

6. REHABILITATION AND RECONSTRUCTION OF SOCIAL INFRASTRUCTURE

The 2005 earthquake is arguably the most debilitating natural disaster in Pakistan's history. Pakistan-administered Kashmir, known as Azad Jammu and Kashmir (AJK), and the eastern districts of the North West Frontier Province (NWFP) bore the full force of the earthquake in terms of number of lives lost, injuries sustained, and destruction of infrastructure and economic assets. This social infrastructure assessment report emphasizes the need to take into account guiding principles for rehabilitation and reconstruction of social infrastructure in Muzaffarabad municipality.

6.1. Review of Existing Social Infrastructure in Muzaffarabad Municipality

The social infrastructure buildings in Muzaffarabad Municipal Area are classified as follows (their locations are shown in Appendix A.6.1).

6.1.1 Administration Buildings

The administrative buildings in Muzaffarabad city are scattered at different locations. The details are shown in Appendix A.6.2.

About 74% of the administrative buildings are made of stone and concrete block masonry. The masonry structure buildings are badly damaged. Almost all the walls of most buildings have major and minor cracks. After the recent earthquake, about 11 of the 33 administrative buildings are totally collapsed while the other 22 buildings, masonry and frame structures, have severe cracks in their columns and beams. The Public Works Department (PWD) building is also completely damaged. The masonry walls in RCC frame structures are also badly damaged. Some of the administrative offices are in working condition. Several completely damaged government offices have put up temporary shelters to be able to function. The AJK Government has a plan to construct the administrative and residential buildings within a year.

6.1.2 Medical / Hospital Buildings

In Muzaffarabad city there are five government hospitals. Their locations are mentioned in Appendix A.6.2. District Health Office (DHO / Civil Hospital, Combined Military Hospital and Leprosy Center constructed of concrete block masonry are completely damaged. The outer columns and beams of one portion of Combined Military Hospital (CMH) have severe cracks but the building is currently in operation. The only hospital in better condition with minor damages is Abbas Medical Institute, which is also in operation.

6.1.3 Educational Buildings

The situation of educational buildings is so much worse. Of a total 33 educational buildings in the city, 17 buildings constructed of concrete block masonry are completely collapsed. The rest of the buildings have cracks and major damages in slabs and load bearing walls. The few RCC frame structures have damages in columns, beams, slabs and walls. Some structures have minor cracks but they are not safe for use and require proper maintenance.

6.1.4 Civil Works / Telecommunication Buildings

Telecommunication building and facility, which is one of the important components for communication and efficient service delivery, was also severely damaged. Although telecommunication services were restored immediately, a lot of the restorations of the buildings were underway. Many of the telecommunication buildings were either destroyed or severely damaged.

The Makri water supply facility, which is an RCC frame structure, has minor cracks. The other stone masonry buildings have major damages as shown in Appendix A.6.2. Currently these building are in operation but they require proper repairs.

6.1.5 Army Buildings

With regard to army buildings, these are located in a restricted area and require special permission from Army Headquarters for a survey to be conducted. This is the reason why damage surveys for these buildings are yet to be conducted.

6.1.6 Industrial / Commercial Buildings

Industrial buildings are situated at different locations in Muzaffarabad municipality. Out of 8 buildings 2 are completely damaged and the rest of the buildings are of concrete block masonry with only one RCC frame structure. The load bearing walls of masonry structures have major cracks. The employees work out from tents and shelters at present.

6.1.7 Residential Buildings for Public Use

All public residential buildings are constructed of stone and concrete block masonry. Two residential buildings are completely damaged while others have major cracks in masonry walls and slabs, but still, people are occupying these damaged houses. Their living conditions are already harsh and proper restoration therefore is required for the safety of the people, at the least.

6.1.8 Public Service Buildings

Nine public service buildings are completely destroyed. The structure types of existing buildings are RCC frame and concrete block masonry. The masonry walls are damaged, slabs have major cracks and some parts of the buildings are completely collapsed with only

the front structure standing. The RCC structures have damages in columns and beams and slabs. The only building in good condition is the Muzaffarabad Development Authority (MDA) office, which is under construction. Some of the offices have set up work areas in tents and shelters. The buildings having less damage can be used after proper retrofitting.

6.1.9 Other Buildings

The list of other buildings in the area is shown in Appendix A.6.2. Four masonry structures are completely collapsed. The buildings that are still standing have major masonry cracks, with some buildings badly damaged but still being occupied in spite of the potential risk of collapse. The RCC structures are also damaged with exposed reinforcement in beams and columns. Some buildings are in use after undergoing repairs but others are not serviceable and require adequate repairs.

6.2. Construction and Management Organizations

A hearing survey was conducted in Public Works Department (PWD) of Muzaffarabad about which organization is taking charge of construction of facilities, and who is carrying out management of the government facilities in each category. Although the PWD had constructed almost all of the facilities, there has been a tendency in recent years for individual organizations to take charge of building their own facilities. As for the management, all the facilities are managed by the concerned organization itself. The management organization for public housing and road infrastructure is Muzaffarabad Development Authority (MDA).

The hearing survey results are summarized as follows and details can be found in the appendix.

6.2.1 Administration Buildings

Of the 37 administration buildings in Muzaffarabad, 19 (51%) are built by Public Works Department. Three (8%) are built by Kashmir Council Federal Government, namely, the Income Tax Office, Excise Office and Accounting General Office. The rest of the buildings are built by the organization concerned of the facilities itself.

6.2.2 Medical / Hospital Buildings

Construction of all the facilities within the municipal area is carried out by Public Works Department.

6.2.3 Education Buildings

Thirty-one facilities (89%) are built by Public Works Department. Among the remaining institutions, Federal Girls Neelum Public School is built by the Federal Government, and the

other three facilities (AJK University x 2, Forest Training School) are built by the organization concerned of the facilities itself.

6.2.4 Civil Work / Telecommunications Buildings

The AJK Radio Station is built by the Federal Government, and the Grid Station is built by WAPDA (Water and Power Development Authority); the other three facilities are built by Public Works Department.

6.2.5 Army Buildings

Although some facilities were built by Public Works Department, almost all facilities are built by the army themselves.

6.2.6 Industrial / Commercial Buildings

Among nine facilities, the municipal mutton market is built by Municipal Corporation, and the match factory is constructed by Industrial Department. The government poultry farm and material testing laboratory are built by Public Works Department. The remaining three facilities are built by the organization concerned of the facilities itself.

6.2.7 Residential Buildings for Public Use

Eight of 13 facilities, or 62%, are built by Public Works Department. Radio Colony is built by the Federal Government, and the other four facilities are built by the organization concerned of the facilities itself.

6.2.8 Public Service Buildings

GPO (General Post Office) and City Post Office are built by the Federal Government. Municipal Corporation erected the new bus stand and is responsible for Neelum Park Tali Mandi. Among the remaining 19 facilities, 8 facilities (30%) are built by the organization concerned of the facilities itself and 11 facilities (41%) are built by Public Works Department.

6.2.9 Other Buildings

The municipal slaughterhouse was built by Municipal Corporation. Meanwhile, the Federal Government is responsible for the Forte, Neelum Stadium, the high power transmission and AJK TV booster. Eleven facilities (48%) are built by Public Works Department.

6.3. Damage Inventory Survey

The Study Team conducted the damage inventory survey for the government building structures in Muzaffarabad Municipal Area. Figure 6.3.1 shows the summary for survey

results of structure damages, location of damage buildings and area of building by visual inspection. Table 6.3.2 shows the damage ratio of existing building structures.

The structure type of government buildings in Muzaffarabad is categorized into two: reinforced concrete and masonry structure using concrete block, stone or bricks. Hence, the criteria for the judgment of damage situation were settled in these two types of the structure as shown below.

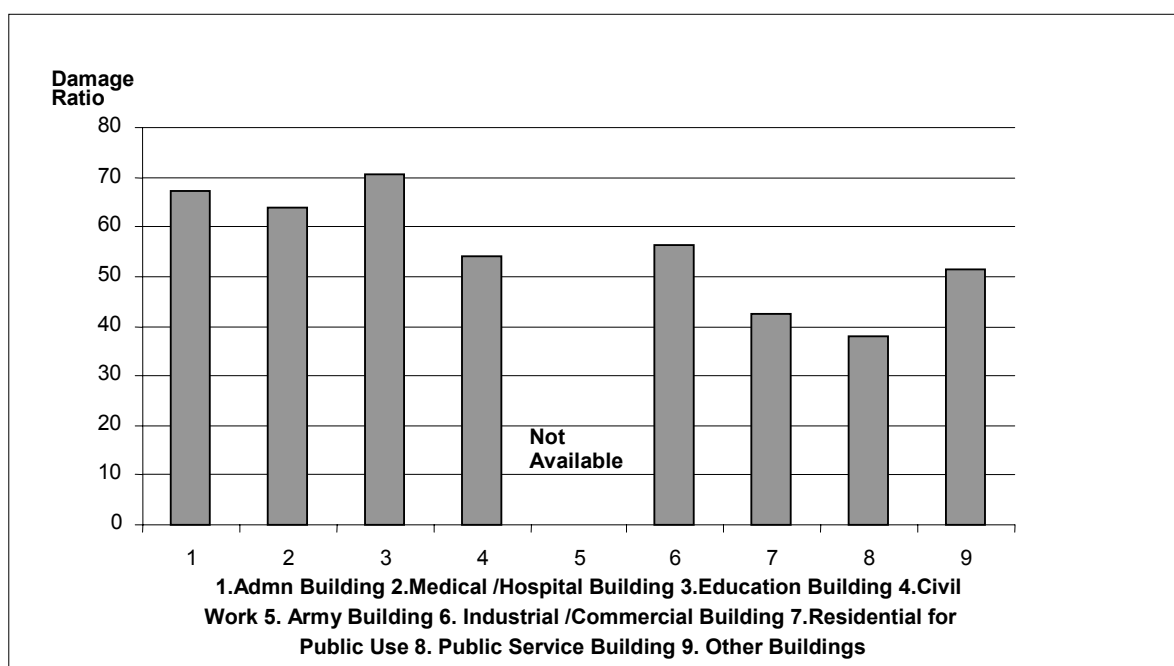
Table 6.3.1 Damage Assessment Criteria

Concrete structure building	
Damage in a non-structure wall or finish although there is no damage in the main structure	0 – 15%
A slight crack in the main structure of a column, a beam, and a floor	16 – 50%
A big crack in the main structure of a column, a beam, and a floor	51 – 85%
Main structure has a crack and building is leaning on its side	86 – 99%
Completely collapsed / demolished	100%

Masonry structure building	
Finishing of wall surface has damage although there is no damage in structure	0 – 15%
Slight crack in the main structure of a wall and a slab	16 – 50%
Big crack in the main structure of a wall and a slab	51 – 85%
Main structure has a crack and building is leaning on its side	86 – 99%
Completely collapsed / demolished	100%

Table 6.3.2 Damage Ratio of Government Buildings

S#	Type of Building	No of Buildings Surveyed	Demolished	Damaged	Damage Ratio
1	Administration Buildings	33	11	22	67.34
2	Medical / Hospital Buildings	5	2	3	63.67
3	Education Buildings	35	17	18	70.5
4	Civil Work	5	1	4	54
5	Army Buildings	N.A.	N.A.	N.A.	N.A.
6	Industrial / Commercial Buildings	8	2	6	56.24
7	Residential for Public use	12	2	10	42.5
8	Public Service Buildings	27	5	22	37.96
9	Other Buildings	20	4	16	51.49



Source: JICA Study Team

Figure 6.3.1 Damage Ratios of Government Buildings

6.4. Critical Issues of Government Buildings

6.4.1 Physical and Social Infrastructure

Restoring the region's basic physical and social infrastructure is the key for improving the rate of re-establishing the community. In particular, it is important to focus on reconstruction of building structures, rehabilitating power and water connections and ensuring communications links.

6.4.2 Repairing and Retrofitting of Existing Structures

Buildings in Pakistan are generally vulnerable to earthquakes. During the reconstruction phase, repair of both damaged and vulnerable buildings needs to include seismic strengthening beginning on a priority basis with especially schools, hospitals as well as government administration buildings.

6.4.3 Public Infrastructure Issues

A significant amount of public infrastructure was severely damaged by the recent earthquake. Safety and serviceability of public buildings such as schools and hospitals is of prime importance, and their reconstruction should incorporate improved building standards to reduce their risk of future collapse or damage.

A vital issue for public infrastructure is to review the still standing, less damaged structures and prepare designs for public buildings ensuring that seismically appropriate standards are applied.

6.4.4 Water and Sanitation Issues

Provincial authorities in consultation with district governments, civil society and communities should develop immediate policies for the rehabilitation and reconstruction of water and sanitation infrastructure in Muzaffarabad. These policies must be in coordination with the housing sector strategy.

6.4.5 Seismic Hazard Issues

Seismic resistance considerations indicate that similar or larger events in the same or neighboring regions are possible. A seismological monitoring network exists but is in need of modernization. Efforts to undertake a new seismic risk analysis of AJK should also be intensified.

6.4.6 Environmental and Social Issues

Geographical conditions and the absence of adequate waste management pose a severe environmental problem. Safe and controlled disposal of rubble and designation of waste disposal zones should be immediately identified and communicated to the communities through hygiene programs, particularly in densely populated areas.

6.5. Proposal for Priority Project on Building Structure

6.5.1 Hospital and School

As mentioned above, there are five hospitals in the municipal area of Muzaffarabad of which two major hospitals are completely collapsed. The other three hospitals are small in scale that they are unable to effectively meet the needs of Muzaffarabad. This has never been more evident than during the earthquake of October 8, 2005, when a tremendous number of victims were brought in needing immediate medical attention. Construction of new hospitals and rehabilitating the existing medical infrastructure are the first priority for the municipality followed by school buildings.



Photo 1

Photo 2

Photo 3

Photos 1 & 2 show the temporary hospital on the site of completely collapsed DHO/Civil Hospital. Photo 3 shows the site of completely collapsed CMH.

It was mentioned earlier that most of the educational buildings constructed of stone and concrete block masonry were completely collapsed causing huge loss of lives. Therefore, second priority should go to construction of the educational infrastructure so that students can continue with their schooling. Therefore, strengthening of the existing infrastructure and constructing new educational buildings are of prime importance.



Photo 4

Photo 5

Photo 6

Photo 4 shows the existing condition of Government Boys College, Eidgah Road.

Photo 5 shows the collapsed SOS school, Makri. Photo 6 shows the partially collapsed structure of Government Girls College near Imam Bargah.

6.5.2 Other Government Infrastructure



6.6. Comparison of Private Buildings and Government Buildings

The general types of buildings, both private and government, in Muzaffarabad city are as follows.

- RCC Frame structure buildings
- Concrete Block Masonry buildings + RCC Slab roof
- Concrete Block Masonry building + steel sheet roof
- RCC Frame structure + concrete block masonry buildings
- Stone Masonry Buildings
- Brick Masonry Buildings

By visual inspections of the Study Team during the survey it was observed that, in the municipal area, the damages in private buildings are less than in government buildings and that the percentage of unserviceable and collapsed buildings for government sector is on higher side. From this it can be concluded that the quality assurance and construction

supervision of government buildings was not satisfactory. Further, the private buildings that are now completely collapsed were non-engineered buildings whereas the government buildings must have had followed the proper design and construction method.

6.7. Building Code and its Enforcement Practice

From discussions with the Executive Engineer of Public Works Department of Muzaffarabad it was known that they have no building codes for Muzaffarabad city. The private and government building constructions until now are not according to any building code specified by the department. Therefore, the government should take steps to make sure the implementation of building codes in future constructions.

6.8. Urban Planning Laws and Regulations Regarding Building Construction

It also came out during the discussion with the Executive Engineer of PWD that urban planning laws have yet to be prepared by AJK government and that it has been following urban planning laws of Rawalpindi Development Authority, which are not in common practice.

6.9. Strategies for Government Buildings

Whilst rehabilitation may require fewer resources than construction of new buildings, the following are expected to be required for timely rehabilitation:

- Planning and technical support to communities for reconstruction, and repair and enhancement of damaged community schemes;
- Technical support to local government agencies for project planning, design, implementation, contracting, supervision and monitoring; and
- Strategic packaging of rehabilitation works based on sound geographical grouping and outsourcing. Different options to be considered include deputation from professional institutions and/or departments in other provinces in the country, recruitment of incremental staff and active engagement of NGOs.

6.9.1 Building Type

Most of the damaged and collapsed government buildings were constructed of concrete block masonry and stone masonry with RCC concrete roof slab. Few buildings which are damaged but not collapsed are RCC frame structure buildings. Therefore it is suggested that the new construction for government buildings must be properly designed and constructed as RCC frame structure or steel structure buildings considering the seismic parameters of declared seismic zone-4.

6.9.2 Inter-sectoral Coordination

Inter-sectoral coordination is essential to adequately address the needs of the affected population and minimize implementation delays in the reconstruction process. Consistency with the housing sector strategy and overall approach is of particular relevance.

6.9.3 Financial Sustainability

In addition to geographical location, the quality of engineering design, the quality of construction and quality of facility operation and maintenance can reduce vulnerability and positively contribute to disaster mitigation and preparedness. Improved scheme sustainability should be considered in the medium to long term, as well as in the selection of repair and improvement measures.

Regarding the major government buildings, reconstruction in earlier stage, and rehabilitations and reconstructions in mid-term stage are listed in tables below.

6.10. Priority Projects

As mentioned above the priority is to construct the Medical & Education buildings and Administration buildings and so on. On that basis, the Study Team makes a stage-wise plan: Stage-1 includes those projects which are most important (see Table 6.10.1). While in stage-2, all the other buildings not coming under stage-1 are included (see Table 6.10.2).

Stage-1: Priority Projects

Stage-2: Long List Projects

Table 6.10.1 Priority Project

Serial No.*1	Name of Facility	Location	Floor Area *2	Rationale
1.6	Municipal Corporation Building / Senior Superintendent Police (SSP) Office	Kachery Road	418 m ²	Totally collapsed; quick recovery is needed for safety and security of municipal area
1.19	Office Public Works Department	Old Secretariat	400 m ²	Quick recovery is need for public administration and urban function
1.21	Office Usher Zakat	Narul	420 m ²	For assisting poor people
2.4	Jinnah Dental Hospital	Center Plate	1,254 m ²	Still operating under dangerous conditions; no other public dental hospital existing
2.6	District Health Office (DHO) / Civil Hospital	Kechary Road	836 m ²	Totally collapsed and it is the only public general hospital
3.4	District Education Office	Eidgah Road	700 m ²	Totally collapsed and needed for quick recovery of education sector
3.9	Government Primary School	Sathi Bagh	700 m ²	Totally collapsed and needed for quick recovery of primary education
3.13	Government Industrial Girls School	Madina Market	500 m ²	Almost collapsed and needed for quick recovery of girls primary education
6.1	Industry Department	Eidgah Road	2,500 m ²	Totally collapsed and there is not any shelter even until now
6.3	Government poultry Farm	Upper Adda	2,000 m ²	Strong need and high demand of citizens
8.5	City Police Station	Main Bazar	250 m ²	Needed for regulating the daily city manners
8.10	Government Printing Press Office	Near Neelam Bridge	1,254 m ²	Needed for public relations and announcement
8.21	Khurshid National Library	Jalalabad	250 m ²	Totally collapsed and needed for basic infrastructure of people's life
9.13	State Guest House	Saheli Sarkar	1,840 m ²	Totally collapsed and needed for federal government officers and other VIPs
9.14	Press Club	Saheli Sarkar	1,254 m ²	Totally collapsed and needed for public relations on government activities

Note: *1 Serial No. in Bldg. Damage Survey Table

*2 Building Floor Area (Before damage)

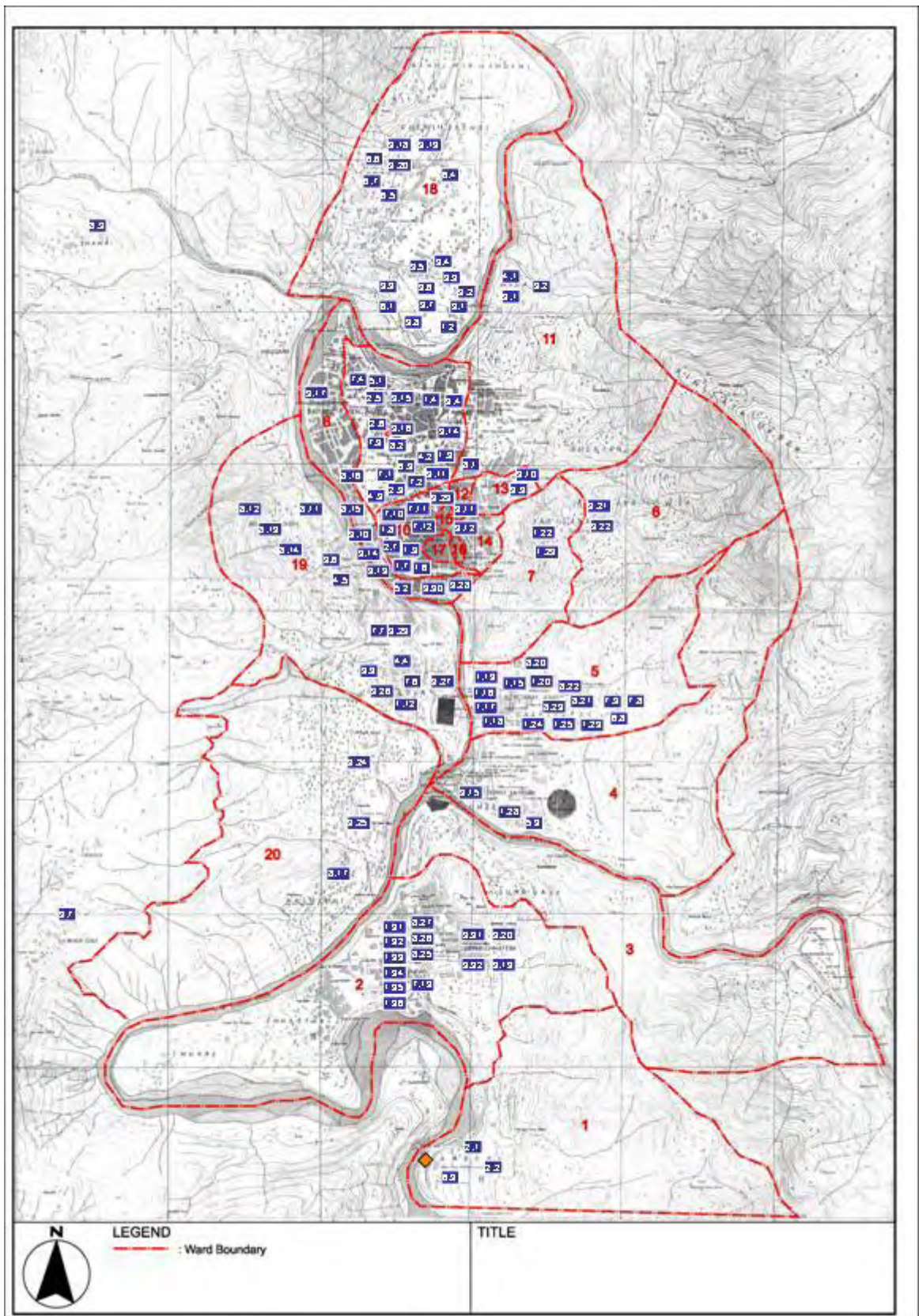
Table 6.10.2 Nominated Buildings for Long List Projects

Serial No.*	Projects	Serial No.*	Projects
	1. ADMINISTRATION BUILDING	3.10	Distt: Education Office
1.1	Local Government Directorate	3.11	AJK University Old Campus
1.2	District Council	3.12	Govt. Girls High School/College
1.3	Municipal Corporation Muzaffarabad	3.14	Forest Training School
1.4	Forest Extension Office	3.15	Govt Vocational Institute
1.5	Environment Protection Institute (EPI) Office	3.16	Elementary Teachers
1.7	District Council & Distt: Administration	3.17	Govt. Jinnah Pilot High School
1.8	Distt: Zakat Office	3.18	AJK University New Campus
1.9	Income Tax & Excise Office	3.19	Govt Boys High School
1.10	SCO Office	3.20	Govt Girls High School
1.11	Forest Directive	3.21	Ranjata High School
1.12	Directorate for Agriculture	3.22	Ranjata Primary School
1.13	Accountant General Office	3.23	Boys Elementary School & College for Men
1.14	MDA Sathra Park	3.24	Girls Middle School
1.15	Office Custodian	3.25	Boys Primary School
1.16	Income Tax Office	3.26	Girls Secondary School
1.17	Okaf Office	3.27	Boys High School
1.18	Small Industries Emporium	3.28	F.G. Neelum Public School
1.7	District Council & Distt: Administration	3.29	Girls High School
1.20	Presidential Secretariat	3.30	K.G. School
1.22	ISI Office	3.31	Govt. Boys High School
1.23	MDA Office	3.32	Govt. Model Science College
1.24	Civil Defense Office	3.33	Primary School
1.25	SSP Office	3.34	Girls Inter College
1.26	CIA Office	3.35	Primary School
1.27	Agriculture Secretariat		
1.28	PWD Domel Office		4. CIVIL WORK/TELECOMMUNICATIONS BUILDING
1.29	Building Municipal Corporation		
1.30	Forest Office	4.1	Ground Water Supply Scheme
1.31	Supreme Court	4.2	Civil Supply Store
1.32	High Court	4.3	AJ K Radio Station
1.33	Assembly/Hostel	4.4	Grid Station
1.34	FWO Office	4.5	Water Supply Pumping Station
1.35	Bank Square		
1.36	Office of AKLAS		5. ARMY BUILDING
1.37	SCO Office	5.1	4 Field Army Avn.
		5.2	5 AK Bdg.
		5.3	1 AK Bdg.
	2. MEDICAL / HOSPITAL BUILDING		
2.1	Abbas Medical Institute		
2.2	Veterinary Grass Farm		6. INDUSTRIAL/ COMMERCIAL
2.3	CMH Muzaffarabad	6.2	Municipal Multan Market
2.5	TB Leprosy	6.4	Old supply
		6.5	Industrial State
		6.6	Industrial Department
	3. EDUCATIONAL BUILDING	6.7	Sewing Machine Plant
3.1	Govt. Agro Technical College	6.8	Material Testing Laboratory
3.2	Education Extension Centre	6.9	Match Factory
3.3	College Hostel		
3.5	Elementary Education Directive		
3.6	Secondary Education Directive		7. RESIDENTIAL FOR PUBLIC USE
3.7	Post-Graduate College for Men	7.1	Dean's House
3.8	Govt Pilot High School	7.2	Radio Colony

Serial No.*	Projects	Serial No.*	Projects
7.3	Residential Forest Quarters	8.20	GPO
7.4	Tourism Rest House	8.22	Jalalabad Park
7.5	Residential Colony (Electricity)	8.23	Office of Electricity Supply
7.6	Residential Colony (Agriculture)	8.24	Office of Transport Authority
7.7	WAPDA Colony	8.25	GPO Office
7.8	Officers Colony	8.26	Directorate for Tourism
7.9	Prime Minister's House	8.27	BOT Petrol Pump
7.10	Minister's Colony		
7.11	Kashmir Council Colony		9. OTHER BUILDINGS
7.12	Residential Colony (Non Gazated)	9.1	Municipal Slaughterhouse
7.13	Residential Area (ACO)	9.2	SOS Village
		9.3	Eid Gah
	8. PUBLIC SERVICE BUILDING	9.4	Old Slaughterhouse
8.1	Khurshid National Library	9.5	Officer's Club
8.2	Forte	9.6	Engineering Workshop
8.3	Fisheries Offices	9.7	Rest House
8.4	City Post Office	9.8	Nursery Abraham
8.6	Central Jail Muzaffarabad	9.9	Forte
8.7	Cooperative Bank	9.10	Neelum Stadium
8.8	National Bank of Pakistan	9.11	Guest House
8.9	Office Electricity	9.12	Narul Guest House
8.11	New Bus Stand	9.15	Animal Husbandry
8.12	Neelum Park Tali Mandi	9.16	PWD Workshop
8.13	Bus Terminal Building	9.17	Electricity Workshop
8.14	Municipal Market	9.18	Sewing Machine Plant
8.15	Police Lines	9.20	Water Supply
8.16	Dispensary Police Lines	9.21	MDA Rest House
8.17	Basic Health Unit	9.22	High Power Transmission
8.18	China Shopping Center	9.23	AJK TV Booster
8.19	Wapda Office		

Note: *The same facility number is applied in the table of "Structure Damage and Location of Damaged Buildings" in Appendix A.6.2

Appendix A.6.1 Location of Government Buildings



Note: Facility numbers in the map is applied same serial number in “Structure Damage and Location of Damaged Buildings” in Appendix A.6.2

Appendix A.6.2 Structure Damage and Location of Damaged Buildings

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition	
1. Administration Building							
1.1	Local Government Directorate	Eidgah Road	860	Masonry	Collapsed	Tents at site	
1.2	District Council	Eidgah Road	940	Masonry	Collapsed	Tents at site	
1.3	Municipal Corporation Mzd.	Upper Adda	500	Masonry	Some portion has damaged walls; slabs have major cracks.	Two rooms in use & tents at site	
1.4	Forest Extension Office	Upper Plate	430	Masonry	Collapsed	Tents at site	
1.5	Environment Protection Institute (EPI) Office	Central Plate	315	Masonry	Collapsed	Tents at site	
1.6	Municipal Corporation Building (Senior Superintendent Police (SSP) Office)	Kechary Road	418	Masonry	Collapsed	Tents at site	
1.7	District Council & District Administration	Kechary Road	1400	Masonry	Some portion is demolished, walls are badly damaged, slab is collapsed.	Tents at site and only one room at old building in use.	
1.8	District Zakat Office	Ward 16	515	Masonry	Collapsed	Wooden shelter exists	
1.9	Income Tax & Excise Office	Kechary Road	618	RCC Structure	Outer columns are damaged, beams have minor cracks, walls have major damage.	Building not in use	
1.10	Special Communication Organisation (SCO) Office	Bank Road	Restricted Area				
1.11	Forest Directive	Bank Road	1260	RCC Structure	Some columns have minor cracks, walls have minor cracks, beams have cracks.	Building in use	
1.12	Directorate for Agriculture	Gogra	680	Masonry	Half of the building is collapsed. Existing walls are badly damaged. Slabs have minor cracks.	Shelter exists	
1.13	Accountant General Office	Sathra	1254	RCC Structure	Columns are damaged Walls have minor cracks. Beams have minor cracks.	Building not in use	
1.14	Muzaffarabad Development Authority (MDA) Sathra Park	Sathra	4,180 (approx)	Park	Sustained boundary wall damage and retaining walls damage.	In use	
1.15	Office Custodian	Old Secretariat	420	RCC Structure	Walls are damaged, columns have minor cracks, beams are damaged.	Building in use	
1.16	Income Tax Office	Old Secretariat	500	RCC Structure	Column damage, Beam damage, Walls are damaged.	Not in use	
1.17	Okaf (religious) Office	Old Secretariat	417	Masonry	Collapsed	Flat area	

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition
1.18	Small Industries Emporium	Old Secretariat	640	Masonry	Collapsed	Shelter exists
1.19	PWD Office	Old Secretariat	400	Masonry	Most of the portion is damaged, walls are badly damaged.	Shelter exists
1.20	Presidential Secretariat	Old Secretariat	500	Masonry	Most of the portion is damaged, existing walls have cracks, there is beam damage, and slabs have minor cracks.	Office in use
1.21	Usher Zakat Office	Narul	420	Masonry	Walls have cracks	In use
1.22	ISI Office	Tariqabad	Restricted Area - Special Permission required from Army			
1.23	MDA Office	Tariqabad	618	R.C.C Structure	No cracks seen in the structure.	Under construction
1.24	Civil Defense Office	Jalalabad	518	Masonry	Walls have cracks, beam have cracks.	In use
1.25	Senior Superintendent Police (SSP) Office	Jalalabad	500	Masonry	Walls are badly damaged, beams have cracks.	In use.
1.26	Criminal Investigation Agency (CIA) Office	Saheli Sarkar	600	Masonry	Collapsed	Tents at site
1.27	Agriculture Secretariat	Ghari Ban	685	Masonry	Collapsed	Flat area
1.28	PWD Domel Office	Domel	700	Masonry	Collapsed	Shelter exists
1.29	Municipal Corporation Building	Jalalabad	55	Masonry	Wall are damaged, beams are damaged.	In use
1.30	Forest Office	Rashid Abad	418	Masonry	Some part collapsed, walls are damaged, slab is damaged.	Tent at site
1.31	Supreme Court	New Secretariat	3,500	Masonry + Frame	Wall are damaged, beams are damaged.	In use
1.32	High Court	New Secretariat	2,800	RCC Frame	Column are damaged, walls have cracks, beams have cracks.	In use
1.33	Assembly/Hostel	New Secretariat	3,344	R.C.C Frame	Beams have cracks, walls have cracks.	In use
1.34	Office of Frontier Works Organisation (FWO)	New Secretariat	Restricted Area - Special Permission required from Army			
1.35	Bank Square	New Secretariat	3,500	RCC + Masonry	Columns are damaged, beam & wall are damaged.	In use
1.36	Office of AKLAS (woods / logging)	New Secretariat	836	RCC Frame	Columns have cracks, beam have cracks, walls are damaged.	In use
1.37	SCO Office (Army)	Upper Chatter	Restricted Area - Special Permission required from Army			
2. Medical/Hospital Building						
2.1	Abbas Medical Institute	Ambore	1,254	RCC	Columns have minor cracks, beams have minor cracks.	In use
2.2	Veterinary Grass Farm Rarro	Ambore	Out of the Municipality Limit			

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition
2.3	Combined Military Hospital (CMH) Muzaffarabad	CMH Road	5,500 (approx)	RCC + Masonry	One portion of the building is collapsed, existing walls are badly damaged. Slab have cracks. Column have cracks.	One portion in use Under construction by UAE funds
2.4	Jinnah Dental Hospital	Center Plate	1,254	RCC + Masonry	Columns have cracks, beams have cracks, walls are damaged.	In use
2.5	TB Leprosy	Center Plate	418	Masonry	Collapsed	Flat area
2.6	District Health Office (DHO) / Civil Hospital	Kechary Road	836	Masonry	Collapsed	Tents at site
3. Educational Building						
3.1	Govt. Agro Technical College	Eidgah Road	1,672	Masonry	Collapsed	Tents at site
3.2	Education Extension Centre	Eidgah Road	1,500	Masonry	Collapsed	Tents at site
3.3	College Hostel	Eidgah Road	750	Masonry	Collapsed	Tents at site
3.4	District Education Office	Eidgah Road	700	Masonry	Collapsed	Tents at site
3.5	Elementary Education Directive	Eidgah Road	900	Masonry	Collapsed	Tents at site
3.6	Secondary Education Directive	Eidgah Road	836	RCC Frame	Collapsed	Tents at site
3.7	Post-Graduate College for Men	Eidgah Road	500	RCC Frame	Beams are damaged, columns are damaged, walls are damaged.	In use (donated by Turkey)
3.8	Govt Pilot High School	Eidgah Road	800	Masonry	Collapsed	Tents at site (donated by Turkey)
3.9	Govt Primary School	Sathi Bagh	700	Masonry	Collapsed	Tents at site
3.10	Distt: Education Office	Sathi Bagh	416	Masonry	Collapsed	Shelter exists
3.11	AJK University Old Campus	Upper adda	6,500	Masonry	Collapsed	Under construction funded by Turkey
3.12	Govt. Girls High School/College	Near Imam Bargah	10,000	Masonry	Walls are damaged, slab collapsed.	Not in use (donated by Turkey)
3.13	Govt Industrial Girls School	Madina Market	500	Masonry	Wall are damaged, slab collapsed.	Not in use
3.14	Forest Training School	Upper plate	420	Masonry	Collapsed	Shelter exists
3.15	Govt Vocational Institute	Central Plate	2,000	Masonry	Collapsed	Flat Area
3.16	Elementary Teachers	Central Plate	1,254	Masonry	Collapsed	Flat Area
3.17	Govt. Jinnah Pilot High School	Lower Plate	1500	Masonry	Slab sustained damage, walls are damaged, beam has a crack.	In use
3.18	AJK University New Campus	Challah Bandi	6,000	RCC	Wall has a crack.	In use
3.19	Govt Girls High School	Challah Bandi	1,300	Masonry	Walls are damaged, some portion collapsed.	In use
3.20	Govt Boys High School	Challah Bandi	1300	Masonry	Walls are damaged, some portion collapsed.	In use
3.21	Ranjata High School	Ranjata	618	Masonry	Columns have cracks, wall has a crack.	In use
3.22	Ranjata Primary School	Ranjata	500	Masonry	Wall has a crack, foundation settled.	In use
3.23	Boys Elementary School and College for Men	Bala Peer	1,672	RCC Frame	Collapsed	Not in use
3.24	Girls Middle School	Nalochi	300	Masonry	Wall has a crack.	In use

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition
3.25	Boys Primary School	Nalochi	200	Masonry + Beams	Walls have cracks, beam has a crack.	In use
3.26	Girls Secondary School	Gojra	1,700	Masonry	Walls are damaged, slab is damaged.	In use
3.27	Boys High School	Gojra	600	RCC	Columns have cracks, beams have cracks, walls have cracks.	In use
3.28	F.G. Neelum Girls Public School	Shoukat Line	500	RCC	Collapsed	Flat area
3.29	Girls High School	Narul	800	Masonry	One portion completely collapsed; columns have cracks, walls have cracks, beams have cracks.	Not in use
3.30	K.G. School	Saheli Sarkar	8,500	RCC + Masonry	Collapsed	Shelter exists
3.31	Govt. Boys High School	Upper Chattar	700	Masonry	Minor crack in column, minor crack in beam.	In use
3.32	Govt. Model Science College	Upper Chattar	2,090	RCC	Walls are damaged.	In Use.
3.33	Primary School	Lower Chattar	300	Masonry	Walls are damaged.	In Use.
3.34	Girls Inter College	Lower Chattar	1,200	Masonry	Walls are damaged, slabs have cracks.	In Use
3.35	Primary School	Mera Tanlian	350	Masonry	Collapsed	Flat area
4. CIVIL WORK/TELECOMMUNICATIONS BUILDING						
4.1	Greater Water Supply Scheme	Makri	2090	RCC	Columns have minor cracks, walls have cracks.	In use
4.2	Civil Supply Store	Upper Adda	500	Masonry	Collapsed	Flat Area
4.3	AJK Radio Station	CMH Road	2000	RCC + Masonry	One portion completely collapsed. Columns have cracks, walls have cracks, beams have cracks.	In use
4.4	Grid Station / Water and Power Development Authority (WAPDA)	Bela Noor Shah	600	Masonry	One portion completely collapsed, Wall have crack	In use
4.5	Water Supply Pumping Station	Bela Noor Shah	300	Masonry	Wall have major crack	In Use
5. ARMY BUILDINGS						
5.1	4 Field Army Area (CMH)	Central Plate	Restricted Area			Special Permission required from Army
5.2	5 AK Brigade	Shoukat Line	Restricted Area			Special Permission required from Army
5.3	1 AK Brigade	Domel.	Restricted Area			Special Permission required from Army
6. INDUSTRIAL COMMERCIAL						
6.1	Industry Department	Eidgah Road	2,500	Masonry	Collapsed	Demolished
6.2	Municipal Mutton Market	Upper Adda	2,400	Masonry	Collapsed	Newly constructed
6.3	Govt Poultry Farm	Upper Adda	2,000	Masonry	One Portion damage, Walla are badly damage	In Use
6.4	Old supply (foods)	Challah Bandi	500	Masonry	Collapsed	Not in Use

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition
6.5	Industrial Estate	Challah Bandi	1,000	Masonry	Walls are damage, Beams have major cracks	In Use
6.6	Industrial Department	Challah Bandi	700	Masonry	Walls are damage, Beams have major cracks	In Use
6.7	Sewing Machine Plant	Challah Bandi	350	Masonry	Walls are damage	In Use
6.8	Material Testing Laboratory	Jalalabad	500	RCC	Minor cracks in beams	In Use
6.9	Match Factory	Ambore	Restricted Area - Special Permission required from Army			
7. RESIDENT FOR PUBLIC USE						
7.1	Dean's House	Upper Adda	1,000	Masonry	Collapsed	Not in Use
7.2	Radio Colony	CMH Road	2,500 (approx)	Masonry	Collapsed	Under Construction
7.3	Residential Forest Quarters	Center Plate	1,000 (approx)	Masonry	Two flats are completely collapsed, Walls have major damage.	In Use
7.4	Tourism Rest House	Center Plate	1,000	Masonry	Walls are badly damage, Slab is damage, Beams damage	In Use
7.5	Residential Colony (Electricity)	Near Neelam Bridge	3,000 (approx)	Masonry	Walls have cracks, Slabs damage.	In Use
7.6	Residential Colony (Agriculture)	Gogra	3,500 approx	Masonry	Walls have cracks, Slabs damage.	In Use
7.7	Water and Power Development Authority (WAPDA) Colony	Bala Peer	2,500 (approx)	Masonry	Walls have cracks, Slabs damage.	In Use
7.8	Officers Colony	Jalalabad	4,000 (approx)	Masonry	Walls have cracks, Slabs damage.	In Use
7.9	Prime Minister's House	Jalalabad	1,500	Masonry	Walls have cracks, Slabs damage.	In Use
7.10	Minister's Colony	Narul	5,000 (approx)	Masonry	Walls have cracks, Slabs damage.	In Use
7.11	Kashmir Council Colony	Narul	3,000 (approx)	Masonry	Walls have cracks, Slabs damage.	In Use
7.12	Residential Colony (Non Gazated)	Narul	3,200	Masonry	Walls have cracks, slabs are damaged.	In use
7.13	Residential Area / Special Communication Organisation (SCO)	New Secretariat	Restricted Area Special Permission required from Army			
8. PUBLIC SERVICE BUILDING						
8.1	Khurshid National Library	Upper Adda	400	RCC	Outer walls have cracks.	In use
8.2	Forte	Center Plate	4,180 (approx)	Structure	Boundary walls are damage	In use
8.3	Fisheries Offices	Shawea	1,000	Masonry	Some walls are collapsed, some have cracks.	In use
8.4	City Post Office	Main Bazar	600	Masonry	Collapsed	Not in use
8.5	City Police Station	Main Bazar	250	Masonry	Room are damaged, outer walls are damaged, one story collapsed.	In use

Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition
8.6	Central Jail Muzaffarabad	Bank Road	3,000	Masonry	Collapsed	Not in use
8.7	Cooperative Bank	Bank Road	836	Masonry	Collapsed	Not in use
8.8	National Bank of Pakistan	Bank Road	900	Masonry	Collapsed	Exist shelter
8.9	Office of Electricity Supply	Near Neelum Bridge	400	Masonry	Beams have cracks, walls are badly damaged.	Not in use
8.10	Govt Printing Press Office	Near Neelum Bridge	1,254	Masonry	Beams have cracks, walls are badly damaged.	In use
8.11	New Bus Stand	Bela Noor Shah	600	RCC	Columns have cracks, beams have minor cracks, walls are damaged.	In use
8.12	Neelum Park Tali Mandi	Bela Noor Shah	8500	Park	Outer walls are collapsed.	Flat area
8.13	Bus Terminal Building	Bela Noor Shah	600	RCC	Columns have cracks, beams have minor cracks, walls are damaged.	In use
8.14	Municipal Market	Bela Noor Shah	12,540	RCC	Columns have cracks, beams have minor cracks.	In Use
8.15	Police Lines	Police Lines	8,000	RCC + Masonry	Columns have minor cracks, beams have minor cracks, walls are damaged.	In use
8.16	Dispensary Police Lines	Police Lines	150	Masonry	Walls have cracks.	In use
8.17	Basic Health Unit	Nalochi	65	Masonry	Walls have cracks.	In use
8.18	Chinar Shopping Center	Shoukat Line	435 (approx)	Masonry	Walls have cracks.	In use
8.19	WAPDA Office	Shoukat Line	380	Masonry	Wall has a crack.	In use
8.20	General Post Office (GPO)	Old Secretariat	500	RCC	There are beam cracks, column cracks, and wall damage.	In use
8.21	Khurshid National Library	Jalalabad	250	Masonry	Collapsed	Shelter exists
8.22	Jalalabad Park	Jalalabad	12,540 (approx)	Park	Boundary wall have cracks.	Plain land
8.23	Office of Electricity Supply	Jalalabad	1,254	RCC	There are wall cracks and beam cracks.	Building repair is under process
8.24	Office of Transport Authority	Ghari Ban	840	RCC + Masonry	Walls are collapsed, columns have damage, beams have damage.	Temporary shelters
8.25	GPO Office	New Secretariat	620	RCC	No cracks are seen in building.	Repairs completed
8.26	Tourism Directorate	New Secretariat	600	RCC	Wall cracks and beam cracks.	In use
8.27	BuildOperate-Transfer (BOT) Petrol Pump	New Secretariat	490	Masonry	Walls have minor cracks.	In use
9. OTHER BUILDINGS						
9.1	Municipal Slaughterhouse	Makri	210 (approx)	Masonry	Demolished	Plain land

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Serial No.	Name of Building	Location	Building Area (m ²)	Type of Structure	Damage Portion	Existing Condition	
9.2	Save Our Soul (SOS) Village (public welfare)	Makri	418 (approx)	Masonry + Frame	There are wall damage, slab damage and beam damage.	Two portions are in use	
9.3	Eid Gah (religious)	Eid Gah Road	1,254	RCC Frame	Columns have minor cracks, beams have cracks.	Tents at site	
9.4	Id Slaughterhouse	Upper Plate	200	Masonry	Demolished	Plain land	
9.5	Officer's Club	Bank Road	800	Masonry	One portion is damage, walls are damaged.	Not in use	
9.6	Engineering Workshop	Bela Noor Shah	420	Masonry + Frame	Wall are cracked, beams have cracks.	In use	
9.7	Rest House	Lohar gali	630	Masonry	Minor crack in walls.	In use	
9.8	Nursery Abraham	Nalochi	500 (approx)	Masonry	One portion collapsed, another part has masonry cracks.	Not in use	
9.9	Forte	Gogra	Restricted Area - Special Permission required from Army				
9.10	Neelum Stadium	Shoukat Line	18,000 (approx)	RCC Frame	Columns have cracks, walls have cracks, beams have cracks.	In use	
9.11	Guest House	Narul	900	Masonry	Stair crack, wall crack and columns crack are seen.	In use	
9.12	Narul Stadium	Narul	1,672	Masonry	Wall are damaged, slabs are damaged.	Not in use, under construction	
9.13	State Guest House	Saheli Sarkar	1,840	Masonry	Collapsed	Plain land	
9.14	Press Club	Saheli Sarkar	1,254	Masonry	Collapsed	Shelter exists	
9.15	Animal Husbandry	Domel	2,400	Masonry	Walls are damaged, columns have cracks, beams have cracks.	In use	
9.16	Workshop PWD	Rashid Abad	735	RCC	Wall crack and column crack are seen	In use	
9.17	Electricity Workshop	Dani Syydan	Out of the Municipality Limit				
9.18	Sewing Machine Plant	Rashid Abad	Out of the Municipality Limit				
9.19	State Bank	Upper Chatter	6,000	RCC	Walls are damaged, beams are damaged, columns have cracks.	In use	
9.20	Water Supply	Upper Chatter	285	Masonry	Walls are badly damaged.	In use	
9.21	Rest House / Muzaffarabad Development Authority (MDA)	Lower Chatter	550	Masonry	Wall damage, column damage and beam damage are seen.	Not in use	
9.22	High Power Transmission	Mera Tanolian	4,180 (approx)	Masonry	One portion is demolished, wall has cracks.	In use	
9.23	AJK TV Booster	Mera Tanolian	480	Masonry	Minor crack in wall.	In use	
Total Number of Facilities: 158							

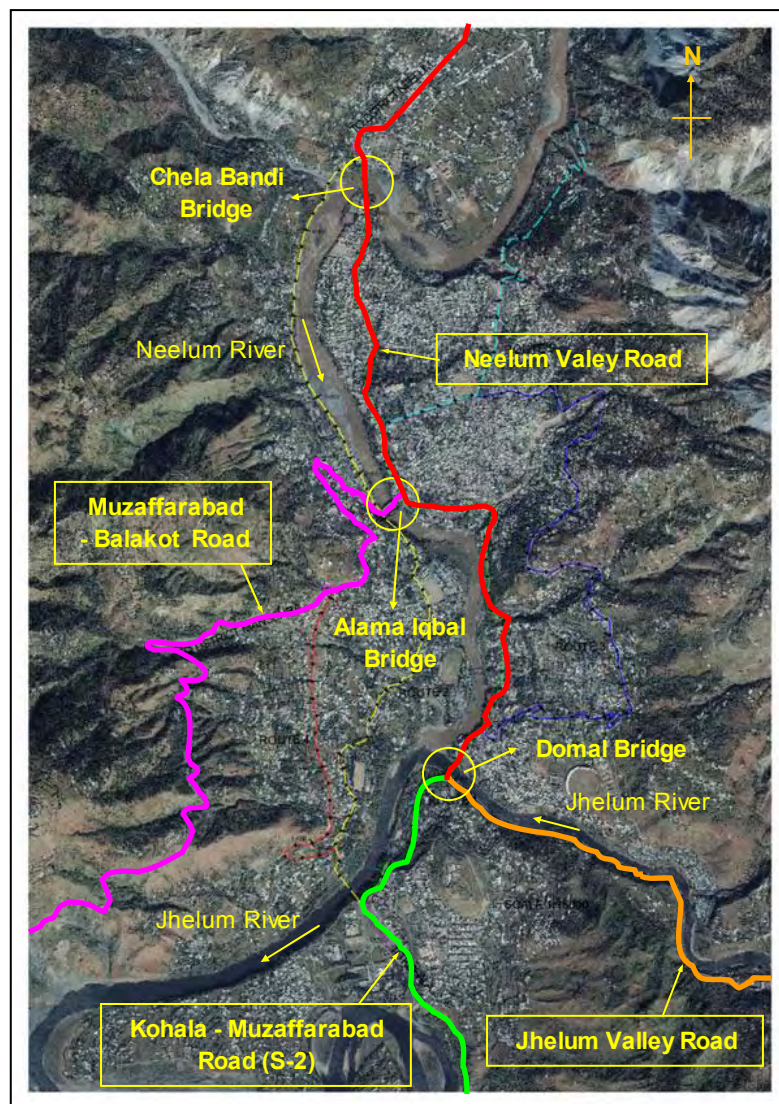
7. TRANSPORTATION

7.1. Review of Existing Road Network in Muzaffarabad City

The urbanization of the city of Muzaffarabad has been mainly developed on the river terrace formed by the Jhelum River and Neelum River. Steep mountainous areas on the periphery of the city restrict the road networks in Muzaffarabad.

7.1.1. Region-wide Road Network

The region-wide network of roads in Muzaffarabad is made up of the following four major routes (refer to Figure 7.1.1):



Source: JICA Study Team

Figure 7.1.1 Region-wide Road Network in Muzaffarabad City

(1) Kohala - Muzaffarabad Road (S-2)

Kohala - Muzaffarabad Road (S-2) is followed from N-75 that is started from Islamabad, and runs along on the left side bank of the Jhelum River and goes into Muzaffarabad city from southern part of the city. The said road sustained damages such as landslides, slope slippages and collapses of road shoulder and carriageway down to the Jhelum river during the October 8 Earthquake, and National Highway Authority (NHA), the road management body, is scheduling the rehabilitation of the damage sections by using World Bank fund.

(2) Neelum Valley Road

Neelum Valley Road starts from Domal Bridge, runs along the Neelum River and leads to Kel, which is a major town in AJK. Many internal roads on Upper/Lower Plate, Medina Market area and Old Secretariat area where the earthquake wreaked havoc are entered from Neelum Valley Road; therefore, it may be asserted as a most important trunk road in Muzaffarabad. This road was also heavily damaged especially along a section of the 50 km road between Muzaffarabad and Chilian. AJK is planning to rehabilitate the road with funding by the Earthquake Emergency Assistance Project of ADB.

(3) Jhelum Valley Road

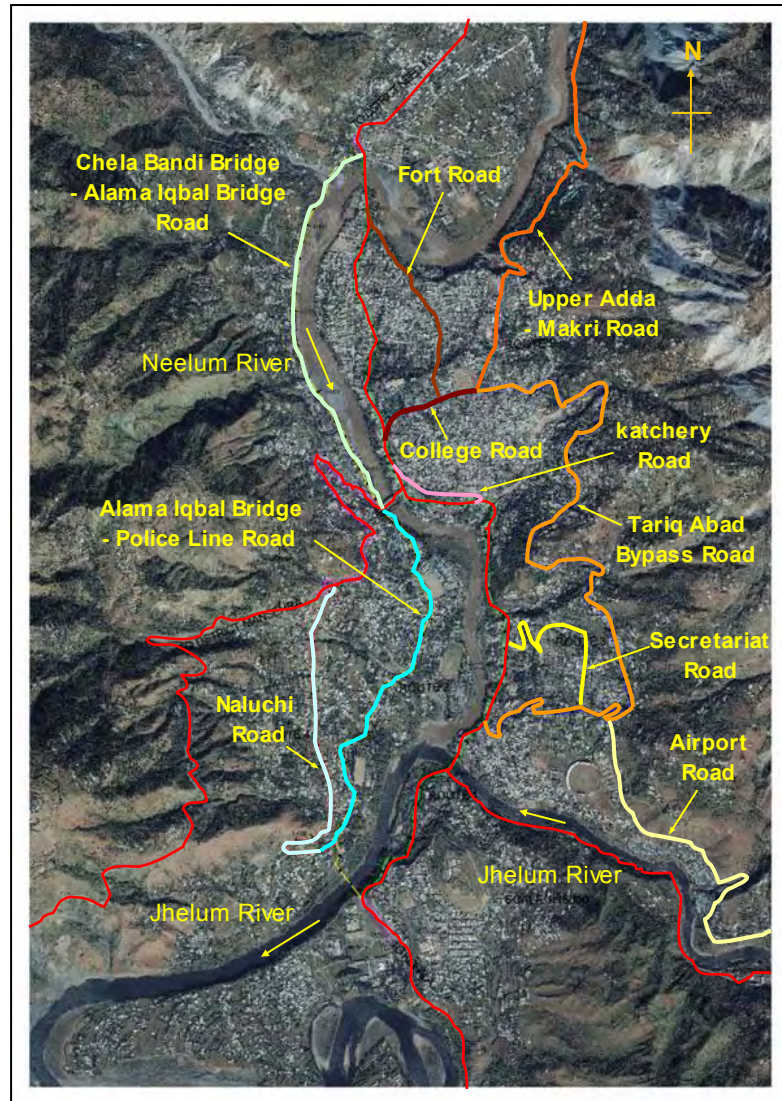
Jhelum Valley Road, which is 56 km long and is one of the most important roads in AJK, starts toward Domal Bridge, runs along the Jhelum River to Chakothei where it is on line of control, and leads to Srinagal of India; it also serves as bus route between Pakistan and India. Due to the fact that the said road is located in parallel with the active fault that caused the October 8 Earthquake, damage to the road is extensive. The rehabilitation of damaged road sections is being scheduled with funding by World Bank as well as bridge reconstructions by Japan Government assistance.

(4) Muzaffarabad - Balakot Road

Muzaffarabad – Balakot Road separates from Neelum Road at southward of Medina Market, crosses Alama Iqbal Bridge, and leads to Balakot to pass N-15 and to Manshera to pass N-35. Around Alama Iqbal Bridge traffic buildup is observed owing to a bus terminal located near the bridge and market shops lining the road. The said road is damaged by rock-falls and slope slippages; however, they are not serious enough as to affect the current road traffic on Muzaffarabad – Balakot Road.

7.1.2. Internal Road Network

The outline of internal road network in the city of Muzaffarabad is as follows (refer to Figure 7.1.2):



Source: JICA Study Team

Figure 7.1.2 Internal Road Network in Muzaffarabad City

(1) College Road

College Road is a main street on Medina Market and Lower/Upper Plate, which starts from Neelum Road and connects Tariq Abad Bypass Road and Upper Adda – Makri Road at the junction on the east of Muzaffarabad University. The width of road pavement is approximately 8.5 m and total length is 0.6 km.

(2) Fort Road

Fort Road is connected with College Road and leads to Chela Bandi Bridge on Neelum Valley Road passing through Lower/Upper Plate. The width of road pavement is 4.5 m and total length is 1.0 km.

(3) Upper Adda – Makri Road

Upper Adda – Makri Road which starts from Upper Plate accesses to remote villages in the north of Muzaffarabad, The road section of 2.1 km long from the beginning point is paved asphalt-concrete, of which width is 4.5 m to 5.0 m. This road has been seriously damaged by the earthquake—slope slippage, collapse of masonry retaining wall and road shoulder and part of carriageway falling down to valley side, since it is constructed on the slope along the Neelum River.

(4) Katchery Road

Katchery Road serves the function as small bypass of Neelum Valley Road, because the width at section of Neelum Valley Road at the south side of Medina Market area is narrow due to the cliff of river terrace approaching to the road. The road has serious damages such as land sliding and collapse of masonry retaining wall and road shoulder, since this road is located on the slope. The width of road pavement is 5.0 m and total length is 0.6 km.

(5) Tariq Abad Bypass Road

Tariq Abad Bypass Road starts from Neelum Valley Road on Old Secretariat area and leads to College Road, which is connected between Old Secretariat and Medina Market area. The total length is 5.0 km and the width of road pavement is 7.0 m to 8.0 m; however, the road width on 0.7 km section of Medina Market side is only 7.0 m to 8.0 m, which is narrower than other sections. The earthquake's impact on the road is serious resulting in slope slippage, collapse of masonry retaining wall and road shoulder and part of carriageway falling down to valley side, since it is passing along the mountain slope on the east of Muzaffarabad city.

(6) Secretariat Road

Secretariat Road starts from Neelum Valley Road and leads to Tariq Abad Bypass Road passing through public office buildings and the presidential house of AJK; total length of road is 1.8 km and pavement width is 7.0 m. The road has damages of landslides and collapse of road shoulder on the slope section.

(7) Airport Road

Airport Road separates from Tariq Abad Bypass Road and leads to Muzaffarabad Airport located on the eastside of the city, of which total length is 4.6 km and pavement width is 3.5 m. Several tertiary link roads managed by Local Government & Rural Development Department of AJK separate from Airport Road. This road has been seriously damaged with landslides, collapse of road shoulder and part of carriageway falling down to valley side, since it is passing along the mountain slope.

(8) Naluchi Road

Naluchi Road is under construction aiming at mitigation of traffic congestion for Neelum Valley Road in urban area of Muzaffarabad city. This road starts from the point of Super Court on the Muzaffarabad – Kohala road in New Secretariat area, crosses the Jhelum River by a new bridge construction and connects with the Muzaffarabad – Balakot road, stretching a total length of 2.5 km.

A part of foundation works of New Naluchi Bridge across the Jhelum River has been carried out. However, since the said bridge was not designed to consider large-scale seismic force, the construction of the bridge was canceled after the October 8 Earthquake. In addition, the construction works of Naluchi Road have been suspended due to rapid price escalation after the earthquake. Since the 0.5 km long road section after crossing the Jhelum River is constructed on the steep mountain slope, the slope of road on the said section was collapsed by the earthquake and it has unstable conditions.

(9) Alama Iqbal Bridge - Police Line Road

The road section Alama Iqbal Bridge - Police Line runs through the center of Gojra area, which lies on the right bank of Neelum River. It is 2.4 km long and 6.5 m to 8.0 m wide; however, the section between Police Line and Naluchi Road is narrow at 3.5 m in width.

(10) Chela Bandi Bridge - Alama Iqbal Bridge Road

The road section Chela Bandi Bridge - Alama Iqbal Bridge is located on the right bank of the Neelum River and its length is 2.3 km. A 0.5 km long section on the side of Chela Bandi Bridge adjoins the landslide area to be observed as high risk in the Study.

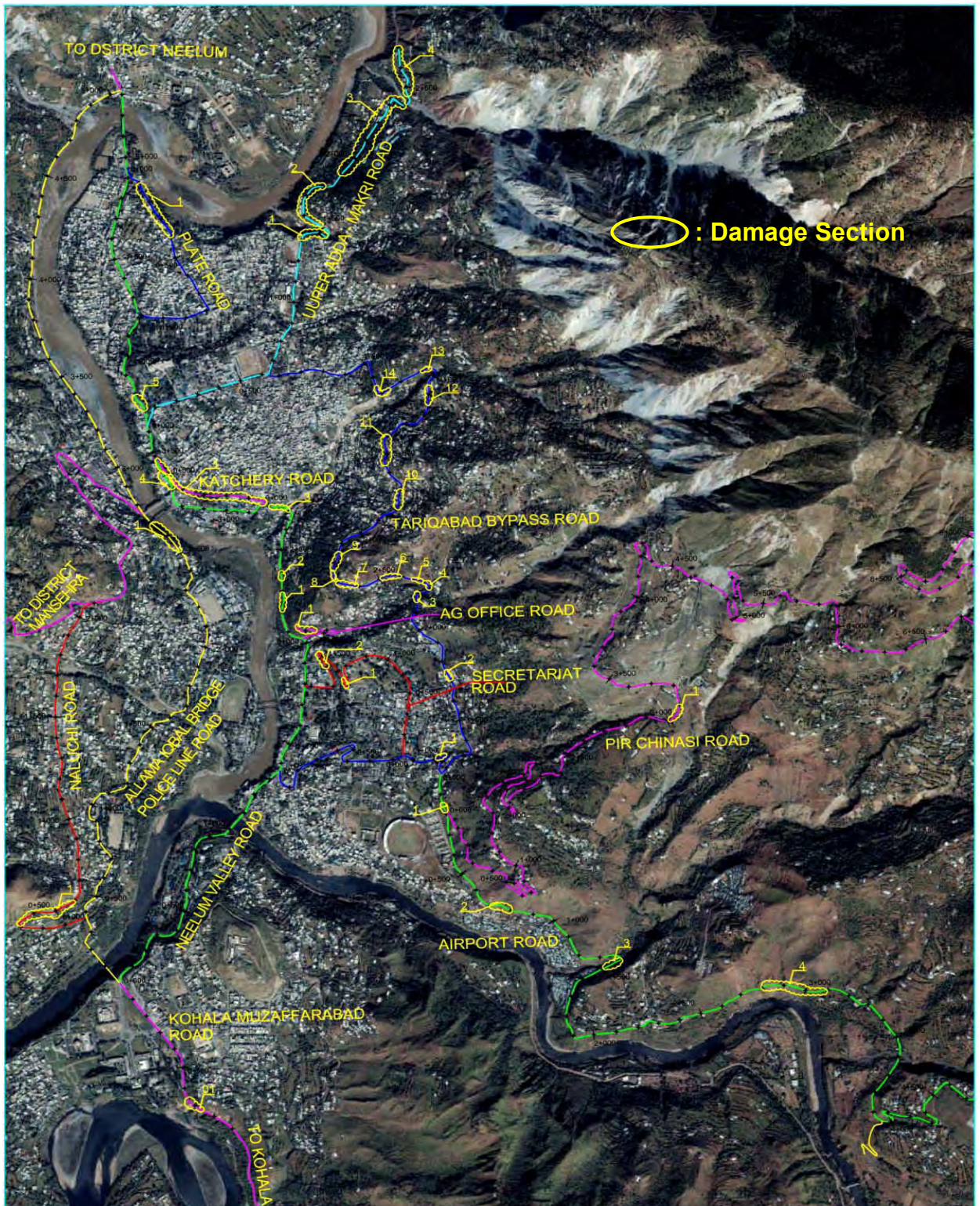
7.2. Damage Inventory Survey

The Study Team conducted a site damage inventory survey for the major roads in Muzaffarabad city area. Table 7.2.1 gives a summary of the survey results on road damage and Figure 7.2.1 illustrates the location of damage sections, and the damage inventory sheets are attached in Appendix-2. It should be remarkable that the road damages occurred on the slope sections on the left bank of Neelum River; on the other hand, the road damage on the right-hand side of Neelum River was comparatively slight.

Table 7.2.1 Summary of Road Damage in Muzaffarabad City

Route	Damage No.	Section (km)		Length (m)	Damage Part	Status
		from	to			
Kohala - Muzaffarabad Road (S-2)	1	Un-known		100	Road sholuder and part of carriageway on valley side.	under progress of retaining wall work.
Neelum Valley Road	1	2+200	2+300	100	Sidewalk, road shoulder and part of carriage on valley side.	under progress of retaining wall work.
	2	2+350	2+400	50	Sidewalk and road shoulder on valley side.	complete temporary retainag wall by gabion.
	3	2+700	2+800	100	Slope collapse on hill side.	
	4	3+300	3+400	100	Masonry retaining wall.	
	5	3+700	3+800	100	Sidewalk and road shoulder on valley side.	under progress of retaining
		Total :		450		
Alama Iqbal Bridge - Police Line Road	1	2+500	2+700	200	Road sholuder, part of carriageway on valley side.	under progress of retaining wall work on valley side.
Tariq Abad Bypass Road	1	1+000	1+050	50	Retaining wall, road shoulder on valley side and crack on pavement.	
	2	1+700	1+750	50	Retaining wall and sidewalk on valley side.	
	3	2+150	2+200	50	Retaining wall, sidewalk and half of carriage way on valley side.	
	4	2+250	2+300	50	Slope collapse on hill side.	
	5	2+300	2+350	50	Retaining wall on valley side.	
	6	2+400	2+500	100	Retaining wall and sidewalk on valley side, and slope collapse on hill side.	
	7	2+600	2+700	100	Retaining wall and sidewalk.	
	8	2+700	2+750	50	Retaining wall and sidewalk on valley side, and slope collapse on hill side.	
	9	2+750	2+850	100	Retaining wall and sidewalk.	
	10	3+200	3+300	100	Retaining wal, sidewalk and crack on pavement on valley side.	
	11	3+450	3+600	150	Retaining wall, sidewalk and half of carriage way on valley side.	
	12	3+850	3+950	100	Retaining wall and sidewalk on valley side, and slope collapse on hill side.	
	13	4+050	4+100	50	Retaining wall and sidewalk on valley side, and slope collapse on hill side.	
	14	4+250	4+350	100	Retaining wall and sidewalk on valley side	
		Total :		1,100		
Naluchi New Road		0+300	0+600	300	Slope collapse on hill side.	under progress of road construction
Upper Adda - Makri Road	1	1+300	1+450	150	Slope collapse on hill side.	
	2	1+500	1+800	300	Retaining wall and road shoulder on valley side, and slope collapse on hill side.	
	3	1+900	2+400	500	Retaining wall and road shoulder on valley side, and slope collapse on hill side.	
	4	2+450	2+700	250	Retaining wall, road shoulder, part of carrageway and crack on pavement on valley side, and slope collapse on hill side.	
		Total :		1,200		
Katchery Road	1	0+000	0+600	600	Retaining wall and road shoulder on valley side, and slope collapse on hill side.	
Fort Road	1	0+600	0+900	300	Scattering debris on road.	under clearing work
Airport Road	1	0+150	0+200	50	Retaining wall.	under progress of retaining wall work on valley side.
	2	0+700	0+800	100	Retaining wall on valley side and slope collapse on hill side.	
	3	1+400	1+500	100	Retaining wall on valley side and slope collapse on hill side.	under progress of retaining wall work on valley side.
		Total :		250		
Pir Chinasi Road	1	3+000	3+100	100	Retaining wall.	
Accountant General Office Road	1	2+250	2+350	100	Retaining wall, road shoulder and part of carrageway on valley side, and slope collapse on hill side.	
Secretariat Road	1	1+300	1+350	50	Retaining wall on hill side.	
	2	1+500	1+600	100	Road shoulder on valley side, and slope collapse on hill side.	
		Total :		150		

Source: JICA Study Team



Source: JICA Study Team

Figure 7.2.1 Road Damage Sections in Muzaffarabad City

7.3. Issues of Existing Road Network

The following issues should be pointed out concerning the existing road network in order to ensure the future rehabilitation and reconstruction activities in Muzaffarabad city:

Issue-1

In comparison to the situation before the earthquake, the volume of traffic on Neelum Valley Road has increased due to the relief activities, and it is expected to even increase further in the future at rehabilitation and reconstruction stage. In addition, the road section of Neelum Valley Road where it faces the south part of Medina Market area is a bottleneck for the road traffic of Neelum Valley Road, because it is narrower compared with other sections due to the cliff of river terrace approaching to the road and the shops standing along the said road section. This condition saturates the road and causes chronic traffic congestion on Neelum Valley Road.

Issue-2

The access to Medina Market area and Lower/Upper Plate area, where the population is concentrated, concerns College Road. Since Old Secretariat area and Medina Market area are divided by a valley, the links between both areas are limited to Neelum Valley Road and Tariq Abad Bypass Road. As it is pointed out earlier, the current traffic on Neelum Road has reached saturation point. Therefore, Tariq Abad Bypass Road should be strengthened to alleviate the traffic congestion on Neelum Valley Road.

Issue-3

Almost all roads that should be functioning as main streets are narrow making it difficult for vehicles to pass each other or to access the main road. This condition is expected to be an obstacle to the smooth transport of materials and goods at rehabilitation and reconstruction stage.

7.4. Current Traffic Volume on Major Road

The Pakistan Transport Study under JICA conducted a traffic count survey at the T-junction to intersect S-2 /Neelum Valley Road and Jhelum Valley Road. Survey details are as follows:

- Survey Point: 3 locations (at Domal Bridge of Muzaffarabad city side for Neelum Valley Road, at Domal Bridge of Kohala side for S-2 and at beginning of Jhelum Valley Road)
- Survey Date & Time: January 31, 2006 (Tue.) 8:00 a.m. ~ February 1, 2006 (Wed.) 8:00 a.m.
- Survey Count: 24 hours

Table 7.4.1 shows 24-hour and peak-hour traffic volumes in terms of number of vehicles and PCU (passenger car unit) on three survey locations. The 24- hour traffic volumes in terms of

PCU on Neelum Valley Road, S-2 and Jhelum Valley Road were 25,561, 16,085 and 5,050, and peak-hour volumes in PCU were 3,282, 1,531 and 455, respectively. Figure 7.4.1 and Figure 7.4.2, shows the hourly traffic volume distribution in terms of PCU for each location.

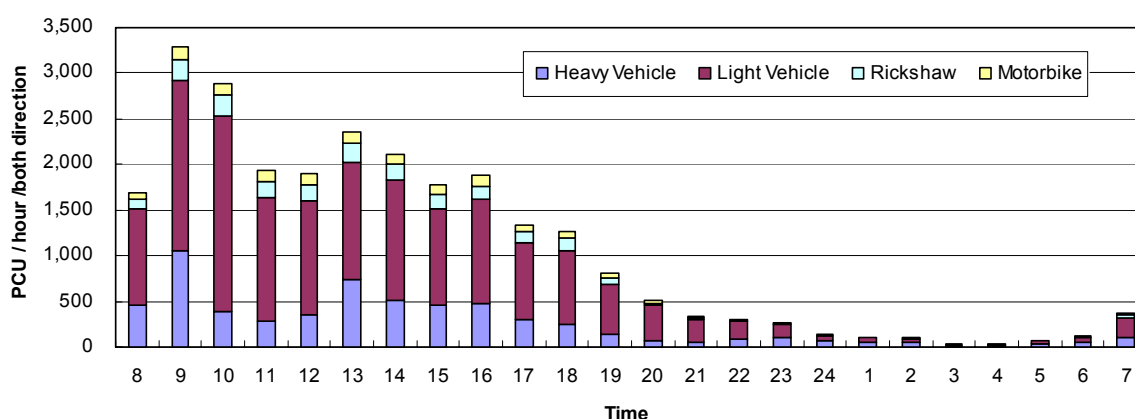
Table 7.4.1 24-hours and Peak-hour Traffic Volume on Major Roads

	unit	Heavy Vehicle		Light Vehicle	Rickshaw	Motorbike	Total	
		Bus	Tractor / Truck					
After Domai Bridge (Center of City side : Neelum Valley Road)	24-hours Volume	Veh.	623 (2.3%)	2,450 (8.9%)	16,128 (58.3%)	4,067 (14.7%)	4,397 (15.9%)	27,665
		PCU	1,246 (4.9%)	4,900 (19.2%)	16,128 (63.1%)	2,034 (8.0%)	1,253 (4.9%)	25,561
	Peak-hour Volume (am 9:00-10:00)	Veh.	99 (3.0%)	432 (13.1%)	1,865 (56.7%)	440 (13.4%)	451 (13.7%)	3,287
		PCU	198 (6.0%)	864 (26.3%)	1,865 (56.8%)	220 (6.7%)	135 (4.1%)	3,282
Before Domai Bridge (Kohala side : S-2)	24-hours Volume	Veh.	177 (1.0%)	1,453 (8.2%)	10,756 (60.5%)	2,271 (12.8%)	3,113 (17.5%)	17,770
		PCU	354 (2.2%)	2,906 (18.1%)	10,756 (66.9%)	1,136 (7.1%)	934 (5.8%)	16,085
	Peak-hour Volume (am 10:00-11:00)	Veh.	13 (0.7%)	99 (5.4%)	995 (54.6%)	396 (21.7%)	319 (17.5%)	1,822
		PCU	26 (1.7%)	198 (13.1%)	995 (65.8%)	198 (13.1%)	96 (6.3%)	1,513
Jhelum Valley Road	24-hours Volume	Veh.	169 (3.1%)	536 (9.9%)	2,903 (53.8%)	1,011 (18.8%)	773 (14.3%)	5,392
		PCU	338 (6.7%)	1,072 (21.2%)	2,903 (57.5%)	506 (10.0%)	232 (4.6%)	5,050
	Peak-hour Volume (am 9:00-10:00)	Veh.	17 (3.4%)	39 (7.8%)	268 (53.6%)	111 (22.2%)	65 (13.0%)	500
		PCU	34 (7.5%)	78 (17.1%)	268 (58.9%)	56 (12.2%)	20 (4.3%)	455

Note: PCU Heavy Vehicle=2.0, Light Vehicle=1.0, Rickshaw=0.5, Motorbike=0.3

Source: Pakistan Transport Plan Study (March 2006) by JICA

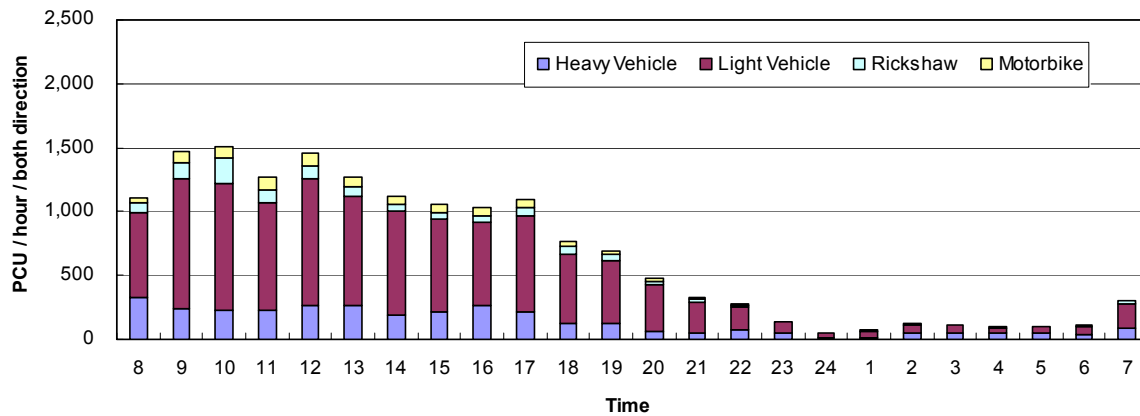
[Domal Bridge of Muzaffarabad City Side : Neelum Valley Road]



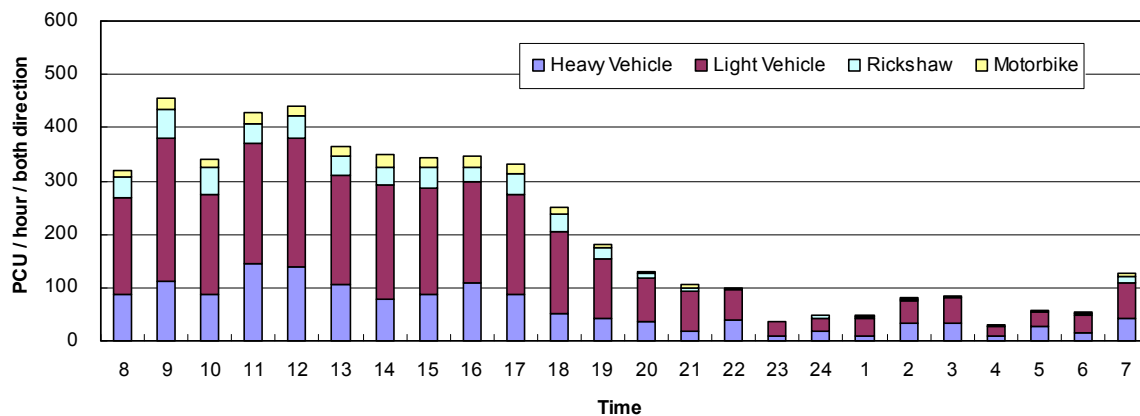
Source : Pakistan Transport Plan Study (March 2006) by JICA

Figure 7.4.1 Hourly Traffic Volume Distribution (unit: PCU) (1/2)

[Domal Bridge of Kohala Side : Kohala-Muzaffarabad Road (S-2)]



[Beginning of Jhelum Valley Road]



Source : Pakistan Transport Plan Study (March 2006) by JICA

Figure 7.4.2 Hourly Traffic Volume Distribution (unit: PCU) (2/2)

Table 7.4.2 Comparison between Possible Traffic Capacity and Peak-hour Traffic Volume

Road & location	Unit : PCU / hour / both direction	
	Peak Hour Traffic Volume	Possible Traffic Capacity as per Japan Highway Standard
Neelum Valley Road (at Domel Bridge of City Side)	3,282	1,235
Kohala – Muzaffarabad Road : S-2 (at Domel Bridge of Kohala Side)	1,513	1,779
at Beginning of Jhelum Road	455	1,282

Source : Pakistan Transport Plan Study (March 2006) by JICA

According to Japan Highway Design Standard, the possible traffic capacities for the three roads surveyed are calculated as shown in Table 7.4.2.

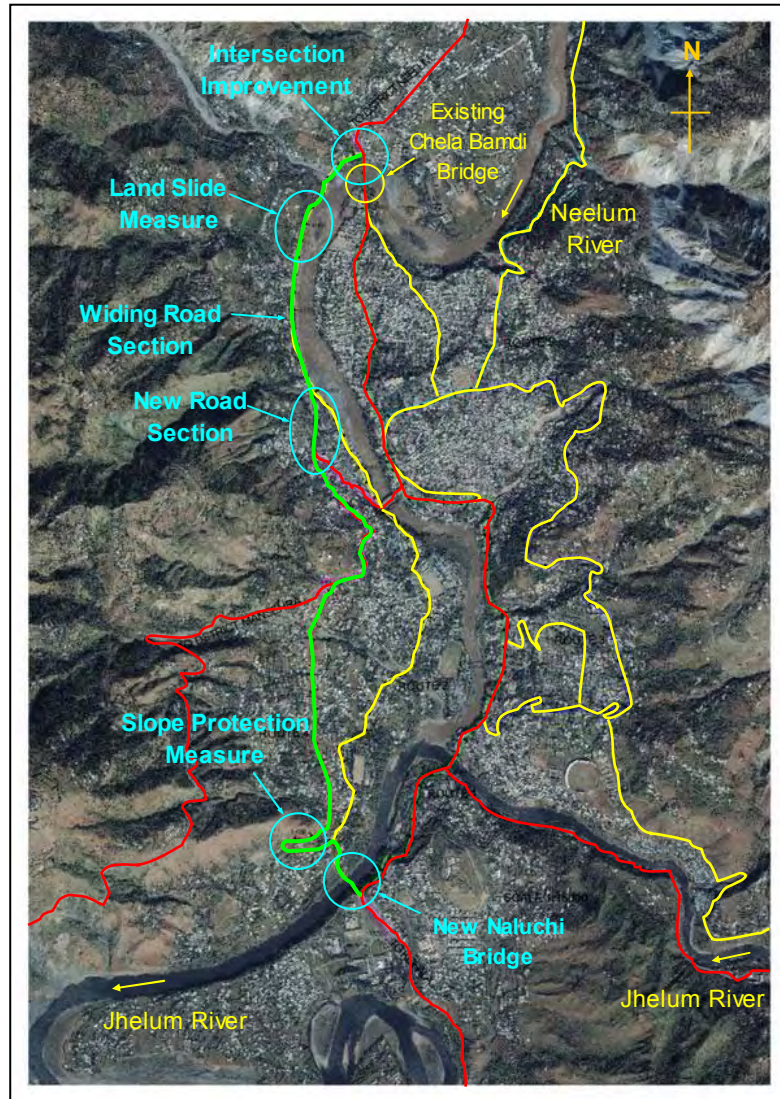
The possible traffic capacity for the Neelum Valley Road on Muzaffarabad city is estimated at 1,235 (PCU) and the peak-hour traffic volume is counted at 3,282 (PCU), an amount that

is almost 2.5 times of possible traffic capacity. In addition, Figure-3 (a) indicates that the hourly traffic volumes between 8:00 a.m. and 6:00 p.m. are to exceed possible traffic capacity of Neelum Valley Road. It should mean that Neelum Road is over capacity against the current traffic volume and future traffic demand at rehabilitation and reconstruction stage. Traffic capacity of S-2 up to Domal Bridge has a bit of space against the current traffic volume and Jhelum Valley Road is within capacity.

7.5. Proposal for High Priority Project on Road Infrastructure

7.5.1. Naluchi New Bridge - Chela Bandi Bridge Bypass Road Project

As mentioned previously, the measures to reduce the burden of traffic on Neelum Road is the most important issue in road network, since the traffic capacity on the said road has been reached to saturated level. Therefore, a new bypass road to be constructed on the right side of Neelum River and Jhelum River should be recommended as the highest priority project in road infrastructure. The alignment of new bypass road will be rehabilitated or existing Naluchi Road, Muzaffarabad – Balakot Road and Chela Bandi Bridge - Alama Iqbal Bridge Road will be improved as shown in Figure 7.5.1.

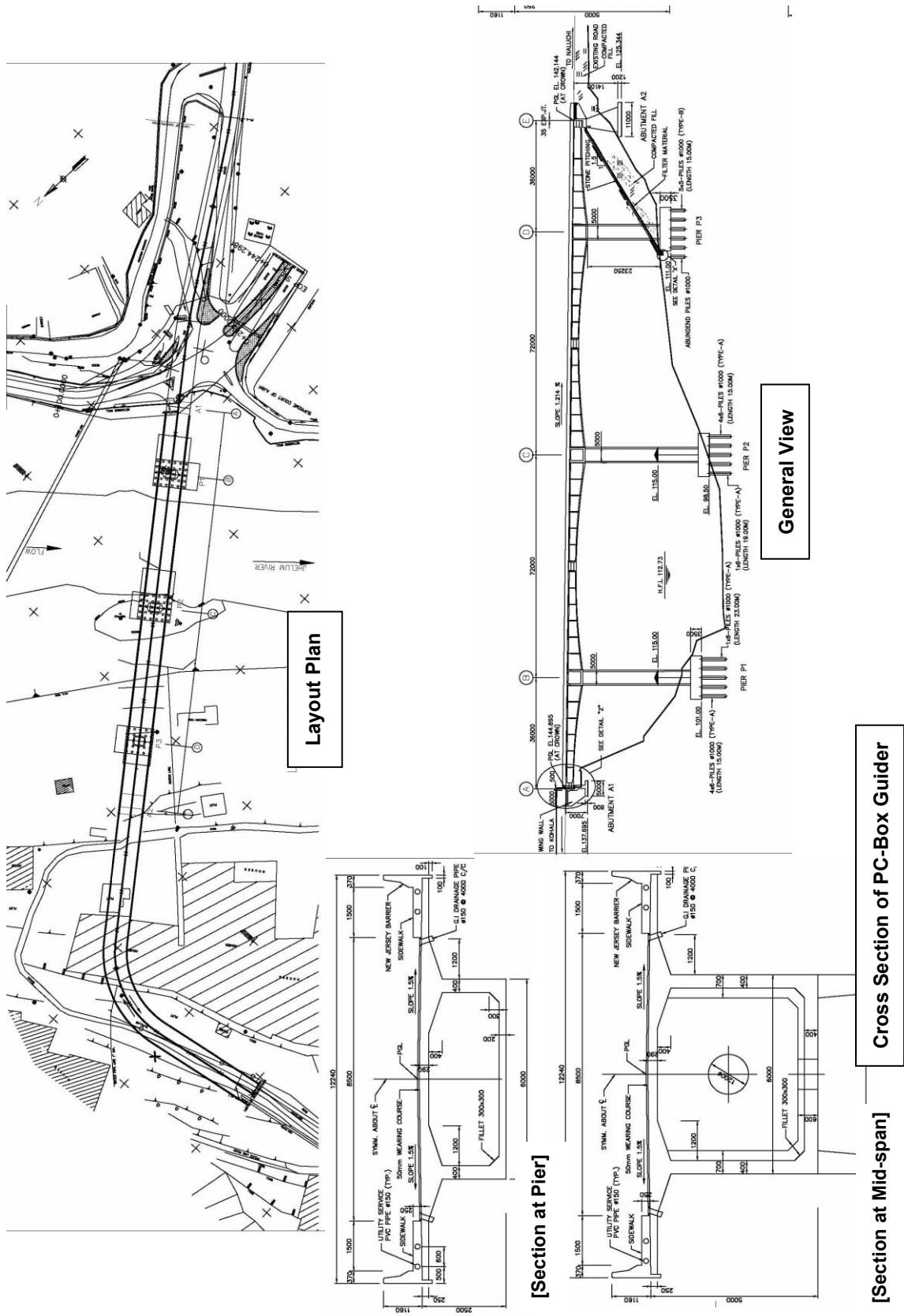


Source : JICA Study Team

Figure 7.5.1 Alignment of Naluchi New Bridge – Chela Bandi Bridge Bypass Toad

In addition, it is recommended that the new bypass road should be strengthened for not only earthquake risk but also natural sediment disaster such as slope slippage, rock fall and landslide, because the alternative route for existing Neelum Road has an important bearing on the rehabilitation and reconstruction schedule in Muzaffarabad City.

The major components of new bypass road project are as follows.



Source: CDO of AJK Government

Figure 7.5.2 Outline of Original Design of Naluchi New Bridge

(1) Construction of New Naluchi Bridge

New Naluchi Bridge was designed as PC box girder type of 4 spans with center span of 72 m long as shown in Figure 7.5.2, and its construction had been commenced. However, since a large-scale seismic force was not considered in design, the construction was canceled even though work on the foundation had already started due to the October 8 Earthquake. The construction of New Naluchi Bridge should be core component in the bypass road project and, therefore, the following issues should be considered in the bridge design:

- 1) Appropriate seismic force shall be introduced in structure design considering the risk of earthquake occurrence. A two-step seismic force is adopted in the earthquake-proof design as specified in Japan Highway Bridge Design Standard. Level-1 of seismic force at 200 gal is considered for normal condition design, and a more large-scale seismic force is in the Level-2 earthquake-proof design. In the reconstruction design for the damaged bridge on Jhelum Valley Road that is assisted by the Japanese Government, 400 gal of seismic force, which is equal to Level-2 of Japan Highway Bridge Design Standard, was considered in structure design.
- 2) Since not only the city of Muzaffarabad but also the northern Neelum Valley Road and surrounding area suffered serious damage, the traffic volume is expected to increase at future rehabilitation and reconstruction stage. Therefore, in the selection of bridge type not only the economic aspect but also the construction period to be required should be considered, in the light of the time scheduling of rehabilitation and reconstruction stage. In general, the concrete bridge is less expensive than the metal bridge, however, the metal bridge requires a shorter construction period than the concrete bridge.

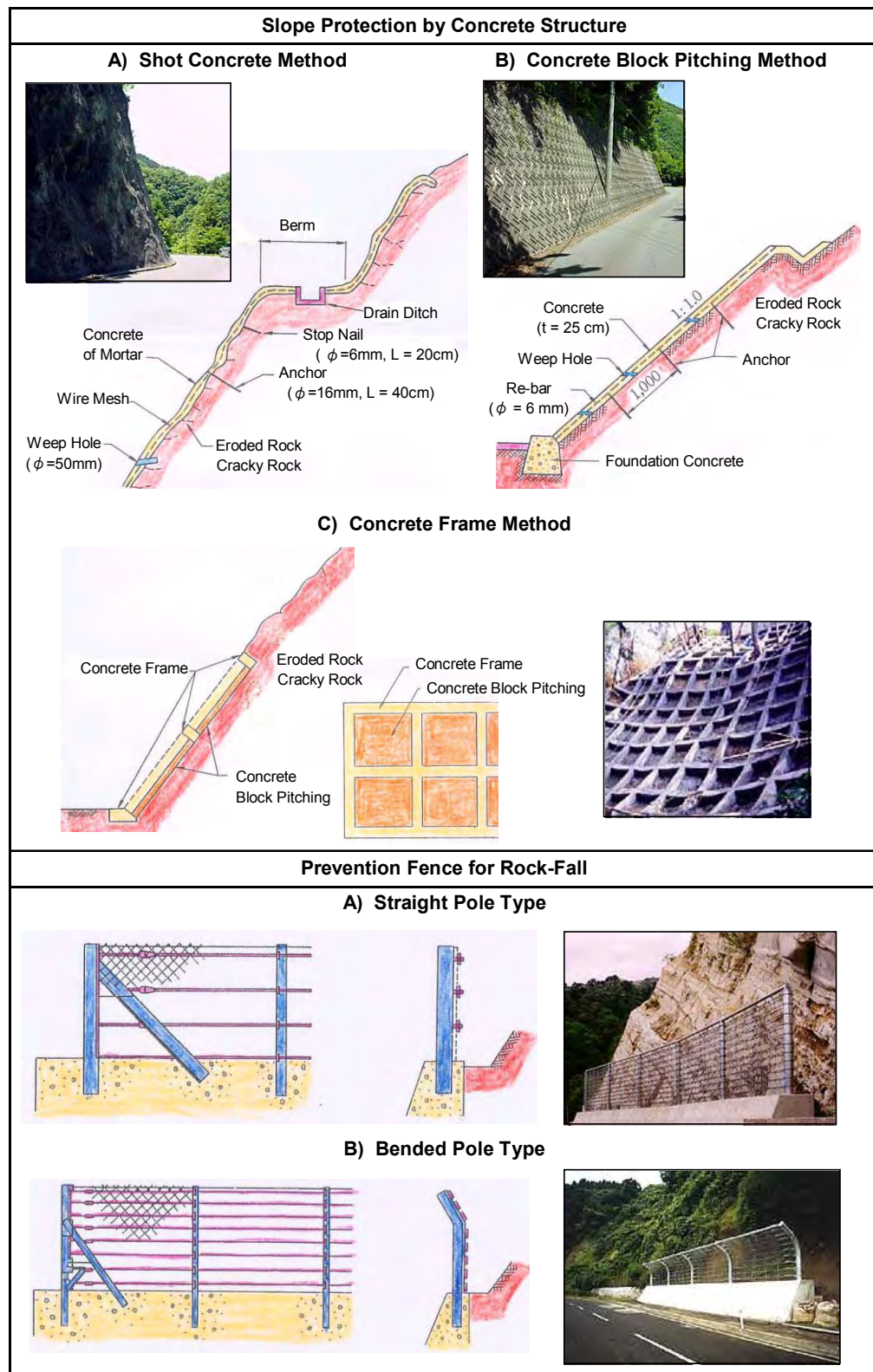
(2) Slope Protection on Climbing Section of Naluchi Road

Naluchi Road is to connect with New Naluchi Bridge. The road has a climbing section of approximately 300 m long that was damaged when the earthquake struck causing rock-fall and slope slippage. It was vulnerable to this kind of damage because the road was constructed by cutting weathered bedrock (see Photo-1). It should be foreseen that the weakness of cutting slope would cause transport interruption by slope collapse because of the risks posed by not only



Photo-1 Slope condition on Climbing Section of Naluchi Road

earthquakes but also heavy rainfall. Therefore, the said climbing section will require measures against slope slippage and rock-fall. Figure 7.5.3 shows the samples of slope protection methods and countermeasure for slope collapse.



Prevention Fence for Rock-Fall

A) Straight Pole Type

B) Bended Pole Type

Source: JICA Study Team

Figure 7.5.3 Samples of Countermeasure for Slope Collapse

(3) Bypass Road Construction of Muzaffarabad–Balakot Road and Chela Bandi Bridge–Alama Iqbal Bridge Road

At the Alama Iqbal Bridge where the Muzaffarabad – Balakot road and Chela Bandi Bridge – Alama Iqbal Bridge Road cross, is one of the congestion points because there is a bus terminal and many retail stores along the roads. To ease this situation, the construction of 500 meters long new bypass road from the point of sharp winding of Muzaffarabad – Balakot road to the Chela Bandi Bridge – Alama Iqbal Bridge is proposed.

(4) Landslide Protection of Chela Bandi Bridge – Alama Iqbal Bridge Road

Through the survey conducted by the Study Team, a high hazardous state was confirmed along Chela Bandi Bridge – Alama Iqbal Bridge Road (see Photo-2a). Therefore, a detailed landslide hazard assessment and appropriate protection measures are necessary prior to the construction of this bypass road.



Photo-2a Landslide Hazardous Place in Chela Bandi Bridge - Alama Iqbal Bridge Road

(5) Improvement of Intersection of Chela Bandi Bridge – Alama Iqbal Bridge Road and Neelum Valley Road

The road width at the intersection of Chela Bandi Bridge – Alama Iqbal Bridge Road and Neelum Valley Road is 4.5 m. and this narrow width is a bottleneck (see Photo-2b). To cope with the traffic demand, the widening of this intersection is proposed based on the appropriate traffic demand forecast survey.

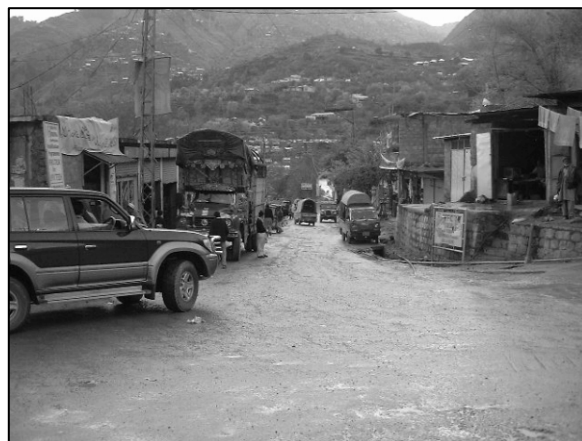


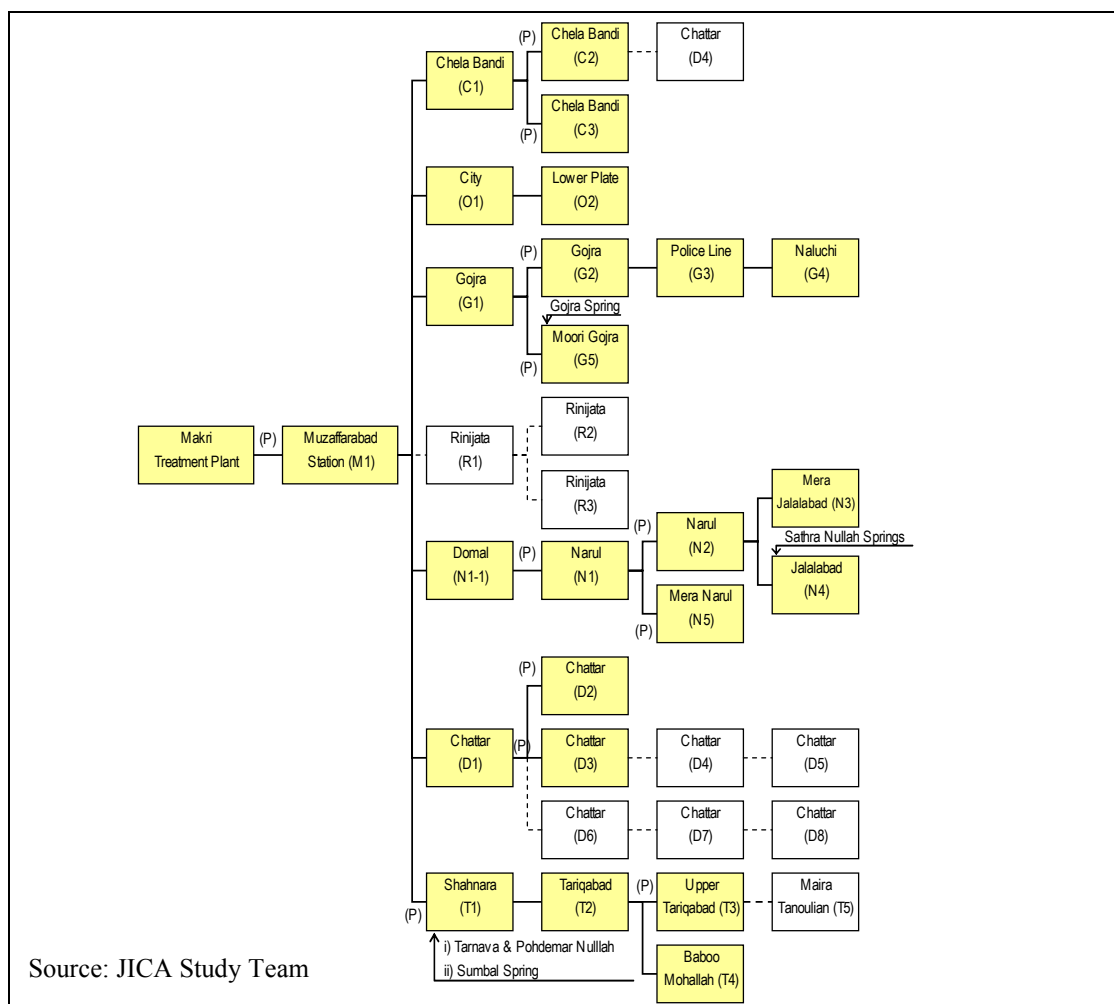
Photo-2b Intersection of Chela Bandi Bridge - Alama Iqbal Bridge Road and Neelum Valley Road

8. ECONOMIC INFRASTRUCTURE

8.1. Water Supply

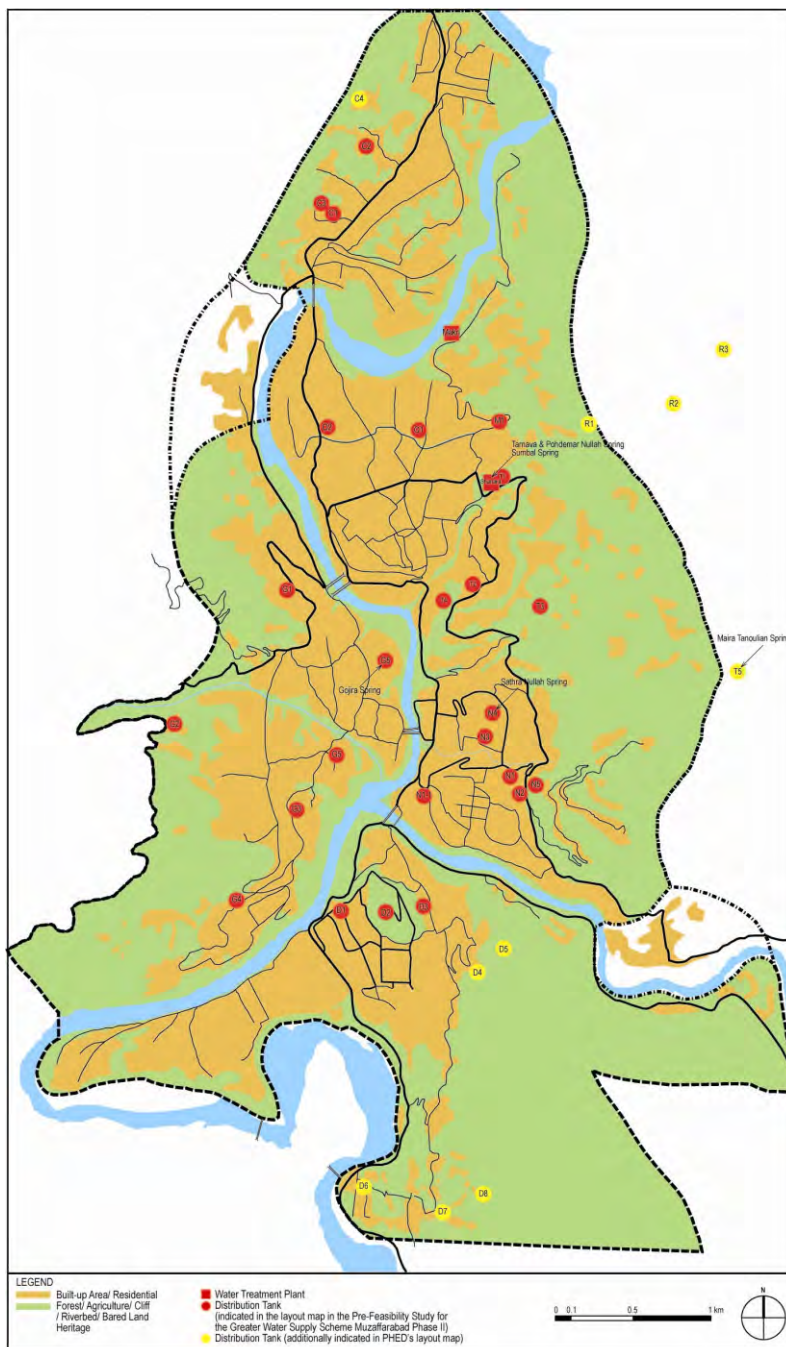
(1) Existing Conditions

Public Health Engineering Division (PHED) of Public Works Department (PWD) is responsible for water supply in the municipal area. Main raw water is obtained from the Neelum river which flows in north and south direction in the city. Pumped raw water from the Neelum river is treated at the Makri water treatment plant (WTP) located at the north of the old city, then pumped to M1 storage tank at the east of the old city. The Makri WTP has a treatment capacity of 4.0 million gallons per day (MGD). From M1 storage tank, the treated water was transmitted by gravity and pumping to other distribution tanks dispersed in the municipal area as shown in the figures below.



- Note 1: (P) means transmission by pumping.
 2: Yellow colored cells mean facilities specified in the pre-feasibility study for the Greater Water Supply Scheme Muzaffarabad Phase II.
 3: Colored cells mean facilities additionally indicated in a PHED location map of the water supply system in the city. Those facilities may obtain the raw water from springs and streams.

Figure 8.1.1 Diagram of Existing Water Supply System



- Note 1: Red colored cells mean facilities specified in the pre-feasibility study for the Greater Water Supply Scheme Muzaffarabad Phase II.
- 2: Yellow colored cells mean facilities additionally indicated in a PHED location map of the water supply system in the city. Those facilities may obtain the raw water from springs and streams.
- Source: JICA Study Team

Figure 8.1.2 Existing Water Supply System

The treated water from Makri WTP was supplemented by water resources of springs and streams. In the mountainous areas, raw water from springs was conveyed to storage tanks, then distributed to customers by gravity flow. Tarnava Nala and Pohdemar streams in the northeast of Makri area supply the raw water of 0.72 MGD which is conveyed by an open

channel and treated in sedimentation and chlorination processes at the Shanara treatment plant, then integrated into the treated water at Shanara storage tank.

Due to the rapid population growth in the 1990s, the municipality anticipated the shortage of water resources and conducted the pre-feasibility study for the Greater Water Supply Scheme Muzaffarabad Phase II in 2002 to identify new water resources capable of supplying the water demand in 2025. In the pre-F/S, the Neelum river was identified as the raw water resource for the target year.

Based on the conditions given in the Pre-F/S, the average daily water demand in 2005 before earthquake was estimated in the Study at 4.75 MGD nearly equivalent to the capacity of existing water supply system of 4.72 MGD.

Table 8.1.1 Estimated Average Daily Water Demand in 2005 before Earthquake

Item	Unit	Qty.
Population* ¹	Person	114,864
Daily Domestic Water Demand per Capita* ³	gallon/capita/day	30
Daily Water Demand for Commercial & Industrial Use* ² (% of Domestic Demand)	%	10
Daily Water Demand for Public Use* ² (% of Domestic Demand)	%	5
Sub-Total	million gallon/day	3.96
Unaccounted for Water* ²	%	20
Total	million gallon/day	4.75

Source: *1 - Information obtained from MCM

*2 – Pre-Feasibility Study for Greater Water Supply Scheme Muzaffarabad Phase II, 2002

*3 – National Reference Manual on Planning and Infrastructure Standards

After the earthquake, people in camps and existing urbanized areas in Maira Tanoulian are supplied drinking water by water trucks which are operated by UNICEF, due to the damage to the water supply system related to the Maira Tanoulian springs. Refugees in camps carry drinking water from public taps. Excluding those areas, people in the urbanized areas are served drinking water by existing pipe network systems. Sequences in the water supply scheme after the earthquake are itemized below.

- Damages to the Makri WTP were rehabilitated by UNICEF shortly after the earthquake to recover the designed treatment capacity.
- Due to damages to intake and transmission facilities of Maira Tanoulian springs, UNICEF operates water trucks which transport drinking water from a distribution tank in the Chatter area to the Maira Tanoulian areas.
- Conveyance and treatment facilities at Shanara WTP were damaged by the earthquake and are still out of use.

- Water volume at the Gojira springs was reduced to 30% of the designed capacity, due to deformation by the earthquake.

(2) Planning Direction

The rehabilitation and reconstruction in the water supply sector shall be focused on rehabilitating the damaged facilities and developing the new water resources which will be capable of compensating the reduced water resources from springs and meeting the water demand in 2016. Actions to be taken for rehabilitation and reconstruction shall be as mentioned below.

- To study the available water volume at the Tarnava Nala and Pohdemar streams and the Maira Tanoulian springs
- To rehabilitate facilities at the Maira Tanoulian springs and the Shanara WTP, if the water resources are sufficiently obtained
- To expand the Makri Water Treatment Plant to meet the water demand estimated at 11.68 million gallons/day in 2016 as shown in Table 8.1.2. The land for the future expansion is available at the existing Makri WTP site
- To extend the existing water distribution network to cover the whole municipal area.

Table 8.1.2 Estimated Average Daily Water Demand in 2016

Item	Quantity	Unit
Population* ¹	176,751	Person
Daily Domestic Water Demand per Capita* ³	50	gallon/capita/day
Daily Water Demand for Commercial & Industrial Use* ² (% of Domestic Demand)	10	%
Daily Water Demand for Public Use* ² (% of Domestic Demand)	5	%
Sub-Total	10.16	million gallon/day
Unaccounted for Water* ²	15	%
Total	11.68	million gallon/day

Source: *1 – Estimated by JICA Study Team

*2 – Pre-Feasibility Study for Greater Water Supply Scheme Muzaffarabad Phase II, 2002

*3 – National Reference Manual on Planning and Infrastructure Standards

According to the pre-feasibility study, the Neelum river is identified as an unique water resource with sufficient water volume and suitable water quality in and around the city. Therefore, it shall be principal to expand the Makri WTP to meet the increased water demand in 2016. The French government has a concern to expand the Makri WTP.

To realize the earthquake-resistant system in the long-term scheme, which will not be limited to the year 2016, the water supply system shall be continuously improved by further efforts as listed below.

- Main water supply facilities shall be improved to be earthquake-resistant structures. The main facilities shall include intake, treatment plant, transmission, distribution tanks, and main distribution pipelines.
- Public facilities, which will be used for evacuation and shelters, shall be equipped with earthquake-resistant water tanks capable of serving drinking water for several days after the earthquake. The public facilities shall include schools, hospitals, and parks.

8.2. Sewerage Management

(1) Existing Conditions before Earthquake

Public Health Engineering Divison (PHED) is responsible for the sewerage management in the municipal area. Sewerage and storm water drainage system has been developed according to the Sewerage and Storm Water Drainage Scheme Muzaffarabad in 1998. Thereafter the Sewerage and Storm Water Drainage Scheme Muzaffarabad Phase II (1st Revision) was proposed in 2002 to install further sewerage pipelines in the expanded urbanized areas in the next consecutive seven years, whereas the necessity for providing a sewage treatment plant was not considered as an urgent issue.

Sewerage pipelines were installed in densely populated areas. The collected wastewater was carried to the streams and main collection pipes, then discharged into Neelum and Jhelum rivers without any treatment process. There was no central treatment plant in the municipality.

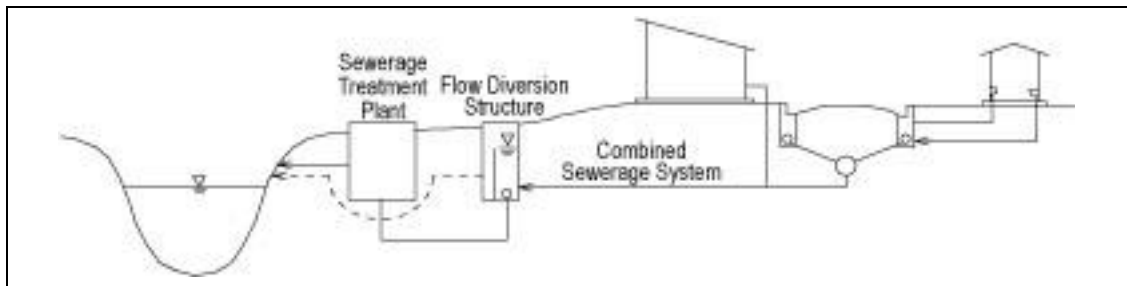
In the earthquake, the pipelines along the large cliff at the south of the old city were damaged and dropped to the ground more than 30 meters lower than the original ground level. As soon as safely possible, PHED began removing those damaged pipes. Since PHED has never conducted a damage inventory survey, damaged portions of sewerage pipelines have not been identified yet.

(2) Planning Direction

Key issues for the rehabilitation and reconstruction in the sewerage management sector shall be firstly, to recover the existing sewerage pipelines and secondarily, to install any treatment process. Rehabiltilation works shall require the inventory survey to confirm damaged portions of the existing sewerage pipelines, thereafter construction works shall be implemented to recovery of the existing pipelines along with the installation of new

pipelines in accordance with the Sewerage and Storm Water Drainage Scheme Muzaffarabad Phase II.

Treatment process shall be primarily formed by septic tanks. In the urban promotion areas with relatively high population density, the feasibility study shall be required to examine the necessity and feasibility of a new central treatment system. The new central treatment system shall be connected to the existing sewerage pipelines by interceptor as shown in the figure below.



Source: JICA Study Team

Figure 8.2.1 Combined Sewerage Collection System

Based on those circumstances, actions to be taken in the sewerage management sector shall be as mentioned below.

- In the short-term: i) inventory survey of damaged sewerage pipes and ii) rehabilitation of damaged sewerage pipes
- In the mid-term: i) construction of sewerage pipes proposed in the revised Phase II scheme, ii) installation of septic tanks, and iii) feasibility study for a new central treatment system
- In the long-term: construction of the new central treatment system

Among those actions, the French government has a concern to develop the central treatment system, while UNICEF proposes to install septic tanks or latrines at public facilities including schools, hospitals, and health centers.

8.3. Flood Protection and Storm Drainage

(1) Existing Conditions before Earthquake

In 1992, Muzaffarabad city experienced the river flood in which the water level reached up to the foot of the Domel bridge. The lower lands around the Domel bridge and the riverbank in front of Block E became inundated.

Storm drainage system was developed in the urbanized areas along with the sewerage system as mentioned in the previous section. Due to the high rainfall intensity in the rainy season,

the flow capacity of drainage channels is however insufficient to discharge the surface water into rivers. For instance, the heavy rainfall in the rainy season causes floods at primary roads around the Domel bridge.

Apart from the damages to the sewerage pipelines, the earthquake caused landslides and stocked the earth and sands in streams in and around the old city. Those streams are located at the Makri area, behind the CMH area, and in the north of Tariqabad.

(2) Planning Direction

Key issues for the rehabilitation and reconstruction in the flood protection and storm drainage shall be to rehabilitate the existing facilities and to upgrade the flow capacity of the drainage channels. Rehabilitation works shall require the inventory survey to confirm damaged pipelines in the city, thereafter construction works shall be implemented to recovery of the pipelines along with the installation of new pipes in accordance with the Sewerage and Storm Water Drainage Scheme Muzaffarabad Phase II. Among the damaged drainage channels, the stream channels shall urgently need to be rehabilitated to remove sediments of earth and sand.

In regard to the flood protection, the proper implementation of the land use plan proposed in the Study shall resolve the flood-prone areas along the Neelum and Jhelum Rivers. Those areas with relatively low topographic conditions are designated as the parks and green areas in the proposed land use plan.

Based on those circumstances, actions to be taken in the flood protection and storm drainage shall be as follows.

- In the short-term: i) inventory survey of damaged sewerage pipes, ii) rehabilitation of damaged sewerage pipes, and iii) removal of the sediments in the streams
- In the mid-term: i) construction of sewerage pipes proposed in the revised Phase II scheme and ii) detailed design study to upgrade the drainage channels
- In the long-term: construction and upgrading of the drainage channels

8.4. Solid Waste Management

(1) Existing Conditions

Municipal Corporation Muzaffarabad is responsible for solid waste management in the municipal area. Solid waste was collected at 65 garbage deposit sites and transported to a landfill site by six dumper trucks. Daily collected volume of the solid waste was estimated at 4,000 – 5,000 ft³/day.

Since an approach road to the landfill site was damaged by the earthquake, the collected solid waste, which is increased to 10,000 – 11,000 ft³ due to debris removal, is dumped into rivers without any treatment process. In response to difficulties in the solid waste management, UNICEF implements projects which are aimed at rehabilitating the approach road to the landfill site and temporarily providing collection vehicles and sanitary workers to replace three damaged collection vehicles. Number of vehicles is currently increased to 15 dumper trucks and one wheel loaders. The landfill site at Shahdara is 25 km far along Kohala road, has the designed capacity for the next five years, and 90% is still available.

(2) Planning Direction

On-going rehabilitation works with the technical assistance by UNICEF involve recovering the approach road and providing the collection vehicles with sanitary workers. Among those efforts, the approach road urgently needs to be recovered along with construction of landfill site to stop dumping the solid waste into rivers.

In the long-term scheme, a new landfill site and collection vehicles shall be required to meet the solid waste volume in the coming years. Since the existing landfill site can be used for the next five years, the required capacity of the new land fill site is estimated at 869,000 m³ based on the population projection in the period from 2011 to 2016.

Based on those circumstances, actions to be taken in the solid waste management sector shall be as follows.

- In the short-term: i) rehabilitation of land fill site and its approach road, ii) procurement of collection vehicles to replace damaged and temporary vehicles, and iii) hiring and training of sanitary workers
- In the mid-term: i) master plan study for solid waste management to identify the new landfill site and ii) detailed design and construction of new landfill site
- In the long-term: procurement of collection vehicles suitable for generated solid waste until 2016

8.5. Electrical Power Supply

(1) Existing Conditions

AJK electricity department (AJKED) is responsible for planning, construction, and operation of the power distribution in AJK. Electricity is supplied to a 65 MVA grid station, located at the west part of the city, via 132 kV dual transmission lines from Mansehra and Jagram. From the grid station, the electricity is distributed to customers by 11 kV and 0.4 kV lines via 800 transformers.

The earthquake affected the substation, transmission, and transformers, then those facilities were rehabilitated by ADB soon after the earthquake. ADB has a plan to implement a project which aims to restore and rehabilitate the power infrastructure not only to pre-earthquake level but also with the enhanced capacity to meet the future power demand for at least five years. AJKED and ADB prepared a proposal for this project in March and are kept waiting to sign on the proposal, because they need to adjust the power supply network with the proposed land use plan in the Study.

Apart from those efforts, the existing constraints were recognized by AJKED as listed below.

- Width of roads is not enough to install distribution lines.
- Road alignment should be straight to mitigate inefficient installation of distribution lines.
- Land use should be planned to accomplish efficient urbanization which will be a benefit for effective installation of distribution lines.
- Stability and durability of power supply needs to be upgraded, since consumers experience power stoppage.

(2) Planning Direction

Rehabilitation and reconstruction works have been done for the electricity supply system by ADB soon after the earthquake. ADB will implement the project for further rehabilitation and upgrading to secure the supply capacity for the demand in the next five years. Therefore, the electricity supply system would be improved to the level suitable for the certain period.

The issues raised by AJKED also would be improved by the proper implementation of the proposed land use in the Study as mentioned below.

- Trunk roads of primary, secondary, and tertiary roads will have the width of 10 – 20 m and pedestrian ways. Service roads will have a 6 m width. Those road widths and pedestrian ways shall provide the space to install distribution lines.
- Based on the hazard analysis, the urbanized areas are accommodated in the areas with relatively gentle slopes of which topographic conditions might allow straight road alignments.
- Future urbanized areas are concentrated in five blocks in which the distribution lines would be effectively installed.

8.6. Gas Supply

(1) Existing Conditions

There is no piped gas network system in Muzaffarabad city. According to the letter issued by Sui Northern Gas Pipelines Limited (SNGPL), Ref SA to MD/04 dated December 8, 2005, SNGPL contemplates a plan to supply the piped gas to the city by installing 71 km of transmission lines from Lower Topa. SNGPL designed another 198 km of a distribution network in the city and estimated a total project cost at Pak Rs. 925,815 million, out of which SNGPL would invest Pak Rs. 136,800 million from its own resources. The remaining Pak Rs. 789,015 million is expected to be disbursed by the federal government.

(2) Planning Direction

Development of the gas network system in Muzaffarabad city shall be considered as a long-term scheme, since the construction works in a short-term scheme should be focused on the recovery of existing facilities.

To develop the gas supply system to upgrade utilities in the city in the long-term scheme, there will be some issues which need to be taken into account for a safe and earthquake-resistant system based on the experiences of earthquakes in Japan. After the Hanshin-Awaji earthquake in Japan in 1995, leaked gas was ignited by short-circuit and caused fires. Due to insufficient road accesses and limited number of fire vehicles, the fires, which simultaneously occurred at various locations in wooden-made housing areas, caused a second disaster of conflagration widely over cities. In the Niigata earthquake in 1964 a damaged petroleum storage tank caused a large fire which continued for 12 days. Based on those experiences, the energy supply systems including gas and petroleum have been upgraded in Japan to create the earthquake-resistant ones. Measures taken for the gas supply system are given below.

- To implement earthquake-resistant construction for main facilities of production factories and storage tanks
- To install pipe networks made with earthquake-resistant materials which are melted steel pipes for high-pressure gas, ductile cast iron pipes with mechanical joints for medium-pressure gas, and polyethylene pipes for low-pressure
- To install interrupting devices which shall interrupt gas supply at production, storage, and large consumption facilities in emergency cases of earthquakes. Those devices shall be operated by a remote control system and an automatic device interlinked with seismometers.

In Muzaffarabad city, there has been no experience of conflagrations and fires caused in buildings, because buildings in the city are made with incombustible materials of concrete, bricks, and stones. In addition to this, loads of energy consumption and combustible goods in a building still seems lower than those in Japan. Therefore, the hazardous nature of conflagrations after earthquakes would not be remarkable in the city, whereas damages to the main facilities of production factories and storage tanks should be prevented by the earthquake-resistant construction. The other measures shall be examined at the time when the lifestyle and economic strength in the city are changed or improved in the future.

8.7. Action Plan

Action to be urgently taken to mitigate the secondary disaster and to improve the living environment shall consist of rehabilitation of the water supply system and the stream channels. Details of two urgent actions are mentioned in the project scheme in the tables below.

Table 8.7.1 Action Plan for Economic Infrastructure (1)

Project Title	Rehabilitation and Reconstruction of Damaged Water Supply Facilities
Background and Objectives	<p>The earthquake caused damages to water supply facilities in Muzaffarabad city as listed below.</p> <ul style="list-style-type: none"> i) Reduction of spring water at Maira Tanoulian and Moori Gojira springs ii) Damages to Maira Tanoulian distribution tank and its apparatus of intake and transmission lines iii) Damages to the Shanara water treatment plant and its related facilities of intake and conveyance lines <p>In the Maira Tanoulian, UNICEF implements the temporary water supply activities by water trucks which transport drinking water from distribution tanks in the Chatter area. People in the Maira Tanoulian area suffer and face inconvenience for the drinking water. In addition to the damages to the water supply systems, the existing capacity of the Makri water treatment plant will be insufficient to meet the water demand in 2016. Based on those circumstances, the rehabilitations for the water supply system shall be required to;</p> <ul style="list-style-type: none"> i) temporarily release the people in the Maira Tanoulian areas from the shortage of water supply by rehabilitating the facilities related to the Maira Tanoulian springs ii) conduct the study to expand the Makri water treatment plant for securing the stable water supply system which will not rely on the unstable water resources of springs and streams
Project Component	<p>Project components shall consist of:</p> <ul style="list-style-type: none"> i) Confirmation of the supply capacity of existing springs and streams at Maira Tanoulian, Moori Gojira, and Shanara ii) Rehabilitation of damaged facilities at Maira Tanoulian springs and Shanara water treatment plant iii) Study of the expansion of the Makri WTP to secure the stable and safe water supply system with the reliable water resource of the Neelum river
Project Period	<ul style="list-style-type: none"> i) Rehabilitation works: 6 months ii) Feasibility study and detailed design: 12 months
Implementation Agency	PHED supported by PWD
Project Effect	<p>Beneficiary: The people in Muzaffarabad city</p> <p>Economic and financial viability: Needs future study</p> <p>Environmental impact: Although natural and social environmental study should be carried out during the design stage, negative impact is not anticipated.</p>

Source: JICA Study Team

Table 8.7.2 Action Plan for Economic Infrastructure (2)

Project Title	Rehabilitation of River Channels in and around the Old City
Background and Objectives	<p>The earthquake caused landslides in Muzaffarabad city. More than 70 landslide areas have been confirmed in the Study. In and around the old city, there are three streams which are blocked by earth and sand due to the landslides. Those streams originally form the storm drainage channels to collect the surface water in the east of the old city and to discharge the collected water into Neelum River. There is apprehension that the uncollected water would cause the inundation in the residential areas along the three streams.</p> <p>The rehabilitation of those channels is, therefore, urgently required to prevent the second damages to the city and residents.</p>
Project Component	<p>Project components shall include;</p> <ul style="list-style-type: none"> i) Removal works at Makri: 1.5 km ii) Removal works at CMH: 2.5 km ii) Removal works at Tariqabad: 4.5 km iv) Protection works along three streams
Construction Period	<ul style="list-style-type: none"> i) Design works: 3 months ii) Removal works: 3 months iii) Protection works: 6 months
Implementation Agency	PHED supported by PWD
Project Effect	<p>Beneficiary: The people in and around Muzaffarabad city</p> <p>Economic and financial viability: Urgent to prevent the second disaster, nevertheless the economic and financial viability</p> <p>Environmental impact: Negative impact is not anticipated, though natural and social environmental study should be carried out during the design stage.</p>

Source: JICA Study Team

9. PARK AND OPEN SPACE

9.1. Assessment of Existing Parks

There are five parks and Narul Stadium in Muzaffarabad city. Also, there are footpaths beside the river at old city area.

Five parks are shown below.

- Jalalabad Garden: in Block-C
- Sathra Park: in Block-C
- Defense Park: in Block-D
- Thuri Park: in Block-D
- Neelum Park: in Block-E

The total area of the parks is 26.4 ha, the average park area per capita in whole city is 2.3 m² before the earthquake.

The park provision before earthquake (2.3 m²/person) is still low. Inadequate park provision can be highlighted by comparing it with figures in other countries (e.g. average of Japanese cities: 8.1 m²/person, Tokyo: 3.0 m²/person, London: 26.9 m²/person, Berlin: 27.4 m²/person, and New York: 29.3m²/person).

Especially, there is no park in the old city, therefore, the old city is a very high density area. Because of the lack of parks, park hierarchy and park network was not established. Regarding to the quality of parks, the construction level of the parks is still low, there are not enough facilities in the parks.

On the other hand, there are resources to establish parks, such as historical monuments or ruins like red fort, beautiful landscapes, natural resources like rivers etc. Based on the resources, new parks would be established. These parks are expected to be sources to empower tourism as visiting points.

The park related objectives are summarized as follows:

- To expand the total park area, and establish park hierarchy
- To improve the quality of parks, especially, suitable park facilities are necessary
- To establish parks against disaster, which can function as evacuation spaces
- To establish parks based on the resources, which can empower the tourism

- To establish parks and green spaces networks connected by footpaths

9.2. Basic Policies for Parks and Green Spaces Development

9.2.1. Establishment of Park Hierarchy and Network of Parks and Green Spaces

Generally, parks are established based on the hierarchy. In this case, the hierarchy shall be: (a) community level, (b) block level, and (c) city level. The community level is basically same as ward level. However in the case of large ward, one ward has several communities.

Also, green spaces will be established along the rivers for recreation or disaster prevention. The parks and green spaces will be connected by footpaths and the green networks are established.

9.2.2. Establishment of Parks and Green Spaces for Disaster Prevention

Parks can be important places at disaster time for emergent evacuation, headquarters to control works against disaster, medical support, space for temporary evacuation life, etc.. Also, in usual time, parks can have functions for education and training against disasters. Therefore, it is important to establish parks, which have functions against disaster and the prevention. Also, in usual time, parks have functions for education and training against disasters.

9.2.3. Tourism Empowerment

Muzaffarabad has been city for tourism. Tourism is one of the main income sources for the citizens. Parks and green paces can contribute to empower the tourism, through creation of beautiful landscape and creation of the visiting points. To create them in Muzaffarabad, historical resources, cultural resources, and natural landscape can be used for new parks. Based on these resources, the following parks can be established.

- Historical Park: It is established based on the historical resources such as ruins, historical monuments like Red Fort.
- Cultural Park: It is established based on the cultural resources such as traditional handicrafts, traditional foods.
- Natural Park: It is established based on the beautiful natural places or a viewing point of beautiful landscapes.

9.3. Concept for Parks and Green Spaces Plan

9.3.1. Parks

The Planning Standard of Park Systems in Urban Area is shown in the Table 9.3.1. These were referenced to Japanese standard.

(1) Community Park

Community park is a small park (0.1-0.25 ha) for a community, basically for ward. The maximum distance to a community park is approximately 250 m. A ward has at least one community park. However, it depends on the area of the ward. In the case of large ward, the ward has plural community parks, according to the maximum distance.

(2) Block Park

Block park is a medium size park (2.0-4.0 ha) for a block, which include several wards. The maximum distance to a block park is approximately 500 m. A block has at least one block park. However, it depends on the area of the block. In the case of large block, the block has plural block park, according to the maximum distance.

(3) City Level Park

City level park includes four types, namely, general park, sports park, historical/cultural park, natural park and riverside park. General park is established for citizen's recreation beside the university or governmental and business area, such as central park in block-A. Historical or cultural park area established based on a historical resources and cultural resources. Natural parks are established based on the natural resources such as beautiful natural places or view point of beautiful landscapes. These parks will be attractive spaces for tourists, and they will empower the tourism development in this city.

Riverside Park is established beside a river for recreation and flood disaster prevention.

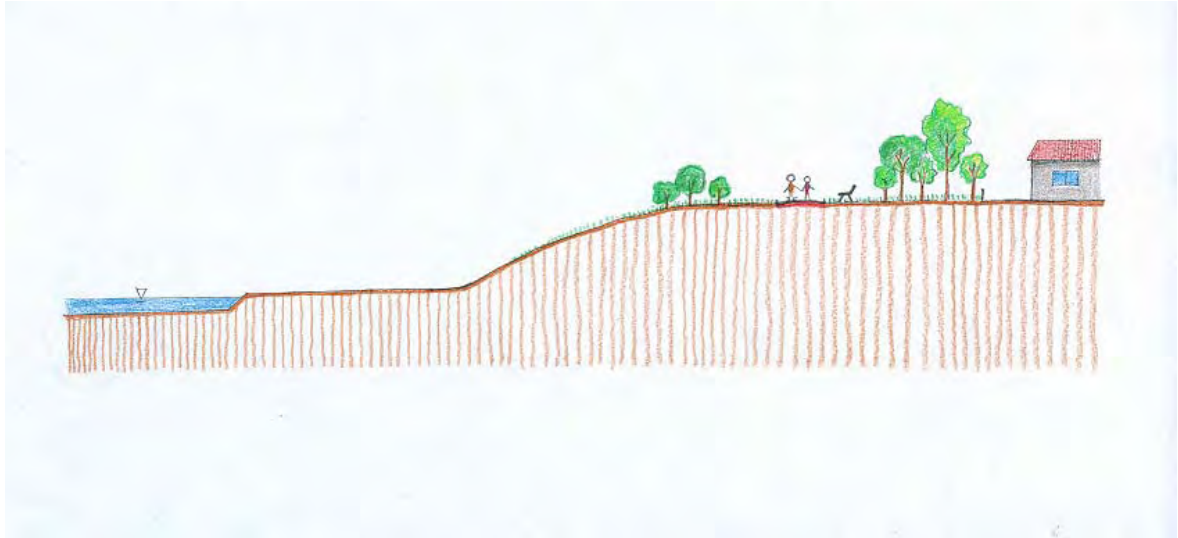
Table 9.3.1 Planning Standard of Park Systems in Urban Are

Type	Size	Distance to the Park
Community Level	0.1-0.25 ha	250 m
Block Level	2.0-4.0 ha	500 m
City Level		
General Park	4-10 ha	
Sports Park	5-10 ha	
Riverside Park	3-10 ha	
Historical/Cultural Park		
Natural Park		

Source: JICA Study Team

9.3.2. Green Spaces

Green spaces are established along a river for recreation and protection from flood. Especially, green spaces must be established along a small river which has danger of mud flood by land slide. In the green spaces, footpaths are established for comfortable walking. The example of green spaces is shown in the Figure 9.3.1.



Source: JICA Study Team

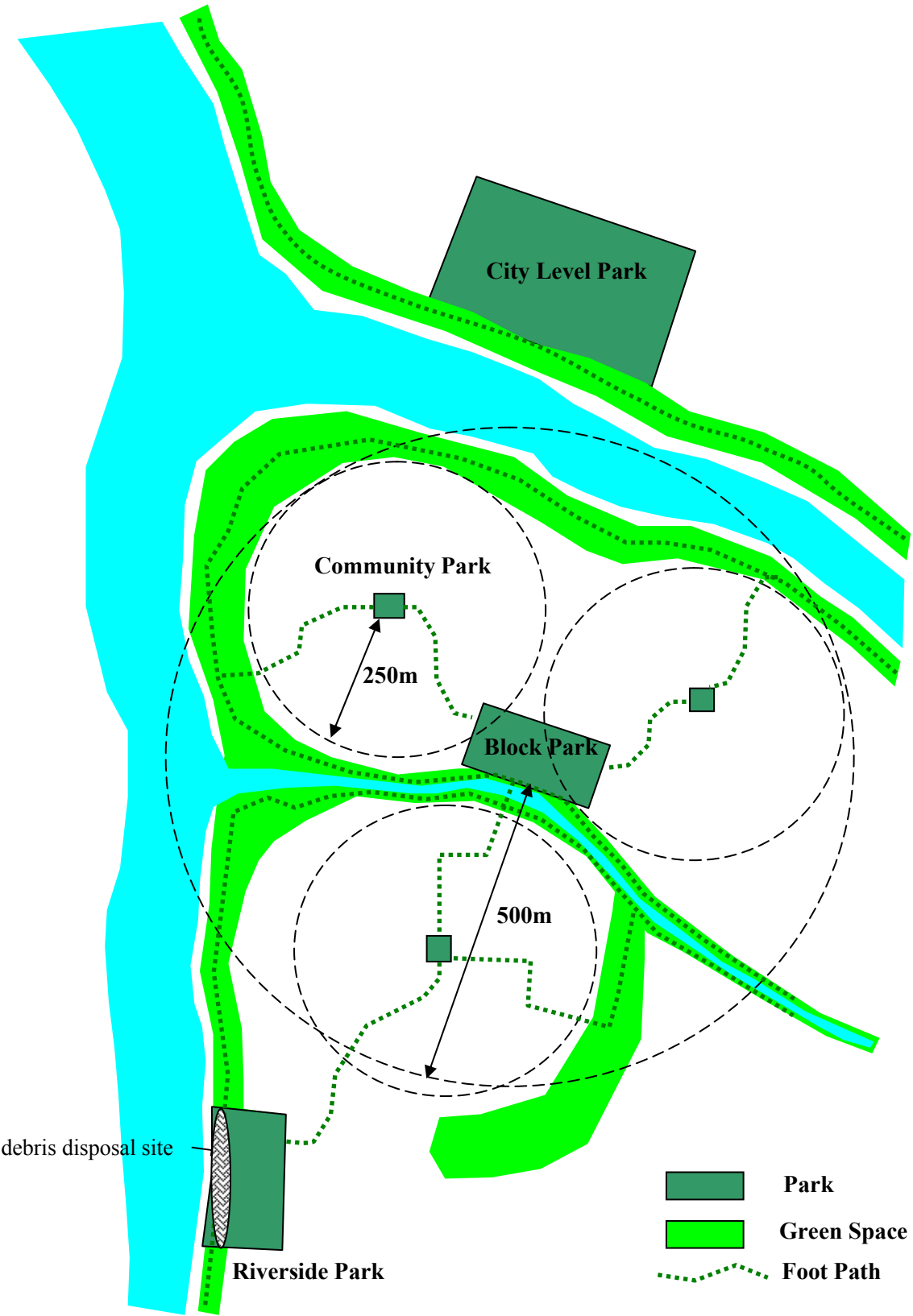
Figure 9.3.1 Example of Green Space with Footpath beside a River

9.3.3. Parks and Green Spaces Network

The park hierarchy (city level park--block park--community park) is established in the city. Also, the green spaces are established along rivers. These parks and green spaces are connected by footpaths. Then, parks and green spaces networks are established.

The creation of park networks is important for improving park functions. Recreational function and environmental function are improved by networks. To establish park networks, parks and green spaces are connected by footpaths across greeneries and along rivers. Currently, Muzaffarabad city has no such network. Therefore, park networks should be established to make environmental and recreational functions more effective.

The concept of parks and green spaces plan is shown in the Figure 9.3.2.



Source: JICA Study Team

Figure 9.3.2 Concept of Parks and Green Spaces Plan

9.4. Park Development Plan

Based on the basic policies and the concept, the park development plan is proposed as it is shown in Figure 9.4.1. The areas are shown in Table 9.4.1.

In whole city, the total area of city level parks and block parks is 63.2 ha. Also, the total area of community parks is estimated 6.0 ha. The total park area is 69.2 ha included community parks. The total area of existing parks is 26.4 ha. Therefore, the planned park area is much higher than existing one.

In urban promotion zone, the total park area of city level parks and block parks is 41.6 ha. The total park area in urban promotion zone is 47.6 ha included community parks(6.0 ha), which is 5.2% of urban promotion zone.

The standard ratio of open space in land use proportions is provided 5% to 7.5% in ‘National Reference Manual on Planning and Infrastructure Standards.’ Therefore, the ratio of parks in urban promotion zone (5.2%) is within the standard ratio of open space (5% to 7.5%).

Park area per person in urban promotion zone is 4.5 m²/person in 2016, and park area per person in whole city is 4.4 m²/person in 2016. The current condition is 2.3 m²/person in whole city, therefore, it is higher than current condition in whole city.

Table 9.4.1 Areas of Parks

	Park Area (ha)			Park Area per Person in 2016 (m ² /person)	
	Urban Promotion Zone	Preservation Zone	Whole City	Urban Promotion Zone	Whole City
City Level Park/ Block Park	41.6 (4.5%)	21.6	63.2	3.9	4.0
Community Park (estimation)	6.0 (0.7%)	0	6.0	0.6	0.4
Total	47.6 (5.2%)	21.6 (1.6%)	69.2 (3.1%)	4.5	4.4

Note: Urban Area includes Main Urban Area and Sub Urban Area

Source: JICA Study Team

Parks development policies by park type are summarized in the Table 9.4.2.

Table 9.4.2 Policies by Park Type

Park Type	Existing Parks	Policies
Central Park	None	To establish it at University site in the old city. The university will be relocated to the new university site in block-A.
Sports Park	Nural Stadium in Block-C	To establish sport park at the Nural Stadium site. To open the grounds of army and training center of the police for citizens.
Riverside Park	Neelum Park Thuri Park	To establish beside rivers for recreation and flood disaster prevention. Neelum Park, Thuri Park can be used as debris disposal site, and after the debris disposals, these parks will be improved on the quality.
Historical/Cultural Park	None	To establish based on the historical/cultural resources. To establish the historical park at Red Fort site.
Natural Park	Sathra Park	To establish based on the natural resources such as beautiful natural places, beautiful landscapes. To improve the quality of Sathra Park.
Block Park	None	To establish block parks in each blocks.
Community Park	None	To establish them in each community.

Source: JICA Study Team



Source: JICA Study Team

Figure 9.4.1 Park and Green Space Network

9.5. Establishment of Parks with Functions against Disaster

Parks can be important place at disaster time for evacuation or medical support etc.

The functions of parks at disaster time are:

- (a) Emergent evacuation
- (b) Headquarter to control works against disaster
- (c) Support of medical services
- (d) Support to live for temporary evacuation
- (e) Base camp for volunteers.

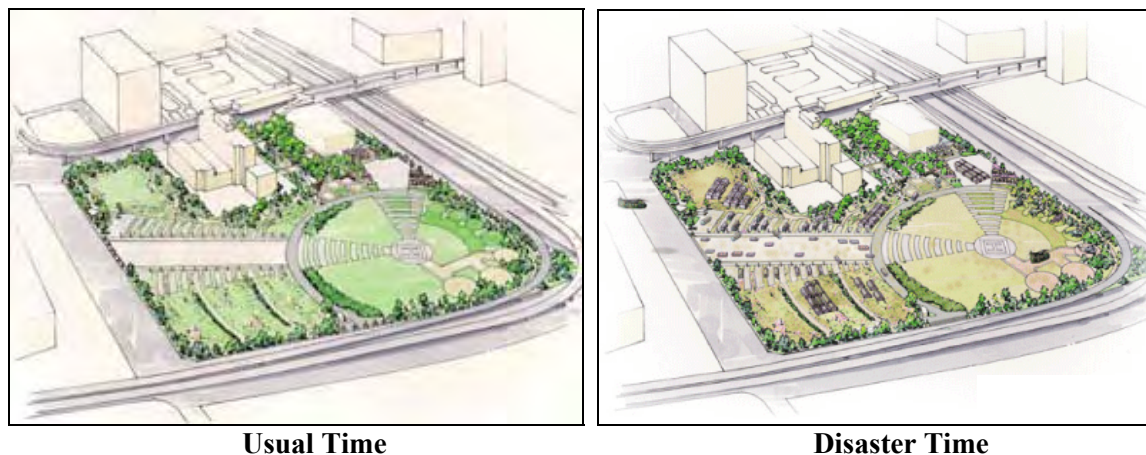
Also, in usual time, parks have functions for education and training for disasters prevention. A park with functions against disaster is basically established on the city level park, because it needs enough space for the following functions. The functions and facilities are summarized in the table below.

Table 9.5.1 Functions and Facilities against Disaster in Parks

Functions	Facilities
Disaster Time	
Emergent evacuation	Square, Ground, Paths
Headquarters to control works against disaster	Office for headquarter Broadcasting facilities, Communication facilities, Speakers for announcement in a park
Support of medical services	Tent, Square
Support to live for temporary evacuation	Water pool, Well, Pond, Stream, Generator, Lighting facilities for emergency, Storehouse, Toilet
Base camp for volunteers	Tents, Square
Usual Time	
Education on disasters prevention	Disaster exhibition Center,
Training on disasters prevention	Square, Ground

Source: JICA Study Team

A Park for disaster prevention can be used as a normal park in usual time, and it changes to the park which has functions for works against disaster when disaster occurs. Image of the conversion is shown in the figures below.



Source: Japan Ministry of Land Infrastructure and Transport

Figure 9.5.1 Image of Park for Disaster Prevention

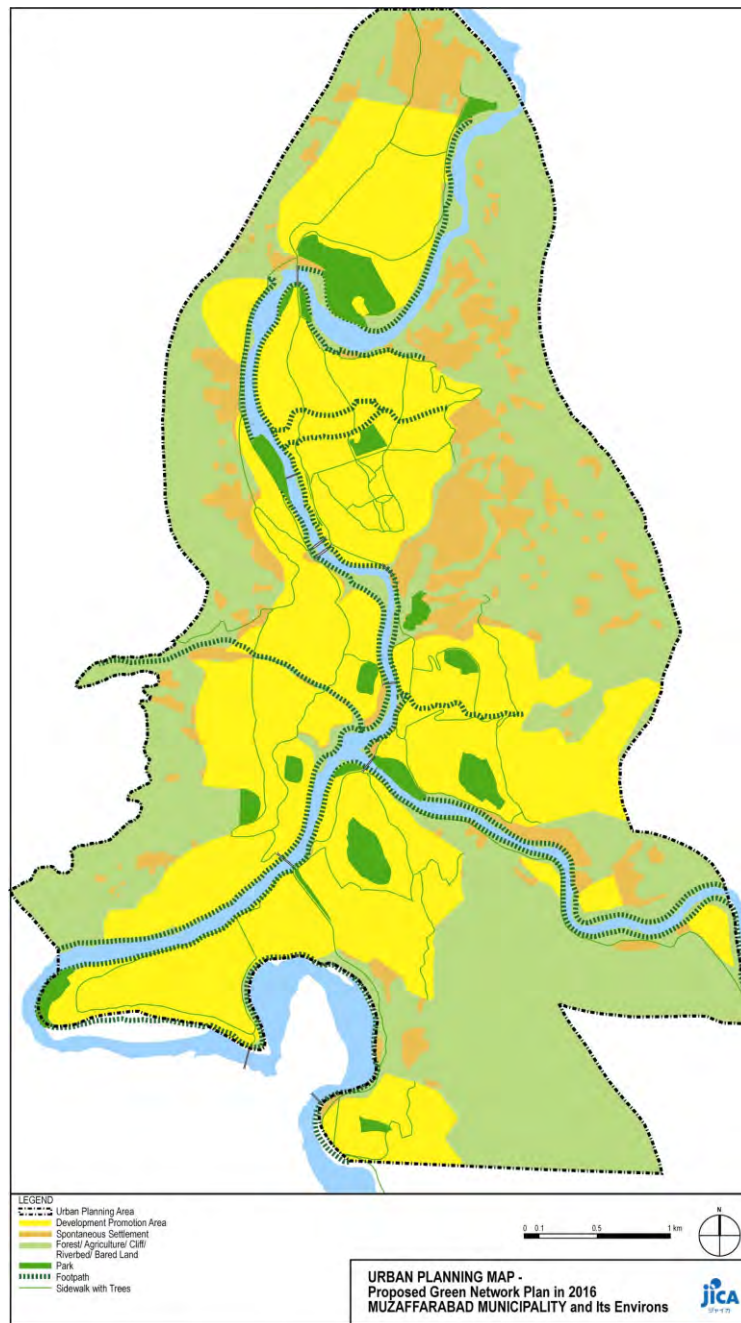
9.6. Implementation Plan

9.6.1. Project List

Parks which will be constructed newly or reconstructed are:

- (a) Riverside park at Chela Bandi (Adjacent to Neelum River)
- (b) Riverside park at Chela Bandi (Adjacent to Chela Bandi Bridge)
- (c) Central Park at old city
- (d) Sathra Park at Jalalabad
- (e) Narul Stadium Park at Jalalabad
- (f) Domel Park at Jalalabad
- (g) Neelum Riverside Park
- (h) New Park at Naluchi
- (i) Thuri Park at Thuri
- (j) Ambore Park at Ambore

The locations of these parks are shown in the figure below. Other parks planned are existing parks or ground, and greenery spaces which are conserved.



Source: JICA Study Team

Figure 9.6.1 Locations of Parks

The implementation body will be MCM for parks. The costs and the schedule are shown in the table below.

Table 9.6.1 Project List on the Parks

No.	Action Plan	Project Name	Implementation Body	Implementation Schedule														
				Phase 1			Phase 2			Phase 3								
				2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016				
PO-1		River Side Park at Chela Bandi (Adjacent to Neelum River)	DAM		■													
PO-3		Riverside Park at Chela Bandi (Adjacent to Chela Bandi Bridge)	DAM			■	■											
PO-5	B-3	Central Park with Function against disaster	DAM		■	■	■											
PO-7		Sathra Park at Jalalabad	DAM							■	■							
PO-9		Narul Stadium Park at Jalalabad	DAM								■	■						
PO-11		Domel Park at Jalalabad	DAM									■	■					
PO-13		Neelum Riverside Park	DAM		■													
PO-15		New Park at Naluchi	DAM				■	■										
PO-17		Thuri Park at Thuri	DAM		■	■												
PO-19		Ambore Park at Ambore	DAM					■	■									
PO-21		Site Selection of New Grave Yard	MCM and DAM				■	■										
PO-22		Construction of New Grave Yard	DAM						■	■	■	■	■	■	■	■	■	■

Source: JICA Study Team

As priority project, Central Park with Functions against disaster is proposed, from view points of urgency, maturity and contribution of rehabilitation and reconstruction process.

9.6.2. Priority Project (Establishment of Central Park with Functions against Disaster)

Proposed Central Park is a general park on city level, which is located in the central area of the old city in Muzaffarabad. The size is 3.1 ha. The old city area is most high density area, and Central Park can be evacuation space for the people in old city area. Therefore, it is proposed that Central Park is established as a park which has functions against disaster. This park will function as a stronghold against disaster on city level at disaster time. In usual time, this has function not only as recreational space but also as a stronghold for education and training on disaster prevention.

(1) Park Functions

The park functions at disaster time and usual time are shown below.

Functions at Disaster Time

(a) Headquarters in a disaster

- Establishment of headquarters on city level
- Information collecting
- Communication among the relating authorities

- Control on running rehabilitation works

(b) Headquarters for medical support

- Sharing the information of rescue works and medical works
- Supply of materials and facilities for “Triage”

(Triage: the process of deciding how seriously injured a person is, so that the most serious cases can be treated first)

(c) Support for evacuation and temporary evacuation life

- Preparation of the evacuation spaces
- Supply of the foods and materials for temporary evacuation life

Functions in Usual Time

(a) Recreation for citizens

- Taking a walk, Exercising, Sports, Play of children etc.

(b) Education and training on disaster prevention

- Training of the authorities concerned, such as communication among the authorities
- Education, vulgarization, and trainings on disaster prevention for citizens

(2) Zonings

Zonings in the park at disaster time and in usual time are shown as follows.

At Disaster Time

(a) Headquarter Zone

- Facilities for control on running rehabilitation work, information collecting, communication with authorities concerned

(b) Medical Supporting Zone

- Open space which can be used for medical supporting

(c) Volunteers Base Camp Zone

- Open space for work of volunteers, car parking for volunteers who came from other regions

(d) Evacuation Zone

- Open space for emergent evacuation and temporary evacuation life

In Usual Time

(a) Core Facilities Zone

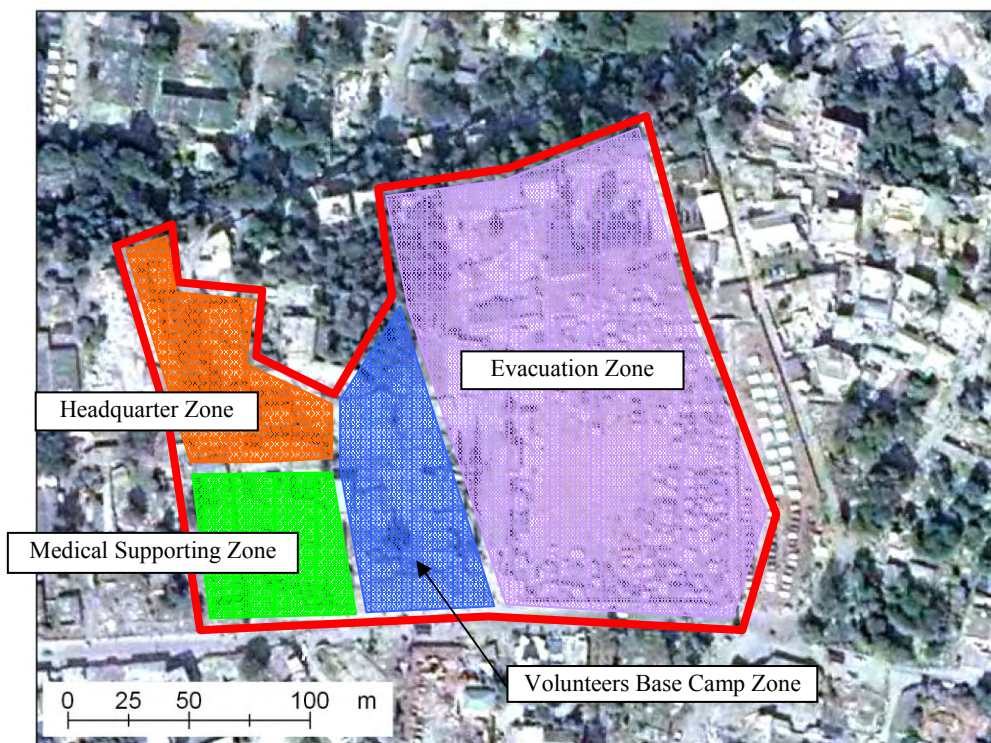
- Core facilities which have multiple functions, such as (a)Earthquake Disaster Exhibition Center, (b)Facility for education or training for disaster prevention, (c) park administration office

(b) Disaster Prevention Training Zone

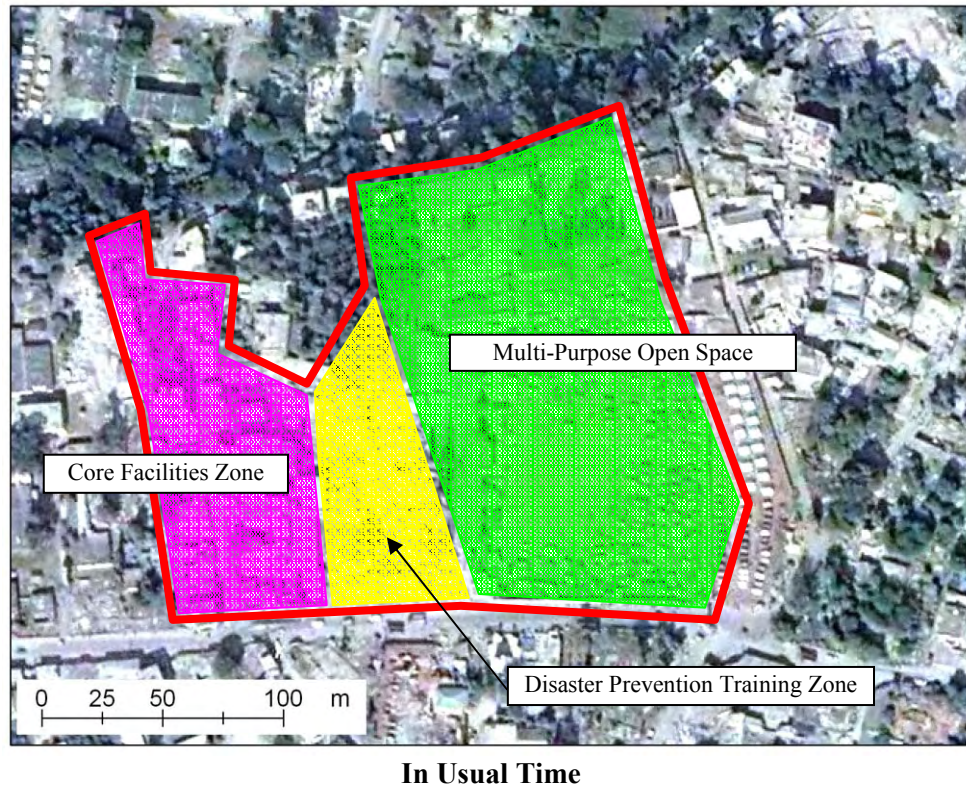
- Open space for outdoor training, such as emergent rescue

(c) Multi-purpose Open Space Zone

- Large open space for training for disaster prevention, and temporary car-parking
- Recreational Spaces with green



At Disaster Time



Source: JICA Study Team

Figure 9.6.2 Zonings in Disaster Time and Usual Time

(3) Park facilities

This park has following facilities for disaster prevention.

- Building for Headquarters with generator
- Reservoir with earthquake-proof
- Well with hand pump
- Storehouse
- Pond (to keep water for emergency)
- Toilet with tank for emergency
- Cooking facilities (barbecue site, etc.)
- Speakers (announcement for park users in usual time, and emergency announcement at disaster time)
- Facilities for exhibition of disaster, and education and training on disaster prevention

(4) Schedule

Table 9.6.2 Schedule

	Responsible Agency	Schedule					
		2006	2007	2008	2009	2010	2011
1) Basic Design and Detail Design	MCM		■				
2) Construction	MCM		■	■	■		

Source: JICA Study Team

(5) Project Effect

Beneficiary: The people in the Muzaffarabad city

Economic and financial viability: Needs future study

Environmental impact: Natural and social environmental study should be carried out during the design stage

(6) Project Summary

This priority project is summarized in the table below.

Table 9.6.3 Project Summary

Project Title	Establishment of Central Park with Functions against Disaster
Background and Objectives	Proposed Central Park is a general park on city level, which is located in the central area of the old city in Muzaffarabad. The size is 3.1 ha. The old city area is most high density area, and Central Park can be evacuation space for the people in old city area. Therefore, it is proposed that Central Park be established as a park which has functions against disaster. This park will function as a stronghold against disaster on city level at disaster time. In usual time, this has function not only as recreational space but also as a stronghold for education and training on disaster prevention.
Project Components	1) Basic Design and Detail Design - Whole park and Open Space - Buildings in the park Main Building for administration, headquarters, exhibition and education on disaster Toilets with tank for emergency Warehouse, etc. 2) Construction - Open space with facilities such as pond, benches, lights - Buildings in the park (ditto)
Construction Period	24 months
Implementation Agency	MCM
Projects Effect	Beneficiary: The people in the Muzaffarabad city. Economic and financial viability: Needs future study Environmental impact: Natural and social environmental study should be carried out during the design stage.

Source: JICA Study Team