TECHNICAL EDUCATION AND
VOCATIONAL TRAINING AUTHORITY
GOVERNMENT OF PUNJAB PROVINCE

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL & ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE
ISLAMIC REPUBLIC PAKISTAN

MAY 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

SYSTEM SCIENCE CONSULTANTS INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to System Science Consultants Inc.

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

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

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

May, 2011

Nobuko KAYASHIMA
Director General
Human Development Department
Japan International Cooperation Agency

SUMMARY

Summary

(1) Country profile

The Islamic Republic of Pakistan (hereunder referred to as "Pakistan) has a land mass of 796,000 square kilometers and a population of approximately 170 million. Lahore city, where the Project area is located, is situated in northeastern Pakistan and is the capital of Punjab province. Elevation is around 215m and the city is located roughly 300km southeast of the Pakistan national capital of Islamabad. Lahore city lies on alluvial plain within the Lavi river basin. Topography tilts very slightly to the southwest. There is a marked difference in temperatures between summer and winter, with maximum temperature reaching 42ºC in May~July and dropping to around 3ºC in December~January. Annual rainfall is approx. 650mm, 60% of which falls in July and August. Rainfall tends to be intense when it occurs, with cases where intensive heavy rainfall causes the Lavi river to overflow inflicting damage including urban flooding.

Pakistan is a developing country with a per capita GNI of around US$ 1,046 (fiscal 2008/09). Poverty rate is 22.3% (fiscal 2005/06). There has been a large demand for development inside Pakistan, with the economic structure of the country relying greatly on foreign assistance and investment. Sector-wise composition of the national GDP shifted from primary industry 45.6%, secondary industry 12.9% and tertiary industry 41.5% in fiscal 1959/60 to a makeup of primary industry 19.6%, secondary industry 26.8% and tertiary industry 53.6% in fiscal 2007/08. The proportion of GDP generated by primary industrial production has thus dropped while that for secondary industrial production has increased over two-fold during this time span. This indicates that stable growth in the secondary industrial sector is highly important to overall growth of the national economy.

(2) Project background, evolution and overview

Aiming at stable socio-economic growth, the Pakistan government has formulated a national development plan "Vision 2030" with 2030 as the target year for achieving comprehensive advances in industrialization. This strategic vision calls for increasing the GDP share by the manufacturing sector from 18% to 30%, and increasing average annual personal income from US$ 742 to US$ 3000 dollars. Furthermore, the Pakistan government positions restructuring of the technical education and vocational training sector (Technical and Vocational Education and Training, hereunder referred to as "TEVT") as a means of raising a workforce aimed at achieving Vision 2030, alleviating poverty and sustaining economic growth. In line with this, the National Vocational and Technical Education Commission (NAVTEC) was established in 2006 targeting policy planning, guaranteed training quality, coordination between agencies and institutions in the educational and training sector, and funding support at the federal level. A subsequent Skilling Pakistan (2008~2012) program (current nomenclature changed to "Skills Strategy 2009~2013") was launched aimed at restructuring the national level TVET sector, and includes 19 major strategic programs.

This Skills Strategy encompasses three primary initiatives: ① training technical personnel able to

respond to industrial sector needs, ② improving access to education, vocational training and employment opportunities, and ③ ensuring the quality of education and training content. It also includes a specific imitative to create advanced model schools (Centers of Excellence, COE) to strengthen educational and vocational training institute management. In addition, Technical Education and Vocational Training Authorities (TEVTA) have been established at the province level, and are engaged in programs to improve technical and vocational training.

Promotion of the above described strategies has already served as a conduit for creating approximately 11,000,000 new jobs within the manufacturing, construction and other industrial sectors over the 10 year period from 1997 to 2007. Nevertheless, the levels of both (i) facility and equipment availability at learning centers to effectively implement technical education and vocational training as well as (ii) the quality of practical education/training content are deemed insufficient to sustain robust growth and modernization of the manufacturing sector.

Particularly within respective industrial sectors, in addition to skilled labor, there is an urgent need for intermediate level technical personnel capable of acting as a go-between for on-site works and top tier management to fully meet sector requirements.

Against this background of need for improvement, the Punjab province TEVTA has embarked upon an initiative to establish a COE as described above. In line with this, the Government College of Technology Railway Road Lahore (a two-year technical college hereunder referred to as the "GCT Railway College"), and which at present is the only TVET institute under the jurisdiction of the Punjab province TEVTA that has an instructor training unit, has been selected as a candidate for the first advanced model school in the country to be established.

The GCT Railway College comprises four departments: Mechanical Department, Auto and Diesel Technology Department, Architectural Department, and Refrigeration and Air Conditioning Technology Department. Nevertheless, industrial sectors in Punjab province have a particularly high need for middle level technical personnel in mechanical and architectural disciplines, and in response to this Japan is currently carrying out a technical cooperation project (Project for Improvement of Technical Education; hereunder referred to as "Technical Cooperation") extending from December 2008 to November 2013. This Technical Cooperation is aimed at strengthening integration among the curricula improvement program, instructor training and requirements of respective industrial sectors necessary to upgrade the GCT Railway College to COE status. At the same time the Architectural Department at GCT Railway College has begun to accept female students as of September 2010.

In this context, the Pakistan government has determined to strengthen the Mechanical Department and Architectural Department of the college, further building on the achievements of the Technical Cooperation already in progress. To this end, the Pakistan government requested the Japanese government to implement a project to establish appropriate facilities and equipment within the college's Mechanical Department and Architectural Department.

(3) Overview of Study results and Project components

Upon receiving the above request, the Japanese government decided to carry out a cooperation preparatory study for the Project. The study was commissioned to the Japan International Cooperation Agency (JICA), a Japanese independent administrative corporation. A study team was subsequently dispatched to Pakistan from September 19 to October 17, 2011, and additionally from February 13 to February 23, 2011. The study team held discussions with concerned officials and personnel of the Punjab province TEVTA and other involved agencies. Site conditions within the Project area were surveyed and necessary data were collected. Following this, a basic Project approach was collated in line with the results of field survey.

The original Project request from the Pakistan government envisioned the GCT Railway College in Lahore, Punjab province as the Project area. An Architectural Department classroom building and Mechanical Department laboratory building were to be constructed within the main campus, and procured equipment was to include 197 items for the Mechanical Department and 17 items for the Architectural Department to be appropriately installed within both existing buildings and the buildings to be newly constructed under the Project.

Afterwards and before field survey under this Study, preliminary adjustment examination indicated that there was not space available for new building construction within the main campus. Accordingly, the envisioned plan was changed such that the Architectural Department classroom building would be built within the college's Jubilee campus and construction of a Mechanical Department laboratory building would be abandoned altogether. Procurement of equipment would be aimed as originally requested at the Mechanical Department and the Architectural Department; however, the content of this procurement was greatly changed in terms of equipment types and quantities to best respond to the requirements of the new revised curricula under the Project. Final request equipment comprised 277 items for the Mechanical Department and 10 items for the Architectural Department.

With regard to the above described request facilities and equipment, in line with findings of field survey based on facility design approach and equipment selection approach as agreed to with the Pakistan government side, it was decided to construct the Architectural Department classroom building within the Jubilee campus. Factors affecting this decision included the need to appropriately address requirements for female students (acceptance of women into the college began from September 2010), as well as study on the number of classes per academic year, number of students per class, curricula content and various Project site conditions, etc. With regard to Project equipment, in addition to including items in line with the agreed equipment selection approach, factors such as space for equipment installation as well as the possibility of continued use of existing equipment were examined, and it was ultimately decided to include under the Project the procurement of 136 items for the Mechanical Department and 5 items for the Architectural Department.

Concerning the scale and components of the building to be constructed under the Project, reference was made to building codes for Lahore city, school building construction planning by the Project

executing agency TEVTA, design content and utilization status for similar school buildings in Pakistan including the existing GCT Railway College, in determining necessary building components, as well as respective room floor space and specifications.

With regard to equipment planning under the Project, the minimum necessary types and quantities are to be provided for practical training under the new curricula for the Mechanical Department and the Architectural Department. In the case where existing equipment can still be used, these are to be subtracted from the calculated necessary design equipment quantities. Equipment quantities under the Project are in line with the following basic approach.

i) With regard to equipment that is basic to practical training and is intended for hands on operation by students during class, around one unit per two students is to be provided. For example, in the case of lathes for practical training in basic metal working, 20 units (including existing units that can still be used) per classroom are to be provided, equivalent to one unit per two students.
ii) In the case of equipment that, while being basic to practical training, can be mastered in terms of operation without intensive hands on schooling, around 3 units per classroom are to be provided. For example in the case of machines for metal plate bending, 3 units per classroom are to be provided equivalent to one unit per 13 students.
iii) With regard to equipment for which, although demand for practical training may be high within industrial sectors as well as under the new curricula, is relatively cost-ineffective to procure in the case of a Project such as this one, a single unit per classroom is to be provided. For example, in the case of the hob tooth cutter, one unit per classroom is to be provided equivalent to one unit per 40 students.

Level of equipment sophistication and complexity is to be on a par with that for industrial high schools in Japan. Priority is to be given to use for practical training. Excessively sophisticated equipment will not be adopted, and preference as well will be given to equipment that can be easily maintained and repaired locally (equipment with local after-procurement service availability). Equipment for the Mechanical Department is to be directly installed in existing department classrooms. Equipment for the Architectural Department, on the other hand, is to be installed within the department classroom building to be newly constructed under the Project.

The following building will be constructed and the following equipment procured for the GCT Railway College under the Project.

1) Building components

・Structure : RC rigid frame; brick masonry walls
・No. of floors / floor space : Partial basement, three above-ground floors, partial roof-top component

Floor	Floor space
・Rooftop	76.5 m^2
・Third floor	644.0 m^2
・Second floor	644.0 m^2
・First floor	634.0 m^2
・Basement	126.5 m^2
(Total floor space)	2,125.0 m^2

・Facilities : Electrical facilities, backup generator, water supply/drain and sanitary facilities, air conditioning/ventilation facilities, fire extinguishing equipment, etc.

Building scale and overview

Room category	No. of rooms	Main function	Design no. of users	Design floor space (m^2) , width(m)
Learning/training department				
Design drawing room	2	Practical design drawing training utilizing drafting boards.	45 students＋instructor	103
CAD laboratory	2	Practical design drawing training using CAD.	Same as above	103
Multipurpose laboratory	1	Material testing; simulated practice in producing RC.	Same as above	180
Standard training room	2	Seated practical training.	Same as above	51
Server/printing room	2	PC server, printer, storage space.	2～3	8
Drawing room storage	1	Storage for design drawing equipment, and modeling materials.	To be determined on the basis of quantity of materials and equipment	25
Multipurpose laboratory equipment storage and preparation room	1	Storage for practical training equipment; lockers	Same as above	25
Multipurpose laboratory material storage	4	Storage for practical training materials in 4 partitioned areas.	Same as above	6
Survey / measurement equipment storage	1	Storage for survey / measurement equipment.	Same as above	30
Administrative department				
Instructors' room	1	This is to be a single large room, equipped with desks and chairs, with private consultation corners and visitor corners that can be set off be set off by movable partitions.	14～20	103
Administrative office	1	Reception; security (2 persons at all times) (3 shifts per day).	2	12
Administrative department rooftop storage	1	Storage for administrative documents and materials.	To be determined on the basis of quantity of materials and equipment	
Female student support department				
Common room	1	Room for female student self study and relaxation (capable of accommodating half the female enrollment at one time).	96/2=48	51
Locker room	1	Lockers to secure hand -carried articles (to accommodate all female students, both for morning classes and afternoon classes).	96×2=192 nos.	12

Resting room	1	Rest space (1person＋1 caregiver staff).	2	8
2nd floor women's lavatory	1	Women only lavatory (for use by both female students and female staff).	5 closet bowls	
Common facilities				
Entrance hall	1set	Common entrance/exit way.	—	Width 5.5m
Hallways	1set	Instructor and student movement flow lines.	—	Width 2.3m
Stairways	2	2 stairway locations are necessary to connect floors as well as provide escaped routes in case of emergency.	—	Width 1.4/1.5m
Multipurpose room	1	For relaxation; displays; meetings, etc.	20～30	50
1st floor men's' lavatory	1	For visitors and staff.	1 person use	—
1st floor women's' lavatory	1	Same as above	Same as above	—
1st floor multipurpose lavatory	1	Wheelchair enabled.	Same as above	—
2nd floor instructors' lavatory (men)	1	For instructors/staff.	2 person use	—
3rd floor male students' lavatory	1	For male students.	4 closet bowls, 4 urinals	—
Kitchenette (1st floor, 2nd floor)	2	Hot water for tea service (for staff and visitors).	1 person use	—
Appurtenant facilities				
Electrical panel room (generator room)	1	Electrical distribution panel, generator.	To be determined on the bases of equipment layout	—
Water receiving tank (pump room)	1	Water receiving tank, pump.	Same as above	—
Elevated water tank (rooftop)	1set	Elevated water tank.	Same as above	—
Water treatment tank	1set	Integrated treatment tank	—	—
Outdoor facilities	1set	Around building and access road.	To be determined on the basis of distance to adjacent structures, vehicle passage width, etc.	—

2) Equipment content

Overview of main equipment

Practical training equipment for Mechanical Department			
Category	Equipment name	Use	Qty.
Basic metal cutting work	Lathe Machine	Round bar, tapered shaft, screw thread cutting works	9 units
Metal cutting work at the applied level	Hobbing Machine	Gear cutting by hob cutting blade	1 unit
	Universal Milling Machine	Face milling, groove cutting along vertical axis	2 units
	Surface Grinder	Surface grinding using whetstone	1 unit
Precision measuring	Universal Gear Inspection Equipment	Checking dimensions, shape, etc. of fabricated gears	1 unit
Welding	TIG Welding Machine	Tungsten electrode (tungsten inert gas) welding	2 units
	Gas Mani Fold System	Distribution and composition of welding gas	1 unit
Metal casting	Tilting Crucible Furnace	Extraction of molten steel by tilting furnace	1 unit
	Power Riddle Machine	Compaction of casting sand by vibro-compression	1 unit

Metal working	Manual Sheet Bending Machine	Manual bending works by anchoring steel plate in L-type holder	2 units
	Manual Sheet Shearing Machine	Manual steel sheet cutting	2 units
Material testing	Brinnell Hardness Testing Machine	Testing hardness of fabricated materials	1 unit
	Torsion Testing Machine	Testing shear resistance and elasticity of testing specimen	1 unit
Fluidic testing	Fluid Friction Apparatus	Measuring fluid frictional force	2 units
	Centrifugal Pump Apparatus	Experiments using centrifugal pump	1 unit
High level working/ finishing (CNC training)	Vertical Machining Center	Training of milling a vertical pluriaxis	1 unit
	Turning Center	Training in multi-functional machinery with tooling interchange capability by NC control	1 unit
	CNC Wire Cut	Training of wire discharge cutting by CNC	1 unit
Fluidic experimentation	Air Compressor Testing Machine	Various experiments using air compressor	1 unit
	Gas Turbine Testing Machine	Operational experiments using gas turbine	1 unit
Electro-mechanical	Electrical Machine Trainer	Test training of electrical motors and power generators	2 units
	Industrial Electronics Trainer	Understanding electronic circuitry used in factories	5 units

Practical training equipment for Architectural Department			
Category	Equipment name	Use	Qty.
Basic building material testing equipment	Simple pressure resistance tester	Testing compression strength of concrete specimens	2 units
	Standard concrete testing set	Training in concrete composition and creating concrete specimens	1 set
	Hand pallet track	Transporting heavy objects fabricated during building material training	2 sets
	Pallet	Base for loading heavy objects transported on the above described track	8 sets

(4) Project implementation period and approximate Project cost

Required period for Project implementation is estimated at 22 months. Preliminary estimate of Project cost to be borne by the Pakistan government is JPY 22 million.

The building, facilities and equipment to be established under the Project at the GCT Railway College will contribute greatly to efforts in upgrading the quality of technical education and vocational training responsive to requirements in industrial sectors, which is a major theme of national development strategy by the Pakistan government. Furthermore, human infrastructure as well as physical infrastructure know-how garnered by TEVTA in the process of upgrading the GCT Railway College to COE level, coupled with experience at the college in accepting female students, have practical implications in terms of technology transfer both within and outside Punjab province. This in turn is anticipated to greatly contribute to training technical personnel, as well as providing employment opportunities to women, both factors essential in alleviating poverty and promoting sustained economic growth under the national development strategy.

The Punjab province TEVTA, the executing agency for the Project, has ample experience and achievement in the areas of development and operation of vocational training related schools within the province, and therefore no problems are anticipated with regard to operation and maintenance capabilities.

Current school staff at the GCT Railway College totals approx. 370 persons. Required number of new staff with implementation of the Project will be around 19 persons (including security personnel), which is equivalent to an increase of only about 5% over the presently deployed school staff. Furthermore, because the building and equipment under the Project represent an extension of the existing GCT Railway College, the present building and equipment operational and maintenance setup can be applied. In addition, necessary budget allocation measures are being taken be the Punjab province TEVTA to support the increase in school staff, and the operation and maintenance of building and equipment to be newly established by the Project. It is accordingly concluded that no problems of note in Project implementation are anticipated.

(5) Project evaluation

The following impacts can be expected as a result of Project implementation.

(Quantitative impacts)

- The current number of students per classroom in the Architectural Department will be reduced from approximately 53~79 persons at present to around 40~45 students with Project implementation.
- The number of lathes, basic practical training equipment within the Mechanical Department, will be increased from one unit per every 3 students to one unit per every 2 students.

(Qualitative impacts)

- Establishment of building and equipment to enable implementation of the revised and improved curricula will upgrade educational quality.

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Abbreviations

Abbreviation	Full Spelling
E/N	Exchange of Notes
G/A	Grant Agreement
GDP	Gross Domestic Product
GNP	Gross National Product
JICA	Japan International Cooperation Agency
TVET	Technical and Vocational Education and Training
NAVTEC	National Vocational and Technical Education Commission
TEVTA	Technical Education and Vocational Training Authority
COE	Center of Excellence
DAE	Diploma Associate of Engineering
JIS	Japanese Industrial Standard
EU	European Union
B/A	Banking Arrangement
A/P	Authorization to Pay
PQ	Pre-qualification
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CNC	Computerized Numerical Control
AVR	Automatic Voltage Regulator
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background and overview of request for grant-aid cooperation

Aiming at stable socio-economic growth, the government of the Islamic Republic of Pakistan (hereunder referred to as "Pakistan") has formulated a national development plan "Vision 2030" with 2030 as the target year for achieving comprehensive advances in industrialization. This strategic vision calls for increasing the GDP share by the manufacturing sector from 18% to 30%, and increasing average annual personal income from US$ 742 to US$ 3000 dollars. Furthermore, the Technical and Vocational Education and Training (TVET) of the Pakistan government has prioritized restructuring of the technical and vocational training sector as a means to alleviate poverty and train a work force that can effectively sustain economic growth. In line with this, the National Vocational and Technical Education Commission (NAVTEC) was established in 2006 aiming at federal government policy planning, a level of guaranteed training quality, coordination between agencies and institutions in the educational and training sector, as well as funding support. A subsequent Skilled Pakistan (2008~2012) program (current nomenclature modified to Skills Strategy 2009~2013) was launched aimed at restructuring the national level TVET sector, including 19 major strategic initiatives.

Skills Strategy encompasses three primary initiatives: ①training technical personnel able to respond to industrial sector needs, ②improving access to education, vocational training opportunities as well as employment opportunities, and ③guaranteeing an appropriate quality of course content for education and vocational training. It also includes a specific initiative to create advanced model schools (Centers of Excellence, COE) to strengthen educational and vocational training institute management. In addition, Technical Education and Vocational Training Authorities (TEVTA) have been established at the province level, and are engaged in programs to improve technical and vocational training.

Promotion of the above described strategies has already served as a conduit for creating approximately 11,000,000 new jobs within the manufacturing, construction and other industrial sectors over the 10 year period from 1997 to 2007. Nevertheless, the levels of both (i) facility and equipment availability at learning centers to effectively implement technical education and vocational training as well as (ii) the quality of practical education/training content are deemed insufficient to sustain robust growth and modernization of the manufacturing sector.

Particularly within respective industrial sectors, in addition to skilled labor, there is an urgent need for intermediate level technical personnel capable of acting as a go-between for on-site works and top tier management to fully meet sector requirements.

Against this background, the Japanese government received a request from the Pakistan government for assistance within the TVET sector. Subsequently, two Projects formulation studies and in July 2008 a preliminary study (aimed as a basis for formulating the current detailed design) were carried out to narrow down the Project region and target school. The target region Punjab was selected from among the candidate provinces on the basis of industrial activity within the province, linkage between

technical schools and business enterprises, as well as the status of institutional restructuring, etc. With regard to target school, the GCT Railway College located in central-urban Lahore city was selected from the standpoint of its promising capacity to serve as a model school under the COE program.

Further to the above studies, the Japanese government is currently carrying out a technical cooperation project (Project for Improvement of Technical Education; hereunder referred to as "Technical Cooperation") extending for a five year period from December 2008 to November 2013. This initiative is aimed at revising curricula, training instructors and improving links with industrial sectors, appropriate to establishing the GCT Railway College as a COE.

On the other hand, however, the status of facilities and equipment at the college is not sufficient at present to effectively implement high quality education in line with the envisioned new curricula, etc. In response to the request from the Pakistan government based on the above described Technical Cooperation, the Japanese government determined in the case of this Project to carry out a grant-aid cooperation preparatory study.

The content of the request from the Pakistan government was modified several times prior to starting field survey. A summary of the original request content is indicated below.

Facilities:	Classroom building for the Architectural Department (1,580m^2, 4 floors); laboratory building for the Mechanical Department (1,657m^2, 1 floor)
Equipment:	Education and training equipment for the Mechanical Department (CNC etc. metal working and machining equipment; measuring and calibrating equipment; testing equipment; etc.)
	Education and training equipment for the Architectural Department (CAD computers and peripherals; drawing desks; material testing equipment; generator; etc.)

1-2 Natural conditions

The Project area is located in Lahore city. Lahore is the capital of Punjab province in the northeast of Pakistan. Lahore city elevation is approximately 215m and is located roughly 300km to the southeast of the national capital of Islamabad. Lahore city lies on alluvial plain within the Lavi river basin. Topography tilts very gently toward the southwest.

(1)Meteorology

1) Temperature

Month-wise temperatures for the period 2005~2009 are shown in the table below. Monthly average temperatures range was 11.7~32.7º. Maximum temperature was 41.4º occurring in June and minimum temperature was 2.3º occurring in December.

Table 1.2.1 Month-wise temperatures at Lahore airport (2005~2009) (unit: ºC)

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Ave
Ave temp	11.7	15.6	20.8	26.8	31.4	32.7	30.8	30.4	28.5	24.9	18.7	13.2	23.8
Ave max temp	19.3	22.6	28.1	35.1	39.2	39.2	35.4	35.0	33.9	32.6	27.0	21.5	30.8
Ave min temp	4.1	8.7	13.6	18.4	23.6	26.2	26.2	25.8	23.1	17.1	10.4	4.8	16.8
Max temp	20.1	27.6	31.7	37.4	40.3	41.4	36.7	35.8	34.6	33.2	27.9	21.8	
Min temp	2.5	5.8	12.8	16.9	22.3	25.2	25.7	24.9	22.5	15.0	9.8	2.3	

2) Rainfall

Month-wise rainfall for the period 2005~2009 is shown in the table below. Yearly average rainfall was 708.9mm. Maximum rainfall was 156.2mm occurring in September. With regard to minimum rainfall, rain is generally little and there are months when no rainfall is recorded. During the period 2005~2009, maximum daily rainfall of 221mm occurred in August 2008.

Table 1.2.2 Month-wise rainfall at Lahore airport (2005~2009) (unit: mm)

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Ave
Ave rainfall	22.7	43.4	45.7	11.9	12.8	69.2	193.8	185.5	101.7	11.5	3.5	6.9	708.9
Max rainfall	58.6	109.1	65.4	22	17.2	135.4	343	439	156.2	53.6	11.2	19.2	1429.9
Min rainfall	0	1.2	0	0	7.0	28.9	107	58.2	28.0	0	0	0	230.3
Daily max rainfall	30.0	47.0	58.6	14.0	13.0	47.0	105.8	221.0	95.0	35.9	6.0	11.2	

3) Humidity

Average humidity in Lahore in 2010 was a minimum 41% in May and a maximum 74% in

August.

Table 1.2.3 Month-wise humidity at Lahore airport (2010) (unit: %)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
Ave humidity	66	61	60	47	41	46	71	74	66	61	68	70	61
Max humidity	86	79	77	65	57	61	82	86	81	81	86	87	77.3
Min humidity	46	42	42	29	25	31	59	62	50	41	49	53	44.1

4) Wind velocity

Month-wise average wind velocity for the period 2005~2009 is shown in the table below. Monthly average wind velocity was 2.9m/s, with prevailing wind direction from the northwest. Wind velocity throughout the year is generally weak, with a monthly average maximum wind velocity of 3.7m/s occurring in June.

Table 1.2.4 Month-wise average wind velocity at Lahore airport (2005~2009; 5pm) (unit: m/s)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
Ave wind velocity	2.4	3.4	3.6	3.6	3.4	3.7	3.1	3.0	2.8	2.1	1.5	1.7	2.9
Wind direction	NW	NW	NW	NW	NW SW	SW SE	SE	SE	SE NW	NW	NW SW	NW	NW

Maximum observed wind velocity for the period 2005~2009 is shown in the table below. During this period, maximum wind velocity was 40.7m/s, recorded June 2, 2009 with wind direction from the northwest.

Table 1.2.5 Maximum observed wind velocity at Lahore airport (2000~2009) (unit: m/s)

Date	Max observed wind velocity	Wind direction
Jun 6, 2000	38.3	NW
May 14, 2001	24.2	NW
May 27, 2002	36.1	SW
Jun 29, 2003	33.9	NW
Jun 6, 2004	33.1	NW
Jun 9, 2005	30.8	NW
May 22, 2006	31.4	NW
May 8, 2007	31.4	NW
Sep 5, 2008	23.3	NW
Jun 9, 2009	40.7	NW

(2) Earthquakes

In Pakistan, seismic activity varies greatly depending on the region. Strong earthquakes are frequent in the case of Baluchistan province bordering on Afghanistan. In contrast, earthquakes on a scale resulting in structural damage almost never occur in Lahore in Punjab province. The Building Code of Pakistan (Seismic Provision 2007) was compiled in 2007 aiming at earthquake resistant design for buildings. This code divides the country into five zones depending on the strength of seismic activity. Under this zoning, Lahore falls within Zone 2A with seismic coefficient set at 0.14.

Table 1.2.6 Seismic zones and corresponding seismic coefficients

Seismic zone	Seismic coefficient (unit: g)
1	0.05~0.08
2A	0.08~0.16
2B	0.16~0.24
3	0.24~0.32
4	Over 0.32

Note: Standard "1g" assumes compact soil geology (shear coefficient: 760m/s), with the above g values determined on this basis according to region-wise geological conditions.

1) Seismic zones and seismic coefficients by region

Seismic zones and seismic coefficients by region in Pakistan are shown in the figures below.

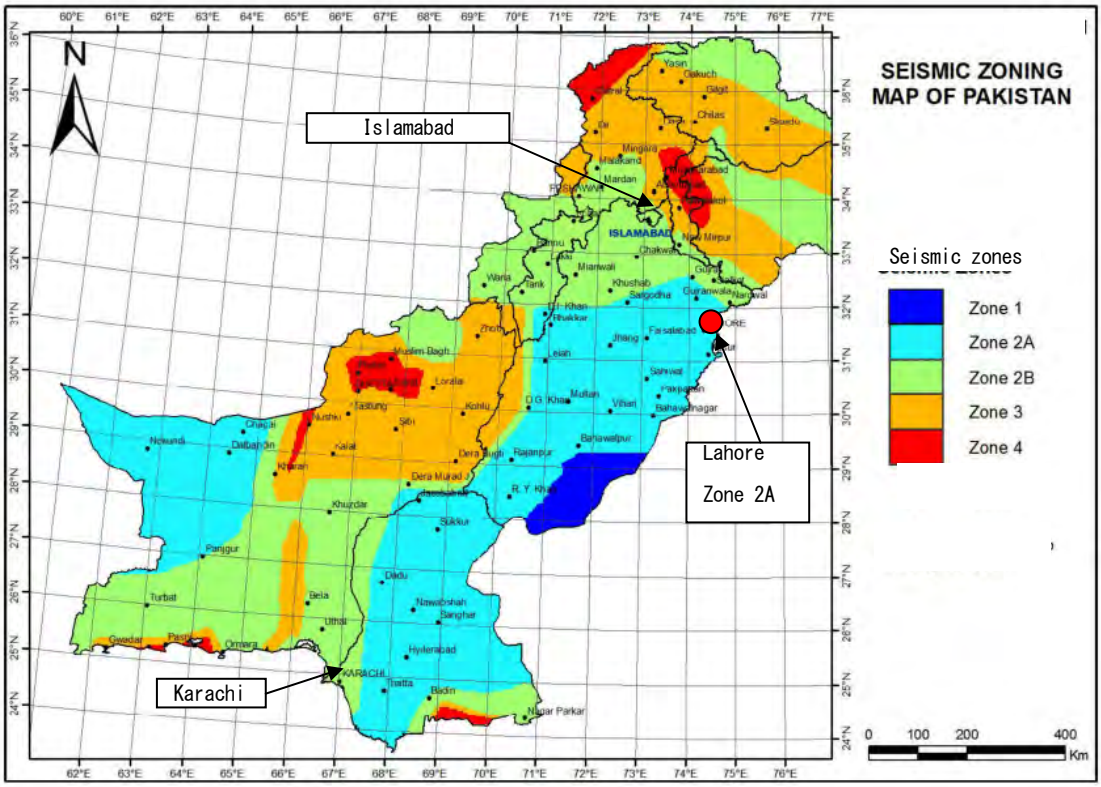


Figure 1.2.1 Seismic zones

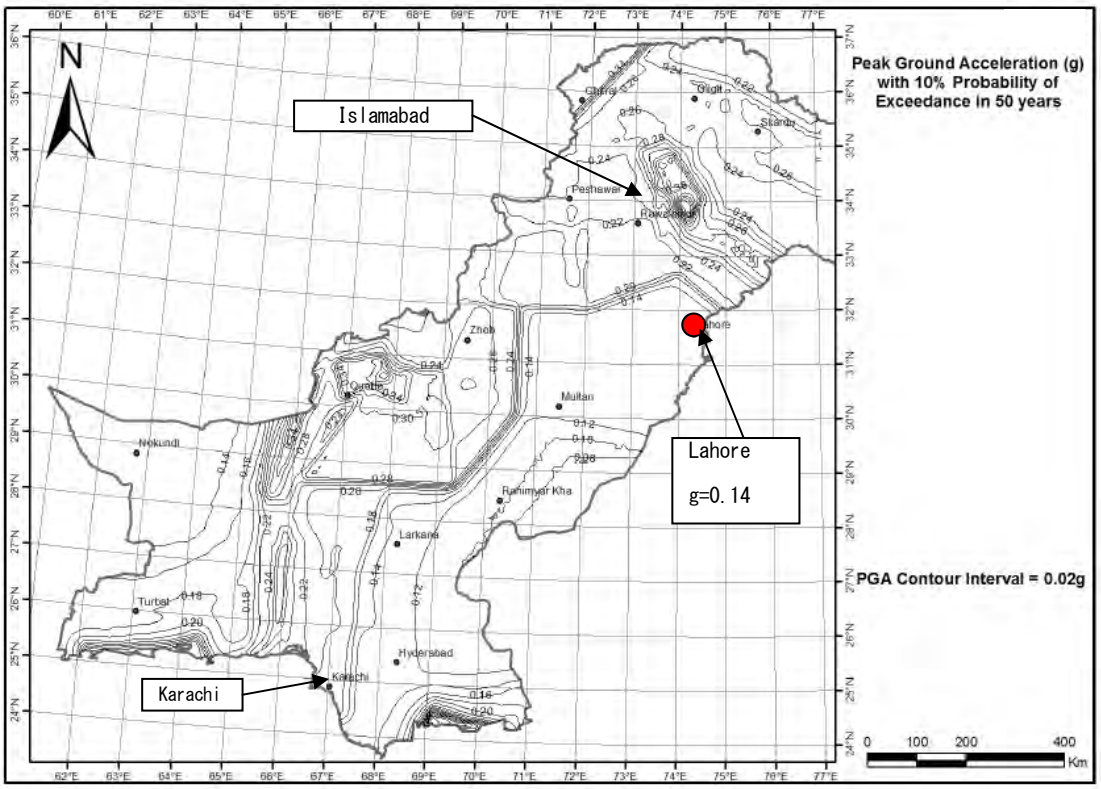


Figure 1.2.2 Seismic coefficients

(3)Topographical survey

Topographical survey comprised (i) level survey every 10m and (ii) elevation survey every 50cm, in order to identify ground contour, existing facility locations, ground elevation differential and optimal access, etc. for the Project site. Site boundary points were first confirmed with the Pakistan side person-in-charge, and the survey was subsequently executed in the presence of the consultant. Overall, the Project site is generally level, with elevation differentials in the range of 300~500mm. Assuming that the Project site sector on the western side of the water supply tower is Z=0, the road at the south side of the site is approx. -270mm, and the road running in front of the male student dormitory at the north side of the site is approx. -450mm. Also, a sewage pipeline runs under the road, with the depth from the road surface to the bottom of the pipeline being approx. 150cm. Direction of downward gradient for the sewage pipeline under the road is from east to west. Wastewater generated within the Project site will be channeled to this sewage pipeline (approx. 300mm dia.).

Detailed mapping of the topographical survey is included in the attached materials.

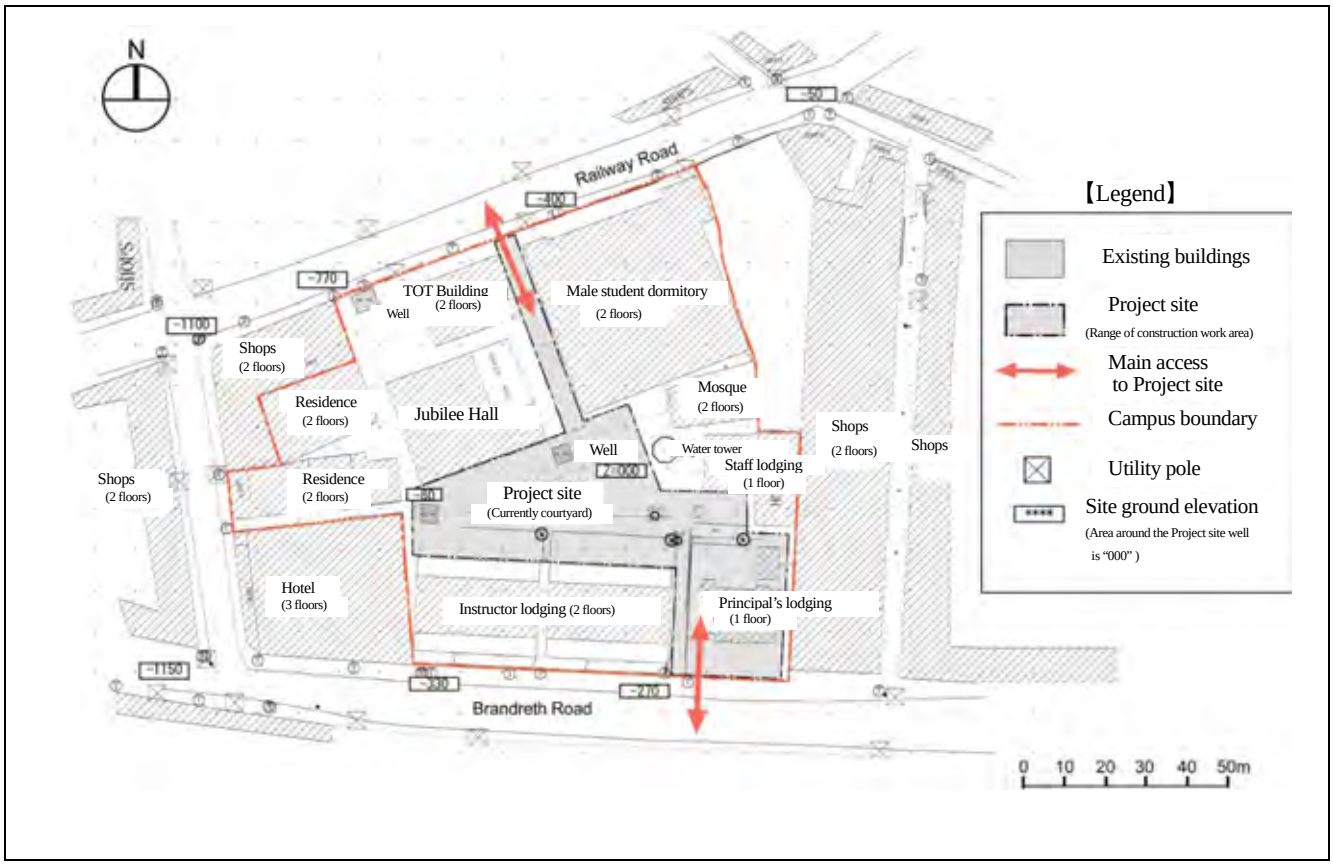


Figure 1.2.3 Overview of results of Project site topographical survey

(4) Geological survey

For geological survey, test drilling was carried out at 4 locations within the construction site area. In conjunction with this, standard penetration testing (SPT), and soil sampling was performed. Test drilling locations at the Project site are shown in the figure below.

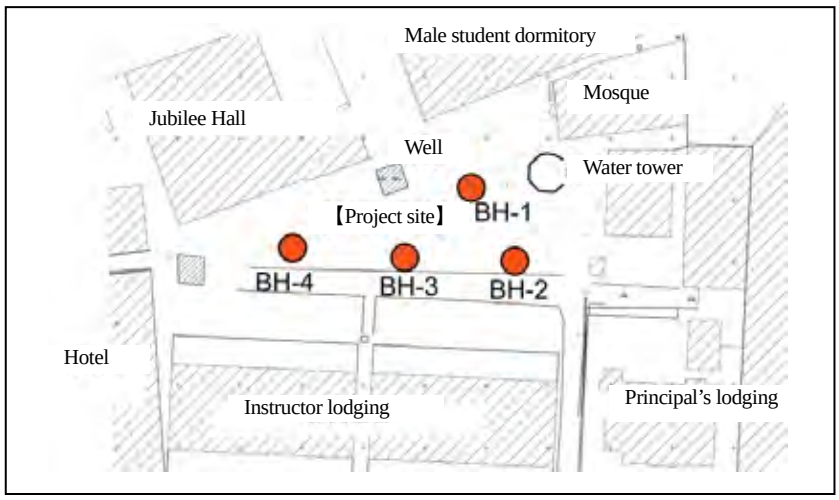


Figure 1.2.4 Test drilling locations

Detailed data from geological survey results are included in the attached materials. An overview of the findings from geological survey is described below.

① Surface layer to a depth of approx. 2.0m is backfill. A silty-clay layer is then found from around a depth of 2.0~3.0 from the surface. Below this lies a sand layer with stable bearing capacity. At the time of survey, the groundwater table was located at -16.50 ~ -17.50m from the ground surface.

② Based on results of in-situ test drilling and laboratory testing of recovered soil samples, it is considered possible to achieve long-term allowable bearing capacity of approx. 90.0kN/m2 at the silty-clay layer located 2.0~3.0m deep from the ground surface. Given the weight of the planned Project building, this does not provide sufficient bearing capacity. In contrast, it is concluded possible to achieve a long-term allowable bearing capacity of approx. 200.0kN/m2 at the fine-sand layer found at a depth of around 5.0m from the ground surface.

③ On the basis of ① and ② above, the building foundation structure will require ground improvement measures for the silty-clay layer. This would comprise columnar improvement using a hardening agent, etc. within this layer. Below this, in the case of building foundation structure reaching the fine sand layer, it is deemed possible to achieve safe and long-term allowable bearing capacity without ground improvement measures by adopting a strip footing type of foundation configuration.

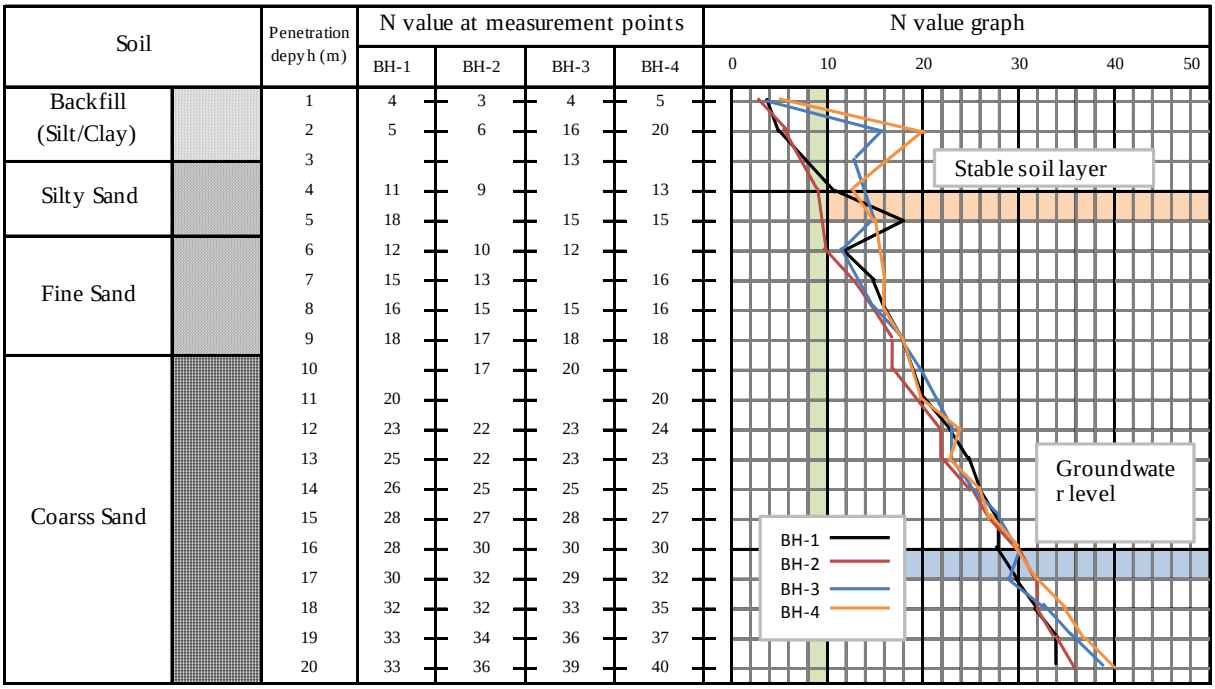


Figure 1.2.5 Overview of geological survey results

1-3 Environmental and social considerations

The Project comprises the construction of an education building, as well as equipment procurement, at a site within the existing GCT Railway College campus. Negative impact on surrounding economic activity and existing infrastructure is considered negligible. Nevertheless, given the fact that the Project site is located in the center of an urban area, and that there are existing school facilities within the site, implementation of the Project will require attention to the following environmental and social factors.

(1) Compatibility with the surrounding environment

In addition to the fact that land use in Lahore city is regulated (with regard to building-to-land ratio, building height, open apron around buildings, site access, parking area construction, etc.), there are also emergency evacuation, fire prevention and sanitation codes, etc. in effect with regard to buildings. These regulations and codes are aimed at quality urban development and are to be strictly adhered to under the Project plan.

(2) Strategies to mitigate any negative environmental and social impacts as a result of Project implementation

The envisioned mitigating strategies to minimize any negative impacts at the construction and operational stages of the Project are summarized below.

Table 1.3.1 Study on mitigating strategy

Item which may be subject to or generate negative impacts	Description (points of concern)	Envisioned mitigating strategy
Land use	Parking area within the site which accommodates several vehicles will have to be relocated during construction.	• Securing an alternative parking area.
	Safe movement flow lines for students and college staff, visitors, etc. must be secured during construction.	• Securing safe movement flow lines by construction supervision personnel and the Pakistan side prior to start of construction.
	Need to remove obstructions within the Project site and ensure access for construction works.	• Confirming that this has been done by the Pakistan side prior to start of construction.
Existing social infrastructure and social services	Concern for planned blackouts and accidental blackouts during and after facility construction	• Installing a generator to provide power when blackouts occur during construction. • Planning for an emergency generator to be installed to service completed facilities at the operational stage of the Project.
Sanitation	Anticipated generation of garbage at the construction and operational stages of the Project.	• Establishing a garbage dump site within the campus that is linked, both during and after construction, with the existing municipal garbage collection system.
Soil contamination	Possibility of soil intrusion by cement dust, cleaning agents for paint, etc. during construction.	• In principal toxic waste is to be promptly removed from the site and appropriately disposed of. • Installing a storage tank specifically in the case of waste oil generated on site.
Noise and vibration	Construction works do not include activities which generate much noise/vibration such as pile driving, etc., and as such noise and vibration will be minor. Also, entry and exit of construction vehicles to the site will be limited to nighttime hours, and it is therefore assumed that no major impact from traffic in this regard on surrounding urban area will occur. Nevertheless, instructor lodgings and male student dormitory are located adjacent to the Project site and it will be necessary to reduce noise to the extent possible during the late night/early morning hours and on holidays.	• Using low noise emitting equipment. • Adjust specific points of construction to be carried out during Friday afternoon, Monday and holidays, including shortening construction sessions during such periods. • Informing the content of construction (explaining construction components to college staff and students, as well as placing informative work signs at appropriate locations within the Project area).
Damage to surrounding buildings	Surrounding buildings are almost all of brick masonry or reinforced masonry construction which is not robust against vibration. Accordingly, it is necessary to adopt construction methods that generate minimal vibration.	• Adopting low-vibration construction methods. • Prior to the start of construction, surveying the present damage status, if any including tilting, of existing surrounding buildings, and explaining this to the Pakistan side.
Accidents	It will be necessary to take measures to prevent damage and accidents (including traffic accidents, etc.) during construction.	• Close management of construction worker safety, as well as fencing off the construction site. • Confirming and thoroughly managing the safety of construction vehicles and equipment.

1-4 Other (global issues, etc.)

The Project will contribute to the enhancement of the technical education and vocational training sector, which is a major policy strategy of the Pakistan government. Furthermore, the Architectural Department facility construction plan will take into consideration that the building will accommodate a predetermined number of female students. Planning will accordingly incorporate necessary facilities for female student college life including a common study room for female students, lockers, lavatory facilities, etc. Up to now, no GCT school anywhere in the country has been accepting female students. By implementing the Project, the GCT Railway College will be the first nation-wide under the GCT program that is specifically designed to enable female student learning activities. It is considered that this will make a major contribution to expanding skilled employment opportunities for women in Pakistan.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Regional and national planning targets and Project objectives

(1) Regional and national targets

Aiming at stable socio-economic growth, the Pakistan government has formulated a national development plan "Vision 2030" with 2030 as the target year for achieving comprehensive advances in industrialization. This strategic vision calls for increasing the GDP share by the manufacturing sector from 18% to 30%, and increasing average annual income from US$ 742 to US$ 3000 dollars. Implementation of this strategy has already created approximately 11,000,000 new jobs within the manufacturing, construction and other industrial sectors over the 10 year period from 1997 to 2007.

Furthermore, TVET of the Pakistan government has prioritized restructuring of the technical and vocational training sector as a means to alleviate poverty and train a work force that can effectively sustain economic growth. In line with this, NAVTEC was established in 2006 aiming at federal government policy planning, a level of guaranteed training quality, coordination between agencies and institutions in the educational and training sector, as well as funding support. A subsequent Skilled Pakistan (2008~2012) program (current nomenclature modified to Skills Strategy 2009~2013) was launched aimed at restructuring the national level TVET sector, including 19 major strategic programs.

Skills Strategy encompasses three primary strategies: ①training technical personnel able to respond to industrial sector needs, ②improved access to education, vocational training opportunities as well as employment opportunities, and ③a separate strategy to create an advanced model school (COE) to guarantee an appropriate quality of course content for education and vocational training; including the strengthening of educational and vocational training institute management.

TEVTA has been established at the province level, and is engaged in programs to improve technical and vocational training.

Particularly within respective industrial sectors, in addition to skilled labor, there is an urgent need for intermediate level technical personnel capable of managing on-site works to fully meet sector requirements.

Against this background of the need to improve the status quo, Punjab province TEVTA has embarked upon an independent strategy including establishing above described advanced model schools (COE). Accordingly in line with this, the GCT Railway College, which at present is the only instructor training facility within TVET under the jurisdiction of the Punjab provincial TEVTA has been selected as the first advanced model school to be established.

The GCT Railway College comprises four departments: Mechanical Department, Auto and Diesel Technology Department, Architectural Department, and Refrigeration and Air Conditioning Technology Department. Nevertheless, industrial sectors in Punjab province have a high need for middle level technical personnel in mechanical and architectural disciplines, and in response to this

Japan is currently carrying out a technical cooperation project (Project for Improvement of Technical Education) extending from December 2008 to November 2013. This technical cooperation project is aimed at strengthening integration among the curricula improvement program, instructor training and requirements of respective industrial sectors. At the same time the Architectural Department at GCT Railway College has begun to accept female students since 2010.

(2) Project objectives

The Project, in conjunction with the above described Technical Cooperation, aims to strengthen the Mechanical Department and Architectural Department at the GCT Railway College and upgrade the quality of technical education and vocational training responsive to requirements in respective industrial sectors within Pakistan. Furthermore, human infrastructure as well as physical infrastructure know-how garnered in the process of upgrading the GCT Railway College to COE level, coupled with experience at the college in accepting female students, have practical implications in terms of technology transfer both within and outside Punjab province. This in turn is anticipated to greatly contribute to training technical personnel in the country, as well as providing employment opportunities to women, both factors essential in alleviating poverty and promoting sustained economic growth under the national development strategy.

2-1-2 Project description

In order to achieve the above described objectives, this Project will make facility and equipment inputs to the GCT Railway College expected to have a synergetic effect with the ongoing GCT Railway College technical cooperation project. In line with this coordinated effort, this Project will construct an architectural department lecture and classroom building, as well as procure educational and training equipment for both the architectural and mechanical departments.

The Project plan to establish facilities and provide equipment for the Mechanical Department and the Architectural Department aiming at upgrading the GCT Railway College as an advanced model school is well in line with the above described national development strategy of the Pakistan government.

Furthermore, the Project is in sync with the ongoing technical cooperation aimed at making the GCT Railway College a COE. A synergetic effect is anticipated from the two Japanese cooperative efforts, and in this regard the impact of Project implementation is considered to be highly significant.

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) General

- The Project plan is a minimal approach with regard to training in terms of number of classes and number of years for course completion, and the degree of upgraded curricula for the mechanical and architectural courses (curricula already being improved under the technical cooperation project targeting the GCT Railway College).
- In the case of the mechanical department, this is to basically comprise 4 classes per year (three year course). One class is basically to be 40 students, with a possibility of up to five more students depending on instructor capability and classroom environment.
- In the case of the architectural course, this basically comprises two classes (three year course). One class is basically to be 40 students, with a possibility of up to five more students depending on instructor capability and classroom environment.
- The Project plan assumes independent Project operation with full consideration to personnel deployment capability, technical level, funding capability, and operation and maintenance capacity.
- From September 2010, the architectural department has begun accepting female students. Facility planning will accordingly include appropriate facilities to accommodate these incoming female students.
- The Project plan will prioritize compatibility and effective integration with the ongoing technical cooperation project targeting the GCT Railway Project.

(Supplementary explanation)

・With regard to the Mechanical Department and the Architectural Department, current and planned number of classes and students are indicated in the table below. Specifically with regards to the Mechanical Department, number of classes and students will remain essentially the same. Enrollment in both morning and afternoon classes will be set at 40 students per class to upgrade instructional and learning efficiency, and is considered to be well within the effective teaching range in this regard. On the other hand, at present the acceptance of female students within the Architectural Department has already begun, and student attendance at morning classes is 79 in the first year. Effective learning is compromised by a student attendance of 79 per class. It is accordingly deemed appropriate for two classes per academic year with 40 students each beginning from 2013. In line with this, Punjab province TEVTA and the GCT Railway College are in the process of recruiting additional necessary teaching staff to accommodate two classes per academic year.

・The Architectural Department building comprises primarily classrooms dedicated to practical training under the school's architectural course. Accordingly, classrooms that have up to this time been used for practical training under the architectural course will have the following intended use upon completion of

the Project building.

a) Classrooms will be used for general education instruction in English, mathematics, sociology, physics, chemistry, etc. aimed at students taking the architectural course. The CAD laboratory will be available for use by other departments that currently do not have a CAD laboratory.

b) Empty TOT (training of trainers) classrooms within the Jubilee site will be readied for general education classes for Architectural Department students. Classrooms and CAD training facilities used up to this time by the Architectural Department will then become available for use by students of other departments.

c) Classrooms used by the Architectural Department are operational; however, other classrooms are obsolete and poorly equipped (illumination even with lights on is around 80LX), and require rehabilitation in order to be suitable for use learning purposes by other departments. In the case of both (a) and (b) above, this is expected to upgrade the learning environment for the overall GCT Railway College.

Table 2.2.1 Current and planned class number and student number for Mechanical Department and Architectural Department

		Current: 2010					Planned: fiscal 2013				
Department	Academic year	No. of classes		No. of students			No. of classes		No. of students		
		a.m.	p.m.	a.m.	p.m.	Total	a.m.	p.m.	a.m.	p.m.	Total
Mechanical	1	4	4	173	140	313	4	4	160	160	320
	2	4	4	159	142	301	4	4	160	160	320
	3	3	3	174	238	412	4	4	160	160	320
	Total	11	11	506	520	1,026	12	12	480	480	960
Architectural	1	1	1	79	56	135	2	2	80	80	160
	2	1	1	53	57	110	2	2	80	80	160
	3	1	1	52	53	105	2	2	80	80	160
	Total	3	3	184	166	350	6	6	240	240	480

Table 2.2.2 Current and planned number of classes and students including female students

	Current: 2010 *1)					Planned: from 2013				
Academic year	No. of classes		No. of students			No. of classes		No. of students		
	a.m.	p.m.		a.m.	p.m.	a.m.	p.m.		a.m.	p.m.
1	1	1	Male	52	56	2	2	Male	48	48
			Female	27	0			Female	32	32
			Total	79	56			Total	80	80
2	1	1	Male	53	57	2	2	Male	48	48
			Female	0	0			Female	32	32
			Total	53	57			Total	80	80
3	1	1	Male	52	53	2	2	Male	48	48
			Female	0	0			Female	32	32
			Total	52	53			Total	80	80
Grand total			Male	157	166			Male	144	144
			Female	27	0			Female	96	96
			Total	184	166			Total	240	240

Note: *1) The number of female students per academic year is as of October 2010.

(2) Basic approach to facility planning

- Project planning will encompass strict adherence to local urban planning legislation, basic architectural stipulations, fire protection law; as well as ensuring safe traffic corridors within the school compound, and establishing an effective balance between aesthetic landscaping and requirements for safety and cost-effectiveness.
- The architectural department building is prioritized for practical training. General lectures are planned for the existing standard classrooms.
- Given the fact that female student will newly be admitted to the school, Project planning will include a female lavatory and common relaxation lounge for female students.

(3) Basic approach to equipment planning

- An appropriate minimum of equipment required for practical training under an improved curriculum is to be provided.
- Equipment quantities are to be an appropriate basic minimum, based on existing usable equipment, as well as appropriate training methods.
- Content and specifications will prioritize equipment for practical application.
- Content and type of equipment to be provided under the Project will take into thorough account capability for effective operation and maintenance given the technical level of personnel responsible for equipment O/M, as well as local contractors to be engaged in this regard.

(4) Basic approach to natural environment criteria

- Existing power supply infrastructure is weak, compounded by the effect of daily scheduled blackouts. Accordingly, Project planning focuses on natural lighting and ventilation, as well as installation of a back-up generator and voltage stabilizer equipment.
- Structure planning will take into account Pakistan government earthquake zoning and earthquake resistance standards.
- Planning will take into consideration the need for dust-proofing measures to protect personal computers and precision equipment from fine dust.
- Planning will take into consideration the need to protect facilities from possible damage incurred during periods of heavy rain.

(5) Socio-economic conditions

- GCT Railway College has an over 100 year history. Existing power and water supply lines consist of obsolete facilities which have been subject to ado improvement and repair when necessary, and are subject to frequent breakdown. Accordingly, Project planning in this regard is based in principle on installing new power and water supply/drainage systems necessary for Project building operation.

- Project planning and operation will take into full account the need to accommodate the Islam Ramadan as well as other important local special events.

- Existing facilities at the Project site, GCT Railway College and Jubilee site, in many cases require rehabilitation. In particular, it is strongly recommended that, from an on-campus sanitary standpoint, that urgently required sewage drainage systems be promptly implemented under the responsibility of the Pakistan government.

- Because the Project Jubilee site is property borrowed from the Evacuee Trust Property Board, it is necessary to obtain a No Objection Certificate (NOC) from the agency prior to facility construction. (The Pakistan side executing agency TEVTA is currently applying for this certificate, and it is anticipated that no problems will be encountered regarding its issuance.)

(6) Local construction conditions, procurement conditions and commercial practices

1) Approach to local construction conditions

- The Project site is located in Lahore, which is an urban area with rapid population increase. Construction works are robust within the city and surrounding area. As a result, construction contractors and related sector businesses are numerous. Procurement of local construction materials and equipment including general construction machinery and locally produced materials such as cement poses little problem, and such procurement will be aggressively pursued under the Project. Almost all construction labor is covered by Pakistani nationals. Nevertheless, there is a chronic shortage of skilled labor. Accordingly, Japanese engineers and local engineers with long term experience will be deployed under the Project during the construction phase to oversee quality control, strict adherence to construction schedule and ensuring works that facilitate effective facility operation and maintenance including future repair works.

2) Approach to procurement of construction material and equipment

- General construction material and equipment can and will be procured locally. Construction

fixtures, hardware and related equipment fixtures (sash, etc.) are generally of foreign manufacture, and pose no problems in terms of quality and durability. Accordingly in this regard, Project planning will also consider adopting imported products to be procured locally within Pakistan.

(7) Engaging local contractors and consultants

- Within Pakistan, there are a large number of large and well experienced construction contractors. Project planning accordingly intends to engage local contractors under sub-contract to a Japanese main contractor with extensive construction implementation experience on similar projects.
- In the case of Pakistan, at the permit application stage prior to start of construction, it is concurrently mandatory that a local engineer (architects, consultants) registered with the local engineer association submit an approval application for facility construction to the architectural screening department of the Lahore municipal authority. Consequently, it is required that a qualified local consultant be engaged during the permit approval application procedure, and be present at key in-situ inspection periods during construction.

(8) Operation and maintenance by the executing agency

- The present budget for the GCT Railway College is not sufficient for effective facility operation and maintenance. The Project executing agency TEVTA will be responsible for arranging the necessary budgetary measures to cover Project O/M. Accordingly, recommendation has been made to TEVTA to appropriately secure the necessary budget allocation from the Pakistan government to cover required facility and equipment O/M costs.
- In order to minimize maintenance frequency, priority will be given to durability of facility and equipment design. Also in line with this, maintenance will prioritize the usability of consumables that can be easily procured locally.

(9) Facility and equipment design level

- With regard to the level of design for facilities and equipment, this is to be in line with the operating capacity of GCT Railway College and TEVTA. This will focus on ease of operation and maintenance, as well as ease of possible future replacement when necessary.
- Taking into account the content of activity within the GCT Railway College, sophisticated automated systems are to be avoided. Instead facilities and equipment will be selected that can be readily addressed in the case of malfunction.

(10) Construction method, procurement procedure and construction period

1) Construction method

- Primary building framing in Pakistan is generally RC rahmen structure. Exterior and interior walls are usually brick masonry. Construction method will ensure quality and durability commensurate with facilities stipulated under grant-aid cooperation.

2) Procurement method

- Material and equipment will in principle be procured within Pakistan. However, where criteria of enhanced quality and durability are a factor, procurement from Japan or other third country will be considered.

3) Construction period

- Project planning will take into account that ample area for necessary temporary construction facilities is not immediately available at the site, in addition to the fact that construction equipment entry and exit from the site is restricted to nighttime (10:00 pm to 6:00 am) in light of the urban site environment.
- The surface stratum at the site is weak soil to a depth of roughly 4.0m. Construction period planning will accordingly take into consideration the fact that structure foundation will require excavating below that depth to reach long-term, stable soil bearing capacity.
- At the site periphery, there are existing facilities serviced by underground water supply and drainage piping. In order that these existing pipe systems can continue to be used, Project planning will include re-routing existing piping that might be affected by facility construction under the Project.

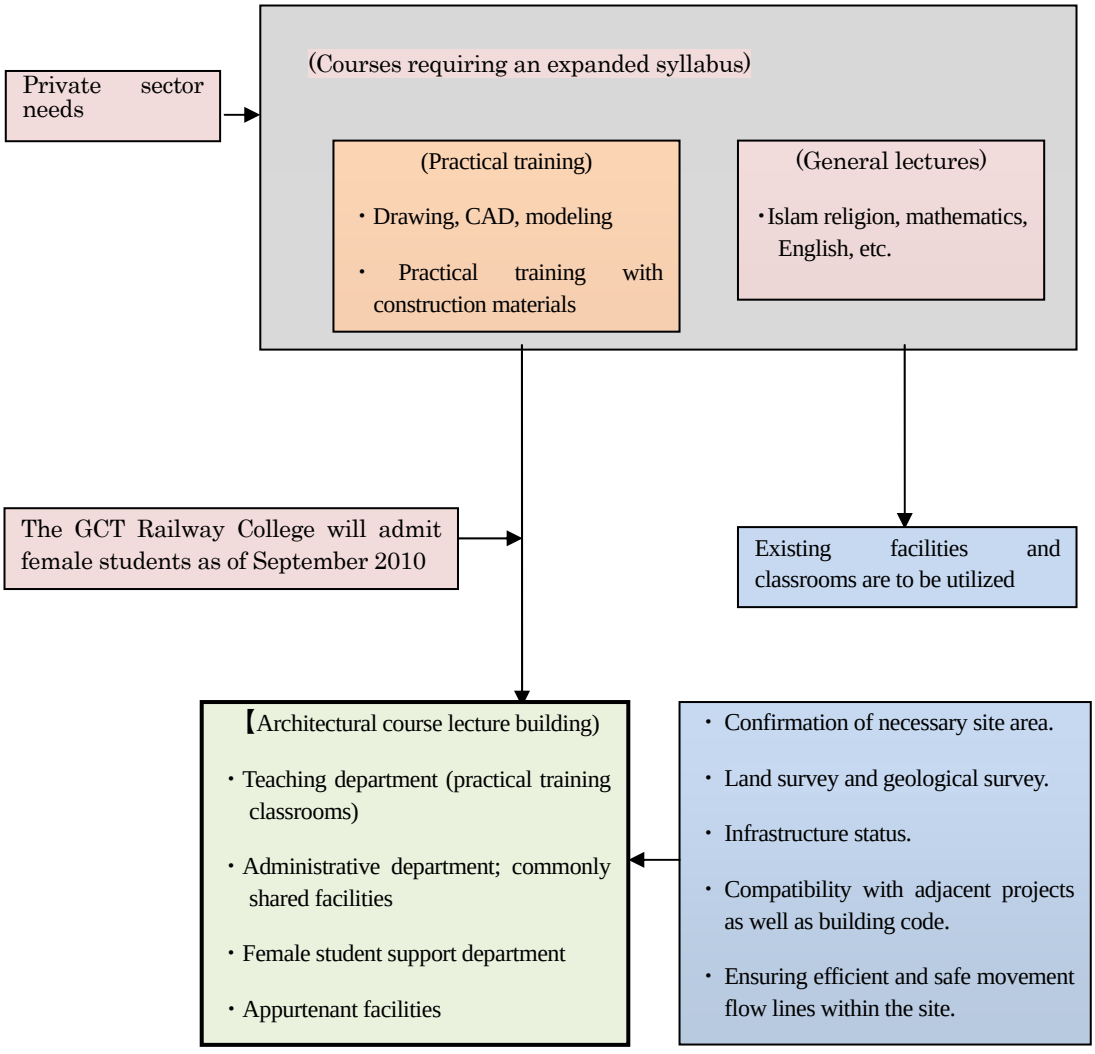
2-2-2 Basic Plan (Construction Plan and Equipment Plan)

2-2-2-1 Project planning concept

With regard to Project facilities and equipment, the plan set out below has been formulated based on the design approach described in Section 2-1 above.

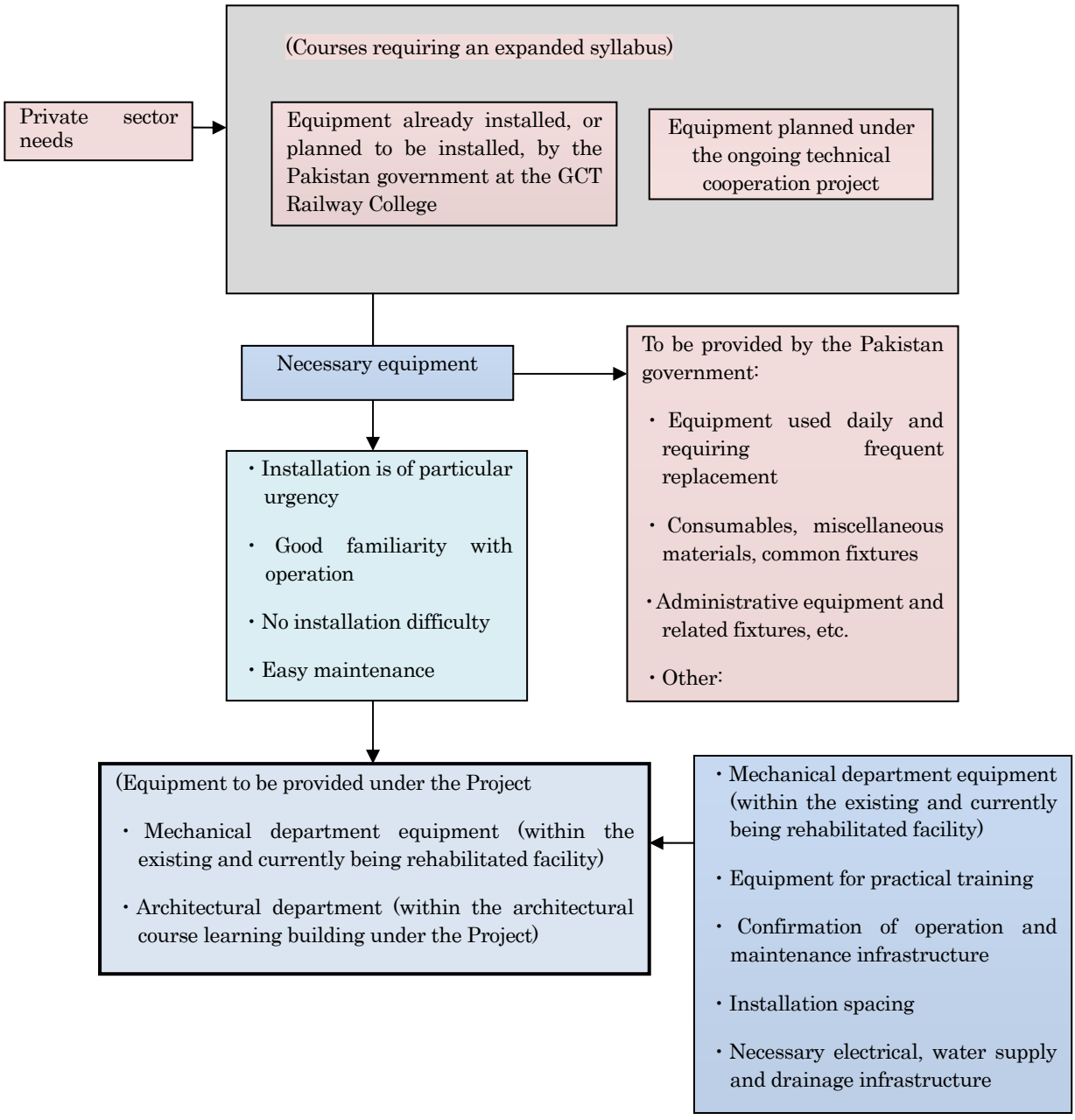
(1) Facility plan

Facility comprises the construction of an architectural department lecture building at the GCT Railway College Jubilee site. Facility concept is as follows:



(2) Equipment plan

Equipment under the Project is to be provided to both the main GCT Railway College campus as well as the Jubilee site. Implementation concept is as follows:



2-2-2-2 Site and facility layout plan

The Project area encompasses both the GCT Railway College main campus and Jubilee site. The facility plan targets the Jubilee site.

The school main campus houses existing general learning facilities as well as practical training workshops and laboratories. The Jubilee site encompasses facilities other than that strictly for student educational purposes including facilities for instructor upgrade training, male student dormitory, instructor lodging, head master lodging, mosque, etc. At present, rehabilitation construction works are underway at the existing Jubilee Hall within the Jubilee site to accommodate the installation of new equipment for the Mechanical Department. After refurbishment, Jubilee Hall is planned to be used for mechanical course workshops. The distance from the main campus front entrance to the Jubilee site entrance is around 300m along the railway road and can be negotiated back and forth within a reasonably short period of time.

The Project building site is located within the Jubilee site in an empty space surrounded in courtyard fashion by other existing structures. This makes necessary a plan taking into full consideration establishing an appropriate distance from existing facilities, maintaining existing walkway flow lines, as well as ensuring safe pedestrian walkways during construction.

Major points with regard to the site and facility layout plan are described below:

① Planning is (i) to ensure that on-campus student walkway flow routes and emergency access routes with regard to on-site existing facilities are maintained, and (ii) ensure that after Project implementation, students have available an efficient walkway flow route for facility utilization.

② The existing access way to the site from the main front road is too narrow to accommodate large vehicles and machinery for construction purposes. Accordingly, this is to be widened by removing the outer wall for the headmaster lodging and instructor lodging at the south side of the site to ensure construction equipment access. Furthermore, the pass way from the south side of the site to the north side of the site is planned to enable fire engines and ambulance vehicles access to the site.

③ In accordance with architectural regulations, the new facility building will allow an open space of 20ft (6.1m) on the south, east and west sides. The space to the north between the newly planned facility and the existing Jubilee Hall is to be approximately 15ft (roughly 4.5m).

④ It will be necessary to establish a parking area commensurate to the occupied floor space within the new facility building as well that of existing facilities on site. Specifically, an existing empty space within the site is to be converted into a parking lot by the Pakistan government side. It is stipulated that 40% of the available parking space is to be allocated for motor bike, bus and bicycle parking. Agreement has been reached with the Pakistan government for a site plan where vehicles will be unable to traverse the site in a manner where access to the parking area overlaps with student walkway routes.

⑤ The entrance way to the Project building will be located at the east side of the site, adjacent to the existing elevated water supply tank. The planned facility entrance way and peripheral water supply tank will be configured in a courtyard fashion to ensure easy and safe walkway access from the main campus.

Based on the above, functional layout, zoning and main accessing route are indicated below.

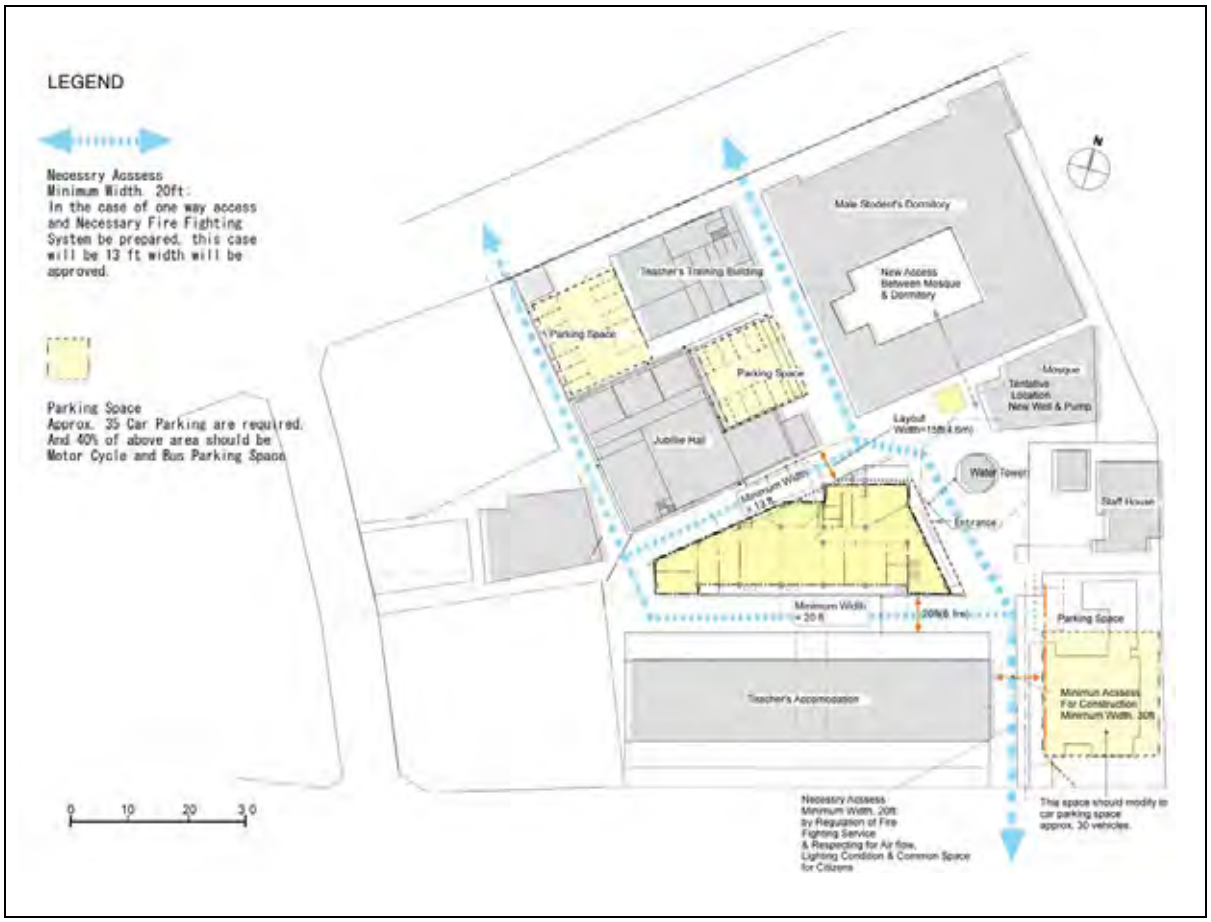


Figure 2.2.1 Facility layout and primary movement flow lines

2-2-2-3 Architectural plan

(1) Design criteria

1) Compliance standards

While thoroughly referring to Pakistan architectural standards applied in Lahore, relevant Japanese architectural standards as well as Japanese Industrial Standards (JIS) will be applied to design.

2) Lateral shear coefficient due to earthquake

Earthquakes are common in Pakistan, and seismic strength is zoned by region. Most earthquakes occur in the western mountainous part of the country. Lahore is located to the east on flat terrain, and seismic activity is slight. In the case of Project structural design, stipulated zone 2A (Z=0.14) for Lahore seismic activity as indicated under Pakistan standard BCP-SP-2007 (Building Code of Pakistan – Seismic Provisions -2007) is to be applied.

3) Wind load

Design wind load is a wind velocity of 41m/s based on the maximum observed wind velocity in Lahore over the past year, i.e. 40.72m/s (June 2, 2009).

4) Soil bearing capacity

The Project building comprises a partial basement, 3 floors above ground, and a partial roof-top component. According to the results of natural conditions survey, it is observed that the surface stratum at the site is a disturbed layer that has been partially excavated to a depth of around 2.5m and then backfilled. The surface stratum is accordingly not suitable as a bearing layer. At a further depth of about 4.0~5.0m from the surface backfill stratum, a clayey layer mixed with silt is present. Below this is a fine sand layer with increasingly more stable bearing capacity. Judging from the results of geologic survey, the silty clay layer directly below the backfill surface layer extending to a depth of around 2.5~3.0m is assumed to have a long-term allowable bearing capacity of around 90.0kN/m^2. Given the weight of the Project building, this is not considered a sufficient bearing capacity. It is considered possible that consolidation of the silty clay layer could occur resulting in ground subsidence. Accordingly, from the standpoint of ensuring foundation stability, a hardening agent is to be used in conjunction with foundation improvement of the silty clay layer and a spread foundation configuration adopted based on soil replacement with material resistant to consolidation such as gravel-mixed sand. Directly below the silty clay stratum targeted as the bearing layer is a fine sand layer with an assumed long-term allowable bearing capacity of around 200.0kN/m^2. On this basis, it is concluded that a spread foundation will provide ample bearing capacity for the Project building.

Another possible approach to foundation configuration would be the use of stabilizing piles. However, these are not generally used locally and would pose problems in terms of construction equipment procurement. Furthermore, this type of foundation is deemed excessive given the fact that construction involves a building with only three stories above ground. This approach will accordingly not be adopted from both the standpoints of procurement difficulty and cost-effectiveness.

5) Structural design

Stress analysis pertaining to structural design is to be based on Japanese analytical method.

6) Facility standards

Standards applied locally, as well as standards for similar facilities in Japan, will be applied.

7) Room floor area

This will be based on previous examples of room floor area in local public facilities. In the case where there are no previous cases examples or criteria are unspecified, reference will be made to standards established by the Architectural Institute of Japan. These will be applied in determining floor space appropriate for the utilization content of each room, and layout to accommodate desks, chairs and appurtenant fixtures

(3) Facility components

1) Facility function and content

The primary facility comprises the architectural department lecture building. Specifically, the facility aims primarily at practical training, and comprises a learning department, administrative department, communal facilities, a female student support department, and appurtenant facilities.

Table 2.2.3 Facility function and content plan

Category	Primary function	Main content
Learning/ training	・Practical training in line with the new curriculum for the architectural department.	Standard classroom, design drawing room, multipurpose laboratory (material testing, etc.).
Administrative	・Supervision and management.	Instructor room, office, storage
Common facilities	・Movement flowlines between rooms; student services.	Entrance way, hallways, lavatories, storage areas, etc.
Female student support	・Support for female student enrollment.	Common room for female student relaxation; female lavatory
Appurtenant facilities	・Sanitary and environmental.	Generator, water purification tank, outdoor facilities (parking lot, access walkway, planting), etc.

2) Facility scale

(Study on necessary rooms for each academic department)

・Points of consideration with regard to implementing a two-tier morning and afternoon class curriculum

GCT Railway College recruits students separately for its morning session and afternoon session.

Nine hours per day are devoted to both the morning session and the afternoon session. The afternoon session begins prior to class completion for the morning session, with a three hour overlap of sessions. Nevertheless, morning sessions and afternoon sessions utilize separate classrooms for lecture and laboratory work during this three hour overlap (i.e., there is no redundancy in classroom use or teaching staff).

・Study on number of classes per academic year

The current Mechanical and Architectural Departments each comprise 3 academic years for course completion. The Mechanical Department comprises 4 classes each in the morning and afternoon per academic year. The Architectural Department comprises 1 class each in the morning and afternoon per academic year. Up until completion of the envisioned Project facility by 2013, this class scheduling will not change. However, since 2010, the college has begun to accept female students, and with this increase in enrollment it is planned to expand the current one class per academic year to two classes. Specifically in the case of the Architectural Department, number of students per academic year has risen from around 50 in 2009 to 79 at present. Accordingly, a plan to expand number of classes to two per academic year, each capable of accommodating 40 students, is considered appropriate.

・Study on number of necessary classrooms

In the case where the Architectural Department is operated at two classes per academic year, the morning session alone will require a minimum of 6 classrooms (including laboratories) given the fact that the architectural course is a 3 year program. Furthermore, in contrast to the design drawing room, the CAD training room and the materials testing laboratory, standard lecture classrooms in the Architectural Department will require an entire set of desks and chairs to accommodate all students. In the case of the Architectural Department lecture building to be established under the Project, this will be primarily aimed at architectural course lectures. General study classes will share already existing classrooms at the college. At the time of Project implementation in 2013, the number of classes in the department will double, making the number of necessary classrooms in the Architectural Department lecture building as shown in the table below. (Details are provided in attached materials.)

Table 2.2.4 Learning hours per week and classroom use configuration within the Architectural Department

Classroom type	As of 2010		Planned for 2013				
	Course hours (a.m. + p.m.)	No. of utilized classrooms	Course hours (a.m. + p.m.)	Raw classroom no. load necessary under the Project	Planned classroom use configuration	Adjusted necessary classroom number*[1]	Planned no. of classrooms
Design drawing room	77	2	154	2.6	One third of design drawing classes are to be shifted to CAD laboratories.	1.8	2
CAD laboratory	38	1	76	1.3	Same as above	1.8	2
Standard training room (architecture course)	75	2	150	2.5	One third of classes are to be shifted to the multipurpose laboratory.	1.8	2
Multipurpose laboratory	Presently not prepared				Same as above	0.8	1
Standard classroom (English, mathematics, etc.)	16	2	32	0.6			Use existing rooms
Science laboratory	3	1	6	0.1			Use existing rooms

Note: *[1]Total hours of classroom use per day are 15 hours including both morning and afternoon. Classes are convened 5 days per week from Monday through Friday. Accordingly, per-week classroom usage is 75 hours (15 hours/day×5 days = 75 hours/week (maximum usage). Given the current classroom usage configuration, classrooms are 80% in operation, with a realistic usage of 60 hours per week. The adjusted necessary classroom number in the above table represents the total classroom hours per week divided by 60.

(Study on rooms outside the learning/training departments)

・Appropriately sized rooms are planned based on the usage configuration by room users/occupants.

(Study on number of classes per academic year)

The current Mechanical and Architectural Departments each comprise 3 academic years for course completion. The Mechanical Department comprises 4 classes each in the morning and afternoon per academic year. The Architectural Department comprises 1 class each in the morning and afternoon per academic year. Up until completion of the envisioned Project facility by 2013, this class scheduling will not change. However, since 2010, the college has begun to accept female students, and with this increase in enrollment it is planned to expand the current one class per academic year to two classes. Specifically in the case of the Architectural Department, number of students per academic year has risen from around 50 in 2009 to 79 at present. Accordingly, a plan to expand number of classes to two per academic year, each capable of accommodating 40 students, is considered appropriate.

(Study on number of necessary classrooms)

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Table 2.2.5 Learning hours per week and classroom use configuration within the Architectural Department

Classroom type	As of 2010		Planned for 2013				
	Course hours (a.m. + p.m.)	No. of utilized classrooms	Course hours (a.m. + p.m.)	Raw classroom no. load necessary under the Project	Planned classroom use configuration	Adjusted necessary classroom number*[1]	Planned no. of classrooms
Design drawing room	77	2	154	2.6	One third of design drawing classes are to be shifted to CAD laboratories.	1.8	2
CAD laboratory	38	1	76	1.3	Same as above	1.8	2
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Multipurpose laboratory	Presently not prepared				Same as above	0.8	1
Standard classroom (English, mathematics, etc.)	16	2	32	0.6			Use existing rooms
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(Study on rooms outside the learning/training departments)

・Appropriately sized rooms are planned based on the usage configuration by room users/occupants.

Based on the above calculation, the learning and training building under the Architectural Department will theoretically need to accommodate 40 students per 2 morning classes and 2 afternoon classes, over a 3 year course. Nevertheless, in actuality, classes will be designed to accommodate 45 persons taking into consideration some fluctuation in number of classroom users.

Targeted number of students and school staff (instructors, lecturers, etc.) under the Project is set out below.

Table 2.2.6 Number of persons using the Architectural Department facility

Category	No. of persons targeted for the Project facility	Determinate criteria / remarks
Total students	・240 persons	40 persons per academic year; two classes over a 3 year course. Morning: (40×2×3 = 240 students)*[1]
(Female students)	(96 persons)	Under the Pakistan government plan, female students are to account for 40% of the overall student body.
Instructors/ lecturers	・14~20 persons	The Pakistan government plan for recruitment calls for 12 instructors and 2 lectures for a total of 14 teaching personnel at the start up of facility operation*[2].
Administrative staff	・2 persons	Two persons are to be on duty at any given time; comprising 3 shifts per day.

Notes: *[1] Afternoon class will entail the same number of students as per morning classes. Calculation avoids this redundancy.

*[2] In principle, the same teaching personnel currently work both morning and afternoon classes. Nevertheless, when classroom load for a particular instructor becomes excessive, contract instructors are employed to ease this burden. It assumed that this will also be the case when the Project facility is completed. Given the need for teaching personnel to have a place to relax between classes, an instructors' room capable of accommodating around 20 persons will be established.

No. of main rooms, components and criteria for size determination is as follows.

Table 2.2.7 Overview of main rooms

Room category	No. of rooms	Primary function	Design no. of users	Similar facility (area/width)	Similar facility floor area (㎡)	Project floor area (㎡)
Learning/training department						
Design drawing room	2	Practical design drawing training utilizing drafting boards.	45 students ＋instructor	2~2.5m^2/ person	92~115	103
CAD laboratory	2	Practical design drawing training using CAD.	Same as above	Same as above	92~115	103
Multipurpose practice laboratory	1	Material testing; simulated practice in producing RC.	Same as above	3~5 m^2/person	138~230	180
Standard training room (Theory class)	2	Seated practical training.	Same as above	1~1.4m^2/ person	46~65	51
Server/printing room	2	PC server, printer, storage space.	2~3	3~5 m^2/person	15~30	8
Preparation room of Multipurpose practice training	1	Preparation for practical training equipment and student's lockers	To be determine on the basis of quantity of materials and equipment		15~30	25
Drawing room storage	1	Storage for design drawing equipment, and modeling materials.	Same as above		15~30	21
Multipurpose practice material storage	4	Storage for practical training materials.	Same as above		5~10	6
Survey / measurement equipment storage	1	Storage for survey / measurement equipment.	Same as above		25~50	30
Administrative department						
Instructors' room (with Teacher's training functions)	1	This is to be a single large room, equipped with desks and chairs, with private consultation corners and visitor corners that can be set off by movable partitions.	14~20	5~8 ㎡/person	100~160	103
Administrative office	1	Reception; security (2 persons at all times) (3 shifts per day).	2	5~8 ㎡/person	10~16	12
Administrative department rooftop storage	1	Storage for administrative documents and materials.	To be determined on the basis of quantity of materials and equipment			
Female student support department						
Common room	1	Room for female student self study and relaxation (capable of accommodating half the female enrollment at one time).	96/2=48	1~1.2 ㎡/person	48~58	51
Locker room	1	Lockers to secure hand -carried articles. (aimed at accommodating all female students, both for morning classes and afternoon classes)	96×2=192	Locker layout for 18 person use	12~30	12
Dispensary/rest area	1	Rest space (1person＋1 nurse staff).	2	4~6 ㎡/ person	8~12	8
2nd floor women's lavatory	1	Women only lavatory (for use by both female students and female staff).	5 toilet units	Japanese case examples [1]		

Common facilities						
Entrance hall	1set	Common entrance way.	—	Two way entry and exit		
Hallways	1set	2 corridors are necessary to ensure efficient instructor and student movement flow lines.	—	Same as above	Width: 3~6m	Width: 2.3m
Stairways	2	2 stairway locations are necessary to connect floors as well as provide escaped routes in case of emergency.		Same as above	Width: 1.2~1.8m	Width: 1.4/1.5m
Multipurpose use areas	1	For relaxation; displays; meetings, etc.	20~30	2~3 ㎡/person	40~90	50
1st floor men's' lavatory	1	For visitors and instructors.	Single person use	Japanese case examples *1	—	—
1st floor women's' lavatory	1	For visitors and instructors.	Same as above	Same as above	—	—
1st floor multipurpose lavatory	1	Wheelchair enabled.	Same as above	Same as above	—	—
2nd floor instructors' lavatory (male)	1	Instructors/staff.	Two person use	Same as above	—	—
3rd floor male students' lavatory	1	Male student lavatory.	4 toilet bowel units; 4 urinal units	Same as above		
Kitchenette (Ground & First floor)	2	Hot water for tea service (for staff).	Single person use	Same as similar facilities locally	—	—
Appurtenant facilities						
Electrical panel room (generator room)	1	Electrical distribution panel, generator.	To be determined on the bases of equipment layout		—	—
Water receiving tank (pump room)	1	Water receiving tank, pump.	Same as above		—	—
Elevated water tank (rooftop)	1set	Elevated water tank.	Same as above		—	—
Water treatment tank	1set	Integrated treatment tank	Same as above *2		—	—
Outdoor facilities	1set	Outdoor facilities (parking lot, access walkway, planting, etc.) around the building; access road, etc.			—	—

Notes: *1 To be set in line with high school construction case examples as set out under construction design guidelines and materials issued by the Architectural Institute of Japan.

*2 In terms of number of persons to be serviced, this would as follows in the case where Japanese standards are applied: based on n=025p, 0.25 ×approx. 270 persons = treatment tank capable of accommodating 68 persons. Also, biochemical oxygen demand (BOD) elimination is to be 55%; and discharged BOD is to be 250ppm or less.

(3) Overall facility plan

As indicated in Section 2-2-2 above (Site and facility layout plan), the Project site is surrounded by existing buildings in a courtyard configuration. The separating distance between existing buildings and the new building under the Project is predetermined, and the new facility construction area is to be the first floor area with regard to precisely establishing separating distance from other structures as well as facility personnel movement lines. Because one above-ground floor is not sufficient to accommodate necessary planned rooms, the Project building is to be 3 stories to adequately house the various components for common use, educational/training purposes and administrative purposes. With regard to appurtenant facilities to operate the new building and equipment, a water receiving tank

and pump house is to be installed in the building basement. An electrical panel and generator room is to be included on the 1st floor. An elevated water tank is to be installed on the building roof.

Because it is recommended that the main entrance to the Project building be located close to the main access corridor to the overall Project site, the main facility entrance is to be located at the east side of the Project site. On the west side of the Project site located away from the main access corridor, it is planned to position the electrical panel room, generator, water receiving tank, elevated water tank and other appurtenant equipment for facility function. Stairways are to be established at both ends of the facility. The main stairway is to be at the east side near the main facility entrance. The other stairway is to be located on the opposite west side of the facility.

In addition, a slope is to be established at the main entrance to enable physically challenged personnel using wheelchairs, etc. to comfortable negotiate the entrance to the 1st floor of the facility. Local building code recommends an elevator facility or sloping to enable wheelchair access to respective floors. In the case of the GCT Railway College, the school does not at present accept students in wheelchairs. Furthermore, the facility comprises 3 above ground floors, and Japanese standards do not call for installing an elevator or slopes to negotiate between floors in case of a building of this size. Accordingly, student, instructor and other personnel movement between floors is to be by stairway.

Nevertheless, in light of the fact that the GCT Railway College may accept wheelchair dependent students in the future, building design will allow for facilitated elevator installation in such case by the Pakistani side.

Main rooms on each floor and general layout are indicated below.

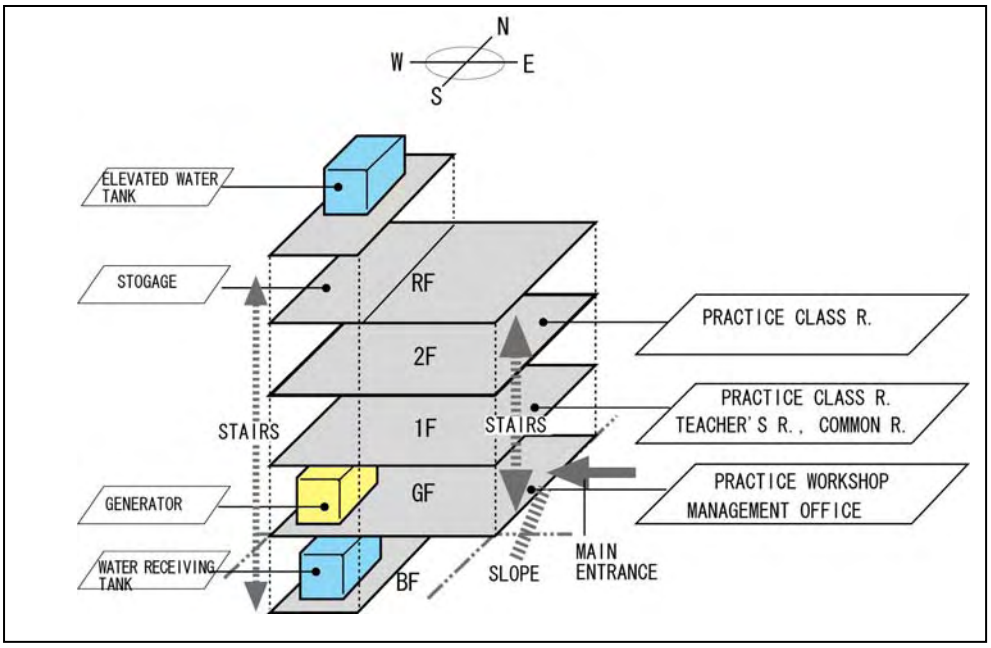


Figure 2.2.2 Overview of main rooms on each floor, and utilization configuration

(4) Floor plan

1) Floor layout for the basement and 1st floor

・Based on utilization pattern for the Project building, it is deemed appropriate to set the main entrance, administrative office, multipurpose use room, multipurpose laboratory and laboratory-1 on the first floor.

・The administrative office is to be located close to the 1st floor entrance for efficient visitor reception as well as security requirements.

・The multipurpose use room is intended for student and visitor relaxation, business and student affairs discussions, as well as posting school notices. Accordingly it also will be located close to the 1st floor entrance. Also, a simple kitchen area will be established that can provide refreshments, etc.

・Specifically, the multipurpose practice laboratory is intended for practical training in making concrete specimens, testing construction materials, architectural wall modeling, etc. Due to the need for transporting in and out practice-use materials, this room is to be located on the 1st floor. Furthermore, the multipurpose practice laboratory is planned as a large room enabling a range of practical exercises in the course of architectural department training. This large room is further planned to be subdivided into 3 smaller areas, i.e. a material testing area, study area and model fabrication area. Adjacent to the room is to be included a preparatory room (including lockers) and a material storage room.

・Men's and women's lavatory and multipurpose lavatory (capable of accommodating physically challenged individuals in wheelchairs), as well as a kitchenette facility are to established.

・The appurtenant electrical panel room (including generator) is to be located next to the west side first floor staircase

・The west side staircase will extend down to the basement. The water receiving tank and pump room will be located in the basement.

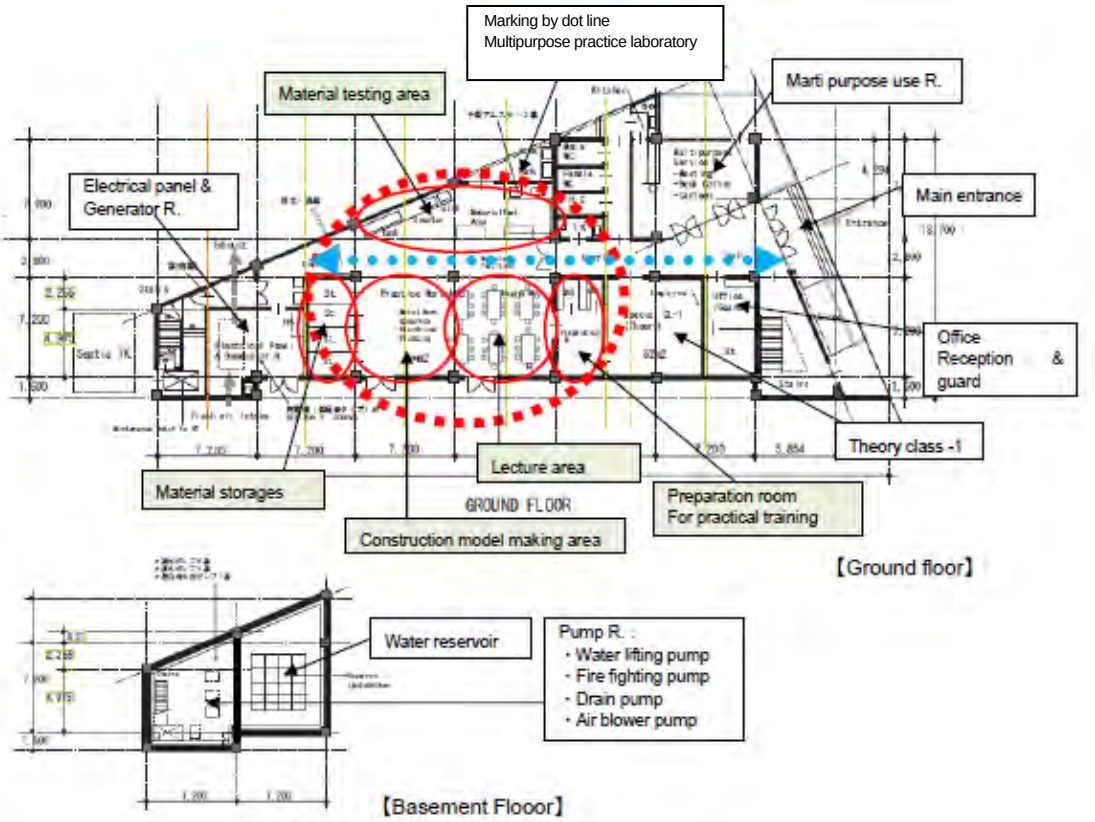


Figure 2.2.3 Floor plan for basement and first floor

2) Floor layout for 2nd floor plan

・ Laboratory-2 (seated study), laboratory-3 (CAD-1), instructors' room, common room for female students, and survey/measurement equipment storage are planned for the 2nd floor.

・The instructors' room needs to be equipped with desks, chairs and space for private discussions. Accordingly, this will be a large room with movable partitions to allow for flexible space management.

・The common room for female students will also combine a locker room and rest area. The locker room will be planned to accommodate small hand-carried items for all female students attending morning and afternoon classes. The rest area will be a room where a maximum of 2 persons can lie down and relax. The common room would be excessively large if planned to accommodate all 96 female students at the same time. Based on similar case examples, the room will be sufficiently large for simultaneous use by one-half of the female student body, i.e. 48 persons.

・Laboratory-3 (CAD-1) is to be capable of accommodating 45 students and is planned to be combined with a server and printer room.

・The women's lavatory and instructor's lavatory are to be established on the 2nd floor, and men's lavatory on the 3rd floor. A drinking fountain equipped with water purification filter is to be installed at the west-side staircase near the lavatory facilities.

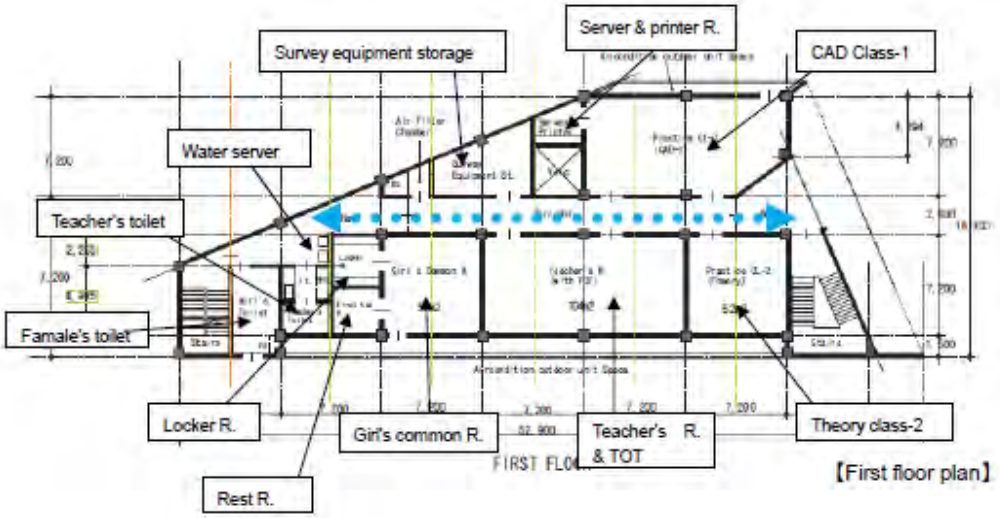


Figure 2.2.4

3) Floor layout for 3rd floor

- Main rooms on the 3rd floor are planned as laboratories including laboratory-4 (design drawing-1), laboratory-5 (design drawing-2) and laboratory-6 (CAD-2).

- Laboratory-4 (design drawing-1), and laboratory-5) are designed at a size to accommodate 25 students each. Furthermore in the case of laboratory-5 (design drawing-2), in light of the fact that this classroom will entail model fabrication, an adjacent storage area will be included to store created models as well as model fabrication materials.

- Laboratory-6 (CAD-2) is to be the same size as the 2nd floor laboratory-3 (CAD-1). It likewise is planned to be combined with a server and printer room.

- Due to the importance of daily laboratory orderliness and clutter-free environment, a storage area for equipment and appurtenances is to be established on the 3rd floor.

- A men's lavatory is planned for the 3rd floor (a woman's lavatory is planned for the 2nd floor). As in the case of the 2nd floor, a drinking fountain equipped with water purification filter is to be installed at the west-side staircase near the lavatory facilities.

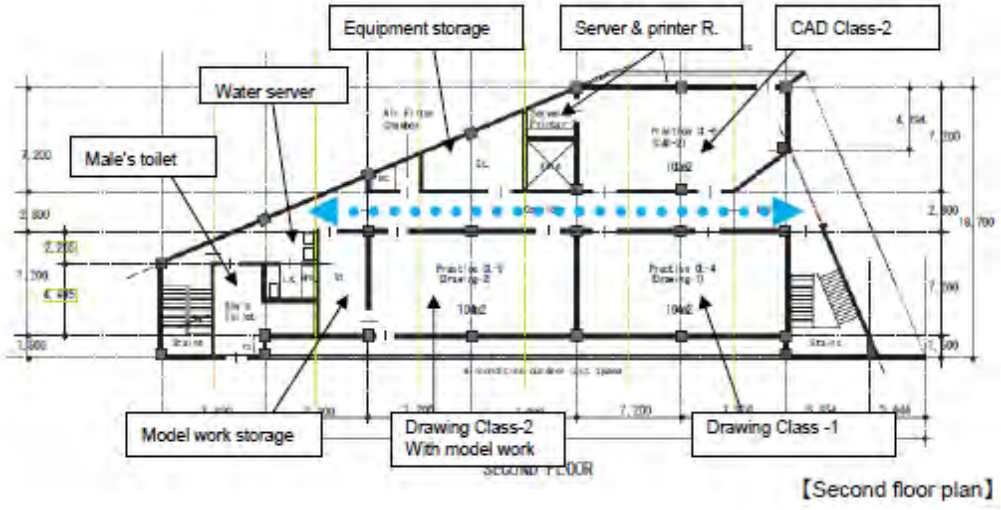


Figure 2.2.5 Floor plan for the 3rd floor

4) Rooftop layout

・The rooftop floor comprises a staircase, air circulation filter room, and overhead roofing. An elevated water tank is to be installed at the top of the staircase.

・The Project area is subject to substantial airborne sand, with potential adverse impact on computer and other precision equipment. A simple air circulation filter room is to be established, to eliminate to the extent possible outside dust prior to airflow to respective main facility rooms. Nevertheless, the level of air filtering will be simple (i.e. not at the level of clean room technology standards). Specifically, the type of planned air filter will be the easily procurable type used in air-conditioning units, etc.

・Due to frequent blackouts, it is deemed necessary to apply natural lighting to the extent possible. The rooftop surface will accordingly incorporate two skylight windows for maximum utilization of sunlight during daylight hours.

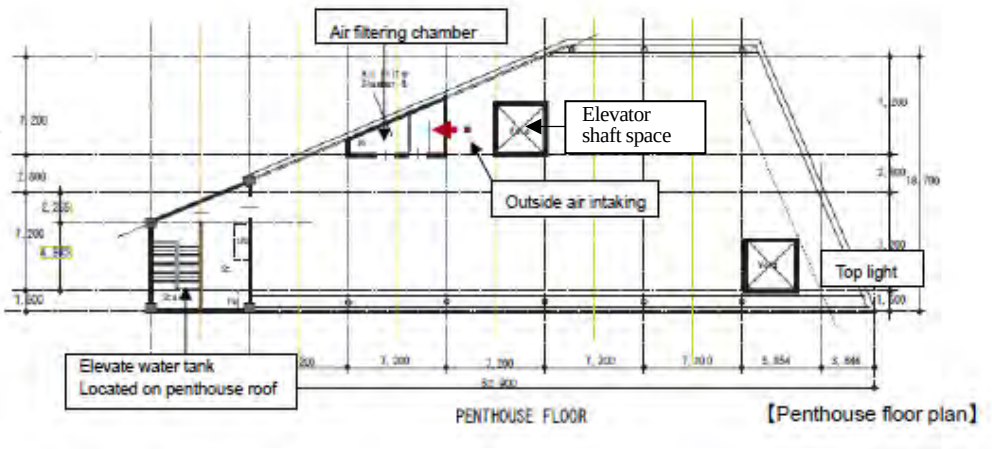


Figure 2.2.6 Floor plan for the rooftop floor

(5) Cross-section plan

The cross-section plan takes into account a range of factors including (i) site peripheral environment and bearing soil conditions, (ii) ceiling height in line with planned room function, (iii) facility piping and conduit behind room ceilings, (iv) natural lighting and ventilation by means of windows and louvers, etc.

(Bearing soil surface and floor elevation)

The Project site is located in Lahore where urban flooding due to heavy rain occurs. Results of interview survey indicate that roads in the vicinity of the site are subject to around 0.5m inundation. Accordingly, the soil bearing elevation for the Project building is to be approximately 0.5m higher than the frontal road surface. Furthermore, the facility 1st floor elevation is to be approximately 0.5m higher than the design ground level in order to prevent water intrusion into the building during periods of heavy rain.

(Number of floors, and floor height)

Number of floors includes a basement, 3 above ground floors and a rooftop floor. Also, local building standards stipulate a floor height of at least 2.9m in the case of occupied rooms. Ceiling height for laboratories, classrooms, female student common room, administrative office, etc. is to be 3.0m, and floor height will accordingly be designed to achieve this ceiling height. In the case of hallways, ceiling height is planned at 2.5m to accommodate behind-ceiling ventilation ducts. On the other hand, with regard to ceilings that do not need to accommodate duct work, hanging ceiling work is not to be performed and instead the bare structural framing is to be exposed and finished with paint coating.

(Energy saving measures)

Summer temperatures in the Project area exceed 40ºC. In contrast, winter temperatures reach below
5ºC. In principle, outer walls are to be single brick masonry with decorative brick finishing, aimed at achieving effective wall insulating function. Furthermore in the case of occupied rooms including laboratories, balcony or canopy structures are to be incorporated to block direct sunray and enable windows to perform natural ventilation. In this manner, windows can remain open despite light rainfall, enabling natural ventilation without resorting to use of mechanical fan ventilation.

(6) Structural plan

1) Soil bearing capacity and foundation configuration

To a depth of approximately 3.0 m from ground surface at the site, soil is soft silty clay mixed with backfill material, and does not provide a stable stratum. On the basis of subcontracted geological survey, the long-term allowable bearing capacity of the fine sand layer at a depth of around 4.5m from the surface is estimated at 200kN/m^2. Accordingly, the following approaches of a) and b) are examined from the standpoint of feasibility, cost-effectiveness, and stability, etc. with reference to local construction methods.

a) Pillar type solid soil cement for soil stabilization method: Inject a hardening agent to a depth of around 5.0 m from the surface to stabilize soil

b) Soil replacement method: Replace soil to a depth of around 5.0 m with gravel-sand mix.

In the case of a raft type spread foundation, the peripheral area around the basement area as well must reach the stable bearing layer of approximately 5.0m depth. Although no special foundation works are deemed necessary, it is still necessary to excavate outside the basement area to establish overall stable bearing.

Firstly, the method of a) work preparations need only for pillar mixing machine and liquid cement tank only. So, no necessary to carry out the huge volume of excavated soil material.

Another side the method of b) will have a problem as a result of increased excavated earth transport cost due to the fact that heavy machinery access to the site is limited to nighttime hours. In the case of excavated earth transported off site, noise pollution affecting the immediately surrounding area has to be taken into consideration. On the basis of the foregoing discussed factors, the method b) is accordingly deemed inappropriate and the method of a) is examined as appropriately for this site condition.

With regard to pile support, driven pile foundation type is excluded from consideration due to vibration from pile embedding works, given the fact that the immediate peripheral area is residential. In the case of basement piles which incur less vibration, special machinery and specifically skilled workers are necessary. This approach is accordingly deemed impractical due to incurred major cost increase over methods against above method of a) and b).

2) Building structure type

The standard structure type applied locally is a main building frame (foundation, beams, and columns) of RC rahmen. In similar fashion, roofing is a combination of RC beams and RC slabs. Walls are generally brick masonry. However, in order to achieve earthquake resistance at key support locations, RC earthquake resistant walls are established.

3) Design criteria

Structure design is to be carried out in line with allowable stress design laws and regulations applying the Japanese standards indicated below. Seismic coefficient for Lahore city will be applied as indicated in Pakistan government seismic-resistant design standard BPS-SP-2007.

・Building Standards Law, and related order for enforcement of said law

・Structure-related technical standards for architecture

・Standard for Structural Calculation of Reinforced Concrete Structures

4) Design stress

(a) Earthquake

With reference to Pakistan seismic-resistant design standard (BPS-SP-2007), and in compliance with Japanese standards, the value for lateral standard shear coefficient is adopted as 0.14 (the product of *Co* and regional coefficient Z)

Design seismic force *Vi* is calculated according to the following formula:

$$Vi = I \times Ai \times Rt \times Co(\cdot Z) \times W$$

Where,

Vi	: seismic force (kN)
I	: importance factor (standard facility : 1.0)
Ai	: Vertical distribution coeffient (1.0≦)
Rt	: Vibration characteristics coefficient (1.0≦)
Co(・Z)	: Standard shear coefficient (0.14)
W	: Building weight (kN)

(b) Wind

The design wind speed is to be the maximum wind speed (41m/s) over the past 10 years in the Project area. Design wind load *Pi* is calculated according to the following formula:

$$Pi = I \times E \times qo \times Cf \times A$$

Where,

Pi	: Design wind load (kN)
I	: Importance coefficient (standard facility : 1.0)

E : Environmental coefficient (1.0)

Qo : Velocity pressure ($0.6 \times E \times Vo^2$: Vo=42m/sec)

Cf : Wind force coefficient

A : Pressure-receiving surface area (m^2)

5) Construction materials and strength

(a) Concrete

Design strength for main building frame is to be $24N/mm^2$. Design strength for levelling concrete is to be $16N/mm^2$.

(b) Reinforcing bar and steel framing

In principle, locally manufactured reinforcing bar and steel framing generally used in Pakistan is to be applied.

- Deformed bar: In the case where Pakistan government stipulations in this regard are not clear, Japanese JIS standards or higher are to be applied.
- Steel framing: In the case where Pakistan government stipulations in this regard are not clear, Japanese JIS standards or higher are to be applied.

(7) Outdoor facility plan

Outdoor facilities comprise the parking lot for teaching staff and students, on-campus service road adjacent to the Project building, walkway from the Project building to the main road, gardened areas, Project name plate, flagpole, on-campus direction board, rain drainage channels, etc.

From the standpoint of cleanliness and ease of maintenance the on-campus service road and parking lot are to be paved with interlocking block. The scope of this paving is to include the approach way from the main road to the Project building, as well as areas critical to building operation and maintenance.

However, replanting existing planted areas (as well as new planting), repair of existing buildings, and construction of a wall with gate around the site will be the responsibility of the Pakistan government.

(8) Electrical and Machinery facility plan

1) Electrical facilities

Electrical facility plan will call for easily operated and maintained equipment. From the standpoint of facilitated maintenance, equipment will comprise materials and items that can be procured locally. Specifically, power supply conditions in Lahore where the Project site is located are poor, with scheduled blackout periods lasting several hours in both morning and afternoon every day. Accordingly, an in-house generator capability is essential. Furthermore, in addition to scheduled blackouts, unpredictable blackouts are frequent with sharp up-down fluctuations in supplied power voltage. Accordingly, the installation of an automatic voltage regulator (AVR) to maintain constant voltage is necessary to prevent damage to computer and other equipment.

① Main cable lead-in works, power reception and voltage step-down

Primary power supply pattern in Pakistan is high voltage 11KV, 50Hz. After transformer step down, this is supplied to facilities at 3-phase 415V and single-phase 230V, 50Hz. Because the Project building is located within a site with existing facilities, a step-down transformer already exists for lead-in from the main power line running along the railway road at the north of the Project site.

Because the existing lead-in power supply is insufficient to operate Project facilities, an additional new power supply capacity is necessary. Under the Project plan, a new step-down transformer is to be mounted approximate to the existing step-down transformer, and is to be connected by underground conduit to the electrical panel room of the Project building to supply low-voltage power. However, in the case where it is necessary to carry out construction works related to the existing main power line or replace the existing transformer, these works are to be carried out (including funding) under the responsibility of the Pakistan government.

② Power supply within the facility

A low voltage distribution panel is to be established within the electrical panel room. Power is then to be supplied by electrical pipe shaft (EPS) to respective floor low voltage panels in the form of 3-phase 415V / single phase 230V, 50 Hz. Each floor electrical distribution panel then passes power to illumination circuits and electrical socket circuits.

③ Mechanically powered facilities

Electrical power is to be supplied from the electrical distribution panels (3-phase 415V, 50Hz) on each floor in order to operate water pump, fire-hydrants, basement drainage pump, as well as air ventilator, etc.

Wiring is to be in principal to adopt local standard cable with cable lock, and wiring conduit for protection.

④ Lighting and electrical sockets

Power supply of single-phase 230V, 50Hz is to be supplied from each floor electrical distribution panel for lighting and electrical socket circuits. Furthermore, circuits feeding equipment installed in damp locations are to be earthed and equipped with an earth leakage breaker. Electric socket configuration is to be the same as that generally used locally.

a) Lumination standards

With regard to lumination devices, planning will rely mainly on fluorescent lights (FL-40W) generally used in Pakistan. Respective room luminance is planned as follows, with reference to standards for existing facilities.

Table 2.2.8 Lumination plan for main rooms

Room	Luminance
Rooms for fine-tuned work including document and design drawing preparation: Design drawing room, CAD design drawing room, CAD laboratory, and instructors' room	400 Lx
Rooms that are not planned for excessively meticulous work: Standard laboratory, female student common room, administrative office, multipurpose room	250 Lx
General work area: Multipurpose laboratory	200 Lx
Areas requiring necessary illumination for safe walking and inspection works: Hallways, staircases, lavatories, and storage areas	75 Lx
Professional staff accesses areas: Electric panel room, water receiving tank chamber, pump room	75 Lx

b) Emergency illumination, and evacuation guiding lights

In order to obtain minimally necessary illumination during blackouts, emergency lighting fixtures with internal storage batteries are to be installed in hallways and staircases. In addition, evacuation guiding lights are to be installed in staircases and at evacuation exits.

⑤ Generating and automatic voltage regulator (AVR) equipment

a) Generating equipment

Generating equipment is planned to provide power supply to areas within the Project building that would be severely affected from an operational standpoint in the case of blackout. The scope of area to be supplied with power from the generator in the event of blackout includes all lighting circuitry; water lift pump; pumping equipment for indoor fire hydrants; electrical socket circuitry for the instructors' room, administrative office, CAD laboratories servers, printing room, etc. With the exception of rooms installed with computer equipment, air conditioning units

(ventilation fan and ceiling fan) as well as other circuitry would not be subject to emergency power supply from the generator.

Power supply capacity would be approximately 165KVA. Specifically, the generator would be engine powered and equipped with automatic start-up and shut-down circuits. A quiet operating type generator will be adopted, given the fact that the existing instructors' sleeping quarters as well as other existing facilities are located adjacent to the Project building. Generator operation is assumed at around 3 hours per day. Accordingly, a fuel tank with one week of fuel capacity is to be installed at a safe location inside the facility.

b) Automatic voltage regulator (AVR)

An automatic voltage regulator is to be installed within the electric panel room receiving stepped-down power via the transformer connected to the main power grid.

Capacity is to be approximately 75KVA to accommodate power load required for Project building use.

⑥ Lightning rod

In order to protect the Project facility from accidents due to electrical discharge resulting from lighting strike, a lightning rod is to be installed on the building roof.

⑦ Phone

a) Telephone switchboard, and intercom

For telephone communication from both outside and within side the facility, a telephone switchboard is to to be installed with 3 lead-in lines from outside and 12 internal extension line circuits. Telephone equipment with intercom capability for internal communication within the facility is to be installed. The main distribution frame (MDF) and telephone switchboard are to be installed within the administrative office. Lead-in telephone line works fall within the scope of Pakistan government responsibility.

b) Intercom broadcast

An intercom broadcast amplifier is to be installed within the 1st floor administrative office. Speakers are to be installed on each stairway, the east-side and west-side halls, multipurpose laboratory, and multipurpose use room to enable general announcements, and guidance broadcasting in the case of emergency.

c) LAN

LAN conduit is to be laid to enable computer networking. LAN conduit layout is to coincide with rooms for which telephone conduit is planned.

⑧ TV conduit

Conduit for TV wiring is to be installed leading from the rooftop to the instructors' room, administrative office and 1st floor general laboratory. (Under the Project, TV antennae and TV units are not to be provided.)

⑨ Automatic fire alarm

Depending on utilization, sensory devices (heat sensors, smoke sensors) are to be installed in necessary rooms for fire indication and warning alert. A fire alert receiving panel is to be installed in the 1st floor administrative office. With regard to details pertaining to fire prevention stipulations, local building regulations and fire prevention regulations are to be adopted.

2) Water supply, sewage and related sanitation facilities

In the case of water supply, sewage and related sanitation facilities, facilities that require complex operation or special maintenance requirements are to be avoided. Facilities will be simple and efficient. Equipment to be adopted will enable local procurement of materials and manufactured items. Specifically, the well within the Project site serves as a water source, and the well pump is often operated by hand. Facility planning in this regard will take into consideration the erratic electric power supply status in the Project and surrounding area.

① Water supply

Water supply in Lahore depends on deep wells drilled at various part of the city. In the case of the Project site, an existing well (depth around 160m) specifically services the GCT Railway College. Because this existing well is already within the Project area, the Pakistan government can relocate the well near the existing elevated water tank without any incumbent effect to Project building layout.

a) Water receiving tank

With regard to water supply to the Project building, this is to be supplied to the facility basement water receiving tank by means of a buried bifurcation pipe from the relocated well pump water supply system. The water receiving tank is to have one-day water supply storage capacity for facility operation plus an additional capacity for in-house fire hydrant operation.

In general local water receiving tanks are of concrete construction with water proofing coating. In light of concern for both leakage from the tank and tank water contamination, a FRP panel fabricated water tank is to be adopted from a sanitary standpoint. (As in Japan, this type of tank is beginning to be adopted in Pakistan.)

b) Elevated water tank

Due to unstable power supply conditions in the Project area, water is to be lifted by pump to the elevated water tank, and water subsequently supplied to the respective water faucets on each floor. The elevated water tank capacity is to be approximately 15% that of the water receiving tank with the exception of capacity for supplying building fire hydrants.

Table 2.2.9 Water receiving tank/elevated water tank capacity

Item	Required water volume	Water receiving tank capacity	Elevated water tank capacity
Number of users: ・Students: 240 ・Teachers/instructors: 20 ・Administrative staff: 2 ・Visitors, etc.: 10 (Total: 272 persons)	**Calculation-1:** ・Personal use: 272 × 80L/person ≒22 tons ・Cleaning and sprinkling: Approx. 2000m^2 × 2L/m^2 ≒4 tons (Total: 26 tons)	**Calculation-2:** In addition to the capacity indicated in the left column, 5 tons are added for fire fighting. ・26 + 5 = 31 tons (Total: 31 tons) (Adjusted: 32 tons)	**Calculation-3:** 30% of the capacity under calculation-1 at left. ・26 x 0.3 = 7.8 tons (Total: 7.8 tons) (Adjusted: 8 tons)

② Sanitary fixtures

With regard to sanitary fixtures, these are to be items that can easily be procured locally from the standpoint of ease of maintenance. Additionally, a multipurpose lavatory is to be established on the 1st floor that enables wheel chair access.

③ Drainage facilities

a) Drainage channels

A main drainage pipeline (φ300mm) that collects rain runoff, miscellaneous drainage and contaminated effluent, runs underground along the road (Railway Road) at the north side of the Project site. A drainage pipe (φ150mm; earthenware fabrication) servicing existing facilities around the Project site is embedded under the corridor linking to the road at the north side of the Project site, and connects with the main drainage pipeline running under the Railway Road. However, the existing drainage pipe within the site is broken in several locations and pit manhole covers are also damaged. As a result, efficient drainage is not possible.

Accordingly, this existing on-site drainage pipe will not be used to service the Project building; and instead, a new drainage pipe is planned for connection to the main drainage pipeline at the road on the north side of the site.

b) Simple water treatment tank

In Pakistan, almost all facilities are equipped only with a simple drainage treatment tank

affixed with a debris screen. The use of fully integrated treatment tanks in the country has begun only recently. Furthermore, installation and drainage treatment standards are not clearly described under building code for Lahore city.

A simple integrated treatment tank to process contaminated effluent and miscellaneous drainage generated by the Project facility is to be installed. The tank is to have a capacity to store and process one day's worth of drainage from the Project facility. With regard to the quality level of treated water, Japan standards for simple treatment tanks are to be applied with regard to design target values of 55% suspended solid (SS) elimination and SS concentration of 250mg/L. In the event that target values under Lahore city standards for treatment tank installation should in the future exceed standards adopted under the original Project, treatment tank upgrading is to be the responsibility of the Pakistan government.

c) Rain runoff drainage

As described earlier, the main drainage pipeline in the area collects all human sewage as well as rainwater runoff, and releases this to the river. During heavy rain, there is the problem of sewage overflow from the pipeline. With regard to rainfall runoff drainage at and around the Project building, this will be discharged via a buried pipe with out passing through the treatment tank. Nevertheless, a sludge collection pit will be installed prior to connection to the main drainage pipeline aimed at collecting debris, sand, etc. to prevent clogging of the main pipeline.

④ Gas

A buried natural gas supply pipeline exists at the Project site. Because the only location where natural gas is planned for use within the Project building is the kitchenette on the first floor, it is planned to simply extend the existing gas pipeline for underground connection to the facility.

3) Air conditioning and ventilation

Air temperatures in the Project area fluctuate greatly between summer and winter. There are also seasonal periods where neither cooling nor heating are necessary. Equipment plan will accordingly prioritize cost-effective operation.

① Cooling and heating

Cooling and heating systems will be planned in line with equipment applied in similar facilities locally. From the standpoint of priority on minimal operation and maintenance cost, and assured repair capability in the case of breakdown, a central cooling and heating system approach will not be adopted. Cooling and heating will be by individual units for each room, which can be operated separately as needed. Wall mounted, heat pump operated units will be adopted in light of ease of operation, and general use locally.

Rooms to incorporate cooling and heating units will be occupied areas including laboratories, instructor's room, administrative office, common rooms, etc. Only in the case of the 1st floor multipurpose laboratory, ceiling fans will also be adopted due to the large size of the room.

② Ventilation

Frequency of ventilation will be kept to the minimum necessary due to impact on cooling and heating load. Due to daily presence of airborne dust, measures will be taken to capture this dust prior to air entry into the air intake. An air filter chamber will be established on the building rooftop, with air-flow ducts connecting to respective floors. The air filter chamber will be equipped with an air blower, and filter over the fresh air intake. The filter is aimed at eliminating the intrusion of insects, airborne debris, and fine dust. Ventilation equipment will be such that it can be procured locally, and can be used continuously with only regular cleaning, etc.

After filtering, fresh air is pumped into ducts routed behind hallway ceilings on each floor, and then fed to the specific rooms. Ventilating frequency (ventilation quantity) for each room is planned to achieve an appropriate balance between the quantity of fresh air intake and the quantity of air flushed outside the Project building by ventilating fan.

4) Fire extinguishing

Fire extinguishing equipment is to be in accordance with local fire fighting regulations and building code.

① Indoor fire hydrants

Indoor fire hydrants are to be located on each floor, with hose reel capability of covering a 25m radius.

② Fire extinguishers

Compact extinguishers for small-scale fire fighting are to be installed in rooms where flame is used, the multipurpose laboratory, and along evacuation routes in the case of fire. Precise installation locations are to follow local fire prevention guidelines. Fire extinguishers will require periodic replacement of fire extinguishing agent, and this is to be done by the Pakistan government side.

③ Fire extinguishing pump

5 tons of water for fire fighting is to be held in reserve below the basement water receiving tank. The fire-fighting pump is to be electric with power backup capability from the in-house generator in the case of blackouts.

④ Other

A connector water pipeline for fire-fighting purposes is to be installed at the outer wall surface near the Project building east-side outdoor corridor. Water from this pipeline is to be fed to the indoor fire hydrants.

(9) Building material plan

1) Main structural materials

Materials to be used are those that (i) are generally marketed locally, and (ii) meet recognized standards. Locally, Pakistan standards, BS standards, ASTEM standards, JIS standards, etc. are widely adopted. Locally applied quality standards will accordingly be used. In addition, in order to facilitate quality control, the types of structural materials to be used will be kept to a minimum. Main structural materials and procurement sources are indicated in Table 2.2.6.

Table 2.2.10 Main structural materials and procurement source

Application	Procurement source
・Replacing weak topsoil	: Gravel, crushed stone and sand of appropriate quality.
・Low strength concrete	: Crushed stone and sand of appropriate quality.
・RC building frame strength of at least 20N/m^2	: Crushed stone and sand of appropriate quality.
・Structural brick masonry	: Brick that can be generally procured locally.
・Exterior decor brick	: High quality brick with appropriate quality.
・On-campus road and parking lot	: Interlocking block paving.

2) Finishing plan

As in the case of the above, materials to be used are those that (i) are generally marketed locally, and (ii) meet recognized standards. Also, the types of structural materials to be used will be kept to a minimum.

a) Exterior finishing

Basic specifications are as indicated below.

Table 2.2.11 External finishing

Location	Specification	Reason for application
・On-campus walkways/ corridors	Interlocking block	Interlocking block has begun to be produced locally. It features easy maintenance, and instances of its use are increasing.
・Scarcement／ building periphery	Concrete trowel finishing; hardener coating; aggregate washout finishing.	These are commonly applied construction methods locally, and have been satisfactorily used as well on previous grant-aid projects.
・Main entrance approach way	Stone pitching generally used locally.	This is generally used locally and is highly durable.
・Ground cover	Mortar trowel finishing with epoxy resin paint coating.	Same as above.
・Exterior wall	Decorative brick or standard brick masonry; mortar trowel finishing with acrylic exterior wall coating.	Same as above.
・Roofing	Asphalt water-proofing, heat insulation; protective mortar; insulating tile cover.	Construction methods generally used locally.
・Balcony	Urethane water-proof coating	Same as above.

b) Internal finishing

Priority will be given to finishing that meets general standards for similar facilities locally, and is of appropriate durability.

Table 2.2.12 Main room internal finishing

	Room	Floor	Baseboard	Waist-high wainscoting	Ceiling	Reason for application
Learning department	・Design drawing room ・General laboratory	Terrazzo tiling	Tiling	Mortar troweling with AEP coating	Rock wool acoustic board	Same as similar local facilities; ease of floor cleaning, and durability
	・CAD laboratory	OA floor + vinyl tiling	Same as above	Same as above	Same as above	Flooring allows for facilitated wiring configuration change.
	・Multipurpose laboratory	Hard acrylic coating; partial ceramic tiling、	Same as above	Same as above	RC with AEP coating.; hallways are to be SUS mesh suspended lattice ceiling	Concrete production to be in line with in-situ work specifications. Hallway ceilings will allow for facility ductwork and piping behind ceiling work.
Administrative department	・Instructors' room ・Administrative office	Terrazzo tiling	Tiling	Mortar troweling with AEP coating	Rock wool acoustic board	Same as similar local facilities
	・Storage	Mortar troweling with epoxy resin coating	Same as above	Same as above	Concrete with AEP coating	Same as above
Female student support department	・Common rooms	Terrazzo tiling	Tiling	Mortar troweling with AEP coating	Rock wool acoustic board	Same as similar local facilities; ease of floor cleaning, and durability
	・Relaxation room	Same as above	Same as above	Same as above	Same as above	Same as above
Communal facilities	・Main entrance hall ・Multipurpose room	Polished finishing of locally procured	Stone	Mortar troweling with AEP coating	Rock wool acoustic board; partial cement board with AEP coating	Same as similar local facilities; ease of floor cleaning, and durability
	・1st floor hallway ・East side stair case	Same as above	Same as above	Same as above	Same as above	Same as above
	・Other staircase / hallway	Terrazzo /Ceramic tiling	Tiling	Same as above	Same as above	Ease of floor cleaning, and durability
	・Lavatory ・Kitchenette (same speciation)	Ceramic tiling	Same as above	Waist high wainscoting: tiling; upper wall: mortar troweling with AEP coating	Cement board with AEP coating	Same as above
	・Storage	Mortar troweling with epoxy resin coating	Same as above	Mortar troweling with AEP coating	Concrete with AEP coating	Priority of functionality
	・Basement	Same as above	None	Mortar coating	Bare concrete	Same as above

c) Other construction fittings

Other construction fittings are to comply with general specifications applied to similar local facilities.

(Windows and doors fronting to the outside)

・Windows fronting to the outside are in principle to be aluminium sash design. Project site air temperatures range from over 40ºC in the summer time. In the case of occupied rooms fronting to the building outside, semi-reflecting type window glass is to be adopted to minimize load on cooling systems. On the other hand, hallways and staircases will be windowed with single layer glass. In addition, 1st floor windows will be protected with iron grilling to prevent unlawful entry into the building.

・In the case of doors fronting to the building exterior, these are to of aluminium sash or steel design with emphasis on durability.

(Interior windows and doors)

・Interior windows will in principle be of aluminium sash design from the standpoint of durability. Doors to occupied rooms will be in principle of wooden design.

・Fire doors necessary within the staircase fire-fighting and protection zones will always remain open, with an automatic closure specification in the event of actual fire.

3) Furniture and furniture fixtures

Educational equipment and materials including desks, chairs, etc. to be used in the laboratories and classrooms of the Project architectural department educational building are to be stored when necessary in shelved storage rooms to be established under the Project. In the case of tables, chairs, cabinets, water faucet and other fixtures for the administrative office, instructors' room, multipurpose room and women's common room, these are to be provided by the Pakistan government.

Table 2.2.13 Overview of furniture and fixtures

	Room	Utilization purpose	General specification	Qty	Remarks
Learning Department	・Design drawing room (45 persons ×2 rooms)	・Drawing tables and chairs for student use ・Instructor desk/chair ・Instructor lectern	・A1 size capable ・Standard type ・Standard type	90 sets 2 sets 2 sets	
	・Design drawing room storage (1 room)	・Storage shelves	・Standard type	1 set	・Storage shelves for modeling works
	・CAD laboratory (45persons×2 rooms)	・Tables and chairs for student PC use ・Instructor desk/chair ・Instructor lectern	・For desktop use; with space for UPS accommodation	90 sets 2 sets 2 sets	・PCs and UPS equipment to be provided by the Pakistan government side
	・Server print room (2 rooms)	・Counter	・For desktop PC and printer hookup	2 sets	・Same as above
	・General laboratory (45persons×2 rooms)	・Student desks and chairs ・Instructor desk and chair ・Instructor lectern	・3 person use ・Standard type ・Standard type	30 sets 2 sets 2 sets	
	・General laboratory (1 room)	・Storage shelves			
	・Multipurpose practice lab (approx. 45 students)	・Student work tables; chairs ・Sink ・Equipment mount	・8 person use (shared instructor use) ・For practical training ・For compression testing use	6 sets 1 set 1 set	・Manual concrete compression test equipment is to be provided under the Project. Other equipment will be the responsibility of the Pakistan government.
	・Prep room (1 room)	・Dressing room for lab work; hand carried item storage	・Approx. 50 person usage	1 set	
	・Storage (4 rooms)	・Storage for laboratory materials and related equipment	・Steel shelf	4 sets	
	・Survey equipment storage (1 room)	・Storage for survey equipment	・Closeted shelf	1 set	・Survey equipment is to be provided by the Pakistan government side
Administrative department	・Storage room (2 rooms)	・Project operational materials and equipment storage	・Steel shelf	1 set	
Female student support department	・Common room (1 room)	・Student use counter, desks and chairs	・Total 48 persons	1 set	
	・Locker room (1 room)	・Student dressing room; hand carried item storage	・Approx. 96 person use (small compartments)	1 set	
	・Relaxation room (1 room)	・For female student relaxation (2 persons)	・Simple bed ・Small locker	2 sets 1 set	
Common area	・Multipurpose room; kitchenette (1 room)	・Water outlet and simple cooking service	・Kitchenette sink, food preparation table, cooking range ・Service counter	1 set 1 set	
	・Kitchenette (2 rooms)	・Kitchenette service in line with facility operation	・Sink ・Hanging cupboard	2 sets 2 sets	

2-2-2-4 Equipment plan

(1) Overall plan

1) Status of existing equipment and infrastructure

The majority of existing practical training equipment was either installed during the 1960s Colombo Plan or during GCT Railway College organization in the 1970s. Particularly in the case of the long-history Mechanical Department, practical training equipment was manufactured over 40~50 years ago and is consequently mostly obsolete. Nevertheless, this equipment is currently still functional and used for training, which is a tribute to the high degree of maintenance effort on the part of the school. Nevertheless from a technical standpoint, training equipment is undeniably obsolete given current needs for equipment know-how within respective industrial sectors.

On the other hand, Architectural Department practical training equipment includes some up to date CAD enabled computers, design drawing tables, etc. However, there is no equipment for acquiring skills in concrete quality control, and a thorough practical learning environment is accordingly not in place.

Against this background, a JICA technical cooperation project has been ongoing since 2009 (2009~2013) aimed primarily at curriculum revision to meet the requirements of the industrial sector. Nevertheless, despite the fact that training equipment for both the Mechanical Department and the Architectural Department is being provided under the above project, equipment is still remains lacking for fully effective training in terms of both departments.

In the case of the Mechanical Department of the GCT Railway College, almost all workshops and laboratories are located within the main campus. These workshops and laboratories exhibit deterioration, and have minimal equipment to meet the needs of practical training. In order to carry out new curricula in the case of under-equipped workshops and laboratories, the Pakistan government is currently rehabilitating facilities within Jubilee Hall adjacent to the main campus. This makes it possible to provide Project equipment for the Mechanical Department to either existing workshop and laboratories or those to be newly created at Jubilee Hall.

The Architectural Department has begun accepting female students from September 2010. At the same time, the number of classes per academic year has been planned for expansion from 1 class to 2 classes. As a result, it is problematic to create new practical training classrooms and laboratories within the existing facility. To address this, a new Architectural Department lecture building is planned under the Project to be constructed at the Jubilee site adjacent to the main campus. The Architectural Department equipment will plan to be provided under the Project.

2) Overview of existing main equipment, level of implementation and utilization purpose

Main equipment, level of implementation and utilization purpose of equipment already installed

in existing workshops and laboratories for which the Pakistan government has made equipment request are summarized below. In addition, existing equipment and existing electrical distribution circuitry diagrams for existing workshops and laboratories are separately attached in appendices-2.

(Mechanical Department workshops/laboratories)

a) Basic machining laboratory

- Main equipment :Standard lathes (20), table top drill press (1), double head grinder (2), power sawing machine, other
- Implementation level :Almost all equipment is either of Pakistan or Japanese manufacture from 20~30 years ago. Nevertheless, equipment has been well maintained and 15 units out of the total 20 lathes are in operation. Although this equipment is essential to basic technical training, quantities for thorough student training are lacking.
- Purpose of use :To carry out basic practical training in machining and tooling.

b) Applied mechanics laboratory

- Main equipment : Standard lathes (4), shaping machines (2), surface grinder (1), milling cutters (6), tool grinder (1), drill press (1), cylinder grinder (1), digital calipers (2), other
- Implementation level :Various tooling machines are installed ranging from manufacture in 1955 to manufacture in 2009. However, equipment geared to responding to practical private sector company machining requirements are few.
- Purpose of use : To carry out practical training mainly in the third year.

c) Measuring technology laboratory

- Main equipment : Micro-meters (various types), digital calipers (13), dial type protractors (2), gear tooth vernier calipers (4), mechanical comparative testing units (2) electrical comparative testing units (2), other
- Implementation level : Equipment is relatively new, and all items are in usable condition. However, equipment geared to responding to practical private sector company testing and measurement requirements are few.

・Purpose of use :To carry out practical training from basic theory to actual application with regard to measuring techniques.

d) Welding workshop

・Main equipment :Welding transformers (4), arc welding rectifiers (2), oxyacetylene gas cutting torch (1), oxyacetylene gas welding torch (1), TIG welders (2), MIG welders (2), other

・Implementation level :Equipment for basic practical welding training is on hand; however, equipment for training in actual works performed on site by private sector companies are few. TIG welders (2) and MIG welders (2) were provided by JICA Technical Cooperation Project in 2010, and are planned for installation within a welding workshop in a separate facility near the existing welding workshop which is currently being prepared by the Pakistan government side.

・Purpose of use :To carry out practical training from basic theory to actual application with regard to welding.

e) Foundry workshop

・Main equipment :Buffing machines (2), optical pyrometers (2), electric sand shifter (1), other

・Implementation level :The above equipment was manufactured 40~50 years ago. Because basic equipment for practical foundry training is broken down, only explanatory lectures without accompanying equipment are currently being carried out.

・Purpose of use :To carry out practical training from basic theory to actual application with regard to foundry working.

f) Metal working laboratory

・Main equipment :Vices (42), hacksaw (1), foot-pedal tool grinder (1), thin sheet cutter (1), thin sheet roller(1), bending unit (1), electric drill (1), other

・Implementation level :With the exception of the electric drill (manufactured in 2000), other equipment was manufactured 40~50 years ago. Furthermore, electrically powered equipment is few, with almost all being hand operated.

・Purpose of use :To carry out practical training from basic theory to actual

application with regard to metal working.

g) Material testing and thermal treatment laboratory

・Main equipment :Brinell hardness tester (1), Rockwell hardness tester (1), Izod impact tester (1), test piece cutter (1), test piece polisher (1), metal microscope (1), other

・Implementation level :Basic equipment is lacking for training in material properties.

・Purpose of use :To carry out practical training from basic theory to actual application with regard to inspecting and identifying material properties.

h) Fluid experiment laboratory

・Main equipment :Fluid friction test equipment (1), Pelton turbine (1), reaction turbines (2), electric-type centrifugal pump (1), engine-type centrifugal pump (1), orifice flow test devices (2), other

・Implementation level :Basic equipment is lacking for training in the properties of hydraulic control.

・Purpose of use :To carry out practical training from basic theory to actual application with regard to inspecting and identifying fluid properties.

i) CNC laboratory

・Main equipment :CNC lathe models (2), computers (6), particle machining centers (3), turning centers (2), other

・Implementation level :The Pakistan government side places maximum priority on appropriately equipping this laboratory. In order to directly respond to needs within respective industrial sectors, the particle machining center (3) and turning center (2) units were provided by JICA Technical Cooperation Project in 2010. However, wire-cutter, etc. equipment is also necessary but as of yet is still lacking.

・Purpose of use :To carry out practical training in mold fabrication primarily in the second and third year.

j) Wood working laboratory

・Main equipment :Wood working lathes (2), band saw (1), copping saw (1),

drill press (1)、automatic planer (1), mortising machine (1), drilling groove finisher (1), disk grinder (1), electrical grinder (1), other

・Implementation level :Various wood working and finishing equipment have been installed; however, the number of wood working lathes (which consume the most time in the work process) are insufficient. This results in an excessive amount of waiting time in the course of the work process.

・Purpose of use :To carry out basic practical training in wood working techniques.

k) CAD laboratory

・Main equipment :Computers (50), multi-input projector (1), CAD software (50 sets), uninterrupted power supply (UPS) units (5), computer desks and chairs (50 sets)

・Implementation level :All of the above equipment was provided by JICA Technical Cooperation Project in 2010 to directly respond to needs within respective industrial sectors. However, machine element sets necessary for training are lacking.

・Purpose of use :To carry out practical training from basic theory to actual application of CAD drafting

l) Design drawing laboratory

・Main equipment :Drawing desks and chairs (150 sets)

・Implementation level :Of the 150 sets procured locally, 45 units are broken down. Furnishings are thus lacking for effective training given the fact that there are 4 classes per academic year in the Mechanical Department.

・Purpose of use :To carry out practical training from basic theory to actual application of design drawing.

m) Electrical equipment laboratory

・Main equipment :Current clamp meters (3), voltmeter (1), magnetic switch offs (5), induction motors / single phase (3), induction motors / 3 phase (2), alternator (1), DC generator (1), other

・Implementation level :Equipment for basic practical training regarding power

supply / electrical power has been installed; however, there is no equipment on hand for practical training in phase shift, etc.

・Purpose of use :To carry out practical training from basic theory to actual application of power supply and control for electrically powered equipment.

n) Electrical circuit laboratory

・Main equipment :Two phenomena oscilloscopes (2)

・Implementation level :Basic knowledge and training in electrical circuits is necessary due to the fact that most machinery now generally includes electrical circuit controls. The laboratory has no operating oscilloscope at present due to malfunction, and is therefore inadequate for practical training in machinery related control circuitry.

・Purpose of use :To carry out basic practical training in electrical and control circuitry

o) Other

・Main equipment :General purpose equipment for measuring and gauging results of practical training exercises (common equipment not assigned to any particular laboratory or workshop).

・Implementation level :Not equipped with the exception of simple equipment like thermometers, testers, etc.

・Purpose of use :Commonly shared equipment that should be permanently on hand to evaluate the effectiveness, etc. of practical training.

（Architectural Department workshops/laboratories）

a) Design drawing laboratory (Drawing class)

・Main equipment :Drawing tables and chairs (50 sets)

・Implementation level :Due to dilapidation and damage, new drawing tables and chairs (Pakistani manufacture) were provided by JICA Technical Cooperation Project in 2010. However, the classroom itself is deteriorated, with insufficient lighting.

・Purpose of use :To carry out practical training from basic theory to actual

application of design drawing drafting.

b) Multipurpose practice laboratory (Materials testing laboratory)

- Main equipment :Desks and chairs (50 sets); water supply and drainage model (1); electrical wiring model (1); material sample (1); others
- Implementation level :Only models of building facilities are displayed around a standard classroom; no hands-on practical training is carried out.
- Purpose of use :Although material training from basic theory to actual application is a prerequisite, only seated lectures while students view models are carried out at present.

c) CAD laboratory (CAD class)

- Main equipment :Computers (52), uninterrupted power supply (UPS), computer desks and chairs (52 sets)
- Implementation level :Although computers are old models, they are sufficient for CAD practical training. The laboratory room itself, however, suffers from dust intrusion due to dilapidated windows; lighting is poor; ventilation is poor; etc.
- Purpose of use :To carry out practical training from basic theory to actual application of CAD drafting.

d) Survey laboratory (Survey equipment storage)

- Main equipment :Transit (1), survey equipment / total stations (5), auto levels (5)
- Implementation level :Almost all equipment was provided by JICA Technical Cooperation Project in 2010. However equipment is kept in a common storeroom which is subject to dust intrusion. There is no dedicated storage area installed with storage cabinets.
- Purpose of use :To carry out practical training from basic theory to actual application of survey techniques.

e) Other

- No laboratory or related equipment is available for practical training in basic fabrication supervision for concrete, brick masonry, etc.

(2) Equipment plan

Equipment under the Project is that intended for practical training in the Mechanical Department and Architectural Department. Project planning envisions the minimal necessary equipment, in terms of both content and quantity, for effective training based on general equipment usage locally, procurement conditions and local operation and maintenance infrastructure.

1) Equipment selection

Approach to equipment selection is based on the following.

① Strengthening practical training capability	Necessary equipment to implement the revised curricula is to be provided, aiming at improved practical training.
② Priority on facilitated student use	Design equipment is aimed at that which can be used by a maximum of students. Equipment requiring excessively specialized instruction for use is to be eliminated from equipment selection.
③Guaranteed maintenance	Based on assessment of personnel to operate equipment and the presence of qualified local service agencies, it is concluded that sufficient equipment maintenance is possible.
④Consumables	In the case of requested consumables, this falls outside the scope of Project equipment provision
⑤ Outside Project scope	Office furniture and other equipment fully within the capability of the Pakistan government side fall outside the scope of the Project. In addition, computer and other equipment requiring constant update are also outside the scope of the Project.
⑥ Procurement source	In principle, procurement will be from either Japan or Pakistan.
⑦ Import restriction	Equipment items that are restricted for import into Pakistan fall outside the scope of the Project.

2) Quantities

Necessary equipment specification under the Project is to be a minimal requirement based on the usage potential of existing equipment as well as envisioned training method. (For example, lathes to be provided for basic technical training in machining are to enable two students to work with a single lathe.)

Quantities of necessary equipment comprise existing equipment that are still usable, plus minimally required new equipment based on training methods. Numbers of necessary equipment per class are planned in line with quantity levels in the case of industrial secondary schools in Japan. Where existing equipment can be continued to be used, design equipment quantity under the Project is the total required quantity minus existing and still usable equipment.

For example in the case of lathes for basic technical training in machining, the required equipment quantityis 20 units, i.e. one unit per two persons out of a class of 40 students. Accordingly, if 15 existing lathe units are still usable, the required quantity for new lathe equipment under the Project is 5 units (i.e., total requirement of 20 units - 15 units = 5 units).

3) Level of equipment specification

Equipment specification will be the minimum necessary for practical training. In the case of some requested equipment, that of Japanese manufacture is intended for industrial use and has performance specifications that exceed the requirements of classroom practical training. In such case, attention will be given to procuring appropriate items for general classroom use from a third country.

4) Determining necessary equipment

Assessing necessary equipment is prioritized in the order of A, B, and C below. (Concerning continued training and necessity for updated computer use, etc., this is to be left up to the Pakistan government side. Accordingly related equipment in this regard is to be given lower priority under the Project.)

A : Trainees can individually engage with and operate equipment without upperclass student or instructor assistance (this type of equipment is lacking at present). It is further necessary that equipment use matches the requirements of sample machining, processing, etc. Also, equipment that requires a minimum of works in terms of installation falls into this category A. (A+ indicates equipment items within the A category that the Pakistan government highly requests.)

B : Selection of Project equipment will focus on smooth operational flow and basic knowledge of operation. Equipment with high practical training effectiveness fall into category B. (B+ indicates equipment items within the B category that the Pakistan government highly requests.)

C : Items planned to be provided by the recipient country. This includes items requiring continuous procurement, such as consumables, micellaneous goods, etc.

5) Approach to selection of Architectural Department equipment

With regard to furniture, furnishings, etc. manufactured locally that are included within the requested equipment for the architectural course, fabrication, implementation and quality control are considered appropriate for the scope of the envisioned Project facility.

In addition, the Pakistan government side initially requested an overhead runner hoist to move or dismantle concrete walls and masonry construction models used for practical fabrication training in the multipurpose practice zone. However, safe hoist operation requires a good level of technical ability from a safety standpoint, and poses danger when operated by inexperienced personnel. Accordingly, pallet forklift equipment or wheeled pallets are to be deployed to ensure safe movement within the area of heavy components including concrete walls and masonry construction models fabricated by students and instructors.

6) Congruence with equipment under the technical cooperation project

Within the list of equipment requested by the Pakistan government, a portion of essential equipment for practical training under the new curriculum has already been provided under the ongoing JICA technical cooperation project. Additionally, other equipment is in the process of being procured. Under the Project equipment study, equipment already provided under the JICA technical cooperation project as well as that in the process of being procured is considered as equipment on hand. Nevertheless, this equipment does not fully meet required quantities. In the case where additional equipment is necessary, this will be selected from an operational and maintenance standpoint with specifications compatible in terms of interchangeable consumables and miscellaneous materials/parts with existing equipment provided (or in the process of procurement) under the technical cooperation project.

7) Study on requested equipment

Based on 1) ~ 6) above, result of study on requested equipment is indicated in the following tables.

The requested equipment list from the Pakistan side is set out by laboratory and workshop. Table 2.2.14 summarizes equipment by laboratory/workshop in order to compare required electric power input.

1) **Mechanical Department**

In accordance with the agreement of priorities of equipment (A-shaded, A, B-shaded, B,C) on site, followings are reasoning of equipment selection for quantity and priority.

Table 2.2.14 Study on requested equipment (1/5)

No.	Requested Equipment Name	Quantity				Priority	Adoption	Reasoning
		Request	Schedule	Existing	Total			
	1. Basic Machine Shop							
1	1-1 Lathe Machine	20	5	15	20	A	○	Lathe is a fundamental equipment in mechanical working. Among 20 existing lathes, 5(not workable) are to be replaced. Training efficiency can be increased (1 lathe for 2 students)
2	1-2 Bench Type Drilling Machine	5	2	1	3	A	○	Effective training is difficult by existing one machine. 2 units are to be supplied so that 13 students can use one machine.
	1-3 Band Saw	1	0	1	1	C	×	Consumable, simple tools, obtainable in Pakistan
	1-4 Square V Block	5	0	0	0	C	×	Same as above.
	1-5 Surface Gauge	5	0	1	1	C	×	Same as above.
	1-6 Steel Surface Plate	2	0	0	0	C	×	Same as above.
	1-7 Outer Compass	5	0	2	2	C	×	Same as above.
	1-8 Inner Compass	5	0	2	2	C	×	Same as above.
	1-9 Plug Gauge Set	1	0	0	0	C	×	Same as above.
	1-10 Ring Gauge Set	1	0	0	0	C	×	Same as above.
	1-11 Engineering Square	10	0	2	2	C	×	Same as above.
	1-12 Protractor	10	0	0	0	C	×	Same as above.
	1-13 Screw Pitch Gauge	10	0	0	0	C	×	Same as above.
	1-14 Hammer	10	0	1	1	C	×	Same as above.
	1-15 Punch Set	10	0	1	1	C	×	Same as above.
	1-16 Pedestal Grinder	1	0	1	1	C	×	Same as above.
	1-17 Chisel Set	10	0	2	2	C	×	Same as above.
	1-18 File Set	10	0	3	3	C	×	Same as above.
	1-19 Oil Jug	20	0	2	2	C	×	Same as above.
	1-20 POM Material (Cylinder)	3	0	0	0	C	×	Same as above.
	1-21 POM Material (Plate)	3	0	0	0	C	×	Same as above.
	1-22 Hand Tap	10	0	3	3	C	×	Same as above.
	1-23 Tap Handle	20	0	5	5	C	×	Same as above.
	1-24 Round Die	10	0	3	3	C	×	Same as above.
	1-25 Die Handle	20	0	5	5	C	×	Same as above.
	2. Advance Machine Shop							
1	2-1 Lathe Machine	4	4	0	4	A	○	Indispensable machines for 3 years grade practical training.
3	2-2 Hobbing Machine	1	1	0	1	A	○	No hobbing machine existing. Hob grinding is necessary technique to learn and it is emphasized in the new curriculum.
4	2-3 Vertical Milling Machine	4	2	1	3	A	○	No hobbing machine existing. Hob grinding is necessary technique to learn and it is emphasized in the new curriculum.
5	2-4 Shaper	2	1	2	3	B	○	Same as above, one unit is to be supplied to increase training efficiency.
6	2-5 Surface Grinder	2	1	1	2	A	○	Same as above, one unit is to be supplied to increase training efficiency.
7	2-6 Universal Tool and Cutter	2	1	1	2	B	○	Same as above, one unit is to be supplied to increase training efficiency.
8	2-7 Micrometer	5	5	0	5	B	○	Min. quantity is required for efficient training
9	2-8 Digital Caliper	5	5	2	7	B	○	Same as above
	2-9 Gear Puller	3	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	2-10 Handy Drilling Machine	5	0	1	1	C	×	Same as above
	2-11 Handy Disc Grinder	5	0	1	1	C	×	Same as above
	3. Metrology Lab.							
8	3-1 Micrometer	10	10	4	14	B	○	Min. quantity is required for efficient training
10	3-2 Anvil Micrometer	5	5	0	5	B	○	Same as above
9	3-3 Digital Caliper	10	10	4	14	B	○	Same as above
11	3-4 Digital Pitch Caliper	5	5	0	5	B	○	Same as above
12	3-5 Dial Indicator	10	10	2	12	B	○	Same as above
13	3-6 Digital Depth Gauge	10	10	1	11	B	○	Same as above
14	3-7 Digital Height Gauge	5	5	1	6	B	○	Same as above
	3-8 Digital Bevel Protractor	6	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
15	3-9 Dial Caliper	10	5	5	10	A	○	Absolute numbers is shortage although fundamental measuring tool, resulting inefficient training work. Min. necessary units are to be supplied.
16	3-10 Dial Bore Gauge	3	3	0	3	B	○	Min. quantity is required for efficient training
17	3-11 Dial Caliper Gauge	3	3	0	3	B	○	Same as above
	3-12 Plug Gauge	3	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	3-13 Gauge Block Set	3	0	1	1	C	×	Same as above
	3-14 Sine Bar	5	0	1	1	C	×	Same as above
	3-15 Plug Gauge Set	3	0	1	1	C	×	Same as above
	3-16 Gear Tooth Micrometer	3	0	0	0	C	×	Same as above
18	3-17 Inner Micrometer	3	3	3	6	A	○	Same as above 3-9
19	3-18 Groove Width Caliper	5	3	0	3	A	○	No existing tool although fundamental measuring tool. Min. necessary units are to be supplied.
20	3-19 Mechanical Comparator	5	2	2	4	A	○	Same as above
21	3-20 Electrical Comparator	5	2	2	4	A	○	Same as above
22	3-21 Engineering Microscope	2	2	0	2	B	○	No existing tool although fundamental measuring tool. Min. necessary units are to be supplied.
23	3-22 Depth Gauge	10	10	2	12	B	○	Min. quantity is required for efficient training
	3-23 Engineering Square	10	0	2	2	C	×	Consumable, simple tools, obtainable in Pakistan
	3-24 Granite Surface Plate	2	0	0	0	C	×	Same as above
24	3-25 Steel Surface Plate	4	4	0	4	B	○	Min. quantity is required for efficient training
25	3-26 Snap Gauge Set	10	10	0	10	B	○	Same as above
26	3-27 Ring Gauge Set	2	2	0	2	B	○	Same as above
27	3-28 Thread Ring Gauge	5	5	0	5	B	○	Same as above
28	3-29 Protractor	10	10	0	10	B	○	Same as above
29	3-34 Point Micrometer	5	5	0	5	B	○	Same as above
	3-35 Profile Projector	1	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan

Table 2.2.14 Study on requested equipment (2/5)

No.	Requested Equipment Name	Quantity				Priority	Adoption	Reasoning
		Request	Schedule	Existing	Total			
30	3-36 Depth Micrometer	5	4	0	4	A	○	Same as 3-21
	3-37 Laser Length Measuring Instrument	1	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	3-38 V Block	10	0	0	0	C	×	Same as above
	3-39 Level	10	0	0	0	C	×	Same as above
	3-40 Thickness Gauge	10	0	0	0	C	×	Same as above
31	3-41 Radius Gauge	5	5	0	5	B	○	Same as 3-25
32	3-42 Screw Pit Gauge	10	10	0	10	B	○	Same as above
	3-43 Wire Gauge	10	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
33	3-44 Universal Gear Inspection Equipment	1	1	0	1	B	○	Same as 3-42
34	3-45 Digital Gauge Tester	1	1	0	1	B	○	Same as 3-42
35	3-46 Taper Gauge	3	3	0	3	B	○	Same as 3-42
36	3-47 Parallel Bar	10	10	0	10	A	○	Practical training following to the New curriculum cannot be available as these tools are not existing. Min. necessary quantities are to be supplied.
37	3-48 Surface Roughness Standard Piece	4	2	0	2	A	○	
38	3-49 Drill Gauge	5	2	0	2	A	○	
39	3-50 Square V Block	10	5	0	5	A	○	
	3-51 Marking Needle	20	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	3-52 Surface Gauge	20	0	0	0	C	×	Same as above
	3-53 Plastic Hammer	20	0	0	0	C	×	Same as above
	3-54 Punch	20	0	0	0	C	×	Same as above
	3-55 Compass	20	0	0	0	C	×	Same as above
	4. Welding Shop							
40	4-1 Arc Welding Machine	6	6	0	6	B	○	Min. quantity is required for efficient training
41	4-2 TIG Welding Machine	4	2	2	4	A	○	Although 2 units are existing on site, this is not enough for 40 students. Another 2 units are to be supplied so that enough training time for each student can be obtainable.
42	4-3 MAG Welding Machine	4	2	2	4	A	○	Same as above
	4-4 Plasma Cutting Machine	2	1	0	1	A	○	Although 2 units are existing on site, this is not enough for 40 students. Another 2 units are to be supplied so that enough training time for each student can be obtainable.
	4-5 Welding Table	16	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
44	4-6 Forging Furnace	5	5	2	7	B	○	Min. quantity is required for efficient training
45	4-7 Pedestal Grinder	1	1	1	2	A	○	Same as 4-4
46	4-8 Gas Mani Fold System	1	1	0	1	A	○	Same as 4-4
47	4-9 Oxygen Gas Cylinder	5	5	4	9	B	○	Min. quantity is required for efficient training
48	4-10 Acetylene Gas Cylinder	5	5	2	7	B	○	Same as above
49	4-11 Oxy-Acetylene Gas Cutting Torch	5	5	2	7	B	○	Same as above
50	4-12 Oxy-Acetylene Welding Torch	5	5	4	9	B	○	Same as above
	4-13 Anvil	5	0	3	3	C	×	Consumable, simple tools, obtainable in Pakistan
	4-14 Swage Block	5	0	0	0	C	×	Same as above
g	4-15 Forging Pincer	10	0	3	3	C	×	Same as above
	4-16 Large Hammer	10	0	3	3	C	×	Same as above
	4-17 Smasher	10	0	3	3	C	×	Same as above
51	4-18 Hand Vice	30	30	10	40	B	○	Min. quantity is required for efficient training
52	4-20 Welding Shield	20	20	3	23	B	○	Same as above
	4-21 Leather Glove	20	0	3	3	C	×	Consumable, simple tools, obtainable in Pakistan
	4-22 Welding Holder	5	0	0	0	C	×	Same as above
	4-23 Welding Earth Clip	5	0	0	0	C	×	Same as above
53	4-24 Air Compressor	1	1	0	1	A	○	Same as 4-4
	4-25 Welding Apron	20	0	2	2	C	×	Consumable, simple tools, obtainable in Pakistan
	4-26 Welding Glass	10	0	2	2	C	×	Same as above
	4-27 Foot Cover	20	0	0	0	C	×	Same as above
	4-28 Wire Brush	20	0	3	3	C	×	Same as above
	4-29 Scriber	20	0	5	5	C	×	Same as above
54	4-30 Cylinder Rack	4	4	2	6	B	○	Min. quantity is required for efficient training
55	4-31 Handy Disc Grinder	5	5	1	6	B	○	Same as above
	5. Foundry Shop							
56	5-1 Tilting Crucible Furnace	2	1	0	1	A	○	Practical training following to the New curriculum cannot be available as these equipment are not existing. Min. necessary quantities are to be supplied.
57	5-3 Jolt Squeeze Molding Machine	1	1	0	1	A	○	
58	5-4 Sand Milling Machine	1	1	0	1	A	○	
59	5-5 Permeability Meter	2	1	0	1	A	○	
60	5-6 Mold Tester	5	1	0	1	A	○	
61	5-7 Pyrometer	2	2	1	3	A	○	
62	5-11 Crucible	8	8	4	12	B	○	Min. quantity is required for efficient training
63	5-12 Mold Box	8	8	4	12	B	○	Same as above
64	5-13 Power Riddle Machine	1	1	0	1	B	○	Same as above
45	5-14 Pedestal Grinder	1	1	1	2	A	○	Same as 5-1
53	5-15 Air Compressor	1	1	0	1	A	○	Same as above
65	5-16 Air Blower	4	2	0	2	A	○	Same as above
66	5-17 Air Gun	5	5	2	7	B	○	Same as 5-11
	5-20 Large Hammer	10	0	3	3	C	×	Consumable, simple tools, obtainable in Pakistan
	5-21 Porging Pincer	5	0	3	3	C	×	Same as above
	5-22 Riddle	10	0	3	3	C	×	Same as above
	5-23 Goggle	20	0	5	5	C	×	Same as above
	5-24 Level	5	0	2	2	C	×	Same as above
	5-25 Leather Globe	20	0	3	3	C	×	Same as above
	5-26 Spatula	20	0	5	5	C	×	Same as above
	5-27 Shovel	10	0	3	3	C	×	Same as above
	5-28 Hand Saw	20	0	3	3	C	×	Same as above
	5-29 File Set	20	0	3	3	C	×	Same as above
	5-30 Chisel Set	10	0	2	2	C	×	Same as above

Table 2.2.14 Study on requested equipment (3/5)

No.	Requested Equipment Name	Quantity				Priority	Adoption	Reasoning
		Request	Schedule	Existing	Total			
	6. Metal Shop							
	6-1 Bench Vice	10	0	42	42	C	×	Consumable, simple tools, obtainable in Pakistan
	6-2 Ring Spanner Set	5	0	0	0	C	×	Same as above
	6-3 Socket Spanner Set	5	0	0	0	C	×	Same as above
	6-4 Pedestal Grinder	1	0	1	1	C	×	Same as above
67	6-5 Power Hack Saw	2	2	1	3	B	○	Min. quantity is required for efficient training
68	6-6 Disc Cutter	2	2	0	2	A	○	Although they are fundamental equipment, not existing or only one unit existing in the shop. Min. necessary quantities are to be supplied.
69	6-7 Manual Sheet Bending Machine	2	2	1	3	A	○	
70	6-8 Manual Sheet Rolling Machine	2	2	1	3	B	○	
71	6-9 Manual Sheet Shearing Machine	2	2	1	3	B	○	
72	6-10 Handy Drilling Machine	2	2	0	2	B	○	Min. quantity is required for efficient training
	6-11 Work Table	10	0	2	2	C	×	Consumable, simple tools, obtainable in Pakistan
73	6-12 Micrometer	3	3	0	3	A	○	Same as 6-6
9	6-13 Digital Caliper	5	5	0	5	B	○	Same as 6-10
74	6-14 Surface Plate for Sheet Metal	5	4	0	4	A	○	Same as 6-6
75	6-15 Lever Shear	5	5	0	5	B	○	Same as above
	6-16 Chisel	10	0	2	2	C	×	Consumable, simple tools, obtainable in Pakistan
	6-17 Hammer	10	0	4	4	C	×	Same as above
	6-18 Steel Snip	10	0	1	1	C	×	Same as above
	6-19 Tong	10	0	2	2	C	×	Same as above
	6-20 File Set	10	0	3	3	C	×	Same as above
	7. Material Testing & Heat Treatment Lab.							
76	7-1 Brinnel Hardness Testing Machine	2	1	1	2	A	○	Although they are fundamental equipment, absolute number is shortage. Min. necessary quantities are to be supplied.
77	7-2 Rockwell Hardness Testing Machine	2	1	1	2	A	○	
	7-3 Izod Impact Testing Machine	1	0	1	1	C	×	Existing one set is enough as frequency in use is not high.
	7-4 Universal Testing Machine	1	0	1	1	C	×	
	7-5 Sample Cut-off Machine	1	0	1	1	C	×	
	7-6 Sample Mount Press	1	0	1	1	C	×	
	7-7 Sample Polishing Machine	2	0	1	1	C	×	
78	7-8 Metallurgical Microscope	2	1	1	2	A	○	Same as 7-1
79	7-9 Torsion Testing Machine	2	1	0	1	A	○	They are not existing in the lab although specified in the new curriculum. Min. quantity is to be supplied.
80	7-10 Rotation Fatigue Testing Machine	2	1	0	1	A	○	
81	7-11 Electric Annealing Furnace	1	1	1	2	A	○	Same as 7-1
82	7-12 Hardening and Quenching Bath	1	1	0	1	A	○	Same as 7-9
45	7-13 Pedestal Grinder	1	1	1	2	B	○	Min. quantity is required for efficient training
83	7-14 Ultrasonic Detecting Equipment	1	1	0	1	B	○	Min. quantity is required for efficient training
	8. Hydraulic Lab.							
84	8-1 Fluid Friction Apparatus	2	2	1	3	B	○	Although Hydraulics and Pneumatics are specified in the New curriculum, but most of necessary equipment, parts, measuring tools are not existing in the lab. Demands from commercial field for this equipment is increasing, but training and lecture in the lab at present are being made by using charts and drawings, students cannot receive actual training by touching actual machine, parts and measuring tool. Min. necessary units are to be supplied.
85	8-2 Venturi Meter Apparatus	2	1	2	3	A	○	
86	8-3 Bernoulli's Theorem Apparatus	2	1	0	1	A	○	
87	8-4 Orifice Flow Apparatus	2	1	1	2	A	○	
88	8-5 Apparatus of Energy Loss	2	1	0	1	A	○	
89	8-6 Centrifugal Pump Apparatus	1	1	1	2	B	○	
90	8-7 Axial Pump Apparatus	1	1	0	1	B	○	
91	8-8 Piston Pump Apparatus	1	1	0	1	B	○	
92	8-9 Pelton Turbine	1	1	1	2	B	○	
93	8-10 Axial Flow Turbine	1	1	0	1	B	○	
94	8-11 Francis Turbine	1	1	0	1	A	○	
95	8-12 Radial Flow Turbine	1	1	0	1	A	○	
96	8-13 Hydraulic Equipment Set	3	2	0	2	A	○	
97	8-14 Hydraulic Bench	2	1	2	3	A	○	
98	8-15 Axial Pump Sectional Cut Model	1	1	0	1	A	○	
99	8-16 Ball Valve Sectional Cut Model	1	1	0	1	A	○	
100	8-17 Vane Pump Sectional Cut Model	1	1	0	1	A	○	
101	8-18 Piston Pump Sectional Cut Model	1	1	0	1	A	○	
102	8-19 Digital Length Measuring Equipment	2	1	0	1	A	○	
	8-20 Digital Tachometer	3	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	9.CNC & Mold Making Lab. Requested amount of the lab is the highest and it is considered GCT put the most importance into this workshop.							
103	9-1 Vertical Machining Center	4	1	3	4	A	○	This is processing machine where small-midi size firms in Lahore city are now commonly using, therefore, students training for the usage and cutting technology is indispensable. One unit is to be supplied to decrease time for waiting and make effective training.
104	9-2 Turning Lathe	3	1	2	3	A	○	Same as above
105	9-3 CNC Wire Cut	2	1	0	1	B	○	It is specified in the New curriculum but no existing equipment in the lab. Min. necessary one unit is to be supplied.
	9-4 CNC EDM Sinker	1	0	0	0	C	×	Too advanced equipment than training level.
	9-5 CNC Laser Cutting Machine	1	0	0	0	C	×	
	9-6 Coordinate Measuring Machine	1	1	0	1	A	×	It is specified in export control items in Japan, which is out of supplied equipment.
106	9-7 Robotics Equipment Kit	2	1	0	1	A	○	Same as 9-3

Table 2.2.14 Study on requested equipment (4/5)

No.	Requested Equipment Name	Quantity				Priority	Adoption	Reasoning
		Request	Schedule	Existing	Total			
	9-8 Computer	10	10	6	16	C	×	Computer is ever improving item. To be procured in Pakistan.
	9-9 2-plate Sample Mold	2	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
107	9-10 DVD Video for Mold Making and Molding	1	1	0	1	A	○	This video is alternative way to teach students how to operate actual equipment.
108	9-11 Manual Injection Molding Machine	2	2	0	2	B	○	Min. quantity is required for efficient training
109	9-12 Pneumatic Equipment Set	3	2	0	2	A	○	It is specified in the New curriculum but no existing equipment in the lab. Min. necessary two units are to be supplied.
73	9-13 Micrometer	3	3	0	3	A	○	Min. necessary units are to be supplied.
	9-14 Digital Caliper	10	0	2	2	C	×	Consumable, simple tools, obtainable in Pakistan
110	9-15 Surface Gauge	5	5	1	6	B	○	Min. quantity is required for efficient training
111	9-16 Steel Fur face Plate	4	1	0	1	A	○	Indispensable plate for measuring work piece. Min. unit is to be supplied.
112	9-17 Depth Gauge	3	3	0	3	A	○	This tool is shortage in the lab. Min. 3 units are to be supplied.
	10. Thermodynamics Lab.							
	10-1 Diesel Engine Injection Cut Model	1	0	0	0	C	×	As similar equipment are existing in Automobile Diesel Department, these equipment are common use with them.
	10-2 Gasoline Engine Cut Model	1	0	0	0	C	×	
	10-3 Diesel Engine Cut Model	1	0	0	0	C	×	
	10-4 Steam Engine Cut Model	1	0	0	0	C	×	
	10-5 Boiler Cut Model	1	0	0	0	C	×	
	10-6 Gasoline Engine Testing Apparatus	1	0	0	0	C	×	
	10-7 Diesel Engine Testing Apparatus	1	0	0	0	C	×	
113	10-8 Ignition Point Testing Machine	1	1	0	1	A	○	Ignition point is one of the characteristics used to determine flammability of petroleum products. It is specified in the New curriculum but no existing equipment in the lab. Min. one unit is to be supplied.
114	10-9 Air Compressor Testing Machine	1	1	0	1	B	○	Min. quantity is required for efficient training
115	10-10 Gas Turbine Testing Machine	1	1	0	1	B	○	Same as above
	10-11 Engine Assembling Kit	4	0	0	0	C	×	As similar equipment are existing in Automobile Diesel Department, these equipment are common
116	10-12 Steam Boiler Experiment Apparatus	1	1	0	1	B	○	Same as 10-9
	11. Wood Work Shop							
117	11-1 Wood Turning Lathe	2	1	2	3	A	○	Necessary equipment to make wood pattern. Only 2 units are existing which is not enough for 40 students practice. One unit is to be supplied to decrease waiting time and increase effective training.
118	11-2 Band Saw Machine	2	1	1	2	B	○	Min. quantity is required for efficient training
	11-3 Meter Saw Machine	1	0	1	1	C	×	Consumable, simple tools, obtainable in Pakistan
	11-4 Disc Sanding Machine	1	0	1	1	C	×	Consumable, simple tools, obtainable in Pakistan
	12. CAD/CAM & Machine Design Lab.							
	12-1 Computer	50	45	50	95	C	×	Computer,etc., is ever improving item. To be procured in Pakistan.
	12-2 UPS	50	45	50	95	C	×	
	12-3 Desk	50	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
	12-4 Laser Printer	2	0	0	0	C	×	Same as above
	12-5 Copy Machine	1	0	0	0	C	×	Same as above
119	12-6 Multi Media Projector	1	1	0	1	B	○	Min. quantity is required for efficient training
120	12-8 Spring Test Equipment	2	2	0	2	B	○	Min. quantity is required for efficient training
121	12-11 Machine Element Set	2	1	0	1	A	○	Previously, lecture was made by using drawings and pictures. Actual equipment is to be supplied to increase effective training.
	13. Drawing Hall							
	13-1 Drawing Desk	150	150	150	300	C	×	These equipment can be available in Pakistan, therefore changed priority to C.
	13-2 Stool	150	150	150	300	C	×	
	14. Power Lab.							
	This lab is comparatively well equipped and most of equipment requested can be procured locally.							
122	14-1 Electrical Machine trainer	2	2	0	2	B	○	Min. quantity is required for efficient training
123	14-2 Transformer Trainer	2	2	0	2	B	○	Same as above
124	14-3 Circuit Breaker Trainer	2	2	0	2	B	○	Same as above
125	14-4 Volt Meter DC/AC	10	10	10	29	B	○	Same as above
	14-5 Tester	10	0	3	3	C	×	Consumable, simple tools, obtainable in Pakistan
	14-6 Watt Meter DC/AC	10	0	4	4	C	×	Same as above
	14-7 Energy Meter	10	0	3	3	C	×	Same as above
	14-8 Meggar	10	0	0	0	C	×	Same as above
126	14-9 Multi Meter	10	10	0	10	B	○	Min. quantity is required for efficient training
127	14-10 Wire Gauge	20	20	0	20	B	○	Same as above
	14-11 Wire Polisher	30	0	3	3	C	×	Consumable, simple tools, obtainable in Pakistan
	14-12 Rotating and Balancing Stand	3	0	0	0	C	×	Same as above
	14-13 Wire Stripper	20	0	3	3	C	×	Same as above
	14-14 Induction Motor	5	0	1	1	C	×	Same as above
128	14-15 Phase Sequence Meter	5	5	0	5	A	○	It is used to study rotation,retaardation in phase. Min.units are to be supplied.
	15. Electronics Lab.							
	15-1 Semi Conductor Trainer	5	0	0	0	C	×	Consumable, simple tools, obtainable in Pakistan
129	15-2 Industrial Electronics Trainer	5	5	0	5	B	○	They are necessary equipment in electronic control experiment, but none of them are existing in the lab. Min. units are to be supplied.
130	15-3 PLC Trainer	5	5	0	5	B	○	
126	15-4 Multi Meter	10	10	0	10	B	○	Min. quantity is required for efficient training
131	15-5 Curve Tracer	5	5	0	5	B	○	Same as above
132	15-6 Regulator Power Supply	10	5	0	5	A	○	They are necessary equipment in electronic control experiment, but none of them are existing in the lab. Min. units are to be supplied.
133	15-7 Oscilloscope	5	2	0	2	A	○	
134	15-8 Function Generator	5	2	0	2	A	○	
	16. Others							
135	16-22 Loupe	10	5	0	5	A	○	This is used for surface inspection of work pieces and graduation reading of measuring tools. 5 units are to be supplied.
136	16-23 Tool Box	20	20	2	22	B	○	Min. quantity is required for efficient training

2) Architecture Department

Table 2.2.14 Study on requested equipment (5/5)

No.	Requested Equipment Name	Quantity				Priority	Adoption	Reasoning
		Request	Schedule	Existing	Total			
	1. Architecture Computer Room							
	Originally, quantity of requested computer was 50. Finally it was decided 90 as 2 classes(each class 45) operation (AM: 2 classes, PM: 2 classes). (CAD room for 45 students x 2 rooms)	90	0	90	90	C	×	Same as computer in mechanical department, CAD lecture is being operated by using computers prepared by GCT and Technical cooperation. In the future, additional procurement and periodical renewal by GCT are required.
	2. Multimedia Room							
	Nothing to be arranged in Multimedia room. Only projector in each room is necessary.	1 Unit	0	2	2	C	×	Several projectors have already been prepared by Technical cooperation. They will be shifted to New building and used.
	3. Practical Workshop (Multipurpose practice laboratory)							
137	Portable Compression Testing Machine	2	2	0	2	A	○	As shortage of leaning in practice is acknowledged as a problem, setting up of this workshop is meaningful. Main items are Material testing equipment, and they are co-use with Mechanical department. Basic equipment of material knowledge such as the Portable compressing test machine, Concrete test standard tool set and handling tools are important to understand the construction material character.
138	Concrete Test Standard Tool Set	1 Unit	1	0	1 Unit	A	○	
139	Hand Pallet Truck	2	2	0	2	A	○	
140	Pallet	8	8	0	8	A	○	
141	White Board	2	2	0	2	A	○	
	4. Design Practical Workshop							
	Main equipment are drawing desks and chairs.	90	90	0	90	B	○	These equipment for one class are being prepared by Technical Cooperation and these will be used in other department when new building is completed. Drawing desks and chairs for 2 drawing rooms are necessary.
	5. Modal Making Workshop							
	Among 2 classes of drawing room, 1 class will be common use with Model making room. Model making room for exclusive use is not prepared.		—		—	C	×	Store house for Model making Table and tool is prepared in common room(Drawing room and Model making room).
	6. Furniture for New Building							
	Desks, chairs, cabinets, etc., directly related to leaning.	1 Unit	1 Unit	0	1 Unit	A	○	Desks, chairs, etc., which have been used in main campus by architecture department will be used in general lecture by other department including architecture department. Setting up of these equipment are necessary when new building is completed.

Note: Among equipment in Architecture department, Desks, Chairs and Rockers for Lecture rooms, Teacher room, Study hall of girls students, Multi purpose study hall, are local manufacturing items, therefore, they are included in the range of Building construction.

8) Main equipment use and specification

The intended use, general specifications, design quantities and level of installation for main equipment to be provided under the Project are indicated in the following tables.

In the case of Table 2.2.15 (main equipment and specifications), the numbering in the left-hand column coincides with the numbering in the left-hand column of Table 2.2.16 (design equipment list) with regard to equipment items.

Table 2.2.15 Use and specifications for main equipment（1/2）

No.	Equipment Name	Scheduled Q'ty	Purpose of Use	Equipment Level	Main Specification
1	Lathe Machine	9	This is used for a round bar, a tapered spindle and screw cutting work.	Vocational School Common Equipment	Distance between center: 550mm or more Swing over Bed: 300mm or more Spindle bore: 35mm or more Bed width: 180mm or more
3	Hobbing Machine	1	This is used for shaping a gear wheel by using a hobbing cutter.	Ditto	Module: Max. 2.0mn Diameter of Gear: 50mm or more Number of Teeth: 6-300 or more Hob spindle speed: Approx. 1500/min
4	Universal Milling Machine	2	This is used for vartical shaping by cutting surface and slot milling.	Ditto	Traverse of table (mm): 300 (swing), 300 (vertical) or more Distance between table and spindle: Approx. 360mm Spindle rotation frequency: Approx. 3,000/min Spindle taper: No.30
5	Shaper	1	Thins is used for surface cutting and slot milling.	Ditto	Stroke: 500mm or more Cutting width: 530mm or more Size of swivelling vise: Approx. 300x300mm Motor: Approx. 1.5kw
6	Surface Grinder	1	This is used for surface cutting by using grinder.	Ditto	Working surface of table: 500x200mm or more Traverse of table: 650x200mm or more Dimension of the wheel: Approx. 250x25x50mm Spindle speed: 2,500/min or more
7	Universal Tool and Cutter Grinder	1	Thins is used for grinding a hard metal tool.	Ditto	Swing over table: Approx. 250mm Grinding wheel stroke: 150 (vertical), 150 (cross)mm or more Wheel speed: 3,000/min or more
33	Universal Gear Inspection Equipment	1	This is used for inspecting a gear wheel size and shape.	Ditto	Max. diameter of Gear wheel: 160mm or more Max. axis length of Gear wheel: 310mm Max. module: 2.0
41	TIG Welding Machine	2	This is used for welding training by tungsten electrode.	Ditto	Rated Input: Approx. 12kW Rated Utilization: 40% or more DC Output Current: Approx. 5-300A AC Output Current: Approx. 20-300A
46	Gas Mani Fold System	1	This is used to distribute welding gas.	Ditto	Gas: Oxygen and Acethylene Type: Parallel, each 5 lines
56	Tilting Crucible Furnace	1	This is used for taking out melting steel by tilting crusible.	Ditto	Max. Temperature: 1,100℃ or more Melting Capacity: 5kg (Aluminum) or more Crusible Size: A70 or bigger Type: Tilting type
57	Jolt Squeeze Molding Machine	1	This is used for hardening a mold by jolting and compressing. It's common equipment and no specialized techniques are required.	Ditto	Table Dimension: 400 x 500mm or more Jolt Capacity: 100kg or more Squeeze Pressure: 4,000kg or more Table Height : 600mm or higher
58	Sand Milling Machine	1	This is uesd for milling and shifting molding sand. It's common equipment and no specialized techniques are required.	Ditto	Sanding Method: Wheel type Capacity: 4.5kg or more Mixing Bowl Dimesions: 350(dia.) x 200(H)mm or more
69	Manual Sheet Bending Machine	2	This is used for bending a metal sheet. It's common equipment and no specialized techniques are required.	Ditto	Type: Manual Max.Bending Thickness: 1.6mm or more Max. Bending Width: 1,200mm or more
71	Manual Sheet Shearing Machine	2	This is used for manual sheet shearing.	Ditto	Type: Manual, Foot Pedal Operation Type Shearing Board Thickness: 1.6mm or more Shearing Board Width: 1,000mm or more
76	Brinne l l Hardness Testing Machine	1	This is used for testing hardness of fabricated materials.	Ditto	Test force: 200-3,000kgh or wider Indenter ball diameter: 2.5-10mm or wider Testing time: Adjustable Testing space: 230(H) x 120(W)mm or wider
79	Torsion Testing Machine	1	This is used for testing shear resistance and elasticity of testing specimen.	Ditto	Type : Table top Torque: 30Nm ormore Testing length: 750mm or more
80	Rotation Fatigue Testing Machine	1	This is used for testing fatigue strength of rotating materials.	Ditto	Type: Tabletop Rotating speed: 1,400rpm or more Safety system: Equipped
84	Fluid Friction Apparatus	2	This is used for measuring a fluid friction.	Ditto	Tube size: 5-17 (diameter) or more Composition: 90° elbow tube/bent tube, 45°elbow tube etc. Caster: Equipped
89	Centrifugal Pump Apparatus	1	This is used for testing a centrifugal pump.	Ditto	Flow capacity: 1.0L/min. or more Head of water: 10m or more Pump speed: 1,500rpm or more
90	Axial Pump Apparatus	1	This is used for testing an axial pump. .	Ditto	Pumping capacity: 100L/min. or more Head of water: Max. 1.8m or more Case: Acrylic
91	Piston Pump Apparatus	1	This is used for testing a piston pump.	Ditto	Pumping capacity: 5L/min. or more Head of water: Max. 50m or more Diameter: 30mm or more Stroke: 25m or more

Table 2.2.15 Use and specifications for main equipment（2/2）

No.	Equipment Name	Scheduled Q'ty	Purpose of Use	Equipment Level	Main Specification
92	Pelton Turbine	1	This equipment is used for testing a pelton turbine.	Vocational School Common Equipment	Pelton wheel size: 120mm or more Pressure measuring range: 0-25mH2O or more Speed: 2,000rpm or more
93	Axial Flow Turbine	1	This is used for testing an axial flow turbine.	Ditto	Tabletop type Torque: 0.15Nm or more Speed: 7,000rpm or more
94	Francis Turbine	1	This equipment is used for testinga a francis turbine.	Ditto	Pumping power: Approx. 50W Head of water: Approx. 14m Speed: 1,200rpm or more
95	Radial Flow Turbine	1	This is used for testing a radial flow turbine.	Ditto	Pumping power: Approx. 25W Speed: 6,000rpm or more Torque: 0.1Nm or more
103	Vertical Machining Center	1	This is used for training of milling a vertical pluriaxis.	Ditto	Working spase size: 600x180mm or more Travel range: 250(X)x150(Y)x230(Z)mm or more Spindle speed: 4,000rpm or more Feeding speed: 5,000rpm or more
104	Turning Center	1	This is used for practical training of multi-functional working machine with NC control.	Ditto	Travel range: 150(X)x220(Y)mm or more Spindle speed: 3,000rpm or more Spindle hole: 25mm or more Feeding speed: 2,500mm/min. or more
105	CNC Wire Cut	1	This is used for training of wire discharge cutting by CNC.	Ditto	Movement of X,Y axis: 350x250mm or more Max. working piece size: 720x500x200mm Max. working piece weight: 300kg or more Motor: AC servo motor
106	Robotics Equipment Kit	1	This is used for testing industrial robots.	Ditto	Type: Pick and place Drive: DC motor Principal post/effector distance: 550mm or more
113	Ignition Point Testing Machine	1	This is used for testing an ignition point of engine .	Ditto	Type: Pensky Martens Closed Cup Temperature: Approx. room temperature to 350° Accessories:Stirrer、Pt100 plobe
114	Air Compressor Testing Machine	1	This is used for testing an air compressor. It's common equipment and no specialized techniques are required.	Ditto	Type: Tabletop, single air compressor testing machine Testing item: Measuring pressure, measuring air flow, measuring temperature, measuring motor shaft capacity etc.
115	Gas Turbine Testing Machine	1	This is used for testing a gas turbine .	Ditto	Type: 2 shaft Gas Turbine Unit Gas: Propane, Butane Experimental item: Performance of Single shaft and 2 shaft unit, Performance of individual components (gas generator compressor, combustion chamber)
116	Steam Boiler Experiment Appratus	1	This is used for a steam boiler experiment.	Ditto	Boiler: Oil/Gas type Tank: Acrylic, 80L or more Caster: Equipped
118	Band Saw Machine	1	This is used for cutting and sizing wood materials.	Ditto	Cutting capacity: 390mm (Depth) or more Sawing blade width: 2-10mm or more Sawing blade length: 3,350mm or more Variable speed
121	Machine Elements set	1	This is used for presenting machine element work.	Ditto	Mount fixing boad: Equipped Learning contents: Center of weight, force triangle, force parallelogram, force plygon, moment principle
122	Electrical Machine Trainer	2	This is used for test training of electrical motors and power generators.	Ditto	Type: Tabletop Learning contents: DC/AC motor operation DC/AC power generating system etc.
123	Transformer Trainer	2	This is used for testing a transformer in an electric circuit.	Ditto	Type: Tabletop Composition: Single phase (Approx. 1kVA)
130	Industrial Electronics Trainer	5	This is used for studying industrial electronics.	Ditto	Measuring item: Photoelectric sensor, Proximity sensor Pressure sensor, Temperature sensor Aluminum trunk case: Equipped
131	PLC Trainer	5	PLC trainer shows students how to use a programmable logic controller and help them study how to used programable logic controllers to control a process.	Ditto	Training item: Fundamentals of Logic, Developping Ladder Logic Programs, Time-based Process Control, etc..
138	Concrete Test Standard Tool Set	1	This is a set of tools for making concrete specimen.	Ditto	Composition:Slump Test Set (Slamp Cone, Slump Scale , Hand Scoop, and more) Air Meter Salt Meter

9) Design equipment use and specifications

Specifications and design quantities for equipment to be provided under the Project are set out in the following tables.

Table 2.2.16 Design equipment list (1/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
1	M- 1- 1 M- 2- 1	Lathe Machine	Distance between center: 550mm or more Swing over Bed: 300mm or more Spindle bore: 35mm or more Bed width: 180mm or more	9
2	M- 1- 2	Bench Type Drilling Machine	Drill capacity: 20mm or more Spindle rotation speed: 300-2400/min or more Quill travel: 120mm or more Vertical table movement: 420mm or more	2
3	M- 2- 2	Hobbing Machine	Module: Max. 2.0mn Diameter of Gear: 50mm or more Number of Teeth: 6-300 or more Hob spindle speed: Approx. 1500/min	1
4	M- 2- 3	Universal Milling Machine	Traverse of table (mm): 300 (swing), 300 (vertical) or more Distance between table and spindle: Approx. 360mm Spindle rotation frequency: Approx. 3,000/min Spindle taper: No.30	2
5	M- 2- 4	Shaper	Stroke: 500mm or more Cutting width: 530mm or more Size of swivelling vise: Approx. 300x300mm Motor: Approx. 1.5kw	1
6	M- 2- 5	Surface Grinder	Working surface of table: 500x200mm or more Traverse of table: 650x200mm or more Dimension of the wheel: Approx. 250x25x50mm Spindle speed: 2,500/min or more	1
7	M- 2- 6	Universal Tool and Cutter Grinder	Swing over table: Approx. 250mm Grinding wheel stroke: 150 (vertical), 150 (cross)mm or more Wheel speed: 3,000/min or more	1
8	M- 2- 7 M- 3- 1	Micrometer	Measuring range: 0-25mm or more Min. reading: 0.001mm Max. allowance: Less than 4μm	15
9	M- 2- 8 M- 3- 3 M- 6- 13	Digital Caliper	Measuring range: 0-150mm or more Min. reading: 0.01mm Max. allowance: Less than 0.02mm	20
10	M- 3- 2	Anvil Micrometer	Measuring range: 5-25mm or more Min. reading: 0.01mm Flatness: Less than 1.5μ	5
11	M- 3- 4	Digital Pitch Caliper	Measuring range: Approx. 10-160mm Min. reading: 0.01mm Max. allowance: Less than 0.05mm	5
12	M- 3- 5	Dial Indicator	Measuring range: Approx. 12.5mm Min. reading: 0.01mm Max. allowance: Less than 0.05mm	10
13	M- 3- 6	Digital Depth Gauge	Measuring range: Approx. 0-150mm Min. reading: 0.01mm Max. allowance: Less than 0.03mm	10
14	M- 3- 7	Digital Height Gauge	Measuring range: Approx. 0-300mm Min. reading: 0.01mm Max. allowance: Less than 0.03mm	5
15	M- 3- 9	Dial Caliper	Measuring range: 0-150mm or more Allowance: Approx. +/- 0.03mm Min. reading: Approx. 0.02mm	5
16	M- 3- 10	Dial Bore Gauge	Composition: 4 size Measuring length: 18-160mm or more Allowance: Less than +/- 12 μm	3
17	M- 3- 11	Dial Caliper Guage	Measuring range: Approx. 10-100mm Min. reading: 0.1mm Allowance: Less than 0.1mm	3
18	M- 3- 17	Inner Micrometer	Measuring length: 5-30mm or more Allowance: Approx. +/- 0.005 Min. reading: Approx. 0.01mm	3

Table 2.2.16 Design equipment list (2/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
19	M- 3- 18	Groove Width Caliper	Inside measuring range: 2.0-26.0mm or more Outside measuring range: 0-25mm or more Min. reading: Approx. 0.01mm	3
20	M- 3- 19	Mechanical Comparator	Base size: Approx. 170x110mm Pole height: 170mm or more Effective travelling range: 100mm or more	2
21	M- 3- 20	Electrical Comparator	Base size: Approx. 170x110mm Pole height: 170mm or more Effective travelling range: 100mm or more Micro adjustment device: Equipped	2
22	M- 3- 21	Engineering Microscope	Total magnification: Approx. 7-45 times Tube: Binocular, Tilting type Eye width adjustment: 55-75mm or more Magnifying system: Zoom	2
23	M- 3- 22	Depth Guage	Max. measuring length: Approx. 150mm Min. reading: Less than 0.05mm Allowance: Less than 0.08mm	10
24	M- 3- 25	Steel Surface Plate	Size: Approx. 600x600x100mm Flatness: Approx. 0.021mm Rib: 2x2	4
25	M- 3- 26	Snap Gauge set	Type: Single-ended Size: 3 sizes or more	10
26	M- 3- 27	Ring Gauge set	Size: M6, 8, 10, 12	2
27	M- 3- 28	Thread Ring Gauge	Size: M6, 8, 10, 12	5
28	M- 3- 29	Protractor	Diameter: Approx. 90mm Total length: Approx. 200mm Graduation: Less than 1 degree	10
29	M- 3- 34	Point Micrometer	Measuring range: Approx. 0-25mm Min. reading: Less than 0.01mm Tipped angle: Approx. 30 degree	5
30	M- 3- 36	Depth Micrometer	Measuring length: 0-75mm or more Base size: Approx. 63.5x16mm Min. display: Approx. 0.01mm	4
31	M- 3- 41	Radius Guage	Composition: 2 size Measuring range: 1.0-7.0R/0.5 step or more 0.75-5.0R/0.25 step or more	5
32	M- 3- 42	Screw Pit Guage	Composition: 2 size Measuring range: 4-60 pitch/inch or more 0.25-2.5mm or more	10
33	M- 3- 44	Universal Gear Inspection Equipment	Max. diameter of Gear wheel: 160mm or more Max. axis length of Gear wheel: 310mm Max. module: 2.0	1
34	M- 3- 45	Digital Guage Tester	Graduation: 0.001mm Measuring range: 25mm or more Allowance: Less than 1μm	1
35	M- 3- 46	Taper Guage	Measuring range: 1-15mm or more Graduation: Less than 0.05mm Allowance: 0.1mm	3
36	M- 3- 47	Pararell Bar	Pararellism: Within 0.005/100 mm Squareness: Within +/- 0.01 mm Finishing: 4 surfaces polishing	10

Table 2.2.16 Design equipment list (3/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
37	M- 3- 48	Surface Roughness Standard Piece	Type: Flat surface Processing: Paper finish, Grinding, Shaping, Front milling, Milling	2
38	M- 3- 49	Drill Guage	Measuring range: 1.0-6.0mm/0.1mm div. 6.0-13.0mm/ 0.1mm div. Plate thickness: 2mm	2
39	M- 3- 50	Square V Block	Squreness: 0.05mm or more Parallelism: 100mm or more Grooved angle: 90 degree or more Clamp: Equipped	5
40	M- 4- 1	Arc Welding Machine	Rated Input: Approx. 12kw Rated Utilization: 40% or more Rated Output Current: Approx. 300A Output Current Range: Approx. 70-300A	6
41	M- 4- 2	TIG Welding Machine	Rated Input: Approx. 12kW Rated Utilization: 40% or more DC Output Current: Approx. 5-300A AC Output Current: Approx. 20-300A	2
42	M- 4- 3	MAG Welding Machine	Rated Input: Approx. 15kW Rated Utilization: 50% or more Rated Output Current: Approx. 350A Rated No-Load Voltage: Approx. 35A	2
43	M- 4- 4	Plasma Cutting Machine	Rated Input: Approx. 5kw Rated Utilization: 40% or more Output Current: Approx. 40A Cooling Method: Air cooling	1
44	M- 4- 6	Forging Furnace	Max Temperature: 1,100℃ or more Capacity: 30L or more	5
45	M- 4- 7 M- 5- 14 M- 7- 13	Pedestal Grinder	Rotating Speed: Approx. 3000rpm Dimension of the wheel: Approx. External Diameter 150 x Thickness 16 x Hole Diameter 12.7mm Legs: Equipped	3
46	M- 4- 8	Gas Mani Fold System	Gas: Oxygen and Acethylene Type: Parallel, each 5 lines	1
47	M- 4- 9	Oxygen Gas Cylinder	Capacity: 47L	5
48	M- 4- 10	Acetylene Gas Cylinder	Capacity: 41L	5
49	M- 4- 11	Oxy-Acetylene Gas Cutting Torch	Gas: Acethylene Number of Nozzles: 3 Cutting Capacity: Approx. 30mm	5
50	M- 4- 12	Oxy-Acetylene Gas Welding Torch	Gas: Acethylene Number of Nozzles: 7, Approx. 200-500 Welding Capacity: 2.0-5.0mm or wider	5
51	M- 4- 18	Hand Vice	Max. Opening Capacity: 130mm or more Clamping Pressure: 1.0kN or more	30
52	M- 4- 20	Welding Shield	Type: Mask type Dimension: Approx. 400(L)mm x 300(W)mm	20
53	M- 4- 24 M- 5- 15	Air Compressor	Air Discharge Pressure: 0.6MPa or more Air Discharge Volume: 250 L/min or more Rotating Speed: 1000 rpm or more	2
54	M- 4- 30	Cylinder Rack	Rack size: 300x600mm or more Weight: 20kg or more Loading capacity: 200kg or more Caster diameter: 300φmm or more	4

Table 2.2.16 Design equipment list (4/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
55	M- 4- 31	Handy Disc Grinder	Grinding Capacity: Approx. 100x5x15 (Outer dia x Thickness x Hole dia.) Rotating Speed: Approx. 12,000 rpm or more	5
56	M- 5- 1	Tilting Crucible Furnace	Max. Temperature: 1,100℃ or more Melting Capacity: 5kg (Aluminum) or more Crusible Size: A70 or bigger Type: Tilting type	1
57	M- 5- 3	Jolt Squeeze Molding Machine	Table Dimension: 400 x 500mm or more Jolt Capacity: 100kg or more Squeeze Pressure: 4,000kg or more Table Height : 600mm or higher	1
58	M- 5- 4	Sand Milling Machine	Sanding Method: Wheel type Capacity: 4.5kg or more Mixing Bowl Dimesions: 350(dia.) x 200(H)mm or more	1
59	M- 5- 5	Permeability Meter	Measuring Method: Ventilation Pressure Sample Size: Approx. 500x500mm	1
60	M- 5- 6	Mold Tester	Use: To test hardness of sand mold Measuring Method: Load Spring Measuing Range: 0-100 degree Type of Indenter: Ball, Approx. 2.5 mm (dia)	1
61	M- 5- 7	Pyrometer	Measuring Range: Approx. 600~1,500℃ Accuracy: ±6℃ or better Display: Digital LCD Power Supply: Battery	2
62	M- 5- 11	Crucible	Material: Aluminum Oxide(VCAD) Capacity: Approx.25kg Dimension: Approx. 170x140x250mm	8
63	M- 5- 12	Mold Box	Size: 25x35x10cm Composition: Tapered stripping frame, Jacket	8
64	M- 5- 13	Power Riddle Machine	Method: Rotation Tap Movement Applicable Sieves: Approx. φ200(dia.) x 60mm Motor: Approx. 0.2 kW Sieve piling: 7 sieves or more	1
65	M- 5- 16	Air Blower	Max. Air Volume: 2.5㎥/min. or more Air Pressure: 5.5kPa or more Overall Length: 440mm or more	2
66	M- 5- 17	Air Gun	Nozzle Gauge: 1.7mm or more Air Pressure: 0.3Mpa or more Air Consumption: 100L/min. or more	5
67	M- 6- 5	Power Hack Saw	Type: Hydraulic type Cutting Capacity: Round Bar 180 (dia.) mm or more Square Bar 150x150 mm or more	2
68	M- 6- 6	Disc Cutter	Disc Size: 400mm or more Cutting Capacity (Round Pipe): 130mm or more Rotating Speed: Approx. 2,000rpm	2
69	M- 6- 7	Manual Sheet Bending Machine	Type: Manual Max.Bending Thickness: 1.6mm or more Max. Bending Width: 1,200mm or more	2
70	M- 6- 8	Manual Sheet Rolling Machine	Type: Manual Roll diameter: 85mm or more Roll length: 1,300mm or more Rolling Capacity: 1.6mm or more	2
71	M- 6- 9	Manual Sheet Shearing Machine	Type: Manual, Foot Pedal Operation Type Shearing Board Thickness: 1.6mm or more Shearing Board Width: 1,000mm or more	2
72	M- 6- 10	Handy Drilling Machine	Max. Drilling Capacity: Steel 13mm or more Rotation Speed: 1,100rpm or more Standard accesory: Side handle etc.	2

Table 2.2.16 Design equipment list (5/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
73	M- 6- 12 9- 13	Micrometer	Measuring Range: 0~25mm or more Graduation: 0.01mm Accuracy: ±4μm or less	6
74	M- 6- 14	Surface Plate for Sheet Metal	Size: Approx. 450 (W) x 600 (L) x 100 (H) mm Flatness Accuracy: 0.06 mm or better Number of Ribs: 1x1	4
75	M- 6- 15	Lever Shear	Blade Length: 150mm or more Cutting Capacity (Copper Plate): 4 mm or more Cutting Capacity (Round bar): φ6 mm or more	5
76	M- 7- 1	Brinnell Hardness Testing Machine	Test force: 200~3,000kgh or more Indenter ball diameter: 2.5~10mm or more Testing time: Adjustable Testing space: 230(H) x 120(W)mm or more	1
77	M- 7- 2	Rockwell Hardness Testing machine	Pre-load: Approx. 10kgf Total load: 60~150kgf or more Testing resolution: 0.5HR Testing space: 200(H) x 150(W)mm or more	1
78	M- 7- 8	Metallurgical Microscope	Total magnification: Approx. x6~ x50 Zoom ratio: 1:8 or more Eyepiece: Tilting binocular tube, 45° or more Interpupillary distance: 55~75mm or more	1
79	M- 7- 9	Torsion Testing Machine	Type : Table top Torque: 30Nm ormore Testing length: 750mm or more	1
80	M- 7- 10	Rotation Fatigue Testing Machine	Type: Tabletop Rotating speed: 1,400rpm or more Safety system: Equipped	1
81	M- 7- 11	Electric Annealing Furnace	Type: Tabletop Chamber capacity: 7 liters or more Max. temperature: 1,200℃ or more	1
82	M- 7- 12	Hardening and Quenching Bath	Type: Hydraulic Capacity: 90L or more Stirring device: Equipped	1
83	M- 7- 14	Ultrasonic Detecting Equipment	Display: LCD, 4" or more Gain: 100dB or more Speed: Max. 5,000m/sec. or more Measuring range: 2.5-10,000mm or more	1
84	M- 8- 1	Fluid Friction Apparatus	Tube size: 5-17 (diameter) or more Composition: 90° elbow tube/bent tube, 45°elbow tube etc. Caster: Equipped	2
85	M- 8- 2	Venturi Meter Apparatus	It allows directo measurement of the static head distribution along a Venturi tube. Manometer tube length: Approx. 400mm Number of manometer tube: 5 or more Flowmeter: 20L/min. or more	1
86	M- 8- 3	Bernoulli's Theorem Demonstration Apparatus	Manometer tube length: Approx. 300mm Number of manometer tube: 5 or more Upstream diameter: Approx. 25mm	1
87	M- 8- 4	Orifice Flow Apparatus	Number of orifice: 5 or more Head of water: 360mm or more	1
88	M- 8- 5	Apparatus of Energy Losses in Bends	Composition: 90° elbow etc. Manometer tube length: Approx. 400mm Number of manometer tube: 10 or more Manometer: 2.5bar or more	1
89	M- 8- 6	Centrifugal Pump Apparatus	Flow capacity: 1.0L/min. or more Head of water: 10m or more Pump speed: 1,500rpm or more	1
90	M- 8- 7	Axial Pump Apparatus	Pumping capacity: 100L/min. or more Head of water: Max. 1.8m or more Case: Acrylic	1

Table 2.2.16 Design equipment list (6/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
91	M- 8- 8	Piston Pump Apparatus	Pumping capacity: 5L/min. or more Head of water: Max. 50m or more Diameter: 30mm or more Stroke: 25m or more	1
92	M- 8- 9	Pelton Turbine	Pelton wheel size: 120mm or more Pressure measuring range: 0-25mH2O or more Speed: 2,000rpm or more	1
93	M- 8- 10	Axial Flow Turbine	Tabletop type Torque: 0.15Nm or more Speed: 7,000rpm or more	1
94	M- 8- 11	Francis Turbine	Pumping power: Approx. 50W Head of water: Approx. 14m Speed: 1,200rpm or more	1
95	M- 8- 12	Radial Flow Turbine	Pumping power: Approx. 25W Speed: 6,000rpm or more Torque: 0.1Nm or more	1
96	M- 8- 13	Hydraulic Equipment Set	Transportable type Composition: Pressure release bulb, pressure manifold, tank manifold etc.	2
97	M- 8- 14	Hydraulic Bench	Tank capacity: 160L or more Pump capacity: 60L/min. or more Head of water: 20m or more	1
98	M- 8- 15	Axial Pump (Sectional Cut Model)	Type: Tabletop Learning content: Axial pump operation	1
99	M- 8- 16	Ball Valve (Sectional Cut Model)	Type: tabletop Learning content: Ball bulb operation	1
100	M- 8- 17	Vane Pump (Sectional Cut Model)	Type: Tabletop Learning content: Vane pump operation	1
101	M- 8- 18	Piston Pump (Sectional Cut Model)	Type: Tabletop Learning content: Piston pump operation	1
102	M- 8- 19	Digital Length Measuring Equipment	Measuring range: 0-100mm Min. reading:0.01mm Allowance: Approx. +/-0.02mm Display: Digital	1
103	M- 9- 1	Vertical Machining Center	Working spase size: 600x180mm or more Travel range: 250(X)x150(Y)x230(Z)mm or more Spindle speed: 4,000rpm or more Feeding speed: 5,000rpm or more	1
104	M- 9- 2	Turning Center	Travel range: 150(X)x220(Y)mm or more Spindle speed: 3,000rpm or more Spindle hole: 25mm or more Feeding speed: 2,500mm/min. or more	1
105	M- 9- 3	CNC Wire Cut	Movement of X,Y axis: 350x250mm or more Max. working piece size: 720x500x200mm Max. working piece weight: 300kg or more Motor: AC servo motor	1
106	M- 9- 7	Robotics Equipment Kit	Type: Pick and place Drive: DC motor Principal post/effector distance: 550mm or more	1
107	M- 9- 10	DVD Video for mold making and molding	Contents: Mold making, molding etc.	2
108	M- 9- 11	Manual Injection Molding machine	Max. Injection Volume: 6g or more Production Takt: 20 productions / hour or more Injection Pressure: Manual Thermoregulator: 2	2

Table 2.2.16 Design equipment list (7/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
109	M- 9- 12	Pneumatic Equipment Set	Type: Transportable AND/OR/NOT function: Equipped Time delay adjuster: Equipped Composition: Pneumatic compressor	2
110	M- 9- 15	Surface Gauge	Length: Approx. 300mm Gauge Processing Method: Quenching Undersurface Processing: Precision Polishing	5
111	M- 9- 16	Steel Surface Plate	Size: Approx. 900 x 900 x 125mm (W x L x H) Plane Frequency: 0.1mm or more Number of Rib: 2 x 2	1
112	M- 9- 17	Depth Guage	Measure Limit: Approx. 150mm Base size: Approx. 100mm Minimum Measure: Less than 0.05mm Instrumental error: Approx. ±0.08mm	3
113	M- 10- 8	Ignition Point Testing Machine	Type: Pensky, Martens Closed Cup Temperature: Approx. room temperature to 350° Accerory: Stirrer、Pt100 plobe	1
114	M- 10- 9	Air Compressor Testing Machine	Type: Tabletop, single air compressor testing machine Testing item: Measuring pressure, measuring air flow, measuring temperature, measuring motor shaft capacity etc.	1
115	M- 10- 10	Gas Turbine Testing Machine	Type: Tabletop Gas: Paraffin or Kerosene Engine speed: 100,000rpm or more	1
116	M- 10- 12	Steam Boiler Experiment Appratus	Boiler: Oil/Gas type Tank: Acrylic, 80L or more Caster: Equipped	1
117	M- 11- 1	Wood Turning Lathe	Working length: 300mm or more Spindle rotation: Flexible Total length: 1,100mm or more Accesory: Scroll chuck etc.	1
118	M- 11- 2	Band Saw Machine	Cutting capacity: 390mm (Depth) or more Sawing blade width: 2-10mm or more Sawing blade length: 3,350mm or more Variable speed	1
119	M- 12- 6	Multi Media Projector	Number of pixels: 1024 horizontal x 768 vertical Projection lenz: Zoom, Approx. F1.8-F1.9 Light output (Brightness): 2,500lm Zoom: Manual	1
120	M- 12- 8	Spring Test Equipment	Type: Tabletop Measuring range: 0-80mm or more Testing item: Spring rule Composition: Tension spring, compression spring	2
121	M- 12- 11	Machine Elements set	Mount fixing boad: Equipped Learning contents: Center of weight, force triangle, force parallelogram, force plygon, moment principle	1
122	M- 14- 1	Electrical Machine Trainer	Type: Tabletop Learning contents: DC/AC motor operation DC/AC power generating system etc.	2
123	M- 14- 2	Transformer Trainer	Type: Tabletop Composition: Single phase (Approx. 1kVA) Three phases (Approx. 2kVA)	2
124	M- 14- 3	Circuit Breaker Trainer	Type: Tabletop Measuring item: Breaking current, Breaking time, Overload breaking current, etc.	2
125	M- 14- 4	Volt Meter DC/AC	DC voltage measuring range: 0-300V or more AC voltage measuring range: 0-150V or more	10
126	M- 14- 9 15- 4	Multi Meter	DC voltage measuring range: 1-1,000V or more AC voltage measuring range: 1-750V or more DC power: 1-20A or more AC power: 1-20A or more	20

Table 2.2.16 Design equipment list (8/8)

No.	Equipment No.	Equipment Name	Main Specification	Q'ty
127	M- 14- 10	Wire Gauge	Measuring range: Surface #0-#36, back surface #0.2-8.0mm or more Width: Less than 2mm	20
128	M- 14- 15	Phase Sequence Meter	Measuring item: Testing the three-phase AC voltage Spec voltage: 100-600V or more Frequency: 45-65Hz or more Display: LED	5
129	M- 15- 2	Industrial Electronics Trainer	Measuring item: Photoelectric sensor, proximity sensor Pressure sensor, temperature sensor Aluminum trunk case: Equipped	5
130	M- 15- 3	PLC Trainer	Training item: Fundamentals of Logic, Developping Ladder Logic Programs, Time-based Process Control, etc..	5
131	M- 15- 5	Curve Tracer	Mode: AC, half-wave rectification etc. Peek voltage/power: Approx. 20V/10A, 200V/1A, 2kV/0.1A	5
132	M- 15- 6	Regulator Power Supply	Output voltage range: DC 0-30 or wider Output current range: 0-3A or wider Current ripple noise: 3mArms or less Display: LED display	5
133	M- 15- 7	Oscilloscope	Frequency range: DC-20MHz Sensitivity: 3% or less CHOP frequency: Approx. 250kHz Input coupling: AC, DC, GND	2
134	M- 15- 8	Function generator	Frequency range:Approx. 0.2-2.0MHz Waveforms: Sine, Triangle, Square or more Display: LED display CMOS Output: Pssible	2
135	M- 16- 22	Loupe	Magnification: x3 or more Field of View: 55mm (dia.) or larger	5
136	M- 16- 23	Tool Box	Type: Double door opening Size: Length 400 x width 200 x height 340mm or more	20
137	A- 3- 1	Portable Compression Testing Machine	Type: Manual Display: Analogue Maximum Capacity:1000kN or more Clearance between Upper and Lower Plates:350mm or more	2
138	A- 3- 2	Concrete Test Standard Tool Set	Composition:Slump Test Set (Slamp Cone, Slump Scale , Hand Scoop, and more) - Air Meter - Salt Meter	1
139	A- 3- 3	Hand Pallet Truck	Loading Capacity: Approx. 3000kg Width of Fork: Approx. 680mm Length of Fork: Approx. 1200mm	2
140	A- 3- 4	Pallet	Size: Approx. 1100x1100x150mm Type: Single side use/can be lifted from four sides	8
141	A- 3- 5	White Board	Type: Two sided white board Materials: Enamel Board Size: Approx. 900 x 1,800 mm Accessories: Casters	2

2-2-3 Outline Design Drawing

Outline design drawings are attached for the following items:

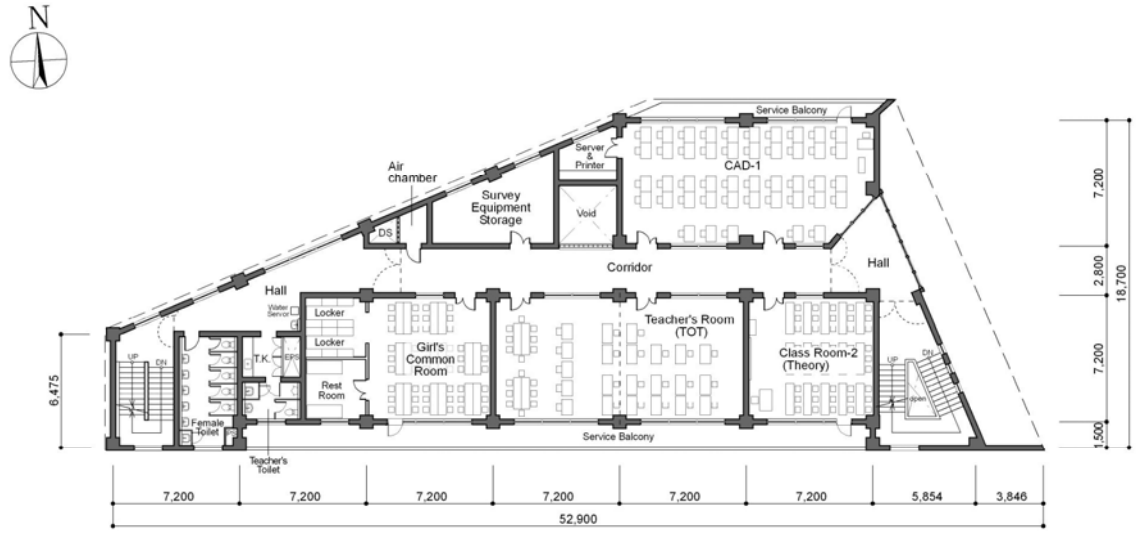
(1) Facility layout drawings

(2) Floor plan drawings-1

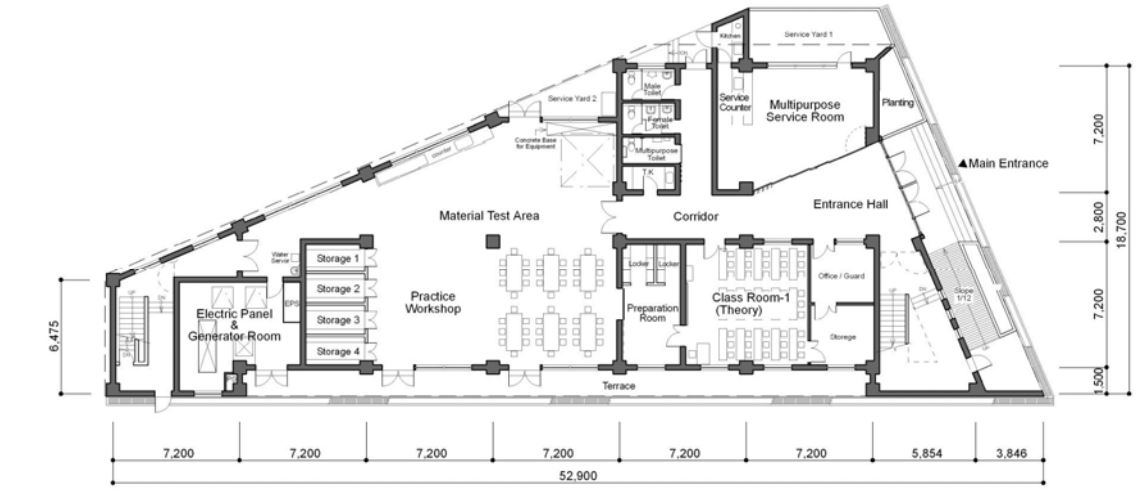
(3) Floor plan drawings-2

(4) Elevation and Cross-sectional drawings

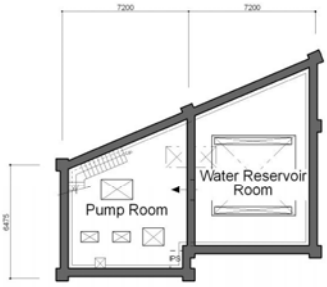

N
Legend:
: Planning Facilities
: Planning Facilities (Pakistan side)
: Existing Building
: Parking Space (Pakistan side)
: In Site Pavement
Railway Road
Side Gate
BOY'S DOMITORY
PATIO
Water Turbine
New Transformer
TEACHER'S TRAINING BUILDING
Parking
Parking (Bike)
MOSQUE
WELL
HOUSES
JUBILLIE HALL
Compressed Platform
WATER TANK
Simple Waste Water Processing Facility
PROJECT BUILDING
TEACHER'S HOUSES
Donation Plate & Flag Pole
HOUSES
School Bus
HOTEL
TEACHER'S HOUSES
Parking Space
CONTROL BOX
Side Gate
Main Gate
Parking Gate
Brandreth Road
0 10 20 30 40 50m
THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL & ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE
Drawing Title
SITE LAYOUT PLAN
Scale



2F / FIRST FLOOR

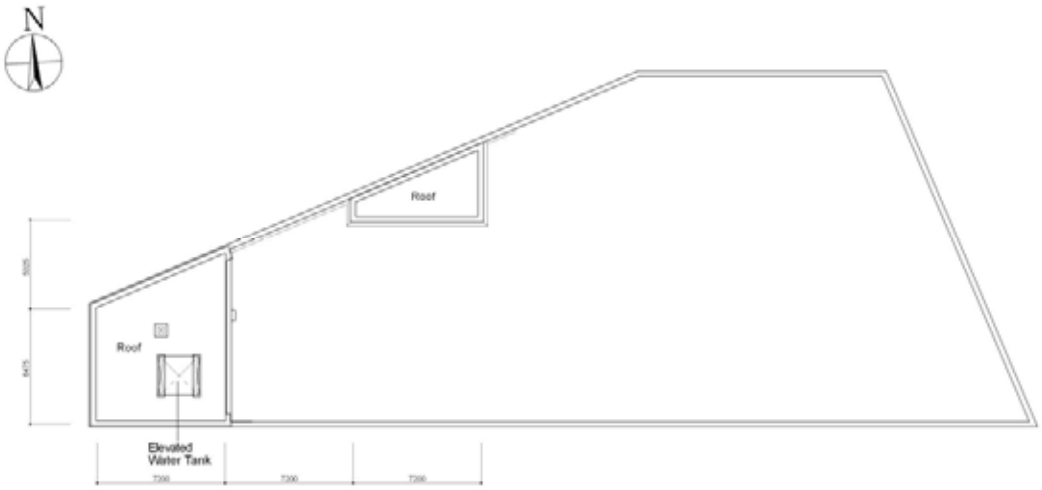


1F / GROUND FLOOR

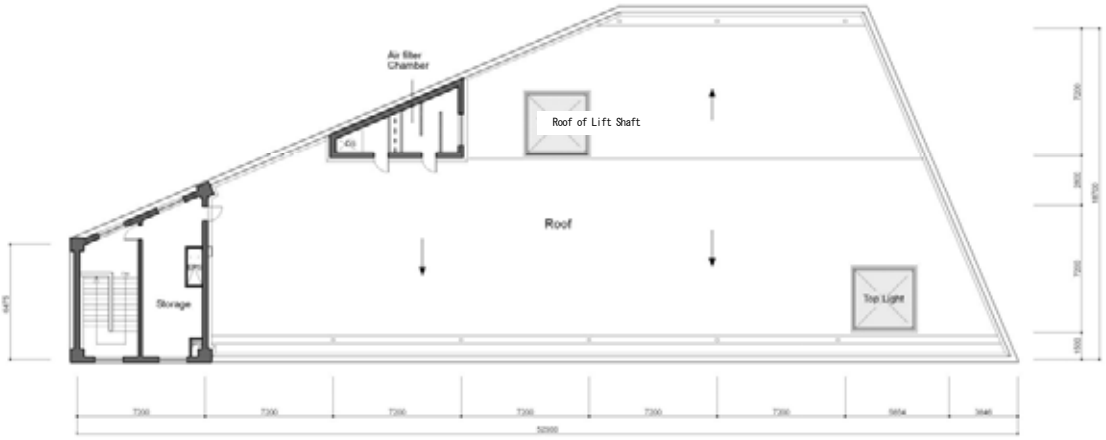


B1F / LOWER GROUND FLOOR

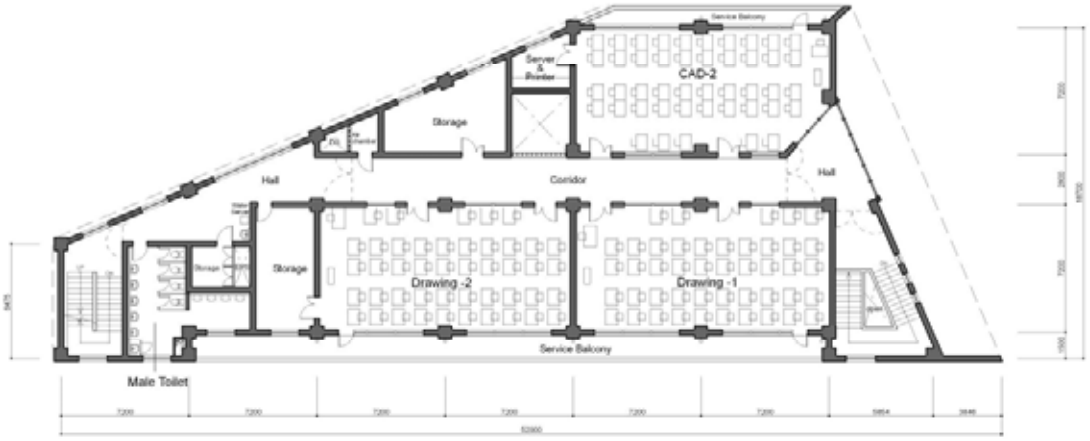
THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL &ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE	Drawing Title B1F/LOWER GROUND FLOOR & 1F/GROUND FLOOR PLAN	Scale 1 : 400



ROOF-2



PENTHOUSE / ROOF-1



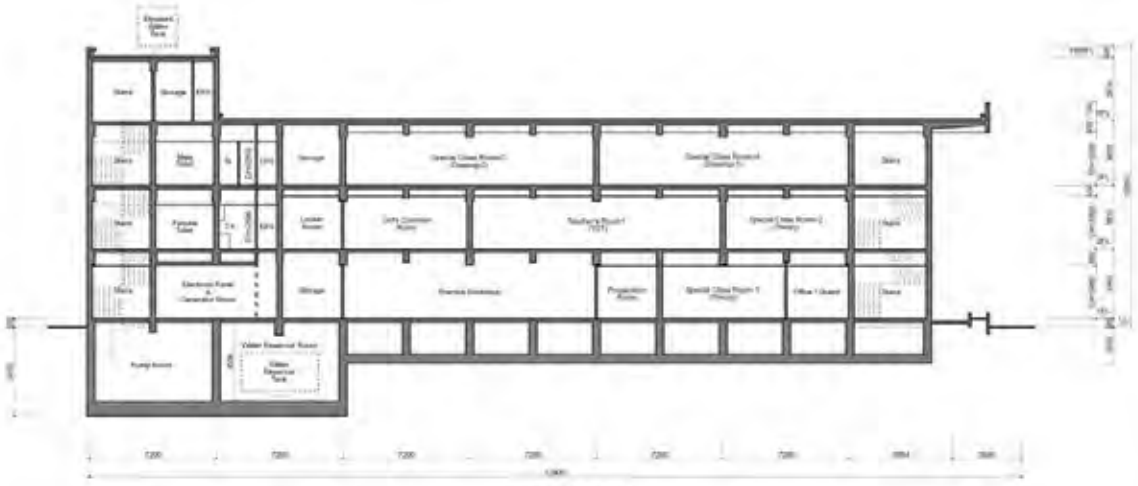
3F / SECOND FLOOR

THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL &ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE	Drawing Title 3F/SECOND FLOOR & ROOF-1, ROOF-2 PLAN	Scale 1 : 400

SOUTH SIDE

EAST SIDE

SECTION - 1



SECTION - 2

THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL &ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE	Drawing Title: ELEVATION, SECTION	Scale: 1 : 400

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic procedural items

After review by concerned agencies within the Japanese government, Project implementation requires a cabinet approval by the Japanese government. After cabinet approval, an Exchange of Notes and a Grant Agreement are signed between the two countries. Following this, the Japanese consultant enters into a consulting contract with the Pakistan government to carry out detailed design and construction supervision. Project construction works including equipment procurement and installation are then carried out by a Japanese contractor who enters into contract with the Pakistan government, and implements Project construction under the supervision of the consultant. Following completion of Project construction works, the executing agency of the Pakistan government then takes over responsibility for facility and equipment operation and maintenance.

(2) Project implementation structure on the recipient country side

The counterpart agency for the Project at the Pakistan federal government level is the Economic Affairs Division, Ministry of Economic Affairs and Statistics. The line executing agency is the Technical Education and Vocational Training Authority (TEVTA). The organization responsible for overall Project implementation is the Government of the Punjab Province. After completion of construction, the GCT Railway College will be responsible for operating and maintaining facilities and equipment.

(3) Basic approach to Project implementation

Project implementation will take into account the fact that it will be implemented under the Japanese grant-aid program, as well as Project site conditions and general local construction sector factors. Implementation is planned in accordance with the approach described below.

1) Thorough discussion and exchange of opinion will be carried out among the Pakistani government executing agency, the Japanese consultant and contractor, and material and equipment suppliers, aiming at smooth implementation of Project construction.

2) In order to efficiently carry out the envisioned construction works within the prescribed period, a local consultant and construction contractor with strong familiarity with local construction and procurement practices will be strongly relied upon. Japanese experts will be dispatched to Pakistan to provide robust support for overall construction schedule management, quality control and safety administration.

3) An a priori construction plan will be formulated to for appropriate implementation procedure, to ensure detailed in-situ safety measures, quality control and construction schedule management. Particularly with regard to materials and equipment that require lengthy time from order to delivery, such delivery period is to be confirmed immediately after construction contract signing to ensure that there is no contractor delay in adhering to the Project implementation schedule.

4) In order to facilitate operation and maintenance of facilities and equipment after completion of Project construction, necessary materials and equipment for implementation are to be procured to the extent possible either (i) of local manufacture or (ii) imported items that are generally marketed locally. Furthermore, construction methods generally applied locally will in principle be adopted.

5) The construction site is enclosed by existing structures and facilities. Accordingly, careful attention will be given to a temporary construction facility plan and safety measures that prevents any potential damage or inconvenience to surrounding residences and other facilities.

6) Construction plan and implementation set up will take into account (i) the fact that abundance of space is not available at the site for temporary construction facilities, and (ii) entry and exit from the site by construction machinery is restricted to late night hours.

2-2-4-2 Implementation Condition

Particular attention will be given the following items in implementing the Project.

(1) Construction schedule

1) Construction permits and authorization

It is necessary to incorporate within the overall construction schedule the time required for procedures in applying for, and obtaining, building permits, construction authorization, etc. during the design and construction phases of the Project.

2) Construction schedule

① Construction method and period in line with site topography and geology

Construction schedule is to take into consideration the time necessary for foundation improvement of the layer extending from the site surface to the structural bearing layer. This silt-sand layer houses embedded infrastructure and will be subject to foundation improvement (soil replacement or injection of soil strengthening material).

② Restrictions on access by large construction equipment into urban area

The Project site is located in a central part of Lahore urban area. Movement of construction machinery is limited to the period from 10:00 in the evening to 6:00 in the morning. Furthermore, the Project implementation schedule will take into account the fact that the site is adjacent to Lahore railway station, and is an area of heavy traffic even in the evening.

③ Surrounding area residents and environment

Construction schedule will take into account the need to keep noise to a minimum during night time hours, Sundays, and holidays in light of the immediate periphery including school staff lodgings, private residences, male dormitory and student mosque, etc.

④ Personnel deployment and work plan taking into account local customs and labour practices

Personnel assignment and employment schedule will take into account important religious holidays of Ramadan, Eid ul-Fitr, etc., as well as shortened working hours and efficiency during the hottest part of the summer.

3) Quality control

An in-situ implementation structure will be designed to enable thorough quality control at each stage of site works in line with requisite standards. Specifically, concrete used in facilities at the site periphery has deteriorated. It is accordingly imperative that temporary facility equipment be established at the site that can on a daily basis carry out aggregate strength testing and saline concentration testing.

4) Strict adherence to construction schedule

Implementation will prioritize contractor transaction and coordination, based on ordering and construction drawings that take into full account construction schedule and in-situ organizational set-up requirements. In-situ implementation setup will be designed to thoroughly coordinate temporary facility and construction equipment operation at the time of construction start-up. This will include assignment of personnel from the preliminary Project stage to oversee construction in a manner whereby works are not back-tracked due to unnecessary change or modification.

5) Finishing schedule

It is anticipated that the construction finishing works stage and the equipment installation works will overlap. In-situ implementation setup will coordinate in a timely manner procedure for equipment installation and finishing works.

6) Third party and peripheral environment concerns

Priority will be placed on absolutely minimal potential damage, injury or inconvenience to residents in the site periphery during construction. This will mandate a thorough set of safety measures in this regard. To maintain site security, it will be surrounded by net fencing with guard personnel at the site entrance and exit. Also, a garbage disposal area and temporary toilet facilities will be included in the implementation plan to enable cleaning of the Project site and frontal road, to accommodate disposal of waste from the site, and ensure sanitary construction site conditions.

(2) Equipment procurement

Points of special note with regard to equipment procurement under the Project are described below.

・ Pre-shipping inspection	:	Lading pre-inspection is first performed by the consultant and then by a certified third party with regard to equipment content and specifications.
・Transport	:	Equipment transport is planned by container to prevent salt contamination or other damage enroute.
・Installation	:	Delivery of equipment requiring installation is to be coordinated with the progress of facility construction.
・ Initial operational supervision	:	In the case of trial operation of equipment, Pakistan side personnel to be responsible for equipment operation and maintenance after Project completion are to be present to ensure proper future operation. An appropriate trial operational period is also to be set in order that Pakistan side engineers are thoroughly versed in specifics of equipment operation and maintenance.

2-2-4-3 Scope of Works

Table shown below indicates the respective responsibilities of the Japanese government and the Pakistan government with regard to Project implementation.

Table 2.2.17 Allocation of work responsibility

Work content	Japanese side	Pakistan side
1. Land acquisition		○
2. Moving or dismantling obstructions within the construction area and land preparation (removal/relocation of trees and other vegetation, existing well, buried objects, obstructing infrastructure, etc.)		○
3. Acquisitioning access and temporary construction facility area (dismantling of obsolete facilities, land preparation, removal of obstacles to south-side access, etc.); garden planting after construction completion; installation of compound wall and gate.		○
4. Ensuring safe movement flow lines for area residents during construction (constructing a west-side wall and ensuring a safe walk route from the men's dormitory to the mosque)		○
5. Parking area construction		
・Parking area within the construction site (south-side access; temporary construction facility area)	○	
・Parking space outside the Project construction area (north-side TT building and east-side of Jubilee Hall		○
6. Necessary permit and authorization applications for construction, including related application costs		○
7. Construction of design building and facilities; design equipment procurement and installation works	○	
8. Public infrastructure lead-in works to the site		
1) Power		
・Application for power reception including from the existing main power line via a newly to be installed transformer		○
・Installation of a transformer with necessary capacity for the Project facilities; underground electrical line from the transformer to the power receiving panel.	○	
2) Water supply		
・Water pipe connection from the relocated well to the Project building water receiving tank		○
・Project facility water supply system (water receiving tank; pump)	○	
3) Drainage		
・Main drainage pipeline (rehabilitation of the existing drainage pipeline and collection pits)		○
・Drainage system for Project facilities and immediate surrounding area (contaminated effluent, miscellaneous drainage water, rain runoff drainage, etc.)	○	
4) Gas		
・Gas canister installation and gas pipe extension and connection to feed Project building kitchenettes		○
5) Telephone / LAN		
・Telephone mainline lead-in to the Project building MDF		○

・Unwired conduit installation for MDF and telephone connection and LAN use	○	
6) Furniture, fittings and fixtures (desks, chairs, curtains, blinds, cabinets, etc.)		
・Design equipment (classroom/laboratory desks and chairs)	○	
・Furniture, fittings and fixtures outside the scope of design equipment		○
9. Commission costs set out below with regard to a Japanese foreign exchange bank based on the approved bank agreement (B/A).		
・Advisory commission for authorization to pay (A/P) documentation		○
・Payment commission		○
10. Import and customs procedures		
1) Sea shipping cost to Pakistan	○	
2) Tax exemption and expediting customs procedures after cargo unloading		○
3) Inland transportation and unloading on site	○	
4) Expediting procedure for inland transportation and unloading on site		○
11. Expediting Japanese expert entry and exit from Pakistan in conjunction with Project works, as well as expediting procedures related to Japanese expert stay in Pakistan		○
12. Exemption of Japanese experts from Pakistan customs duties, domestic taxes and income tax during assignment in Pakistan		○
13. Appropriate and effective operation and maintenance of facility equipment provided under the Project		○
14. Necessary cost for facility construction, and equipment transport and installation not included under the grant-aid cooperation		○

2-2-4-4 Consultant Supervision

Basic approach and points of particular importance with regard to the construction supervision and procurement supervision plans under the Project are set out below.

① The consultant and executing agency will coordinate closely to ensure smooth implementation of construction works, as well as equipment delivery and installation. Particularly with regard to infrastructure lead-in works under the responsibility of the Pakistan government, timing of these works is closely tied to construction works by the Japanese side, and thorough a priori discussions between both parties are to be carried out concerning construction schedule and specifications.

② Prior to commencement of construction works, detailed design documents and construction drawings submitted by the contractor are to be thoroughly reviewed, and the appropriateness of temporary facility planning, quality of planned materials and construction method is to be screened.

③ In conjunction with completion of construction and facility handing over, inspection of the content of completed construction and whether or not delivered equipment meets design specifications is to be carried out. Items that require further work or repair are subsequently to be appropriately pointed out.

④ With regard to construction supervision, construction engineers will be assigned full time to the

site during construction, including the spot dispatch when necessary of facility and equipment engineers.

2-2-4-5 Quality Control Plan

(1) Facility quality control

Basic approach and points of particular importance with regard to facility quality control under the Project are set out below.

① Design criteria

Design criteria for materials and structural components to be used under the Project are in principle to be in compliance with Japanese standard specifications for building construction JAASS-5 (Architectural Institute of Japan), common specifications for building construction work (Ministry of Land, Infrastructure and Transport), building construction supervision guidelines (Ministry of Land, Infrastructure and Transport), and Japan Industrial Standards (JIS). Soil in the Project area is heavy in salt content. Accordingly construction method will take into account the need for saline resistance with regard to underground concrete works, in compliance with local specifications.

② Foundation conditions

The Project building foundation is to be a spread foundation configuration. Soil at the site is weak, and is to be replaced with improved soil. Furthermore, soil strengthening and stabilization works are to be carried out. Furthermore, the strength of the foundation bearing layer is to be verified in-situ by test methods enabling timely foundation assessment, including plate loading test, etc.

③ Main construction method and primary construction materials

Particularly with regard to main construction works including concrete, etc., consultation is to be carried out with the construction contractor to confirm aggregate composition, cement, water, concrete placement method, temperature and curing procedure based on trial mixing, etc. prior to start of construction. Construction works will take into careful consideration methods that facilitate work management, with particular attention to the appropriate placement of mixed concrete with consistent quality. With regard to other primary materials as well, construction methods will be such that local engineers can readily check construction quality in-situ, and ensure uniform work quality from the start of construction.

④ Quality control check sheets

Aiming at thorough quality control of construction works, quality control check sheets will be prepared to enable confirmation of procurement, implementation, curing and completion at each stage of construction by comparison to original preliminary inspection, mixing test and respective material test results.

(2) Equipment quality control

There are few equipment items under the Project that require a complicated level of performance. Accordingly, priority in equipment selection is placed on durability, and repair capability by local agents.

2-2-4-6 Procurement Plan

(1) Construction materials and equipment

Construction materials and equipment, including imported items, can for the most part be procured locally in Pakistan, and this approach in principle will be followed. However, construction materials and equipment will be procured either from Japan or an appropriate third country in the case of specific items whose delivery has a major impact on the construction schedule, or durability and quality aspects are a priority.

(2) Facility equipment

Pakistan imports a wide range of equipment from Japan, Europe, China and other Asian countries. Accordingly, there are numerous local agents capable of providing equipment maintenance as well as spare parts. In the case of facility equipment under the Project, this is in principle to be procured either from Japan or locally. Procurement from a third country will be studied in the case where (i) the same equipment item adopted under the ongoing technical cooperation project is not of Japanese manufacture, or (ii) the equipment item, if procured from Japan, would be considered excessively expensive and overly designed given Project requirements.

2-2-4-7 Operational Guidance Plan

To ensure appropriate operation of equipment provided under the Project, equipment layout, installation and initial operation and maintenance instruction is to be carried out under the direct supervision of the equipment manufacturer or by local agent with support from experts dispatched from Japan. Local agents to be contacted in case of equipment malfunction are also to be confirmed.

2-2-4-8 Soft Component Plan

Both Mechanical Department equipment and Architectural Department equipment provided under the Project are for educational and training purposes. Accordingly, equipment does not require specific or sophisticated operational training. Furthermore, instructors at the GCT Railway College where Project equipment is to be installed have basic technical knowhow in equipment operation. Accordingly, detailed human resource development is deemed unnecessary in light of the fact that concerned personnel can absorb skills for initial and post-initial operation via the above described supervision.

2-2-4-9 Implementation Schedule

In the case of the Project being implemented under grant-aid cooperation from the Japanese government, an Exchange of Notes (E/N) and Grant Agreement (G/A) are signed between the two governments, following which, (i) detailed design, (ii) tender document preparation, (iii) bidding and contracting for construction works and equipment, (iv) construction and equipment procurement and installation, and (v) completion and handing over are to be performed under the implementation schedule.

(1) Detailed design

On the basis of the preliminary study for the Project, a consultant contract is entered into following the E/N and G/A signing. The consultant carries out detailed design for facility construction, and drafts tender document and drawings. Required time period for this after signing the consultant contract is estimated at around 6 months, including tender document approval, tendering, and entering into contract with the selected contractor. During this period, necessary building permit and construction authorization applications are to be completed.

Although the Project is to be implemented under the auspices of Japanese grant-aid cooperation, application for local building permits and construction authorization are necessary. A time period of approximately 2 months is normally estimated as necessary to prepare application documents and drawings, establish coordination with related projects, and obtain the requisite permits and authorization after review of Project content by the Pakistan side. Accordingly, consultation will be made with the Pakistan government to enable permit and authorization issuance within the detailed design time period.

Permit and authorization application is the responsibility of the Pakistan government and it is requested that implementation schedule be strictly adhered to in this regard. Furthermore, any cost intailed by addenda or changes to the content of detailed design in the course of permit/authorization application are to be borne by the Pakistan government.

(2) Tendering

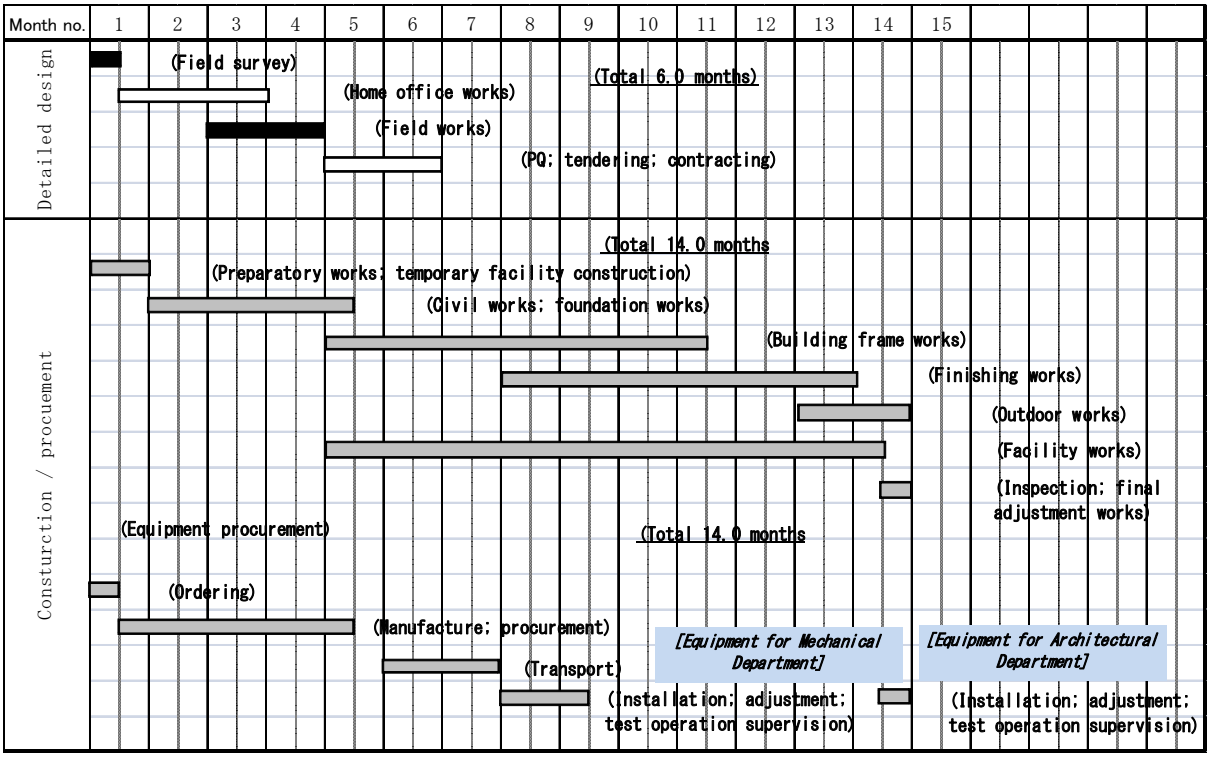
Upon completion of detailed design, a public invitation to tender is issued for construction works and procurement under the Project. Candidate tenderers are then subject to prequalification in line with the Japanese grant-aid cooperation system. Qualified tenderers are then short-listed. Qualified candidates are invited by the executing agency for tendering which is carried out in Japan in the presence of concerned officials and consultant personnel. A contract with the awarded tenderer is then signed. The time from public invitation to tender through site briefing and tender documentation and drawing submittal is approximately 0.5 months. The time from this submittal until contract

signing with the selected contractor is estimated at approximately 2.0 months.

(3) Construction, and material/equipment procurement

After signing of contract with the contractor, construction works and equipment procurement/manufacture begin after approval by the Japanese government. Project implementation schedule is estimated to take 22.0 months from the signing of E/N and G/A to completion of construction.

Table 2.2.18 Project implementation schedule



2-3 Obligation of Recipient Country

In order to carry out the Project, it is necessary that the project components described below are implemented within the designated period by the executing agency of the Pakistan government. Furthermore, TEVTA, the executing agency in question, has clearly stated that it will make the necessary budgetary allocation for works under its responsibility, and has already begun the process of securing such funds. It is thus assumed that the required funding will be available.

In addition, the Pakistan government is already moving forward with preparatory works to receive the project equipment at the Government College of Technology Railway Road Lahore (GCT Railway), and it is again concluded that the Pakistan government has ample capability to execute the works for which it is responsible under the Project.

Project components under the responsibility of the Pakistan government are outlined below. Details are available in the attached annexes.

(1) Proposed construction site

① Land acquisition for the proposed construction site is to be carried out prior to handing over tender drawings for Project construction.

② The following are to be carried out prior to the start of Project construction: (i) any obstacles or obstructions within the construction area are to be moved, (ii) unneeded structures are to be dismantled and removed, (iii) site land preparation is to be carried out, and (iv) safe movement flow lines for residents around the site including teaching staff and students are to be established.

③ The following are to be carried out prior to the start of Project construction: (i) dismantling and removal of existing obstacles and obstructions, as well as land preparation necessary to ensure appropriate access to the site for construction works, as well as for establishing an area for temporary construction facilities.

④ The following are to be carried out promptly within the Jubilee site (outside the construction area under the Project) upon completion of Project construction: establishing an appropriate parking area, peripheral wall, gate, entranceway, planting and outdoor facilities.

(2) Infrastructure

① At the railway road side the north of the site, transformer and related lead-in works are planned to be carried out to install a transformer adjacent to the existing transformer facility, specifically with capacity to power Project facilities. In the case where the public power

corporation requests that power reception for both existing facilities at the Jubilee site and facilities planned under the Project are to be from a single source location, power reception and step-down transformer related works, as well as all related application procedures are to be carried out by the Pakistan government side prior to trial operation of Project facilities and equipment.

However, the Japanese government will carry out electrical circuitry works leading from the new transformer to the Project facility electrical panel room.

② The existing well within the construction area is to be moved to the north side of the water supply tower, and subsequent configuration of water supply pattern to service existing facilities is to be modified prior to the start of construction under the Project.

③ Water supply works from the above well to the receiving tank to be constructed under the Project are to be carried out prior to trial operation of facilities and equipment established under the Project.

④ In the case where collector boxes and underground piping for existing water supply and drainage systems within the Jubilee site exhibit damage, this is to be promptly repaired prior to the start of Project construction.

⑤ Electrical lead-in works for telephony to the main distributing frame (MDF) within the Project compound, LAN conduit works within Project facilities, as well as related permit application procedures, are to be carried out prior to trial operation of Project facilities and equipment.

⑥ Gas pipe connection to the first floor Project facility kitchen is to be carried out prior to trial operation of Project facilities and equipment.

⑦ Pakistan side will allocate the required budget for the procurement, installation and operation of the passenger lift for facility to disabled students / faculty, as per necessity of the operation of the new architecture course building.

(3) Installation of project equipment

It is planned to install mechanical course related equipment within existing facilities. Accordingly, prior to installation, the following works are to be carried out under the responsibility and cost of the Pakistan government.

1) General items

① With respect to installation of project equipment, existing equipment in the target workshop/laboratory that needs to be dismantled and removed, or equipment relocation to make space for equipment under the Project, is to be carried out, in addition to general

preparation for installation of equipment to be provided under the Project.

② Work to translocate existing equipment to the refurbished Jubilee site, as well as preparatory works for installing new equipment under the Project, are to be carried out.

③ In the case of installing project equipment in existing workshops/laboratories, wiring works are to be carried out proximate to the location for installed equipment for necessary power (3 phase; single phase). In addition, in the case where distribution panels for respective workshops/laboratories need to be replaced or new wiring is necessary, it is recommended that to the extent possible earth leakage circuit breakers (ELCB) enabled with residual current relay be installed.

④ Concerning other utility works (water supply, drainage, gas, ventilation, air conditioning, etc.), when these become necessary under the Project for project equipment operation, works in this regard are to be carried out by the Pakistan government.

2) Specific items relating to respective workshop/laboratories

Content of works under the responsibility of the Pakistan government with regard to respective workshops/laboratories prior to equipment installation under the Project are outlined below.

Project equipment installation location	Content of construction works under the responsibility of the Pakistan government
Basic Machine Shop	● 1-1 Establishing ample space for lathe machine installation: This requires removal of the existing, unusable 5 units of machine to make space for the new lathes to be provided under the Project.
Advance Machine Shop	● 2-1 Establishing ample space for lathe machine installation: This requires removal of the existing, unusable 4 units and moving the remaining one usable unit to make space for the new units under the Project. ● Establishing necessary power input: Project equipment requires a power input of 19KVA. Total power feed to the obsolete equipment to be removed is 6KVA. This difference assumes a power input increase requirement of 13KVA.
Welding Shop	● 4-1、4-2、4-11 existing unusable equipment must be removed to enable space for project equipment under the Project.
Foundry Shop	● Ample space for project equipment is available. ● From the point of view of establishing an appropriate working environment, four ventilation fans are necessary in conjunction with project equipment installation.
Material Testing Lab	● It is planned that existing equipment be transferred to the material testing lab on the Jubilee site. The space for this equipment has been determined at the Jubilee hall. ● Existing equipment transfers, as well as preparatory works for project equipment installation are to be carried out. ● 7-1、7-2、7-4、7-10、7-11 equipment concrete mounting or steel frame mounting works are necessary.

Hydraulic Lab	● In light of the fact that existing material testing equipment will be moved to Jubilee hall, equipment to be provided under the Project will have ample space. ● Works to transfer existing equipment, as well as preparatory works for installing project equipment, are necessary.
CNC Lab	● Subject equipment is planned to be installed at either Jubilee CNC hall or at the pneumatic lab. ● It is necessary to establish adequate space for equipment, as well as carry out preparations for equipment installation. ● Necessary power supply: Power requirement for project equipment to be installed in the CNC hall and pneumatic lab is approximately 21KVA. It is necessary that a power capacity be established that can effectively operate this equipment.
Thermodynamic Lab	This is a new lab which features ample space for project equipment installation in light of the fact that a similar laboratory is also being incorporated within Jubilee hall currently undergoing refurbishment. ● Nevertheless, it will be necessary to carry out works to move and prepare reinstallation of existing equipment.
Other	● With regard to the metrology lab, metal shop, wood working shop, auto CAD lab, drawing hall, power lab, and electronics lab, space for installing project equipment is available; however, preparatory works for installation are necessary. ● With regard to all workshops and laboratories planned for installation of project equipment, reinspection, and if necessary repair, of existing electrical circuitry and distribution panels is required in light of the fact that cases have been observed where electrical distribution panel, wiring and breaker location are not appropriate.

(4) Furniture, fixtures and fittings

Provisions of desks and chairs for practical training classrooms within the architectural course lecture building to be established under the Project are included within the Project scope. However, desks, chairs, bookshelves, cabinets, drinking fountains and taps for the administrative office, and multipurpose room are to be procured by the Pakistan government. Likewise, administrative computer equipment, copy machine, office equipment, cleaning gear, curtains, etc. are to be procured by the Pakistan government.

(5) Operation and maintenance

The Pakistan government is to be responsible for securing the necessary staff and funding for Project operation and maintenance, and accordingly assume responsibility for the appropriate and effective operation and management of facilities established and equipment provided under the grant-aid cooperation.

(6) Permit application procedures

It is essential that application for and obtainment of required permits necessary for construction of Project facilities is carried out with the relevant agencies within the Pakistan government that oversee construction works. This must be completed prior to the start of Project facility construction.

In the case where permits are required in conjunction with equipment procurement and installation, permit application and obtainment is to be completed by the time of equipment delivery and subsequent installation.

(7) Exemption from import duties and other taxes

Off loading, clearing customs and overland transport procedures for material and equipment procured under the Project are to be promptly carried out. In addition, customs duties, domestic taxes, value added taxes (VAT) and other administrative taxes are to waived in the case of material and equipment procured under the Project, as well as for Japanese experts assigned in-situ in line with provisions under the approved Project contract.

(8) Banking Arrangement (B/A)

It is necessary that the Pakistan government establish a banking arrangement with a Japanese authorized foreign exchange bank promptly upon signing of the Exchange of Notes and Grant Aid agreement.

(9) Authorization to pay (A/P)

Following signing of the consultant agreement and contractor contract, the Pakistan government is to notify authorization to pay to the bank with which it has entered into a banking arrangement. In conjunction with this, the Pakistan government is to bear the commission costs incurred at each stage of payment.

(10) Expediting and support for immigration and exit procedures, and stay in Pakistan

On the basis of the provisions of the approved contracts, the Pakistan government is to expedite and provide necessary support to Japanese experts and engineers with regard to their entry into, exit from, and stay within Pakistan during the Project.

(11) Other

The Pakistan government is to be responsible for other sundry costs and procedures not specifically included within the grant-aid cooperation framework, but related to effective implementation of the Project.

2-4 Project Operation Plan

2-4-1 Operation plan

(1) Operational format

The facilities and equipment to be provided under the Project for the Mechanical and Architectural Departments within the GCT Railway College will, in the same manner as the existing classroom buildings, laboratory and workshops at the school, be operated by the GCT Railway College under the jurisdiction of the Punjab province TEVTA.

(2) Operational setup

In the case of the Architectural Department learning and training building to be newly established at the college's Jubilee site under the Project, the main entity for operation (including a general administrative department overseeing accounting (lecture fee collection), event management, etc.) will be the operation and maintenance department within the GCT Railway College main campus adjacent to the Jubilee site. Accordingly, it is not necessary to establish a new operation and maintenance department specifically for facilities and equipment to be provided under the Project. Nevertheless, given the fact that the Project facility will be a stand-alone independent building, it is recommended that a separate branch room of the operation and maintenance department be created to manage reception, security and cleaning duties at the new facility. In any case, the operational setup will be designed to keep operational cost to a minimum.

2-4-2 Personnel plan

In the case of the GCT Railway College, the number of classes and students for the mechanical course will be the same after Project implementation. On the other hand, the number of students for the architectural course is expected to increase. Specifically, one class per year is planned to expand to two classes per year. In conjunction with this, increase in teaching staff is planned as described below.

- With regard to the mechanical course, there will be no change in the number of classes. As of fiscal 2010, the number of instructors in this discipline is 28. With expanded workshop/laboratory capacity under the Project, an additional 6 instructors will be added by the end of fiscal 2012, raising the planned number of instructors to 34. And 3 of Lab. Technician will be added because of the increasing the number of Lab.

- On the other hand, the number of architectural classes are planned to be doubled. As of fiscal 2010, the number of instructors in this discipline has been planned to increase from 7 to 12. With the completion of the architectural course lecture facility under the Project at the end of fiscal 2012, it is same teaching staff as 12. Specifically, this would comprise 10 instructors in architectural theory by the end of fiscal 2010 plus an additional 2 instructors in practical structural systems in line with the new department curriculum. And 4 of Lab. Technician will be added because of the facilitating the new practical Lab.

The above instructor increase plan is currently under phased implementation. A request has already been made to TEVTA from the GCT Railway College to recruit 4 mechanical course instructors and 3 architectural course instructors. This recruitment is underway and it is anticipated that the recruitment target will be met.

The Pakistan government aims to make the GCT Railway College a center of excellence (CoE) with regard to mechanical course and architectural course training. In this regard it is actively recruiting additional required instructional staff. It is accordingly concluded that necessary personnel for both teaching and Project facility operation can be brought on board without problem.

Anticipated increase in instructional and administrative staff to effectively operate Project facilities is outlined below.

However, assistant management personnel for laboratories and workshops are not included in the table below. The reason for this is that, with regard to practical training preparations and cleanup after lesson completion, current assistant staff on hand is considered sufficient.

Table 2.4.1 Current staff, and projected necessary staff for Project operation

Job type		Present (FY 2010)	At the time of Project facility operation (end of FY 2012)	Personnel increase
【Mechanical course】				
Chief Instructor	(Grade 19)	3	3	
Senior Instructor	(Grade 18)	3	3	
Instructor	(Grade 17)	15	21	6
Junior Instructor	(Grade 16)	7	7	
(Sub total of instructor)		**28**	**34**	**6**
Lab. Technician	(Grade 14)	23	26	3
(Sub total of Instructor & Technician)		**51**	**60**	**9**
【Architectural course】				
Chief Instructor	(Grade 19)	1	1	
Senior Instructor	(Grade 18)	2	2	
Instructor	(Grade 17)	9	9	
Junior Instructor	(Grade 16)			
(Sub total of instructor)		**12**	**12**	
Lab. Technician	(Grade 14)		4	4
(Sub total of Instructor & Technician)		**12**	**16**	**4**
【Security Staff】				
Security guards (2 persons × 3 shifts)			**6**	**6**
(Total)		**63 persons**	**82 persons**	**19 persons**

Source: Above table is referred by PC-1 document prepared by Pakistan side, Feb. 2011.

2-4-3 Operation and maintenance plan

Necessary personnel cost, electricity, water and telecommunications cost and security administrative cost will be covered by subsidy from TEVTA (Punjab provincial government), GCT Railway College tuition costs as well as income generated by short term course implementation, etc.

Operational outlay for Project facilities is broadly divided into operational cost and maintenance cost. Operational cost entails daily upkeep costs (personnel cost, lighting and heating cost, water purification tank maintenance service and related water quality processing cost, administrative office consumables cost, etc.). Maintenance cost comprises periodic facility repair as well as equipment repair and replacement cost (painting, electric bulb replacement, on site pavement repair, and upgrading or replacement of provided equipment). Specifically with regard to facility construction repair, further equipment procurement or other project facility and equipment repair or augmentation as deemed necessary for the Project, TEVTA intends to supplement its annual budget to cover these costs.

Furthermore, in line with implementation of the Project, the Pakistan government is studying operation and maintenance costs (PC-1 process) with regard to expenditure for O&M during the Project implementation procedure as well as after Project completion in order to carefully identify the scope of necessary cost that it is prepared to bear. It is accordingly concluded that the Pakistan side will be able to meet its share of necessary operation and maintenance costs both during and after Project implementation.

(1) Personnel cost

Personnel cost on the Pakistan side in conjunction with Project implementation comprises that for a total of 17 persons, i.e. 9 instructors as indicated in the above table, and 8 security personnel and maintenance custodial workers. This represents only a very minor increase in personnel, given the fact that total employment currently at the GCT Railway College is approximately 370 persons (total for instructors, administrative personnel, and security and contract workers). The Punjab province TEVTA posits the college as a major strategy in creating COEs, and has clearly indicated its willingness to prioritize necessary budget allocation in this regard. TEVTA as already begun recruiting instructors for the Mechanical and Architectural Departments, and it is accordingly concluded that there will be no problem in securing the required personnel cost for staff increase under the Project.

(2) Utility costs

① Electricity

Increased electricity cost during Project operation will comprise (i) that necessary to operate new equipment input to the Mechanical Department, and (ii) that necessary to operate lighting, air

conditioning and ventilating systems inside the new Architectural Department building to be constructed under the Project. However, given the fact that level of illumination in existing classrooms is extremely poor, the envisioned Project building is planned to rely to the extent possible on natural light. Air conditioning operation will not be central, but instead comprise wall mounted units individually run for each separate classroom. Building exterior walls will be specified for good insulation performance. As a result, electricity load for the new facility is concluded to be far less than that for existing college buildings.

② Water

Water is drawn from a dedicated on-site well where the Project facility is to be located. The Project building can be accommodated by a branch-off from the existing system, and therefore operational cost in this regard will be minimal.

③ Telecommunication

This comprises phone line and related telecommunications cost. Although an increase in frequency and hours of phone use can naturally be expected as a result of Project operation in proportion to the increase of teaching staff, this will be minor compared to current cost in this regard by the college as a whole.

(3) Cost for treatment tank maintenance service

A simple water treatment tank will be installed from the standpoint of Project building sanitation. The operation and maintenance cost required for this tank will comprise the electricity cost to run the aeration blower, as well as the tank inspection and cleaning cost incurred around once every two months.

(4) Operation and maintenance of Project building and equipment

① Technical level required for effective maintenance

In the case of equipment to be provided under the Project, including new input to meet the requirements of practical training under the new curriculum, these are on a level with industrial secondary schools in Japan. Excessively sophisticated industrial use equipment is not adopted. Also with regard to existing equipment at the GCT Railway College, lathes acquired 20~30 years ago are still operable. It is accordingly concluded that college staff have basic technical skills for equipment repair and maintenance, and that these skills can be applied to the operation and maintenance of equipment to be provided under the Project.

② Spare parts, equipment servicing structure, consumables and miscellaneous materials

With regard to spare parts and equipment servicing structure, this is not expected to be a problem given the fact that almost all equipment will be procured locally, and therefore parts and after-service will be readily available.

Furthermore in the case of consumables and other miscellaneous materials as well, it is concluded that these can be easily procured locally.

Specifically with regard to the procurement of spare parts, consumables and miscellaneous materials necessary for practical training, Punjab province TEVTA has clearly indicated that it is prepared to augment its conventional budget allocation to the GCT Railway College to cover these costs.

③ Facility operation and maintenance

The facility to be constructed under the Project is planned with thorough consideration to durability. Nevertheless, long-term facility operation necessitates budget allocation for daily cleaning (floor sweeping, trash disposal), short-term regular equipment inspection (overall equipment condition, status of moving components within the building, windows and doors, etc.), long-term facility inspection and repair (roof water-proofing, exterior wall repair, etc.)

At present unused and deteriorated laboratory and workshop buildings are undergoing repair. Other existing, but obsolete, classrooms and facilities are planned for phase-wise rehabilitation. In conjunction with Project implementation, TEVTA will allocate budget for necessary existing facilities and outdoor infrastructure renovation. It is accordingly concluded that appropriate operation and maintenance will be possible following Project facility completion.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The breakdown of respective costs to be borne by the Pakistan government is estimated as follows. The estimated project cost to be borne by the Japanese government does not indicate a set grant-aid value based on the immediate exchange of notes, and remains subject to further review by the Japanese government.

(1) Cost borne by the Pakistan government

Project cost (Portion borne by the Pakistan government) is Approx. PRs 21 million (approx. 22 million Japanese yen) as indicated in the table below.

Table 2.5.1 Project Cost borne by the Pakistan government side (unit: million)

Item	Cost (PRs)	Cost in JPY	Remarks
1) Before the start of construction: ・ Removal/dismantling of existing obstructions and obstacles, as well as land preparation, to ensure construction equipment and material access to the area, and ensure a temporary construction facility area, etc.	Approx. 3.5	Approx.3.7	
2) Prior to the completion of construction: ・Removing and relocating the existing equipment for the workshop/lab of the project equipment. ・ Construction of foundation, electricity supply and necessary preparation for installation of the project equipment, etc.	Approx. 2.1	Approx.2.2	Approx. 2.1 million PRs is excluded the equipment cost procured by Pakistan side
3)At the time of construction completion: ・Telephone lead-in works, LAN conduit, TV wiring, and installation of furniture, fixtures and fittings necessary for Project operation and administration. And connections works for water supply from the relocated well to the project water reservoir, gas pipe extension works, etc. ・Procurement and installation of computer equipment in CAD laboratories.	Approx. 12.0	Approx.12.6	Approx. 12.0 million PRs is excluded the Cost of new transformer (630KVA) for existing building in Jubilee campus area
4)After Project completion: ・Construction of a parking area outside the construction area, security box (control room), gate and fence. ・ Landscaping and outdoor facility installation, etc. (outside the Project construction scope). ・Installation and operation the passenger lift for facility to disabled students/faculty, as per necessity.	Approx. 2.6	Approx.2.7	Approx. 2.6 million PRs is excluded the Cost of passenger lift (6 persons, 3 stage)
5)Other items in the course of Project implementation: ・Payment of fees related to banking arrangement (B/A) and authorization to pay (A/P).	Approx. 0.2	Approx.0.2	
6)Other costs including contingency	Approx. 0.6	Approx.0.6	
Total	Approx .21.0	Approx.22.0	

Source: ・The Pakistan side costs are referred by PC-1 document prepared by Pakistan side, Feb. 2011.
Note: ・The cost of above item 5) will be confirmed by both of Japanese side bank and Pakistan side bank.

(2) Calculation criteria

・Calculation as of: October 2010

・Exchange rate: US$ 1.00 = JPY 89.91; US$ 1.00 = PRs 85.62; PRs 1.00 = JPY 1.05
EUR 1.00 = JPY 115.28; GB£ 1.00 = JPY 139.03

・Construction period: Implementation is to be divided into one phase. Respective time periods required for detailed design and subsequent construction are indicated under the implementation schedule.

・Other: The Project is to be implemented under the grant-aid program of the Japanese government.

2-5-2 Operation and Maintenance Cost

Project implementation is not intended to substantially expand student enrolment at the GCT Railway College; instead it is aimed at upgrading the quality of current education at the institution. Accordingly, the Project will not have a major impact on personnel cost or facility operational cost at the school. Moreover, the Project plan incorporates energy saving measures including natural lighting and ventilation. From the standpoint of implementing effective education within an appropriate educational environment, it is concluded that the Project will not place any sizable additional pressure on present operational and maintenance costs.

With regard to any additional increase in operation and maintenance cost in conjunction with Project implementation, it is concluded that this will be well within the budgetary capability of the GCT Railway College and TEVTA (Punjab provincial government). Furthermore, TEVTA (Punjab province) has clearly stated its intent to prioritize necessary budget allocation to the college under the Project aiming at a CoE (center of excellence) capable of mechanical and architectural education responsive to industry needs within the private sector. Accordingly, it is concluded that there will be no problem in guaranteeing the required cost for Project operation and maintenance.

(1) Funding status

Annual budget trends for the executing agency TEVTA as well as allocation from TEVTA to the GCT Railway College are indicated in the table below. In addition to yearly increase in TEVTA budget, the amount of funding allocated from TEVTA to the GCT Railway College has also shown a steady increase. In particular, the GCT Railway College budget for fiscal 2010~2011 shows a significant increase in allocation for existing facility/equipment repair and maintenance in addition to staff remuneration.

Table 2. 5.2 Budget trends for TEVTA and the GCT Railway College (unit: PRS '000)

	FY 2008-2009	FY 2009-2010	FY 2010-2011
TEVTA budget	3,910,859	5,444,802	5,749,680
Other than development budget – Remuneration, other	3,029,769	3,737,703	4,249,680
Development budget – Development budget allocated to schools under TEVTA jurisdiction – Operation and maintenance as well as other sundry costs	881,090	1,707,099	1,500,000
GCT Railway College budget	88,172	91,647	106,944
Remuneration budget – Compensation/allowance	86,317	90,670	101,480
Budget other than remuneration - Water and electricity cost - Operation and maintenance cost - Communication and transportation cost - Training cost; others	1,855	977	5,464

Source: Cost items in the above table are in line with budget documents for TEVTA and GCT Railway College

(2) Operating income and expenditure

1) Operating income

The operating budget for the GCT Railway College comes from two sources, i.e. (i) funding subsidy from TEVTA, and (ii) tuition fees paid by students. In addition, sporadic self finance programs are implemented in response to private sector business demand. However, these are carried out only on behalf of the mechanical department, and income is allocated to allowances for instructors overseeing training, as well as utility and educational material costs during training sessions; and accordingly, does not constitute a stable income source for the GCT Railway College.

2) Operating expenditure

Newly necessary operating expenditure after Project implementation will include expanded staff for both the mechanical and architectural departments, as well as operation and maintenance costs for facilities and equipment provided under the Project. An overview of operational expenditure is indicated in the table below.

Table 2.5.3 Summary of personal expenditure (unit: PRS '000)

Expenditure item	Breakdown		Amount (PRs/year)
Personnel costs and allowance			
・Personnel costs	・Mechanical department instructors (6 persons)	6 persons × PRs 25,000/month x 13	1,950
	・Mechanical department Lab. technician (3 persons)	3 persons ×PRs 15,300/month x 13	597
	・Architecture department Lab. Technician (4 persons)	4 persons ×PRs 15,300/month x 13	795
	・Security Guards (2 persons) (3 shifts)	6 persons ××PRs 11,000/month x 12	792
		(Sub total)	4,134
・Allowances *1)	・Allowance, social security, etc.	1 year	(Sub total) 2,480
			(Total) **6,614**

Note: ・Above table is referred by the cost allocation plan of the PC-1 prepared by Pakistan side, February 2011.
・Following items are estimated because the PC-1 is not informed following cost items.
・*1) : Allowance is determined as a percentage for personal cost for the GCT Railway College's budget data.

Table 2.5.4 Summary of operation & maintenance expenditure (unit: PRS '000)

Expenditure item	Check times	Check point	Contents	Approx. cost	Remarks
Architecture building maintenance					
Facility maintenance costs	2 times / month	- finish / - furniture, hardware - equipment	- inspections and repairs - refueling, cleaning, etc.	300	
Simple septic tank and sewage drainage system maintenance	4 times / year	- simple septic tank - drainage system	- sludge collection - check pump	100	25 thousand PRs / 1 time
Furniture, fixtures and maintenance	1 time/ month	- plate, legs, moving parts	- inspections and repairs of the damaged section	100	
2. Expense Management					
Administrative supplies expense	Full year		- printing, stationery, etc.	1,330	
Utility costs *3)	Ditto		- electricity prices	1,390	
Communication costs	Ditto		- telephone, etc.	85	
Transportation costs	Ditto		- due to the movement staff	250	
Event fee	Ditto		- Exhibitions etc	50	
3. Equipment & machinery maintenance costs					
Machinery / Equipments maintenance costs	Full year		- inspections and repairs - refueling, cleaning, etc	500	
Supplies expense	Ditto	- consumable parts	- inspections and repairs / replacement	200	
Fleet renewal &funding update	Ditto	- whole planed equipments	- funding update	400	
A. Total annual maintenance costs required				4,705	
1) Exterior painting and roof waterproofing repair	Every 10 years	- exterior wall, grid security - roof	- paint repair damaged portions - joint & Drain Repair	2,300	Expected, 5% of construction costs of finishing work
2) Consumables replacement facility devices	Every 5 years	- air conditioning / pump - electrical control panel	- refrigerant replacement, inspection - replacement and repair of deteriorated parts	3,240	Expected, 5% of construction costs of mechanical & electrical work
3) Inspections and repairs of the whole yard	Every 5 years	- paving, planting -outside facilities lines	- repair of Inter locking pavement - repair of pit and piping line	800	Expected, 5% of construction costs of Outdoor facility work
B. Maintenance costs after completion of 10 years *2)				5,140	Excluding price increases
C. Above average annual maintenance cost conversion: A + (B ÷ 10 years)= 4,705 + 514 = 5,219 (Total average annual conversion)				**5,219**	

Note: ・*2): TEVTA will allocate the required annual maintenance costs of GCT Railway College. Other costs such as renewal or necessity of the maintenance costs are allocated from development budget of TEVTA.
・*3) : Electricity cost will increase approximately 2 times more, in the case of assuming that the in-house generator will operate for 2 hours every operational day.

3) Independently sustainable operation

New expenditure following completion of Project implementation cost of labor costs, operation and maintenance of facilities and equipment, etc. are estimated approximately PRs 11,833 thousand (PRs 6,614,000 + PRs 5,219,000 = PRs 11,833,000) as indicated in the above table. With regard to the GCT Railway College budget (PRs 106,944 thousand) as of fiscal 2010~2011, an increase in budget after Project building and equipment completion of around 10% will be necessary. TEVTA (Punjab province) has made clear that it will allocate necessary funding for operation and maintenance of the GCT Railway College including the Project facility. It is accordingly concluded that independently sustainable operation of the college will be possible.

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Preconditions

As preconditions to implementing the Project, the following need to be carried out by the Pakistan government.

① Land acquisition for the proposed construction site

(i) Verification of land ownership of the construction site; (ii) moving or dismantling any obstacles or obstructions within the construction area; (iii) land preparation for building construction; (iv) establishing safe movement flow lines for residents around the site including teaching staff and male students; (v) necessary dismantling and removal of existing obstacles/obstructions and land preparation to ensure construction access to the site as well as an appropriate area for temporary construction facilities.

② Moving/adjusting infrastructure, and carrying out lead-in works

(i) Moving the existing well within the construction site area and carrying out water works that tap into the water supply system to existing on-campus facilities; (ii) repairing any existing damage to on-campus water supply and drainage systems; (iii) implementing lead-in works to the Project facility including power, water supply, drainage, phone line, etc.

③ Permit application procedures

(i) Carrying out application procedures and obtaining permits for Project facility construction from the relevant agencies within the Pakistan government; (ii) obtaining any necessary permits in conjunction with equipment procurement and installation.

④ Preparatory works prior to Project equipment installation

Moving where necessary existing equipment and carrying out preparatory works for accommodating new equipment to be installed within the existing facility of the Mechanical Department.

⑤ Other works, furniture, fixtures and fittings

After completion of Project construction: (i) constructing compound wall and gate; (ii) outdoor planting; (iii) installing furniture, fixtures and fittings necessary for facility operation and maintenance including (for rooms other than classrooms and instructors' room) desks, chairs, book shelves, cabinets, drinking fountains and taps, computer equipment, copy machine, office equipment, cleaning gear, curtains, etc.

⑥ Exemption from import duties and other taxes; B/A and A/P procedures; expediting and support for Japanese expert immigration and exit procedures, and stay in Pakistan

Based on the approved contract: (i) exempting Japanese experts from customs duties and value added taxes, etc; (ii) carrying out the necessary B/A and AP procedures for contract payments to the Japanese side; (iii) expediting and providing necessary support to Japanese experts and

engineers with regard to their entry into, exit from, and stay within Pakistan in the course of their assignments under the Project.

3-2 Necessary inputs by recipient country

In order to realize and sustain Project effect, items to be carried out by the Pakistan government are described below.

① Operation and maintenance

Secure necessary personnel and budget for Project operation and maintenance, and subsequently implement appropriate O&M for the building constructed and equipment procured under grant-aid cooperation.

② Cooperative structure with related agencies

Agreement by the executing agency TEVTA (Punjab province government) with related agencies towards sustained funding allocation for operation and maintenance of the GCT Railway College including the Project building and equipment.

③ Linkage with industrial sectors

(i) Setting up a structure for mutual exchange with industrial sectors as well as monitoring the employment performance of school graduates, in order to continually reflect this in technical education content that is best responsive to the identified needs of industrial sectors; (ii) ensuring that technical education carried out by the GCT Railway College responds to the specific requirement for intermediate technical personnel within industrial sectors.

3-3 Important assumptions

Important assumptions in realizing and sustaining Project effect are indicated below.

① The security and political situation in Pakistan does not markedly deteriorate.

② There is no change in the Pakistan government's policy to emphasize technical education and vocational training

3-4 Project evaluation

3-4-1 Relevance

On the basis of the factors set out below, the Project is judged to have high relevance for implementation under the Japanese grant-aid cooperation program.

① The Project is in sync with Vision 2030, the national development strategy by the Pakistan government with a target year of 2030 for achieving major strides in industrialization. Furthermore, the Project dovetails with the Skills Strategy 2009~2013 program aimed at restructuring the TVET sector to effectively develop human resources to alleviate poverty and promote economic growth, and including three basic initiatives: ①training technical personnel able to respond to industrial sector needs, ②improving access to education, vocational training opportunities as well as employment opportunities, and ③guaranteeing an appropriate quality of course content for education and vocational training. The program also lays out a specific strategy to create advanced model schools (Centers of Excellence, COE) to strengthen educational and vocational training institute management within the TVET sector. The Project has direct relevance to all of the above discussed initiatives and is therefore deemed appropriate for implementation in this regard.

② The Project target school is a two-year technical training institute under the jurisdiction of the Punjab province government. It is a public school with low tuition cost, and target Project beneficiaries will be the adolescent and young adult age group within Punjab province, including persons from financially distressed backgrounds. The range of potential target beneficiaries is this large, comprise about half population of Pakistan within Punjab province alone. The Project is therefore deemed appropriate for implementation in this regard.

③ The Project calls for upgrading the target school to COE level aimed at developing intermediate-level technical personnel capable of responding to needs within respective industrial sectors of the country. Providing personnel to the workforce with a high level of technical training will contribute to economic and industrial development, as well as stabilizing the nation's public security by expanding employment opportunities for the country's young people. The Project is therefore deemed appropriate for implementation in this regard.

④ The Project is compatible with Japanese government assistance strategy and approach, including the fact that implementation poses a minimal burden in terms of any potentially negative economic or social impacts and is not intended as a profit-making enterprise. Furthermore, an amplified development effect can be expected in light of the Project's linkage with the related Japanese technical cooperation project already in progress. The Project is therefore deemed appropriate for implementation in this regard.

3-4-2 Effectiveness

The following impacts can be expected as a result of Project implementation.

(Quantitative impacts)

- The current number of students per classroom in the Architectural Department will be reduced from approximately 53~79 persons at present to around 40~45 students with Project implementation.
- The number of lathes, basic practical training equipment within the Mechanical Department, will be increased from one unit per every 3 students to one unit per every 2 students.

(Qualitative impacts)

- Establishment of building and equipment to enable implementation of the revised and improved curricula will upgrade educational quality.

APPENDICES

[Appendices-1]

1. Member List of the Study Team

（1） Preparatory Survey

	Position	Name	Organization
1	Team Leader	Takayuki KONDO	Assistant Director Social Security Division Technical and Higher Education Division Higher Education and Social Security Group, Human Development Department, JICA
2	Coordinator	Kenichi SHIROUZ	In Charge for Study Technical and Higher Education Division Higher Education and Social Security Group, Human Development Department, JICA
3	Project Manager / Architectural Facilities Planning	Masahiko WATANABE	System Science Consultants Inc.
4	Technical Education Planning	Reimei NAKANO	Overseas Vocational Training Association
5	Building Design / Facilities Planning	Akihiro HAYAHARA	System Science Consultants Inc.
6	Equipment Planning / Cost Estimation	Noriyuki FUKUCHI	System Science Consultants Inc. (Office P.P.M)
7	Construction & Procurement Planning / Cost Estimation	Yoshiya NAKANIHI	System Science Consultants Inc.

（2） Explanation on Draft Final Report

	Position	Name	Organization
1	Team Leader	Toshiya SATO	Senior Representative Pakistan Office, JICA
2	Coordinator	Naoki UMEMIA	In Charge for Study Technical and Higher Education Division Higher Education and Social Security Group, Human Development Department, JICA
3	Project Manager / Architectural Facilities Planning	Masahiko WATANABE	System Science Consultants Inc.
4	Building Design / Facilities Planning	Akihiro HAYAHARA	System Science Consultants Inc.
5	Equipment Planning / Cost Estimation	Noriyuki FUKUCHI	System Science Consultants Inc. (Office P.P.M)

2. Study Schedule

(1) Preparatory Survey

No	Day	Week	(Official Members) *Project leader *Coordinator	Project Manager /Architectural Facilities Planning	Technical Education Planning	Building Design/Facilities Planning	Equipment Planning/ Cost Estimation	Construction & Procurement Planning/ Cost Estimation
			a) T.Kondo /S.Kenichi	b) M.Watanabe	c) R.Nakano	d) A.Hayahara	e) N.Fukuchi	f) Y.Nakanishi
1	19-Sep	Sun		Narita-> Bangkok -> Lahore TG643 (NRT 10:00 / BNC 14:30) TG345 (BNC 19:50 / LHE 22:30)			Osaka-> Bangkok -> Lahore TG623 (KIX 11:45/BNC 15:35) TG345 (BNC 19:50/LHE 22:30)	As same as b) c) d)
2	20-Sep	Mon		**Meeting with TEVTA and GCT:** -ICR Explanation-A *Schedule Explanation *Request the Questionnaire -Catch up: *Existing Condition, Back ground & FuturePlan. *Condition of Class R. & Workshop *Priority	←	← Observation of the Existing Condition (Main Campus & Jubilee Site)	← Observation of the Existing Condition (Main Campus & Jubilee Site)	← Observation of the Existing Condition (Main Campus & Jubilee Site)
3	21-Sep	Tue	Narita-> Bangkok -> Lahore TG641 (NRT 11:00 / BNC 15:30) TG345 (BNC 19:50 / LHE 22:30)	Meeting with TEVTA and GCT: -Clear the Situation & Plan: *Educational System *Curriculum & Class use *Curriculum & Equipment use	←	Ditto	Ditto	Ditto
4	22-Sep	Wed	AM: Team meeting & Meeting with Technical Cooperation Team PM: **Meeting with TEVTA and GCT;** -ICR Explanation-B -Observation of the Sites (Main Campus & Jubilee Site)	←	←	Ditto	Ditto	Ditto
5	23-Sep	Thr	Meeting with TEVTA and GCT Railway Road: -Confirmation of: *Request Component and Priority *Operational matter, staffing and budgets *Project schedule & Client's works -Observation of Women's related facilities	←	←	Regal Situation Survey: -Urban Regulation -Facility Construction -Procedure of Design Permit -Fire Fighting, Etc.	Ditto	Ditto
6	24-Sep	Fri	AM: Ditto -Discussion of Minute's Content PM: Observation of Sites & Related Facilities	←	←	Catch up: -Outline of the Building Condition, Usage and Regal Situation	Catch up: -Outline of the Existing Equipment Condition & Usage	Preparation of: -Natural Condition Survey -Site Survey
7	25-Sep	Sat	Team Meeting Observation of the Sites & Related Facilities	←	← Educational Condition Related	← Facility Function Related	← Equipment Function Related	← Construction Condition Related
8	26-Sep	Sun	Team Meeting Adjustment of Minutes	←	← Educational Condition Related	← Ditto	← Ditto	← Ditto
9	27-Sep	Mon	Meeting with TEVTA and GCT: -Confirmation of Minute's Content	←	← Meeting with GCT	Existing Facilities & Equipment Condition Survey	←	Survey of other Donor Project: -Project Type
10	28-Sep	Tue	**Signing of Minutes** TEVTA, GCT Railway Road, (NAVTEC)	←	← Meeting with GCT	Infrastructure Survey: -Electricity -Water, Waste Treatment & Garbage Collection	Existing Equipment Survey -Architectural Course -Mechanical Course	Construction & Procurement Survey
11	29-Sep	Wed	Move from Lahore to Islamabad by Car **Visit to EOJ and JICA** Islamabad -> Bangkok TG350(ICT 23:20/BKC 6:25)	← Move from Islamabad to Lahore by Car	Meeting with GCT railway/Road: -Curriculum & Staffing -Soft component	Related Facility Survey -Women's use -Etc	← Ditto	* Start the Natural Condition Survey
12	30-Sep	Thr	Bangkok -> Narita TG676(BKC 7:35/ NRT 15:45)	Needs & Request to CGT -Architectural Course -Mechanical Course	←	Site Survey -Layout Related -Service Access	Procurement Survey -Suppliers -Service Condition	Site Survey Natural Condition Survey
13	1-Oct	Fri		Other Donor Survey -Project Type -Tender Procedure -Cost & Schedule	Ditto -Prioritized Training Contents	Local Engineering Condition -Local Consultant -Design Condtion -Association	Ditto	Other Donor Survey As same as the Project Manager
14	2-Oct	Sat		Team Meeting Progress of Each Survey	←	←	←	←
15	3-Oct	Sun		Team Meeting Documentation	←	←	←	←
16	4-Oct	Mon		Local Facility Survey: -Operational Condition -Women's Facilities	←	Design Condition Survey	Procurement Condition Survey	Construction & Procurement Survey
17	5-Oct	Tue		Meeting with GCT: -Use plan & Rehabilitation Plan for Existing Facilities	Meeting with GCT: -Curriculum -Training Equipment -Class Room Type	Ditto	Meeting with GCT: -Architectural Course	Ditto
18	6-Oct	Wed		Ditto	Meeting with GCT: -Staff & Class Use Plan	Ditto	Meeting with GCT: -Mechanical Course	Ditto
19	7-Oct	Thr		Meeting with TEVTA & GCT: -Facilities Outline -Equipment Outline	←	Ditto	Meeting with TEVTA & GCT: -Facilities -Equipment	Supervising of the Natural Condition Survey
20	8-Oct	Fri		Draft Planning	←	←	←	Ditto Construction Survey
21	9-Oct	Sat		Team Meeting Progress of Each Survey	←	←	←	←
22	10-Oct	Sun		Team Meeting Documentation	←	←	←	←
23	11-Oct	Mon		Construction & Procurement Survey	Additional Survey Move to Islamabad Islamabad->Bangkok TG350(ICT 23:20/BKC 6:25)	Design Condition Survey	Additional Survey Move to Islamabad Islamabad->Bangkok TG350(ICT 23:20/BKC 6:25)	Construction & Procurement Survey
24	12-Oct	Tue		Meeting with GCT: -Draft Plan	Bangkok->Narita TG676(BKC 7:35/NRT 15:45)	Meeting with GCT: -Draft Plan	Bangkok->Osaka TG672(BKC 11:00/KIX 18:30)	Adjustment the Natural Condition Survey
25	13-Oct	Wed		Ditto		Ditto		Construction & Procurement Survey
26	14-Oct	Thr		Meeting with TEVTA & CGT: -Explanation of Draft Plan -Confirmation of Memorandum		←		Ditto
27	15-Oct	Fri		**Visit to EOJ & JICA**		Additional Survey		Additional Survey
28	16-Oct	Sat		Team Meeting Progress of Each Survey		Team Meeting Progress of Each Survey		Team Meeting Progress of Each Survey
29	17-Oct	Sun		Additional Survey Lahore->Bangkok TG346(LHE 23:40/BKC 6:10)		Additional Survey Lahore->Bangkok TG346(LHE 23:40/BKC 6:10)		Additional Survey Lahore->Bangkok TG346(LHE 23:40/BKC 6:10)
30	18-Oct	Mon		Bangkok->Narita TG676(BKC 7:35/NRT 15:45)		Bangkok->Narita TG676(BKC 7:35/NRT 15:45)		Bangkok->Narita TG676(BKC 7:35/NRT 15:45)

EOJ	: Embassy of Japan in Pakistan	ICR	:Inception Report	
JICA	: JICA Pakistan Office			
NAVTEC	: National Vocational Technical Education Comity			
TEVTA	: Technical Education and Vocational Training Authority in Lahore			
GCT	: Government College of Technology Railway Road Lahore			

(2) Explanation on Draft Final Report

No	Day	Week	(Official Members) *Project leader *Coordinator	Project Manager /Architectural Facilities Planning	Building Design/Facilities Planning	Equipment Planning/ Cost Estimation
			a) T.Sato/N.Umemiya	b) M.Watanabe	c) A.Hayahara	d) N.Fukuchi
1	13-Feb	Sun	Narita-> Bangkok -> Lahore TG643 (NRT 10:00 / BNC 14:30) TG345 (BNC 19:50 / LHE 22:30)	←		Osaka-> Bangkok -> Lahore TG623 (KIX 11:45/BNC 15:35) TG345 (BNC 19:50/LHE 22:30)
2	14-Feb	Mon	Meeting with TEVTA & GCT - Explanation of draft report - Contents of M/D - Site observation	←	←	←
3	15-Feb	Tue	Meeting with GCT - Explanation of project contents - Confirmation of Pakistan side works - Visit to Panjab univrsity, etc.	←	Visit to Lahore municipality - Building permit Meeting with local engineer	Explanation and confirmation of the equipmqnt plan with GCT - Equipmqnt plan - Layout plan, etc.
4	16-Feb	Wed	Team meeting - Adjusment of the M/D	←	←	←
5	17-Feb	Thr	AM : **Signing of M/D** (TEVTA, Chairman) PM : **Signing of M/D** (Punjyab province)	←	Additonal survey - Materials - E&M equipment	Meeting with GCT mechanical course - Confirmation the installation space & electrical panel
6	18-Feb	Fri	Move from Lahore to Islamabad by Car **Visit to EOJ and JICA** Islamabad -> Bangkok TG350(ICT 23:20/BKC 6:25)	←	Ditto	Ditto
7	19-Feb	Sat	Bangkok -> Narita TG676(BKC 7:35/ NRT 15:45)	Adition! survey for facility planning Move from Ialamabad to Lahore	Additional survey of Facility related	Additional survey of Equipment related
8	20-Feb	Sun		Team meeting Additonal survey	←	←
9	21-Feb	Mon		Meeting with GCT & TEVTA - Confirmation of the Pakistan side works and schedule - Confirmation of the Draft Plan	Additonai survey of Facilities	Additonai survey of Equipment
10	22-Feb	Tue		Meeting with TEVTA - Palistan side works	Ditto	Ditto
11	23-Feb	Wed		Meeting with TEVTA & GCT Move to Ialamabad Ialamabad->Bangkok TG350(ICT 23:20/BKC 6:25)	←	←
12	24-Feb	Thr		Bangkok->Narita TG676(BKC 7:35/NRT 15:45)	←	Bangkok->Osaka TG672(BKC 11:00/KIX 18:30)

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GCT	:	Government College of Technology Railway Road Lahore

3. List of Parties Concerned in the Recipient Country

Name	Position	Organization
Central Government of Pakistan		
ZAFAR HASAN REZAH	Joint Secretary	Economic Affair Division, Government of Pakistan
Government of Punjab Province		
UBAID RUBBANI QURESHI	Secretary (Former at October 2010)	Planning and Development Department, Government of Punjab
ALI TAHIR	Secretary (Present at February 2011)	Ditto
Technical Education and Vocational Training Authority (TEVTA), Punjab Province		
SAEED AHMED ALVI	Chairperson	TEVTA, Punjab
KHAWAJA ADNAN ZAHIR	General Manager (Operations)	Ditto
MUHAMMD ABID JAVED	Coordinator	Ditto
SH. FAROOK AHMED	Advisor (Project & Planning)	Ditto
JAWED IQBAL MALIK	General Manager (Academics)	Ditto
AMJAD DURAIZ	General Manager (Operations)	Ditto
AQUIB SHARIF	Deputy Manager (M & E)	Ditto
Engr. IMTIAZ AMJAD	Assistant Manager (Works/Civil)	Ditto
RAB NAWAZ	Sub Engineer (Electrical)	Ditto
SHAUKAT ALI	Sub Engineer (Civil)	Ditto
GCT Railway Road College, Lahore		
ARIF ALI NADEEM	Principal	GCT Railway Road, Lahore
MUHAMMAD AQEEL	In charge Mechanical Dept.	Ditto
AMJAD ELAHI	Senior Instructor Mechanical Dept.	Ditto
MAHMOOD AKHTAR KHAN SALEEM	In charge Architecture Dept.	Ditto
ABDUL JABBAR	Senior Instructor Architecture Dept.	Ditto
Engr. UMAR HAYAT	Instructor Electronical / Electronics	Ditto
Town Hall / Related Organization, Lahore		
QAMAR UL ISLAM	District Officer (SP) City District Officer Lahore	Town Hall, Lahore
QAMAR UL ISLAM	District Officer (SP) City District Officer Lahore	Ditto
RAJA MUHAMMAD ALTAF	Fire Officer City District Govt Lahore	Ditto
MAZHAR AHMED	Civil Defense Officer Lahore	Ditto
MANZOOR HUSSAIN	Assistant Meteorologist	Metrological Station, Lahore
IJAZ AHMED	Assistant Director Physical	Quality Control Center Ferozpur Road Lahore
ABDOUL HAQ BHATTI	Chief Planning Officer	Govt. of Punjab Health Department Lahore

University / College		
Dr. JAMAL TARIQ MIAN	Chairman, Mechatronics & Control Engineering Dept,	University of Engineering and Technology, Lahore
Dr.HAMEED ULLAH MUGHAL	Professor & Chairman, Mechanical Department	Ditto
Prof. Dr. ANIS A SIDDIQI	Professor and Head Architecture Dept.	College of Arts & Design
Other Donor		
MUHAMMAD A AMIR	Monitoring & Evaluation Officer	GTZ Provincial Management Unit Punjab School Libraries Project Lahore
Architect / Engineer		
PARAVEL IQBAL	Lahore Chapter Institute of Architects, Pakistan	Architect, Lahore
Najib Ahmed	Senior Engineer	Design men, Islamabad
Others		
Khalio Bashir Butt	Executive Engineer	LESCO
Usman Babar	Sub Divisional Officer	WASA
Embassy of Japan in Pakistan		
Naru OTSUBO	First Secretary	Embassy of Japan in Pakistan
Akira GOTO	Second Secretary	Ditto
JICA Office in Pakistan		
Takatoshi NISHIKATA	Chief Representative	JICA Office in Pakistan
Toshiya SATO	Senior Representative	Ditto
Noriko HARA	Staff	Ditto
Takeshi SAHEKI	Staff	Ditto
Chieko YOKOTA	Staff	Ditto
Nazia Seher	Local Staff	Ditto
Project for Development of COE for Technical Education at GCT Railway Road College / JICA Technical Cooperation Project		
Takeshi SOMUKAWA	Chief Advisor/ Coordinator	Technical Cooperation Project Lahore, Punjab Province
Minoru ITO	Expert on Architecture Engineering	Ditto
Koji SAWADA	Expert on Mechanical Engineering	Ditto

4. Minutes of Discussions

(1) Preparatory survey stage

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL & ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE

In response to the request from the Government of Pakistan (hereinafter referred to as "GOP"), Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to conduct a Preparatory Survey on the Project for Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road of Punjab Province (hereinafter referred to as "the Project").

JICA sent to Pakistan Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Takayuki Kondo, Human Development Department, JICA, and is scheduled to stay in the country from September 19, 2010 to October 18, 2010. The Team held discussions with the officials concerned of GOP and conducted a field survey at the study areas.

In the course of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Lahore, September 28, 2010

Mr. Takayuki Kondo
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Saeed Ahmad Alvi
Chairperson
Technical Education and Vocational Training Authority, Punjab

Mr. Ubaid Rubbani Qureshi
Secretary
Planning and Development Department
Government of the Punjab

Mr. Zafar Hasan Reza
Joint Secretary
Economic Affairs Division
Government of Pakistan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the capacity of Mechanical and Architecture Departments of Government College of Technology Railway Road Lahore (hereinafter referred to as "GCT Railway") through construction of Architecture building and improving the necessary equipments of Mechanical and Architecture Departments.

2. Modification of the title of the Project

After discussion with the Team, both parties agreed to modify the Project title from "Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road and other institutes include GCT(s) of Punjab" to "Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road of Punjab Province". After consultation with the Government of Japan, the Project title shall be finalized.

3. Project site

The site of the Project is GCT Railway in Punjab Province.

4. Responsible and Implementing Agency

4.1 The Counterpart Ministry is Economic Affairs Division, Ministry of Economic Affairs and Statistics.

4.2 The Responsible Agency is Government of the Punjab Province.

4.3 The Implementing Agency is Technical Education and Vocational Training Authority (hereinafter referred to as "TEVTA"), Punjab.

4.4 The Executing Agency is Government College of Technology Railway Road Lahore.

5. Components requested by the GOP

After discussions with the Team, the components described in Annex-1 were finally requested by GOP. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

6. Japan's Grant Aid Scheme

6-1. GOP understood the Japan's Grant Aid Scheme explained by the Team, as described

in Annex-3.

6-2. GOP will take the necessary measures, as described in Annex-4, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

7. Schedule of the Study

7-1. The consultants will proceed to further studies in Pakistan until 17 October, 2010.

7-2. JICA will prepare the draft final report in English and dispatch the draft report explanation mission to Pakistan in order to explain its contents around mid February, 2011.

7-3. In case that the contents of the draft final report is accepted in principle by the GOP, JICA will complete the final report and send it to the GOP by around June, 2011.

8. Other relevant issues

8-1. Facilities and equipment within the scope of consideration under the Project comprise that essential for learning under the revised mechanical and architecture curricula at GCT Railway and which cannot be provided by Technical Cooperation Project.

8-2. Facility design will adhere to stipulations under urban planning law and construction standard regulations. It will also ensure on-site access and exit ways for safety purposes.

8-3. With regard to the Mechanical Department, the Pakistan side has requested expansion of the existing one story building into a two story building. However, structural concerns make this proposal unsuitable for consideration under grant-aid assistance. Construction or expansion of the building of Mechanical Department will not be included in the Project.

8-4. From September 2010, GCT Railway began accepting females into its Architecture Department. New building will include the minimum components to accommodate these new female students as described in Annex-1.

8-5. Tax Payment

With regard to the implementation of the Project, GOP has committed to take appropriate measures to exempt custom duties, value-added tax, and other fiscal levies which may be imposed in Pakistan.

8-6. Approval of PC-1

The Team requested that the Pakistani side should complete preparation and approval of the PC-1 from Central Development Working Party (CDWP) by the end of March

2011 as it is one of the prerequisites for Government of Japan to make commitment of grant for the Project.

Both sides agreed that the Team will provide the cost estimates by the middle of December 2010 to the Government of Punjab for processing of PC-1 for its approval.

The Pakistani side will promptly inform JICA Pakistan office the result after the approval by CDWP.

Annex-1: Components Requested by the Pakistan Side
Annex-2: Project Site Location Map
Annex-3: Japan's Grant Aid Scheme
Annex-4: Major Undertakings by each Government

COMPONENTS REQUESTED BY THE PAKISTAN SIDE

Annex-1

The definication of Priority
A: Necessary, B: Less necessary than "A", C: Unnecessary (It is not an object of Preparatory Survey)

1. Facilities (Architecture Course Practical Training Building)

No.	Categories		Major Components (Rooms)	Q'ty	Remarks (Following matter should be respected)	Priority
1.	Training & Education	1-1	Special Class Room-CAD (computer)	2	Server and Printer Corner or Room	A
		1-2	Special Class Room-Drawing (drawing table)	2	Equipment Store Corner or Room	A
		1-3	Special Class Room-Model Making	1	Ditto	A
		1-4	Practical Training Work shop - Practical training space * Material Test * Concrete Practice * Plumbing Practice * Metal Practice * Electrical Practice - Survey Equipment Room - Material and Tool Storage	1	Server and Printer Corner or Room	A
		1-4	Common Class Room (Theory Education)	2	Equipment Store Corner or Room	A
		1-5	Storage	unit	Document and Equipment Store	A
2.	Management	2-1	Teacher's Room (Including TOT)	1	Assistant use same room	A
		2-2	Copy and Documentation Room	1	Near the Teacher's room	A
		2-3	Meeting Room	1		A
		2-3	Storage	unit	Document and Equipment Store	A
3.	Girl's Education	3-1	Girls Common Room	1	Locker	A
		3-2	Toilet for Girl's Student	1		A
		3-3	Cafeteria and kitchen	1	Easy access to outside	A
4.	Common	4-1	Reception and Guard Room	1		A
		4-2	Toilet for Boy's Student	1		A
		4-3	Toilet for Women	1		A
		4-4	Toilet for Men	1		A
		4-5	Common Toilet (Men/Women)	1		A
		4-6	Tea Kitchen	1		A
		4-7	Entrance Hall	1		A
		4-8	Storage	unit	Document and Equipment Store	A
		4-9	Machine Room, Electrical Panel Room	unit		A
		4-10	Stairs, Corridor	unit		A
5.	Others	5-1	Garbage Stock Depot.	unit		B
		5-3	External Work Around the New Building	unit		A

2. Equipment

The definication of Priority

A: Necessary, B: Less necessary than "A", C: Unnecessary (It is not an object of Preparatory Survey)

Shadowed cells mean the strongly requested by the Client side in the same priority.

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
1	**Basic Machine Shop**			
1-1	Lathe Machine	6		A
1-2	Bench Type Drilling Machine	2		A
1-3	Band Saw	1		C
2	**Advance Machine Shop**			
2-1	Lathe Machine	2		A
2-2	Hobbing Machine	1		A
2-3	Universal Milling Machine	2		A
2-4	Shaper	1		B
2-5	Surface Grinder	1		A
2-6	Universal Tool and Cutter Grinder	1		B
2-7	Micrometer	5		B
2-8	Digital Caliper	5		B
2-9	Gear Puller	3		C
2-10	Handy Drilling Machine	5		C
2-11	Handy Disc Grinder	5		C
3	**Metrology Lab.**			
3-1	Micrometer	10		B
3-2	Anvil Micrometer	5		B
3-3	Digital Caliper	10		B
3-4	Digital Pitch Caliper	5		B
3-5	Dial Indicator	10		B
3-6	Digital Depth Gauge	10		B
3-7	Digital Height Gauge	5		B
3-8	Digital Bevel Protractor	6		C
3-9	Dial Caliper	5		A
3-10	Dial Bore Gauge	3		B
3-11	Dial Caliper Guage	3		B
3-12	Plug Guage	3		C
3-13	Gauge Block Set	3		C
3-14	Sine Bar	5		C
3-15	Plug Guage set	3		C
3-16	Gear Tooth Micrometer	3		C
3-17	Inner Micrometer	3		A
3-18	Groove Width Caliper	3		A
3-19	Mechanical Comparator	2		A
3-20	Electrical Comparator	2		A
3-21	Engineering Microscope	2		B
3-22	Depth Guage	10		B
3-23	Engineering Square	10		C
3-24	Granite Surface Plate	2		C
3-25	Steel Surface Plate	4		B
3-26	Snap Gauge set	10		B
3-27	Ring Gauge set	2		B

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
3-28	Thread Ring Gauge	5		B
3-29	Protractor	10		B
3-30	Digital Surface Tester	1		C
3-31	Tube Micrometer	5		C
3-32	Autocolymeter	1		C
3-33	3-Point Caliper	5		C
3-34	Point Micrometer	5		B
3-35	Profile Projector	1		C
3-36	Depth Micrometer	4		A
3-37	Laser Length Measuring Instrument	1		C
3-38	V Block	10		C
3-39	Level	10		C
3-40	Thickness Guage	10		C
3-41	Radius Guage	5		B
3-42	Screw Pit Guage	10		B
3-43	Wire Guage	10		C
3-44	Universal Gear Inspection Equipment	1		B
3-45	Digital Guage Tester	1		B
3-46	Taper Guage	3		B
3-47	Pararell Bar	10		A
3-48	Surface Roughness Standard Piece	2		A
3-49	Drill Guage	2		A
3-50	Square V Block	5		A
3-51	Marking Needle	20		C
3-52	Surface Guage	20		C
3-53	Plastic Hummer	20		C
3-54	Punch	20		C
3-55	Compus	20		C
4	**Welding Shop**			
4-1	Arc Welding Machine	6		B
4-2	TIG Welding Machine	2		A
4-3	MAG welding Machine	2		A
4-4	Plasma Cutting Machine	1		A
4-5	Welding Table	16		C
4-6	Forging Furnace	5		B
4-7	Pedestal Grinder	1		A
4-8	Gas Mani Fold System	1		A
4-9	Oxygen Gas Cylinder	5		B
4-10	Acetylene Gas Cylinder	5		B
4-11	Oxy-Acetylene Gas Cutting Torch	5		B
4-12	Oxy-Acetylene Gas Welding Torch	5		B
4-13	Anvil	5		C
4-14	Swage Block	5		C
4-15	Forging Pincer	10		C
4-16	Large Hummer	10		C
4-17	Smasher	10		C
4-18	Hand Vice	30		B
4-19	File set			C
4-20	Welding Shield	20		B

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
4-21	Leather Glove	20		C
4-22	Welding Holder	5		C
4-23	Welding Earth Clip	5		C
4-24	Air Compressor	1		A
4-25	Welding Apron	20		C
4-26	Welding Glass	10		C
4-27	Foot Cover	20		C
4-28	Wire Brush	20		C
4-29	Scriber	20		C
4-30	Cylinder Rack	4		B
4-31	Handy Disc Grinder	5		B
5	Foundry Shop			
5-1	Tilting Crucible Furnace	1		A
5-2	Cupola Furnace	1		B
5-3	Jolt Squeeze Molding Machine	1		A
5-4	Sand Milling Machine	1		A
5-5	Permeability Meter	1		A
5-6	Mold Tester	1		A
5-7	Pyrometer	2		A
5-8	Laddle	4		B
5-9	Shank	4		B
5-10	Laddle Shank	4		B
5-11	Crucible	8		B
5-12	Mold Box	8		B
5-13	Power Riddle Machine	1		B
5-14	Pedestal Grinder	1		A
5-15	Air Compressor	1		A
5-16	Air Blower	2		A
5-17	Air Gun	5		B
5-18	Trovel	20		B
5-19	Silk	20		B
5-20	Large Hummer	10		C
5-21	Forging Pincer	5		C
5-22	Riddle	10		C
5-23	Goggle	20		C
5-24	Level	5		C
5-25	Leather Glove	20		C
5-26	Spatula	20		B
5-27	Shovel	10		C
5-28	Hand Saw	20		C
6-29	File set	20		C
5-30	Chisel set	10		C

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
6	**Metal Shop**			
6-1	Bench Vice	10		C
6-2	Rig Spanner Set	5		C
6-3	Socket Spanner Set	5		C
6-4	Pedestal Grinder	1		C
6-5	Power Hack Saw	2		B
6-6	Disc Cutter	2		A
6-7	Manual Sheet Bending Machine	2		A
6-8	Manual Sheet Rolling Machine	2		B
6-9	Manual Sheet Shearing Machine	2		B
6-10	Handy Drilling Machine	2		B
6-11	Work Table	10		C
6-12	Micrometer	3		A
6-13	Digital Caliper	5		B
6-14	Surface Plate for Sheet Metal	4		A
6-15	Lever Shear	5		B
6-16	Chisel	10		C
6-17	Hummer	10		C
6-18	Steel Snip	10		C
6-19	Tong	10		C
6-20	File Set	10		C
7	**Material Testing and Heat Treatment Lab.**			
7-1	Brinnel Hardness Testing Machine	1		A
7-2	Rockwell Hardness Testing machine	1		A
7-3	Izod Inpact Testing machine	1		C
7-4	Universal Testing Machine	1		C
7-5	Sample Cut-Off Machine	1		C
7-6	Sample Mound Press	1		C
7-7	Sample Polishing Machine	2		C
7-8	Metallurgical Microscope	1		A
7-9	Torsion Testing Machine	1		A
7-10	Rotation Fatigue Testing Machine	1		A
7-11	Electric Annealing Furnace	1		A
7-12	Hardening and Quenching Bath	1		A
7-13	Pedestal Grinder	1		B
7-14	Ultrasonic Detecting Equipment	1		B
8	**Hydraurics Lab.**			
8-1	Fluid Friction Apparatus	2		B
8-2	Venturi Meter Apparatus	1		A
8-3	Bernoulli's Theorem Demonstration	1		A
8-4	Orifice Flow Apparatus	1		A
8-5	Apparatus of Energy Losses in Bends	1		A
8-6	Centrifugal Pump Apparatus	1		B
8-7	Axial Pump Apparatus	1		B
8-8	Piston Pump Apparatus	1		B
8-9	Pelton Turbine	1		B
8-10	Axial Flow Turbine	1		B
8-11	Francis Turbine	1		A
8-12	Radial Flow Turbine	1		A

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
8-13	Hydraulic Equipment Set	2		A
8-14	Hydraulic Bench	1		A
8-15	Axial Pump (Sectional Cut Model)	1		A
8-16	Ball Valve (Sectional Cut Model)	1		A
8-17	Vane Pump (Sectional Cut Model)	1		A
8-18	Piston Pump (Sectional Cut Model)	1		A
8-19	Digital Length Measuring Equipment	1		A
8-20	Digital Tachometer	3		C
9	**CNC & Mold Making Lab.**			
9-1	Vertical Machining Center	1		A
9-2	Turning Center	1		A
9-3	CNC Wire Cut	1		B
9-4	CNC EDM Sinker	1		C
9-5	CNC Laser Cutting Machine	1		C
9-6	Coordinate Measuring Machone	1		A
9-7	Robotics Equipment Kit	1		A
9-8	Computer	10		A
9-9	2-plate Sample Mold	2		C
9-10	DVD Video for mold making and molding	1		A
9-11	Manual Injection Molding machine	2		B
9-12	Pneumatic Equipment Set	2		A
9-13	Micrometer	3		A
9-14	Digital Caliper	10		C
9-15	Surface Gauge	5		B
9-16	Steel Surface Plate	1		A
9-17	Depth Guage	3		A
10	**Thermodynamics Lab.**			
10-1	Diesel Engine Injection (Sectional Cut	1		C
10-2	Gasoline Engine (Sectional Cut Model)	1		C
10-3	Diesel Engine (Sectional Cut Model)	1		C
10-4	Steam Engine (Sectional Cut Model)	1		C
10-5	Boiler (Sectional Cut Model)	1		C
10-6	Gasoline Engine Testing Apparatus	1		C
10-7	Diesel Engine Testing Apparatus	1		C
10-8	Ignition Point Testing Machine	1		A
10-9	Air Compressor Testing Machine	1		B
10-10	Gas Turbine Testing Machine	1		B
10-11	Engine Assembling and Disassembling Kit	4		C
10-12	Steam Boiler Experiment Appratus	1		B
11	**Wood Work Shop**			
11-1	Wood Turning Lathe	1		A
11-2	Band Saw Machine	1		B
11-3	Meter Saw machine	1		C
11-4	Disc sanding Machine	1		C

2-1. Mechanical Course Equipment

No.	Item	Q'ty	Remarks	Priority
12	CAD/CAM & Machine Design Lab.			
12-1	Computer	45		A
12-2	UPS	45		A
12-3	Desk	50		C
12-4	Laser Printer	2		C
12-5	Copy Machine	1		B
12-6	Muli Media Projector	1		B
12-7	CAD/CAM Software	50		B
12-8	Spring Test Equipment	2		B
12-9	Machine Design Simulation Software	1		B
12-10	Photo Elastic Unit	1		B
12-11	Machine Elements set	1		A
13	Drawing Hall			
13-1	Drawing Desk	150		C
13-2	Stool	150		C
14	Power Lab.			
14-1	Electrical Machine Trainer	2		B
14-2	Transformer Trainer	2		B
14-3	Circuit Breaker Trainer	2		B
14-4	Volt Meter DC/AC	10		B
14-5	Tester	10		C
14-6	Watt Meter DC/AC	10		C
14-7	Energy Meter	10		C
14-8	Meggar	10		C
14-9	Multi Meter	10		B
14-10	Wire Gauge	20		B
14-11	Wire Polisher	20		C
14-12	Rotating and Balancing Stand	3		B
14-13	Wire Stripper	20		C
14-14	Induction Moter	5		C
14-15	Phase Sequence Meter	5		A
15	Electronics Lab.			
15-1	Semi Conductor Trainer	5		C
15-2	Industrial Electronics Trainer	5		B
15-3	PLC Trainer	5		B
15-4	Multi Meter	10		B
15-5	Curve Tracer	5		B
15-6	Regulator Power Supply	5		A
15-7	Oscilloscope	2		A
15-8	Function generator	2		A
16	Others			
16-1	White Board	15		C
16-2	Cabinet	15		C
16-3	Dust Box	15		C
16-4	Plastic Pallet	15		C
16-5	Steel Rack	15		C
16-6	Working Desk	15		C
16-7	Plastic Container	30		C
16-8	Safety Glass	50		C

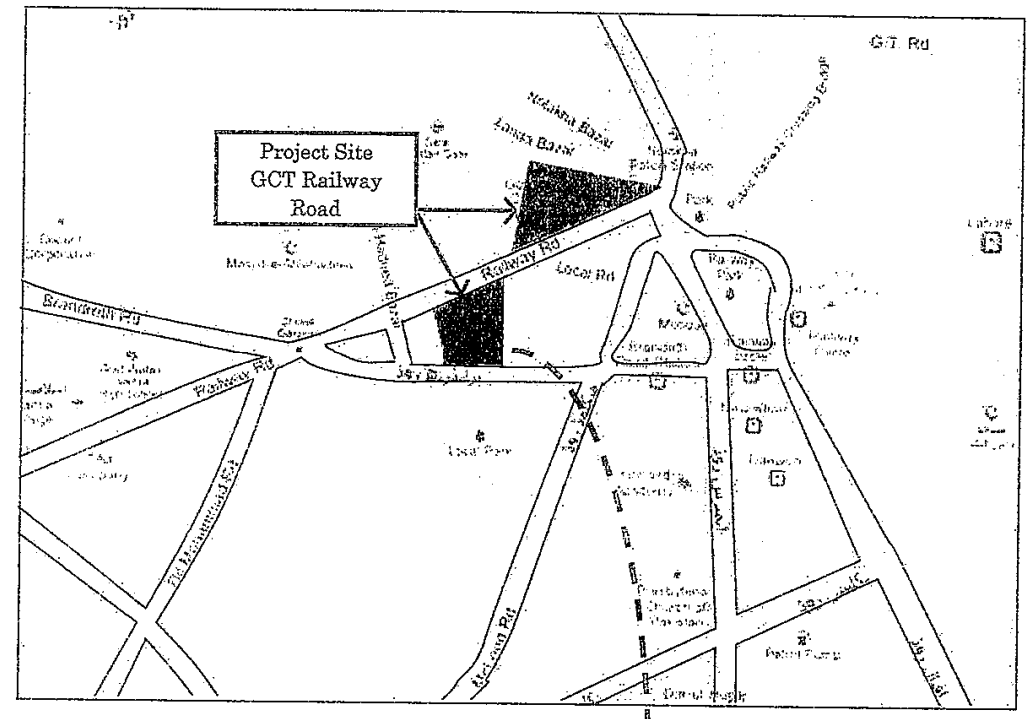
2-1. Mechanical Course Equipment

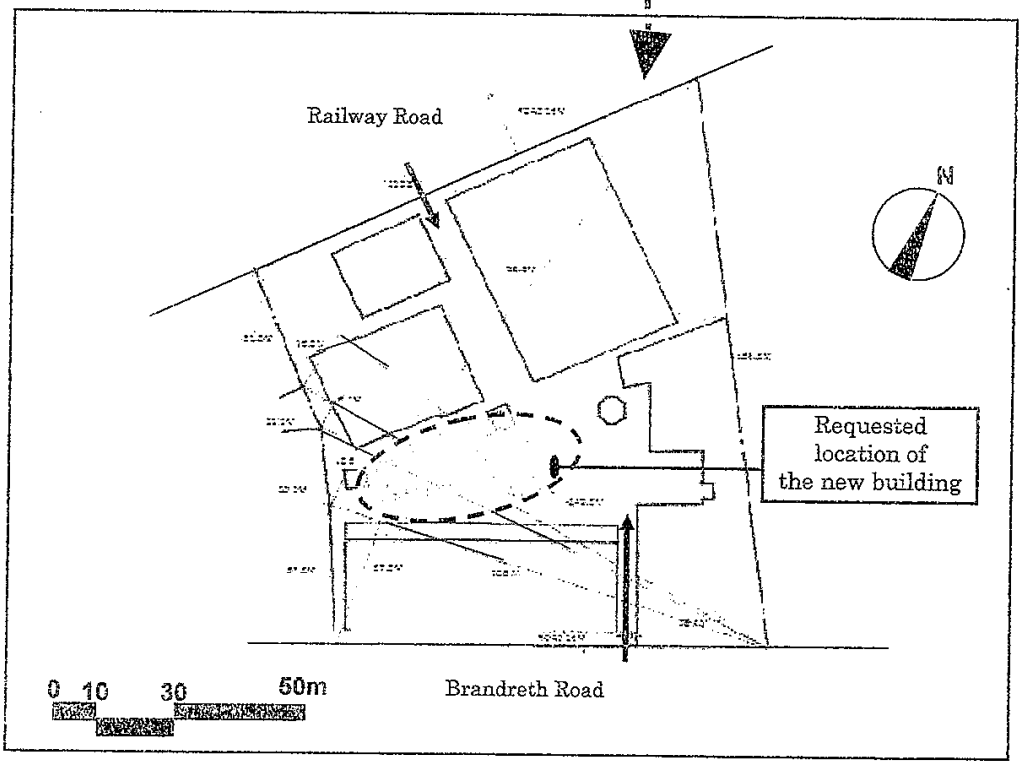
No.	Item	Q'ty	Remarks	Priority
16-9	Helmet	50		C
16-10	Leather Glove	50		C
16-11	Apron	50		C
16-12	Blue Sheet	10		C
16-13	Stand Fan	10		C
16-14	Punching Pannel for Tools	10		C
16-15	Hand Cart	5		C
16-16	Hand Lifter	1		C
16-17	Hand Pallet Truck	1		C
16-18	Tool set	10		C
16-19	Plastic Bucket	10		C
16-20	Stool	50		C
16-21	Magnifing Glass	3		C
16-22	Loupe	5		A
16-23	Tool Box	20		B
16-24	Hand Vice	50		C
16-25	Table Vice	30		C
16-26	Drum Extension Chord	20		C
16-27	Halogen Light Stand	20		C

2-2. Architecture Course Equipment

No.	Item	Q'ty	Remarks	Priority
1	**Architecture Computer Room**			
1-1	Computer Work Station & UPS	80	15 were procured and repaired were 50, total 65 had been procured	B
1-2	Generator	1	Ditto	C
1-3	Plotter	1	Ditto	C
1-4	Printer	2	Ditto	C
1-5	Scanner	2	Ditto	C
1-6	Software	80	Lack of appropriate software	B
2	**Multimedia Room**			
2-1	Projector Set	1	Already procured	C
2-2	Meeting and Public Address Audio System	1		C
2-3	Table & Chairs	50	Already procured	C
3	**Practical Training Workshop**			
3-1	Amsler Type Material Testing Machine	2	Manual type	A
3-2	Concrete Test Standard Tool Set	1 unit		A
3-3	Repetition Material Testing Machine	1		C
3-4	Steel Work Tables & Chair	10	5 chairs for 1 table	C
4	**Design Practice Workshop**			
4-1	Drafting Table & Chair	130	130 were procured	C
5	**Model Making Workshop**			
5-1	Worktable & Chair	50		B
5-2	Tool Sets	1 unit		C
6	**Furniture for New Building**			
6-1	Educational use table & chair	1 unit	Related to number of the Students	A
6-2	Steel Cabinet	10		C
6-3	Office Table & Chair	20		C

Project Site Location Map





Japan's Grant Aid Scheme

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc. The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

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

2. Preparatory Survey

(1) Contents of the Survey

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

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

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

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

(2) Selection of Consultants

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

(3) Result of the Survey

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

3. Japan's Grant Aid Scheme

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

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

(2) Selection of Consultants

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

(3) Eligible source country

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

(4) Necessity of "Verification"

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

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

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

(6) "Proper Use"

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

(7) "Export and Re-export"

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

(8) Banking Arrangements (B/A)

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

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

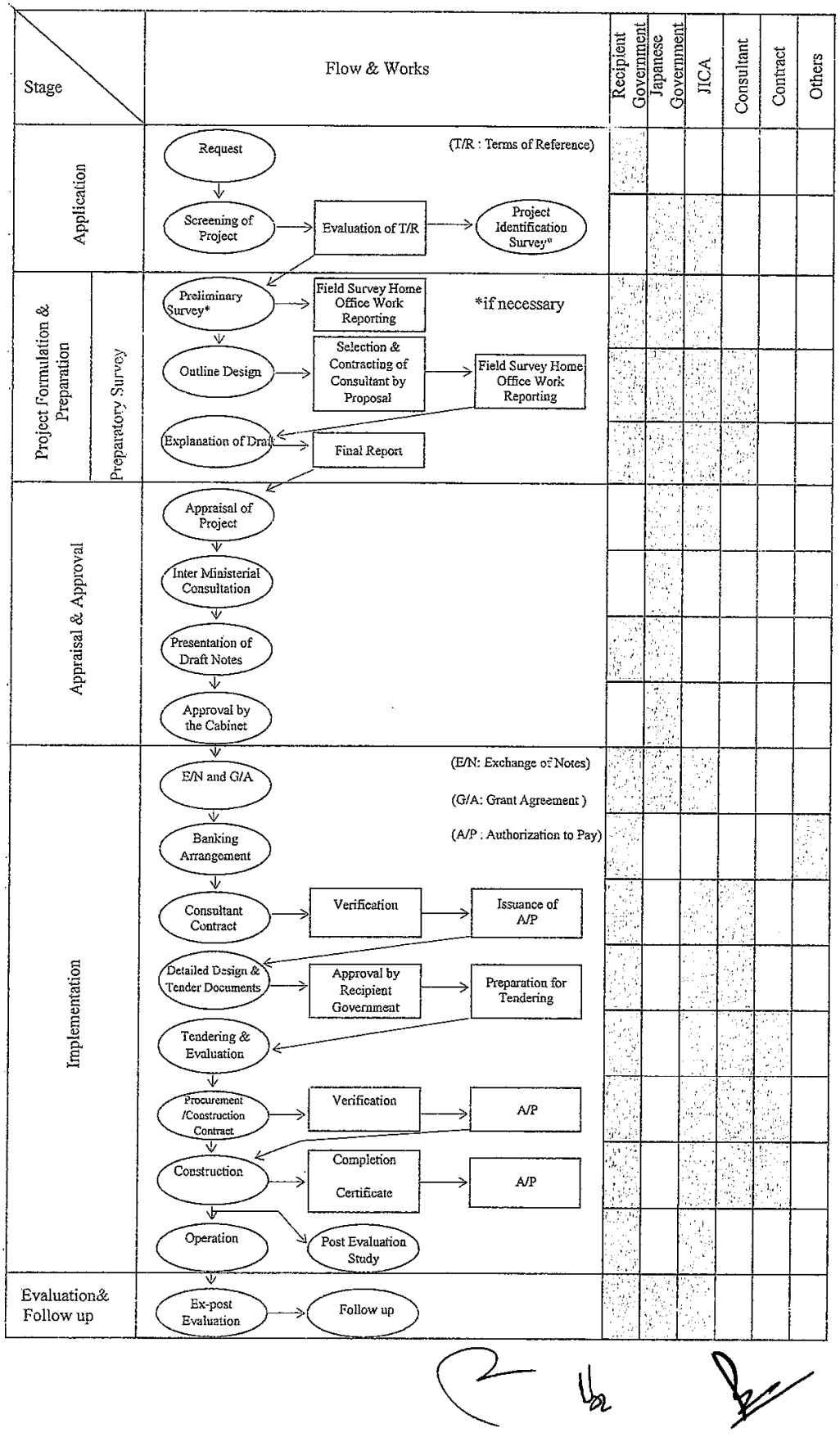
(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

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

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure a lot of land and appropriate access road from the main road necessary for the implementation of the Project and to clear the site.		㉑
2	To construct the following facilities		
	1) The building	㉒	
	2) The gates and fences in and around the site		㉓
	3) The parking lot		㉔
	4) The road within the site	㉕	
	5) The road outside the site		㉖
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site.		
	1) Electricity		
	a. The distributing power line to the site		㉗
	b. The drop wiring and internal wiring within the site	㉘	
	c. The main circuit breaker and transformer	㉙	
	2) Water Supply		
	a. The city water distribution main to the site		㉚
	b. The supply system within the site (receiving and elevated tanks)	㉛	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		㉜
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	㉝	
	4) Gas Supply		
	a. The city gas main to the site		㉞
	b. The gas supply system within the site	㉟	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		㊱
	b. The MDF and the extension after the frame/panel	㊲	
	6) Furniture and Equipment		
	a. General furniture		㊳
	b. Project equipment	㊴	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products in the recipient country.		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	㊵	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		㊶
	3) Internal transportation from the port of disembarkation to the project site	㊷	(㊸)
5	To ensure that customs duties, Value added Tax, any other taxes and fiscal levies charges which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted.		㊹
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		㊺
7	To ensure that the Facilities, the products and the quipment be maintained and used properly and effectively for the implementation of the Project		㊻
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		㊼
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		㊽
	2) Payment commission		㊾
10	To give due environmental and social consideration in the implementation of the Project.		㊿

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

(2) Explanation of Draft Final Report Stage

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY (BASIC DESIGN)
ON THE PROJECT FOR STRENGTHENING OF DAE MECHANICAL & ARCHITECTURE DEPARTMENTS IN GCT RAILWAY ROAD OF PUNJAB PROVINCE
(EXPLANATION OF THE DRAFT REPORT)

In response to the request from the Government of Pakistan (hereinafter referred to as "GOP"), the Government of Japan decided to conduct the Preparatory Study for the Project for Strengthening of DAE Mechanical & Architecture Departments in GCT Railway Road of Punjab Province (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Pakistan Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Toshiya Sato, Senior Representative, JICA Pakistan Office, and is scheduled to stay in the country from 13th February to 23rd February, 2011.

In the course of discussions, both parties have confirmed the main items described in the attached sheets.

Lahore, February 17, 2011

Mr. Toshiya Sato
Senior Representative
Pakistan Office
Japan International Cooperation Agency

Mr. Saeed Ahmad Alvi 17.02.2011
Chairperson
Technical Education and Vocational Training Authority, Punjab

Mr. Ali Tahir 17/2/11
Secretary
Planning and Development Department
Government of the Punjab

Mr. Waqar Hussain Abbasi
Deputy Secretary
Economic Affairs Division
Government of Pakistan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the capacity of Mechanical and Architecture Departments of Government College of Technology Railway Road Lahore (hereinafter referred to as "GCT Railway") through construction of Architecture building and improving the necessary equipments of Mechanical and Architecture Departments.

2. Responsible and Implementing Agency

2.1. The Counterpart Ministry is Economic Affairs Division, Ministry of Economic Affairs and Statistics.

2.2. The Responsible Agency is Government of the Punjab Province through Technical Education and Vocational Training Authority (hereinafter referred to as "TEVTA").

2.3. The Implementing and Executing Agency is TEVTA, Punjab.

3. Components of the Draft Final Report

The Pakistani side has agreed and accepted in principle the contents of the draft final report explained by the Team, the facility construction plan, the list of equipments described in Annex-1 and -2.

4. Japan's Grant Aid Scheme

4-1. GOP understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex-3 and -4.

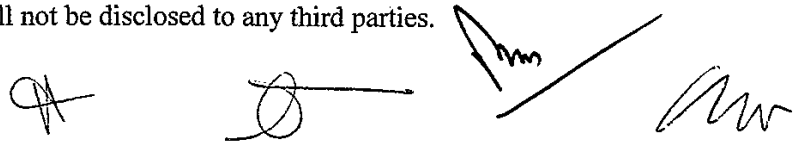
4-2. GOP will take the necessary measures, as described in Annex-5, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

5. Schedule of the Study

JICA will complete a final report based upon the findings of this survey and send it to Pakistan by around May, 2011.

6. Confidentiality of the Project

Both sides agreed that the contents of the draft report would be kept confidential, be dealt with carefulness and will not be disclosed to any third parties.



7. Confidentiality of the Project Cost Estimation

Both sides agreed that the Project Cost Estimation should never be duplicated or released to any outside parties before signing of all the Contracts for the Project. The Pakistani side understood that the Project Cost Estimation attached as Annex-6 is not final and is subject to change.

8. PC-1 Procedure

The Pakistani side agreed to complete the PC-1 procedure within April 2011 in coordination among the concerned parties at the Federal and Provincial government level.

9. Manipulation training

Manipulation training on how to operate equipments will be provided by Japanese contractors upon their installation.

Annex-1: Facility construction plan
Annex-2: Equipment List
Annex-3: Japan's Grant Aid Scheme
Annex-4: Flow Chart of Japan's Grant Aid Procedures
Annex-5: Major Undertakings by each Government
Annex-6: Project Cost Estimation

Facility construction plan

1. Outline of the facility

(1) Purpose of the building

- Architecture course practical education lecture building

(2) Number of stories and floor area

(Floor)	(Floor area, approx.)
- Penthouse	76.5 m2
- Second floor	644.0 m2
- First floor	644.0 m2
- Ground floor	634.0 m2
- Basement floor	126.5 m2
Total	Approx. 2,125.0 m2

(3) Building structure type

- The main building frame (foundation, beams, columns, slabs) are planned by RC rahmen type structure and main walls are designed by brick masonry.

2. Overview of main rooms

Table Overview main rooms

Room category	No. of rooms	Primary function	Design no. of users	Floor area Approx.(㎡)
Learning/training department				
Design drawing room	2	Practical design drawing training utilizing drafting boards.	45 students + instructor	103
CAD laboratory	2	Practical design drawing training using CAD.	Same as above	103
Standard training room (Theory class)	2	Seated practical training.	Same as above	51
Multipurpose laboratory	1	Material testing; simulated practice in producing RC.	Same as above	180
Server/printing room	2	PC server, printer, storage space.	2~3	8
Preparation room of Multipurpose laboratory	1	Preparation for practical training equipment and student's lockers	To be determine on the basis of quantity of materials and equipment	25
Drawing room storage	1	Storage for design drawing equipment, and modeling materials.	Same as above	21

Multipurpose laboratory material storage	4	Storage for practical training materials.	Same as above	6
Survey / measurement equipment storage	1	Storage for survey / measurement equipment.	Same as above	30
Administrative department				
Instructors' room (with Teacher's training functions)	1	This is to be a single large room, equipped with desks and chairs, with private consultation corners and visitor corners that can be set off by movable partitions.	14~20	103
Administrative office	1	Reception; security (2 persons at all times, 3 shifts per day).	2	12
Administrative department rooftop storage	1	Storage for administrative documents and materials.	To be determined on the basis of quantity of materials and equipment	
Female student support department				
Common room	1	Room for female student self study and relaxation (capable of accommodating half the female enrollment at one time).	96/2=48	51
Locker room	1	Lockers to secure hand-carried articles. (aimed at accommodating all female students, both for morning classes and afternoon classes)	96×2=192	12
Dispensary/rest area	1	Rest space (1person+1 nurse staff).	2	8
2nd floor women's lavatory	1	Women only lavatory (for use by both female students and female staff).	5 toilet units	
Common facilities				
Entrance hall	1set	Common entrance way.	—	
Hallways	1set	2 corridors are necessary to ensure efficient instructor and student movement flow lines.	—	Width: 2.3m
Stairways	2	2 stairway locations are necessary to connect floors as well as provide escaped routes in case of emergency.		Width: 1.4/1.5m
Multipurpose use areas	1	For relaxation; displays; meetings, etc.	20~30	50
1st floor men's' lavatory	1	For visitors and instructors.	Single person use	—
1st floor women's' lavatory	1	For visitors and instructors.	Same as above	—
1st floor multipurpose lavatory	1	Wheelchair enabled.	Same as above	—
2nd floor instructors'-lavatory (male)	1	Instructors/staff.	Two person use	—
3rd floor male students' lavatory	1	Male student lavatory.	4 toilet bowel units; 4 urinal units	
Kitchenette (Ground & First floor)	2	Hot water for tea service (for staff).	Single person use	—
Appurtenant facilities				
Electrical panel room (generator room)	1	Electrical distribution panel, generator.	To be determined on the bases of equipment layout	—
Water receiving tank (pump room)	1	Water receiving tank, pump.	Same as above	—
Elevated water tank (rooftop)	1set	Elevated water tank.	Same as above	—
Water treatment tank	1set	Integrated treatment tank	Same as above	—
Outdoor facilities	1set	Outdoor facilities (parking lot, access walkway, planting, etc.) around the building; access road, etc.		—

Annex-2

Equipment List (1/3)

No.	Equipment Number of related Labo/ Workshop	Equipment Name	Q'ty
1	M- 1- 1 M- 2- 1	Lathe Machine	9
2	M- 1- 2	Bench Type Drilling Machine	2
3	M- 2- 2	Hobbing Machine	1
4	M- 2- 3	Universal Milling Machine	2
5	M- 2- 4	Shaper	1
6	M- 2- 5	Surface Grinder	1
7	M- 2- 6	Universal Tool and Cutter Grinder	1
8	M- 2- 7 M- 3- 1	Micrometer	15
9	M- 2- 8 M- 3- 3 M- 6- 13	Digital Caliper	20
10	M- 3- 2	Anvil Micrometer	5
11	M- 3- 4	Digital Pitch Caliper	5
12	M- 3- 5	Dial Indicator	10
13	M- 3- 6	Digital Depth Gauge	10
14	M- 3- 7	Digital Height Gauge	5
15	M- 3- 9	Dial Caliper	5
16	M- 3- 10	Dial Bore Gauge	3
17	M- 3- 11	Dial Caliper Guage	3
18	M- 3- 17	Inner Micrometer	3
19	M- 3- 18	Groove Width Caliper	3
20	M- 3- 19	Mechanical Comparator	2
21	M- 3- 20	Electrical Comparator	2
22	M- 3- 21	Engineering Microscope	2
23	M- 3- 22	Depth Guage	10
24	M- 3- 25	Steel Surface Plate	4
25	M- 3- 26	Snap Gauge set	10
26	M- 3- 27	Ring Gauge set	2
27	M- 3- 28	Thread Ring Gauge	5
28	M- 3- 29	Protractor	10
29	M- 3- 34	Point Micrometer	5
30	M- 3- 36	Depth Micrometer	4
31	M- 3- 41	Radius Guage	5
32	M- 3- 42	Screw Pit Guage	10
33	M- 3- 44	Universal Gear Inspection Equipment	1
34	M- 3- 45	Digital Guage Tester	1
35	M- 3- 46	Taper Guage	3
36	M- 3- 47	Pararell Bar	10
37	M- 3- 48	Surface Roughness Standard Piece	2
38	M- 3- 49	Drill Guage	2
39	M- 3- 50	Square V Block	5
40	M- 4- 1	Arc Welding Machine	6
41	M- 4- 2	TIG Welding Machine	2
42	M- 4- 3	MAG Welding Machine	2
43	M- 4- 4	Plasma Cutting Machine	1
44	M- 4- 6	Forging Furnace	5
45	M- 4- 7 M- 5- 14 M- 7- 13	Pedestal Grinder	3
46	M- 4- 8	Gas Mani Fold System	1

Equipment List (2/3)

No.	Equipment Number of related Labo/ Workshop	Equipment Name	Q'ty
47	M- 4- 9	Oxygen Gas Cylinder	5
48	M- 4- 10	Acetylene Gas Cylinder	5
49	M- 4- 11	Oxy-Acetylene Gas Cutting Torch	5
50	M- 4- 12	Oxy-Acetylene Gas Welding Torch	5
51	M- 4- 18	Hand Vice	30
52	M- 4- 20	Welding Shield	20
53	M- 4- 24 M- 5- 15	Air Compressor	2
54	M- 4- 30	Cylinder Rack	4
55	M- 4- 31	Handy Disc Grinder	5
56	M- 5- 1	Tilting Crucible Furnace	1
57	M- 5- 3	Jolt Squeeze Molding Machine	1
58	M- 5- 4	Sand Milling Machine	1
59	M- 5- 5	Permeability Meter	1
60	M- 5- 6	Mold Tester	1
61	M- 5- 7	Pyrometer	2
62	M- 5- 11	Crucible	8
63	M- 5- 12	Mold Box	8
64	M- 5- 13	Power Riddle Machine	1
65	M- 5- 16	Air Blower	2
66	M- 5- 17	Air Gun	5
67	M- 6- 5	Power Hack Saw	2
68	M- 6- 6	Disc Cutter	2
69	M- 6- 7	Manual Sheet Bending Machine	2
70	M- 6- 8	Manual Sheet Rolling Machine	2
71	M- 6- 9	Manual Sheet Shearing Machine	2
72	M- 6- 10	Handy Drilling Machine	2
73	M- 6- 12 9- 13	Micrometer	6
74	M- 6- 14	Surface Plate for Sheet Metal	4
75	M- 6- 15	Lever Shear	5
76	M- 7- 1	Brinnell Hardness Testing Machine	1
77	M- 7- 2	Rockwell Hardness Testing machine	1
78	M- 7- 8	Metallurgical Microscope	1
79	M- 7- 9	Torsion Testing Machine	1
80	M- 7- 10	Rotation Fatigue Testing Machine	1
81	M- 7- 11	Electric Annealing Furnace	1
82	M- 7- 12	Hardening and Quenching Bath	1
83	M- 7- 14	Ultrasonic Detecting Equipment	1
84	M- 8- 1	Fluid Friction Apparatus	2
85	M- 8- 2	Venturi Meter Apparatus	1
86	M- 8- 3	Bernoulli's Theorem Demonstration Apparatus	1
87	M- 8- 4	Orifice Flow Apparatus	1
88	M- 8- 5	Apparatus of Energy Losses in Bends	1
89	M- 8- 6	Centrifugal Pump Apparatus	1
90	M- 8- 7	Axial Pump Apparatus	1
91	M- 8- 8	Piston Pump Apparatus	1
92	M- 8- 9	Pelton Turbine	1
93	M- 8- 10	Axial Flow Turbine	1

Equipment List (3/3)

No.	Equipment Number of related Labo/ Workshop	Equipment Name	Q'ty
94	M- 8- 11	Francis Turbine	1
95	M- 8- 12	Radial Flow Turbine	1
96	M- 8- 13	Hydraulic Equipment Set	2
97	M- 8- 14	Hydraulic Bench	1
98	M- 8- 15	Axial Pump (Sectional Cut Model)	1
99	M- 8- 16	Ball Valve (Sectional Cut Model)	1
100	M- 8- 17	Vane Pump (Sectional Cut Model)	1
101	M- 8- 18	Piston Pump (Sectional Cut Model)	1
102	M- 8- 19	Digital Length Measuring Equipment	1
103	M- 9- 1	Vertical Machining Center	1
104	M- 9- 2	Turning Center	1
105	M- 9- 3	CNC Wire Cut	1
106	M- 9- 7	Robotics Equipment Kit	1
107	M- 9- 10	DVD Video for mold making and molding	2
108	M- 9- 11	Manual Injection Molding machine	2
109	M- 9- 12	Pneumatic Equipment Set	2
110	M- 9- 15	Surface Gauge	5
111	M- 9- 16	Steel Surface Plate	1
112	M- 9- 17	Depth Guage	3
113	M- 10- 8	Ignition Point Testing Machine	1
114	M- 10- 9	Air Compressor Testing Machine	1
115	M- 10- 10	Gas Turbine Testing Machine	1
116	M- 10- 12	Steam Boiler Experiment Appratus	1
117	M- 11- 1	Wood Turning Lathe	1
118	M- 11- 2	Band Saw Machine	1
119	M- 12- 6	Multi Media Projector	1
120	M- 12- 8	Spring Test Equipment	2
121	M- 12- 11	Machine Elements set	1
122	M- 14- 1	Electrical Machine Trainer	2
123	M- 14- 2	Transformer Trainer	2
124	M- 14- 3	Circuit Breaker Trainer	2
125	M- 14- 4	Volt Meter DC/AC	10
126	M- 14- 9 15- 4	Multi Meter	20
127	M- 14- 10	Wire Gauge	20
128	M- 14- 15	Phase Sequence Meter	5
129	M- 15- 2	Industrial Electronics Trainer	5
130	M- 15- 3	PLC Trainer	5
131	M- 15- 5	Curve Tracer	5
132	M- 15- 6	Regulator Power Supply	5
133	M- 15- 7	Oscilloscope	2
134	M- 15- 8	Function generator	2
135	M- 16- 22	Loupe	5
136	M- 16- 23	Tool Box	20
137	A- 3- 1	Portable Compression Testing Machine	2
138	A- 3- 2	Concrete Test Standard Tool Set	1
139	A- 3- 3	Hand Pallet Truck	2
140	A- 3- 4	Pallet	8
141	A- 3- 5	White Board	2

JAPAN'S GRANT AID

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

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

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

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

2. Preparatory Survey

(1) Contents of the Survey

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

- Confirmation of the background, objectives, and benefits of the Project and also

institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.

- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

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

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

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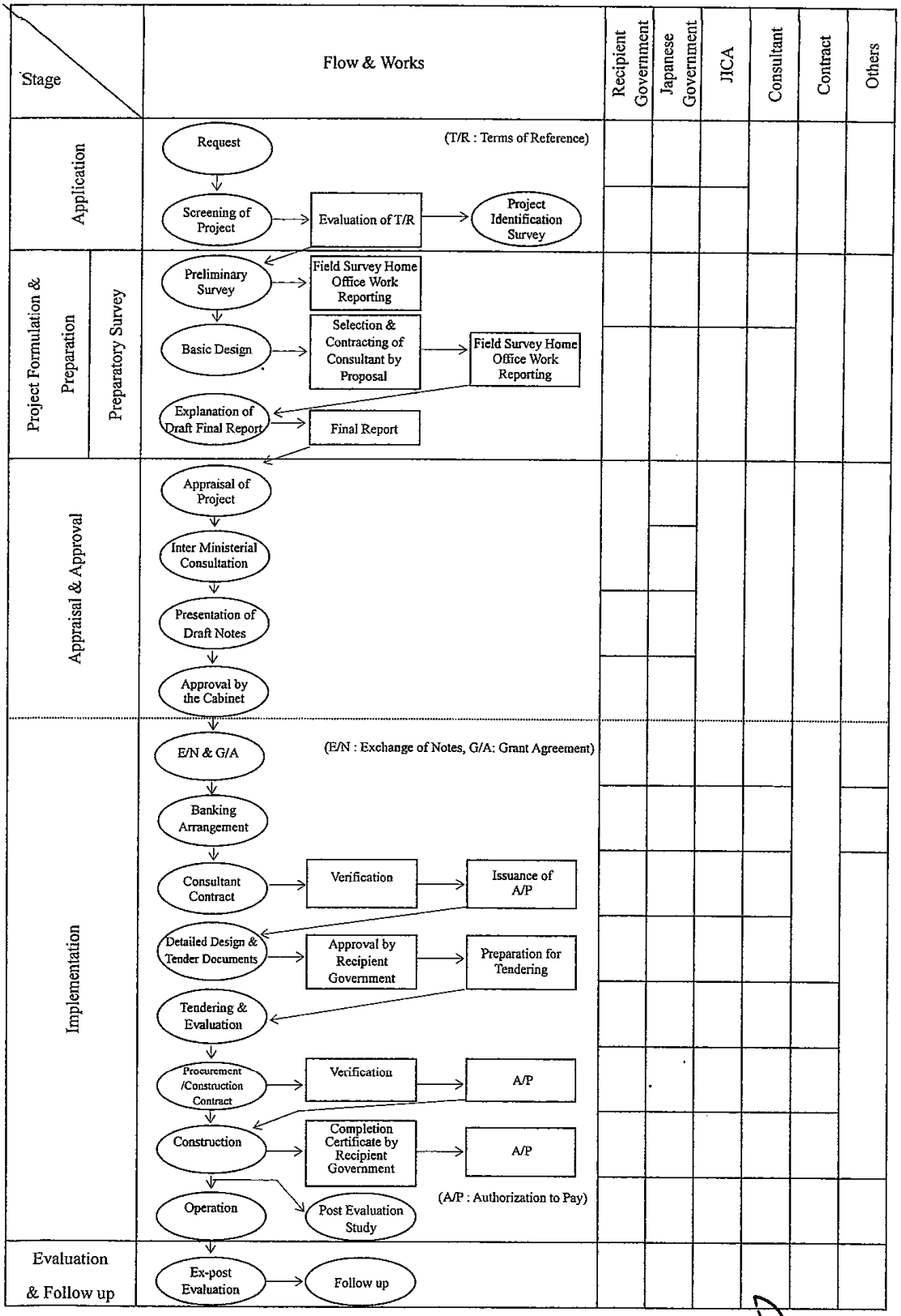
(End)

Annex-4

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-5

Major Undertakings by Each Government

1. Work content covered by Grant Aid and Recipient Side

Work content	To be covered by Grant Aid	To be covered by Recipient Side	Schedule
1. Land acquisition		O	A
2. Moving or dismantling obstructions within the construction area and land preparation (removal/relocation of trees and other vegetation, existing well, buried objects, obstructing infrastructure, etc.)		O	A
3. Acquisitioning access and temporary construction facility area (dismantling of obsolete facilities, land preparation, removal of obstacles to south-side access, etc.); garden planting after construction completion; installation of compound wall and gate.		O	A
4. Ensuring safe movement flow lines for area residents during construction (constructing a west-side wall and ensuring a safe walk route from the men's dormitory to the mosque)		O	A
5. Facility construction			
・Construction of design building and facilities; design equipment procurement and installation works	O		B
・Parking area within the construction site (south-side access; temporary construction facility area)	O		B
・Parking space outside the Project construction area (north-side TT building and east-side of Jubilee Hall		O	B
・Fences, gates and gate house		O	B
6. Necessary permit and authorization applications for construction, including related application costs		O	A
7. Public infrastructure lead-in works to the site			
1) Power			
・Application for power reception including from the existing main power line via a newly to be installed transformer		O	B
・Installation of a transformer with necessary capacity for the Project facilities; underground electrical line from the transformer to the power receiving panel.	O		B
2) Water supply			
・Water pipe connection from the relocated well to the Project building water receiving tank		O	B
・Project facility water supply system (water receiving tank; pump)	O		B
3) Drainage			
・Main drainage pipeline (rehabilitation of the existing drainage pipeline and collection pits)		O	B
・Drainage system for Project facilities and immediate surrounding area (contaminated effluent, miscellaneous drainage water, rain runoff drainage, etc.)	O		B
4) Gas			
・Gas canister installation and gas pipe extension and connection to feed Project building kitchenettes		O	B
5) Telephone / LAN			
・Telephone mainline lead-in to the Project building MDF		O	B
・Unwired conduit installation for MDF and telephone connection and LAN use	O		B

6) Furniture, fittings and fixtures (desks, chairs, curtains, blinds, cabinets, etc.)			
・Design equipment (classroom/laboratory desks and chairs)	○		B
・Furniture, fittings and fixtures outside the scope of design equipment		○	B
8. Commission costs set out below with regard to a Japanese foreign exchange bank based on the approved bank agreement (B/A).			
・Advisory commission for authorization to pay (A/P) documentation		○	C
・Payment commission		○	C
9. Import and customs procedures			
1) Sea shipping cost to Pakistan	○		C
2) Tax exemption and expediting customs procedures after cargo unloading		○	C
3) Inland transportation and unloading on site	○		C
4) Expediting procedure for inland transportation and unloading on site		○	C
10. Expediting Japanese expert entry and exit from Pakistan in conjunction with Project works, as well as expediting procedures related to Japanese expert stay in Pakistan		○	C
11. Exemption of Japanese experts from Pakistan customs duties, domestic taxes and income tax during assignment in Pakistan		○	C

Remarks:
A: Items to be completed before the start of the construction
B: Items to be completed before the completion of the construction
C: Items to be taken care of in the course of the project implementation

5. References

No	Title	Form Book/Video Map/Photos	Original /Copy	Publisher	Issued in
1	PC-1 FOR STRENGTHENING OF DAE MECHANICAL & ARCHITECTURE DEPARTMENT IN GOVT. COLLEGE OF THE TECHNOLOGY, RAILWAY ROAD LAHORE	Book	Copy	TEVTA,PANJAB	2011
2	NOTIFICATION OF GOVT. COLLEGE OF THE TECHNOLOGY, RAILWAY ROAD LAHORE	Book	Copy	TEVTA,PANJAB	2008
3	PROSPECTUS 2010-2011 OF GOVT. COLLEGE OF THE TECHNOLOGY, RAILWAY ROAD LAHORE	Book	Copy	GOVT. COLLEGE OF THE TECHNOLOGY, RAILWAY ROAD LAHORE AND TEVTA, PANJAB	2010
4	ILO/SKILLS-AP/JAPAN REGIONAL TECHNICAL MEETING ON DEVELOPING NATIONAL SKILLS STRATEGIES	Book	Copy	ILO	2007
5	SUMMARY OF THE FEDERAL BUDGET 2010-11	Book	Copy	FINANCE DIVISION OF GOVERNMENT OF PAKISTAN	2010
6	YEAR BOOK 2008-2009	PDF	Copy	FINANCE DIVISION OF GOVERNMENT OF PAKISTAN	2009
7	ANNUAL BUDGET STATEMENT 2010-2011	PDF	Copy	GOVERNMENT OF PUNJAB	2010
8	WHITE PAPER 2010-2011	PDF	Copy	Ditto	2010
9	REPORT ON MONITORING AND EVALUATION FOR 1st YEAR PILOT AND OTHER COURSES DAE ARCHITECTURE TECHNOLOGY AND DAE MECHANICAL TECHNOLOGY	Book	Copy	JICA PROJECT OFFICE OF GCT RAILWAY ROAD AND TEVTA	2010
10	MAJOR FINDING IN THE TNA(TRAINING NEEDS ASSESMENT) CONDUCTED BY GCT RAILWAY ROAD	Book	Copy	Ditto	2009
11	PAKISTAN BUOLDING CODE BCP SP-2007	PDF	Copy	GOVERNMENT OF PAKISTAN	2007
12	MODEL BUILDING AND ZONING BY LAWS FOR TOWN MUNICIPAL ADMINISTRATIONS IN PUNJAB	PDF	Copy	LOCAL GOVERNMENT & COMMUNITY DEVELOPMENT DEPARYMENT GOVERNMENT OF PANJYAB	2007
13	ABRIDGED CONDITION OF SUPPLY (WATER AND ELECTRICITY)	Book	Copy	WATER AND POWER DEVELOPMENT AUTHORITY	2010
14	WEATHER DATA	Book	Copy	LAHORE AIR PORT	2010