No.

JPAN INTERNATIONAL COOPERATION AGENCY(JICA)
EARTHQUAKE RECONSTRUCTION AND REHABILITATION AUTHORITY (ERRA)

THE URGENT DEVELOPMENT STUDY ON REHABILITATION AND RECONSTRUCTION IN MUZAFFARABAD CITY IN THE ISLAMIC REPUBLIC OF PAKISTAN

FINALREPORT II
Urgent Rehabilitation Projects

May 2007

PACET Corp.
NIPPON KOEI CO.,LTD.

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Report Organization

This report consists of the following volumes:

Final Report I

Volume 1	**:**	**Summary**
Volume 2	**:**	**Main Report**
Volume 3	**:**	**Sector Report**

Final Report II

Urgent Rehabilitation Projects

In Final Report I, **volume 1 Summary** contains the outline of the results of the study. **Volume 2 Main Report** contains the Master Plan for rehabilitation and reconstruction in Muzaffarabad city, Pakistan. **Volume 3 Sector Report** contains the details of existing conditions, issues to overcome, and proposals for future reconstruction by sector.

Final Report II deals with the results and outcomes on **the Urgent Rehabilitation Projects** which were prioritized and implemented in parallel with master plan formulation work under the supervision of JICA Study Team.

The exchange rate applied in the Study is:

(Pakistan Rupee)		(Japanese Yen)
Rs.1	=	¥1.91

(Pakistan Rupee)		(US Dollar)
Rs.60.30	=	US$ 1

PREFACE

In response to the request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct the Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City in the Islamic Republic of Pakistan and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched the Study Team headed by Mr. Ichiro Kobayashi of Pacet, consisted of Pacet and Nippon Koei, to the Islamic Republic of Pakistan from February 2006 to April 2007. JICA set up an Advisory Committee chaired by Prof.. Kazuo Konagai from the University of Tokyo, which examined the study from the specialist and technical points of view.

The Study Team held discussions with the officials concerned of the Government of the Islamic Republic of Pakistan and conducted the Study in collaboration with the Pakistani counterparts. Upon the last return to Japan, the Study Team finalized the study results for delivery of this Final Report II.

I hope that this report will contribute to rehabilitation and reconstruction of Muzaffarabad city and to the enhancement of friendly relationship between the two countries.

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

May 2007

Kazuhisa Matsuoka
Vice President
Japan International Cooperation Agency

Mr. Kazuhisa Matsuoka
Vice President
Japan International Cooperation Agency
Tokyo, Japan

May 2007

Letter of Transmittal

Dear Mr. Kazuhisa Matsuoka,

We are pleased to formally submit herewith the Final Report II entitled "The Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City in the Islamic Republic of Pakistan".

This report compiles the results of the study, which was undertaken in the Islamic Republic of Pakistan from February 2006 to April 2006 by the Study Team organized jointly by Pacet and Nippon Koei under the contract with the JICA

The Final Report II is composed of the Main Report for Urgent Rehabilitation Projects. The Main Report includes the results of the urgent rehabilitation projects, which are carried out by this Study. It is truly hoped that the outcomes of the Final Report II will contribute to enhance rehabilitation and reconstruction of Muzaffarabad City and victims of earthquake will back to normal life soon.

Finally, we would like to express our sincere gratitude and appreciation to all the officials of your agency, the JICA advisory Committee, the Embassy of Japan in the Islamic Republic of Pakistan, and Ministry of Foreign Affairs. We also would like to send our great appreciation to all those who have extended their kind assistance and cooperation to the Study Team, in particular, relevant officials of Earthquake Reconstruction and Rehabilitation Agency (ERRA) and Azad Jammu Kashmir (AJK) Government.

Very truly yours,

Ichiro Kobayashi
Team Leader, JICA Study Team
The Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City in the Islamic Republic of Pakistan

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LIST OF ABBREVIATIONS

Abbreviation	Name
AASHTO	American Association of State Highway and Transportation Office
ACI	American Concrete Institute
AJK	Azad Jammu and Kashmir
CBO	Community Based Organization
CSO	Civil Society Organizations
DBNH	Design of Bridges on National Highways
DCRD	Directorate of Curriculum & Research Development
DEE	Directorate of Education Extension
DMS	Disaster Management System
ERRA	Earthquake Reconstruction and Rehabilitation Authority
F/R	Final Report
GIS	Geographic Information System
GOAJK	Government of Azad Jammu and Kashmir
GOJ	Government of Japan
GOP	Government of Pakistan
GSP	Geological Survey of Pakistan
HFT	Himalayan Frontal Thrust
IC/R	Inception Report
IOM	International Organization for Migration
IT/R	Interim Report
JICA	Japan International Cooperation Agency
LCB	Local Competitive Bidding
LOC	Line of Control
MBT	Main Boundary Thrust
MCM	Municipal Corporation Muzaffarabad
MCT	Main Central Thrust
MDA	Muzaffarabad Development Authority
NHA	National Highway Authority
NRC	National Review Committee
NWFP	North West Frontier Province
NGO	Non Governmental Organizations
NESPAK	National Engineering Service Pakistan
PCPHB	Pakistan Code of Practice for Highway Bridges
PCU	Passenger Car Unit
PCF	Pond Cubic Feet
PR/R	Progress Report

Abbreviation	Name
PSI	Pond Squire Inch
PTC	Primary Teaching Certificate
SERRA	State Earthquake Reconstruction and Rehabilitation Agency
SFPR	Standard for Roads in Pakistan
SBS	Standardization of Bridge Superstructures
T.T.	Teacher's Training
ToT	Training of Trainers
USGS	US Geological Survey
UBC	Uniform Building Code
WTP	Water Treatment Plant
WES	Warning and Evacuation System

The Urgent Development Study on
Rehabilitation and Reconstruction in Muzaffarabad City in
the Islamic Republic of Pakistan

Urgent Rehabilitation Projects

EXECUTIVE SUMMARY

1. GENERAL

1.1. Background of the Study

Earthquake and Damages

An earthquake measuring 7.6 on the Richter scale occurred at 8:50 a.m. October 8, 2005 (Pakistani Standard Time). The seismic center was reported at 90 km north-northeast from Islamabad, at 34.493 degrees north latitude, and 73.629 degrees east longitude. The epicenter was 26 km below ground level. Muzaffarabad city, the capital of AJK, is located close to the epicenter of the earthquake. Government buildings in the area were heavily damaged mainly in the northern part of the city. Moreover, the road network was cut due to landslides caused by the earthquake, and this worsened earthquake damages.

Background of Urgent Rehabilitation Projects

Since the northern part of Muzaffarabad city is located close to the epicenter and dislocation, many buildings and structures were heavily damaged. Many government buildings have been damaged as well. The government, therefore; has not been functioning well since the event and this has caused difficulties in formulating rehabilitation and reconstruction plans.

Furthermore, taking into consideration the present situation of the affected people and their hopes toward immediate reconstruction, it is needed to formulate a rehabilitation and reconstruction master plan in a short period. It is also urged to implement some immediate rehabilitation projects, which are a matter of urgent need.

1.2. Objective of the Study

The Study aims at achieving the following two objectives:

1) Formulation of Rehabilitation and Reconstruction Master Plan (Target year: 2016)
2) Implementation of Pilot Rehabilitation Project, if necessary

1.3. Study Area

The Study area is Muzaffarabad city, covering 17 sq.km, and its surrounding areas.

1.4. Counterpart Agency

The Counterpart agency for the Study is Earthquake Reconstruction and Rehabilitation Authority (ERRA). Pakistani and Japanese sides have agreed to set up the Steering

Committee under the initiative of ERRA for effective study implementation. Reports that include progress of the study will be presented and discussed at Steering Committee meetings at each stage of the Study.

1.5. Urgent Rehabilitation Project

JICA Study Team conducted five "Urgent Rehabilitation Projects" simultaneously with formulation of Master Plan.

i) Community Empowerment Project on Debris Removal

ii) Landslide measuring Device Installation and Disaster Education Activities Project

iii) School Rehabilitation Project

iv) Promotion of Disaster Management Education Project

v) West Bank Bypass Construction Study Project

2. COMMUNITY EMPOWERMENT PROJECT ON DEBRIS REMOVAL

2.1. Background

One of the important principles of reconstruction procedure is to rely on self-help approaches that use affected individuals as main actors. Yet often, there are many problems and constraints that can not be dealt with by such individuals, and thus, mutual-help among members at the neighborhood level becomes important.

Communities are responsible for the activities that are planned in their neighborhoods. The Study Team carried out a debris removal pilot project, and that was quite successful and one good example of community activity.

2.2. Project Implementation

The JICA study team conducted a social experimental survey, to identify the needs of affected communities. It was resulted that the highest prioritized needs of both male and female are debris removal and reconstruction of houses.

Ward #13 was selected as a target area for the project. The reasons for the selection were:

– Ward #13 was one of the most serious damaged areas, and a lot of debris was still on the streets, and;

– CBO has already organized and the members were active in the relief activities after the earthquake.

Main activities carried out by the CBO with the assistance of JICA Study team were summarized as followings.

■ To Mobilize the Community

- To establish the CBO.
- Open a combine Bank account of the CBO
- To identify the temporary debris removal sites.
- To conduct the market survey for the purchase of tools and equipments and arrange manpower.
- To prepare the cost estimate for the debris removal work.
- To prepare a implementation Plan for the debris removal work
- Implementation of debris removal work.
- Supervision of debris removal work.

2.3. Results of the Project

The debris on the two main streets has been removed with amount of approximately 2,100 cubic meter. The CBO collected the debris and brought them into temporal debris keeping sites in the ward.

2.4. Conclusion

Debris removal from their neighborhoods is the first step for long-term reconstruction; this activity also needs to have community participation. By having residents participate this activity, the bonds of community as well as motivation in rehabilitating their places by their own efforts will increase.

3. LANDSLIDE PILOT PROJECT FOR MUZAFFARABAD CITY

3.1. Background

The October 8, 2005 earthquake (M-7.6) in Pakistan has triggered numerous landslides in the city and its surroundings. JICA Study Team investigated 40 km2 in and around Muzaffarabad and identified 70 landslide areas. 18 areas were identified as high risk landslide areas, where it will affect human activities or cause a great damage to lives and properties. These landslides, which mostly became active after the earthquake, have posed considerable hazards to local populations. Especially in rainy season, these landslides and associated debris flows have great potential hazards to people and property, because most of local people in the earthquake-affected areas have lived in landslide areas or their impact areas.

The purpose of this Landslide Pilot Project is to establish a timely warning and speedy evacuation system to reduce the risk of death, injury, property loss and damage.

3.2. Development of Warning and Evacuation System

To carry out timely warning and speedy evacuation, a Disaster Management Section (DMS) has been set up in the Municipal Corporation Muzaffarabad (MCM). The DMS shall be

responsible fully for the operation of the warning and evacuation system. A Warning and Evacuation System (WES) has been developed in close consultation with MCM. The warning system of landslide movements in this pilot project is made up of two extensometers for detection of landslides, and two rain gauges.

In the target area, information regarding standard values was not available; some standard values that were used in Japan are revised and selected conservatively as tentative standard values for the target area, as shown in Table 1, together with monitoring method and frequency. These standard values should be improved as rainfall and displacement information is collected from the installed equipment.

Table 1 Tentative Standard Values

Warning Level	Standard Values	Monitoring Method	Monitoring Frequency
Normal	Rainfall: below 10 mm/h Extensometer: below 1 mm/h	Regular, 9:00 a.m. to 16:00 p.m.	Once a week
Attention	Rainfall: 10～20 mm/h Extensometer: 1～2 mm/h	Regular, 9:00 a.m. to 16:00 p.m.	Once every three days
Warning	Rainfall: 20～30 mm/h accumulative: above 80 mm Extensometer: 2～4 mm/h	Strengthening monitoring	24 hours
Evacuation	Rainfall: above 30 mm/h accumulative: above 120 mm Extensometer: above 4 mm/h	Evacuation	

Source: JICA Study Team

3.3. Mobilizing Local Communities

Much emphasis was given to social mobilization and community participation to effectively reduce landslide risks for the communities living in the path of a potential disaster.

To fully understand the landslides, communities need to understand risks and overcome fear to make them more resistant to the damaging effects of natural hazards The Project encourages people to take action before a disaster occurs through initiatives for evacuation and moving to safer places.

3.4. Recommendations

1) Sustainable operation of early warning and evacuation system

The early warning and evacuation system was established and landslide-measuring devices were installed in Muzaffarabad. Sustainable operation of early warning and evacuation system is necessary to reduce landslide risks.

2) Development of Early warning and evacuation system to other natural disaster-prone area

Many earthquake affected areas are also located in mountainous area and have been suffering natural disasters such as landslides and debris flow. Experience of the pilot project can contribute to the risk reduction of natural disaster in these disaster-prone areas.

3) Structural Countermeasures against natural disaster

Pilot project focuses on soft components such as disaster education and evacuation drills. JICA Study Team recommends that it be essential for Muzaffarabad and adjacent areas to implement hard components such as construction of check dam.

4. SCHOOL REHABILITATION PROJECT

4.1. Background

JICA decided to construct a government high school as a pilot project for the rehabilitation and reconstruction in Muzaffarabad. Since poor seismic resistance capacity of school buildings collapsed by the earthquake, more than 17,000 students died. Construction of school building is important for a step for rehabilitation and reconstruction. Together with construction of school, the disaster management education project also carried out by the study team.

4.2. Selection of Project

The project is the first permanent building construction in Muzaffarabad and model school for earthquake resistant structural. In order to select target school, Japanese side received request from Pakistani side and Japanese side considered land owner, size of school, easiness of construction, budget, location etc. for final selection.

4.3. Outline of Project

Structure design of the building follows the standard and even considers the Japanese practice: Draft of [Revision / Update of Building Code of Pakistan, Stage-II, Recommendations for Detailed Seismic Design Parameters and Criteria for Seismic Resistant Design of Buildings in Pakistan, June 2006] issued by NESPAK under the Ministry of Housing and Works.

- Base Share Coefficient V/W is 0.168 based on “1997 Uniform Building Code”
- Frame analysis with linear force-deformation relation is applied.
- Safety of member’s section is confirmed by ultimate strength design method

4.4. Architectural Design

Architectural design of the school is shown as following table.

Table 2 Summary of Design

Site Area	1,293.33 sqm. (14,058 sqf.)
Number of Classrooms to be Constructed	10 classrooms (same as before earthquake) Size of classroom 7,300 x 5,500 m (24 x 18 ft)
Number of Laboratories to be Constructed	3 rooms (Computer lab. Science lab. & Library)
Total Floor Area	783.69 sqm. (8,518 sqf.)
School Grade	Grades 1 to 10 - Primary school: Grades 1 to 5 - Junior high school: Grades 6 to 8 - High school: Grades 9 to 10

Source: JICA Study Team

4.5. Contract Arrangement

JICA Pakistan Office and Zoom Engineer, the contractor, was signed the agreement of the school construction in September 2006. JICA Study Team supervised the construction of school on behalf of JICA Pakistan Office.

4.6. Construction of School

JICA Study Team was in charge of construction supervision which are comprised of management schedule, quality control, cost control and safety control.

4.7. Operation and Maintenance

A well-maintained school environment does not only enhance learning and gives prestige to the school but also helps the government to save on costly repairs, restoration or rehabilitation of school facilities. School maintenance, therefore, being a major management function, must be given serious attention by school officials. The up-keeping of school facilities, including school site and buildings, furniture, and other equipment/tools/materials is necessary for effective learning

4.8. Impact of Pilot Project

Since the pilot project is a first permanent building in Muzaffarabad, it enhances earthquake resistant design manual preparation, construction permit issue process and construction related administration. In order to construct a seismic resistance building, Japanese construction engineer instructed construction method at site during construction and transferred the construction techniques. Since Japanese engineer instructed construction period management, the construction was finished on time. Through those activities, it is possible to transfer technology in terms of seismic resistance design, construction permit process, building construction technology and other construction related technology to the Pakistani side.

5. DISASTER MANAGEMENT EDUCATION

5.1. Background

The construction of disaster management model school in Muzaffarabad, Sathi Bagh government girls high school project has some characteristics in terms of disaster management, the structure design is seismic resistant design and the school has playground for evacuation and water reservoir for emergency case. Hence it is very significant for the school to comprise soft component as well as physical function in terms of disaster preparedness.

Disaster Management Education was never taught in schools in Pakistan, thus teachers and students did not know how to protect them by themselves. Taking this lesson into consideration, the proposed project will cover the following activities:

- Development of student material on Disaster Management Education
- Development of teaching aids on Disaster Management Education
- Conducting teacher training on Disaster Management Education
- Organizing system in the school for Emergency

Implementing the drills for evacuation involving community in the school area.

5.2. Implementation of the Project

(1) Formulation of Text Book

New materials comprise the following contents and the revision committee reached a consensus on them.

- Precious life
- Will to live
- Mutual help
- Mechanism of Earthquake
- Scales of Earthquakes (Only for Upper Primary)
- Types of landslides
- Signs of hazards (landslides)
- Other natural disasters
- Survival Techniques and Preparedness

According to these amendments, texts and pictures were also reviewed drastically and it took more than one month to complete all the changes. Revised materials have been printed out and were prepared for their approval.

During the presentation, JICA Study Team explained that the team was developing an animated story on survival techniques, which would be used in the teacher training and in the school for children. The committee deeply understood the effectiveness of such audio-visual teaching aids and encouraged JICA Study Team to precede the work.

After the approval of the materials in the steering committee, JICA Study Team organized two types of training on Disaster Management Education, one for Training of Trainers (so-called ToT) for five days from January 8th to 12th 2007 and another for Teacher's Training (so-called T.T.) for five days from January 22nd to 26th 2007. Teacher's Guide and Animated story are developed for the both training. Details of the trainings are discussed in this report later.

(2) Teacher's Guide

JICA Study Team has developed the textbooks, "Natural Disaster and Survival Techniques", specially prepared for Primary Students in the Earthquake affected areas. In terms of their developing stages, textbooks comprise two types, one targeting Class from 1 to 3; another is for Class 4 and 5. Along with the textbooks, students should be taught the topics on Disaster Management Education in the effective manner with the help of teacher's guidance. Therefore it is highly recommended for teachers to attend the proper training before imparting the important information to their students.

Teacher's guide was designed for every teacher who would like to hold a well-organized class on Disaster Management Education by using the textbook. It helps even those who have not taken a proper training, to understand how to utilize the textbook effectively in their classes.

(3) Training

JICA Study Team conducted two types of training, one for Training of Trainers (so-called ToT) and another for Teacher's Training (so-called T.T.) in January in collaboration with Department of Education AJK in Muzaffarabad. Training of Trainers was designed based on strategy for the trainings of "The project for promotion of Disaster Management Education in Muzaffarabad City", one of urgent rehabilitation projects of "The Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City in the Islamic Republic of Pakistan". The aim of the training was basically to prepare master trainers in order to fulfill our objectives, which are to strengthen teachers' and students' abilities to manage natural

disaster including earthquakes in Muzaffarabad City and to promote Disaster Management Education through responsible agency, Department of Education, AJK. Hence, it was deliberately considered that involvement of governmental agency would play a vital role for making a ripple effect on promotion of Disaster Management Education in AJK as well as in the city.

The aims of Teacher's Training are already mentioned in this report before. Since JICA Study Team constructs the model school for disaster management as one of the pilot projects, it is very significant for the school to comprise soft component as well as physical function in terms of disaster preparedness. The school can contribute to the prevalence of Disaster Management Education, to disseminate its information and practice, which will be accessible to everyone. These ideas are implicated with our basic concept, which is that students are the main targets for this whole project, expecting to be transferred what they gain to their families and neighbors.

5.3. Recommendations

In principle, the continuation of the disaster management education is highly essential. Through the continuation, it is required to revise the textbooks and the teacher's guide following the teacher's training based on the feedbacks and lessons learnt. Furthermore, it is desirable to expand the disaster management education not only in Muzaffarabad but also the whole AJK and even for the whole Pakistan. In order to achieve this future vision, it is necessary that the disaster management education should be incorporated in the Federal curriculum.

6. PRELIMINARY DESIGN FOR WEST BANK-BYPASS PROJECT

The project intends to decrease traffic congestion in Muzaffarabad city and to enhance rehabilitation activity. Moreover, the villages located in the northern part of the city will enhance rehabilitation and development. The project will be a symbol for rehabilitation of the Muzaffarabad city. For these reasons, in the rehabilitation and reconstruction master plan, the high priority was given to the west bank-bypass project that aimed to reinforce the new trunk route in the west of the Neelum river. The study team carried out the preliminary design for the new bypass road that will consist of a 5.7 km long road including a new bridge.

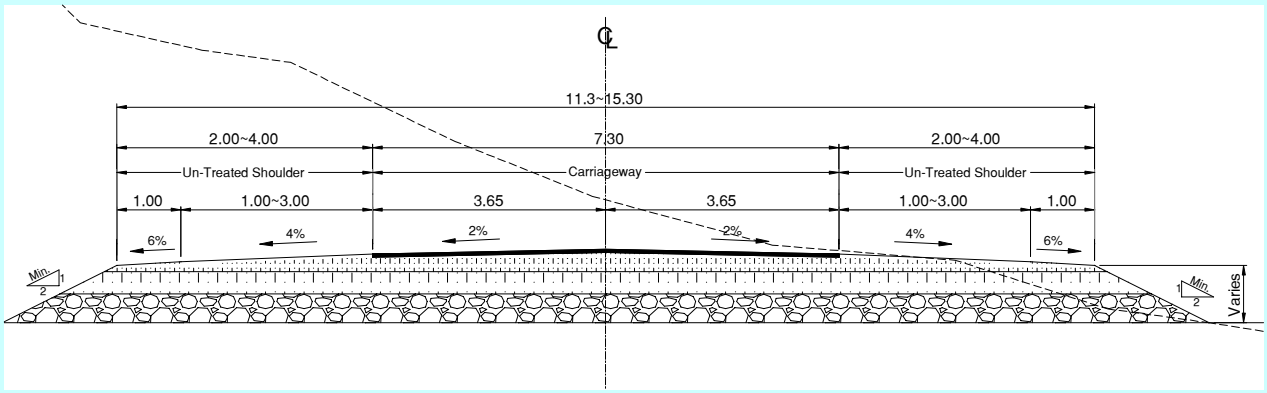
6.1. Road Alignment Study

Major geometric design criteria for the bypass road was formulated as listed in the table below on the basis of NHA, AASHTO, and NWFP standards.

Table 3 Applicable Geometric Design Criteria

Classification	Applied Criteria or Value
Road Classification	Primary in provincial roads
Design Speed	50 km/h
No's of traffic lane	2
Lane width	3.65 m
Shoulder width	1.00 m (Min.)
Min. Radius (horizontal alignment)	75 m
Max. Super elevation (horizontal alignment)	10 %
Max. Grade /1 (vertical alignment)	14 %
Stopping Sight Distance (crest curve)	65 m
Passing Sight Distance (crest curve)	345 m
Stopping Sight Distance (sag curve)	65 m

Notes: /1 means 8 % applied as per site conditions.

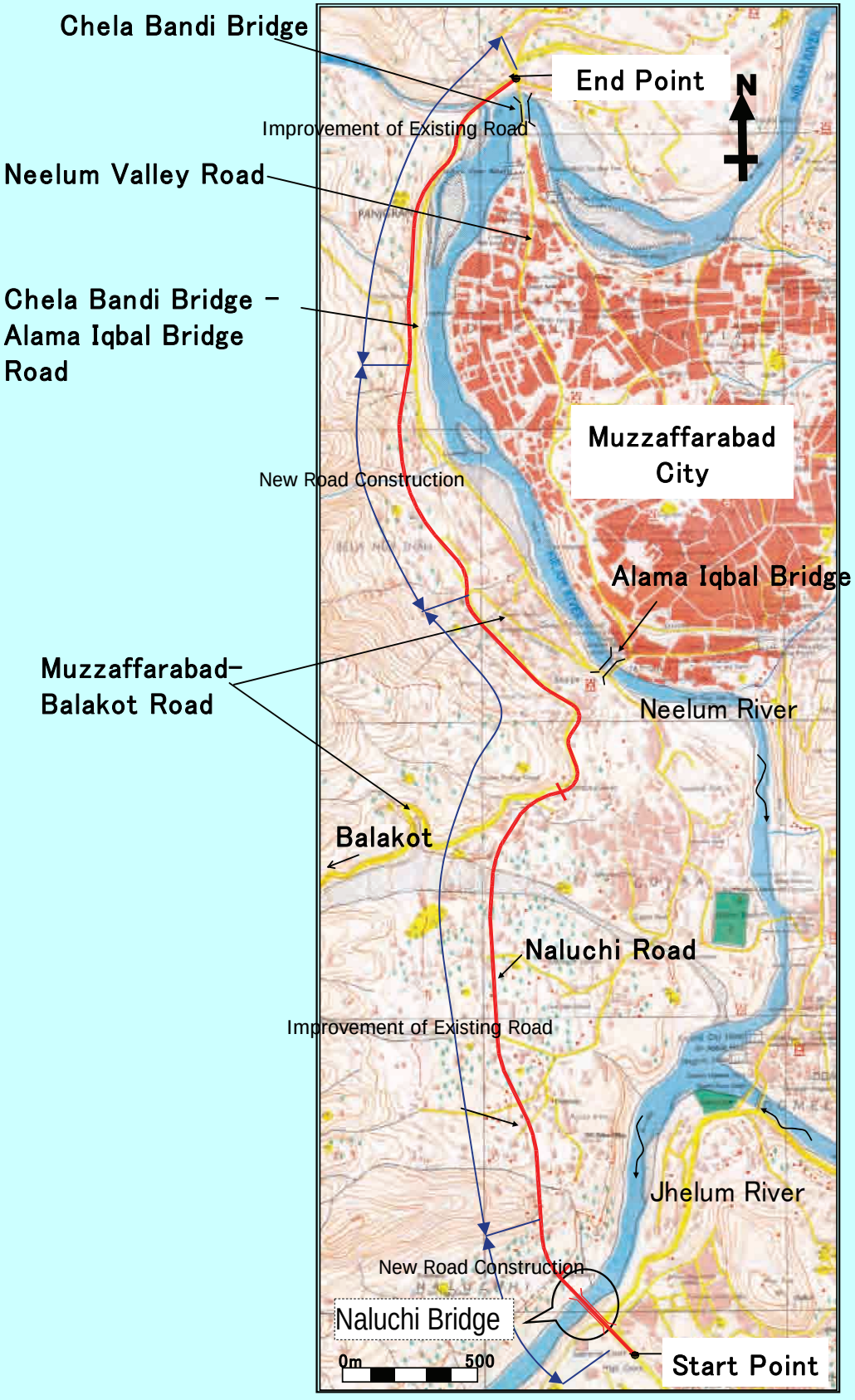


Source: JICA Study Team

Figure 1 Typical Cross Section

Considering possible alternative routes, the bypass road is broadly subdivided into three sections; section 1 from Naluchi Bridge to junction of the bypass road and Naluchi road, section 2 from junction of the bypass road and Naluchi road, to junction of Naluchi road and Chela Bandi Bridge-Alama Iqbal Bridge road, and section 3 from junction of Naluchi road and Chela Bandi Bridge-Alama Iqbal Bridge road to junction at west bank side of Chele Bandi Bridge along Neelum Valley Road.

Based examination of various control points such as pylons, schools, hospitals, graveyards and permanent buildings, the most appropriate route was selected as depicted below.



Source: JICA Study Team

Figure 2 Selected Route for Bypass Road

6.2. Alternative Study of Naluchi Bridge

Alternative Routes of Jhelum River Crossing

The alternative routes of Jhelum river crossing site of West Bank Bypass were formulated so as to recognize control points such as governmental buildings, residential area, and critical hazardous area. The each alternative was evaluated from view points of geometric aspect, construction cost, socio-economic environment, bridge construction, and serviceability. Alternative B was, then, selected as an optimum route.

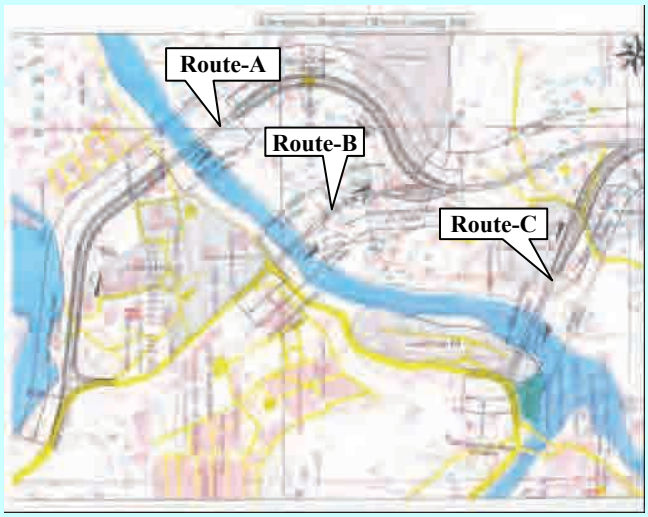


Figure 3 Alternative Routes of River Crossing Site

Alternative Bridge Type Study

Alternative bridge type was formulated based on a total length of about 240 m to 250 m, site conditions, accessibility for construction materials, and topographic conditions.

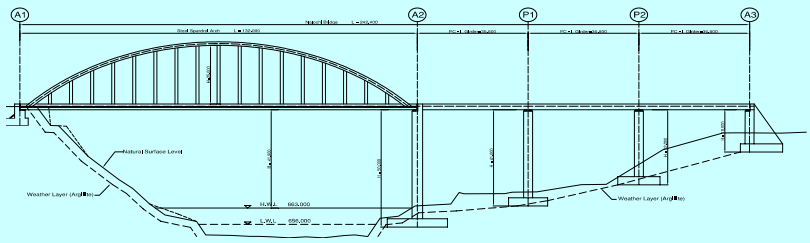
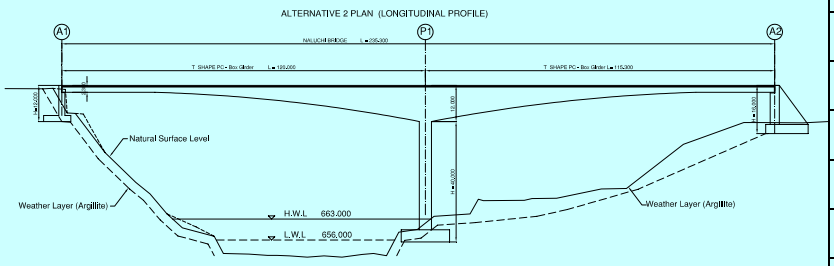
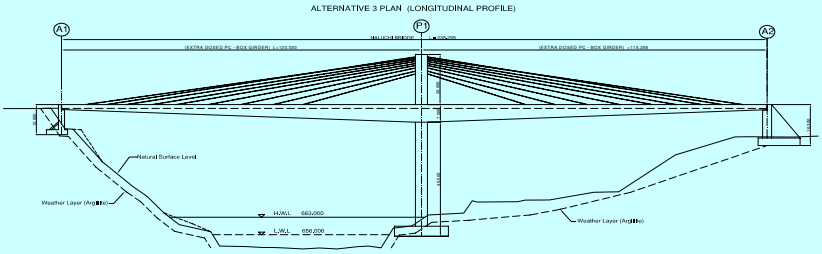
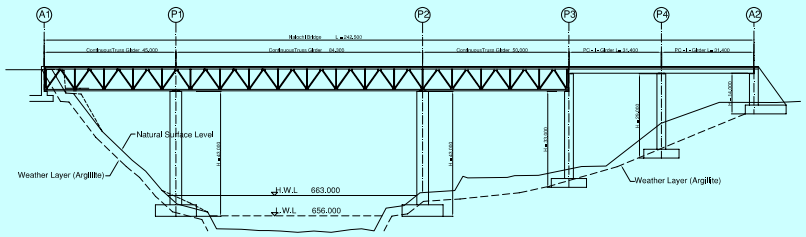
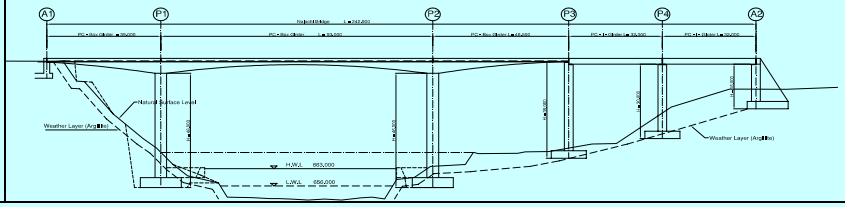
Table 4 Alternative Bridge Type and Span Arrangement

Alternative	Bridge Type	Span Arrangement
Alt-1	Steel Arch + 3 span plate girder bridge	136 m + 3 @ 38m= 250 m
Alt-2	Two span continuous PC Box Girder	2 @ 125 = 250 m
Alt-3	Two Span Continuous PC Extra Dosed Bridge	2 @ 125 = 250 m
Alt-4	Three span continuous steel truss + two span plate girder bridge	50 + 85+ 50 +2 @ 32.5 = 250 m
Alt-5	Three span continuous PC box Girder + two span PC I girder bridge	50 + 85+ 50 +2 @ 32.5 = 250 m

Source: JICA Study Team

Each alternative was evaluated from five evaluation items consisting of construction cost, construction aspect, structural aspect, construction period, maintenance aspect and technology transfer aspect. The evaluation result was simply rated with five ranks from excellent to bad. Then, Alternative 3 of tow span continuous PC extra dosed bridge was selected as an optimum bridge type.

Table 5 Comparison of Alternative Bridge Types

	General View	Evaluation Results	
Alt-1		Cost（x5）	Bad(5)
		Construction (x2)	Bad(2)
		Structural（x1）	Bad(1)
		Period（x5）	Fair(9)
		Maint.（x2）	Bad(2)
		Tech.（x1）	Poor(2)
		Total Point	21
Alt-2		Cost（x5）	Poor(10)
		Construction (x2)	Poor(4)
		Structural（x1）	Bad(1)
		Period（x5）	Fair(9)
		Maint.（x2）	Excellent(10)
		Tech.（x1）	Poor(2)
		Total Point	36
Alt-3		Cost（x5）	Fair(15)
		Construction (x2)	Good(8)
		Structural（x1）	Fair(3)
		Period（x5）	Fair(9)
		Maint.（x2）	Good(8)
		Tech.（x1）	Excellent(5)
		Total Point	48
Alt-4		Cost（x5）	Good(20)
		Construction (x2)	Bad(2)
		Structural（x1）	Fair(3)
		Period（x5）	Excellent(15)
		Maint.（x2）	Poor(4)
		Tech.（x1）	Bad(1)
		Total Point	45
Alt-5		Cost（x5）	Excellent(25)
		Construction (x2)	Bad(2)
		Structural（x1）	Fair(3)
		Period（x5）	Bad(3)
		Maint.（x2）	Good(8)
		Tech.（x1）	Bad(1)
		Total Point	42

Source: JICA Study Team

Picture: Outcomes of The Urgent Rehabilitation Projects

1. GENERAL

1.1. Introduction

In response to the request of the Government of Pakistan (hereinafter referred to as "GOP"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct "The Urgent Development Study on Rehabilitation and Reconstruction in Muzaffarabad City in the Islamic Republic of Pakistan" (hereinafter referred to as "the Study"), within the framework of the Agreement on Technical Cooperation between GOJ and GOP signed on April 30, 2005 (hereinafter referred to as "the Agreement").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of GOJ, undertook the Study in accordance with the relevant laws and regulations in force in Japan.

On the part of GOP, the Earthquake Reconstruction and Rehabilitation Authority (hereinafter referred to as "ERRA") acted as the counterpart agency to the Japanese Study Team (hereinafter referred to as "the Study Team") and also as the coordinating body in relation with other governmental and non-governmental organizations concerned with the smooth implementation of the study. However, in the course of the implementation of the Study, the Government of Azad Jammu and Kashmir (hereinafter referred to as "GOAJK") work together as a counterpart agency with the Study Team.

1.2. Background of the Study

1.2.1. 2005 Kashmir Earthquake

On October 8, 2005 an earthquake measuring 7.6 on the Richter scale occurred at 8:50 a.m. (Pakistani Standard Time). The seismic center was reported at 90 km north-northeast from Islamabad, at 34.493 degrees north latitude, and 73.629 degrees east longitude, and the epicenter was 26 km below ground level[1].

The location of seismic center is shown in Figure 1.2.1.

[1] United States Geological Study Reports (USGS).

Source: Pakistan Earthquake Seismic events map Reference Number X-26, Created on Oct. 14, 2005 by MapAction（www.mapaction.org）

Figure 1.2.1 Location of the Seismic Center

1.2.2. Background of the Formulation of Rehabilitation and Reconstruction Plan of Muzaffarabad City

Since the northern part of Muzaffarabad is located close to the epicenter and dislocation, many buildings and structures were damaged. And among them were many government buildings. The government, therefore, has not been functioning well since the event, and this has caused difficulties in formulating rehabilitation and reconstruction plans.

Furthermore, taking into consideration the present situation of the affected people and their hopes toward immediate reconstruction, it is needed to formulate a rehabilitation and reconstruction master plan in a short period, and it is also urged to implement some immediate countermeasures, which are a matter of urgent need.

1.3. Objectives of the Study

The Study aims at achieving the following two objectives:

1) Formulation of Rehabilitation and Reconstruction Master Plan (Target year: 2016)

2) Implementation of Urgent Rehabilitation Project, if necessary

1.4. Study Area

The Study covers Muzaffarabad city with an area of 17 km^2 and its surrounding areas. Muzaffarabad city has divided into 20 wards as shown figure below.

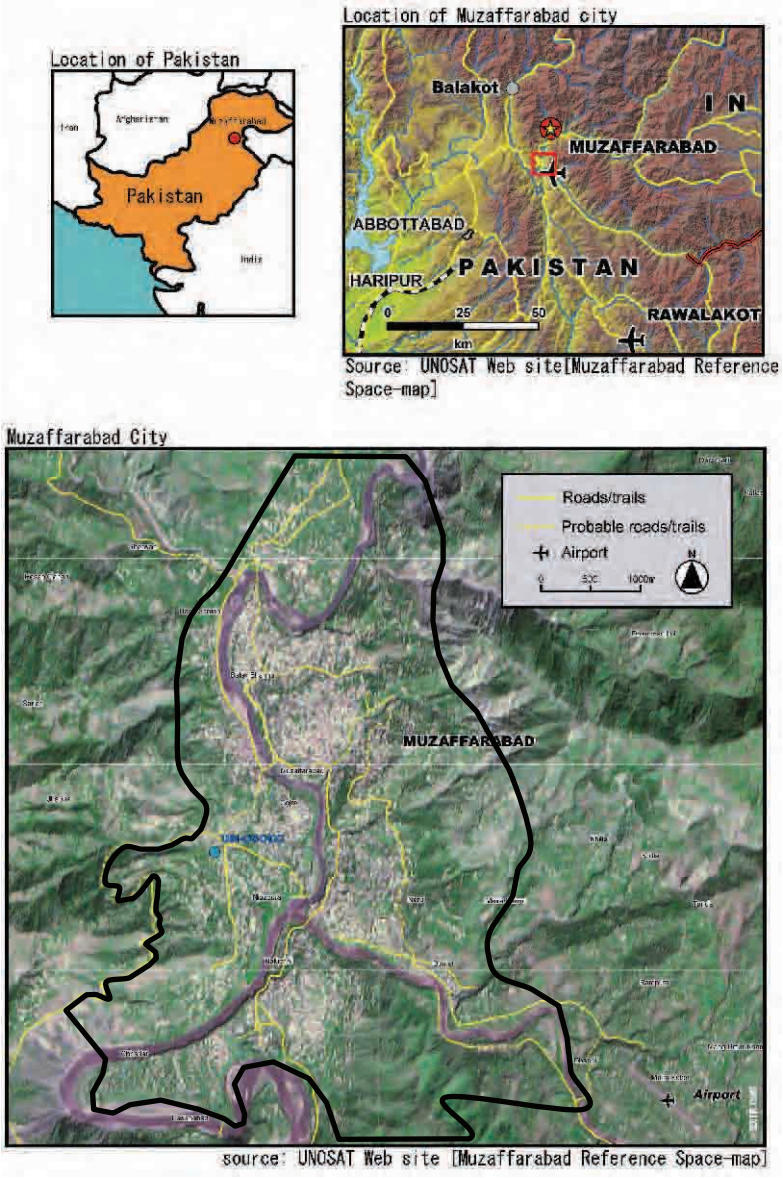


Figure 1.4.1 Study Area Location Map

1.5. Counterpart Agency

The Counterpart agency for the Study is Earthquake Reconstruction and Rehabilitation Authority (ERRA).

Pakistani and Japanese sides have agreed to set up the Steering Committee under the initiative of ERRA to effectively conduct the Study. Reports that include progress of the study are presented and discussed at Steering Committee meetings at each stage of the Study. The Committee is composed of the following authorities and organizations:

- Earthquake Reconstruction and Rehabilitation Authority
- Economic Affairs Division, Ministry of Economic Affairs and Statistics
- Planning and Development Department, GOAJK

- Central Design Office Works Department, GOAJK
- Public Works Department, GOAJK
- NESPAK
- Representation of Planning Division
- Any other member appointed by ERRA

The study is implemented under the following cooperation structure:

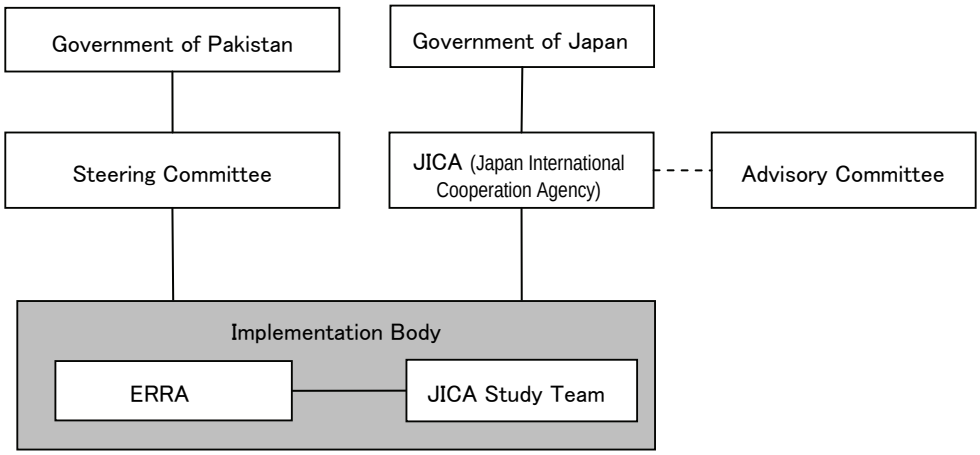
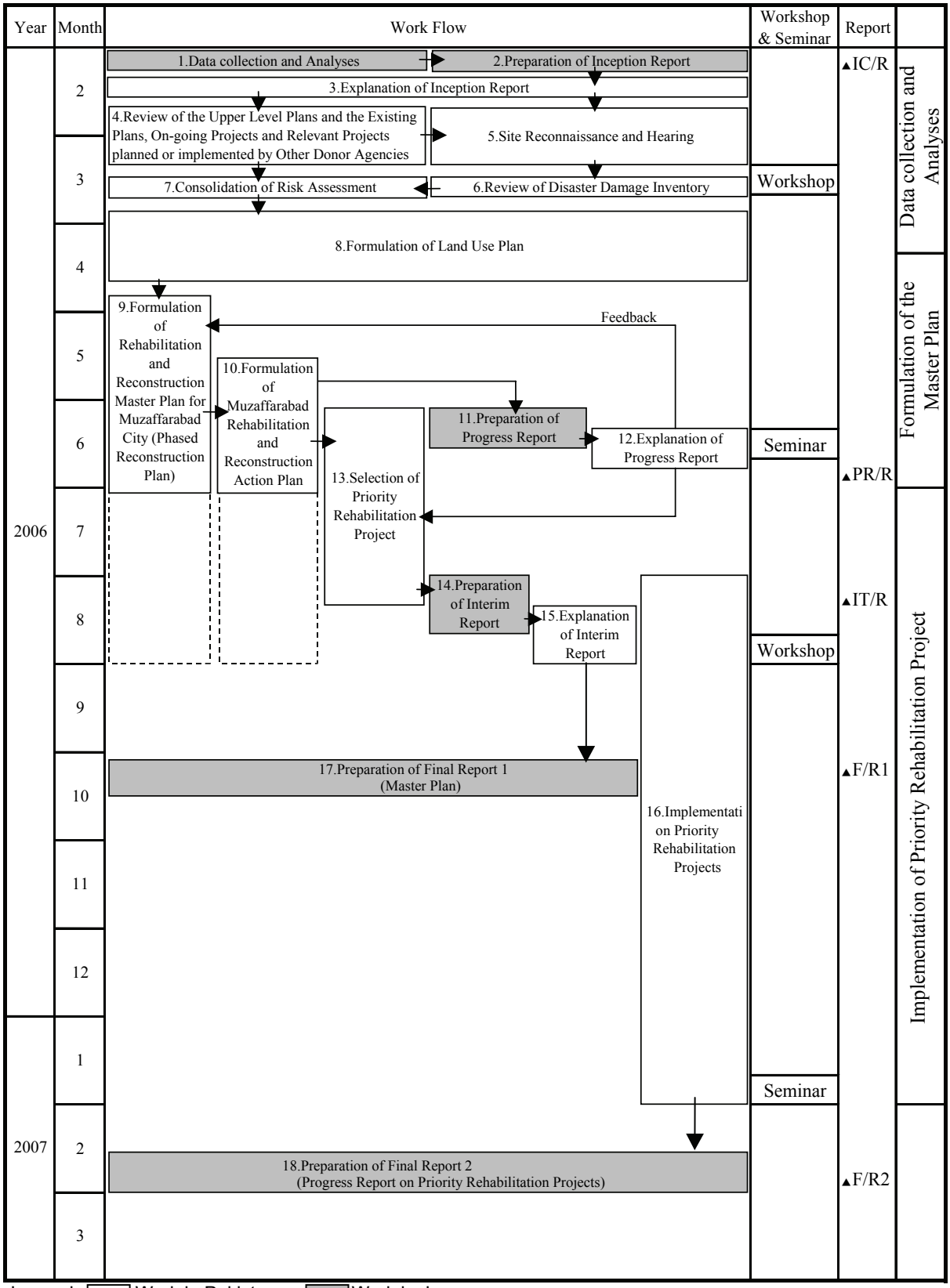


Figure 1.5.1 Cooperation Structure for Study Implementation

The work schedule of the tasks, interrelations among the tasks, and logical flow of the Study are shown in Figure 1.5.2.



Legend: Work in Pakistan Work in Japan
IC/R Inception Report PR/R Progress Report IT/R Interim Report F/R Final Report
Source: JICA Study Team

Figure 1.5.2 Work Flow of the Study

1.6. This Report

The report covers the urgent projects, which are implemented by the JICA Study Team, as a part of the mater plan study. Those urgent projects are important to understand master plan and to enhance rehabilitation and reconstruction of Muzaffarabad city. Urgent projects are covered only limited area or number because of the nature of the project. However, the results of the urgent project are feed back to master plan study to formulate more realistic plan and also enhance rehabilitation and reconstruction activities. During the study period, JICA Study Team carried out five urgent projects: 1) debris removal, 2) landslide, 3) construction of school, 4) disaster management education and 5) preliminary study for west bank-bypass. This report includes the results of the urgent projects. As for the rehabilitation and reconstruction of Muzaffarabad city, separate volume of reports were prepared and submitted to Pakistani government in January 2007.

2. COMMUNITY EMPOWERMENT PROJECT ON DEBRIS REMOVAL

2.1 Introduction

One of the important principles of reconstruction procedure is to rely on self-help approaches that use affected individuals as main actors. Yet often, there are many problems and constraints that can not be dealt with by such individuals, and thus, mutual-help among members at the neighborhood level becomes important.

Such activities are recommended to develop within the neighborhood, and then continue within the area so that it will contribute to nurture the community bonds. This bond is anticipated to accelerate the recovery process. Area-wise, mutual-help aims to improve areas that are not owned by individuals, but located within the neighborhoods such as roads, parks, and open spaces.

Communities are responsible for the activities that are planned in their neighborhoods. The Study Team carried out a debris removal pilot project, and that was quite successful and one good example of community activity.. There were at least two reasons in the success: i) the project generated temporary income to the resident, and ii) it got the residents' own neighborhood cleaned and proved they could do it by themselves. This experience provides the important message that involving communities in the reconstruction process is very important and Community-Based-Organizations (CBOs) are useful organization to initiate rehabilitation and reconstruction activities.

2.2 Project Implementation

2.2.1 Needs Assessment of Residents

The JICA study team conducted a social experimental survey, to identify the needs of affected communities. It was resulted that the highest prioritized needs of both male and female are debris removal and reconstruction of houses. The debris removal is the top prioritized need because it is a critical pass before any kinds of restoration and reconstruction. Therefore, the debris removal work was decided for the pilot project to empower a community.

Table 2.2.1 Needs Expressed by Male

Priority	Needs
1	Removal of debris
2	Reconstruction of houses
3	Improvement of water supply & sanitation system
4	Provision of soft loans to restart business & other entrepreneur activities
5	Provision of health facilities
6	Re-build schools, specifically for girls education
7	Widen street and connecting roads to access the main roads
8	Establishment of an organized market
9	Public park for women & children

Source: JICA Study Team

Table 2.2.2 Needs Expressed by Female:

Priority	Needs
1	Removal of debris
2	Reconstruction of earthquake proof houses
3	Restoration of education for children (Reconstruction of new school buildings)
4	Restoration of sewage and water supply
5	Establishment of vocational training schools for girls
6	Establishment of counseling center for women, girls & children
7	Application of law & order to reduce the increased crime rate
8	Create job opportunities for young people both male & female

Source: JICA Study Team

2.2.2 Identify the Community to Conduct the Project

Ward #13 was selected as a target area for the project. The reasons for the selection were:

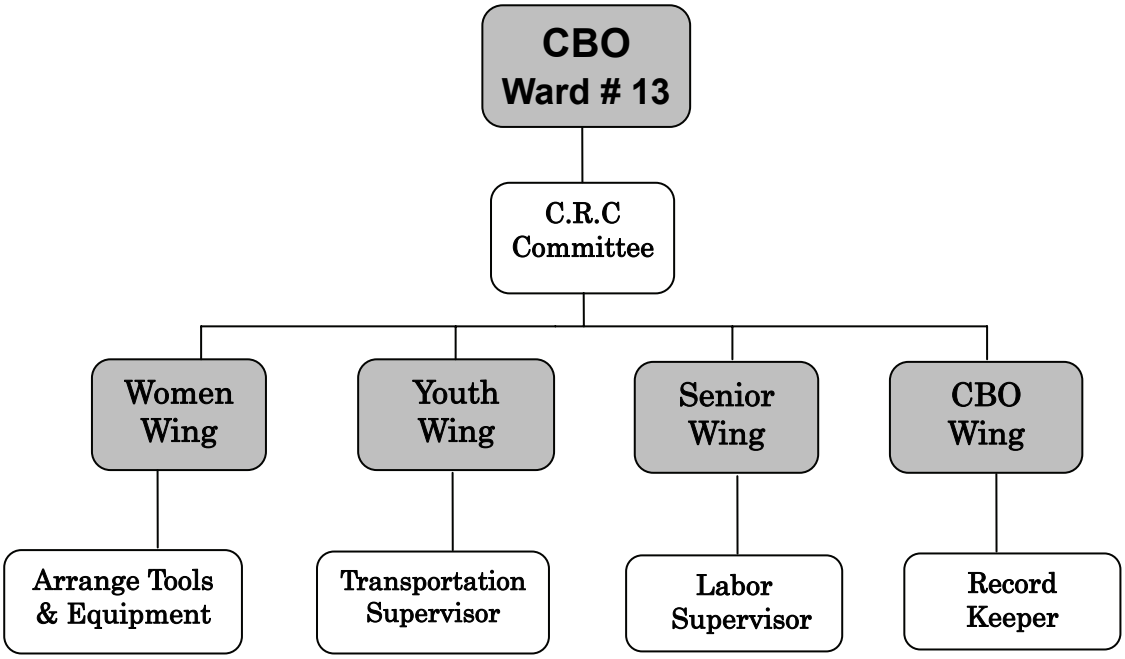
1) Ward #13 was one of the most serious damaged areas, and a lot of debris was still on the streets, and;

2) CBO has already organized and the members were active in the relief activities after the earthquake

MCM advised and recommend that ward 13 was suitable for this decision.

2.2.3 Prepare Implementation Plan by the CBO under the assistance of JST

The implementation plan attached as the appendix was prepared by the CBO under the assistance of JICA Study Team. The essence of the plan is summarized as below.



Source: JICA Study Team

Figure 2.2.1 The organizational structure of the community reconstruction committee

(1) Debris collection Sites:

The debris collection sites are mentioned as under.

1) Street number one (including link streets)
2) Street number Two (including link streets)
3) Street number three (including link streets)

(2) Process of Collection of the Debris

Process of Collection of the Debris is shown in the table below:

Table 2.2.3 Process of Collection Of the Debris

Step one	Step Two	Step Three	Step Four	Step Five
Identification of debris collection sites in the Ward	Identification of temporary debris keeping sites in the Ward	Formation and mobilization of teams for debris collection.	Debris collection from the main streets, and bringing to the temporary debris keeping sites	Debris Colleton from the narrow streets, and bringing to the temporary debris keeping sites.

Source: JICA Study Team

(3) Work of Schedule

Work of Schedule is shown in the table below:

Table 2.2.4 Work of Schedule

Items	Phase-1	Phase-2	
	2006		
	March	April	May
1. To formulate the implementation plan			
2.To establish "Community Reconstruction Committee" in the CBO			
3. To mobilize workers and to mobilize the tools, machineries, and equipment			
4. To prepare the shirts for the workers			
5. To gather the debris and remove them to the suitable place			
6. Reporting		▲ IT/R	▲ F/R

Note : IT/R : Interim Report
F/R : Final Report

Source: JICA Study Team

2.2.4 Main Activities carried out by the CBO

Main activities carried out by the CBO with the assistance of JICA Study team were summarized as followings.

- To Mobilize the Community
- To establish the CBO.
- Open a combine Bank account of the CBO
- To identify the temporary debris removal sites.
- To conduct the market survey for the purchase of tools and equipments and arrange manpower.
- To prepare the cost estimate for the debris removal work.
- To prepare a implementation Plan for the debris removal work
- Implementation of debris removal work.
- Supervision of debris removal work.

The mile stones of the activities are shown as followings.

(1) Signing of Agreement between the CBO and JICA Study Team:

JICA Study teams sign the agreement with CBO Tameer for the debris removal pilot Project on April 17, 2006. The ceremony was attended by the acting team leader of JICA study team Mr.Seki, Mr.Nishimura, Administrator Municipal Corporation Mr.Zahid Amin and all CBO members.

Picture: Signing of Agreement

(2) Launching Ceremony:

The launching ceremony of debris removal pilot Project was held on April 25, 2006 which was attended by Mr. Nagase, Ms. Eriko Inui, Mr. Ibayashi, Miss Fozia Durrani and Mr. Waseem from JICA study team.

Picture: Project of Debris Removal

(3) Start of work:

The Implementation of debris removal work was started on 24 April 2006 from street 1, 2 and their link streets.

Picture: The Street in Ward#13

(4) Details of work:

Daily three tractor trolleys, thirty labors were used to remove the debris from street # 1, 2 and their link street. The debris on the two main streets has been removed with amount of approximately 2,100 cubic meter. Total eight wheel barrows, fifteen shovels and ten excavators were also used to remove the debris. The tractor trolleys removed daily 68 cubic meter debris to the temporary debris removal site. The labors daily collected 113 cubic meter debris with wheel barrows from the mention streets.

Picture: Debris Removal Work

(5) Final Ceremony of Debris Removal Program

Final Ceremony of Debris Removal Empowerment Project was held in Ward # 13.The Ceremony was attended by large number of community members Male/females and representative of IOM, Marci corps, Media persons and Members of JICA Study team. The CBO members appreciated the support and help of the JICA study team for debris removal pilot Project. The representative of Municipal Corporation also appreciated the support of JICA study team. The team leader of JICA study team also appreciated the participation of community in debris removal pilot project, he encourage the community to take part in future rehabilitation and reconstruction activities. The team member of JICA study team Ms.Fozia Durrani thanked the CBO members for taking active part in planning, implementation and monitoring of the debris removal pilot project. She urges the need of more community members to take part in rehabilitation and reconstruction activates.

Picture: Ceremony for Completion of the Work

2.3 Results of the Project

2.3.1 Removed Debris

The debris on the two main streets has been removed with amount of approximately 2,100 cubic meter. The CBO collected the debris and brought them into temporal debris keeping sites in the ward, and Municipal Corporation brought the collected debris at temporal keeping sites to final debris disposal sites which are outside of the ward.

Picture: The Street on which Debris is removed

2.3.2 Constraints

Constraints are as follows:

- The mobility of tractor trolleys was very difficult because the streets are very narrow.
- The trolleys cannot drop the debris on the main road sites because due to debris on road the traffic and pedestrians were disturbed.
- Due to noise and air pollution shop keepers and residence of ward number 13 were disturbed.
- Some people of the community were not cooperative, they threw the debris of their houses on the streets which were already cleaned by the CBO.
- As there is a huge amount of debris in Ward 13, the amount which was allocated for the project was not enough, due to this other members of the community were not cooperative.

2.3.3 Lessons Learned

- Project formulation based on the people's needs is important.
- Good example of public private partnership.
- Community gained confidence after the Establishment of the CBO.
- Capacity of the CBO was built through the management of the project.
- After registration of the CBO, CBO can apply for any project to government and donors.
- The success of the project is a good example for other CBOs to participate in the rehabilitation and reconstruction activities.

2.3.4 Recommendations

- Before starting the debris removal project, the permanent debris disposal sites should be identified with the help of Municipal Corporation.
- There is a need of proper coordination and cooperation among the donors for debris removal activities
- It is difficult for the labors to collect the debris during day time in summer; it is recommended that debris removal should be started at evening time.
- Labor should be given caps for the day work to protect them from the heat.
- Gloves should be provided to the labors because there were some sharp metals and pieces of glasses in the rubble.

2.4 Conclusion

Debris removal from their neighborhoods is the first step for long-term reconstruction; this activity also needs to have community participation. By having residents participate this activity, the bonds of community as well as motivation in rehabilitating their places by their own efforts will increase. This activity will focus community members on their neighborhood as a whole, and will include public spaces such as roads and streets.

In this proposed activities, three aspects need to be emphasized: i) area for working needs to include the public areas, ii) activities of residents should include assessment and planning, and iii) CBOs are responsible for organizing such activities but also need to retain transparency, accountability and credibility in their activities.

The targeted area in the ward, based on prioritized area developed by the community members, will include public spaces. It is important to put activities at these spaces in the initial stage so that all communities could benefit from such secured public spaces. For example, by removing debris from streets will allow the trucks and trolleys to function, which will accelerate the productivity of rehabilitation activities. Second, the activities of residents needs to have a planning procedure; for example, mapping the debris distribution to grasp the current condition, which will enable them to plan work procedures for the activity. Furthermore, together with coordination of CBOs, community members will be responsible to plan the work schedules, which are recommended to get efficient results. Third, to recap, as the representative of neighborhood residents, CBOs are responsible for maintaining long-term favorable interaction with residents, and thus need to put abundant effort in the transparency, accountability and credibility of their activities, including finances.

3. LANDSLIDE PILOT PROJECT FOR MUZAFFARABAD CITY

3.1 Introduction

The October 8, 2005 earthquake (M-7.6) in Pakistan, in addition to loss of about 30,000 lives in Muzaffarabad city, has triggered numerous landslides in the city and its surroundings. These landslides, which mostly became active after the earthquake, have posed considerable hazards to local populations. Especially in rainy season, these landslides and associated debris flows have great potential hazards to people and property, because most of local people in the earthquake-affected areas have lived in landslide areas or their impact areas.

For this dangerous condition, it is necessary to take drastic measures, such as execution of landslide countermeasures and relocation of residents' houses in the impacted areas. However, these drastic measures will require a lot of time and cost. Therefore, it is indispensable to develop and implement a warning and evacuation system before the rainy season comes, to prevent and mitigate damage to the inhabitant from landslide and debris flow hazards.

JICA Study Team investigated 40 km^2 in and around Muzaffarabad and identified 70 landslide areas. 18 areas were identified as high risk land slide areas, where it will affect human activities or cause a great damage to lives and properties.

The purpose of this Landslide Pilot Project is to establish a timely warning and speedy evacuation system to reduce the risk of death, injury, property loss and damage.

3.2 Development of Warning and Evacuation System

(1) Establishing a Disaster Management Section

To carry out timely warning and speedy evacuation, a Disaster Management Section (DMS) has been set up in the Municipal Corporation Muzaffarabad (MCM). The DMS shall be responsible fully for the operation of the warning and evacuation system. Its main roles are listed as follows:

- Information about threats, hazards and protective actions
- Notification, warning and communication procedures
- Evacuation and locating family members in an emergency
- Emergency response
- Shelter management and relief services

- Management of warning system
- Assistance to returning affected communities

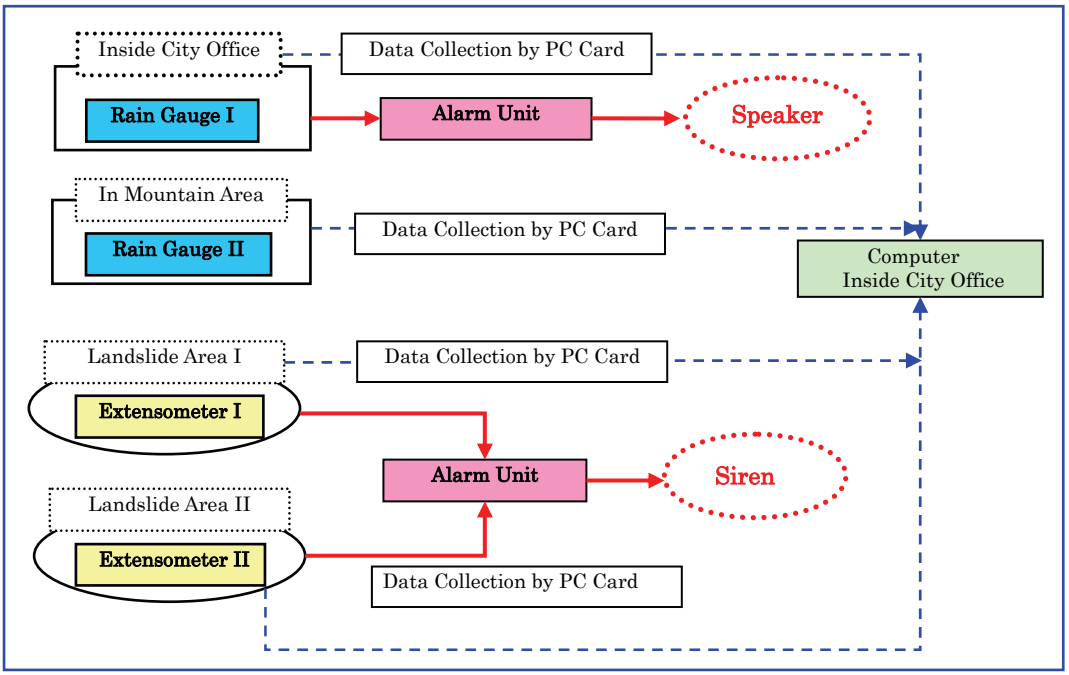
In addition, under the DMS, four groups shall be constituted as follows:

- Monitoring Group
- Warning Information Group
- Evacuation and Rescue Group
- Technical Analysis Group

The MCM shall be responsible fully for the execution of this project. The Administrator of the Municipal Corporation Muzaffarabad will issue the warning.

(2) Warning System

A Warning and Evacuation System (WES) has been developed in close consultation with MCM. The warning system of landslide movements in this pilot project is made up of two extensometers for detection of landslides, and two rain gauges. Figure 3.2.1 gives a schematic illustration of this warning system.



Source: JICA Study Team

Figure 3.2.1 Schematic Illustration of Warning System

As shown in Figure 3.2.1, of those two rain gauges, one rain gauge is installed near City Office. The rainfall data are transmitted directly to the DMS set in the City Office. The

real-time information of rainfall conditions can be obtained from the Rainfall Information Board installed in the DMS. Also, the rain gauge is connected with a siren and speaker for delivering a warning. When a rainfall exceeds the standard rainfall, a disaster can be predicted.

Moreover, two extensometers that are installed respectively at the head of two landslides are connected with an alarm unit including a siren and speaker (an extensometer measures deformations however small). When any one of the two landslides moves faster than the standard displacement, the siren and speaker can show a warning.

A communication system has been developed to report emergencies, warn personnel of danger, keep families and households informed, coordinate response actions, and to keep in contact with key agencies involved in providing services.

A Warning and Evacuation Manual has been developed to guide the DMS to follow the key processes including operating procedures to run the system more efficiently

(3) Standard Values and Warning Level

In the target area, information regarding standard values is not available; some standard values that were used in Japan are revised and selected conservatively as tentative standard values for the target area, as shown in Table 3.2.1, together with monitoring method and frequency. These standard values should be improved as rainfall and displacement information is collected from the installed equipment.

As shown in Table 3.2.1, the warning is catalogued into the following four levels, and the main activities in each level are as follows:

- Normal Level — Normal monitoring and observation on a regular basis shall be conducted.
- Attention Level — Normal monitoring and observation on a regular basis shall be conducted, but the frequency of monitoring and observation shall be increased, for example, once a day to once every three days, depending on ongoing status of the ground deformation and meteorological change.
- Warning Level — This means that the hazards of landslides and debris flows are becoming higher and higher. The local people in these hazardous areas may evacuate on their own judgment when they receive warning information.
- Evacuation Level — An official announcement of evacuation shall be made, and the involved communities and people in these hazardous areas shall swiftly move to the designated evacuation areas.

Table 3.2.1 Tentative Standard Values

Warning Level	Standard Values	Monitoring Method	Monitoring Frequency
Normal	Rainfall: below 10 mm/h Extensometer: below 1 mm/h	Regular, 9:00 a.m. to 16:00 p.m.	Once a week
Attention	Rainfall: 10～20 mm/h Extensometer: 1～2 mm/h	Regular, 9:00 a.m. to 16:00 p.m.	Once every three days
Warning	Rainfall: 20～30 mm/h accumulative: above 80 mm Extensometer: 2～4 mm/h	Strengthening monitoring	24 hours
Evacuation	Rainfall: above 30 mm/h accumulative: above 120 mm Extensometer: above 4 mm/h	Evacuation	

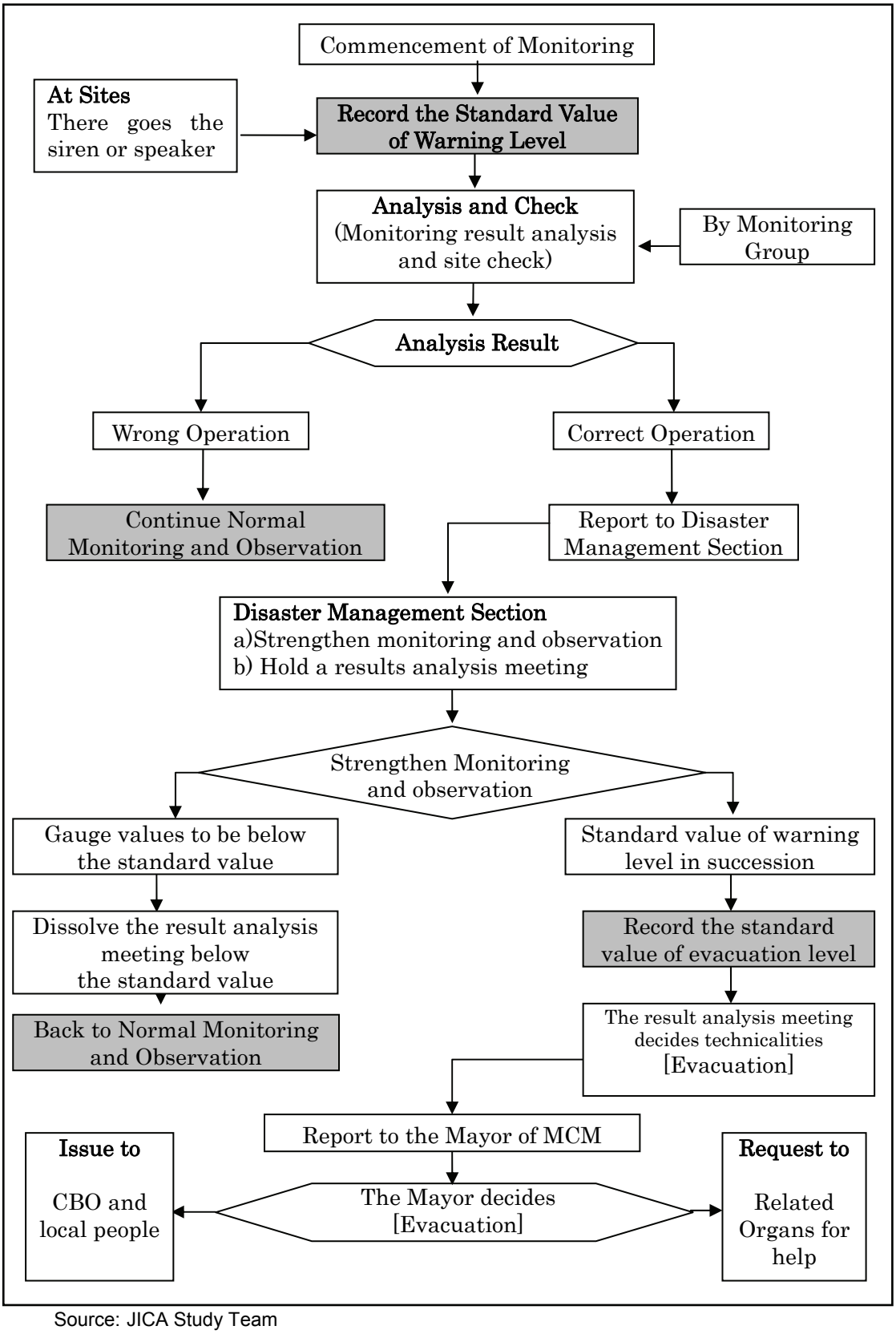
Source: JICA Study Team

Moreover, the cancellation of warning shall be technically decided by the DMS and then issued by the Mayor/Administrator of the MCM.

The criteria for the cancellation of warning are as follows:

- No precipitation for over 24 hours is confirmed; and
- The decreased movement of landslide is checked from the results of monitoring and observation for over 24 hours.

The flowchart of warning and evacuation system is shown in Figure 3.2.2.



Source: JICA Study Team

Figure 3.2.2 Flowchart of the Warning and Evacuation System

(4) Evacuation Plan

Evacuation is a risk management strategy, which is used as a means of mitigating the effects of an emergency or disaster on a community. The purpose of evacuation is to relocate people from dangerous areas to safe areas. However, to be effective it must be correctly planned and executed. The process of evacuation is usually considered to include the return of the affected community.

The evacuation process comprises five stages:

- Decision to evacuate
- Transmission of warning
- Withdrawal and Movement
- Shelter
- Canceling of evacuation and Return

These are usually temporary refugee areas or stopping points. The facilities available would depend upon the nature of the hazard. The DMS provides a solution to short-term accommodation problems and road to the evacuation. The evacuation planning map is given in Figure 3.2.3.

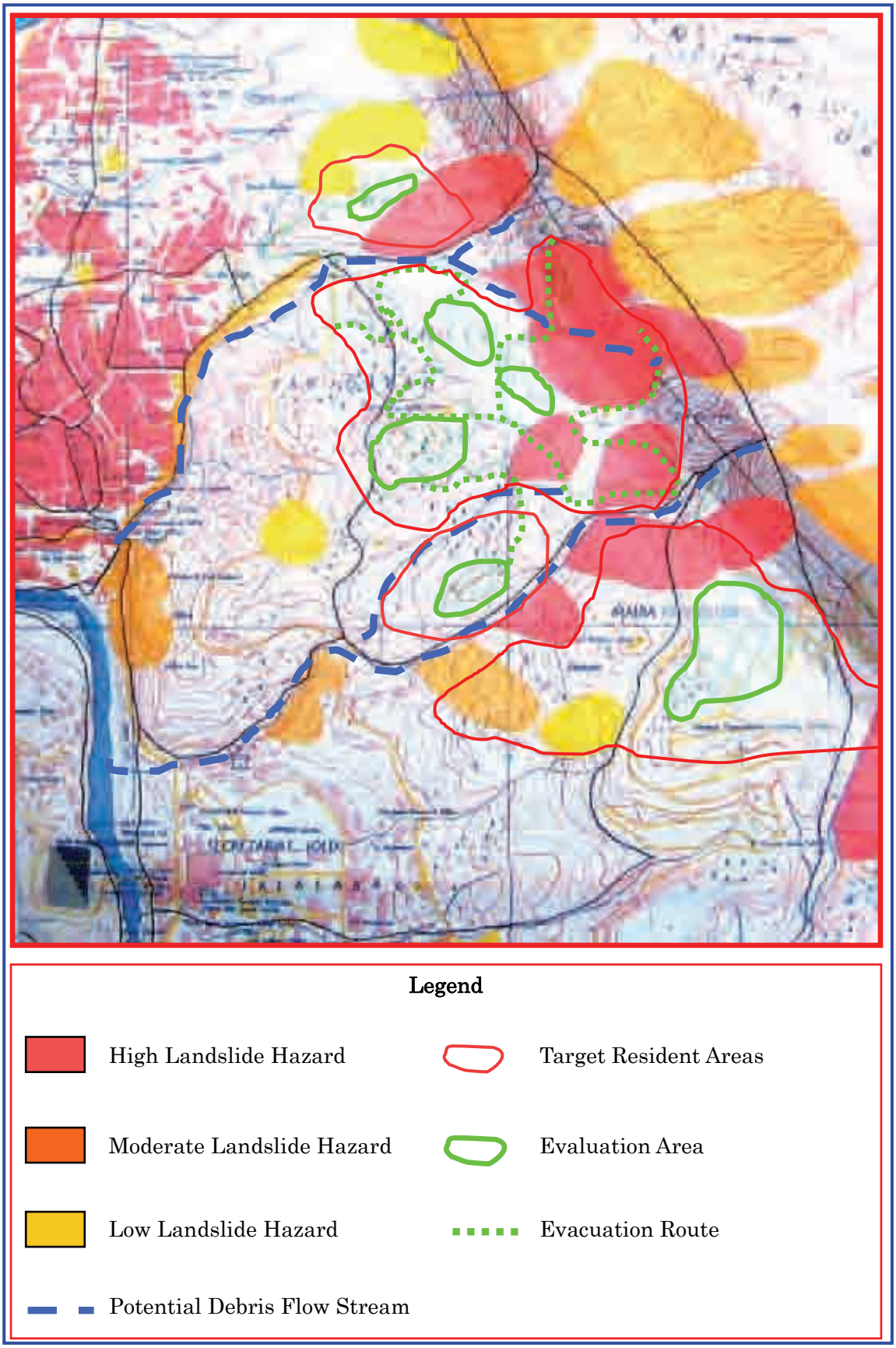
Responsibility for the establishment and management of evacuation facilities should rest with MCM in consultation with local CBOs and community members. This will ensure that the most appropriate site, venue and facilities are utilized.

The relief and basic human services include accommodation, food and water; in addition, these facilities should also provide a greater range of welfare and support services. This will help facilitate the recovery process.

Services provided may include:

- Temporary accommodation;
- First aid;
- Food; and
- Information and referral services.

The above services may be provided at the evacuation center, or alternatively at a suitable venue nearby, easily accessible to both people staying at the evacuation center and others affected by the hazard.



Source: JICA Study Team

Figure 3.2.3 Evacuation Planning Map

3.3 Mobilizing Local Communities

Much emphasis has been given to social mobilization and community participation to effectively reduce landslide risks for the communities living in the path of a potential disaster.

To fully understand the landslides, communities need to understand risks and overcome fear to make them more resistant to the damaging effects of natural hazards The Project encourages people to take action before a disaster occurs through initiatives for evacuation and moving to safer places.

(1) Establishing CBOs

Given the high levels of vulnerability of parts of the population to landslide hazard, it is essential for community to be organized for any eventual emergency response.

The overall goal of establishing CBOs is to empower local communities to manage the hazard and be able to reduce and minimize any negative impacts. The objectives of the establishment of the community organizations are:

- Reducing vulnerability of communities during landslide emergencies through community participation; and
- Empowering communities through building their capacities to cope with emergencies/disasters.

In the hazard prone areas, two CBOs were established in Tariqabad and Rinjata areas. In addition, two informal groups in Deharian saeeda and Maira Tanoulian were formed. These informal groups are in the process of electing their officers and executive board members, and initiating the registration process.

Adequate representation of women in CBOs has been ensured and their participation in decision making as well as in formulating gender equitable and disaster preparedness strategies.

Initiatives are also underway to establish an apex-body to include all CBOs and will cover the whole disaster prone areas and provide leadership role to the local CBOs.

(2) Capacity Building of CBOs

Building up of the appropriate capabilities within the communities and the dissemination of basic knowledge about the landslide hazard preparedness activities including development of response procedures, design and installation of warning systems, exercises to test emergency operational procedures and skill would be crucial for local people in order to play an important role in the disaster management.

The capacity building process included regular meetings with CBO members, consultations and dialogues. For this purpose a process has been designed, consisting of mass awareness campaign, capacity and capability enhancement of focal persons in the disaster management education including prevention, reduction, preparedness, mitigation, response, warning, emergency operation, rescue and evacuation.

(3) Disaster Prevention Education

To educate and sensitize local communities on how to avoid hazards and minimize the losses, a pamphlet was prepared in English and it was translated in Urdu. The content includes basic knowledge about landslide hazards occurrence, preparedness, protection, warning and evacuation and key action messages. The pamphlet was distributed among the key community members.

Besides the regular discussions during the meetings with the local communities on the disaster prevention education, two seminars were conducted in Tariqabad and Ghore Pher Rinjata. About 85 community members representing all hazard prone areas of the Muzaffarabad city participated in these seminars. The participants were selected in consultation with communities using refined selection criteria. During selection of the participants women participation has been taken into consideration.

The seminars were much appreciated by the communities and the feedback is that these seminars on disaster prevention were held for the first time in their communities.

(4) Identification of Focal persons

During the seminars 25 focal persons representing each locality were selected in consultation with CBOs. These focal persons will be trained in preparedness activities in warning information dissemination, assisting communities in evacuation to the safe areas. The specific roles of the focal persons for the disaster responses are required right from the time a warning commences. The following are the required responses at the time of prediction.

- Passing warnings
- Organizing emergency shelters
- Assembling all people and putting them on alert to meet the situation
- Preparing to evacuate people

(5) Evacuation Training

Practical evacuation training is necessary to provide a consistent approach to the identification and mitigation of landslide hazards and to sustain the program. Evacuation training was conducted in collaboration with DMS and local communities on June 28. DMS

and focal persons played a lead role to involve communities. The evacuation training afforded an opportunity to both DMS and local communities including focal persons to learn in case of the real event. The training drill conducted helped in finding out the feasibility of the warning and evacuation system and to ensure greater role clarity to the key players and to ensure the availability and functional condition of equipment and resources.

(6) Community-based Urgent Countermeasure Works against Landslide Disaster

Crack filling activity has been suggested one of the effective and economically feasible measure that can be under taken through community participation to prevent infiltrating water in surface drain ditches and to avoid hydraulic thrusts in open cracks within landslides area which may trigger landslide.

In Rinijata close to shrine where extensometer were installed, the Landslide expert selected two sites and identified open cracks to be filled by the community on pilot basis to set an example for focal persons and communities for subsequent replications in other areas.

The focal persons and 33 community members including seven women gathered on the identified sites and started crack filling work on 20th Aug. 2006. They gathered clay in the surrounding areas and plugged those cracks identified by the Landslide Expert. The community members have shown keen interest and actively participated in the landslide mitigation works.

3.4 Recommendations

(1) Sustainable operation of early warning and evacuation system

The early warning and evacuation system was established in Muzaffarabad through the pilot project, landslide measuring devices were installed and two hazardous landslides have been monitored. Furthermore, evacuation trainings including disaster education encouraged self-help efforts of local people as well as reinforcing the early warning and evacuation system. Consequently, there were no fatal accidents in the project area, although many small landslides and debris flows occurred during 2006 monsoon season. In the situation where drastic countermeasures were difficult to be conducted economically, the early warning system and urgent countermeasures have contributed to mitigate landslide disasters. However, natural hazards still remain as unsolved issues, and the high potential hazard area lie behind residential districts of Muzaffarabad City. Therefore sustainable operation of early warning and evacuation system is necessary to reduce natural disasters.

Recommendable further activities for sustainable operation of early warning and evacuation system in Muzaffarabad are:

- Supplemental technical training and evacuation training both for DMS and local communities.
- Comprehensive study to clarify the mechanisms of natural disasters, and feedback to revise the early warning and evacuation system
- Natural disaster education and evacuation training for local communities
- Debris flow/landslide monitoring

(2) Development of Early Warning and Evacuation System to Other Natural Disaster-prone Area

Many earthquake affected areas are also located in mountainous area and have been suffering natural disasters such as landslides and debris flow. Experiences of the pilot project can contribute to the risk reduction of natural disasters in these natural disaster-prone areas.

Key factors in developing to risk reduction of natural disasters are:

1) Detailed hazard mapping

A hazard map is fundamental to risk management of natural disaster. Detailed ground mapping is required to evaluate natural disaster risk. Its accuracy depends critically on the accuracy of the available base map. At least a topographic map at 1:10,000-scale or a more accurate topographic map is required to identify landslide and debris flow.

2) Establishment of administrative disaster management section and community based organization

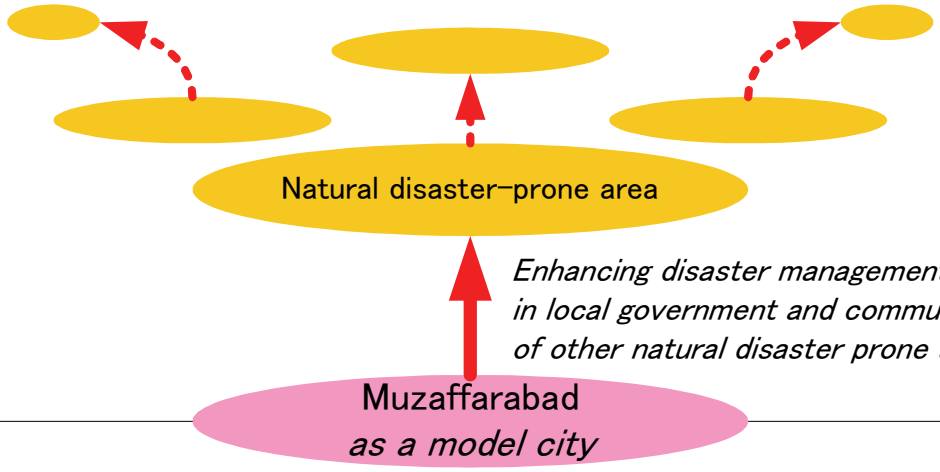
Establishment of administrative disaster management section and community based organization is necessary to manage the natural hazard and to reduce and minimize negative impacts of natural disaster.

3) Capacity building both in local government and communities

Technology transfer including monitoring works of landslide etc, evacuation training and disaster education are effective for reinforcement of the government's administrative capacity and information sharing and awareness-raising of natural disaster in local people.

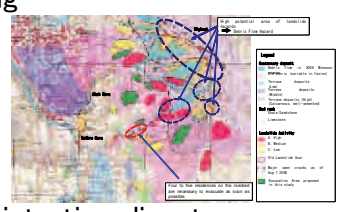
4) Promotion of voluntary evacuation of local people

Although the early warning system provides effective information and support voluntary evacuation, self-help is fundamental principle.



Components for Community Disaster Management

1. Detailed hazard mapping



Hazard map

2. Establishment of administrative disaster management section and community-based organization

Town meeting

3. Capacity building both in local government and communities

Major activities: Transfer of technology, monitoring, countermeasure work by people's participation, disaster education

4. Promotion of voluntary evacuation of local people

Voluntary education

Figure 3.4.1 Image of Development of Early warning and Evacuation system to Natural Disaster-prone Area

(3) Structural Countermeasures against Natural Disasters

In this Study, the activities against landslides/debris flows almost comprise of soft components, for example disaster education and evacuation drills. On the other hand, any hard components (e.g., construction of check dams) were not undertaken. This means that there is still potential of secondary natural disasters such as after shocks and landslides/debris flows in/around Muzaffarabad City. Therefore this JICA Study emphasizes that it is essential for Muzaffarabad and adjacent areas to implement countermeasures or projects listed in the action plan and the project list shown in the final report of this JICA Study.

4. SCHOOL REHABILITATION PROJECT

4.1. General

Initially, the Pakistani side selected several schools needed rehabilitation and then made a request to JICA for schools for urgent rehabilitation project. The Project Team conducted a site survey of the selected schools in the city and had discussions with ERRA/NESPAK, Education Secretariat AJK and Municipal Corporation Muzaffarabad.

The project is the first permanent building construction in Muzaffarabad and model school for earthquake resistant structural. In order to select target school, Japanese side received request from Pakistani side and Japanese side considered land owner, size of school, easiness of construction, budget, location etc. for final selection. As a result, it was confirmed that the Sathi Bagh Government Girls High School was the most prioritized and eligible for rehabilitation and reconstruction. The school facility was totally collapsed by the earthquake. By rehabilitating the school, it can become a model for the construction of disaster prevention schools.

4.2. Project Selection

The earthquakes caused extensive damage to the city. Especially collapse of school buildings was a disaster because it led a great number of student deaths. When disaster strikes, schools in Japan fill the role of place for evacuation and shelter, whereas the weak structured school buildings in Pakistan brought about so much tragedy. In addition, disaster management education was never taught in schools in Pakistan, thus teachers did not know how to protect students there. Learning from the lessons of the past, the JICA Study Team selected construction of a model school for disaster prevention as one of the pilot projects and proposed the project for promotion of disaster management education, which will be absolutely essential for all the teachers and students for the future. The rationale of constructing the school is explained as below.

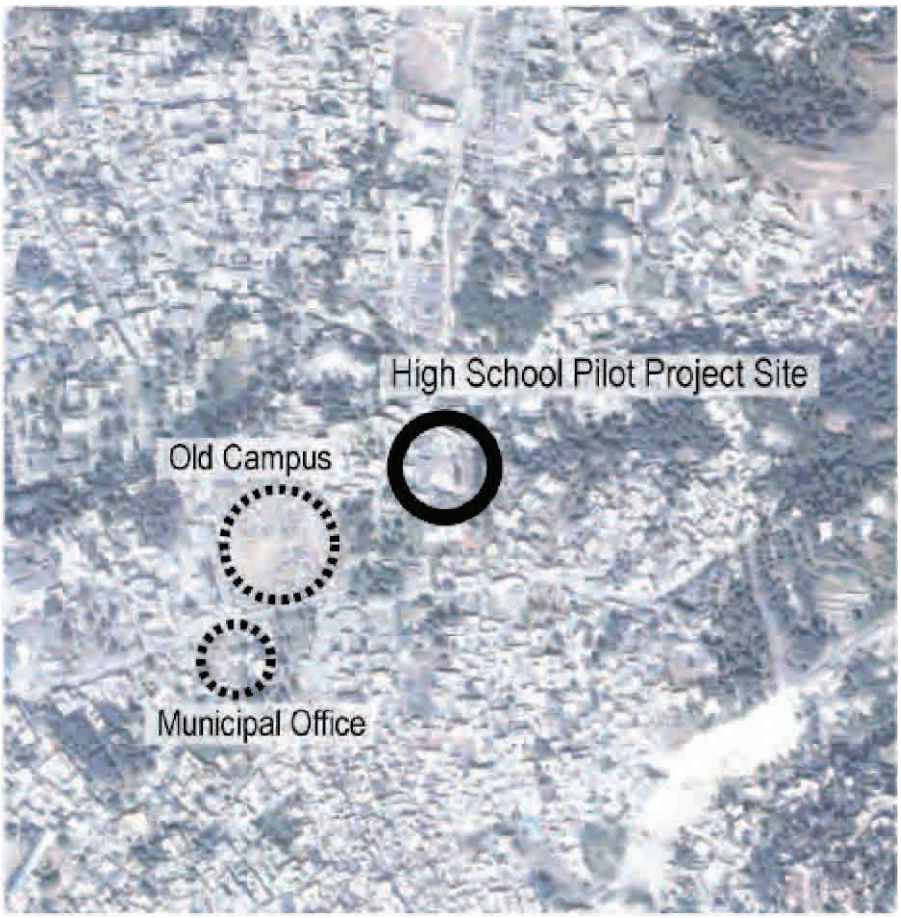
4.2.1. Only one Girl's High School

Although some private schools exist, there is no single government girl's school in this most populated area. A government boy's school (Pilot Boys High School No.1) constructed by a Turkish donor is situated near this girl's high school already rehabilitated. In order to enhance gender equity in education, girls schools should be prioritized.

4.2.2. Location and Site

Ward 11, where the model school will be constructed, is the most populated area and the largest ward in the city. The site is the only available location in the ward. Property is owned

by Education Secretariat, AJK, and there is not any constraints in the use of the land for school reconstruction. There were occupants within the site, but there was a plan to relocate occupants to other places even existing temporary tent classrooms.



Source: JICA Study Team

Figure 4.2.1 Location of the School

4.2.3. Sufficient Number of Teachers and Children

Government has already appointed teachers for the school and a staff of 25 was working there as shown in Table 4.2.1. About 300 students were studying in the tent school temporarily at the present as shown in Table 4.2.2. The new school will motivate the children in this area to go to school, and the number of the student is expected to increase from the present number.

Table 4.2.1 Number of Teachers and Staff in Government Girls High School Sathi Bagh (May 25, 2006)

	Status	Male	Female	Total
	Formal	N/A	20	20
	Informal	N/A		
	Formal	1		1
	Informal			
	Formal	2		2
	Informal			
	Formal	1		1
	Informal			
	Formal		1	1
	Informal			

Source: JICA Study Team

The number of students has increased considerably within a month since the JICA Study Team started survey. The reasons are presumed as follows:

1) new term has just started to receive new admissions,

2) provision of books and bags by donors attracted more students,

3) affected people who were displaced came back to their previous land, and

4) quality of teaching was accepted.

The new school will motivate more children in this area to go to school and the number of students is surely expected to further increase from the present number.

Table 4.2.2 Number of Students in Government Girls High School Sathi Bagh (May 25, 2006)

	Before 8th Oct. 2005		After 8th Oct. 2005			
			29th April, 2006		24th May. 2006	
	Girls	Total	Girls	Total	Girls	Total
KG	7	7	7	7	25	25
Grade 1	6	6	10	10	15	15
Grade 2	11	11	10	10	20	20
Grade 3	10	10	14	14	20	20
Grade 4	13	13	13	13	20	20
Grade 5	2	26	11	11	27	27
Grade 6	30	30	26	26	28	28
Grade 7	23	23	20	20	30	30
Grade 8	58	58	26	26	30	30
Grade 9	31	31	24	24	26+26	52
Grade 10	25	25	20	20	25	25
Total	240	240	181	181	292	292

Source: JICA Study Team

4.2.4. Sufficient Budget Allocation

Budget for school management including salary for teachers, maintenance for school and other running costs will be disbursed to the school by Education Secretariat, AJK.

4.2.5. Supportive Infrastructure

Sufficient infrastructure for water supply, power supply and telecommunication is supplied for the school site.

4.3. Outline of the Project

JICA decided to construct a government high school as a pilot project for the rehabilitation and reconstruction in Muzaffarabad. Since poor seismic resistance capacity of school buildings collapsed by the earthquake, more than 17,000 students dieded. Construction of school building is important for a step for rehabilitation and reconstruction. Together with construction of school, the disaster management education project also carried out by the study team. General information on the construction works is given below.

4.3.1. Project Title

Construction of Disaster Prevention Model School in Muzaffarabad Government Girls High School Sethi Bagh

4.3.2. Project Component

Reconstruction of School

- Construction of a girl's high school building (including a survey, detailed design, tender document, tender evaluation, contract negotiation and construction supervision)
- Procurement of equipment necessary for operation of school
- Development of schoolyard, drainage and planting
- Betterment of an access road to school (debris removal, paving)

Promotion of Disaster Management Education

- Development of student material on Disaster Management Education
- Development of teaching aids on Disaster Management Education
- Holding teacher training on Disaster Management Education

Project Implementation Body

- Reconstruction of School: Education Secretariat AJK, Muzaffarabad
- Proposed Project for Promotion of Disaster Management Education: Education Secretariat AJK, Muzaffarabad

- Project Implementation Period: September 2006 to March 2007 for construction for school construction

Project Location

- Sethi Bagh near Katha Wali Mosque, Ward 11, Muzaffarabad Municipality

Building Structure of School and Scale of School

- Building Structure: Single story seismic resistant reinforced concrete building
- Number of Classrooms and others: 10 classrooms, 2 laboratory rooms, 1 library, a room for staff, headmaster, accounting/administration, toilets
- Number of Pupils: About 300 (as of May 2006)
- Number of Staff: About 24 (as of May 2006)
- Total Floor Area of School Building: 780 m^2
- School Site Area: 2,185 m^2

4.4. Design Policy and Concept

The design policies described below are considered to meet the standard design of the education facilities in Pakistan, to utilize local materials and workers, and to reflect other requirements for specific conditions such as hot summers and cold winters.

4.4.1. Structural Design

(1) Seismic Resistant Design

a. Code and Standard

Structure design of the building follows the standard and even considers the Japanese practice: Draft of [Revision / Update of Building Code of Pakistan, Stage-II, Recommendations for Detailed Seismic Design Parameters and Criteria for Seismic Resistant Design of Buildings in Pakistan, June 2006] issued by NESPAK under the Ministry of Housing and Works.

Safety of member's section was confirmed by the strength design method provided by ACI Building Code.

b. Design Load

- Base Share Coefficient V/W is 0.168 based on "1997 Uniform Building Code"
- Frame analysis with linear force-deformation relation is applied.
- Safety of member's section is confirmed by ultimate strength design method

c. Dead Loads

The dead load is the static weight of all walls, floor slabs, roof slabs and finishing including all other permanent construction.

Unit weight of reinforced concreate = 150 pcf

Unit weigh of steel = 490 pcf

Unit weigh of plaster = 62.4 pcf

d. Live Loads

The live load assumed for the purpose of design produced by the intended occupancies, including distributed and concentrated load, etc. for defferent areas are as follows:

Snow load = 30 psf

Live load on roof slab = 30 psf

e. Material

Concreate strength 4,000 psi = 27.6 N/mm^2

Steel reinforcement Grade 60

Yield strength 60 ksi = 414 N/mm^2

(2) Technology transfer and on-the-job training

The team intends to transfer seismic resistant design technology to the local officers/engineers/technicians. Especially, seismic design concept for the structural design.

4.4.2. Architectural Design

(1) Building Layout

Building layout is to follow and minor modification of the standard plan including an inner courtyard authorized by the NESPAK. It is an effective semi-enclosed space for outdoor multi-activities, i.e. assembly court, playground, outdoor lecture, buffer space, and so on.

(2) Roof Shape

In terms of roof shape, the design is a combination of shed roof (single-pitch roof) and ridge roof (gable roof) effective for safe waterproofing by quick runoff of rainwater. And these triangular spaces (between flat beam/ceiling and roof slab) will be effective buffer spaces for heat insulation.

(3) Material Selection

In order to promote the local economy, the Project aimed at utilizing local products for building materials and local manpower. After the JICA Project Team had examined the

procurement availability of local materials and workers and their quality and level, the building design was simplified, adopting ordinary construction methods and techniques.

(4) Structure System

The design calls for construction of a seismically resistant structure system applying reinforced concrete with a single story.

(5) Standard Size of Classroom

Size of classroom (7,300 x 5,500 m) follows the school facility standard of Pakistan, i.e., 7,315 x 5,486 m (24 x 18 ft).

(6) Specific Education Room

Laboratory for related functions such as computer training, science education and library are provided.

(7) Inner Courtyard

A semi-closed courtyard is created by a U-shaped building layout for outdoor multi activities with a platform (stage) and two flagpoles.

(8) Consideration for Disabled People

To avoid any barrier of access by disabled persons a ramp with moderate slope and with handrails are situated on at least one side of every staircase.

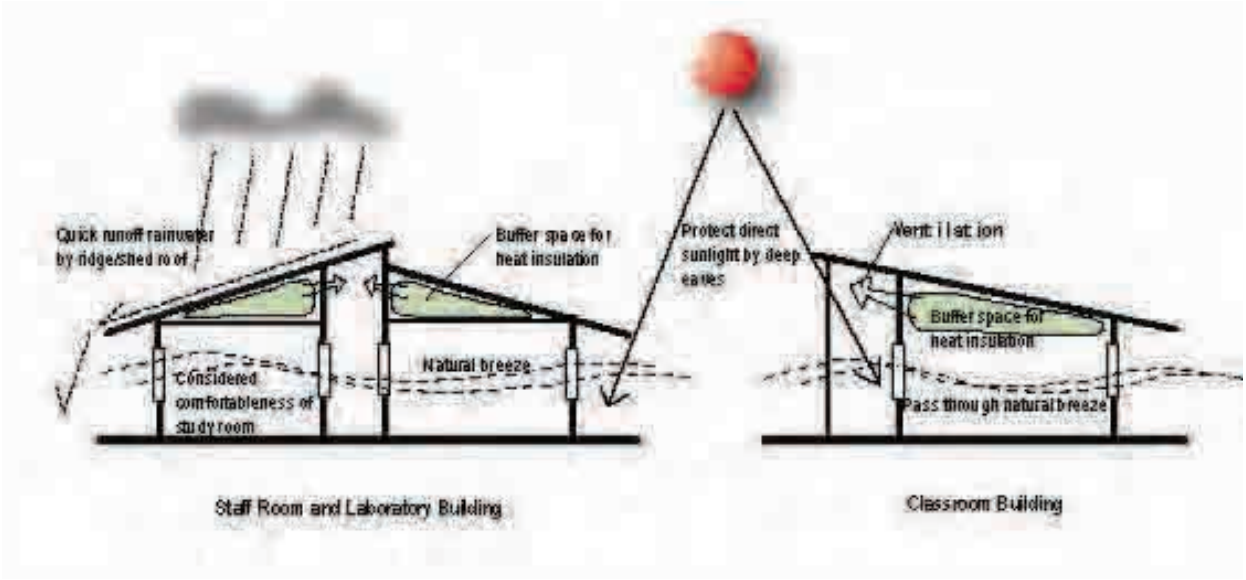
(9) Water Reservoir

Provision is also made for enough volume from an elevated water tank to supply not only the latrines, kitchen and garden but also the needs of evacuated people in case of emergency.

Table 4.4.1 Facility to be Constructed by the Project

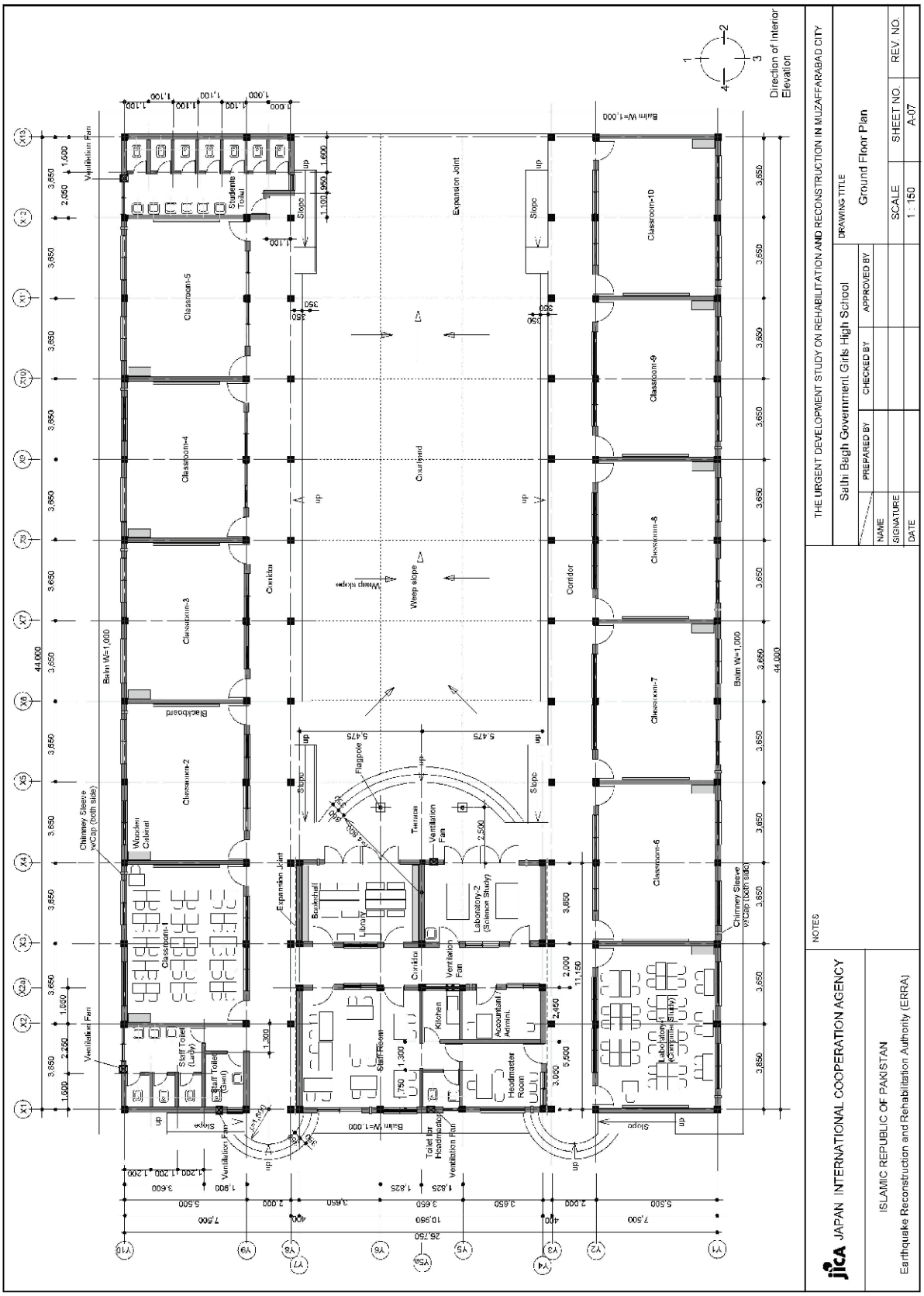
Site Area	1,293.33 sqm. (14,058 sqf.)
Number of Classrooms to be Constructed	10 classrooms (same as before earthquake) Size of classroom 7,300 x 5,500 m (24 x 18 ft)
Number of Laboratories to be Constructed	3 rooms (Computer lab. Science lab. & Library)
Total Floor Area	783.69 sqm. (8,518 sqf.)
School Grade	Grades 1 to 10 - Primary school: Grades 1 to 5 - Junior high school: Grades 6 to 8 - High school: Grades 9 to 10

Source: JICA Study Team



Source: JICA Study Team

Figure 4.4.1 Building Design Concept



Source: JICA Study Team

Figure 4.4.2 Ground Floor Plan

4.5. Contractual Arrangement

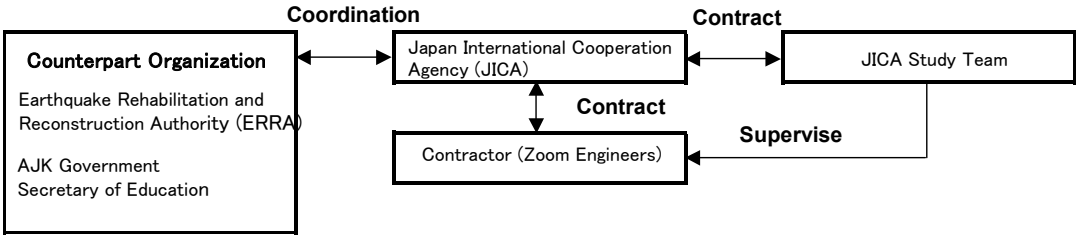
In order to commence construction of the school, necessary arrangements for the ordinary bid process on a Local Competitive Bidding (LCB) basis were made. The bid documents were prepared for distribution to the contractors and bid notifications were announced to Class-1 qualified bidders through advertisements in three major newspapers.

The bidding was processed in early August 2006, qualified bidders were evaluated initially, which were assessed their technical capacity, financial capability and equipment/manpower availability through submitted documents. Then, it was evaluated their price offer. As a result, one reliable contractor was selected as the contractor.

4.6. Construction of School

4.6.1. Organization of School Construction

Organizations for the construction works supervision are summarized as follows:



Source: JICA Study Team

Figure 4.6.1 Organizations for the Construction Works Supervision

JICA Pakistan Office and Zoom Engineer, the contractor, is signed the agreement of the school construction. JICA study Team is supervise the construction of school on behalf of JICA Pakistan Office.

4.6.2. Method of Supervision

In general, supervision of the construction works covered four items:

- Construction schedule management
- Quality control
- Cost management
- Safety control

More specifically, the construction supervision services are based on the following duties and responsibilities:

- Supervision of the contractor's construction program and quality control, by such means as approval and inspection of construction materials and works.
- Inspection and approval of dimensions, and numbers of the constructed works and facilities.
- Minor alterations to the tender specifications and drawings.
- Preparation of reports and papers as required by ERRA and JICA.

The above services were required from commencement of the construction to completion of all the construction works. Throughout the construction period, the Study Team Engineer is assigned to the Project's site to supervise and coordinate the construction works. Experts in several professional fields were dispatched to the Project site, in addition to the Study Team Engineer, as deemed necessary, for smooth implementation of the work.

The major construction works consisted of the following:

- Preparatory work such as building temporary access gate/fence and setting up temporary office
- Site clearance and initial grading
- Construction of school building
- Paving and landscaping around the new buildings
- Construction of boundary fence
- Improvement of access road

4.6.3. Project Management

(1) Subject of the Study Team's Management

It was clearly pointed out what the Study Team checked, controlled and managed in this Project. The Study Team's management activities consisted of the following four subjects:

a. Document Checkup

The Consultant checked, controlled and managed the materials as well as methods which the Contractor employed, and the results which the Contractor thereby created, by the documents that the Contractor sent to the Consultant for approval, in light with the specifications stipulated in the tender documents.

b. Job-Site Checkup

When construction work was ordinarily going on, the Consultant attended to the Contractor's work practices and inspection activities at construction site, as the need arose. It should be noted, however, that the Consultant was not an inspector who works jointly with

or on behalf of the Contractor, but a checker looking over whether the Contractor's work practices and inspection activities were appropriately carried out in accordance with the specifications in the tender-documents.

c. Completion Checkup

When a given part or entire part of the Project's work was completed, in accordance with the Contractor's written request, the Consultant inspected the completed work to determine whether the work was completed according to the specifications.

d. Report

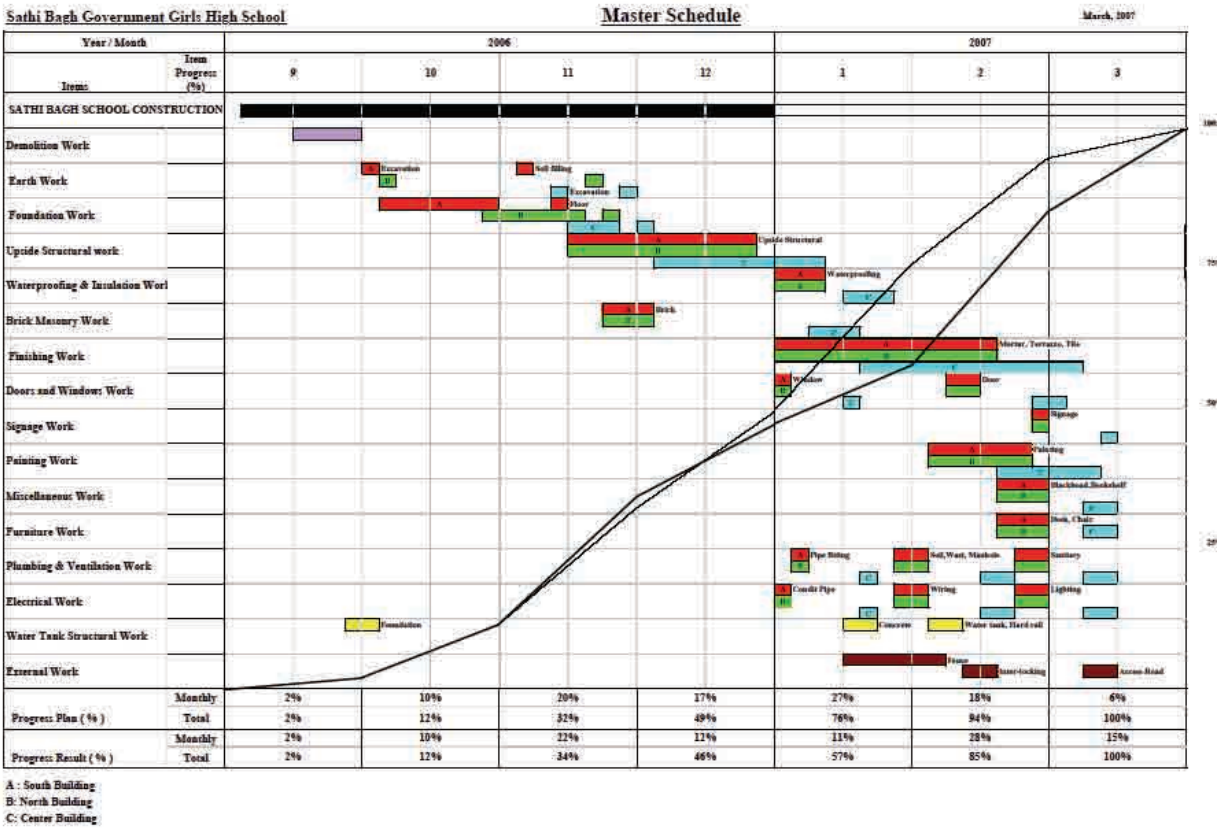
The Study Team gave a progress of the project as Monthly Report to ERRA and JICA.

(2) Progress Control

The Study Team carried out a progress control of this project as scheduled and completed within contract period.

a. Construction Schedule Chart

Construction schedule was shown below as an example. The actual progress was different from the figure.



Source: JICA Study Team

Figure 4.6.2 Construction schedule

b. Progress Report

The Study Team checks the progress report submitted by the contractor every month and reports to the JICA, ERRA and AJK government as monthly report. Monthly reports contained the progress, results of quality test, data of construction materials, instruction letter, schedule of next month and any events.

(3) Quality control

a. Quality Control Process

Quality Control (QC) should be carried out in conformity with the designs and specifications in the Tender Documents and should be based on the internationally authorized standards stipulated in the Tender Specification.

In this Project, a process of QC was summarized in the following table.

Table 4.6.1 Quality Control Set-up Before the Work

QC Process Flow			
What should be inspected as QC?	What document should be produced as QC?	Who should produce such document as QC?	Who should check and approve such document as QC?
1.Construction Method	Shop Drawing Approval Docs. Work Execution Plan	The Contractor	The Study Team
2.Installation Method	Shop Drawing Approval Docs. Work Execution Plan	The Contractor	The Study Team
3.Materials			
(1) Construction Materials (ex. cement, aggregate, re-bar, pipe, valve, fitting, etc.)	Shop Drawing Approval Docs. Work Execution Plan	The Contractor	The Study Team
(2) Operation Equipment (ex. chemical dosing system, flow meter, etc.)	Shop Drawing Approval Docs. Work Execution Plan	The Contractor	The Study Team

Source: JICA Study Team

b. Analysis and Tests for Quality Control

Testing and analysis of the following items for quality control were done by the Contractor.

Table 4.6.2 Items for Test and Analysis

Test Item	Standard	Remarks
Water Content	ASTM-D2216	soil condition at site
Grain Size Analysis	ASTM-D421	ditto
Permeability Test	ASTM-D24-34	ditto
Compaction Test	ASTM-D1557	ditto
Specific Gravity	ASTM-D853	ditto
Direct Shear	ASTM-D3080	ditto
Atterberg Limited	ASTM-D423-425	ditto
Consolidation Test	ASTM-D243	ditto
Triaxial Compression Test(CD)	ASTM-D4768-88	ditto
Unconfined Compression Test	ASTM-D2166-66	ditto
Density Test(field)	ASTM-D1556	ditto
C.B.R	ASTM-D1883	ditto
Compressive Strength Test	ASTM-C39-83b	for Concrete
Slump Test	ASTM-C505-509	ditto
Hydrostatic Test		Pressure and leakage for pipes installation

Source: JICA Study Team

Regarding material and workmanship, the JICA Study Team prepared the inspection sheet and control the quality on the following items.

Table 4.6.3 Quality Control Items

Quality Item		Test/Inspection/Check/Measurement
Material	Concrete	Design mix, Compression Test、Temperature of concrete and air, slump test、Inspection of concrete factory, Check of method statement,
	Re-bar	Mill sheet
	Cement	
	Brick	Sample check
	Tile	
	Drain material	
Workmanship	Fabrication of re-bar	Measurement of dimension
	Formwork for concrete	Observation

Source: JICA Study Team

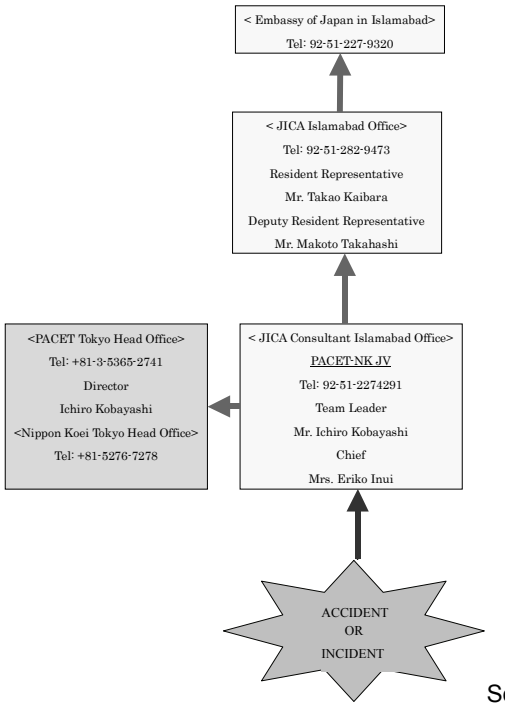
c. Controlling Form of the Work Done

The plan of the controlling form of the work done was shown in the table below; photos were taken of all works.

4.6.4. Safety Control

(1) Emergency Contact Numbers and Organizations

The emergency contact numbers and organizations in case of accident and emergency were shown in the figure below.



Source: JICA Study Team

Figure 4.6.3 Emergency Contact Numbers and Organizations

(2) Safety Control Check Points

To ensure a safe and clean work environment, the following items were checked. The Study Team requested the Contractor to submit the safety control activities report every month.

a. General

- Advance confirmation of working method, procedures and staff in charge for each work
- Port of helmet and safety shoes
- Work stoppage due to bad weather condition with strong wind and/or heavy rain

b. Mobilization, setting-up and demobilization

- Prohibition of over-loading and pre-studying of the access condition
- Prohibition of entering within the working radius of a crane
- Ensuring safety and working passes
- Placing fire extinguishers at appropriate locations
- Keeping the site clean and putting machinery, equipment and hand tools in order after the work

c. Earth work, Concrete work, Housing Work, etc.

- Inspection of machinery, equipment (checking oil level, wire slings, etc.) and hand tools prior to the commencement of work

- Paying attention to safety around workers and ensuring a signal between operator and assistants during the operation of construction equipment.

4.7. Operation and Maintenance

A well-maintained school environment does not only enhances learning and gives prestige to the school but also helps the government to save on costly repairs, restoration or rehabilitation of school facilities. School maintenance, therefore, being a major management function, must be given serious attention by school officials. The up-keeping of school facilities, including school site and buildings, furniture, and other equipment/tools/materials is necessary for effective learning.

4.7.1. Maintenance

Maintenance of school facilities can be classified into three types:

- **Daily Maintenance** is the proper use and daily care of school facilities. It includes routine activities intended to keep facilities in operation such as cleaning, lubricating, adjusting or even replacing minor parts.
- **Preventive Maintenance** is application of appropriate measures to prevent damage or deterioration. Examples of preventive maintenance are checking of furniture, doors, and windows for loose nails and hinges, and application of wall coating/repainting for scribbling marks. An effective preventive maintenance program requires assessment of items' functionality to record their physical condition so that damage or undue deterioration can be avoided by appropriate action.
- **Emergency Maintenance** is the application of urgent measures, which may be temporary in nature, to avoid greater damage. An example of this is the temporary repair of leaking roofs, while processing requirements for permanent repair work.

4.8. Impact of Pilot Project

Since the pilot project is a first permanent building in Muzaffarabad, it enhances earthquake resistant design manual preparation, construction permit issue process and construction related administration. In order to construct a seismic resistance building, Japanese construction engineer instructed construction method at site during construction and transferred the construction techniques. Since Japanese engineer instructed construction period management, the construction was finished on time. Through those activities, it is possible to transfer technology in terms of seismic resistance design, construction permit

process, building construction technology and other construction related technology to the Pakistani side.