

4-5-2 Division of Responsibility

(1) Japanese Responsibility

1) Equipment

① The Japanese side will be responsible for the equipment under the present project from their production in Japan, to transportation, installation and adjustment up to the point of their transfer.

② Items of Equipment

- a. Radar Equipment for Weather Surveillance Radar
- b. Equipment for Power Supply
- c. Equipment for Air conditioning

③ Items of Work

- a. Initial Work
- b. Power Supply Work
- c. Installation of Radars
- d. Final Work
- e. Adjustment of Radars

2) Facilities

① Buildings

- a. Radars Towers (one each at Karachi and Islamabad)

② Items of Work

- a. Construction Work
 - Foundation, Body and Finish
- b. Electrical Equipment Work
 - Interior of the buildings
- c. Water Supply, Drainage and Sanitation
 - Interior of the buildings and laying of pipes to the water supply points and to the existing catch basins within the premises
- d. Ventilation Work

(2) Pakistani Responsibility

1) Items Related to Construction of Radar Towers and Equipment

- ① Preparation of Sites for Radar Towers
 - a. Removal of Existing Buildings and Part of Fence
 - at Islamabad
 - b. Banking and Levelling
 - at Karachi and Islamabad
- ② Service Work for Power Supply, Telephone Lines, Water Supply and Drainage needed for Radar Towers and Radar Observation up to the determined locations within the premises.
- ③ Installation of Lines required for Transmission of Radar Data
- ④ Temporary Supply of Power and Water for construction
- ⑤ Work on Exterior of the Structures
- ⑥ Provision of Furniture

2) Provision of Convenience etc.

- ① Securing duty-free status and convenience for entering and leaving as well as staying in the country for individuals and groups engaged in the project
- ② Securing duty-free treatment of construction materials and equipment brought into Pakistan for the project and convenience of passage through customs and internal transportation
- ③ Acquisition of construction permits prior to commencement of work
- ④ Securing sites for temporary offices, work space and store space for materials and equipment required during construction

4-5-3 Implementation Schedule

(1) Supervisory Structure

A well-qualified supervisor will be sent and stationed in Pakistan during the whole period of the work to carry out the important work of technical and administrative negotiations and consultations on the work with the Government of Pakistan and the PMD.

1) The supervisor on site will be a person capable of making appropriate judgements of the situation of the site and of making decisions in all areas.

2) The supervisor on site will have a good grasp of the situation, maintain close coordination between the Government of Pakistan and the PMD and the constructors and ensure smooth progress of the work by keeping in close touch with the Pakistani organizations concerned, the Japanese Embassy and the JICA Office.

3) The supervisor on site will be particularly responsible for maintaining coordination between the construction work and the installation work of the equipment and make supervisions and directions in carrying out the construction work and adherence to the term of works of the high-quality radar towers and installation of the most up-to-date radars.

4) The term of reference of the supervisor on site are as follows:

- Preparation of periodic reports on the progress of the works (once a month)
- Checking and approving the working drawings of the radar towers, inspection of reinforcement and supervision of placement of concrete
- Checking and approving the working drawings for installation of the radars, inspection of the radome and supervision of the layout of the radar site
- Checking and approving the detailed drawings of the finish and supervision of the finishing work
- Maintaining periodic consultations and supervising the schedule
- Inspection after completion (including that of radar materials and equipment)
- Attendance at the inspection at the time of handing over to the PMD (the owner)
- Preparation of a general report

5) The chief engineer inspects the local conditions at the site during appropriate periods before and after the commencement of the construction of the radar towers, before and after the completion of the towers and at the commencement of the installation of the radar equipment and before and after the adjustment, taking over and inspection of the radars. He discusses with the Government of Pakistan and the PMD in consultations with the constructors in order to ensure that the commencement and the completion of the work on the radar towers and the installation, adjustment and inspection of the radars are implemented without any difficulties.

6) The members responsible for design will back up the work of the supervisor in Japan.

7) The person responsible for inspection of the radar will be responsible for inspecting the radars produced in Japan.

(2) Plan of Procurement of Materials for Construction

As a the basic principle, materials will be procured at the sites in order to reduce construction costs.

(3) Plan of procurement of Materials for Radar Equipment

In principle, Japanese products will be procured for the radar equipment. Since, however, imports to Pakistan are strictly restricted by state regulations with a view to nurturing the national economy, it is inevitable to procure materials on site for radar equipment that are subject to the regulations.

(4) Execution Schedule

1) Construction Work of the Radar Towers

The time required for the construction the radar towers will be 12.5 months after the constructor has been chosen.

2) Installation Work of the Equipment

The installation of the radar equipment will be carried out in the following sequence after the decision of the constructor: preparation of the working drawings of the radar equipment, check and approval of the drawings, production at the factory, test at the factory, transportation by sea, delivery to the sites, installation and adjustment, inspection, and taking over. The period of works will be 12.5 months after the selection of the constructor.

Table 4-5-1 shows the execution schedule after the Exchange of Notes.

Table 4-5-1 The Schedule of Working

ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Exchange of Notes(E/N)	▼																	
Consultant Contract with Japanese Consulting Firm	→																	
Detailed Design & Tender Documents			—															
Approval of Government of Pakistan				▼														
Official Notice				—														
Tendering & Evaluation				▽														
Contract with Japanese Firm					—													
Site Pre-Construction Arrangement			-----															
Radar Tower Construction						—												
Radar Manufacture																		
Factory Inspection									○	○			○					
Shipment, Customs Clearance, Domestic Transport																		
Radar Installation Work																		
Radar Adjustment, Operation Guidance																		
Completion Inspection, Handing Over																		→

4-6 Estimated Cost of the Project

(1) Cost of Undertaking of the Government of Pakistan

The total cost of the works for which the Government of Pakistan is responsible is estimated at Rs. 500,000. This consists of the following costs at Karachi and Islamabad.

1) Cost of installing electric power, telephone and water supply systems	Rs 250,000
2) Cost of embankment work	Rs 100,000
3) Cost of removal of existing buildings	Rs 50,000
4) Cost of laying internal lines	Rs 100,000

4-7 Plan of Maintenance and Administration

4-7-1 Maintenance and Administration Structure

(1) Staffing Arrangement

The staffing arrangement after the installation of the new radars is described in 3-4-4.

(2) Maintenance and Administration of Equipment

The radar equipment introduced under the project is composed of materials of the radar equipment and parts for power supply.

For the materials of the radar equipment, it will be desirable to make a checklist and to carry out periodic inspections, i.e. 2 times a month.

4-7-2 Cost of Maintenance and Administration

The approximate costs required for maintenance and administration of the sites of the weather surveillance radars are as follows. The same items apply to both the Karachi and Islamabad locations.

(1) Cost of Labour	Rs 400,000 a year
(2) Cost of Equipment	
1) Maintenance Costs	Rs 260,000 a year
(3) Cost of Electricity Use	
1) Commercial Power Supply	Rs 18,000 a year
2) Maintenance Cost of Stand-by Generators (including cost of fuel, spare parts and repair)	Rs 22,000 a year

Estimated cost at one site is Rs 700,000 a year.

Total estimated cost of Labour at the two sites is Rs 800,000 a year, which corresponds to about 2% of establishment charge of budget of PMD for the year 1988/1989. This cost is judged to be easily affordable from the PMD budget.

Chapter 5 Evaluation of the Project

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Weather Surveillance Radars are capable of detecting quickly and repeatedly meteorological phenomena which extend over wide areas and are particularly effective in detecting rainfall. Many meteorological services in the world, therefore, and those in areas which frequently suffer from heavy rain accompanying typhoons and cyclones, in particular, are equipped with weather surveillance radars.

In Pakistan, which is subject to sudden occurrences of concentrated heavy rains accompanying Cb-clusters and monsoon depressions, weather surveillance radars are used as an effective means of detecting meteorological phenomena, but, almost all the weather surveillance radars in Pakistan are old and the supply of spare parts is inadequate for maintaining radar observations. Because of these conditions, the radars in Pakistan cannot operate at full capacity and radar observations have been made difficult.

Furthermore, recent developments in electronics have led to progress in radar technology and hence the individual capability of the system and functions of the radar assemblies have been considerably increased. The most remarkable functional development creates digital information of radar echo data from rainfall which can be displayed as images on a monitoring screen, allowing the observers to ascertain the spatial distribution as well as the intensity of the rainfall. In the area of observation systems, improvements in digital transmission allows the radar information to be conveyed directly to the users.

Implementation of the Project, under which these advanced radars will be installed at Karachi and Islamabad, will lead to an increase in the accuracy of weather forecasts for areas around these two points and to improvements in the quantity and the quality of meteorological information published by the PMD. This will lead to benefits, not only to the meteorological services themselves, but to benefits to organizations involved in disaster-prevention, aviation and agriculture as well as to the general public.

5-1 Impact on Meteorological Services

The weather surveillance radars planned for the Project are designed to be able to control the antenna elevation in order to detect the rainfall area at certain levels and precisely detect distant rainfall. Because the received signals of the radar echo are digitalised, an area of range up to about 500 km

from the radar can be displayed with a 2.5 km resolution on the monitor and continuous observations can be made. Consequently, quantitative measurements of the development and decay of torrential rain, which is the major cause of meteorological disasters in Pakistan, can be observed by the radars. It is possible to issue and disseminate cautions or warnings in severe weather, in order to prevent disaster.

Improvements and benefits expected from the installation of radars are shown in Table 5-1-1.

Benefits to the meteorological services are shown as utility values in Table 5-1-2. This was worked out by taking the situation in Japan as a standard in order to evaluate the benefits resulting from the installation of the radars in Pakistan.

The existing radar at Karachi can only roughly detect rainfall areas and observation data are taken down as sketches and converted into encoded reports. The utility value of the data is "2". There being no radar at Islamabad, the utility value is nil. The value for the new radars capable of providing data of the same quality and quantity as radars in Japan is "10".

Rainfall data measured from rain gauges at the surface synoptic observatories are reported to the PMD. There are, however, no automatic weather stations which can interpret the observation data. Forecasters cannot make use of the rainfall data in real time to detect local torrential rain. At Karachi, where the obsolete radar cannot be used in quantitative observation of the rainfall, the installation of a weather surveillance radar capable of making detailed observation of the precipitation will raise the utility value to "10".

Users of real-time information from the radars would not only be forecasters who are responsible for issuing weather forecasts and warnings, but also personnel engaged in the aviation services and agriculture, as well as those working to prevent natural disasters.

Since the existing weather surveillance radar at Karachi has no in-built function for the dissemination of data, radar data need to be converted into WMO code for dissemination. The new radars to be provided under this Project have the ability of data communication. Taking this into account, the Project can be estimated as a 100% improvement in the meteorological services. The meteorological telecommunications network in Pakistan has not been fully established. It is, therefore, not possible to distribute radar data to

all the meteorological stations, immediately upon the installation of new radars. It is possible, however, to disseminate radar data from the radar site at Karachi through to the forecasting office of PMD Headquarters through communication circuits reserved for use by meteorological services and to Karachi Airport through the radio communication system. Dissemination of radar data to other users will depend upon the installation of new telecommunication networks in Pakistan.

Forecasters will be able to receive radar data every five minutes instead of the current three-hourly observational data and therefore details of the rainfall area accompanying Cb-clusters and cyclones can be obtained, constantly. Additional data from surface synoptic observatories, however, cannot be obtained to detect the details on rainfall areas. The evaluation, therefore, is "8".

With regards to short-range forecasts, it is not possible to make a numerical prediction, as made by computer at the Japan Meteorological Agency. It is, therefore, difficult to make predictions on local characteristics of rainfall as well as development and decay. It is possible, however, to make an objective prediction by extrapolating data on movements, as well as development and decay, of rainfall. Consequently the evaluation of improvement is "4".

In summarising the above-mentioned points, the benefits of the installation of the new weather surveillance radars will be an overall improvement to an 85% level in operations, from the present levels of 13% at Karachi and 3% at Islamabad, as calculated from the standard level of the operation experienced in Japan.

Table 5-1-1

Brief Description of Characteristics of
Prototype Radar and Improved Radar

Purpose	The existing operational status(Karachi)	Improvement (Karachi, Islamabad)	Effect
Radar Observation	Control of Elevation Angle is not possible	Capability of observation will be improved by the operation of the optimum elevation angle	Intensity of distant rain can be detected with higher accuracy
	Observation of intensity of rain is not possible	Intensity of rain can be detected; the area of rain and the amount of rain can be detected	Spatial distribution of rain can be detected with an accuracy of 2 ~ 3 km and thus the quantity of information will be remarkably improved
	Radar data in analogue form are only available	Digital radar echo data are available	Radar echo data with a high resolution can be transmitted
	Dissemination of radar data converted into WMO code is made via Telex. Time consumable work is required for encoding and decoding	Observation on the radar can be continuously conducted in order to detect development and decay of the intensity of rain	24 hour watch of a heavy rain can be made and therefore timely and adequate forecasts and warnings can be issued
	Users at the outside of the radar site cannot observe radar echo directly	Dissemination of radar echo images to the airport meteorological office is possible	Aeronautical operators can take direct observations of radar echo
Short-Range Forecasts	Short-range forecasts are difficult due to lack of meteorological data	Capability of replay of sequential digital radar data makes it possible to indicate movements, development and decay of precipitation cells	Prediction of movements of precipitation cells is possible

Table 5-1-2 Estimation of Benefit for the Meteorological Radar Data

I t e m	Present		After Int- roduction of the Radar	The Condition in Japan
	Karachi	Islamabad		
① To obtain meteorological observational data cotinuously	2	0	10	10
② To obtain spacial rainfall data immediately	2	0	10	10
③ To obtain accurate spacial rain-fall data with a 2.5 km resolution	0	0	10	10
④ To disseminate promptly meteorolo-gical informations to users	0	0	10	10
⑤ To enable meteorological forecast to get sufficient meteorological data	2	1	8	10
⑥ To issue meteorological information timely	2	1	8	10
⑦ To make short-range forecast	0	0	4	10
Total	8	2	60	70

5-2 Impact on Society

It is estimated that an overall improvement in prediction ability at PMD will be achieved due to the improved capability in detecting rainfall areas gained by the installation of the new weather surveillance radars. Consequently, data application to prevent natural disasters, aviation and agricultural disasters will be greatly improved.

(1) Reduction of Urban Disasters

It is known that many floods occur after local torrential rain in urban areas, where drainage systems are not fully established.

It will be possible to make accurate forecasts on the possibility of floods in urban areas due to heavy rain accompanying cyclones and sudden and local torrential rain associated with the development of Cb-clusters mentioned above. In Pakistan, cities with a large population and a large number of artificial structures are easily affected by local torrential rain. The radars can be of great use in protecting lives and properties by providing information at the time of observation.

After the introduction of the radars, meteorological information will be distributed to those concerned with the prevention of urban meteorological disasters and various disaster-prevention organizations, with a view to enabling them to carry out their duties. Weather surveillance radars to be installed at Karachi and Islamabad will give effective meteorological information to the public (about 36,000,000) living in those areas within a 300 km range from the radar sites.

(2) Improvement in Countermeasures for Flooding of Rivers

There are many dams, namely the Rawal dam in the city of Islamabad, the Tarbela dam along the Indus, (about 30 km away northwest from the city of Islamabad) and the Mangla dam (about 60 km away southeast from the city of Islamabad). These dams are used for water supply to the city and also for irrigation, but not as flood control systems. Although the outlet water-gates are constructed in these dams, dam-control against floods is not carried out at present, due to the fact that no rainfall data can be collected in the areas concerned and hence no prediction can be made for estimating water coming into the dams.

The WAPDA has a project to develop water resources in the urban areas of the capital city which is expected to be completed by 2010, aiming at the

full control of dams in order to use water reservoirs efficiently. It is planned in this project that effective use of water reservoirs will be achieved through the efficient coordination of a flood warning system of FFC and hydrological information service of PMD.

The weather surveillance radars to be introduced can be an important tool in calculating the total amount of rainfall within a 5 km resolution. As they are capable of working out rainfalls in detectable areas, the amount of runoff can easily be calculated and these data can be used for predicting peak periods of floods and highest water levels. Thus, the necessary measures can be taken by adjusting the discharge from dams, reducing peak water levels during floods and measuring required embankment strength.

As for rivers without dams, the water level can be estimated from calculated values of discharge from the river areas concerned, based on radar data. It is possible to make a prediction for the flood peak time and water level, based on radar data.

Consequently, flood disasters will be reduced by use of a system which can be established in the project of WAPDA in order to predict possible floods in small rivers from radar data. With regards to floods in larger areas, evacuation of inhabitants can be made, with the issue of advanced notification of expected peak time and the peak water level of the flood.

(3) Safety Operation of Aviation

As mentioned in section 2-2, take-off and landing operations of aircraft in Pakistan are seriously affected by adverse weather conditions, such as the sudden occurrence of squalls and local torrential rain accompanying Cb-clusters in the ITCZ. Karachi International Airport is a major airport with a large volume of international and domestic air traffic. The meteorological service at Karachi Airport has suffered from the ineffective operation, since the prototype radar installed at the Karachi Meteorological Office only disseminated hourly or 3 hourly reports on radar observations (i.e. rapid changes in the activity of Cb-clouds could not be observed).

Access to the new radar will be available to the Karachi Aeronautical Meteorological Station. Consequently, radar data and weather analyses will be prepared with a view to enabling the aeronautical meteorological observatory to distribute forecasts, route forecasts and significant weather information to all airlines, control towers, flight information centres, civil aviation bureau, and all airports in Pakistan. The aeronautical meteorological observatory can issue timely and adequate meteorological information thus

allowing effective and safety flight plans to be formulated by the airline operators concerned based on meteorological information.

In turn, air traffic controllers can adequately instruct the pilots-in-command to take immediate action while in the air.

(4) Reduction of Damage to Agriculture

The PMD at Islamabad is responsible for issuing 24 hours forecasts as well as cautions and warnings, in order to increase agricultural output in the granary area of the Punjab. This is done through the agriculture improvement authorities, agricultural offices concerned and also directly to the farmers through Radio Pakistan. Overflow of waters into agricultural areas, caused by heavy rainfalls have occurred every year. It will be possible for necessary measures to be taken by the agricultural authorities to prevent these disasters by taking into account the issued cautions and warnings of heavy rainfall received from the PMD based radar data. For example, it will be possible to make a drainage plan based on current information, instead of an arbitrary plan which have been made in the past by taking into account the experiences obtained previously.

Based on hourly rainfall obtained from these weather surveillance radars, adequate corrections can be made and thus it is possible to estimate a rainfall quantity over certain periods, daily, monthly and annually. These estimates will be used as meteorological data for agrometeorology and as data on rainfall distribution. In turn, this will make agrometeorological services improve, resulting in a further increase of agricultural products.

Chapter 6 Conclusion of the Project

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6-1 Conclusion

Pakistan suffers from meteorological disasters almost every year, in particular, sudden and local torrential rain and hail, thunder as well as strong winds, which cause serious damage. Heavy rain can cause floods, landslides and inundation of farms, resulting in loss of life, property and livestock as well as disrupting transportation systems such as flight operation. The greatest task for the meteorological services in Pakistan, is to supply meteorological information for the prevention and reduction, of damage caused by natural disasters, and to maintain safety in aviation operations. Upgrading meteorological observations is the most fundamental item urgently required for efficient and suitable implementation of the meteorological services. However, meteorological observation in Pakistan is still in the infant stage of development both in the quality and the quantity of observational instruments. In order to resolve this situation, the preparation of meteorological service networks, which enable one to detect meteorological phenomena effectively (mainly because of recent improvement of detective ability) should be given the first priority, and would be fundamental to achieving an efficient meteorological service. So, prompt establishment of the meteorological radar network is required, especially for heavily populated areas, to detect local torrential rain caused by Cb-clusters and prevent disasters.

Karachi is located in the southern part of Pakistan which is prone to natural phenomena such as cyclones and heavy rain in the monsoon season. With a population exceeding 5,200,000, Karachi is the largest city and the gateway to Pakistan both by sea and by air, and is greatly affected once subject to bad weather conditions. The weather surveillance radar in Karachi is aged and so, the new radar to be installed will improve the present meteorological operation within an area having a 300 km radius from Karachi, occupied by 30,000,000 inhabitants. In particular, adequate meteorological information will be issued promptly with a view to enabling the public to take necessary measure in order to prevent natural disasters. In addition, a remote monitoring display of this radar at Karachi Airport will ensure safety of aviation operations.

Islamabad is the political centre of Pakistan and is located in the northern part of the granary region in the Punjab. This city is located along the upper streams of the Indus and other major rivers. The new radar to be installed at Islamabad will improve meteorological services in the granary area, within a 300 km radius from Islamabad, in which about 30,000,000 inhabitants live. In particular, adequate meteorological information can be made available promptly in order to reduce damage to agriculture caused by meteorological disasters.

As mentioned above, it can be regarded that the highest priority is to install new radars at Karachi and Islamabad, along with establishing a meteorological radar network throughout Pakistan, and to complete the foundation of meteorological services. This will, in turn, enhance the meteorological observation ability of the PMD, reduce meteorological disasters and ensure safety in aviation operations. It is deemed to be a Project deserving of Grant Aid from Japan.

6-2 Recommendations

This Project greatly contributes to the development of meteorological services in Pakistan. With a view to protecting life and property of the Pakistani people during meteorological disasters, reducing damage to agricultural products and securing the safety of transportation systems. It is recommended that the following points be noted and implemented as far as possible, in order to enhance the essential parts of the Project.

(1) Technical Cooperation

Most of the circuits in the radars to be installed under this Project are of modular design. This means that up-to-date knowledge of newly developed radar technology is essential to carrying out operation and maintenance of the new radars. It is especially important that the meteorologists responsible for the operation and maintenance of the radars have a sound knowledge of circuit analysis and digital circuits, as well as for securing stable operation and ensuring to take efficient and effective measures as necessary. For acquiring knowledge, it is recommended that a programme of training be prepared by the Japanese side to enable Pakistani meteorologists to receive the necessary education related to the radars, as follows;

- Training for the operation and maintenance of the radar system : two (one for each site) trainees for two month.

(2) Future Plan - concerning Completion of Meteorological Radar Network in Pakistan

Weather surveillance radars are to be installed at Karachi and Islamabad under this Project. It is desirable to establish a meteorological radar network to cover the whole area of Pakistan, as meteorological disasters occur not only in surrounding areas of Karachi and Islamabad, but also all over Pakistan. It is possible to greatly improve the capability of meteorological observation in Pakistan by the complete establishment of a radar network and, in particular, to obtain the whole picture of the ITCZ. In this way, radar information obtained from the radar network can be distributed to

the government authorities for protection against natural disasters. A structure for further effective use of the radar data will have to be established.

The two weather surveillance radars to be installed under this Project will, on the completion of the network, be major components of the radar network and play an important rôle in keeping constant meteorological observation in Pakistan.

Appendix

Appendix

I . Minutes of Discussions

II . Members List of the Basic Design Study Team

III . Survey Itinerary

IV . Name of Discussants

1 . Minutes of Discussions


MINUTES OF DISCUSSIONS
ON THE BASIC DESIGN STUDY
ON THE PROJECT
FOR ESTABLISHMENT OF METEOROLOGICAL RADAR NETWORK
IN THE ISLAMIC REPUBLIC OF PAKISTAN

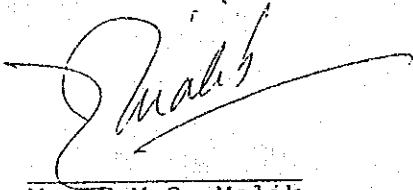
In response to the request of the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a basic design study on the Project for Establishment of Meteorological Radar Network and entrusted the study to the Japan International Cooperation Agency(JICA). JICA sent to Pakistan a study team headed by Mr. Haruo Suzuki, Duputy Director, Grant Aid Planning and Survey Department, JICA, from 25th October to 21st November 1988.

The Study team has visited the proposed sites as well as related organizations and has had a series of discussions on the Project with officials concerned of which the representative is Mr. F.M.Q. Malik, Director General, Pakistan Meteorological Department.

As the result of the above, both parties have agreed in principle to recommend to their respective governments that the major points of understanding reached between them, attached herewith, must be examined towards the realization of the Project.

Islamabad, 3rd November 1988


Mr. Haruo Suzuki
Leader
Basic Design Study Team
Japan International
Cooperation Agency


Mr. F.M.Q. Malik
Director General
Pakistan Meteorological
Department

ATTACHMENT

1. Objective of the Project

The objective of the Project is to install the meteorological radar systems and to construct the necessary buildings for the radar systems in order to upgrade the operation of meteorological services which protects social and economic activities against natural disasters.

2. Organization

Pakistan Meteorological Department (PMD) is responsible for implementing the Project. Mr. F.M.Q. Malik, Director General represents the organization.

3. Project sites

Proposed project sites and their requirement/background can be summarized as follows:

1) Karachi;

Replacement of 24-year old radar-system. PC-1 was cleared in 1987 under the title of "Modernization Project of PMD".

2) Islamabad;

Installation of a C-band radar (inclusive of a building) in the premises of PMD, Islamabad. PC-1 was cleared in 1985 together with the introduction of main frame computers.

Further information such as address, latitude, longitude, altitude, landownership and topographic map around each site is shown in Annex I.

4. Request of the Government of Pakistan

The Team will convey a request of the Government of Pakistan, which is listed in Annex II, to the Government of Japan. The latter will make the necessary arrangement for the Project within the scope of "Japan's Grant Aid Program".

5. "Japan's Grant Aid Program"

The Team explained about "Japan's Grant Aid Program" in various manners and the Government of Pakistan came to understand its scheme, procedures and undertakings relevant to the Aid.

6. Measures to be taken by the Government of Pakistan

The Government of Pakistan shall take the necessary measures which are shown in Annex III, on condition that the Grant Aid by the Government of Japan is extended to the Project.

7. Budget and Personnel for the operation and maintenance

The Government of Pakistan shall prepare the necessary budget and personnel for the operation and maintenance of the meteorological radar systems which will be aided with, on condition that the Grant Aid by the Government of Japan is extended to the Project.

ANNEX I

1. Address, latitude, longitude, altitude and landownership of each site are as listed below.

Karachi : 24 54N, 67 08E, 22mAMSL

University Road, Karachi-32 (P.O.Box No.8454)

In the premisses of PMD

Islamabad: 33 75N, 73 10E, 520mAMSL

H-8 Sector, PMD, Islamabad (P.O.Box No.1214)

In the premisses of PMD

2. Topographic maps are shown below.

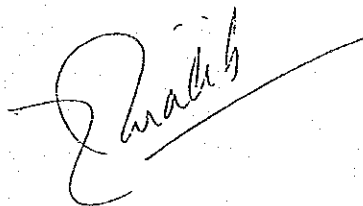
A handwritten signature in cursive script, possibly reading 'Zarab', with a long horizontal line extending to the right.A small handwritten mark or signature in the bottom left corner, consisting of a few loops and a vertical line.

ANNEX II

In accordance with the results of the discussions, the meteorological radar station at each site shall be equipped with the following items:

- (1) Meteorological radar system (C-band) for Karachi and Islamabad
 - 1) Antenna assembly
 - 2) Antenna servo control assembly
 - 3) Transmitter-receiver assembly
 - 4) Operating console assembly
 - 5) Digital video integrator and processor (DVIP)
 - 6) Dehydrator compressor assembly
 - 7) Colour monitor display assembly
 - 8) Automatic voltage regulator assembly
 - 9) Power distribution board assembly
 - 10) Radome
 - 11) Standby generator system
 - 12) Air-conditioner
 - 13) Spare parts
 - 14) Test equipment and special tools

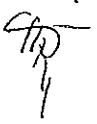
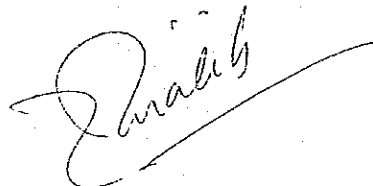
- (2) Necessary building for the meteorological radar system at Islamabad site.

A handwritten signature in black ink, appearing to read 'Zarali', with a long horizontal line extending to the right.A small handwritten mark or signature in the bottom left corner, possibly '410' with a checkmark.

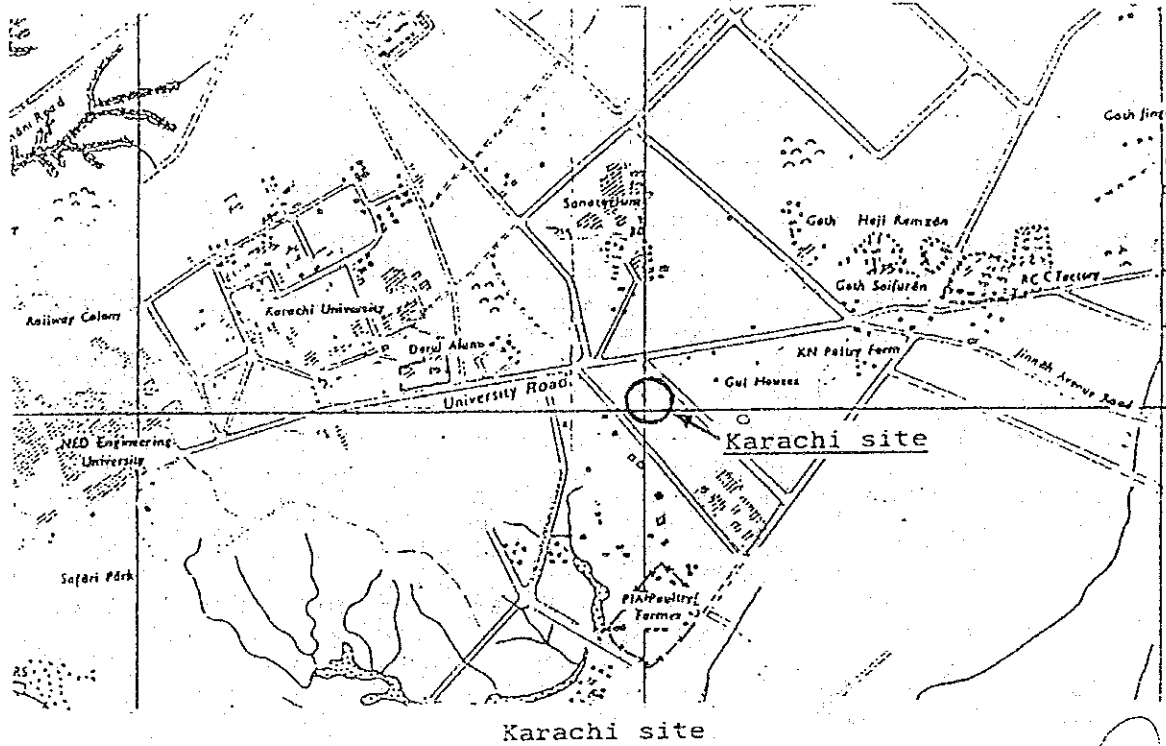
ANNEX III

The necessary measures to be taken by the Government of Pakistan are shown as follows:

- (1) To provide necessary information for detailed design(D/D) of the Project;
- (2) To secure the necessary land for each radar site by the date of "the Exchange of Notes";
- (3) To carry out cleaning and leveling of the sites and to construct access road by the commencement of the construction work;
- (4) To secure the necessary building permit and frequency allocation by the commencement of the construction work;
- (5) To install the power distribution line to each site by the commencement of the construction work;
- (6) To install water supply and telephone trunk line to each site, if necessary, by the commencement of the construction work;
- (7) To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement"; namely, the advising commission of the "Authorization to Pay" and payment commission;
- (8) To bear all the expences, other than those to be borne by the Grant, if necessary;
- (9) To prepare the necessary certificate for tax exemption of the meteorological radar systems and the auxiliary facilities in order to ensure prompt unloading and customs clearance at ports of disembarkation in Pakistan;
- (10) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Pakistan with respect to the supply of the products and services under the verified contracts;
- (11) To establish the organization which will operate and maintain the meteorological radar systems completely from a financial and technical point of view, in time for the completion of the installation.

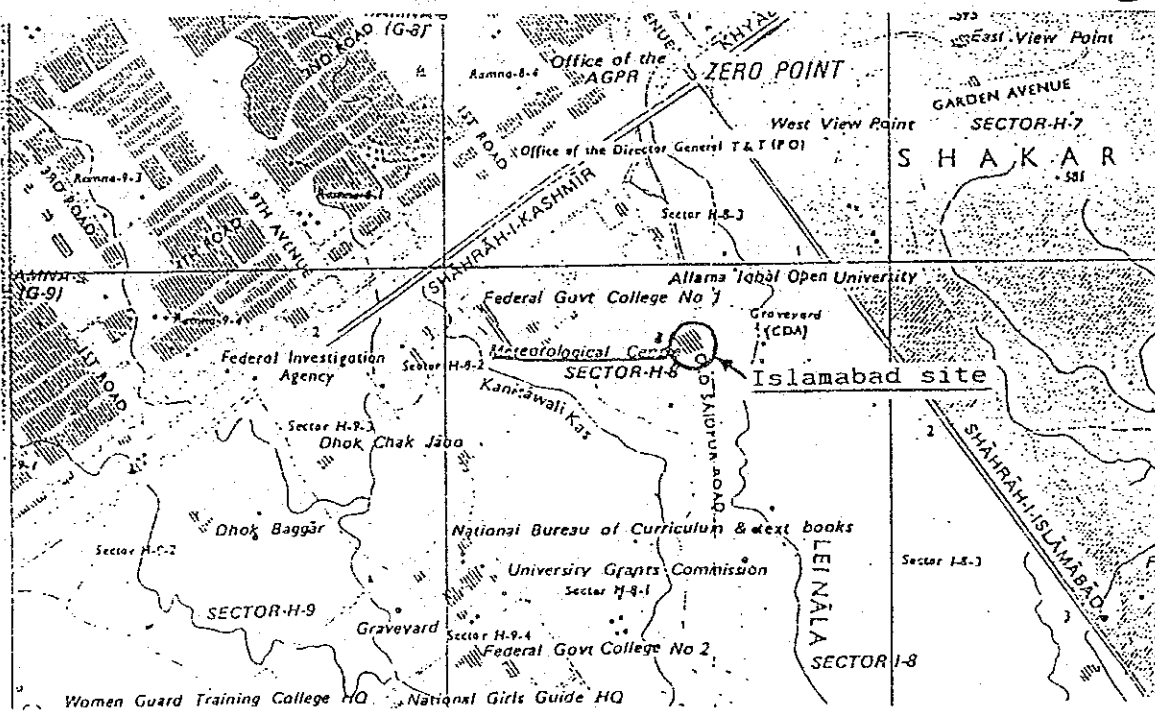


Topographic Maps



Karachi site

Encl 1



Islamabad site

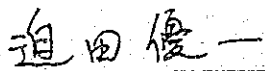
MINUTES OF DISCUSSIONS
ON
THE PROJECT FOR THE ESTABLISHMENT
OF
METEOROLOGICAL RADAR NETWORK
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

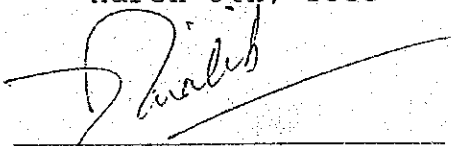
In response to the request of the Government of the Islamic Republic of Pakistan for Grant Aid for the Project for the Establishment of the Meteorological Radar Network in the Islamic Republic of Pakistan (hereinafter referred to as "the Project"), the Government of Japan decided to conduct a basic design study on the Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Pakistan the team headed by Mr. Haruo Suzuki, Dupty Director, Grant Aid Planning and Survey Department, JICA, from October 25th to November 21st, 1988.

As a result of the study, JICA prepared a draft final report and dispatched the team headed by Mr. Yuichi Sakoda, Assistant to Director, Observations Division, Observations Department, Japan Meteorological Agency, to explain and discuss it from March 2nd to March 11th, 1989.

Both parties had a series of discussions on the report and agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined toward the realization of the Project.

March 9th, 1989


Mr. Yuichi Sakoda
Team Leader
Basic Design Study Team
(Draft Final Explanation Team)
Japan International Cooperation
Agency


Mr. F.M.Q. Malik
Director General
Pakistan Meteorological
Department

ATTACHMENT

1. The Pakistan side has agreed in principle to the Basic Design proposed in the Draft Final Report.
2. The Pakistan side has understood Japan's Grant Aid system and confirmed the measures to be taken by the Pakistan side for realization of the Project as shown in the Annex which are manifested in the ANNEX-III of the MINUTES OF DISCUSSIONS on the Project signed on November 3rd, 1988 on condition that the Grant Aid by the Government of Japan is extended to the Project.
3. The Government of Pakistan will assure the necessary budget and personnel for the operation and maintenance of the facilities and equipment provided, on condition that the Grant Aid by the Government of Japan is extended to the Project.
4. The Final Report (10 copies in English) on the Project will be submitted to the Pakistan side by the end of April, 1989.
5. The Team will convey to the Government of Japan the request of the Government of Pakistan for Training in Japan in the field of "Operation and Maintenance of radar system" (2 trainees x 2 months).

① 10

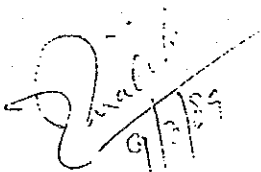
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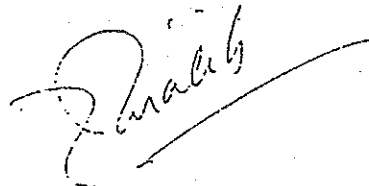
ANNEX III

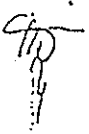
The necessary measures to be taken by the Government of Pakistan are shown as follows:

- (1) To provide necessary information for detailed design(D/D) of the Project;
- (2) To secure the necessary land for each radar site by the date of "the Exchange of Notes";
- (3) To carry out cleaning and leveling of the sites and to construct access road by the commencement of the construction work;
- (4) To secure the necessary building permit and frequency allocation by the commencement of the construction work;
- (5) To install the power distribution line to each site by the commencement of the construction work;
- (6) To install water supply and telephone trunk line to each site, if necessary, by the commencement of the construction work;
- (7) To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement": namely, the advising commission of the "Authorization to Pay" and payment commission;
- (8) To bear all the expences, other than those to be borne by the Grant, if necessary;
- (9) To prepare the necessary certificate for tax exemption of the meteorological radar systems and the auxiliary facilities in order to ensure prompt unloading and customs clearance at ports of disembarkation in Pakistan;
- (10) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Pakistan with respect to the supply of the products and services under the verified contracts;
- (11) To establish the organization which will operate and maintain the meteorological radar systems completely from a financial and technical point of view, in time for the completion of the installation.


9/2/55

(11)





II . Members List of the Basic Design Study Team

(1) Members of the Basic Design Study

Name	Organization	Assignment
Mr. Haruo SUZUKI	Japan International Cooperation Agency (JICA)	Leader Dupty-Director, Grant Aid Planning Department
Mr. Hisao Ohno	Japan Meteorological Agency	Meteorological System External Relation Officer, Planning Division, Administration Department
Mr. Yuichi SAKODA	Japan Meteorological Agency	Meteorological Radar System Assistant to Head, Observations Division, Observations Department
Mr. Katsusuke YAMAGUCHI	Japan Weather Association	Meteorological Observation System
Mr. Takehiro YOSHIDA	Japan Weather Association	Design of Meteorological Radar
Mr. Osami KANDA	Japan Weather Association	Meteorological Data Communication System
Mr. Akio NAITO	Japan Weather Association	Meteorological Data Analysis System
Mr. Akira SHIRAI	Japan Weather Association	Design of Facility

(2) Members for the Discussion of Draft Final Report

Name	Organization	Assignment
Mr. Yuichi SAKODA	Japan Meteorological Agency	Leader Assistant to Head, Observations Division, Observations Department
Mr. Kaku HAMAKAWA	JICA	Project Coordinator Second Basic Study Division, Grant Aid Planning Department
Mr. Katsusuke YAMAGUCHI	Japan Weather Association	Meteorological Observation System
Mr. Takehiro YOSHIDA	Japan Weather Association	Design of Meteorological Radar
Mr. Akira SHIRAI	Japan Weather Association	Design of facility

III . Survey Itinerary

(1) Basic Design Study

Day	Date	Itinerary	Place of Study	Contents of the Study
1st day	1988 25 OCT (Tue)	Lv. Tokyo(TG-641) via Bangkok Ar. Karachi(TG-507)		
2nd	26 OCT (Wed)	Lv. Karachi(PK-308) Av. Islamabad	Islamabad	Courtesy call on Embassy of Japan
3rd	27 OCT (Thu)		ditto	Courtesy call on JICA Office, Aviation Division, PHD and NAMC. Confirmation the survey schedule.
4th	28 OCT (Fri)	Lv. Islamabad(PK-301) Av. Karachi		
5th	29 OCT (Sat)		Karachi	Explanation of Inception Report in PHD H/Q. Site survey at Karachi.
6th	30 OCT (Sun)		ditto	Meeting with PHD. Visit Karachi Aeronautical Metrological Observatory and Control Tower of Karachi International Airport
7th	31 OCT (Mon)	Lv. Karachi(PK-302) Av. Lahore	Lahore	Visit Lahore Met. Office and Flood Forecasting and Warning Centre.
8th	1 NOV (Tue)	Visit Multan	Multan	Meeting with Multan PHD. Visit Test Farm.
9th	2 NOV (Wed)	Lv. Lahore(PK-382) Av. Islamabad	Sialkot Lahore	Inspection of Sialkot Weather Radar. Meeting with Lahore PHD.
10th	3 NOV (Thu)		Islamabad	Discussion about the draft of Minutes with PHD. Signing and exchange the Minutes at PHD.
11th	4 NOV (Fri)		ditto	
12th	5 NOV (Sat)		ditto	Discussion with Aviation Division Rearrange the survey schedule in JICA Office

Day	Date	Itinerary	Place of Study	Contents of the Study
13th	6 NOV (Sun)	Lv. Islamabad via Bangkok Av. Tokyo (Messers. Suzuki & Sakoda)	Islamabad	Inspection of another proposed site for Radar (Messrs. Yamaguchi, Kanda, Yos Yoshida, Naito & Shirai).
14th	7 NOV (Mon)	Lv. Islamabad Av. Lahore (by car)	Islamabad Lahore	Visit CDA to collect the relevant document (Messrs. Yamaguchi, Kanda & Shirai). Visit Flood Forecasting and Warning Centre (Messrs. Naito & Yoshida).
15th day	8 NOV (Tue)	Visit Sargodha	Islamabad Sargodha	Discussion with PMD. Visit UNDP. Estimation about construction cost with Pakistan contractor. Inspection of Sargodha Radar Site. Discussion with Lahore PMD.
16th	9 NOV (Wed)	Lv. Lahore Lv. Islamabad Av. Karachi Av. Karachi (PK-313) (PK-305)	Islamabad	Inspection of the top of Margara Hill.
17th	10 NOV (Thu)		Karachi	Discussion with PMD.
18th	11 NOV (Fri)		ditto	Inspection of proposed Site for new Karachi Radar.
19th	12 NOV (Sat)		ditto	Discussion with PMD and collection of the relevant document.
20th	13 NOV (Sun)		ditto	ditto
21st	14 NOV (Mon)		ditto	ditto Visit Karachi Port.
22nd	15 NOV (Tue)	Lv. Karachi (PK-308) Av. Islamabad	ditto	Approval and signing of summary of discussion.
23rd	16 NOV (Wed)		Islamabad	Inspection of the proposed Radar Sites including the top of Margara Hill.
24th	17 NOV (Thu)	Visit Peshawar (by car)	Peshawar	Inspection of Cherat Radar Site. Visit Peshawar Airport.
25th	18 NOV (Fri)		Islamabad	
26th day	19 NOV (Sat)		ditto	Re-inspection of the proposed Radar Sites.
27th	20 NOV (Sun)	Lv. Islamabad (PK-309) Av. Karachi	Islamabad	Report the survey result to Embassy of Japan and JICA Office.
28th	21 NOV (Mon)	Lv. Karachi (TG-508) via Bangkok Av. Tokyo (TG-604)		(Messrs. Yamaguchi, Kanda, Yoshida, Naito & Shirai)

(2) Discussion of Draft Final Report

Day	Date	Itinerary	Place	Contents of the Study
1st day	1989 2 MAR (Thr)	Lv. Tokyo(TG-641) via Bangkok Ar. Karachi(TG-507)		(Messrs. Yamaguchi, Yoshida&Shirai)
2nd	3 MAR (Fri)		Karachi	Meeting with PHD.
3rd	4 MAR (Sat)		ditto	Explanation of Draft Final Report to PHD.
4th	5 MAR (Sun)	Lv. Tokyo(TG-641) via Bangkok Ar. Karachi(TG-507)	ditto	(Messrs. Sakoda & Hamakawa) Explanation and approval of Draft Final Report to PHD.
5th	6 MAR (Mon)	Lv. Karachi(PK-300) Av. Islamabad	Islamabad	Courtesy call on JICA Office. Arrangement of schedule.
6th	7 MAR (Tue)		ditto	Courtesy call on Aviation Bureau, EAD and PHD. Explanation and approval of Draft Final Report to PHD.
7th	8 MAR (Wed)	Lv. Islamabad Av. Karachi(PK-301)	Karachi	Discussion about Minites with PHD. Survey about the cost of materials for radar installation and tower construction
8th	9 MAR (Thr)		ditto	Approval and signing of Minites. Survey about the cost of materials for radar installation and tower construction
9th	10 MAR (Fri)	Lv. Karachi(PK-308) Av. Islamabad	ditto	Survey about the cost of materials for radar installation and tower construction
10th	11 MAR (Sat)		Islamabad	Report the discussion about the Draft Final Report to JICA Office.
11th	12 MAR (Sun)	Lv. Islamabad via Beijin Av. Tokyo(PK-752)		(Messrs. Sakoda, Hamakawa, Yamaguchi, Yoshida & Shirai)

IV. Name of Discussants

Name	Designation
(Aviation Division, Rawalpindi)	
Mr. Muhammad Rashid	:Joint Secretary, Aviation Division
Col. Abbas Ali Khan	:Deputy Secretary, Aviation Division
Mr. Muhammad Saleem Baig	:Section Officer
Mr. Hayat Shah Zafar	:Officer in charge M.R.I.O. :Survey of Pakistan
(Pakistan Meteorological Department: PMD)	
* Karachi	
Mr. F. M. Q. Malik	:Director-General
Mr. Ghulam Farid	:Director(Maintenance)
Mr. Zeya	:Director(Forecast and Climate)
Mr. Khan Ahmad Yar Khan	:Director(Climat. Data-Processing Center)
Mr. Muhammad Sajjad Hussain	:Sr. Electronic Engineer (NMCC)
Mr. Mehboob E. Ansari	:Electronic Engineer (Maintenance)
Mr. Muhammad Ayub	:Assistant Meteorologist(Planning)
Mr. H. Rafiq	:Dy. Director(Workshop)
Mr. Muhammad Ibrahim Siddiqui	:Electronic Assistant
Mr. Sajid Rashid Khan	:Meteorological Assistant
Mr. Muhammad Muslehuddin	:Meteorologist (Karachi Airport)
Mr. Shakeel Ahmad Khan	:Officer (Weather Surveillance Radar)
* Islamabad	
Mr. Chaudhry Qamar-uz-Zaman	:Director(National Agro-Met. Center: NAMC)
Mr. Sarfraz Mahmood	:Dy. Director(NAMC)
Mr. Anjum Bari	:Meteorologist
Mr. Ghulam Rasool	:Meteorologist
Mr. Fereidoon Hashemi	:WHO, Sr. Expert in Agrometeorology

* Lahore

Mr. Abdul Majid : Director
(Flood Forecasting and Warning Center: FFWC)
Mr. Abdul Latif Khan : Director (Regional Met. Center)
Mr. Zia-ud-Din : Sr. Meteorologist (FFWC)
Mr. Muhammad Munir Sheikh : Sr. Meteorologist (FFWC)
Mr. Abdul Razzaque : Assistant Electronic Engineer (FFWC)
Mr. S. A. Rizvi : Assistant Meteorologist (FFWC)
Mr. Ajmal Khan : Draftman (FFWC)

* Multan

Mr. Ghulam Sawar Khan : Meteorologist
Mr. Bashir Ahmad : Assistant Meteorologist
Mr. M. Khalil Ahmad : Assistant Meteorologist

* Sialkot

Mr. Matlub Hussain Shah : Assistant Electronic Engineer
Mr. Abdul Mannan Qureshi : Assistant Electronic Engineer

* Sargodha

Mr. M. Qaisar Hayat Khan : Electronic Engineer (RMC, Lahore)
Mr. Muhammad Yusof : Assistant Electronic Engineer
Mr. Muhammad Younus Malik : Assistant Electronic Engineer

(Pakistan Public Works Department: PPWD)

* Karachi

Mr. Zafeer-Ul-Haque : Superintending Engineer
Mr. Nazir Ahmed Memon : Senior Engineer
Mr. Anwar Ali Baloch : Executive Engineer (Civil)
Mr. Ghulam Murtaza Choudhry : Assistant Engineer (Civil)
Mr. A. S. Siddiqui : Assistant Engineer (Civil)

* Islamabad

Mr. S. A. Qureshi : Deputy Director General
Mr. Shafaat Ali Malik : Senior Architect

Mr. Doest Ali :Architect
Mr. Aurang Zab :Exective Enginneer (Structure)

* Lahore

Mr. Muhammad Munnawar :Exective Engineer
Mr. B. A. Alvi :Exective Engineer
Mr. Muhammad Hanif :Sub-Engineer

(Capital Development Authority, Islamabad)

Mr. Raja Iqbal Shahin :Public Relation Officer
Mr. Abdul Wahid Shahid :Director (Programming, Evaluation and Costing)
Mr. Ghulam Haider Choudhry :Director (Central Engineering Laboratory)
Mr. M. K. Pasha :Director (Urban Planning)
Mr. Raja Khalid Mumtaz :Deputy Director (Architecture)
Mr. Abdul Jabbar Millano :Deputy Director (Development and Building Control)
Mr. Saeedulla K. Bangash :Deputy Director (Structure)
Mr. Tayab Ali Shaikh :Deputy Director General (Works)
Mr. Muhammad Iqbal :Deputy Director (Urban Planning)

(Karachi Development Authority:KDA)

Mr. Ahmed Hussain :Controller of Buildings, Karachi Building Authority
Mr. Khalid M. Siddiqui :Deputy Controller of Buildinga (Structure),

Karachi Building Authority

(National Insurance Corporation:NIC)

Mr. A. Sattar Khan :Manager (Administration)
Mr. Anwaer Sikander Khan :Deputy Manager

(Other Governmental Authorities)

* Karachi

Mr. Razi Ahmed Siddiqui :Deputy-Director (Planning),
Geological Survey of Pakistan

* Islamabad

Mr. Shaheen Babur :Statistical Officer, Federal Bureau of Statistics,
Ministry of Finance

* Japanese person concerned

Mr. Shunji KOBAYASHI :Ambassador of Extraordinary
and Plenipotentiary of Embassy of Japan

Mr. Jiroh KOBAYASHI :Ministry of Embassy of Japan

Mr. Ryousuke HARAGUCHI :First Secretary of Embassy of Japan

Mr. Kazuo TANIGAWA :The Representative of JICA Office in Pakistan

Mr. Shouji NISHIKAWA :Deputy-Representative of JICA Office in Pakistan

Mr. Masato TOGAWA :Deputy-Representative of JICA Office in Pakistan

JICA