2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing

1.2 Power Requirements

(1) Power Voltage : 220VAC single-phase, 220/380VAC three-phase

(2) Frequency : 50Hz

(3) Power Consumption : to be designed to minimize

1.3 Design criteria for the parts

(1) Metal material, bolts and other metal parts of outdoor equipment shall be durable material for anti-corrosion.

(2) The equipment shall be connected with connectors.

2. Function Requirements

2.1 General

(1) SIM shall provide a capability to perform training of ATC by using Surveillance Data Display (SDD) and Flight Data Display (FDD).

(2) SIM shall be capable of creating exercise scenarios for simulating various air situations and recheck activities by trainees.

(3) SIM shall be capability to increase and decrease the number of SDD/FDD without upgrading software and run the exercise at the same time.

(4) Each SDD/FDDS shall have workstation, monitor, and input devices.

(5) SIM shall provide recording and replay function for lecture.

(6) Parameters of the exercise scenario shall be changeable during an exercise.

(7) SIM Server shall generate surveillance data and flight data.

(8) PSP shall create the exercise scenario and control simulated aircrafts during an exercise.

(9) Simulated aircraft shall be controllable by PSP.

(Source: JICA Study Team)

c) Voice Communication Switching System (VCSS)

Table- 2.16 VCSS Major Equipment Specification

Purposes

VCSS is used to connect the air traffic controllers to voice communications such as radio telephony and telephone network to guide the aircraft pilot and make calls both internally within airport and externally. With a VCSS, the controllers can communicate through both radio and telephone using a single workstation called a controller working position (CWP).

Equipment Configuration

Bishkek

No.	Equipment	BISHKEK			
		TECH EQ Room	ATC OP Room	SIM Room	TWR+ Old TWR
1	Voice Communication Switching Equipment	1			
2	Controller Working Position	1	7*	6*	3
2-1	Touch Entry Device	1	13	9	3
2-2	Plug-In-Panel	1	13	9	3
2-3	Loudspeaker	2	26	18	6
2-4	Microphone	1	13	9	3
3	Technical Monitoring & Control System	1			
4	Master Clock System	1			
4-1	Master Clock Unit	1			
4-2	Desk Mount Slave Clock	1	13		3
5	Voice Recorder	1			
6	Accessary				
6-1	Headset		24	12	3
6-2	Handset	1	13		3

* CWP is as follows.

- Bishkek: ACC (W), ACC (E), APP (Bishkek), APP (Issyk-Kul), APP (Stand-by), OP Supervisor, FIS
- SIM: ACC x2, APP, Operational Supervisor, Instructor/Pseudo pilot, Pseudo pilot

Osh

No.	Equipment	OSH			
		TECH EQ Room	ATC OP Room	TWR	Briefing Room
1	Voice Communication Switching Equipment	1			
2	Controller Working Position	1	3*	2	1
2-1	Touch Entry Device	1	5	2	1
2-2	Plug-In-Panel	1	5	2	1
2-3	Loudspeaker	2	10	4	2
2-4	Microphone	1	5	2	1
3	Technical Monitoring & Control System	1			
4	Master Clock System	1			
4-1	Master Clock Unit	1			
4-2	Desk Mount Slave Clock	1	5	2	1
5	Voice Recorder	1			
6	Accessary				
6-1	Headset		12	2	
6-2	Handset	1	5	2	

* CWP is as follows.

ACC, APP, OP Supervisor

Specification

1. General Requirements

1.1 Environment Conditions

VCSSS shall be designed to be operated under following environment conditions (except COTS).

(1) Temperature : -0°C to +40°C (Indoor), -30°C to +50°C (Outdoor)

(2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing

1.2 Power Requirements

(1) Power Voltage : 220VAC single-phase, 220/380VAC three-phase

(2) Frequency : 50Hz

(3) Power Consumption : to be designed to minimize

1.3 Design criteria for the parts

(1) Metal material, bolts and other metal parts of outdoor equipment shall be durable material for anti-corrosion.

(2) The equipment shall be connected with connectors.

2. Function Requirements

2.1 General

(1) VCSS shall uninterruptedly switch voice communication lines for ATC by actions at Touch entry device of Controller working positions.

(2) VCSS switching function shall be fully dual configuration and provide automatic switchover in case of failure.

(3) A VoIP-based VCSS shall be required for controlling (switching) and interfacing digital and analog air-to-ground VHF radio telephony and inter-facility telephone voice communications used for the ATC operation.

(4) Voice Communication Switch Equipment shall be functionally separated into different modules.

(5) VCSS architecture shall be capable of accommodating a sufficient number of simultaneous voice paths to carry the maximum offered voice traffic.

(6) VCSS shall support characteristics of analogue radio communications such as push-to-talk and channel selection.

VCSS shall be able to listen to multiple channels at once for incoming calls, and when multiple connections are ongoing at the same time, the sound from them shall be mixed together and played through the same speakers.

(Source: JICA Study Team)

d) VHF Air-Ground Communication System

Table- 2.17 VHF Major Equipment Specification

Purposes
Air-Ground Communication System is used for VHF radio communication channel between air traffic controller and pilot on the Tower Control at Osh.

Equipment Configuration

No.	Equipment	Osh
		Tower
1	VHF Air-Ground Transceiver (118.3 main & stand-by, 121.5)	2
2	VHF Antenna	2

Specification
1. General Requirements
1.1 Environment Conditions
VHF Air-Ground Communication System shall be designed to be operated under following environment conditions (except COTS).
(1) Temperature : -0°C to +40°C (Indoor), -30°C to +70°C (Outdoor)
(2) Relative Humidity : ≤ 95% (Indoor), 100% (Outdoor), No condensing
(3) Wind loading : 45 m/s
1.2 Power Requirements
(1) Power Voltage : 220VAC single-phase, 220/380VAC three-phase
(2) Frequency : 50Hz
(3) Power Consumption : to be designed to minimize
1.3 Design criteria for the parts
(1) Metal material, bolts and other metal parts of outdoor equipment shall be durable material for anti-corrosion.
(2) The equipment shall be connected with connectors.

2. Function Requirements
2.1 General
(1) The VHF transceiver shall be designed to be remote and local controlled, and all necessary interface equipment shall be supplied and installed.
(2) Transmitter/Receiver shall be contained in a 19-inches wide rack or cabinet together with other necessary equipment.
(3) For Transmitter, Automatic Level Compensation (ALC) circuit shall be provided for increasing average modulation degree without causing over modulation.
(4) Operating frequency shall be selectable by switch-programmable synthesizer.
(5) Built-in meter or display shall be provided on front panel for routine checking of RF Output Power, Power Supply, Modulation depth and Reflection Power.
(6) For Receiver, Squelch on-off switch and squelch level control including squelch terminal shall be provided.
(7) Built-in speaker shall be provided with volume control.

(Source: JICA Study Team)

2.2.3 Outline Design Drawing

Refer to the outline design drawing attached at the end of this report.

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

As the project is implemented under the Japanese grant aid system, the project will be implemented smoothly by keeping in constant contact with the partner country's relevant organizations and officials, the consultant, and constructors. Prior to the start of construction, the consultant and the constructor shall thoroughly examine the construction details indicated in the design documents. Then, with regard to the construction period, materials to be used, construction methods, quality control methods, health and safety management, etc., they shall comprehensively judge the socio-economic conditions such as lifestyle, culture, laws and regulations of the Kyrgyz, natural conditions, intentions of the implementing agencies, surrounding environment and location conditions, labor force and characteristics of the construction work, and formulate a construction plan to ensure efficient and economic implementation of the work policy.

In principle, the procurement of labor and construction materials and equipment shall be conducted locally, but if there are obstacles in terms of quality or stock quantity, or if it is advantageous to procure them in Japan, judging from the perspective of ease of maintenance and management after handover, they shall be procured in Japan. In such cases, a transport plan shall be drawn up and various conditions such as timing of delivery, transport routes and methods shall be comprehensively examined, and appropriate measures shall be taken so that the progress of construction is not affected.

2.2.4.2 Implementation Conditions

The basic working hours of the construction work shall be from 8am to 5pm, and no night work shall be conducted except in unavoidable cases such as construction delays due to rainfall.

Equipment installation work shall be conducted so as not to interfere with airport operations.

Equipment procurement contractors are selected through public tendering for Japanese corporations with certain qualifications. In principle, tenders are negotiated with the lowest price bidder, the successful bidder is decided, and a procurement contract is concluded with the Kyrgyz side.

The equipment/systems in the project will basically be Japanese products, as they are not manufactured in Kyrgyz and can be manufactured and procured in Japan. However, taking into account the budget for project implementation, third country procurement will also be considered.

The equipment supplier shall supply, deliver, and install the necessary equipment based on the contract, and shall also provide technical guidance to the Kyrgyz side on the operation and maintenance of the procured equipment.

In addition, to ensure the continuous use of the equipment after procurement, the procurers, manufacturers, and agents shall be instructed to ensure a supply system for spare parts and consumables required for each equipment and shall provide support for free repairs during the warranty period and for paid repairs after the warranty period, technical guidance, and other services.

The responsible agency on the Kyrgyz State side in the procurement is KAN, which is responsible for the maintenance of ATC and security facilities.

2.2.4.3 Scope of Works

The scope of the procurement for this project is a one-package procurement, as it is an ATC system of the same type. The following table outlines the respective burdens to be borne by Japan and the Kyrgyz Countryside when implementing this grant aid project.

Table- 2.18 Scope of works

Obligations of the Japan Side	Obligations of the Kyrgyz Side
1. construction of a new control tower and ACC <Osh ACC> 1) Site development (disposal of existing soil and fill) 2) Common temporary construction (paving of construction roads, procurement of temporary materials, etc.) 3) Construction of control facilities 4) Construction of power station building 5) Installation of septic tanks 6) Installation of emergency generators 7) Installation of elevator facilities 8) Installation of power receiving and transforming facilities 9) Exterior construction	1. building-related site development, building design and construction <Osh ACC> 1) Land acquisition 2) Land rezoning 3) Construction site preparation (removal of existing grass, trees, and other obstacles) 4) Preparation of access roads to the construction site 5) Design for 10 kV cable laying, substation installation and connection 6) Installation of 10 kV cables (with the possibility of laying overhead power lines) 7) Design for well drilling 8) Well drilling 9) Building Permit Application Procedures
2. Procurement and installation/adjustment work of the equipment <Bishkek ACC> 1) Multi-Sensor Data Processing System (MSDPS) 2) ATC Training Simulator System (SIM) (for airway and approach control) 3) Voice Communication Switching System (VCSS) <Osh ACC> 1) Multi-Sensor Data Processing System (MSDPS) 2) Voice Communication Switching System (VCSS) 3) VHF Air-Ground Communications Systems (for airfield control) 3. Maintenance and management education and training of the subject equipment 4. Maritime and inland transport of the equipment	2. Equipment-related site maintenance, building design and construction <Bishkek ACC> 1) Provision of new ACC/APP operation room and ATC training simulator room. 2) Procurement of new ATC console: Enroute console x2, Approach console x3, Operational supervisor console x1, Flight information service console x1. 3) Relocation of existing equipment, which are installed in the existing console such as direction finder monitor, NAV-aid monitor, and necessary radio equipment/telephone set, to new consoles. 4) Procurement and installation of UPS and AVR (Automatic Voltage Regulator) for new ATC system. 5) Removal, temporary installation, or dismantling of existing equipment for securing installation space of new equipment. <Osh ACC> 1) Procurement of new ATC console: Enroute console x1, Approach console x1, aerodrome control console x1. 2) Relocation of existing console including associated equipment to new ACC and control tower: operational supervisor console x1, technical supervisor console x1, aerodrome control console x1. 3) Procurement and installation of UPS and AVR for new ATC system. 4) Installation of a new fiber-optic terminal (Optical Node) to be connected to existing airport fiber-optic network. 5) Relocation of existing ATC equipment and NAV-aid equipment to new ACC and control tower. 3. Transportation, storage, recycling, and disposal of removed equipment 4. Assignment of counterpart personnel 5. Participation in equipment installation/adjustment work (including commissioning/completion inspection)

(Source: JICA Study Team)

2.2.4.4 Construction Supervision

Some construction materials and equipment for the project will be procured from Japan. Japanese construction methods and techniques will be used for their construction and installation. Therefore, engineers from Japan will be dispatched to ensure the quality and accuracy of these materials and equipment.

2.2.4.5 Quality Control Plan

1) Quality management plan for the facility

a) Identification of major works and main materials

For major works such as concrete placing, consult with the contractor on concrete test mixing, material testing (aggregate, cement, water), piling groundwork (excavation) and concrete placing design drawings, temperature and curing methods before starting construction, In major construction works such as concrete placement, etc., the following shall be discussed and confirmed with the contractor: concrete test mixing, material testing (aggregate, cement, water), pile groundwork (excavation), concrete placing design drawings, temperature, curing methods, etc. During construction, care should be taken to ensure that homogeneous concrete can be properly placed by setting up simple and manageable methods.

For other key materials, set up a method that can be easily checked on site by the local engineer to ensure that construction is of uniform quality from the start of construction.

b) Setting up consistent quality control sheets

A quality control chart should be prepared so that the results of pre-inspection, mixing tests and various material tests can be checked and verified at each stage of selection, construction, and completion, in a way that the quality of the work can be consistently controlled.

2) Quality control plan for equipment

a) Adoption of ICAO standards and Eurocontrol regulations

The specifications and functions of the equipment of the ATC system shall be governed by ICAO standards and Eurocontrol regulations.

b) Approval of equipment production drawings

The consultant shall request the equipment manufacturer to submit equipment specifications, schedule, process plans and construction plans, and shall check and approve that the equipment functions and installation are planned in accordance with the contract specifications.

c) Product Inspections

The consultant shall conduct on-site inspections of major equipment at the manufacturing plant to verify test data. Alternatively, request submission of manufacturer's test data and check the results. Verify that the manufactured equipment has the performance specified in the approved specifications and approve the shipment.

d) Pre-shipment inspection

In the presence of the contractor, a pre-shipment inspection of the number of personnel must be conducted by a third-party organization commissioned by the consultant.

e) Final inspection

The final inspection of the relevant system is conducted in the presence of the consultant and the procurer, starting with the equipment for which the individual equipment adjustment and the system adjustment work have been completed. During the final inspection, the manufacturer's technicians will operate the equipment to obtain the test data necessary for acceptance inspection and check the specifications and the number of personnel when the equipment is operated individually and in system.

f) Acceptance and handover

After the completion of the initial operational guidance, the contractor, consultant, and the responsible KAN representative of the Kyrgyz implementing agency on the Kyrgyz side confirm the product inspection data, the final inspection test data conducted at the site and the acceptance inspection results and complete the handover.

2.2.4.6 Procurement Plan

1) Procurement plan for materials and equipment

a) Material procurement plan

Cement and aggregates are locally produced, and material inspections are conducted in accordance with SNiP standards, so their adoption should be considered. Reinforcing steel bars are locally produced or imported from abroad by local agents, and if adopted, quality control information such as submission of mill sheets (attached documents certifying the steel material quality) or results of tensile tests should be checked. There are several ready-mixed concrete plants in Osh city, and there are sufficient pumping and mixing vehicles. The project site is within an hour's drive by vehicle from the existing plant and therefore ready-mixed concrete will be actively considered for use. Steel frames can be procured locally, but as the quality could not be confirmed, these materials will be procured from third countries. As for finishing materials, OA floors shall be procured from Japan, while other main finishing materials and substrates shall be procured locally. As for fittings, there are many inferior Russian and Kazakhstan-made fittings commonly used locally, and there are problems with the durability and quality of moving parts. For this reason, all steel and aluminum fittings (including hardware) shall be procured from Japan. Glass shall be procured locally.

For materials and equipment to be procured in Japan, an appropriate transport plan will be drawn up so as not to affect the progress of the construction work, as mentioned above.

The overall transportation period for the equipment is planned to be approximately three months, which is the number of days for transport and customs clearance procedures.

b) Transport plan

Transport shall be provided from Japan to the site for each piece of equipment, and the transport range shall be from Japan or a third country to Manas and Osh International Airports.

In principle, the following transport routes shall be used.

Yokohama Port (Japan) → (sea transport) → Lianyungang (China) → (land transport thereafter) → Khorgos (Kazakhstan) → Almaty (Kazakhstan) → Bishkek Station (Kyrgyz duty-free procedures) → Manas International Airport/Osh International Airport

In the project, steel frames to be procured from a third country (Vietnam) are planned to be transported from Phu My Port near Ho Chi Minh City in Vietnam via Lianyungang Port in China to the site via the above route.

Equipment to be procured from third countries will be unloaded at the port of Mersin on the Mediterranean Sea in southern Turkey and transported overland to Manas International Airport in Kyrgyz. The port of Mersin is approximately 4,800 km from the site, and assuming that the equipment is transported via the countries of Armenia, Iran, Turkmenistan, Uzbekistan, and Kazakhstan, it will take approximately two months to be delivered, including customs clearance. The transportation costs of materials and equipment to be used for the construction work, which will be procured from Japan and third countries, are included in the construction costs.

c) Customs clearance

The customs clearance time shall consider the time required by Japan to process the contractor's application and the internal approval procedures of the relevant authorities of the Kyrgyz State, which is approximately one week.

2.2.4.7 Operational Guidance Plan

1) Initial operational training, operational guidance, and other plans

The equipment to be procured under the project has basically the same functions as existing equipment, but initial operational training on how to operate and maintain the equipment, as well as on the various new functions added, is essential. Therefore, initial operational training on the equipment is provided by engineers dispatched by the manufacturer from Japan or the country of manufacture to KAN maintenance and management personnel for several days of on-the-job training. The technician providing the instruction should be considered to be the technician who conducted the adjustment tests of the system/equipment concerned.

2.2.4.8 Soft Component (Technical Assistance) Plan

1) Background to planning soft components

The grant aid will improve the safety of air transport and strengthen its functions by rebuilding the control facilities at Osh International Airport and updating the ATC system at the Bishkek ACC and Osh ACC. The introduction of the new ATC system is expected to improve the reliability and continuity of ATC services by renewing ageing systems. On the other hand, if the ATC system to be introduced through this grant aid should fail, there is concern that it will have a significant impact on the safety of aircraft operations, not only in the Kyrgyz, but also in neighboring Central Asian countries. Therefore, in order to ensure the smooth and stable operation of the ATC system that has been developed, it is necessary to improve the capacity of the Kyrgyz ATC engineers to operate and maintain the system, and to improve their practical skills in the supply and management of spare parts in order to respond quickly in the event of a failure.

In this grant assistance, some of the existing equipment will be relocated to the new control tower and ACC. Therefore, it is necessary to formulate a carefully coordinated transition plan by the relevant organizations, conduct transition tests that do not affect current operations, and make transition decisions on the day of the transition and switch back in the event of an emergency. For this reason, training on the methodology related to the procedures from the planning stage to the transition is necessary.

In addition, the project is expected to involve changes that may affect the safety of air navigation services in the Kyrgyz, such as changes in the organizational structure for conducting air navigation services in the country, changes related to hardware and software such as systems and equipment, and changes related to the operation of the services, as a result of a series of facility improvements. Therefore, it is also necessary to identify possible risks and consider measures to mitigate each risk in advance to ensure that safety is not compromised by these changes.

Furthermore, when updating the ATC system, it is essential that the work proceeds without suspending ATC operations and that 24-hour ATC is provided. For this reason, it is necessary to conduct the switchover to the newly installed equipment while continuing the operation of the existing equipment in the renewal of the Bishkek ACC system, which is capable of controlling air traffic all over the Kyrgyz in the KAN. As for Osh ACC, since Bishkek ACC can temporarily cover the ATC operations of Osh ACC, it was decided to suspend the operations of Osh ACC's air route control for a certain period of time to conduct the work of updating the ATC system. As a result, the Osh Airport Control Tower was relocated, the Bishkek ACC was also relocated, and the Osh ACC suspended its operations to conduct the update. Furthermore, in line with the relocation, the timing of the installation of systems other than those to be upgraded in this facility development on the KAN side is to be prepared on the KAN side, so it is necessary to consider the timing of their installation during the entire process.

When relocating, it is necessary to formulate a transition plan that is closely coordinated by the relevant organizations, conduct transition tests that do not affect current operations, and make decisions on the day of transition and on emergency cutbacks. On the other hand, the KAN requested that air traffic controllers have a period of familiarization for the operation of the system to be updated to this maintenance, and it was decided to select an appropriate time before and after the relocation to provide a period of familiarization after the completion of the updated installation. This makes the relocation of multiple control facilities more complex, and relocation planning requires training in methods pertaining to procedures from the planning stage to the transition.

Multi Radar Data Processing System (MSDPS)
(Center of the console and subject to renewal in the project)

Automated Weather Observing System (AWOS)
(subject to relocation by the KAN)

(Source: JICA Study Team)

Figure- 2.19 Existing Aerodrome Control System at Osh Tower

2) Objectives of the soft components

The objectives to be achieved through technology transfer through the implementation of the soft component is to reach a state where the operation of the new ATC system is smoothly transferred from the existing ATC system and a capacity is developed to sustain its operational maintenance and management. Specifically, the following four objectives will be implemented.

- **Objective 1: To improve the capacity to prepare system migration plans for the relocation of control tower and ACCs**

Introduce examples of system migration in Japan to ATC technical officers to help them understand the work required to migrate from the existing ATC system to the new ATC system to be introduced under the project. In addition, the migration process and necessary documents will be discussed with those in charge, so that those in charge in the field in the Kyrgyz can smoothly migrate the system on their own and develop a migration plan.

- **Objective 2: Improve risk avoidance and trouble-shooting capacity during operational transition**

Ensure that ATC technical officers are able to proactively identify and analyse the risks assumed in the implementation of the formulated transition plan and take measures to reduce them. In addition, they should be able to respond immediately in the event of trouble.

- **Objective 3: To improve the operation and maintenance management capability of the ATC system**

Lectures and practical exercises on appropriate methods of operation and maintenance of the equipment to be developed under the project will be given to ATC technical officers to improve their operation and maintenance management capabilities at the field level. In addition, lectures, and practical exercises on appropriate management methods for spare parts of the equipment to be maintained under the project will be provided to improve their supply management skills.

■ **Objective 4: Improve safety management capacity for the operation of information processing and communication systems**

Teach ATC technical officers the need for risk analysis in the operation and maintenance of ATC systems. Furthermore, instruct ATC technical officers on the methods for conducting actual risk analysis. This will enable them to implement risk reduction measures during and after the introduction of new systems and operations to ensure continued stable operations. Risk analysis is conducted in accordance with the ICAO Safety Management Manual (Doc 9859) to identify and analyze risks. It refers to the process of assessing them in terms of frequency of occurrence and impact and implementing measures to mitigate them to an acceptable level. Specifically, it consists of (i) hazard identification, (ii) consequence analysis and verification of significance, (iii) analysis of causes and estimation of frequency of occurrence, (iv) consideration of mitigation measures and assessment of risk acceptability, (v) risk reduction measures and (vi) preparation of safety assessment documents.

The risk acceptability assessment is based on the following diagram.

Table- 2.19 Safety risk assessment matrix

	Risk severity				
Risk probability	*Catastrophic A*	*Hazardous B*	*Major C*	*Minor D*	*Negligible E*
Frequent 5	*5A* Unacceptable	*5B* Unacceptable	*5C* Unacceptable	*5D Acceptable* Reduce risk	*5E Acceptable* Reduce risk
Occasional 4	*4A* Unacceptable	*4B* Unacceptable	*4C Acceptable* Reduce risk	*4D Acceptable* Reduce risk	*4E Acceptable* Reduce risk
Remote 3	*3A* Unacceptable	*3B Acceptable Reduce risk*	3B Acceptable Reduce risk	*3D Acceptable Reduce risk*	*3E Acceptable*
Improbable 2	*2A* Acceptable Reduce risk	*2B* Acceptable Reduce risk	*2C* Acceptable Reduce risk	*2D* Acceptable	*2E* Acceptable
Extremely improbable 1	*1A* Acceptable	*1B* Acceptable	*1C* Acceptable	*1D* Acceptable	*1E* Acceptable

3) Soft component results

The status to be achieved as a result of the soft component implementation is as follows.

- Transition plans for Bishkek ACC, Osh Control Tower and Osh ACC are developed and the necessary concepts are mastered. These transition plans represent individual plans, but the three transition plans are linked, including equipment installation works, personnel training, etc.
- The knowledge required for KANs to proactively identify and assess risks related to operations and develop risk reduction measures will be acquired.
- The skills required to operate and maintain the maintenance equipment and existing equipment associated with the project will be acquired. In addition, personnel will be trained to train the ATC technical officers who will conduct maintenance and management tasks.
- Maintenance and safety management skills related to the operation of the system are acquired.

The following measures will be implemented to achieve the above.

- Introduce examples of system migration in Kyrgyz to help KANs understand the work required to continue the operation of the Osh Airport Control Tower and ACC, and to resume ATC and operations after the relocation; discuss the work process (migration steps) and necessary documentation with the persons in charge, so that they can develop their own migration plans; and Improve the project implementation capacity of the field personnel in Kyrgyz so that they are able to smoothly transition and respond to any problems on their own. Table- 2.20 shows the considerations required for transition planning and Table- 2.21 shows a general example of the work process.
- Teach KAN control technical officers the need to analyze possible risks to the transition plan and instruct them on the methodology for conducting the actual risk analysis. This will enable them to implement risk mitigation measures during and after the introduction of new systems and operations, so that stable operations can continue. In addition, lectures on appropriate methods of operation and maintenance of the target equipment will be given to KAN ATC officers to improve their operation and maintenance management skills at the field level.

Table- 2.20 Considerations required for transition planning

(1) Transition plan - Clarification of preconditions - What level of impact on control operations is acceptable? - Review of final draft plan (2) System - A high level person needs to be in charge of the transition to make the Go/No Go decision and to determine the completion of the transition. -The responsible person should also be clarified in the implementing department (control department, control engineering department). (3) Risk assessment. - Assessment of the various risks assumed during the implementation of the transition work, analysis of the hazards and decision on acceptability. - Consideration of proposed hazard countermeasures. - The person responsible for (2) makes the final decision on the results of the evaluation. (4) System configuration - Identify equipment and systems required for the transition.

(Source: JICA Study Team)

Table- 2.21 A general example of the work process

Transition steps (Equipment system)	Transition steps (Radio systems)
(1) Checking the number of personnel (2) Appearance check (3) Check unit mounting (4) Equipment cable wiring (5) Check input/output power supply. (6) UPS installation (7) Check construction wiring. (8) Install additional equipment. (9) Check operation of equipment alone (10) Functional operation check (11) Level acquisition (12) Check system functions. (13) Interconnection test (14) Preparation for operational transition (2 rehearsals and transition)	(1) Line switching procedure (2) Execution of the outage procedure (3) Line restoration (4) Test signal transmission (5) Rehearsal confirmation (6) Performance check through actual operation (for a certain period)

(Source: JICA Study Team)

4) Methods for checking achievement of results

- Objective 1 related:

For system migration, have a draft migration plan prepared for one of the equipment in this maintenance (e.g., Multi-Sensor Data Processing System (MSDPS) or communication equipment) and judge it according to its completeness.

- Objective 2 related:

To have a risk management table prepared for the identification and analysis of possible risks in the implementation of the developed transition plan, and to be judged on the basis of the completeness of the risk management table.

- Objective 3 related:

The operation and maintenance management capabilities of Multi-Sensor Data Processing Systems (MSDPS), etc., shall be judged by the degree of completion of the operation and maintenance management manuals and their deliverables.

- Objective 4 related:

Safety management of ATC operations is judged by the degree of completion of the safety assessment hazard table.

5) Soft component activities (input plans)

The content and scale of inputs on the Japanese and Kyrgyz side are planned as follows.

Table- 2.22 Objective 1: Improve capacity to develop a system migration plan for the relocation of the control tower and ACC

Training item	Japanese side	Kyrgyz side
<Achievements> KANs can develop their own transition plan based on an understanding of the work process (transition steps) and documentation required, etc., for the relocation of ACC and control tower.		
1. Activities		
Required skills/industries	Activity 1. Lecture on the concept and implementation of system transition planning as practiced in Japan. Activity 2. Guidance on the preparation of a draft transition plan chart by KAN.	-2 ATC technical officers from Bishkek ACC -2 ATC technical officers from Osh Airport -2 ATC technical officers from Osh ACC (Total: 6 persons)
Current required level of technology	—	**Current situation:** The case involves the relocation of Bishkek ACC, the relocation of Osh control tower and the relocation of Osh ACC, all of which will be conducted in the close timing. For the relocation, a transition plan needs to be developed to ensure that airport operations are not suspended. The KAN has limited experience and history in developing in-depth transition plans. **Planning:** As a requirement for a smooth and safe system migration, in terms of equipment maintenance, it is necessary to formulate a plan for identifying faulty parts in the event of a failure, switching channels, and returning back to the operation by existing system in case of fail. KAN will be provided with knowledge on system migration in Japan, including these tasks, and will be asked to formulate a migration plan.
Participants (target group)	—	ATC technical officers to develop plans for the development of communication and surveillance systems
2. Implementation method		
Implementation resources	1 Japanese consultant with a background as an ATC engineer with the Japanese Civil Aviation Authority. (1.5 man/month(M/M) local work)	Provision of training facilities
Type of deliverables	Training texts and planning summaries based on experience of implementation in Japan (planned outcomes, activities, achievements, etc.)	Proposed transition plan
3. Contents of training		
Overview	Classroom instruction on how to develop an equipment transition plan sheet using actual examples of system transitions implemented at Japanese air stations. The knowledge on how to ensure a smooth and reliable transition is taught through practical training in the formulation of a draft plan for the equipment operation tasks required for the transition of ACC ATC operations, airport approach control operations and airfield control operations associated with this project.	
Training item	- Explanation of Japan's transition plan - Arrangement of work related to the transition of maintenance equipment - Preparation of draft transition plan	

Table- 2.23 Objective 2: Improve risk avoidance and trouble-shooting capacity during operational transition

Training item	Japanese side	Kyrgyz side
< Achievements > A risk analysis methodology for the operational transition procedures of the systems required to start operations following the relocation of the Bishkek ACC, Osh Airport Control Tower and Osh ACC is acquired and the transition plan is faithfully implemented.		
1. Activities		
Required skills/industries	**Activity 1.** Lecture on system migration risk management as practiced in Japan. **Activity 2.** Advise on risk avoidance and troubleshooting during migration, based on Japanese experience.	-2 ATC technical officers from Bishkek ACC -2 ATC technical officers from Osh Airport -2 ATC technical officers from Osh ACC (Total: 6 persons)
Current required level of technology	—	**Current situation:** In the operational transition, it is necessary to monitor the normal operation of the information processing and communication systems of ATC, as well as to maintain the normal operation of the conventional aircraft at Bishkek ACC and Osh Airport. In the event of equipment operational failures, it is necessary to implement close coordination of equipment operations, including, if necessary, switching back to conventional equipment. KAN lacks experience in similar operational transitions. **Planning:** Prior to the system transition, a risk analysis should be conducted to ensure that the ATC system will not be down, and the ability to instantly respond to any problems that may occur during the transition should be developed. This will ensure that normal equipment operation is maintained during the transition and that ATC operations of ACC and airports, and aircraft operations are not affected.
Participants (target group)	—	ATC technical officers in charge of managing the transition of various departments during the transition of ACC and airport systems
2. Implementation method		
Implementation resources	1 Japanese consultant with a background as an ATC engineer with the Japanese Civil Aviation Authority. (0.50 man/month(M/M) local work)	Provision of training facilities
Type of deliverables	Training texts, materials related to risk management in the context of transition.	Risk management tables associated with the transition. (ATC operations version and equipment operation operations version).
3. Contents of training		
Overview	Examples of risk management and risk analysis of system migrations conducted in the HMA will be presented.	
Training item	Risk management for the transition. Measures to be taken to deal with potential problems during transition. Preparation of a risk management chart for the transition.	

Table- 2.24 Objective 3: Improve the operational and maintenance capacity of the ATC system

Training item	Japanese side	Kyrgyz side
< Achievements > Skills required for the operation and maintenance of MSDPS, and communication systems are acquired, and operation and maintenance inspection capabilities are improved.		
1. Activities		
Required skills/industries	**Activity 1.** Lecture on Japanese operation and maintenance management systems and practices **Activity 2.** Guidance on the preparation of operation and maintenance manuals **Activity 3.** Lecture on how to implement supply management in Japan	ATC technical officers responsible for the maintenance and management of the KAN system (2 communications (C), 2 surveillance (N) and 2 information processing systems) (Total: 6 persons)
Current required level of technology	—	**Current situation:** Operation, maintenance, and inspection work is conducted in accordance with the manufacturer's manuals, which results in inconsistent work depending on the person in charge of implementation. Some equipment is not responsibly managed, for example, maintenance support is not available for some equipment. **Planning:** An operation manual and maintenance manual can be prepared to establish common work procedures and ensure appropriate equipment operation.
Participants (target group)	—	Control technicians responsible for maintaining communications, surveillance, and information processing equipment.
2. Implementation method		
Implementation resources	1 Japanese consultant with a background as an ATC technician for the Japan Civil Aviation Authority (0.50 M/M local work).	Provision of training facilities
Type of deliverables	Training texts, etc.	Operation and maintenance manuals (including maintenance equipment)
3. Contents of training		
Overview	The maintenance and management system for air navigation radio facilities in Japan is explained and efficient and appropriate implementation methods are taught in classroom lectures. Practical training is provided to enable the preparation of operation and maintenance manuals that can be properly operated and maintained, for example by using manufacturer's manuals and photographs of operations and maintenance work on actual equipment.	—
Training item	A classroom lecture on Japan's equipment maintenance management system. Explanation of the Japanese supply management system. Lecture on inspection, maintenance, and restoration. Preparation of operational manuals Preparation of maintenance management manuals	—

Table- 2.25 Objective 4: Improve safety management capacity for the operation of information processing and communication systems

Training item	Japanese side	Kyrgyz side
< Achievements > The knowledge required to proactively identify and assess hazards and formulate operational risk reduction measures for the operation and maintenance of information processing and communication systems has been acquired and safety management skills have been improved.		
1. Activities		
Required skills/industries	**Activity 1.** Lecture on basic issues relating to safety management. **Activity 2.** Lecture on safety management as practiced in Japan regarding the maintenance of new equipment. **Activity 3.** Guidance on the preparation of risk assessments, including hazard identification and mitigation measures, for the equipment in this project.	-6 ATC technical officers from KAN (Total: 6)
Current required level of technology		**Current situation:** To safely and reliably conduct ATC operations at Bishkek ACC and Osh Airport using the equipment in this project, it is necessary to maintain the equipment used in the control system in good working order at all times. Therefore, it is necessary to identify hazards that hinder this and to establish measures to mitigate them. Although there are provisions for safety management, safety management as a practice and risk analysis have not yet been implemented. **Planning:** Teach safety management and risk assessment methods for the operation and maintenance of ATC equipment in the Japanese Civil Aviation Authority, so that maintenance equipment can be operated continuously, and ACC and airport control services can be provided safely.
Participants (target group)		ATC technical officers in charge of maintaining the system.
2. Implementation method		
Implementation resources	1 Japanese consultant with a background as an ATC technician for the Japan Civil Aviation Authority (0.50 M/M local work).	Provision of training facilities
Type of deliverables	Training texts on safety management and risk assessment in relation to equipment.	Hazard extraction Risk management table (equipment version)
3. Contents of training		
Overview	To explain the approach and practice of safety management in the Japanese Civil Aviation Authority and to teach the need for safety management and hazard analysis. Conduct a risk assessment of the equipment involved in the maintenance of the aircraft, and teach the hazard risks and mitigation measures, and have the participants prepare a risk management chart (equipment version).	—
Training item	Safety management of equipment. Safety assessment of equipment. Preparation of risk management charts for equipment.	—

6) Implementation Schedule for the Soft Component

The implementation schedule of the soft component will be aligned with the project's main project implementation schedule. The operational transition of Bishkek ACC, Osh ATC, and Osh ACC will be carried out after the completion of equipment delivery. Therefore, the transition planning for the soft component should be conducted in a process that takes into account the preparation period for the operational transition by KAN. In addition, the plan for operation and maintenance management capability and safety management should be implemented after the completion of technology transfer related to transition plan development.

The implementation process for the soft component, taking into consideration items such as a plan that does not affect the operation of the current ATC and management system, familiarization period for air traffic controllers to operate the equipment, interconnection test, and operational familiarization, is shown below, along with the implementation process for the main body of the grant aid project.

In addition, the details of the training contents are described in the following pages and thereafter.

Table- 2.26 Implementation Schedule for the Soft Component

Months			1	2	3	4	5	6	Number of Person	M/M
Year / Month			December 2026	January 2027	February 2027	March 2027	April 2027	May 2027		
Grant aid Procurement of equipment			Unpacking, delivery, installation, adjustment							
				Initial operation training						
								Acceptance and handover		
Soft Component	Objective 1	ATSEP							1	1.50
	Objective 2	ATSEP							1	0.50
	Objective 3	ATSEP							1	0.50
	Objective 4	ATSEP							1	0.50

The following items are to be considered in Objective 2, Improve the capacity for transition planning and troubleshooting.

- Since Bishkek ACC is an important facility that provides air route control covering the entire Kyrgyz, it is necessary to constantly monitor for problems during the switchover and make decisions on whether to cancel or continue the transition. Switchover should be implemented instantaneously, and careful observation should be made for any problems that may occur as a result of the transition.
- In the Osh tower relocation, it is necessary to minimize the time period during which ATC services cannot be provided because it is difficult to switch over instantaneously due to the control equipment, control equipment, and weather-related equipment to be relocated from the old control tower.

7) Training contents for Air Traffic Safety Electronics Personnel

This training will be provided to a total of six persons, two from each of the persons in charge of telecommunications, monitoring, and information processing systems. The training is scheduled to last for a total of three months: two months for training related to Objective 1 and 2, and one month for training related to Objective 3 and 4.

In this soft component, the ATSEP in Kyrgyz will develop their own transition plan for the system and operational transition associated with this project. Therefore, in this soft component activity, Japanese experts will first conduct training to support the "transition planning work" and provide technology transfer and planning support for the actual work. In addition, to enable the identification of risks that may occur during the transfer and the formulation of countermeasures, training will be provided to ATSEP on "risk analysis methods," and human resources will be developed who can continue risk analysis of the operation in the future. In addition, in order to manage risks during the transition of the project's equipment, Japanese experts will provide technical guidance on the concept of "transition planning risk management" and support the preparation of documents necessary for risk management.

Training for the acquisition of skills required for operation and maintenance management and human resource development of ATSEP who perform maintenance management tasks will also be conducted as one of the soft components of the "Maintenance Management Capacity Improvement" program. The training will include education on equipment management and safety assessment.

Table- 2.27 and show the process related to training and education.

Table- 2.27 Training program for Transition plan (Objective 1&2)

Day	1st month	2nd month
1	Move from Japan to Bishkek	Preparation for training
2	Meeting with KAN at Bishkek, Equipment confirmation.	Creation of Risk management chart (Bishkek ACC)
3	Meeting about Osh Tower, Equipment confirmation.	Confirm Risk management chart (Bishkek ACC)
4	Meeting about Osh ACC, Equipment confirmation.	Practical classroom lecture on troubleshooting measures in Japan (ACC)
5	Transition plan schedule study	Practical classroom lecture on troubleshooting measures in Japan (ACC)
6	Practical classroom training on transition planning chart preparation by Japanese experts.	Practical classroom lecture on troubleshooting measures in the site (ACC)
7	Classify the training results	Classify the training results
8	Preparation for training	Preparation for training
9	Practical classroom training on transition planning chart preparation procedures	Practical classroom lecture on troubleshooting measures in the site (ACC)
10	Organizing work for transition of maintenance equipment	Preparation for Transition Simulation (Bishkek ACC)
11	Organizing work for transition of maintenance equipment	Preparation for Transition Simulation (Bishkek ACC)
12	Creation of Transition Plan Chart (ACC)	Transition Simulation, troubleshooting (Bishkek ACC)
13	Creation of Transition Plan Chart (TWR)	Confirm a result of Risk management
14	Classify the training results	Classify the training results
15	Preparation for training	Preparation for training
16	Risk identification work (ACC Function)	Move from Bishkek to Osh
17	Risk identification work (ACC Function)	Confirm Risk identification work
18	Risk identification work (TWR Function)	Creation of Risk management chart (TWR)
19	Risk identification work (TWR Function)	Creation of Risk management chart (TWR)
20	Practical classroom training for Risk management (Bishkek ACC)	Practical classroom lecture on troubleshooting measures in Japan (TWR)
21	Classify the training results	Classify the training results
22	Preparation for training	Preparation for training
23	Practical classroom training for Risk management (Bishkek ACC)	Practical classroom lecture on troubleshooting measures in the site (TWR)
24	Practical classroom training for Risk management (TWR)	Preparation for Transition Simulation (TWR)
25	Practical classroom training for Risk management (TWR)	Preparation for Transition Simulation (TWR)
26	Practical classroom training for Risk management (Osh ACC)	Transition Simulation, troubleshooting (TWR)
27	Practical classroom training for Risk management (Osh ACC)	Confirm a result of Risk management
28	Classify the training results	Move from Osh to Bishkek
29	(Move to 2nd month)	Classify the training results
30		Evaluation outputs
31		Move from Bishkek to Istanbul
		Move from Istanbul to Japan

Table- 2.28 Training program for Operation and Maintenance management (Objective 3&4)

Day	3rd month		
1	Move from Japan to Bishkek	15	Preparation for training
2	Equipment operation and management system survey at Kyrgyz	16	Practical training on safety assessment
3	Maintenance system survey at Kyrgyz	17	Practical training on hazard management for equipment
4	Safety management and hazard analysis survey at Kyrgyz	18	Practical training on hazard management for equipment
5	Move from Bishkek to Osh/ Operation management survey	19	Practical explanation of Safety Management (Change Management Procedures) Overview
6	Operation management hazard analysis survey at Osh airport	20	Practical training on the operation of equipment in Japan
7	Move from Osh to Bishkek	21	Classify the training result
8	Preparation for training	22	Preparation for training
9	Practical classroom lecture on the equipment maintenance management system in Japan	23	Preparation of operational guidelines (ACC/TWR)
10	Practical explanation of the supply management system in Japan	24	Preparation of operational procedure deliverables
11	Practical classroom training on inspection, maintenance, and restoration	25	Preparation of maintenance and inspection manuals (ACC/TWR)
12	Practical training on safety management of equipment	26	Preparation of deliverables for maintenance and inspection procedures
13	Practical training on safety management of equipment	27	Evaluation outputs
14	Classify the training result	28	Classify the training result
		29	Move from Bishkek to Istanbul
		30	Move from Istanbul to Japan

The items to be implemented in this plan regarding the preparation of the Transition Plan Table, Transition Plan Risk Management Table, Operation Procedures, and Maintenance Procedures are as follows.

A) Transition Plan Chart

The schedule for the transition of Bishkek ACC, Osh Control Tower, and Osh ACC will be managed, and practical training will be conducted to prepare a plan table that clearly describes the work to be performed at each point in time, as well as presentation and guidance on the deliverables.

B) Transition Plan Risk Management Chart

Based on the risk analysis method, the trainees will learn about various troubles that may occur during the transition, identify risks during the transition, practice creating a transition plan risk management chart, and present and teach the deliverables.

C) Operational Procedures

Lectures on the outline of operation manuals, operation of maintenance equipment and various parameter change items, practical training in creating operation manuals, and presentation and instruction of the results.

D) Maintenance Manual

The trainees will be given an overview of maintenance manuals, lectures on major maintenance and inspection items required for maintenance equipment, practical training in preparing maintenance manuals, and presentation and instruction of the results.

8) Outputs of Soft Component

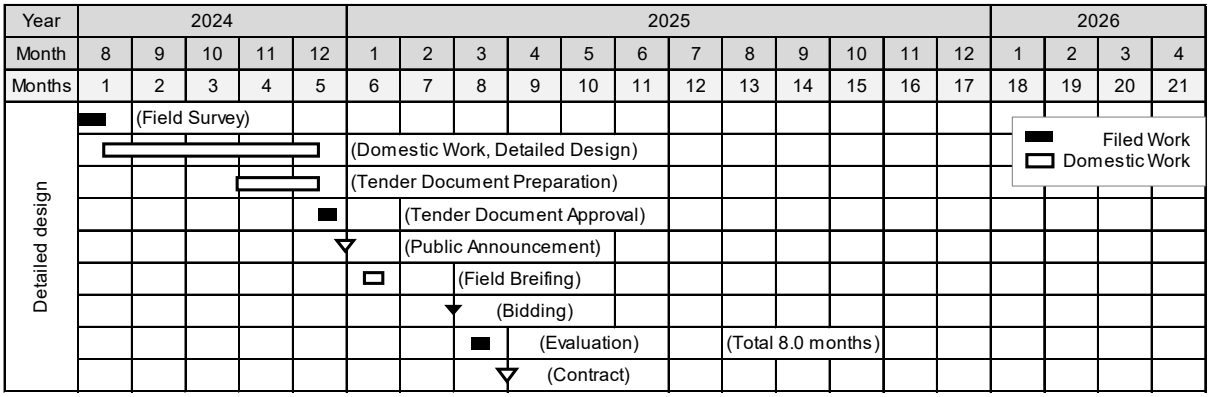
Outputs or deliverables of the Soft Component are as follows:

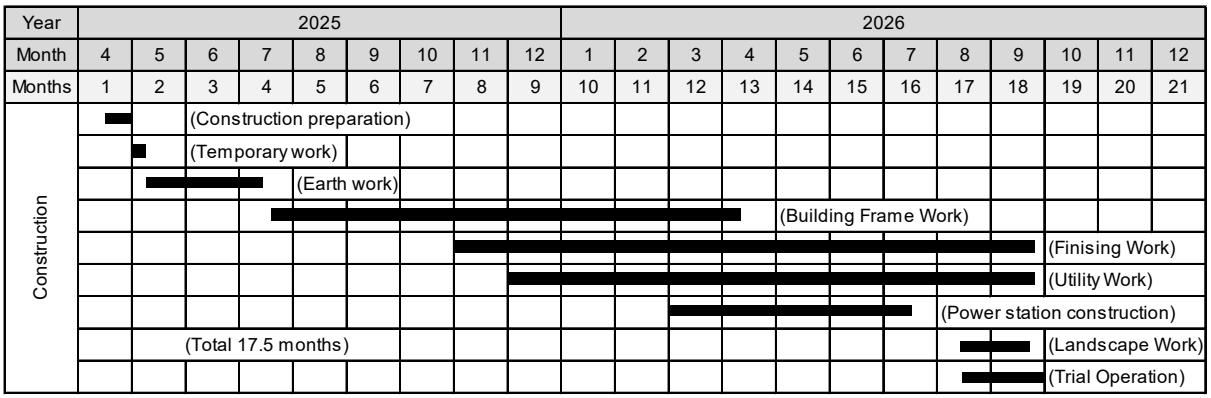
a) Deliverables to the Project Owner
   i. Final Report of Soft Component on the Completion of Activities
   ii. Textbooks

b) Deliverables to JICA
   i. Progress Report of Soft Component
      - Initial targets / results
      - Progress status of initially-planned inputs and activities
      - Results thus far (test results)
      - Project Owner's feedback
   ii. Completion Report of Soft Component
      - Outline of Project (name of Project, signing dates of E/N and G/A, maximum grant amount stipulated in E/N and G/A, amount of Consultant Agreement)
      - Outline of Soft Component (costs, background, planned objectives, expected results, planned activities, assistance providers and participants, implementation schedule (timing and M/M), actual activities conducted, actual outcomes produced in comparison with planned outcomes)
      - Remaining tasks and recommendations for sustaining and developing the effects to meet the objectives.
      - Attached documents (Soft Component implementation schedule, participants list, attendance record, list of outputs (document titles, names of authors, summaries))
      - Packet of reference materials (outputs (Completion Report to the Project Owner, O&M manuals produced, textbooks used, results of retention tests, etc.) video clips, photos, and newspaper articles.)

2.2.4.9 Implementation Schedule

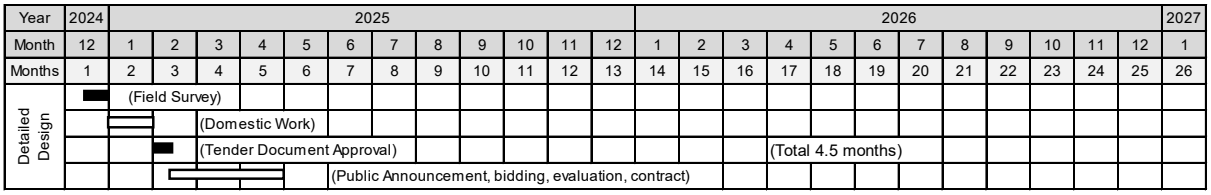
1) Construction Schedule

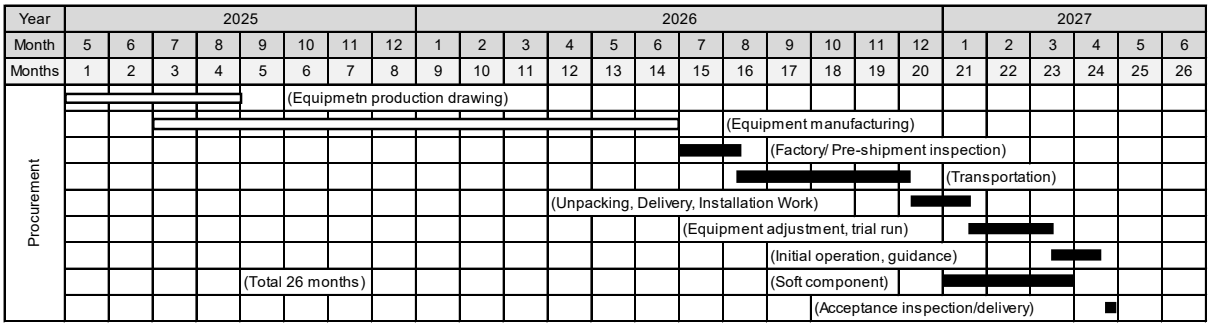




(Source: JICA Study Team)

2) Equipment Schedule





(Source: JICA Study Team)

2.3 Obligations of Recipient Country

2.3.1 General Obligation of Kyrgyz

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

The Government of Kyrgyz needs to promptly draw up an arrangement with a bank in Japan to open a special account to 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 Kyrgyz also needs to issue the Authorization to Pay (A/P) that is needed for the Japanese contractor to receive the payments. The Government of Kyrgyz 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 Material

The Government of Kyrgyz shall ensure that there will be exemption from customs duties and taxes, which may be imposed with respect to the import of the equipment and products.

(3) Entrance to the Site and Construction Permit

KAN shall obtain entrance and construction permits for the Contractor to execute the works.

(4) Removal of Existing Equipment for Installation of New Equipment

KAN shall remove the existing equipment, to secure necessary spaces for the installation of the new equipment.

(5) Taxes and Fiscal Levies for Procurement of Materials and Services

The Government of Kyrgyz 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

KAN shall provide, at its own expense, adequate spaces at the sites necessary for the Contractor to temporarily store materials, equipment, etc.

(7) Provision of Commercial Power at the Site

KAN shall provide commercial power for the procured equipment at each site for proper operation after taking-over the equipment.

(8) Improvement of Existing Main Power Distribution Network

KAN shall improve and provide the power distribution system and line to the sites at its own expense.

2.3.2 Responsibility of the Works to be Implemented by the Kyrgyz Side

Table- 2.29 shows the list of specific obligations of the Kyrgyz side at each airport.

Table- 2.29 Specific Obligations of the Kyrgyz Side

Site	Obligations of the Kyrgyz Side
Bishkek ACC	1) Provision and installation of new ACC/APP operation room and ATC training simulator room. 2) Procurement of new ATC console: Enroute console x2, Approach console x3, Operational supervisor console x1, Flight information service console x1. 3) Relocation of existing equipment, which are installed in the existing console such as direction finder monitor, and NAV-aid monitor and necessary radio. equipment/telephone set, to new consoles. 4) Removal, temporary installation, or dismantling of existing equipment for securing installation space of new equipment. 5) Procurement and installation of UPS and AVR for new ATC system.
Osh ACC	1) Land acquisition 2) Land rezoning 3) Construction site preparation (removal of existing grass, trees, and other obstacles) 4) Preparation of access roads to the construction site 5) Design for 10 kV cable laying, transformer installation and connection 6) Installation of 10 kV cables (with the possibility of laying overhead power lines) 7) Design for well drilling 8) Well drilling 9) Building Permit Application Procedures 10) Procurement and installation of new ATC console: Enroute console x1, Approach console x1, aerodrome control console x1. 11) Relocation of existing console including associated equipment to new ACC and control tower: Operational Supervisor console x1, Technical Supervisor console x1, Aerodrome Control console x1. 12) Relocation of existing ATC equipment and NAV-aid equipment to new ACC and control tower. 13) Procurement and installation of UPS and AVR for new ATC system. 14) Installation of a new fiber-optic terminal (Optical Node) to be connected to existing airport fiber-optic network and related cabling works.

2.4 Project Operation Plan

2.4.1 Construction Operation Plan

(1) Organizational Structure

The Osh branch of KAN has a wireless technology support center for flights consisting of 50 engineers, but there are no engineers to repair the building. However, Bishkek has a chief engineer for architecture and construction who manages KAN facilities throughout Kyrgyz. Repair and construction work is outsourced to external construction companies. All construction work is carried out under the supervision of the chief engineer for architecture and construction and the general engineer, who are fully responsible for ensuring the quality and compliance with deadlines of the construction work.

In this plan, the facility content will be within the technical range that can be handled by the current maintenance management personnel, and equipment with low maintenance costs will be selected. The plan aims to reduce running costs.

(2) Grade Setting

The control tower is a facility that passengers see first when planes take off and land, and it is one of the airport's related facilities. KAN has requested a building that represents the fusion of Japanese and Kyrgyz cultures. The control tower has a unique characteristic of being a tower-shaped building, and it inevitably becomes a symbol of the airport. However, since it is not a facility used by general passengers like a passenger terminal, it is necessary to plan while considering cost, maintenance management, and ease of construction so that it does not become too extravagant.

In terms of grade setting, it is important to emphasize maintenance management and ease of construction. We will plan to create a simple and beautiful building that is always well-maintained, using materials from Japan and Kyrgyzstan as a building that symbolizes the airport. Regarding the interior, since it is a business facility, we will consider the ease of work for the staff and set the grade to the same level as the local general business facility, except for the office where some controllers conduct voice communication, which requires soundproofing and is covered with tile carpet.

2.4.2 Equipment Operation Plan

(1) Organization for Operation and Maintenance Services

1) Organizational Structure

KAN is an ATC service provider that conducts ATC at each airport and enroute control in Flight Information Region of the Kyrgyz. They own ATC equipment such as radar, air-ground communication equipment for voice communication with aircraft, navigational aid equipment such as VOR/DME, NDB, and weather observation equipment. They are responsible for the installation, operation, and maintenance of these equipment.

Table- 2.30 shows the operation and maintenance personnel including air traffic controllers at each KAN airport.

Table- 2.30 The number of operation and maintenance staff at each airport

Airport	ATC Controller	Maintenance Engineer/Technician	MET Observation staff	Remarks
Manas Airport	74	76	35	
Kazarman Airport	2	1	2	
Karakol Airport	2	1	1	
Issyk- Kul Airport	4	9	7	
Naryn Airport	2	1	2	
Talas Airport	1	1	2	
Osh Airport	47	50	27	
Jalal – Abad Airport	1	2	2	
Batken Airport	2	3	2	
Caravan Airport	1	2	1	
Isfana Airport	2	2	2	
Total	138	148	83	

(Source: hearing from KAN)

The classification and number of personnel for equipment operation and maintenance at Manas and Osh airports, which are main airports in the Kyrgyz, are shown in Table- 2.31 and Table- 2.32 respectively.

Table- 2.31 Manas Airport Operation and Maintenance Staff

Category	Chief Engineer	Shift Engineer	Full-time Engineer	Operation Engineer	Elec. & Mech. Engineer	Shift per day
Supervisor group	2	9		—		5 (day & night)
Navigation (ILS, NDB)	1	8		4		4 (day & night)
Communication (VHF, HF, AFTN)	1	8		8		4 (day & night)
Surveillance (Radar, WAM)	1	8		6		4 (day & night)
Building Facility	1	8		11		4 (day & night)

(Source: hearing from KAN)

Table- 2.32 Osh Airport Operation and Maintenance Staff

Category	Chief Engineer	Shift Engineer	Full-time Engineer	Operation Engineer	Elec. & Mech. Engineer	Shift per day
Supervisor group	1	7		4		5 (day & night)
Navigation (ILS, NDB)	1	2		4		4 (day & night)
Communication (VHF, HF, AFTN)	1	2		6		4 (day & night)
Surveillance (Radar, WAM)	1	4		4		4 (day & night)
Building Facility	1	4		8		4 (day & night)

(Source: hearing from KAN)

Operation and maintenance personnel for ATC and navigational aid equipment are basically required to have graduated from a technical school or a technical university. They are placed in each airport. Replenishment of personnel is conducted irregularly and only when there is a vacancy. ATC equipment and navigational aid equipment are operated 24 hours a day, so they are maintained and managed in four shifts: day shift, night shift, and holiday. Regarding the technical level of operation and maintenance personnel, each personnel receive qualification training and operational/technical training on a regular basis (about 5 years) in Kazakhstan and Russia, for improving their knowledge and meeting international standards in terms of technology. In addition, operational and maintenance personnel accumulate experience through OJT and learn how to deal with failures and repair methods in each airport site.

2) Procedure for Operation and Maintenance Services

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

- 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 above procedures, maintenance services have been conducted by five steps periodical maintenance services following international standard. Suitable time intervals for maintenance services are shown in the Table- 2.33.

Table- 2.33 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 the standard parameters by flight calibration and field inspection.

(Source: hearing from KAN)

2.5 Project Cost estimation

2.5.1 Initial Cost Estimation

(1) Kyrgyz Side

1) Preparation for ACC/Tower sites in the two airports

It is estimated that the total preparation cost will be 132.24 million KGS (approximately 213 million JPY) for site clearance and for the installation of the new ATC Consoles and ancillary facilities, including water supply and toilet, and improvement power supply in the sites of the two airports.

Table- 2.34 Initial Cost Estimation (Kyrgyz Side)

Items		Description	Approximate project cost (million KGS)
Facility	Osh ACC	Land acquisition	30.48
		Access roads	7.44
		Power supply	2.54
		Water Well	7.02
ATC System	Bishkek ACC	Procurement and installation of new ATC console	56.89
		Relocation of existing equipment	9.97
		Power supply equipment procurement and installation	5.95
		Removal of existing equipment	2.97
	Osh ACC	Procurement and installation of new ATC console	Included in Bishkek ACC cost
		Relocation of existing console including associated equipment	Included in Bishkek ACC cost
		Relocation of existing ATC equipment	Included in Bishkek ACC cost
		Power supply equipment procurement and installation	Included in Bishkek ACC cost
		Installation of a new fiber-optic terminal (Optical Node)	8.98
Total			132.24

2) Banking Commission

It is estimated that the cost of opening a bank account will be 1.39 million KGS (approximately 2.245 million JPY), which is necessary for the remittance of the Japanese grant aid.

(2) Condition for the Cost Estimates

1) Cost Estimate Month

The applied cost estimate month for this project is August 2023, since the preparatory onsite survey was implemented from 14th August 2023 to 30th August 2023.

2) Exchange Rate

The average exchange rate ((a) and (b)) is applied for a period of three months, from 1 May 2023 to 31 July 2023. In this case, (a) is calculated using the TTS (Telegraphic Transfer Selling rate) rate of Mitsubishi UFJ Bank, and (b) is taken from the Reference Exchange Rate of Central Bank of Kyrgyz.

(a) USD 1 = JPY 141.03

(b) KGS 1 = JPY 1.6112

2.5.2 Operation and Maintenance Cost

The budget for operation/maintenance/repair of KAN consists of salaries, equipment maintenance and repair, procurement of spare parts and subcontract costs. Annual budget of KAN is systematically formulated and distributed to each of the departments/sections. In case replacement of an existing equipment or installation of new equipment becomes necessary, a new budget will be requested and appropriated separately from the annual budget. Therefore, it can be expected that the budget necessary to properly operate/maintain/repair the equipment installed under the Project will be secured.

Table- 2.35 Budget for Operation and Maintenance Services of Air Navigation Safety Equipment (KAN)

Item	Outline Budget (million KGS)
Personnel expenses Salary, Overtime, Welfare	411.39
Maintenance and repair cost	28.88
Equipment Procurement	148.80
Outsource service charge. (Flight Inspection, etc.)	10.50
Telephone, Communication fee	38.68
Water & Electricity	27.74
Quest visiting, participating seminar	31.86
Others	60.57
Total of Annual budget in FY 2021	758.42

(Source: hearing from KAN)

3 PROJECT EVALUATION

3 PROJECT EVALUATION

3.1 Preconditions

In implementing this project, the following items need to be carried out by the KAN.

- Acquisition of land for the project site, tax exemption procedures, and other items to be borne by the projector prior to the start of construction without delay.
- Clearing of the project site.
- Drawing in water and electricity for construction to the project site.
- Construction of access roads to the project site.
- Conduct necessary discussions with the City of Osh to obtain construction permits, as well as with the Building Permit Commissioner, and obtain construction permits prior to the start of construction work.
- Prompt and reliable execution of duty-free and customs clearance procedures for imported materials and equipment to be procured for the project.
- Procurement of the control console to be installed in the new control tower, as well as reliable relocation of the existing equipment in the current control tower that is to be relocated, and implementation of operational verification testing after relocation.

3.2 Necessary Input by the Recipient Country

It is necessary for KAN who mainly manage these airports to tackle the following important matters for the Project to progress and provide satisfactory results:

(1) Consistent Maintenance Expenditure

The maintenance costs are paid by KAN budget. Even though the maintenance costs are deemed to increase to cover the new equipment, the magnitude of expenditure is expected to be minimal. It is deemed necessary for KAN to consistently secure a maintenance budget.

(2) Improvement of Understanding and Ability on Safety and Efficiency in International Airport

International Civil Aviation Organization (ICAO) is developing international roadmap of air traffic management operations and systems. Furthermore, ICAO considers developing the guidance material of minimum air traffic management systems which are required to guarantee aircraft operational safety.

According to these international trends, it is necessary for Kyrgyz to improvement the safety of aircraft operations and the ability of aircraft surveillance in Manas, Osh and Issyk-Kul International Airport, which air transportation demands increase. Moreover, the improvement of air traffic operational efficiency is key factor for maximizing the airport capacity and increasing the usability for passengers. The improvement of safety and efficiency by KAN, which are correspond with international trends, realize effective utilization of facilities, which are provided by this Project.

(3) Human Resource Development for Maintenance

ICAO proceeds to establish international standard of Air Traffic Safety Electronics Personnel (ATSEP) for achieving appropriate maintenance of air navigations systems. This standard includes programs for training of ATSEP and maintaining necessary skill of maintenance for air navigation systems. Based on these trends of international standards, it is necessary factors for improving of the safety of aircraft operations that learning the method for maintaining air navigation systems appropriately, avoiding occurrence of system troubles and faults and resolving those issues immediately.

As per the above mentioned, it is deemed necessary for KAN to consistently proceed skill improvement program of maintenance by ATSEP.

3.3 Important Assumptions

For that this Project to progress and continue to provide satisfactory results, important assumptions are as follows:

- State Civil Aviation Agency under The Cabinet of Ministers of the Kyrgyz Republic that is superior organization of KAN understand the Project.

3.4 Project Evaluation

3.4.1 Relevance

(1) Appropriateness of the Subject

This project will construct facilities and procure ATC equipment at Osh International Airport to improve the safety of aircraft operations and meet future air cargo demand. The section, scope, and relevance for the project are as follows.

Table- 3.1 Appropriateness of the Subject

Section	Request Scope	Relevance
Facilities	New Air Traffic Control Tower and ACC	The control tower at Osh International Airport has been deteriorating for about 50 years since its construction, and the low height of the tower makes it impossible to see aircraft at the end of the runway, making it difficult to ensure the safety of aircraft operations. Securing the field of view of airfield controllers through the construction of a control tower that meets safety standards and the construction of an ACC that is linked to airfield control in the same robust building are the minimum scale and scope to maintain safety and reliability as an international airport. Therefore, the content of the plan for the installation of the tower and ACC is considered to be appropriate.
Equipment	ATC Equipment	The ATC systems used at the three international airports - Manas, Osh, and Issyk-Kul International - have been in operation for about 15 years and are beyond the manufacturer's warranty period. Therefore, as the system ages, reliability and efficiency issues may arise. In addition, if the ATC system were to be shut down due to a disaster or failure, not only would the manufacturer not be able to provide support, but the risk of being unable to control the airways for an extended period of time could affect the continuity of operations. For this reason, the maintenance of a multi-sensor information processing system, an ATC training simulator, and an ATC communication control system is of minimum project scope. In addition, since airfield control operations conducted visually from the control tower cannot be replaced from Manas Airport, the maintenance of new ATC equipment (airfield control tables, control and communication control equipment, and VHF air-to-air communication equipment) to maintain the functions necessary for airfield control operations when switching operations to the new control tower is of minimum scale and scope. Therefore, it is necessary to plan for the maintenance of ATC equipment. Therefore, the contents of the maintenance plan for ATC equipment are considered reasonable.

(2) The Subject of Benefit

The direct beneficiaries of the construction of the tower, ACC, and upgrading of ATC equipment will support KAN's ATC operations and contribute to improving the safety not only of aircraft, air passengers, and air cargo using Manas, Osh, and Issyk-Kul International Airports, but also of aircraft passing over Kyrgyz FIR.

Indirectly, the project will benefit all Kyrgyz citizens in terms of social and economic benefits by facilitating trade and smooth human exchange with overseas countries through air logistics.

(3) Project Objective

The goal of this project is to improve the safety and handling capacity of aircraft operations at Osh International Airport, Manas International Airport, and Issyk-Kul International Airport in Kyrgyz by replacing the control tower and updating the ATC system at these airports, and to contribute to the strengthening of regional connectivity and the economic development of southern Kyrgyz by reducing the dependence on land transport via Russia or China and enhancing the functionality of the Kyrgyz air sector.

(4) Consistency with Medium- and Long-Term Objectives

In the “Civil Aviation Development Concept of the Kyrgyz Republic (2021-2025)”, the State Civil Aviation Agency (SCAA) identifies the problems in the civil aviation sector in the Kyrgyz and presents an approach to solve them. The approach consists of nine items in order of priority, and the objectives and measures to achieve them are described. Among them are “Improving the safety of domestic airlines”, “Improvement ATC services” and “Development airport infrastructure in Kyrgyz”.

The Project will be able to contribute to achieve medium- and long-term objectives in Kyrgyz through realizing the improvement the safety and efficiency of aircraft operations, the correspondence to increasing demand of domestic passengers and the modernization of ATC systems.

3.4.2 Effectiveness

(1) Quantitative Effectiveness

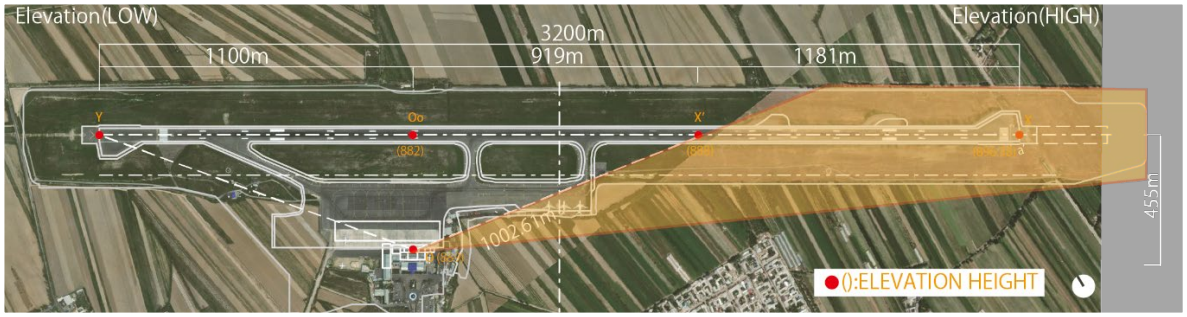
The quantitative evaluation of the construction of the control tower and the Installation of ATC Equipment was conducted as follows. The target value of the quantitative effect expected from the project implementation is after the completion of the project. Based on the technical studies conducted during this study, the quantitative effects of the project implementation are assumed as shown in Table-3.3.

Table- 3.2 Expected Effects and Outcome Indicators

Input / Act	Expected Output	Expected Outcome
Construction of New Air Traffic Control Tower	Aerodrome control that meets ICAO standards.	It can ensure airport safety in line with ICAO standards.
Installation of ATC Equipment	Increase of Aircraft track capacity.	Safety of aircraft operations and aircraft track capacity will be improved to meet increased aviation demand.

Table- 3.3 Quantitative Effectiveness

Indicator	Base Value (Before implementation)	Target Value (After implementation)
Percentage of runway sections visible at Osh Airport (%)	63.1	100
Number of aircraft that the ATC system can handle simultaneously.	400	2000



The orange area is the area where visibility is difficult. Percentage of runway length that is currently visible: (1,100 + 919) / 3,200 = 63.1%, Percentage of improvement due to construction of control tower：100 - 63.1 = 36.9%

(Source: JICA study team)

Figure- 3.1 Runway visibility range

(2) Qualitative Effectiveness

The qualitative evaluation of the implementation of this project is as follows.

- Improved visibility from the control tower at Osh International Airport and integration of the control tower and ACC will improve the safety of aircraft operations at Osh International Airport and the efficiency of ATC operations.
- Upgrading the ATC systems at Osh, Manas, and Issyk-Kul International Airports will improve the safety of aircraft operations and aircraft handling capacity over Kyrgyzstan.
- Improved safety of aircraft operations and aircraft handling capacity will enhance regional connectivity and stimulate human and logistical flows.