

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR
IMPROVEMENT OF FIRE FIGHTING EQUIPMENT
IN YEREVAN CITY
IN
THE REPUBLIC OF ARMENIA**

OCTOBER, 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

FIRE EQUIPMENT AND SAFETY CENTER OF JAPAN

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PREFACE

In response to a request from the Government of the Republic of Armenia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Fire Fighting Equipment in Yerevan City and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Armenia a study team from February 28 to March 19, 2008.

The team held discussions with the officials concerned of the Government of Armenia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Armenia in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Armenia for their close cooperation extended to the teams.

October 2008

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

October 2008

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for Improvement of Fire Fighting Equipment in Yerevan City in the Republic of Armenia.

This study was conducted by Fire Equipment and Safety Center of Japan, under a contract to JICA, during the period from February to October, 2008. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Armenia and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Sadahiko Naito
Project manager,
Basic design study team on the Project for
Improvement of Fire Fighting Equipment
in Yerevan City
Fire Equipment and Safety Center of Japan

SUMMARY

SUMMARY

1. Outline of the Recipient Country

The Republic of Armenia (hereinafter referred to as “Armenia”) is an inland country which gained its independence from the former Soviet Union in 1991. It has a total population and national land area of three million and 29,800 km² (1/13th of Japan) respectively. More than 90% of the national land is situated at an elevation of 1,000 m or higher with an average elevation of 1,800 m, indicating that the country primarily consists of mountainous areas. The city of Yerevan, the subject city of the Project and the capital of Armenia, is located in the Ararat Basin, the elevation of which is approximately 1,000 m. This basin constitutes the largest flat land in the country. The country is dominated by a continental highland climate. While the mean annual temperature is 11.4°C, the temperature considerably fluctuates from a lowest temperature of -25°C in winter to a highest temperature of 40°C in summer. The mean annual rainfall of approximately 320 mm is quite low, resulting in few natural sources of water as there are no major rivers or other sources from which water can be obtained.

The economic indices of Armenia show a GDP of US\$ 8.7 billion, a GNI per capita of US\$ 1,930 (World Bank, 2006) and an annual economic growth rate of 13.7%. The main industries are agriculture, lapidary and machine manufacture. Diamond jewellery accounts for 36% of Armenia’s total export value.

2. Background, History and Outline of the Requested Project

The Government of Armenia established the Armenia Rescue Service (hereinafter referred to as “ARS”) in 2005 and also formulated the 2008-2010 Midterm Expenditure Project to consolidate the country’s fire services. This project lists two priority issues to protect the people and the national land. These two priority issues are “improvement of the firefighting skills and reinforcement of the firefighting equipment at each fire station” and “renewal of the nationwide communication and warning system in Armenia”.

However, the reality is that the severe fiscal situation makes it impossible to renew either the fire tank engines or ladder trucks which are incapable of a quick turnout because of their advanced state of deterioration. The resulting use of the functionally imperfect fire vehicles for firefighting means a troublesome response to fires and other disasters. Under these circumstances, the Government of Armenia has made a request for Japanese grant aid for the improvement of fire vehicles in Yerevan.

The objective of the Project is to protect the lives and property of the citizens of Yerevan from fires and other disasters to secure safety and peace of mind in the target area by means of improving the fire service strength through the provision of new fire vehicles for 13 fire stations in Yerevan, the capital.

Yerevan has a concentration of one-third of the total population and more than half of the fires in Armenia occur in this city. As the booming economy has been pushing forward the expansion and redevelopment of urban areas, the number of fires and other disasters is expected to increase in the coming years. This prospect illustrates the extremely high level of the urgency and necessity of the Project.

3. Summary of the Study Findings and Project Contents

In response to the request by the Government of Armenia, the Government of Japan decided to conduct a basic design study and the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team to Armenia from 28th February to 19th March, 2008. The Study Team discussed and confirmed the contents of the request with ARS and other organizations related to the Project in Armenia, visited 13 fire stations in Yerevan and gathered the necessary information. Subsequently, the Study Team examined the optimal contents and scale of the Project and estimated the project cost. A mission was dispatched to Armenia from 15th to 24th July, 2008 to explain and discuss the Summary of the Basic Design. The Study Team has now compiled the final Basic Design Study Report.

The field survey confirmed that all of the fire vehicles currently deployed at the 13 fire stations in Yerevan are suffering from malfunctioning due to their state of extreme deterioration and are unable to meet the 10 minute response time required by the relevant Armenian standards. Moreover, they are incapable of satisfactorily conducting firefighting activities. It was, therefore, decided to decommission all of the existing fire vehicles and to deploy the minimum but sufficient number of new fire tank engines and ladder trucks to solve the problem of the inadequate firefighting and rescue capabilities of each fire station.

For the formulation of the equipment deployment plan, the necessity to deploy new fire vehicles and the number and types of fire vehicles were determined based on the operating system of ARS. In this process, various factors were taken into consideration, including the area, population, existence of narrow roads, number of fires a year, water supply situation, existence of medium to high buildings and gradient of local roads in the service area of each fire station. Each fire vehicle will carry fire hoses, discharge nozzles, equipment as well as tools used by ARS for firefighting and rescue activities, protective clothing to ensure the safety of firefighters, breathing apparatus and other urgently required equipment.

The fire vehicles to be deployed under the Project will be the first new trucks since Armenia's independence from the former Soviet Union and it has been decided to introduce a soft component covering the firefighting and operating techniques (skills) related to fire tank engines and the operating techniques (skills) related to ladder trucks.

The deployment plan, purpose of use of each type of fire vehicle and the range of loaded equipment are outlined below.

Fire Vehicle Deployment Plan

Target Fire Stations	Types of Fire Vehicles to be Deployed					Total
	3,500 lit. Fire Tank Engine 4 x 2	3,500 lit. Fire Tank Engine 4 x 4	10,000 lit. Fire Tank Engine	1,000 lit. Small Fire Truck	Ladder Truck	
No. 1 FRD	1		1			2
No. 2 FRD	2					2
No. 3 FRD	2					2
No. 4 FRD	2					2
No. 5 FRD	1		1			2
No. 6 FRD	1					1
No. 7 FRD		2				2
No. 8 FRD	1		1	1	1	4
No. 9 FRD		1	1			2
No. 10 FRD	1					1
No. 11 FRD	2					2
No. 12 FRD		2		1		3
SFD		1	1		1	3
Total	13	6	5	2	2	28

Types of Fire Vehicles and Their Purpose of Use

Type of Truck	Purpose of Use	Main Loaded Equipment	Quantity
3,500 lit. Fire Tank Engine (4 x 2)	Carries a 3,500 lit. water tank and a chemical fluid tank for efficient firefighting; arrives at the scene of a fire first and independently conducts firefighting until water is relayed.	Suction pipes; fire hoses; discharge nozzles; hose couplings; hose carrier; portable turret nozzle; combined cutter; rod cutter; three extension ladder; single section ladder; protective clothing sets; breathing apparatus; portable radio equipment; others	13
3,500 lit. Fire Tank Engine (4 x 4)	Has the additional capability of travelling in hilly areas with sloping roads to the functions of a 3,500 lit. fire tank engine(4x2).	Suction pipes; fire hoses; discharge nozzles; hose couplings; hose carrier; rod cutter; three extension ladder; single section ladder; protective clothing sets; breathing apparatus; portable radio equipment; others	6
10,000 lit. Fire Tank Engine	Carries a 10,000 lit. water tank and a chemical fluid tank for efficient firefighting; capable of conducting water discharge for a long time	Suction pipes; fire hoses; discharge nozzles; hose couplings; rod cutter; three extension ladder; single section ladder; protective clothing sets; breathing apparatus; portable radio equipment; others	5
1,000 lit. Small Fire Truck	Is small and mobile to deal with fires in dense residential areas with narrow roads and carries a 1,000 lit. water tank to continually discharge water until relayed water from a follow-on fire tank engines becomes available.	Suction pipes; fire hoses; discharge nozzles; hose couplings; hose carrier; combined cutter; rod cutter; three extension ladder; protective clothing sets; breathing apparatus; portable radio equipment; others	2
Ladder Truck	Has a basket of which the highest working height is 30 m or more to deal with fires involving medium to high buildings with 10 stories or less.	Fire hoses; turret nozzle; rod cutter; single section ladder; protective clothing sets; portable radio equipment; others	2

4. Estimated Project Duration

The total project duration will be approximately 21 months, including the period required for the detailed design, equipment procurement and the soft component.

5. Verification of the Project Relevance

The implementation of the Project is expected to achieve the following concrete effects (outcomes) in the light of its stated objectives.

- (1) The deployment of 28 new fire vehicles at 13 fire stations will enable swift and effective firefighting and rescue activities.
- (2) The renewal of the deteriorated fire tank engines will substantially shorten the response time (from the issue of a dispatch order to the arrival of a tank engine at the scene of a fire to commence water discharge) to 10 minutes or less.

- (3) The deployment of new ladder trucks will enable swift rescue and firefighting activities at medium to high buildings.

Some 1.1 million citizens of Yerevan will benefit from the Project and the renewal of the fire vehicles under the Project will make a major contribution to improving the protection and safety of the citizens from fires and other disasters. The responsible organization and implementation body of the Project on the Armenian side are the Ministry of Emergency Situations and ARS respectively. The ARS is capable of conducting the operation and maintenance of the new fire vehicles with its own funding, personnel and technical expertise.

Based on the above assessment results, it is judged that the implementation of the Project with Japanese grant aid is relevant to the purpose of the grant aid scheme of the Government of Japan.

It is hoped that the Armenian side will heed the following recommendations to ensure the efficiency and effectiveness of the Project and also to sustain the effects of the Project for a long time.

- Continual education/training on ladder truck and fire tank engine operating techniques
For the effective use of the fire vehicles to be deployed under the Project in the face of fires and other disasters, it is essential for fire personnel to master practical operating and handling skills. While technical guidance regarding these skills will be provided under the soft component of the Project for trainers, the Armenian side should provide continual education/training so that the said skills are spread throughout ARS.
- Implementation of the quantitative assessment of the fire service strength, including the response time
Reduction of the response time is highly effective to mitigate the damage caused by a fire, etc. Detailed analysis of the available response time data is necessary to clarify the problems so that measures to shorten the response time can be prepared.
- Fire Prevention Measures for Medium and High Buildings
The maintenance of escape stairs or fire compartmentation of many medium to high buildings is important, so guidance for persons concerned should be sufficiently provided by ARS. In addition, in accordance with the Law On Fire Security, fire prevention guidance should be conducted for new medium and high buildings that are required to have fire prevention equipment installed such as sprinklers or indoor fire hydrants.

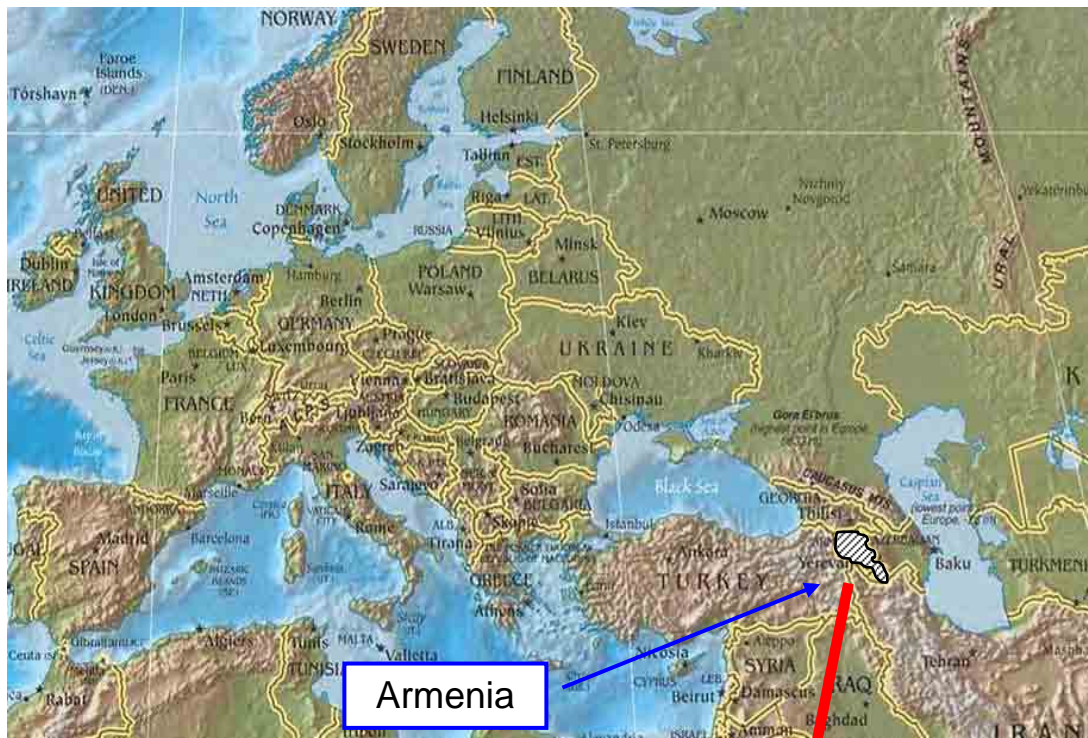
- Promotion of comprehensive firefighting measures

Comprehensive disaster prevention measures should be implemented, combining improvement of the hardware represented by improvement of the fire service strength under the Project with such soft measures as guidance on fire and disaster prevention by the fire service for local residents and businesses.

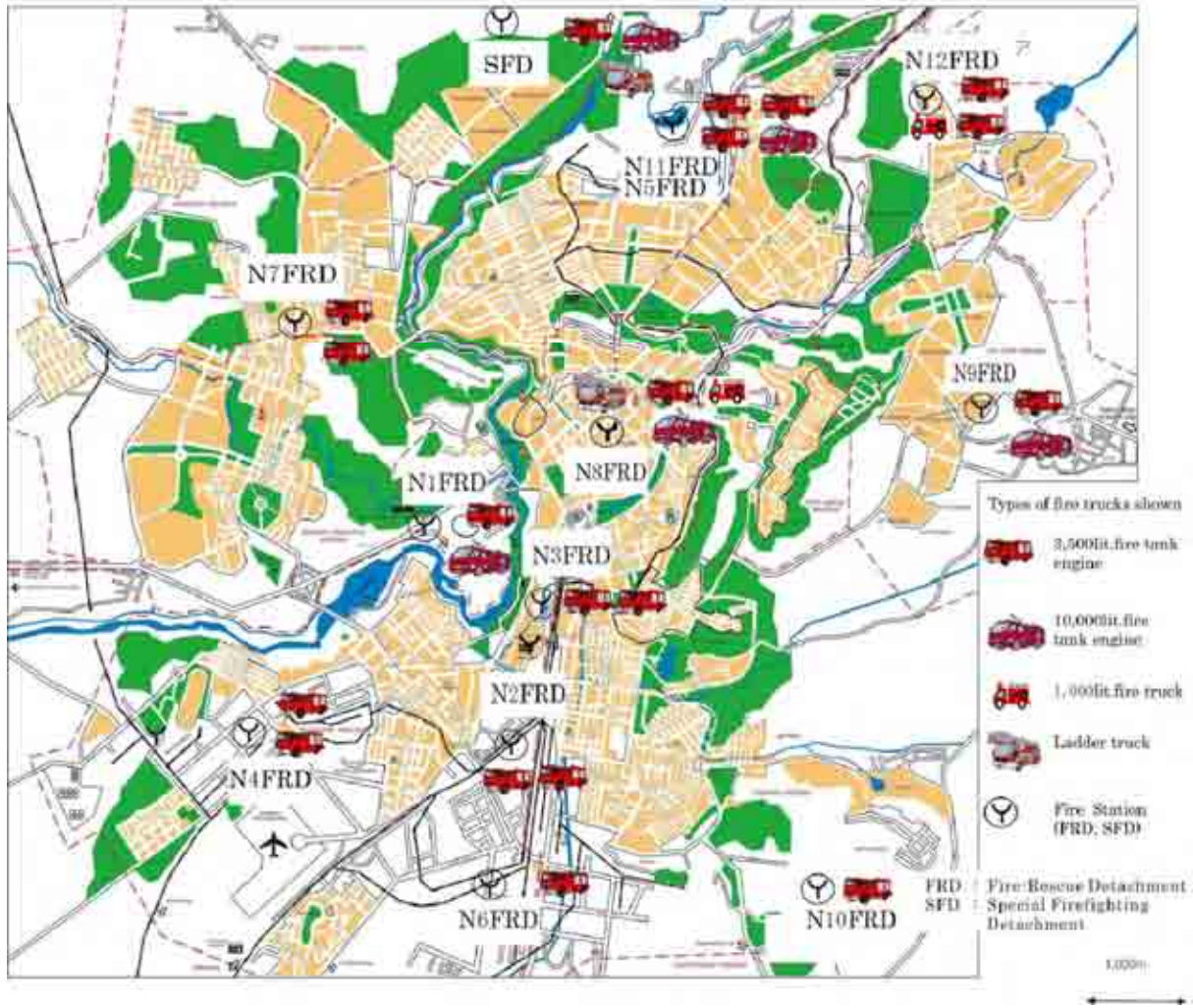
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SITE MAP

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ABBREVIATIONS

Abbreviation	English name
AMD	Armenian Dram
ARS	Armenian Rescue Service
EBRD	European Bank for Reconstruction and Development
E/N	Exchange of Notes
EUR	Euro
FM	Frequency Modulation
FRD	Fire-Rescue Detachment
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
ILO	International Labor Organization
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
SFD	Special Firefighting Detachment
USAID	United States Agency for International Development
VHF	Very High Frequency

CHAPTER 1

BACKGROUND OF THE PROJECT

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BACKGROUND OF THE PROJECT

1.1 Background of the Project

The Government of the Republic of Armenia (hereinafter referred to as “Armenia”) established the Armenia Rescue Service (hereinafter referred to as “ARS”) in 2005 and also formulated the 2008-2010 Midterm Expenditure Project to consolidate the country’s fire services. This project lists two priority issues to protect the people and the national land. These two priority issues are “improvement of the firefighting skills and reinforcement of the firefighting equipment at each fire station” and “renewal of the nationwide communication and warning system in Armenia”.

However, the reality is that the severe fiscal situation makes it impossible to renew either the fire tank engines or ladder trucks which are incapable of a quick turnout because of their advanced state of deterioration. The resulting use of the functionally imperfect fire vehicles for firefighting means a troublesome response to fires and other disasters.

Yerevan, the capital of Armenia has a concentration of one-third of the total population and more than half of the fires in Armenia occur in this city. As the booming economy has been pushing forward the expansion and redevelopment of urban areas, the number of fires and other disasters is expected to increase in the coming years. Under these circumstances, the Government of Armenia has organized the project aiming for the improvement of fire equipment in Yerevan (hereinafter referred to as the “Project”) and made a request for Japanese grant aid for the Project.

1.2 Natural Conditions

Yerevan is characterised by a continental highland climate with a hot summer and cold winter. There are few trees in mountain areas because of the dry ground, in turn due to the low level of rainfall.

The city is located in the Ararat Basin. The elevation is around 1,000 m and the average annual rainfall is approximately 320 mm. This low level of rainfall means a lack of major rivers and other natural sources of water.

The mean annual temperature is 11.4°C but the temperature considerably fluctuates from a lowest temperature of -25°C in winter to a highest temperature of more than 40°C in summer. The climate of Yerevan is summarised in Table 1-1-1.

Table 1-1-1 Climate of Yerevan

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest Temperature (°C)	15	20	26	30	34	38	42	40	39	33	25	17
Mean Temperature (°C)	-3.7	-2.3	4.0	11.1	15.9	20.1	24.0	24.2	20.0	13.9	6.2	-1.2
Lowest Temperature (°C)	-25	-23	-17	-7	-1	5	7	7	-2	-7	-14	-24
Rainfall (mm)	23	24	29	42	51	27	14	10	13	26	28	22

1.3 Environmental and Social Considerations

As the Project intends the renewal of existing fire vehicles, it will not have any new impacts on the environment or society.

1.4 Other

As the Project intends improvement of the fire service strength through the deployment of new fire vehicles, it will not have any negative impacts on such global issues as gender, human security, poverty reduction and aid trends. As some of the planned fire vehicles aim at improving the fire service strength in areas in which low income citizens of Yerevan dwell, they will make a positive contribution to the protection of inhabitants of the target areas from fire, enhancing the safety of these areas.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2

CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

2.1.1 Higher Goal and Objective of the Project

The higher plan for the Project is the “2008 – 2010 Midterm Expenditure Project” of which goal is to protect people and national land from disasters. This Midterm Expenditure Project has two priority issues. One is “improvement of the firefighting skills and reinforcement of the firefighting equipment at each fire station” and the other is “renewal of the nationwide communication and warning system in Armenia”.

The objective of the Project is to protect the lives, bodies and property of the citizens of Yerevan from fire and other disasters by means of improving the fire service strength through the provision of new firefighting equipment for fire stations in Yerevan, the capital of Armenia with a high priority for the fire service, thereby ensuring safety in the city.

2.1.2 Outline of the Project

The Project intends ① the deployment of new fire vehicles of appropriate types and sizes at fire stations in Yerevan to improve the fire service strength in the city while decommissioning many of the existing highly deteriorated fire vehicles and ② the improvement of firefighting skills to ensure the effective use of the newly deployed firefighting equipment. As an outcome of the Project, it is expected that the significant improvement and strengthening of the fire service in Yerevan will mitigate the damage caused by fires and other disasters and improve the safety in the city.

The requested Japanese assistance consists of ① the procurement and deployment of nineteen 3,500 lit. fire tank engines, five 10,000 lit. fire tank engines, two 1,000 lit. small fire trucks and two ladder trucks, totalling twenty-eight fire vehicles, and ② a soft component aimed at the transfer of effective fire vehicle operating skills.

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Basic Policy

(1) Scope of the Requested Japanese Assistance

The requested Japanese assistance, i.e. the Project, aims at improving the fire service strength in Yerevan by means of planning and procuring fire vehicles of the appropriate sizes and specifications for 13 fire stations, i.e. 12 fire-rescue detachments (FRDs) and one special firefighting detachment (SFD). The scope of the Project is the procurement of the necessary fire vehicles.

These trucks will carry a range of firefighting equipment which is necessary to conduct firefighting activities as well as the minimum rescue activities. Such equipment and the spare parts required for the maintenance of the fire vehicles are also included in the scope of the Japanese assistance.

(2) Technical Guidance

The outcome of the Project will be the deployment of new fire vehicles mounted with the necessary equipment. The following targets should also be achieved to further enhance the positive effects of the project outcome.

- Technical capability of local firefighters to operate fire tank engines and to conduct effective firefighting
- Technical capability of local firefighters to operate ladder trucks

The training of local firefighters to master the above skills is, therefore, included in the scope of the Japanese assistance.

(3) Selection of the Target Sites

The target sites of the Project are 13 fire stations (12 FRDs and 1 SFD) in Yerevan.

(4) Selection of Equipment

The following criteria are used for the selection of equipment for the Project.

- Equipment which can be operated with the experience, technical capacity and ability currently possessed by ARS

- Equipment which does not require a substantial increase of the manpower and maintenance cost, etc.

The field survey has identified the following three urgent tasks for ARS.

- Shortening of the response time (time from dispatch after receiving a turnout order to the commencement of firefighting activities <water discharge>)
- Increase of the number of fire vehicles which are ready to respond at any time and which are loaded with water
- Firefighting and rescue measures to deal with fires at high rise buildings

The fire vehicle operation plan in Armenia basically demands the turning out of two fire tank engines to deal with a fire and two fire tank engines are deployed at each FRD. However, the fire vehicle deployment standards based on the Law On Fire Security stipulate the deployment of a third fire tank engine at each FRD to deal with a large-scale fire or a situation involving multiple fires within the geographical area of jurisdiction.

Meanwhile, most of the fire tank engines which are currently deployed are more than 20 years old and the Project primarily intends the replacement of these old vehicles. Ladder trucks and aerial platforms are deployed at some of the FRDs in Yerevan and the Project plans the replacement of two aging such vehicles.

Based on the above-mentioned background, the required number of fire vehicles to be renewed will be determined by examining the number of units necessary at each fire station and inspecting the condition of each vehicle. The specifications and deployment of each type of fire vehicle are then determined for each FRD based on the following indicators.

< Indicators >

- Number, condition and locations of hydrants and other firefighting water sources
- Existence of an area with narrow roads
- Sloping situation of roads
- Number of fires per year
- Number of medium to high buildings
- Population size
- Area

The scale and specifications of the equipment are decided to meet the following requirements.

- Equipment which can be operated and maintained with the budget and manpower of ARS

- Equipment which can be fully operated and maintained with the relevant capability of the fire personnel working at the target sites
- Optimum equipment of the minimum requirement which is used for firefighting tactics employed in Japan and other countries to deal with disasters which are likely to occur in Yerevan
- Equipment which can perform basic firefighting activities on its own when some time is required for other fire companies to reach the scene
- Radio equipment which can be used within the framework of the existing fire radio system
- Spare parts which are necessary for the maintenance of fire vehicles to be procured under the Project

2.2.1.2 Natural Conditions

(1) Climate

Yerevan is characterised by a continental highland climate with substantial temperature fluctuations from -25°C to more than 40°C. In view of such a harsh climate, the equipment design will give careful consideration to use at very high and low temperatures.

(2) Topography

The city is very undulating. Some areas have many steep hills, making the deployment of fire vehicles with steep hill climbing capability and a good travelling performance on roads with poor conditions essential.

(3) Water Supply

The rainfall is low throughout the year and the city has few rivers and other natural water sources for the supply of firefighting water. Because of the scarce water resources, in Yerevan municipal water is supplied for approximately four hours a day. It is, therefore, necessary for ARS to request that the water board supply water to the hydrants to support firefighting activities. To make matters worse, a small number of hydrants installed during the Soviet period are highly deteriorated due to the lack of proper maintenance and many of them do not function properly. As such, the procurement and deployment of new fire vehicles which have a water tank is imperative. As chemicals are used to ensure efficient firefighting with a small amount of water, the new fire vehicles must carry a chemical fluid tank.

In regard to the water quality, the field survey discovered the corrosion of most of the fire pumps, pipes and water tanks of the existing fire vehicles. Moreover, the concentration of chloride ions

in drinking water is high at 50 to 70 mg/lit. in some areas. Since chloride ions are characterized by strong metal corrosive action and the stainless steel is generally corroded in the concentration of 50 mg/lit. or more, special attention should be given to the quality of materials for water tanks and pipes.

2.2.1.3 Socioeconomic Conditions

The buildings in Yerevan are basically constructed of stone and reinforced concrete and have a fire-resistant construction. However, a large quantity of wood and other combustible materials is used on the inside. Once a fire starts, it can engulf an entire room in some 10 minutes. Any delay of evacuation leads to a high risk to human life. Therefore, ARS adopts the target of reaching a fire scene within 10 minutes.

In Japan which has a high percentage of wooden houses, studies on actual fires and combustion tests have established that a fire rapidly spreads some 10 minutes after initial ignition (see Attached Table 3 – “Flashover”, combustion data provided by the Fire Technology and Safety Laboratory of the Tokyo Fire Department). The Project aim is the commencement of firefighting activities within 10 minutes after a mobilization order is issued, which is stricter than ARS standards, by shortening the onsite arrival time for the deployment of fire vehicles and through the implementation of soft component program.

2.2.1.4 Procurement Conditions

Most of the existing fire vehicles have a petrol engine. However, petrol engine ladder trucks and fire tank engines are generally not manufactured, so diesel engine trucks will be procured.

(1) Permit Systems and Laws Relevant to Project Implementation

1) Permit System

Vehicle examination for registration will be conducted by the Technical Committee of the Transport Police. One principal requirement for vehicle registration is that vehicles must be manufactured by manufacturers approved by the Government of Armenia. The new vehicles will be registered as fire vehicles by ARS after their handing over.

Radio equipment is subject to control under the Radio Communication Law and the Radio Law, etc. However, as the new radio equipment to be provided under the Project is equivalent to the existing equipment using the already established radio system, no special permit is required for its use.

2) Relevant Laws

The Road Traffic Law of Armenia will be referred to for the design of the fire vehicles. As there is no law in Armenia for the control of emissions by diesel vehicles, the standard specification of the vehicle manufacturers will be accepted.

(2) Applicable Design Standards

There is no vehicle production plant in Armenia. The existing fire vehicles of ARS are mostly petrol engine vehicle made in the former USSR. As petrol engine fire vehicles are no longer manufactured today, the standards, etc. for diesel engine fire vehicles manufactured in Japan, Europe and the US will be applied to the new fire vehicles.

In regard to loading equipment, Japanese standards (JIS) or comparable US or European standards will basically be used.

The new radio equipment will be designed to use VHF (FM) as the standard to match the existing radio communication system.

2.2.1.5 Operation and Maintenance Capability of the Implementing Body

The ARS has its own inspection and maintenance guidelines for fire vehicles. Based on these guidelines, a senior engineer (crew member qualified to drive a fire vehicle) is responsible for the inspection and maintenance of fire equipment at each FRD and conducts daily checks as well as periodic inspections.

As breakdown repair and annual servicing, etc. of fire vehicles are entrusted to ARS's own workshop or a private maintenance shop, there is an established inspection and maintenance system.

There is no question regarding the competence of the workshop mechanics as remounting of the engines, overhaul of the fire pumps and other complicated work are satisfactorily conducted. As ARS staff has little experience of maintaining diesel vehicles, initial technical training will be provided by the fire vehicle manufacturer(s) on the maintenance of diesel engine fire vehicles.

2.2.1.6 Equipment Grade

The grades of the equipment planned under the Project are determined in accordance with the following conditions and policy to sustain the positive effects of the Project.

The mandatory requirements for the new fire vehicles are compatibility with the types of disasters, topography, meteorological conditions, etc. of the Project site, excellent general versatility and robustness and ease of operation and maintenance.

To meet the above requirements, fire vehicles using proven and reliable technologies in terms of manufacture and operation will be procured instead of the latest fire vehicles using advanced technologies.

2.2.1.7 Procurement Method and Schedule

(1) Procurement Method

The eligible countries for fire vehicle procurement will be those countries which have a manufacturer of fire vehicles which satisfy the following conditions at the Project site.

- Fire vehicles of which the mechanisms and functions can be fully utilised with the equipment operating skills of fire personnel to implement fire tactics
- Fire vehicles which are compatible with the geographical, topographical and meteorological conditions and which conform to the relevant laws
- Fire vehicles of which the quality and robustness ensure the preservation of the initial performance level for a long time and which have a high level of resistance to breakdowns
- Fire vehicles which can be maintained by the existing maintenance capability of ARS
- Fire vehicles which can withstand the cold climate of Armenia

(2) Implementation Period

As the Project is a long project covering a period of more than 20 months from the signing of the E/N to the final handing over, an efficient implementation schedule will be carefully planned.

2.2.2 Basic Plan

2.2.2.1 Planning Process for the Design

The planning processes for the basic plan are as shown in Fig. 2-2-1. Firstly, the fire vehicle deployment plan (contents of the request) is checked against the environment (local conditions) for the fire service in Yerevan and the basic design policies and criteria. The next step is examination of the internal factors of the fire service organization, including such soft aspects as firefighting tactics and the deployment of fire companies, which require improvement or introduction so that the fire vehicle deployment plan reflects the desirable fire service strength. Meanwhile, the equipment plan is formulated to select the types, specifications and scales of the fire vehicles so that the minimum range of fire vehicles, etc. to maintain the required level of the fire service strength can be provided by the Japanese side.

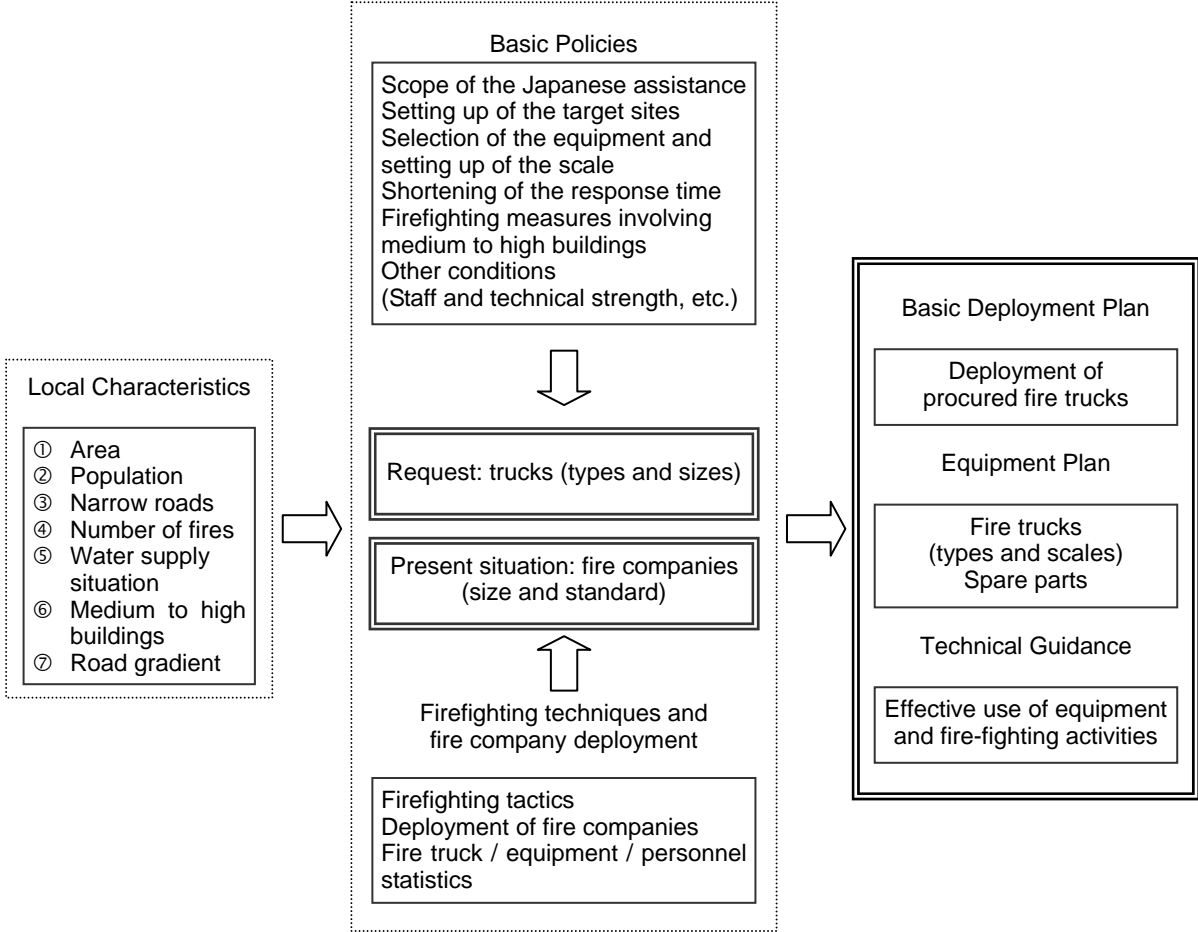


Fig. 2-2-1 Planning Processes for the Basic Plan

The purpose of the basic plan is not simply the formulation of an equipment plan in order to renew aged equipment but to plan the minimum range of equipment required to maintain the fire service strength of each FRD. Accordingly, the first step of the planning is the determination of the required

fire equipment to correspond to the required level of the fire service strength as identified by the planning processes. In particular, the fire vehicle deployment plan commands central importance.

2.2.2.2 Changes from the Original Request

At the time of the Basic Design Study, ARS made an additional request for small fire trucks with a small water tank (500 – 1,000 lit.), pick-up trucks to carry hoses, rescue equipment and personnel and a command post vehicle to transport the commander to the disaster scene at the time of a large-scale disaster. These items were examined from the viewpoint of the criteria referred to in (4) – Selection of Equipment in 2.2.1.1 – Basic Policy. Table 2-2-1 shows the outcome of this examination. In regard to the request for one ladder truck and one aerial platform, considering the identical purpose of usage, it was agreed by ARS to integrate these into two ladder trucks, which allow quick operation. Currently, baskets can be provided for both types of the vehicles, and there is merit in respect of unifying maintenance and operation and to share maintenance parts.

Table 2-2-1 Changes from the Original Request

Fire Station	Original Request	Additional Request	Examination Results
No. 1 FRD	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1	Fire Truck 500 – 1,000 lit. x 1	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1
No. 2 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2
No. 3 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2
No. 4 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2
No. 5 FRD	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1		10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1
No. 6 FRD	3,500 lit. Fire Tank Engine x 1		3,500 lit. Fire Tank Engine x 1
No. 7 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2
No. 8 FRD	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1	Fire Truck 500 – 1,000 lit. x 1	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1 1,000 lit. Small Fire Truck x 1 Ladder Truck x 1
No. 9 FRD	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1		10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1
No. 10 FRD	3,500 lit. Fire Tank Engine x 1		3,500 lit. Fire Tank Engine x 1
No. 11 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2
No. 12 FRD	3,500 lit. Fire Tank Engine x 2		3,500 lit. Fire Tank Engine x 2 1,000 lit. Small Fire Truck x 1
SFD	10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1 Ladder Truck x 1 Aerial Platform x 1		10,000 lit. Fire Tank Engine x 1 3,500 lit. Fire Tank Engine x 1 Ladder Truck x 1
Undecided		Pick-Up Truck x 4	Not provided as these can be substituted by other vehicles
ARS HQ		Command Post Vehicle x 1	Not provided as this can be substituted by another vehicle

Notes

- 1) FRD : Fire-Rescue Detachment (fire station)
SFD : Special Firefighting Detachment (special fire station)
- 2) Based on the Minutes of Discussions dated 5th March, 2008

2.2.2.3 Deployment Plan for Fire Vehicles

The extreme shortage of fire vehicles equipped with the necessary functions at each FRD in Yerevan indicates the urgent necessity to introduce the minimum but necessary number of fire tank engines and ladder trucks which form the foundations for firefighting activities. Meanwhile, the pick-up trucks and command post vehicle additionally requested by ARS have been omitted from the scope of the Project as their deployment is neither urgent nor necessary given the fact that they are not involved in firefighting, rescue or other activities on a daily basis.

(1) Deployment Plan for Fire Tank Engines

1) Deployment Standards

The ARS adopts the principle of dispatching two fire tank engines to the scene of a fire as already mentioned in 2.2.1.1 – Basic Policy. In the light of the actual firefighting activities in Yerevan, the practice of the turning out of two fire tank engines is judged to be appropriate because of the advantages listed in Table 2-2-2.

Table 2-2-2 Advantages of Turning Out of Two Fire Tank Engines

Type of Activity	Description of Advantage
Preparation for water discharge	<ul style="list-style-type: none"> ① By deploying one fire tank engine by a building on fire and another by a hydrant or another water source, water relay to the former is possible even if the building on fire is some distance from the nearest hydrant. ② As the crew members of the first fire tank engine and second fire tank engines can be fully engaged in firefighting and water intake/relay operation respectively, water for firefighting can be smoothly supplied. ③ After securing water supply from a source, the crew members of the second fire tank engine can assist those of the first tank engine.
Firefighting	<ul style="list-style-type: none"> ① The ease of securing water supply means the swifter commencement of firefighting and rescue activities. ② Equipment, such as three extension ladders, forcible entry tools and extension hoses, etc. can be swiftly transported to the scene of a fire.

The present locations of the FRDs mean that any turning out for an incident outside each FRD's own service area takes some time to reach the scene and it is difficult to ensure the turning out of two fire tank engines for an outside response. Therefore, the deployment of two fire tank engines at each FRD under the Project is appropriate. In addition, in due consideration of the travelling speed of fire tank engines (20km/hr at traffic congestion time, 30km/hr at normal time), as shown in Figure 2-2-2, it is possible to arrive within the jurisdiction of a fire station within approximately eight minutes.

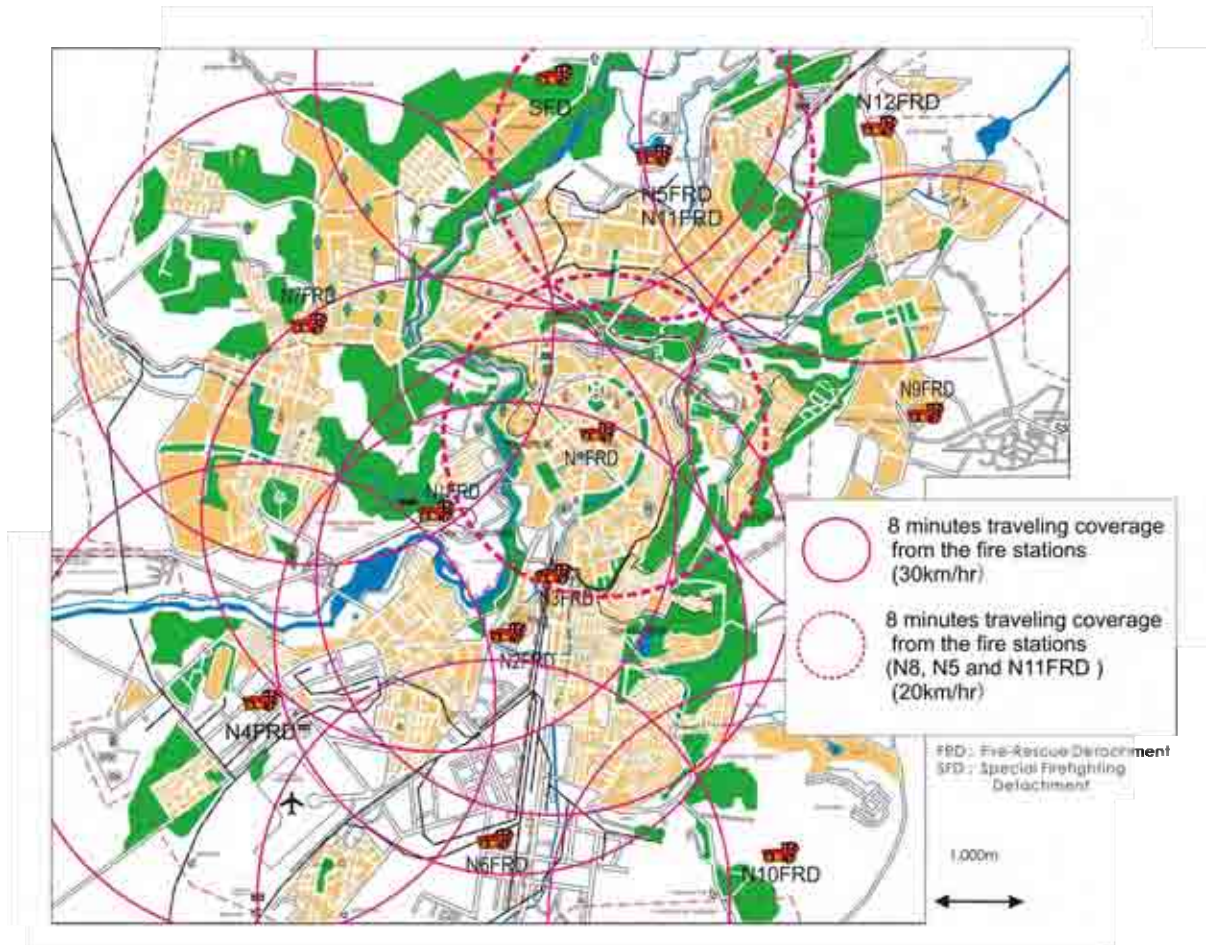


Fig. 2-2-2 Eight Minutes Travel Coverage from Fire Stations

In regard to a third reserve fire tank engines at each FRD as required by the Law On Fire Security Standards, the manpower to operate such a vehicle is currently unavailable. Once the new fire tank engines are deployed under the Project, the number of operable fire tank engines will increase from the present level. Moreover, a fire tank engine of another FRD which is requested to provide assistance can reach the scene faster than mobilising a reserve fire tank engine. Therefore, the deployment of a reserve fire tank engine is low-priority.

2) Types of Fire Tank Engines for Deployment

The roads in Yerevan are generally wide enough for the use of medium size fire tank engines. In principle, two medium size fire tank engines will, therefore, be deployed at each FRD. Given the extremely poor water supply situation in Yerevan, however, some of the second fire tank engines should have a larger water tank (10,000 lit.). There are some dense residential areas in the city where the roads are narrow. The provision of small fire tank truck is, therefore, necessary in view of effective firefighting activities in these areas. The further details are described in 2.2.2.4 – Equipment Plan.

3) Deployment Plan

Yerevan is classified into four zones, (East, West, North and South) as shown in Fig. 2-2-3 based on the topography and the existing fire stations are located in these four zones as described in Table 2-2-3.

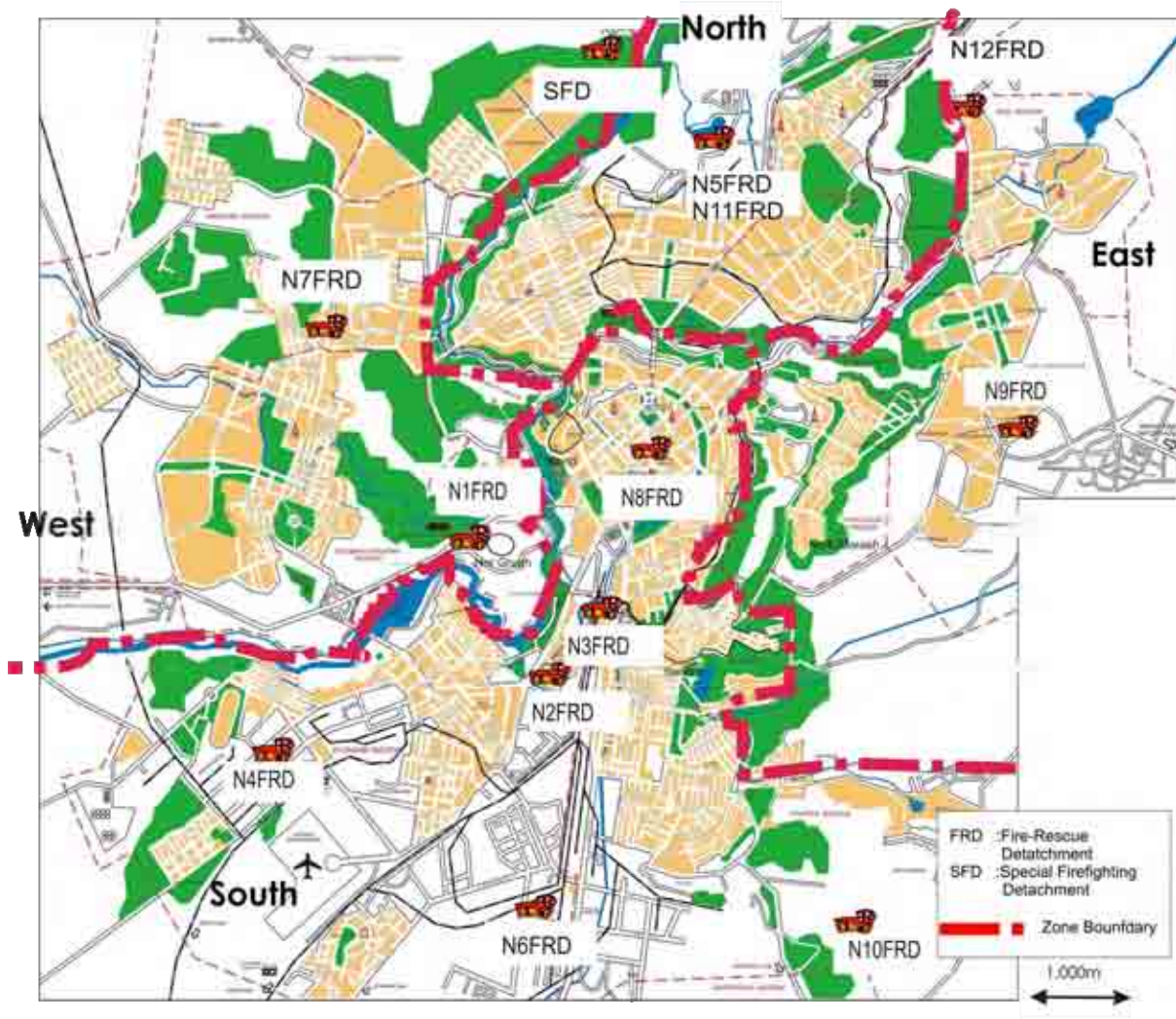


Fig. 2-2-3 Geographical Zone of Yerevan and Deployment of Fire Stations

Table 2-2-3 Fire Stations in Yerevan

	Principal Fire Station	Medium Size Fire Station	Small Fire Station
Zone	Responsible for an area with a concentration of government offices, hospitals, medium to high rise buildings and/or houses or many large-scale commercial facilities, provides assistance to other FRD	Serving an area with a population of 40,000 or more	Serving an area with a small population and a small number of buildings
East	No. 9 FRD	No. 12 FRD	
West	No. 1 FRD; SFD	No. 7 FRD	
South	No. 8 FRD	No. 2 FRD; No. 3 FRD; No. 4 FRD	No. 6 FRD; No. 10 FRD
North	No. 5 FRD	No. 11 FRD	

These four zones are linked to each other by a limited number of roads. The present state of each fire station and the characteristics of each service area are outlined in Table 2-2-4.

As explained earlier, two fire tank engines will be deployed at each fire station under the Project except at the No. 6 FRD and No. 10 FRD of which the service areas have a small population of permanent residents and a small number of buildings. A minimum number (five) of large fire tank engines (10,000 lit. water tank) will be deployed at the principal fire stations.

There are five FRDs of which the area of jurisdiction is characterised by narrow roads and dense housing. Whether or not the deployment of two small fire trucks as requested by ARS is sufficient to serve these areas will be examined in the following paragraph 4) – Deployment of Small Fire Trucks with a Water Tank.

Table 2-2-4 Current Conditions and Characteristics of the Service Area of Each Fire Station

2-14

Zone	FRD No.	Fire Station Status	Service Population	Service Area (km ²)	No. of Water Sources		Other Water Sources	No. of Fires (Average for Last Three Years)	Existing Fire Vehicles		Staff Strength	No. of Medium to High Buildings (Four Stories or More)	Service Area Characteristics					Situation of Service Area	Necessity for 4 x 4 Vehicle
					Hydrants	Usable Hydrants			Fire Tank Engines	Ladder Trucks			Traffic Congestion	Special Buildings*1	Sloping Roads	Narrow Roads and Dense Housing	Densely Populated		
East	No. 9	Principal	143,000	14.47	96	10	Pool	196	3	1	59	636	○	○	○	○	Densely populated area on a hill with many tall buildings and poor water supply situation. The roads and ground are often very steep. (EL 1,200 - 1,400 m)	Yes	
	No. 12	Medium	50,500	8.00	27	4	-	174	2	1	55	242			○		Located in the northwestern corner of Yerevan with few buildings. The roads and ground are often very steep. (EL 1,230 - 1,450 m)	Yes	
West	No. 1	Principal	75,160	16.82	58	46	-	242	3		55	284	○	○	○	○	The area to the south of this station is densely populated with many narrow roads. Fire tank engines from this station turn out to fires in the city center.		
	SFD	Principal	40,400	6.86	55	34	-	180	3	1	67	176					Many medium to high buildings in the service area. The fire vehicles, including a ladder truck, deployed at this station serve the entire city.	Yes	
	No. 7	Medium	106,500	25.68	129	15	River	243	3	1	59	449			○		Serves a hilly area in the west of the city. The roads and ground are often very steep. (EL 880 - 1,100 m)	Yes	
South	No. 8	Principal	145,360	18.81	111	56	Pool	291	5	1	66	649	○		○	○	Serves the central area of the city which is densely populated with many tall buildings. The number of commercial facilities is high. The roads are narrow in many parts of the service area.		
	No. 2	Medium	145,100	40.57	52	27	-	192	2		55	359			○		Leading industrial area in Yerevan with many factories and warehouses. The population size is large.		
	No. 3	Medium	119,200	48.41	181	38	-	222	2		59	258			○		An industrial area with factories and warehouses. The area to the west of this station has many narrow roads.		
	No. 4	Medium	141,300	25.72	86	26	-	186	3		59	579					A residential area with many medium to high buildings		
	No. 6	Small	13,470	7.60	147	7	-	149	2		35	269					Located at the southern tip of Yerevan with few buildings.		
	No. 10	Small	9,300	18.11	3	2	-	141	2		31	25					Serves a suburban residential area located in the southwestern corner of the city.		
North	No. 5	Principal	132,000	10.80	183	69	River	197	2		55	461	○			○	Densely populated urban area with many commercial and industrial premises.		
	No. 11	Medium	77,800	8.10	105	13	-	182	2		55	294					Residential area		
	Total		1,199,090	249.95	1,233	347		2,595	34	5	710	4,681							

*1 Special buildings include government buildings, general hospitals, large commercial facilities and schools.

4) Deployment of Small Fire Trucks with a Water Tank

Several residential areas of low income people exist on the hillsides of Yerevan. As shown in Fig. 2-2-4 and Table 2-2-5, these areas are characterised by narrow roads and dense housing.

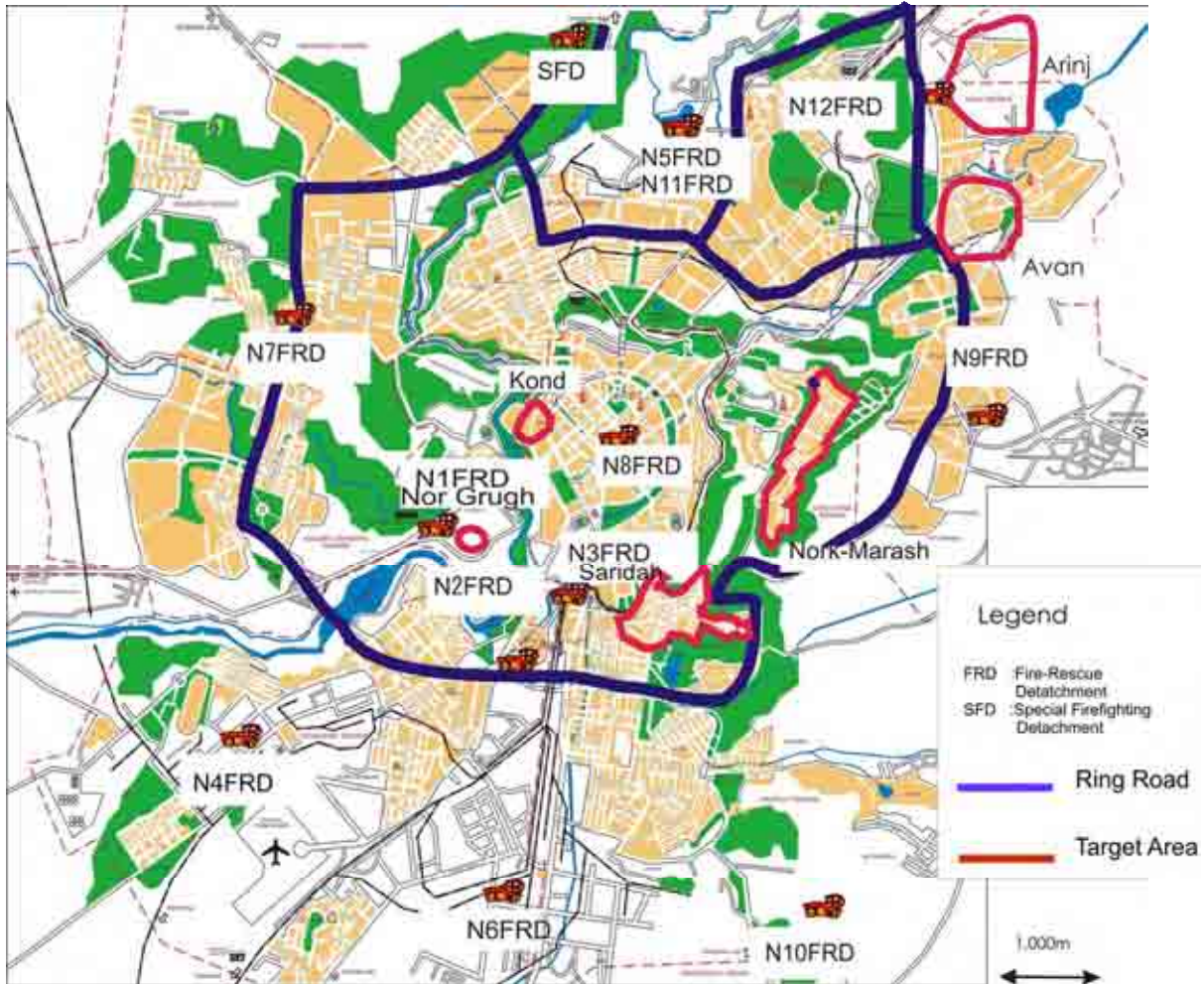


Fig. 2-2-4 Areas with Narrow Roads and Dense Housing in Yerevan

Table 2-2-5 Outline of Areas with Narrow Roads and Dense Housing in Yerevan

Area	Responsible FRD	Area (km ²)	Population	Average No. of Fires Per Year in Last Four Years
Nor Grugh	No. 1 FRD	1.5	13,800	28
Kond	No. 8 FRD	0.2	16,000	
Part of Nork Marash	No. 8 FRD and No. 9 FRD	4.6	11,000	27
Saridah	No. 3 FRD	2	21,000	14
Avan	No. 12 FRD	1.2	13,000	44
Arinj	No. 12 FRD	1.9	10,000	7

In these areas, the roads are narrow and steep. A lot of wood is used for building extension, roofs and verandas.

When a fire occurs in these areas with narrow roads, medium size fire tank engines find it difficult to enter the areas. The small number of available hydrants makes the securing of water supply and the extension of hoses lengthy operations. The resulting delay in the commencement of actual firefighting activities can mean the unnecessary spread of a fire and extensive damage.

In view of the likely situation in these areas, it is essential to quickly send small fire trucks with a water tank to the fire scene in order to reduce both human and material damage.

The areas in question are served by the No. 1, No. 3, No. 8, No. 9 and No. 12 FRDs. Table 2-2-6 shows the distance and travelling time from each FRD to each area.

Table 2-2-6 Distance and Travelling Time from Each FRD to Each Area

Area	No. 1 FRD		No. 3 FRD		No. 8 FRD		No. 9 FRD		No. 12 FRD	
	Time	Rank	Time	Rank	Time	Rank	Time	Rank	Time	Rank
Kond	3 mins (1.6 km)	2	4 mins (2.0 km)	3	2 mins (1.0 km)	1	> 10 mins (5.3 km)	-	> 10 mins (6.0 km)	-
Nor-Grugh	1 min (0.5 km)	1	6 mins (3.0 km)	3	4 mins (2.0 km)	2	> 10 mins (5.8 km)	-	> 10 mins (7.2 km)	-
Saridah	9 mins (4.4 km)	4	2 mins (1.0 km)	1	3 mins (1.6 km)	2	8 mins (4.2 km)	3	> 10 mins (5.5 km)	-
Nork-Marash	> 10 mins (5.6 km)	-	7 mins (3.5 km)	-	6 mins (2.8 km)	1	9 mins (4.2 km)	2	9 mins (4.2 km)	2
Avan	> 10 mins (5.6 km)	-	> 10 mins (5.7 km)	-	> 10 mins (5.5 km)	-	3 mins (1.6 km)	1	3 mins (1.3 km)	1
Arinj	> 10 mins (7.9 km)	-	> 10 mins (7.5 km)	-	> 10 mins (5.8 km)	-	8 mins (4.2 km)	2	2 mins (1.3 km)	1
Judgement (FRD to deploy)					O				O	

Notes

- (1) The rank is based on the speed of arrival of a fire vehicle from each FRD to individual areas.
- (2) The time is based on an average travelling speed of 30 km/hr.

Based on the information in Table 2-2-6, one small fire truck with a water tank will be deployed at the No. 8 FRD and No. 12 FRD as such fire truck can reach each area in approximately five minutes.

(2) Deployment Plan for Ladder Trucks

Many medium to high buildings in Yerevan are located in the Kentron (Center) District, the Nor Nork District in the East Zone, the Arabkir District in the North Zone, the Davitashen District, Ajapnyak District and Malatia Sebastia District in the West Zone and the Erebuni District and

Shengavit District in the South Zone as shown in Fig. 2-2-5 and Table 2-2-7. Among these districts, the Malatia Sebastia District and Shengavit District are dominated by high rise apartment buildings with a fire-resistant construction and escape staircases. The other districts have many such facilities used by an unspecified number of citizens as hospitals, schools and commercial facilities. There is a concentration of public facilities, such as government offices, universities and hospitals, especially in the Kentron District in the city center and the Arabkir District.

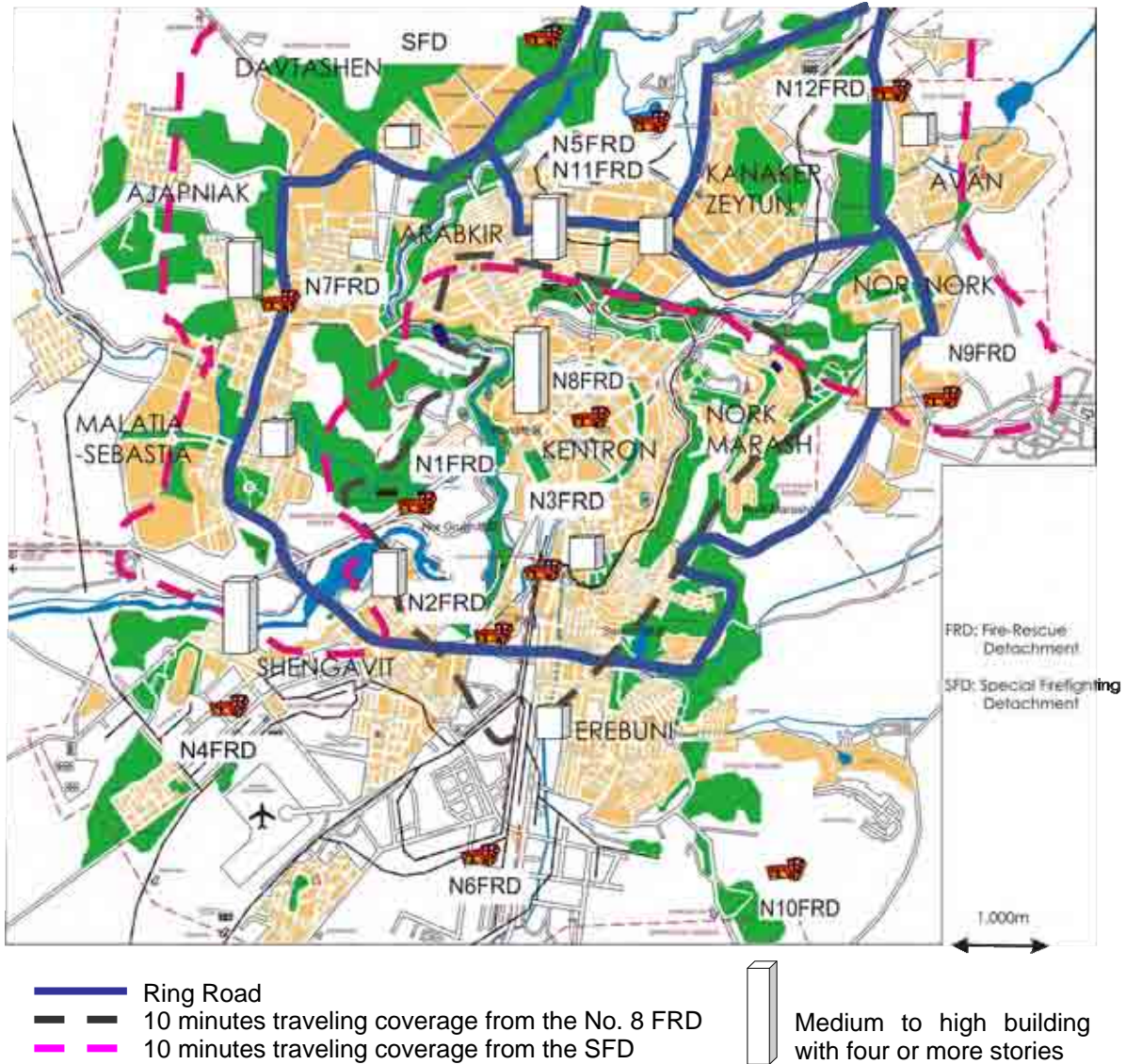


Fig. 2-2-5 Geographical Range Reachable by Ladder Truck in 10 Minutes from the FRD of Its Deployment

Table 2-2-7 Number of Medium to High Buildings

FRD	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	SFD
No. of Buildings with Four or More Stories	284	359	258	579	461	269	449	649	636	25	294	242	176

In principle, fire vehicles are given priority status for road use as emergency vehicles and are able to travel at roughly 30 km/hr in urban areas except during the rush hours. This means that they can cover a distance of 5 km in 10 minutes. The Kenton District and Arabkir District in the city center, however, have a high traffic volume apart from late night time and the traveling speed is some 20 km/hr due to congestion if ladder truck is deployed at the No.8 FRD. This means that a ladder truck of the No. 8 FRD situated in the Kenton District, can reach anywhere in the Kenton District in 10 minutes but only parts of the Arabkir District because of traffic congestion. Fire vehicles of No. 8 FRD cannot reach the South Zone in the Erebni District within 10 minutes, but almost all high rise buildings are situated within 10 minutes from No. 8 FRD.

The deployment of a ladder truck at the SFD located on the periphery of the city with good road conditions will make it possible for this truck to travel 8.3 km in 10 minutes (50 km/hr). Fig. 2-2-5 shows the geographical coverage of a ladder truck in 10 minutes from either the No. 8 FRD or the SFD.

If a ladder truck is deployed at the SFD, it will be able to reach the Arabkir District and Ajapniak District in the North Zone, the Davtashen District and Malatia Sebastia District in the West Zone and the Nor Nork District in the East Zone in 10 minutes. Although only a part of Shengavit District can be reached within 10 minutes, it is not a problem because of the following reason. High rise buildings in this district are apartment buildings and are equipped with escape staircases and as the SFD is situated within approximately 9 km, a ladder truck can reach the Shengavit District in approximately 10 minutes. Based on these considerations, each one ladder truck will be deployed at the SFD and the No. 8 FRD.

(3) Driving Method

Four wheel drive vehicles have excellent climbing ability and are suitable for mountainous or uneven terrain. The East Zone and West Zone of Yerevan in particular have many steeply sloping roads (for a long stretch with a gradient of 6 – 8%) and paved but badly uneven roads because of the lack of repair. To make matters worse, the roads are often covered with snow or are frozen in winter, making the deployment of some four wheel drive vehicles essential.

As the service areas of small fire trucks (with a 1,000 lit. water tank) are characterized by narrow roads as well as hilly areas, two such vehicles to be deployed at the No. 8 FRD and No. 12 FRD (one each) will be four wheel drive vehicles. In regard to medium size fire tank engines (with a 3,500 lit. water tank), six such engines to be deployed at the No. 7, No. 9 and No. 12 FRDs of which the service areas have many steeply sloping roads and at the SFD of which the service area covers the entire city will be four wheel drive engines as described in Table 2-2-4 – Current Conditions and Characteristics of the Service Area of Each Fire Station. The overall examination results are shown in Table 2-2-8.

Table 2-2-8 Overall Fire Vehicle Deployment Plan

Fire Station Vehicle Type	Requested					Planned					Remarks
	3,500 lit. Fire Tank Engine	10,000 lit. Fire Tank Engine	1,000 lit. Small Fire Truck	Ladder Truck	Aerial Platform	3,500 lit. Fire Tank Engine		10,000 lit. Fire Tank Engine	1,000 lit. Small Fire Truck	Ladder Truck	
						Rear Drive	4 x 4				
No. 1 FRD	1	1	1			1		1			
No. 2 FRD	2					2					
No. 3 FRD	2					2					
No. 4 FRD	2					2					
No. 5 FRD	1	1				1		1			
No. 6 FRD	1					1					
No. 7 FRD	2						2				
No. 8 FRD	1	1	1			1		1	1	1	
No. 9 FRD	1	1					1	1			
No. 10 FRD	1					1					
No. 11 FRD	2					2					
No. 12 FRD	2						2		1		
SFD	1	1		1	1		1	1		1	
By Type of Drive System						13	6				
By Vehicle Type	19	5	2	1	1	19		5	2	2	
Total	28					28					

2.2.2.4 Equipment Plan

(1) Fire Vehicles

1) 3,500 lit. Fire Tank Engines

These will be deployed at each FRD as the core fire vehicles of ARS. They will carry a medium size 3,500 lit. tank which will allow independent firefighting activities as the lead fire vehicle until water relay commences. These engines will also have a chemical fluid tank for efficient firefighting. Each engine will be operated by a company of six crew members and will have a double cabin.

2) 10,000 lit. Fire Tank Engines

In view of the poor water supply situation in Yerevan and the occasional necessity for a principal fire station to assist other fire stations, a large fire tank engine capable of discharging water for a long time will be deployed at each principal FRD and at the SFD. In consideration of the withstand load of bridges in the city, these fire vehicles will carry a 10,000 lit. water tank and chemical fluid tank for efficient firefighting. As in the case of the 3,500 lit. fire tank engines, these trucks will be operated by individual companies of six crew members each and will have a double cabin.

3) 1,000 lit. Small Fire Trucks

These small trucks will provide good mobility so that firefighting and rescue activities at the initial stage can be swiftly conducted when a fire occurs in an area with narrow roads and dense housing. They will carry a 1,000 lit. water tank which will enable them to continually discharge water until relay water is supplied by a follow-on fire tank engine. As compactness is essential to ensure mobility, these vehicles will have a single cabin for three crew members who will provide the minimum required crew strength.

4) Ladder Trucks

When considering the withstand load of several bridges in the city (attached Table 1, minimum 30 tons), an aerial platform weighs more than a ladder truck, so it is not desirable. Since a ladder truck is capable of raising, extending and rotating the ladder faster than an aerial platform and is easier to operate, the ladder truck is selected. The specifications are described as follows.

High rise building with 10 or more stories (total height of 30 m or more) in Yerevan have fire prevention and evacuation systems. As such, ladder trucks are aimed at serving medium to high buildings with up to nine stories. They will be equipped with a basket of which the

maximum workable height is more than 30 m and a single cabin for three crew members who will constitute the minimum requirement to operate the ladder.

(2) Superstructure

1) Pump Performance

As water discharge by each fire tank engine for a long time is required to extinguish a fire, the fire vehicle specifications must include the capacity of the water pump to continually operate for a long time. The discharge capacity of the water pump is 2,400 lit./min (1.1 MPa) or more which is equivalent to the pumping system of the existing fire vehicles for the 3,500 lit. and 10,000 lit. truck tank engines and 1,800 lit./min (0.8 MPa) or more for fire trucks with a 1,000 lit. water tank. Ladder trucks are not equipped with water pumps. Instead, they discharge water fed from other fire tank engines.

2) Water Tank

In consideration of the properties of city water in Yerevan (high chloride ion concentration), a suitable material and thickness will be selected for the water tanks and piping to ensure a long service life.

3) Chemical Fluid Tank (Fire Extinguishing Fluid Storage Tank)

A chemical fluid tank will be added to the 3,500 lit. and 10,000 lit. fire tank engines so that fire extinguishing fluid can be mixed with water to ensure efficient firefighting activities with a small amount of water in view of the poor water supply situation in Yerevan.

(3) Main Loaded Equipment, etc.

1) Protective Clothing Sets

Because of the use of protective clothing with less than an ideal fire-resistant performance by ARS at present, 17 firefighters have been injured in the last three years. As sets of protective clothing are the most important item for the protection of firefighters from heat and falling objects at the scene of a fire which is filled with dense smoke and heat, the provision of a sufficient quantity of such sets is extremely necessary. Four sets of protective clothing will be provided for each fire tank engine and three sets will be provided for each ladder truck or small fire truck.

Helmet : resin construction with a transparent plastic face shield and neck protector

Protective clothing : heat-resistant and flame retardant synthetic fabric with a safety belt

Fire gloves : heat-resistant and cut protective synthetic fabric

2) Breathing Apparatus

This breathing apparatus protects firefighters from smoke and toxic gas. Three sets will be provided for each fire vehicle to be procured under the Project except ladder trucks.

3) Spare Parts

Although parts, including chassis-related consumable supplies, are easily available in Armenia or neighboring countries, special parts for fire vehicles — for example, parts for fire pumps and ladders — should be ordered from the manufacturer and therefore will require time to procure. In addition, fire vehicles cannot be utilized when replacement parts take a long time to arrive, so some spare parts should be ensured.

Based on the above-mentioned view, a minimum two-year supply of special spare parts for fire vehicles will be planned.

Table 2-2-9 summarizes the basic specifications for each type of fire vehicle (including loaded equipment).

Table 2-2-9 Summary of Main Equipment Specifications

Type of Truck	(1) 3,500 lit. Fire Tank Engine (13 4x2 and 6 4x4 Engines)	(2) 10,000 lit. Fire Tank Engine (5 Engines)
Outline	Has a fire pump, water tank and chemical fluid tank and conducts firefighting and rescue activities using its excellent mobility; the 4 x 4 type is suitable for travelling on steep sloping roads; designed for very low temperature.	In addition to a fire pump, large water tank and chemical fluid tank, uses a monitor nozzle for extensive discharge for firefighting; designed for very low temperature.
W x L x H (m)	≤ 2.5 x 8.0 x 3.4	≤ 2.5 x 9.0 x 3.4
Gross Weight (kg)	≤ 13,000	≤ 24,000
Engine Type	Diesel	Diesel
Ratio of Engine Output to Weight (HP/ton)	≥ 14	≥ 14
Maximum Speed (km/hr)	≥ 100	≥ 90
Driving Method	4 x 2 (rear drive); 4 x 4	6 x 4 (rear drive)
Steering Wheel	Left-hand drive (power steering)	Left-hand drive (power steering)
Seating Capacity (Cabin Type)	6 (double cabin)	6 (double cabin)
Pump Performance (lit./min)	≥ 2,400 (at 1.1 MPa)	≥ 2,400 (at 1.1 MPa)
Water Tank Capacity (lit.) / Material	≥ 3,500 / FRP or stainless steel	≥ 10,000 / FRP or stainless steel
Chemical Tank Capacity (lit.) / Material	≥ 350 / FRP or stainless steel	≥ 1,000 / FRP or stainless steel
Electrical Components	Blue flasher; electronic siren with sound amplification system; in-vehicle radio equipment; search light	Blue flasher; electronic siren with sound amplification system; in-vehicle radio equipment; search light
Loaded Equipment	Suction pipe; fire hose; discharge nozzle; playpipe; foam nozzle; hose carrier; portable monitor nozzle*; combined cutter*; rod cutter; power cable cutter; three section ladder; single section ladder; basket stretcher; rescue rope; hose bridge; collecting breeching; dividing breeching; adaptors; crowbar; spades; axes; ceiling hooks; suction pipe strainer; dry chemical extinguishers; protective clothing sets; portable radio equipment; flash light; breathing apparatus	Suction pipe; fire hose; discharge nozzle; playpipe; foam nozzle; rod cutter; power cable cutter; three section ladder; single section ladder; rescue rope; hose bridge; collecting breeching; dividing breeching; adaptors; crowbar; spades; axes; ceiling hooks; suction pipe strainer; dry chemical extinguisher; protective clothing sets; portable radio equipment; flash light; breathing apparatus
Paint Colour	Red	Red

Those with the * mark will be loaded onto one fire tank engine of each fire station..

Type of Truck	(3) 1,000 lit. Small Fire Truck (2 Trucks)	(4) Ladder Truck (2 Trucks)
Outline	Has a fire pump and water tank to conduct firefighting and rescue activities; suitable for travelling on narrow or steep roads because of its small size and excellent mobility; designed for very low temperature.	Uses an extendable and rotating ladder and basket at the top end of the ladder for firefighting and rescue activities involving medium to high buildings; designed for very low temperature.
W x L x H (m)	≤ 2.2 x 6.0 x 3.4	≤ 2.5 x 10.0 x 3.7
Gross Weight (kg)	≤ 6,500	≤ 16,000
Engine Type	Diesel	Diesel
Ratio of Engine Output to Weight (HP/ton)	≥ 17	≥ 14
Maximum Speed (km/hr)	≥ 100	≥ 90
Driving Method	4 x 4	4 x 2 (rear drive)
Steering Wheel	Left-hand drive (power steering)	Left-hand drive (power steering)
Seating Capacity (Cabin Type)	3 (single cabin)	3 (single cabin)
Pump Performance (lit./min)	≥ 1,800 (at 0.8 MPa)	
Water Tank Capacity (lit.) / Material	≥ 1,000 / FRP or stainless steel	
Ladder Performance		Maximum work height ≥ 30 m; basket withstand load ≥ 270 kg; automatic tilt correction system; safety mechanisms
Electrical Components	Blue flasher; electronic siren with sound amplification system; in-vehicle radio equipment; search light	Blue flasher; electronic siren with sound amplification system; in-vehicle radio equipment; search light
Loaded Equipment	Suction pipe; fire hose; discharge nozzle; hose carrier; combined cutter; rod cutter; power cable cutter; three section ladder; single section ladder; rescue rope; hose bridge; collecting breeching; dividing breeching; adaptors; crowbar; spades; axes; suction pipe strainer; dry chemical extinguishers; protective clothing sets; portable radio equipment; flash light; breathing apparatus	Fire hose; rod cutter; power cable cutter; single section ladder; rescue rope; spades; axes; dry chemical extinguishers; protective clothing sets; portable radio equipment; flash light; floor plate for jack
Paint Colour	Red	Red

2.2.3 Basic Design Drawings

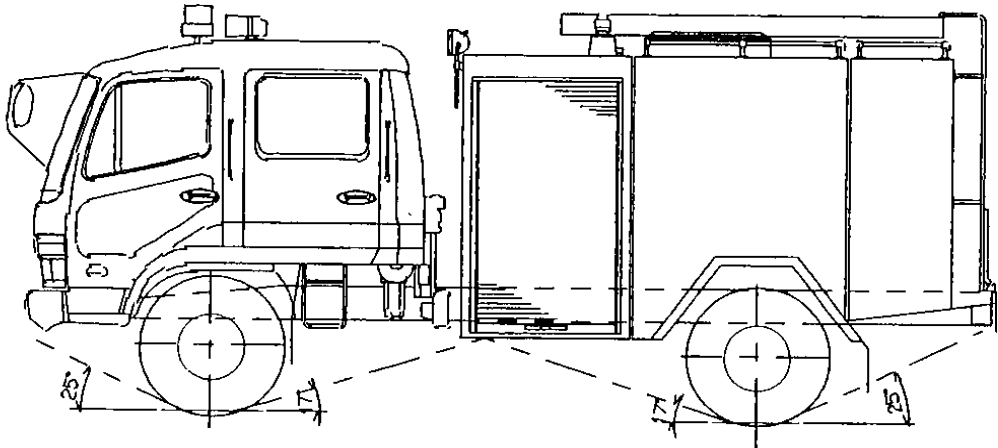


Fig. 2-2-6 3,500 lit. Fire Tank Engine

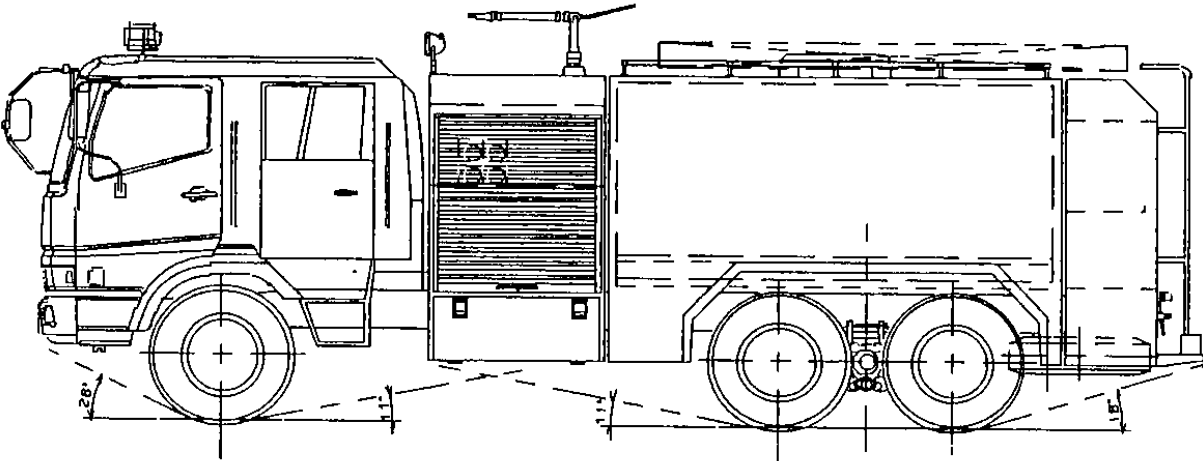


Fig. 2-2-7 10,000 lit. Fire Tank Engine

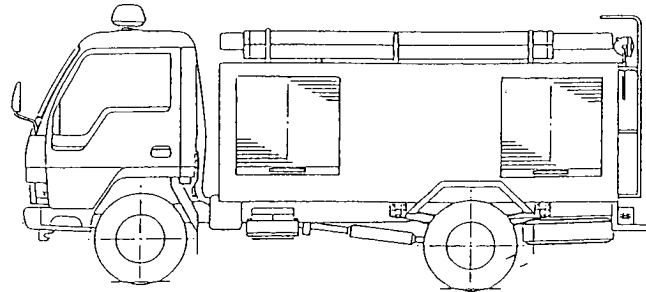


Fig. 2-2-8 1,000 lit. Small Fire Truck

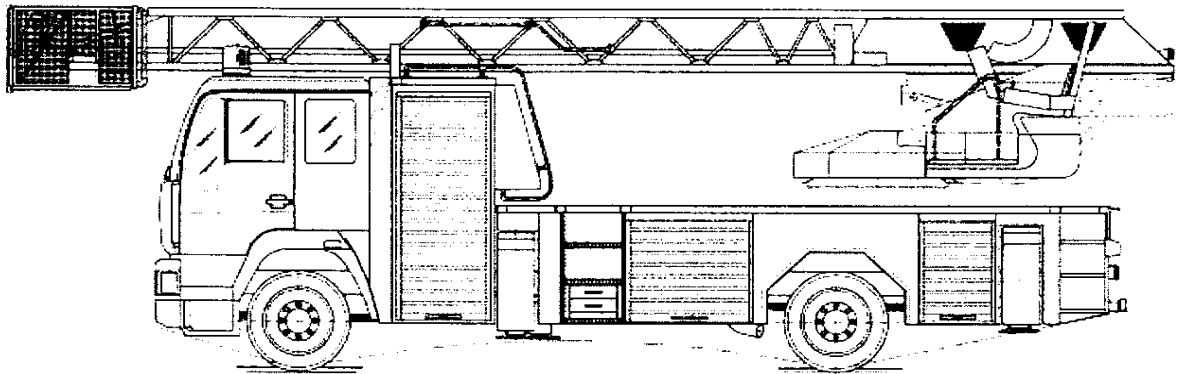


Fig. 2-2-9 Ladder Truck

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

(1) Basic Issues

The Project will be implemented in the following sequence in accordance with the guidelines for grant aid.

- 1) Following the cabinet decision of the Government of Japan to approve the Project, the Exchange of Notes (E/N) on the grant aid will be signed between the Government of Japan and the Government of Armenia and the Grant Agreement (G/A) will be concluded between the Japan International Cooperation Agency (JICA) and the Government of Armenia.
- 2) Following the signing of the E/N and G/A, a design and a consultant agreement will be concluded between a Japanese consultancy firm and the Government of Armenia. The work will commence immediately after verification of the said agreement by JICA.
- 3) Tender documents will be prepared based on the Basic Design Study Report and approval from the Government of Armenia will be obtained.
- 4) A tender will be held to select a Japanese equipment supplier.
- 5) While the project implementation body in Armenia will be responsible for the execution of the tender, the consultant will provide full assistance to ensure the smooth progress of the tender.
- 6) The successful tenderer will conclude a procurement contract as the equipment supplier with the Government of Armenia and will commence the work immediately after verification of the said contract by JICA.

(2) Equipment Procurement Policy

Various procurement sources, including third countries, will be examined based on past delivery record of equipment similar to the planned equipment to Armenia, prices and after-service system, etc.

(3) Project Implementation System

The Project will be implemented in the manner described below.

- 1) The implementation body will be ARS.
- 2) The ARS will also be responsible for the operation and maintenance of the fire equipment procured under the Project.

Fig. 2-2-10 shows the project implementation system incorporating the various organizations in Japan and Armenia.

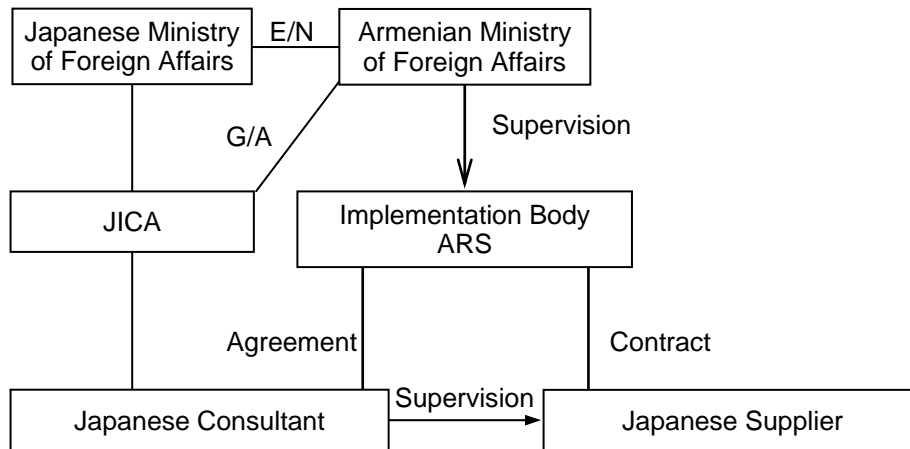


Fig. 2-2-10 Project Implementation System

2.2.4.2 Implementation Conditions

For the procurement of the fire equipment, the relevant schedule will be prepared taking the following conditions into consideration to ensure the smooth transportation and handing over of the equipment.

- The supplier will constantly check the transportation situation of the equipment to ensure the swift collection of the shipped equipment and customs clearance.
- The Armenian side will ensure that tax exemption measures are in place and the smooth import, customs clearance and registration of the fire vehicles.

2.2.4.3 Scope of Works

The Japanese side will be responsible for the fire equipment to be procured under the Project until its handing over to the Armenian side in Yerevan. The transportation of the equipment from the handing over site to each FRD and subsequent maintenance will be the responsibility of the Armenian side as shown in Table 2-2-10.

Table 2-2-10 Scope of Works

No.	Item	Responsible Side	
		Japan	Armenia
1	Acquisition of land and construction of buildings to store the procured equipment		●
2	Provision of a store room for spare parts		●
3	Procurement, test operation and adjustment of the fire vehicles; guidance for operation and maintenance	●	
4	Supply of water and fuel required for test operation of the fire vehicles		●
5	Procurement of the loaded equipment and guidance for its handling	●	
6	Procurement of the spare parts and guidance on their handling	●	
7	Provision of power supply, water supply and drainage facilities required for the procured equipment		●
8	Tax exemption and customs clearance of the procured equipment		●
9	Registration of the fire vehicles		●
10	Transportation of the procured equipment to the handing over site	●	
11	Self-propelled traveling of the fire vehicles from the handing over site to each fire station		●
12	Soft component	●	

2.2.4.4 Consultant Supervision

In accordance with the process set for Japan's grant aid scheme, a Japanese consultant will conclude a detailed design and procurement supervision agreement (i.e. consultant agreement) and will conduct the assigned work after verification of the agreement by JICA. The principal work to be conducted by the consultant is explained next.

(1) Detailed Design Work

1) Detailed Design

Based on the findings of the Basic Design Study and the E/N, the consultant will conduct the final checking of the planned project contents, review the equipment specifications and prepare the tender document which will be essential for potential tenderers for equipment procurement and transportation to estimate the costs.

2) Tender-Related Work

The consultant will discuss the tenderer selection method and tender method with the project implementation body in Armenia and will conduct the tender on behalf of the said body. The types of tender-related work are listed below.

- Preparation of the tender documents
- Announcement of the forthcoming tender
- Distribution of the tender documents

- Witnessing of the tender
- Examination of the tenders
- Preparation of a tender report
- Preparation of a tender assessment report

(2) Procurement Supervision

The consultant will ensure that fire vehicles are properly manufactured as scheduled, and that loaded equipment, in-vehicle radio communications systems and spare parts meet the required technical specifications in accordance with the contract. In particular, to ensure that everything progresses as scheduled, the consultant will stay in close contact with suppliers and the Armenian side to share information from the approval of drawing to the handing over including the transportation, commissioning and adjustment periods after equipment has arrived at the site so as to take measures if and when it becomes necessary.

An engineer from consultancy firm specialized in fire equipment will witness in a timely manner equipment performance tests and inspections at the manufacturing plants to ensure strict quality control. The consultant will also dispatch supervisors (engineers) responsible for procurement to Yerevan as field representatives (for spot supervision) to witness the test operation, adjustment and training by the supplier prior to the handing over of equipment to the Armenian side, to issue the work completion certificate and to prepare the final work report.

2.2.4.5 Procurement Plan

(1) Equipment Supplier

The equipment supplier will conduct the design, manufacture, painting, factory tests and inspections, packing and transportation of the fire vehicles and other equipment in accordance with the specifications prepared by the consultant and will hand them over to the Armenian side after full checking of the quantity and operating status of all of the equipment through field tests and inspections. The equipment supplier will prepare reference materials which are required to obtain permits for the use of a handing over site and inland transportation and will fully discuss the contents with ARS. The Armenian side will be responsible for obtaining the said permits.

(2) Procurement Sources

As fire vehicles are not manufactured in Armenia, the fire vehicles which are currently used in Yerevan were made in such third countries as the former Soviet Union, France and Germany. It is impossible to obtain replacement parts for those fire vehicles manufactured in the former Soviet Union as production by the manufacturer has since ceased. Also the French and German fire

vehicles are second-hand vehicles and therefore parts for these trucks cannot be procured. Given the lowest winter temperature of -25°C in Armenia, the selection of a fire vehicle manufacturer(s) which can meet the vehicle specifications suitable for a cold region is essential. Moreover, corrosion of the water tanks and piping of the Soviet-made fire vehicles owned by ARS is observed due to the high corrosive chloride ion concentration of water used in Yerevan. This means that a high manufacturing level is required for the potential supplier(s) of the new fire vehicles. The survey on four Russian manufacturers which have experience of exporting fire vehicles found some technological problems. Consequently, the Russian manufacturers are judged to be ineligible as a procurement source for the Project. Either manufacturer lacks experience in the manufacturing of diesel fire engines. According to a survey conducted at the plant of Kamaz regarded as the most technical firm and which has integrated system of production from diesel engine chassis to the superstructure, water leaking from piping during discharge was not considered to be a defect despite the fact the fire vehicle in question was new and awaiting shipment. The quality control system is questionable. Furthermore, the Russian manufacturers only have experience of manufacturing fire vehicle for less than 10 years even though fire vehicles are used for a minimum period of some 15 years or even 20 years on some occasions. Moreover, they only have experiences in exporting to CIS nations, which correspond to the delivery to the domestic markets. This infers they are not accepted by other countries not only from the technical but also the quality aspect.

Table 2-2-11 List of Possible Equipment Procurement Sources

No.	Equipment	Procurement Source	
		Japan	Third Country
1	Fire vehicles	●	●
2	Loaded Equipment	●	●
3	Spare Parts	●	●

(3) Transportation Plan

The transportation of large equipment from Japan or the US will involve maritime transportation to a port of landing. As Armenia is an inland country, the likely port of landing in the present context will be the Port of Poti in neighbouring Georgia or the Port of Bandar Abbas in Iran. The equipment will be transported by land between the port of landing and Yerevan. In contrast, procurement from a European manufacturer will result in transportation by land only.

2.2.4.6 Operational Guidance Plan

The fire vehicles to be procured under the Project will be the first such vehicles for Armenia in some 20 years. As the handling methods and mechanisms will differ from those of the existing fire vehicle, methodical guidance and training on their handling and operation will be provided by engineers and operators of the manufacturer. Particularly careful guidance will be provided for all firefighters involved with ladder trucks, their superior commanders and trainers in view of the risks of ladder operation in high places. In the case of the fire tank engines, guidance on their operation, including the operation of the loaded equipment, will be provided for the crew leaders as well as their senior commanders, at each fire station and also for trainers. In view of the limited maintenance experience of diesel engine vehicles on the part of local mechanics, an engineer dispatched by the fire vehicle manufacturer will provide guidance on engine inspection and maintenance. Guidance on fire vehicle operation at a real fire scene is not planned as such guidance is beyond the capability of a manufacturer.

2.2.4.7 Soft Component Plan

The fire vehicles to be deployed under the Project will be the first such trucks since Armenia's independence in 1991. As many of their functions and operational requirements will differ from those of the existing fire vehicles in Armenia, the provision of operational guidance to suit the actual firefighting activities will be necessary. However, it is difficult for a fire vehicle manufacturer to provide this kind of guidance, making the inclusion of a soft component in the Project highly effective to ensure the efficient and effective use of the newly procured vehicles. For this reason, it has been decided to introduce a soft component in relation to the skills required to operate the fire tank engines and ladder trucks to be deployed under the Project.

(1) Operational and Firefighting Techniques for Fire Tank Engines

In principle, two fire tank engines turn out in Armenia. The forward truck conducts water discharge while the rear truck is engaged in water intake/relay at a hydrant or other water source. Because of the small number of usable hydrants, much time is spent extending the hose and some 7 minutes are generally required to prepare for water discharge. Because of this rather long preparation time for support, water from the equipped tank sometimes runs out, necessitating suspension of the firefighting. The key requirements are, therefore, to extend the hose in a short time and to start water discharge to ensure that a fire does not intensify before relay water arrives from the rear. During actual firefighting, water discharge should be conducted as near as possible to the origin of the fire and entry to the building on fire should be made if possible to conduct firefighting as well as rescue activities.

When entering a fire scene filled with dense smoke and heat, firefighters must wear fire-retardant protective clothing and carry breathing apparatus. In addition, they should be protected from the heat by the spraying of water. However, the existing protective clothing is less than ideal and injuries involving firefighters have actually occurred.

The specifications of the planned fire tank engines enable the efficient extension of the hose and the discharge of a high pressure spray, etc. and guidance will be provided on the effective use of these functions. Further guidance on crew safety will be provided as individual firefighters as well as commanders should be capable of making correct judgments, including the avoidance of dangerous entry into buildings which are on fire.

Technical guidance will also be provided on effective firefighting activities using rescue tools and equipment, primarily such forced entry tools as hydraulic cutters and rod cutters.

(2) Operational Techniques for Ladder Trucks

The existing ladder trucks were manufactured some 30 years ago and their functions and mechanisms considerably differ from those of the new ladder trucks to be procured under the Project.

Because of the complicated construction of ladder trucks and the need to pay extra attention to crew safety, ladder truck operators must be highly skilled and possess the ability to correctly judge the situation of a disaster and to safely operate the ladder.

The planned new ladder trucks have a basket which does not exist in the case of the existing ladder trucks. The technical guidance on ladder truck operation will include firefighting and rescue activities using the basket to ensure the efficient and effective use of the new ladder trucks.

A Japanese consultant supervising the procurement of the Project with experience in instructing firefighting in a previous soft component program will directly provide instructions. In addition, a manual written in Armenian will be prepared and trainees will include personnel responsible for education and training at the Crisis Management State Academy which is responsible for educating firefighting personnel so that ARS themselves will be able to hand over knowledge and skills after the Project..

The implementation of the soft component described above will achieve the following goals.

- Swift and efficient firefighting activities using the fire tank engines
- Efficient firefighting and rescue activities in high places using the ladder trucks

2.2.4.8 Implementation Schedule

The implementation schedule for the Project is shown below.

Sequence of Months		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Detailed Design	Signing of the E/N	▼																						
	Consultant Agreement		▲																					
	Preparation of the Tender Documents			▬																				
	Approval of the Tender Documents			■																				
	Tender					■																		
Procurement	Design and Manufacture of the Equipment for Procurement						▬																	
	Transportation of the Equipment																				▬			
	Guidance on Operation and Test Operation																					■		
	Soft Component																						■	

Fig. 2-2-11 Project Implementation Schedule

2.3 Obligations of the Recipient Country

As part of the implementation process of the Project as a grant aid project of the Government of Japan, the Government of Armenia will be required to undertake the measures described below.

2.3.1 Procedural Matters for Which the Recipient Country is Responsible

- (1) Acquisition/Securing of the Necessary Land/Space

It will be necessary for the Armenian side to secure places to keep the fire vehicles and spare parts. As spaces of the existing facilities are to be used for this purpose, no new building, such as a garage, will be required. However, the ownership of the existing facilities must be guaranteed.

- (2) Registration of the Fire Vehicles

The new fire vehicles must be properly registered as they will travel on ordinary roads.

- (3) Tax Exemption

The Government of Armenia will exempt Japanese nationals from all customs duties, internal taxes and other fiscal levies which are imposed in Armenia with respect to the procurement and supply of equipment and services under the verified contract.

The Government of Armenia will also ensure the swift customs clearance of procured fire vehicles and equipment and exempt these items from all taxes.

(4) Provision of Facilities

The Government of Armenia will accord Japanese nationals whose services may be required in connection with the supply of equipment, etc. and services under the verified contract such facilities as may be necessary for their entry to Armenia and stay therein for the performance of their work.

The Government of Armenia will also supply fuel, fire extinguishing water and others which will be required for the test operation and adjustment of the fire vehicles.

(5) Banking Arrangements

The Government of Armenia will open an account in its name at a bank in Japan and will issue an authorisation to pay (A/P) to the bank in question. The Government of Armenia will pay without fail the commission for the notice of the A/P and other bank commission based on the banking arrangements.

2.3.2 Work to be Undertaken by the Recipient Country for the Project

(1) Spare Parts Cabinet

The Armenian side must provide a lockable cabinet for spare parts.

(2) Infrastructure Development

As the new fire vehicles and equipment will be deployed at existing fire stations, the development of new infrastructure will be unnecessary. However, the garage at the No. 10 FRD does not have a gas heating system unlike all other fire stations and the Armenian side must provide an alternative heating system to the existing hot water heating system to prevent freezing of the fire engine tanks and piping in the garage in winter.

(3) Equipment Transportation

The Armenian side must transport the equipment handed over at the designated place in Yerevan to the destinations, i.e. the FRDs, SFD and workshop.

(4) Operation and Maintenance System for the Procured Equipment

The Armenian side must secure the services of the personnel required for the operation and maintenance of the procured equipment. The ARS will prepare tools required for diesel engine inspection and maintenance.

2.4 Project Operation Plan

2.4.1 Personnel

As the Project consists of simply the renewal of the existing fire vehicles except for small fire trucks, the fire personnel deployed at each FRD will continue operating the new vehicles. In the case of 1,000 lit. small fire trucks, necessary personnel are expected to be secured separately. If members are reshuffled to meet a vehicle deployment plan, it will be as shown in Table 2-4-1. The total required number of fire crews will be 616 firemen including 6 persons in 4 shifts per 3,500 lit. and 10,000 lit. fire tank engine, 3 persons in 4 shifts per 1,000 lit. small fire truck and 2 persons in 4 shifts per ladder truck. This can be accommodated by the present 620 fire crew members so ARS will plan the required reshuffle.

Education and training will be conducted in the form of the training of new recruits at the Crisis Management State Academy and OJT at each FRD.

Table 2-4-1 Fire Personnel Before and After the Deployment of the New Fire Vehicles

Fire station	Fire Tank Engine (3,500 lit. or 10,000 lit. Tank)	Small Fire Truck	Ladder Truck	Current personnel			Redeployed personnel			remarks
				Senior Officers and Correspondent	Fire-fighters	Total	Senior Officers Correspondent	Fire-fighters	Total	
No. 1 FRD	2	-	-	6	48	54	6	48	54	
No. 2 FRD	2	-	-	6	48	54	6	48	54	
No. 3 FRD	2	-	-	6	52	58	6	48	54	4 (move-out)
No. 4 FRD	2	-	-	6	52	58	6	48	54	4 (move-out)
No. 5 FRD	2	-	-	6	48	54	6	48	54	
No. 6 FRD	1	-	-	6	28	34	6	24	30	4 (move-out)
No. 7 FRD	2	-	-	6	52	58	6	48	54	4 (move-out)
No. 8 FRD	2	1	1	6	59	65	6	68	74	9 (move-in)
No. 9 FRD	2	-	-	6	52	58	6	48	54	4 (move-out)
No. 10 FRD	1	-	-	6	24	30	6	24	30	
No. 11 FRD	2	-	-	6	48	54	6	48	54	
No. 12 FRD	2	1	-	6	48	54	6	60	66	12 (move-in)
SFD	2	-	1	6	61	67	6	56	62	5 (move-out)
Total	24	2	2	78	620	698	78	616	694	4 (margin)

2.4.2 Maintenance System

Under ARS maintenance and inspection system, daily checks and repair of minor breakdowns will be carried out at each fire station; whereas, the workshop will conduct periodic inspections and main repairs. Workshop personnel and major equipment are shown respectively in Table 2-4-2 and Table 2-4-3. Mechanical engineers who are university graduates will give instructions and guidance to other staff and maintain the equipment.

Table 2-4-2 Present Workshop Personnel

Classification	No. of Staff
Mechanical engineers	2
Mechanics	5
Welder	1
Lathe worker	1
Engine mechanic	1
Rubber vulcanizing worker	1
Total	11

Table 2-4-3 Major Equipment

Equipment Name	Quantity
Welder	1
Crane	1
Lathe	1
Electric crane	1
Drill	1
Compressor	1

Although no problems will arise in the operation and maintenance of fire vehicles in general, they have no experience with the recently manufactured vehicles, in particular with diesel engines. During the initial operation, where basic maintenance knowledge and skills for the new vehicle are transferred by engineers of the vehicle manufacturer, if education on fuel injection mechanisms that are different from petrol engines is provided to mechanics, engine repairmen and mechanical engineers responsible for inspection and maintenance of fire vehicles, and if skills in inspection and maintenance are acquired by them, there will be no problems with diesel engines as with petrol engine vehicles now. At the same time, ARS will procure the equipment necessary for these inspections and maintenance.

With respect to a maintenance cost after procurement of the equipment, a drastic reduction is anticipated due to a decrease in problem vehicles; on the other hand, new spare parts will become necessary. In order to continuously purchase these parts, a budget of approximately ¥100,000 (282,000AMD) per single unit will be secured, which amount is equivalent to the budget of fire departments in Japan. Furthermore because fuel efficiency will be improved by 33% (2km travel will improve to more than 3km) and the market price of diesel engine fuel is approximately 10% cheaper than gasoline, a 40% reduction in fuel cost is expected through the implementation of the requested Japanese assistant project. The 2008 budget for fuel is 107 million AMD across the country and the number of fire vehicles owned by fire stations in Yerevan is nearly one third (1/3) that of all nationwide. Of the fuel cost of 35 million AMD, 40% or approximately 14 million AMD can be saved and appropriated to maintenance cost.

Spare truck chassis parts are available from agents of chassis manufacturers in Armenia. With respect to purchasing spare parts such as special pumps for fire vehicles, the manufacturer of the fire vehicles establishes an agency for the distribution of the spare parts in Armenia, hence there is no problem for procurement.

2.5 Project Cost Estimation

2.5.1 Initial Cost Estimation

The Armenian portion of the project cost is estimated below based on its obligation under the Project discussed earlier.

Table 2-5-1 Armenian Portion of the Project Cost

Cost Item	Amount
Transportation Cost (from the handing over site in Yerevan to each fire station)	AMD 20,000 (¥7,000)
Fuel required for test operation and adjustment	AMD 300,000 (¥106,000)
Diesel engine maintenance tools	AMD 903,000 (¥320,000)
Procedures for fire engine registration	AMD 1,680,000 (¥596,000)
Procedures for A/P	AMD 2,257,000 (¥800,000)
Total	AMD 5,160,000 (¥1,829,000)

2.5.2 Operation and Maintenance Cost

As the Project does not involve the recruitment and deployment of new personnel, no additional personnel cost will be incurred. Apart from the procurement of tools, etc. for the inspection and maintenance of the diesel engines, no problems are anticipated relating to operation and maintenance as long as funding is available to meet the fuel, lubricating oil, consumables, spare parts and utility costs of the present level.

2.6 Other Relevant Issues

The subject project for the requested Japanese assistance is a long-term project lasting for more than 20 months from the E/N to the final handing over. As such, it is essential to implement the Project swiftly as well as efficiently. Given the fact that Armenia is an inland country, the road transportation of the new fire vehicles, etc. will involve customs clearance in at least two countries. For this reason, the Armenian side must take the necessary measures to ensure tax exemption and swift customs clearance.

For the efficient and effective use of the new fire vehicles, it will be essential for the trainers and other target persons of the soft component to master the contents of the technical guidance as quickly as possible.

CHAPTER 3

PROJECT EVALUATION AND RECOMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMENDATIONS

3.1 Project Effects

3.1.1 Project Effects

The expected effects (outcomes) of the implementation of the Project are summarized in Table 3-1-1 in view of the stated project objectives (goals).

Table 3-1-1 Effects of Project Implementation and Degree of Improvement

Present Situation and Problems	Measures Under the Project	Direct Effects and Degree of Improvement	Indirect Effects and Degree of Improvement
1. All of the 21 operable fire vehicles deployed at the various FRDs have functional problem due to aging. As a result, they cannot quickly respond, hindering firefighting and rescue activities.	<ul style="list-style-type: none"> ▪ The existing fire vehicles will be removed from service and 28 new fire vehicles will be deployed at 13 FRDs. 	<ul style="list-style-type: none"> ▪ 28 fire vehicles will be operable (100%). 	<ul style="list-style-type: none"> ▪ The safety and peace of mind of the citizens, including the poor, will improve. ▪ The safety of firefighters will be secured, boosting their morale. ▪ The trust of the citizens in the fire service is expected to improve.
2. Because of the aging trucks, it takes 19 – 43 minutes for a fire tank engines to reach the scene of a fire to commence water discharge after receiving a turnout order.	<ul style="list-style-type: none"> ▪ The old fire tank engines will be removed from service and 26 new fire tank engines will be deployed. ▪ Firefighting techniques will be taught to trainers and fire personnel to shorten the time required to prepare for water discharge. 	<ul style="list-style-type: none"> ▪ The response time (time from dispatch after receiving a turnout order to the commencement of firefighting activities <water discharge>) will be substantially reduced to 10 minutes or less except during rush hours. 	<ul style="list-style-type: none"> ▪ Turnout to assist a neighboring FRD will become much quicker, making it easier to deal with large-scale fires. ▪ The fire tank engine operating skills will be inherited.
3. The fire vehicles which are effective to deal with fires involving medium to high buildings are so deteriorated that they cannot be used for rescue activities. Their firefighting capacity is severely reduced.	<ul style="list-style-type: none"> ▪ New ladder trucks will be deployed. ▪ The ladder truck operating techniques will be taught to trainers and fire personnel. 	<ul style="list-style-type: none"> ▪ Swift firefighting and rescue activities will become possible. ▪ The rescue of people will be possible from some 4,700 medium to high buildings in the city. ▪ The time to prepare for water discharge will be shortened from seven minutes to two minutes. 	<ul style="list-style-type: none"> ▪ The safety from fire at medium to high buildings will be much improved. ▪ The ladder truck operating skills will be inherited.
4. As there is no fire vehicle capable of entering dense residential areas with narrow roads, firefighting activities are delayed in these areas.	<ul style="list-style-type: none"> ▪ Small fire trucks will be deployed so that these areas can be reached in six minutes. 	<ul style="list-style-type: none"> ▪ A firefighting system which serves 85,000 people, including the poor, will be put into place. 	<ul style="list-style-type: none"> ▪ The safety of the lives of the citizens, including the poor, will improve.

3.1.2 Benefits and Indicators for Positive Outcomes

The Project target is 1.1 million citizens of Yerevan and the deployment of the new fire vehicles will secure the safety of these citizens from fires and other disasters. The indicators for the positive outcomes of the Project are outlined in Table 3-1-2 below.

Table 3-1-2 Indicators for Positive Outcomes of the Project and Baseline Survey Results

Indicators for Positive Outcomes	Baseline Survey Results
1. Ratio of fire vehicles which can turn out within one minute Present : 0 out of 21 Target : 28 out of 28 (100%)	<ul style="list-style-type: none"> ▪ When a dispatch order is issued by the Crisis Management Center, fire vehicle drivers immediately board their respective trucks to start the engine and wait for other fire personnel to get on board. None of the vehicles can depart without filling air into the air-brake and this filling operation takes 2 – 8 minutes. ▪ To control the degree of improvement after the implementation of the Project based on turnout records kept at the Crisis Management Center.
2. Response time Present : 19 – 43 mins. Target : 10 mins. or less	<ul style="list-style-type: none"> ▪ At present, 2 – 8 minutes are required to fill the air-brake system with air after a dispatch order has been issued and a further 10 – 28 minutes are required to travel to the scene of a fire because of the inability of the fire tank engines to travel at speed. Moreover, some seven minutes are required to extend the hose to the source of a fire to commence water discharge. ▪ The time required to reach the scene of a fire can be reduced by the deployment of the new trucks. The hose extension time can also be reduced to one minute through the relevant training under the soft component. ▪ To control the degree of improvement after the implementation of the Project based on turnout records kept at the Crisis Management Center.
3. Preparation time for water discharge by a ladder truck Present : 7 mins. Target : 2 mins. or less	<ul style="list-style-type: none"> ▪ Water discharge from the top of a ladder requires two firefighters to carry the hose to reach the top of the extended ladder. At present, it takes these firefighters seven minutes to prepare for water discharge. ▪ As the new ladder trucks have a basket, firefighters will be able to stay in the basket during ladder extension. As a result, it will be possible for these firefighters to commence water discharge in two minutes. ▪ To control the degree of improvement after the implementation of the Project based on ladder truck turnout records kept at the Crisis Management Center.

3.2 Recommendations

3.2.1 Recommendations

The following recommendations are made for the project implementation body in Armenia to make the Project efficient and effective and also to sustain the effects of the Project for a long time.

(1) Continual Education/Training on Ladder Truck and Other Fire Tank Engines Operating Techniques

For the effective use of the fire vehicles to be deployed under the Project in the face of fires and other disasters, it is essential for fire personnel to master practical operating skills. As part of the Project, technical guidance on application and operating skills will be provided through the soft component program including personnel responsible for education and training, and various manuals will be distributed.

At present, newly recruited fire personnel undergo guidance on the operation and maintenance of fire equipment at the Crisis Management State Academy. However, this guidance primarily consists of classroom teaching and fire personnel are expected to acquire practical firefighting skills through OJT after their deployment at a FRD. Given the present lack of systematic education, the introduction of education/training which ensures the maximum performance of the fire vehicles in response to the type and scale, etc. of a fire is essential.

It will be necessary for personnel responsible for education and training to ensure continual education/training on operation, maintenance and other relevant skills based on the outcomes of the technical guidance under the Project. At the same time, the effects of team training at each FRD in Yerevan should be regularly checked to develop opportunities for individual firefighters to improve their technical skills.

(2) Implementation of Quantitative Assessment of the Fire Service Strength, including the Response Time

The Crisis Management Center possesses detailed records on the time spent by a fire vehicle to complete operation in response to a dispatch order to deal with a fire or another disaster. At present, analysis of the response time using these records is not conducted. As it is essential to shorten the response time to reduce the damage caused by fires, etc., it is necessary for ARS to analyze the available response time data in detail to clarify any problems so that appropriate measures can be prepared to solve the problems. When the further advancement of urbanization and an increase of the traffic volume in the coming years are considered, it may be necessary to introduce a new FRD(s). Analysis of the response time will provide data to examine the necessity for the introduction of a new FRD(s).

(3) Fire Prevention Measures for Medium and High Buildings

There are many housing complexes or multi-purpose buildings at the project site from the Soviet period and medium to high buildings constructed after independence. The maintenance of escape stairs or fire compartmentation of existing medium to high buildings is important, so guidance

for persons concerned should be sufficiently provided by ARS in order to protect people's lives in case of fire. In addition, in accordance with the Law On Fire Security, fire prevention guidance should be conducted for new medium and high buildings that are required to have fire prevention equipment installed such as sprinklers or indoor fire hydrants.

(4) Promotion of Comprehensive Firefighting Measures

The number of fire incidents per unit population in Yerevan is much higher than that in Japan and shows an increasing trend. Furthermore, fires may become much more complicated and larger with an increase of the number of medium to high buildings.

In order to properly deal with such a situation, improvement of the hardware, such as improvement of the fire service strength under the Project, must be combined with soft measures, including fire and disaster prevention measures by ARS for local residents and businesses as listed below, to establish a comprehensive disaster prevention system.

As part of these measures, the use of the new fire vehicles for publicity as well as fire/disaster prevention education and training for the public should prove to be very effective to enhance the interest of people and businesses in the fire service and to raise their awareness of disaster preparedness.

- Publicity on the need for fire/disaster prevention
- Fire/disaster prevention education/training for residents and businesses
- Fostering and training of voluntary disaster prevention bodies formed by residents and businesses
- Evacuation drills in medium to high apartment

3.2.2 Technical Cooperation and Collaboration with Other Donors

(1) Participation in Training Organized by Japanese Fire Services

The participation of Armenian training officers in such training will improve their skills and will, therefore, be highly effective.

(2) Dispatch of Japanese Expert

The transfer of firefighting techniques through the dispatch of a Japanese expert will undoubtedly be effective for the maximum realization of the positive effects of the grant aid. However, the Project includes a soft component whereby training is provided for trainers in Armenia. As it is possible to ensure the efficient and effective use of the new equipment through this soft component, there is no strong urgency for technical cooperation.

(3) Collaboration with Other Donors

There is a low prospect of collaboration with other donors, such as the fire service in France which has supplied second-hand fire vehicles, etc. in the past as these old fire vehicles will be decommissioned because of their deterioration.

APPENDICES

1. Member List of the Study Team

1-1 Basic Design Study

Work Assignment	Name	Affiliation
Leader	Toshiyuki IWAMA	Head of the Information Communication and Governance Team, Project Management Group 1, Grant Aid Management Department, JICA
Planning Manager	Yasumichi ARAKI	Information Communication and Governance Team, Project Management Group 1, Grant Aid Management Department, JICA
Chief Consultant / Fire Prevention, Operation and Maintenance Planner	Sadahiko NAITO	FESC (Fire Equipment and Safety Center of Japan)
Fire Vehicle and Equipment Planner	Hiroshi TANUMA	FESC
Procurement Planner and Cost Estimator	Takashi KIHARA	FESC
Interpreter	BALAYAN Zaruhi	FESC
Hi-rise Building Fire Protection Planner	Shinji AOKI	FESC

Note: Affiliation was correct at the time of the field survey.

1-2 Explanation of the Summary of the Basic Design

Work Assignment	Name	Affiliation
Leader	Shumon YOSHIARA	Deputy Director General (for Economic Infrastructure Development), Grant Aid and Loan Support Department, JICA
Chief Consultant / Fire Prevention, Operation and Maintenance Planner	Sadahiko NAITO	FESC
Fire Vehicle and Equipment Planner	Hiroshi TANUMA	FESC
Hi-rise Building Fire Protection Planner	Yukio MASUMA	FESC
Interpreter	KOPITOV Ivan	FESC

2. Study Schedule

2-1 Basic Design Study

Day	Date	Day of Week	Activity		Over-Night Stay
			Study Team (Naito/Tanuma/Kihara/Aoki)	Study Team (BALAYAN)	
1	February 24th	Sun	- Narita (LH715)13:15 → Munich 17:45		Munich
2	25th	Mon	- Visit for possible procurement (Rosenbauer in Linz, Austria)		Munich
3	26th	Tue	- Visit for possible procurement (Metz in Karlsruhe, Germany)		Munich
4	27th	Wed	- Visit for possible procurement (Iveco-Magirus in Ulm, Germany) - Munich 21:10 → Yerevan 04:10 next day (LH3256)	- Narita 13:15 → Munich 17:45 (LH715)/Munich 21:10 → Yerevan 04:10 next day (LH3256)	On board
5	28th	Thu	- Visit to the ARS of the Ministry of Territorial Administration - Explanation of and discussions on the Inception Report; confirmation of the contents and schedule of the field survey		Yerevan
6	29th	Fri	- Site survey (No.2 FRD, No.6 FRD, No.10 FRD and the Crisis Management Centre)		Yerevan
7	March 1st	Sat	- Site survey (No.5 FRD, No.9 FRD, No.11 FRD, No.12 FRD and the Workshop)		Yerevan
8	2nd	Sun	- Arrangement and analysis of the gathered information and preparation of the draft Minutes		Yerevan
9	3rd	Mon	- Confirmation of the scope of the Japanese assistance and obligations of the Armenian side		Yerevan
10	4th	Tue	- Discussions on the Minutes - Site survey (No.7 and SFD)		Yerevan
11	5th	Wed	- Signing of the Minutes		Yerevan
12	6th	Thu	- Site survey (Crisis Management State Academy); discussions with the Department of Rescue Force; gathering of information, including that on other donors		Yerevan
13	7th	Fri	- Confirmation on the Questionnaire; site survey (State Fire Inspection and No.3 FRD)		Yerevan
14	8th	Sat	- Technical discussions with the Department of Rescue Force - Site survey (No.1 FRD, No.4 FRD, No.8 FRD, SFD and areas with narrow roads)		Yerevan

Day	Date	Day of Week	Activity	Over-Night Stay
15	9th	Sun	- Technical discussions with the Department of Rescue Force; arrangement of the gathered information	Yerevan
16	10th	Mon	- Technical discussions with the Department of Rescue Force; survey on high buildings	Yerevan
17	11th	Tue	- Discussions with the ARS and the Department of Rescue Force (equipment specifications and deployment plan); gathering of information	Yerevan
18	12th	Wed	- Survey on the procurement conditions (North); survey on local fire stations (Vanadzor and Gyumri); survey on the border customs at Bagratashen ; survey on possible transportation routes	Yerevan
19	13th	Thu	- Discussions with the ARS and the Department of Rescue Force (equipment specifications and deployment plan); gathering of information	Yerevan
20	14th	Fri	- Discussions with the ARS and the Department of Rescue Force (equipment specifications and deployment plan); gathering of information	Yerevan
21	15th	Sat	- Discussions with the ARS and the Department of Rescue Force (equipment specifications and deployment plan); gathering of information	Yerevan
22	16th	Sun	- Discussions with the ARS and the Department of Rescue Force (scope of the Japanese assistance, scope of the undertakings of the Armenian side and operation and maintenance system); gathering of information	Yerevan
23	17th	Mon	- Discussions on the scope of the Japanese assistance, equipment specifications, deployment plan, obligations of the Armenian side, operation and maintenance system; confirmation of sites (No.9 FRD, ARS Workshop and private workshops)	Yerevan
24	18th	Tue	- Confirmation of the scope of the Japanese assistance, equipment specifications, deployment plan, obligations of the Armenian side, operation and maintenance system	Yerevan
25	19th	Wed	- Yerevan 16:20 → Moscow 18:35 (SU194)	Moscow
26	20th	Thu	- Visit for possible procurement (Moscow 9:45 → U9•357 → Nizhnekamsk 11:25 Visit to Kamaz in Naberezhnye Chelny, Russia); Nizhnekamsk 19:50 → U9•362 → Moscow 21:30)	Moscow
27	21st	Fri	- Reporting to the Embassy of Japan in Moscow - Moscow (JL442) 17:15 →	On board
28	22nd	Sat	- → Narita 8:50	

2-2 Explanation of the Summary of the Basic Design

Day	Date	Day of Week	Activity	Over-Night Stay
			Study Team Members(Naito /Tanuma /Masuma /KOPITOV)	
1	July 14th	Mon	- Narita 11:05 → Moscow Domodedovo 16:10 (JL441)	On board
2	15th	Tue	- Moscow Domodedovo 01:20 (S7907) → Yerevan 05:05 - Visit to the ARS	Yerevan
3	16th	Wed	- Technical discussions with the ARS	Yerevan
4	17th	Thu	- Technical discussions with the ARS	Yerevan
5	18th	Fri	- Technical discussions with the ARS	Yerevan
6	19th	Sat	- Technical discussions with the ARS; gathering of information and reference materials	Yerevan
7	20th	Sun	- Arrangement of the gathered information and reference materials	Yerevan
8	21st	Mon	- Technical discussions with the ARS	Yerevan
9	22nd	Tue	- Technical discussions with the ARS	Yerevan
10	23rd	Wed	- Signing of the Minutes	Yerevan
11	24th	Thu	- Yerevan 07:10 → Moscow Sheremetyevo 09:05 (SU192) - Reporting to the Embassy of Japan in Moscow - Moscow 18:00 (JL442)	On board
12	25th	Fri	- Arrival at Narita (08:25)	

3. List of Parties Concerned

(1) Embassy of Japan in Russia

Hiroki Hazumi	Counselor
Jiro Iida	First Secretary
Yukiko Mizuno	Second Secretary

(2) JICA Program Coordinator in Armenia

Mher Sahakyan

(3) Ministry of the Territorial Administration

Vache Terteryan	First Deputy Minister
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(4) Ministry of the Emergency Situations

Mher Shahgeldyan	Minister
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(5) Ministry of the Foreign Affairs

Areg Hovhannissian	Head of Department of Asia, Pacific and Africa
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(6) Armenia Rescue Service: ARS

Edik Barseghyan	Director
Dr. Rafael Sinanyan	Advisor to the Director
Sergey Azaryan	Head of the Department of Population and Territories Protection
Arshavir Avagyan	Advisor to the Head of the Department of Population and Territories Protection
Vachagan Nikogosyan	Head of the Department of Rescue Forces
Pavlik Gyozyan	Deputy Head of the Department of Rescue Forces
Ashot Asatyan	Head of the Department of Finance and Economy
Arman Avagyan	Head of the Department of International Cooperation
Emma Mkrthcyan	Deputy Head of the Department of International Cooperation
Ashot Gharibyan	Head of the State Fire Inspection
Hamlet Matevosyan	Rector, Crisis Management State Academy
Mher Harutyunyan	Head of the Crisis Management Centre, Department of Operative Management
Arshavir Avakyan	Manager for Chemical, Radiological and Biological Situation Monitoring Section, Monitoring Centre, Department of Population and Territories Protection
Spartak Avetisyan	Manager of Workshop, Department of the Logistical Provision

Tachat Mnatsakanyan	Manager for Equipment Storage, Department of the Logistical Provision
Vardan Hayrapetyan	Senior Trainer, Department of the Logistical Provision
Aram Babayan	Head, No.1 FRD, Rescue Department of Yerevan City
Artavazd Asoyan	Head, No.2 FRD, Rescue Department of Yerevan City
Vahram Matevosyan	Head, No.3 FRD, Rescue Department of Yerevan City
Sahak Vardanyan	Head, No.4 FRD, Rescue Department of Yerevan City
Samvel Gevorgyan	Head, No.5 FRD, Rescue Department of Yerevan City
Aram Sargsyan	Head, No.6 FRD, Rescue Department of Yerevan City
Ashot Zohrabyan	Head, No.7 FRD, Rescue Department of Yerevan City
Arsen Saroyan	Head, No.8 FRD, Rescue Department of Yerevan City
Kamo Voskanyan	Head, No.9 FRD, Rescue Department of Yerevan City
Andranik Barbaryan	Head, No.10 FRD, Rescue Department of Yerevan City
Armen Gevorgyan	Head, No.11 FRD, Rescue Department of Yerevan City
Harutyun Petrosyan	Head, No.12 FRD, Rescue Department of Yerevan City
Nersik Hepoyan	Head, SFD, Rescue Department of Yerevan City
Avetis Manukyan	Head, Special Rescue Detachment, Rescue Department of Yerevan City
Andranik Pogosyan	Head, Regional Rescue Department of Shirak
Artur Avetisyan	Head, Gyumri No.2 FRD, Regional Rescue Department of Shirak
Sashik Ghazaryan	Head, Vanadzor No.1 FRD, Regional Rescue Department of Lorri

(7) Bagratashen Customs

Soghomon Meliksetyan	Manager, Customs Inspection
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(8) Fire Truck Manufacturers

Rosenbauer International

Hannes Draxler	Manager, Overseas Marketing
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Metz Aerials GmbH & Co.KG

Adrain Haid	Export Manager
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Iveco Magirus Brandschutztechnik GmbH

Peter Rahner	Sales Manager Northern Europe
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Manfred Hertenberger	Regional Sales Manager (Asia)
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KAMAZINSTRUMENTSMETSMASH Joint Stock Company

Valery E. Eremin	The First Deputy Director-General-Commercial Director
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Vyacheslav A. Sharov	Designer
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Joint Stock Company FOREIGN TRADE COMPANY KAMAZ

Marat S. Sirazetdinov Caucasus Region Director

(9) Dealers

Zhora Usnunts Director Yerevan Kamaz Auto Center LLC

Meruzhan Eghiazaryan Director MLL Motors LLC

4. Minutes of Discussions

4-1 Basic Design Study

Minutes of Discussions
on the Basic Design Study on the Project for Technical Re-equipment and Modernization of
Devices of the Fire-Rescue Detachments of the Armenia Rescue Service
in the Republic of Armenia

In response to the request from the Government of the Republic of Armenia (hereinafter referred to as "GORA"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct a Basic Design Study on "The Project for Technical Re-equipment and Modernization of Devices of the Fire-Rescue Detachments of the Armenia Rescue Service" (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the GORA the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Toshiyuki IWAMA, Team Director, ICT and Governance Team, Project Management Group 1, Grant Aid Management Department, JICA, and is scheduled to stay in the Armenia from February 28 to March 19, 2008.

The Team held discussions with the officials concerned of the GORA and conducted the field survey at the study areas.

In the course of the discussions and field survey, both sides have confirmed the main contents described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Yerevan, March 5, 2008


Toshiyuki IWAMA
Leader
Basic Design Study Team
Japan International Cooperation Agency


Edik BARSEGHYAN
Director
Armenia Rescue Service
Republic of Armenia

ATTACHMENT

1. Objective of the Project
The objective of the Project is to improve the effectiveness of the fire engines of the Armenia Rescue Service (ARS) in Yerevan City for the fire-fighting activities.
2. Project Site
The Project site is Yerevan City shown in Annex-1.
3. Responsible and Implementing Organization
 - 3-1 The responsible and implementing organization is ARS.
 - 3-2 The organization chart is shown in Annex-2.
4. Items requested by the GORA
After discussions with the Team, the items described in Annex-3 were finally requested by the GORA. JICA will assess the appropriateness of the request and will report the findings to the GOJ. ARS side understands that Japan's Grant Aid Project may not be able to cover all the items and also understands the need to optimize the components of the requested items from the viewpoint of necessity, practicability, sustainability, cost-effectiveness and financial viability.
5. Japan's Grant Aid Scheme
 - 5-1 The GORA side understands the Japan's Grant Aid scheme and the necessary measures to be taken by the GORA, as explained by the Team and as described in Annex-4.
 - 5-2 The GORA side will take necessary measures, as described in Annex-5, for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.
6. Schedule of the Study
 - 6-1 The consultants will proceed to further study in Armenia until March 19, 2008.
 - 6-2 JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around July, 2008.
 - 6-3 In case that the contents of the report is accepted in principle by the GORA, JICA will complete the final report and send it to the GORA by the end of November, 2008.
7. Other Relevant Issues
 - 7-1 Both sides confirmed that each fire station needed two fire tank engines to respond to the cases of fire and one fire tank engine to be used in the development of the situation according to the Code of Laws on firefighting. Both sides agreed that the necessity for replacement of the fire tank engines should be determined by the survey of condition of all existing fire tank engines by the Team. Both sides confirmed that the requested number of fire tank engines should be the following: nineteen (19) fire tank engines with the capacity of 3500 L, five (5) fire tank engines with capacity of 10000 L, one (1) Ladder truck and

one (1) Aerial Platform. ARS is planning to allocate these five (5) vehicles to five (5) fire stations based on the past record of large fire incidents and accessibility to be covered all area of Yerevan city.

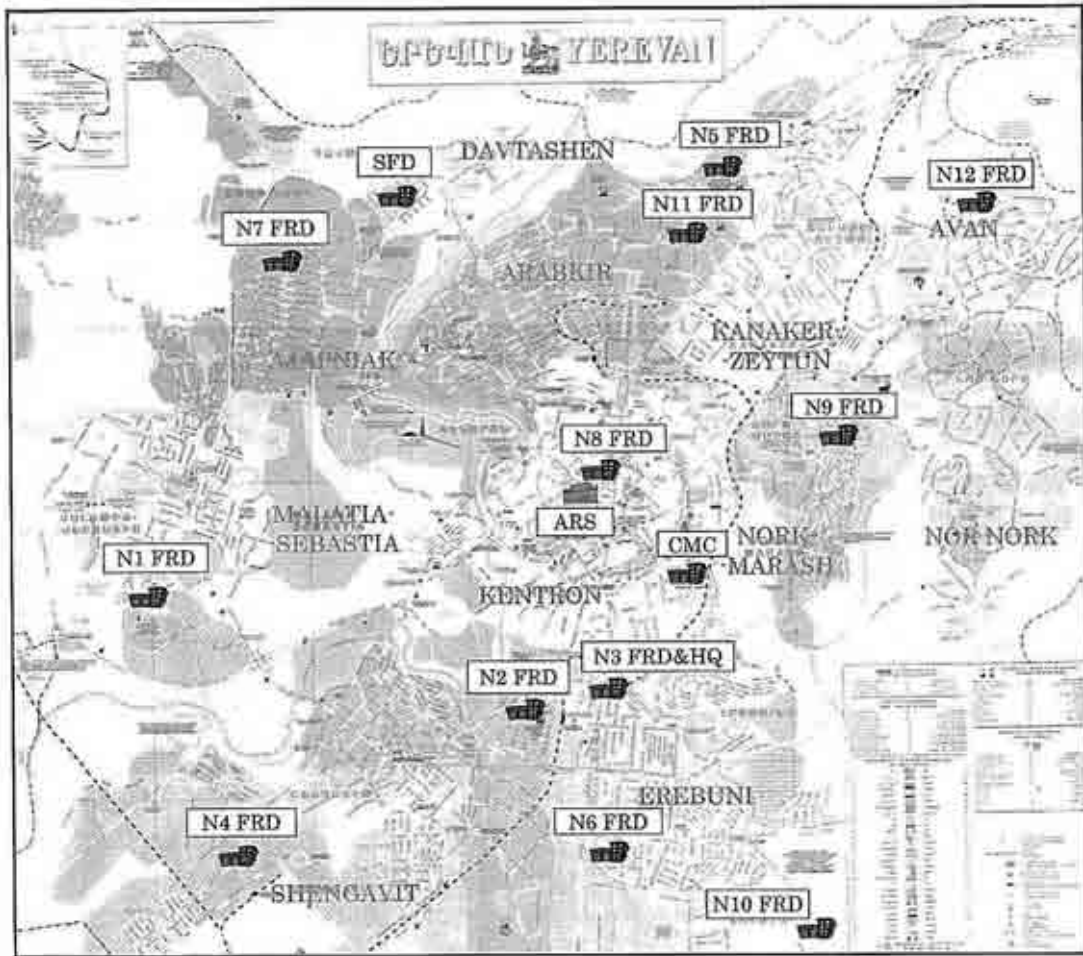
At the same time ARS requested to add one (1) cross-country vehicle for the firefighting Staff during the management of the activities to be carried out at the fire scene, two (2) fire trucks with the capacity of 500 to 1000 L for firefighting activities in difficult-to-reach places of Yerevan city, four (4) pick-up trucks on which the ARS will place water pumps, hoses and rescue equipment to contribute to the firefighting activities. The ARS mentioned that it would appreciate the assistance from the consultants in making the final list of the spare parts.

- 7-2 ARS requested a Ladder Truck (50m) instead of a Ladder Truck (30m) of the original request. The Team explained that a Ladder Truck (50m) is very difficult to operate and might be not appropriate to the road and traffic conditions of Yerevan City. The Team also explained that it is not common in Japan as well. Rather than, high rise building must be equipped with appropriate fire prevention facilities.
- 7-3 The Team explained that the Aerial Platform and the Ladder truck had been used at the same purpose and the Aerial Platform had disadvantage over the Ladder Truck in respect to the operational aspects. Both sides agreed that it would be decided through further discussions during the field survey.
- 7-4 ARS requested pick-up truck with tools and equipment. As for tools and equipment of the fire engines, the Team explained that it should be in principle based on the current practice of the existing fire vehicle. These tools and equipment shall be mounted to the fire engines instead of the pick-up truck.
- 7-5 The Team recommends ARS to set up the priority order of the requested items by the end of the field survey. The Team will provide related information to ARS as much as possible to enable setting the priority, if necessary.
- 7-6 The GORA side shall ensure prompt tax exemption and customs clearance of the products to be allocated under ODA.
- 7-7 The GORA side explained that tax exemption will be decided by a committee. Approval will take around ten days.
- 7-8 The GORA side shall cover the expenses of fuel-lubricant materials regarding the transportation of the items and vehicles provided by ODA.
- 7-9 The GORA side understands to stick national flag of Japan and/or ODA symbol mark sticker is required on all the Equipment procured by the Japanese Grant Aid.
- 7-10 The GORA side shall submit answers of the questionnaire given by the Team before 10 March, 2008.

- Annex - 1 Site of the Project
- Annex - 2 Organization Charts
- Annex - 3 Requested Equipment List
- Annex - 4 Japan's Grant Aid Scheme
- Annex - 5 Major undertakings to be taken by each Government

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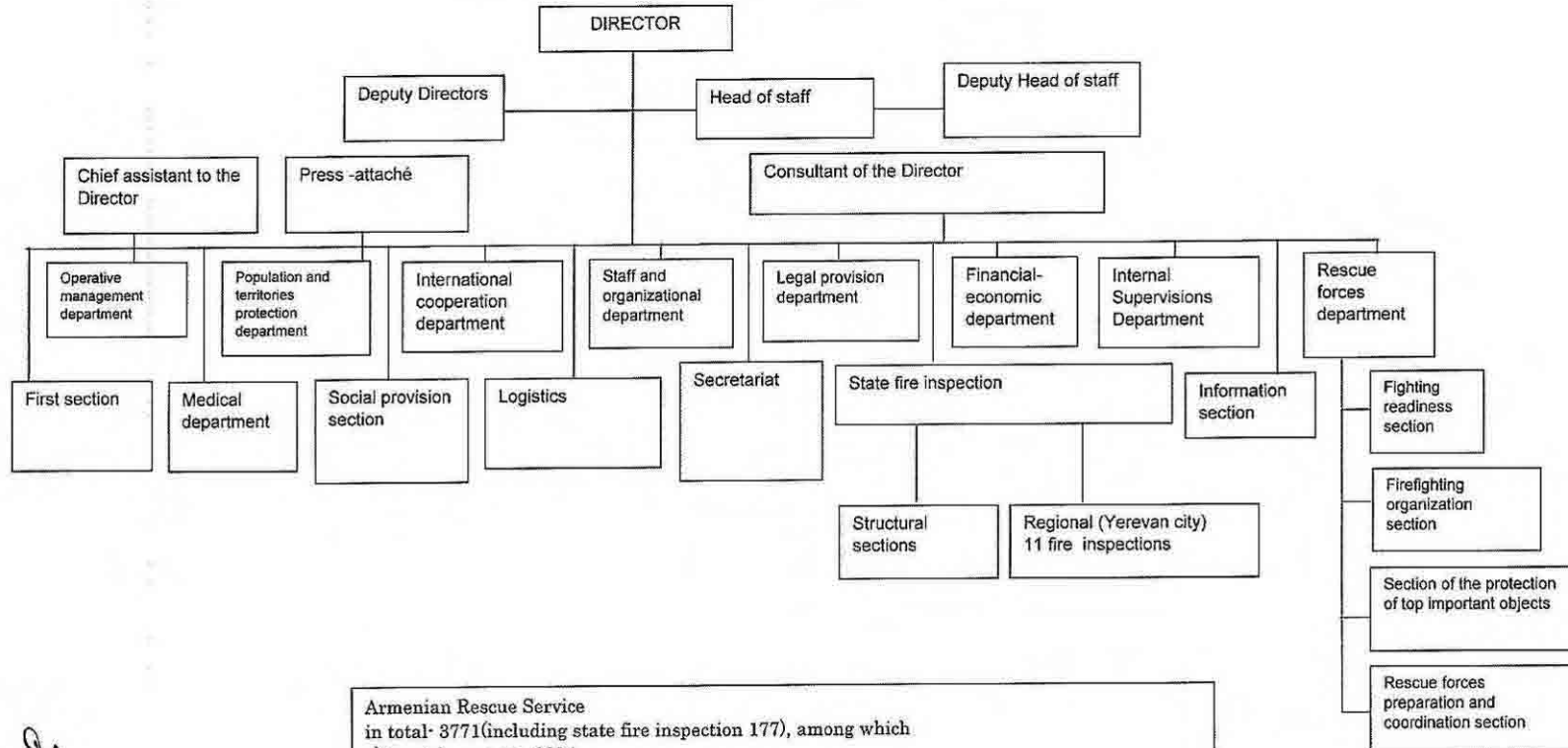


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Armenia Rescue Service

Annex 2



Armenian Rescue Service
 in total- 3771(including state fire inspection 177), among which
 a)Special servants- 3294
 b)Civil officers 284
 c)Technical provision specialists- 193

A4-5

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THE DISTRIBUTION OF THE REQUESTED FIRE TRUCKS AMONG FIRE-RESCUE DETACHMENTS

	Fire Tank Engine 3500 l	Fire Tank Engine 10000 l	Ladder Truck	Aerial Platform	Fire truck 500 to 1000 l	Pick-up	Cross- country vehicle	Spare parts	Justification
Fire-Rescue Detachment - 1	1	1			1				
Fire-Rescue Detachment - 2	2								
Fire-Rescue Detachment - 3	2								
Fire-Rescue Detachment - 4	2								
Fire-Rescue Detachment - 5	1	1							
Fire-Rescue Detachment - 6	1								
Fire-Rescue Detachment - 7	2								
Fire-Rescue Detachment - 8	1	1			1				
Fire-Rescue Detachment - 9	1	1							
Fire-Rescue Detachment - 10	1								
Fire-Rescue Detachment - 11	2								
Fire-Rescue Detachment - 12	2								
Special Firefighting Detachment	1	1	1	1					
Fire-Rescue Detachment						4			
Fire-fighting Staff							1		
Total	19	5	1	1	2	4	1		

JAPAN'S GRANT AID SCHEME

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

(1) Grant Aid Procedures

1) Japan's Grant Aid Scheme is executed through the following procedures:

- Application (Request made by a recipient country)
- Study (Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- Determination of Implementation (The Notes exchanged between the Governments of Japan and the recipient country)
- Implementation (Implementation of the Project)

2) Firstly, the application or a request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Japan's Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes

signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

(2) Basic Design Study

Contents of the Study

The aim of the Basic Design Study conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Basic Design Study are as follows:

- i) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation,
- ii) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economical point of view,
- iii) Confirmation of items agreed on by both parties concerning the basic concept of the Project,
- iv) Preparation of a basic design of the Project,
- v) Estimation of costs of the Project.

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

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the

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implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Basic Design Study is (are) recommended by JICA to the recipient country to also work in the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

(3) Japan's Grant Aid Scheme

1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) "The period of the Grant Aid" means the one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However in case of delays in delivery, installation or construction due to unforeseen factors such as natural disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

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When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, constructing, and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

4) Necessity of the "Verification"

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

5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the followings:

- i) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
- ii) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
- iii) To secure buildings prior to the procurement in case the installation of the equipment.
- iv) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
- v) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

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vi) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

6) "Proper Use"

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

7) "Re-export"

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

8) Banking Arrangement (B/A)

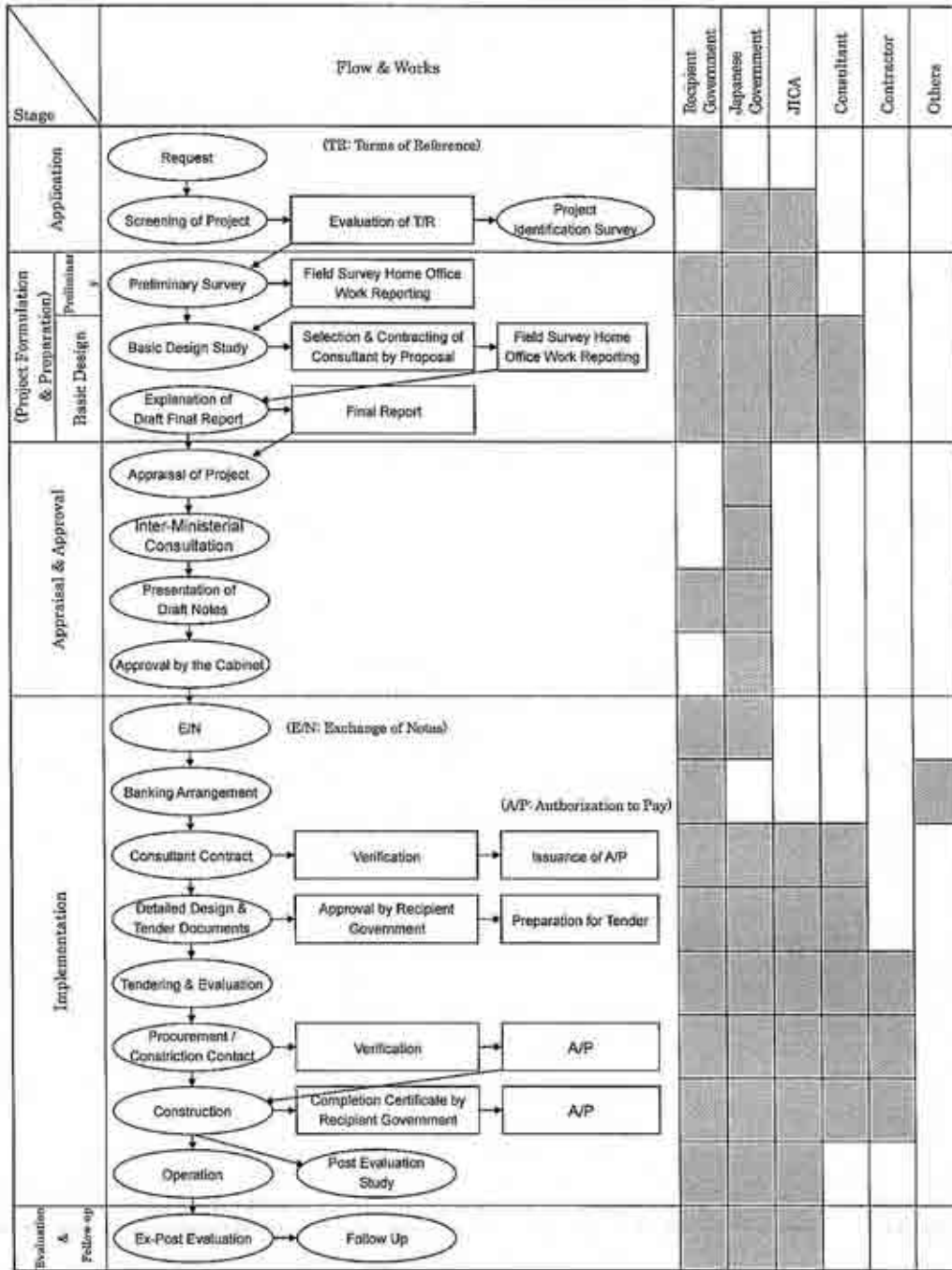
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover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

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

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Grant Aid Procedures



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Annex 5

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine and land transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		●
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		●

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

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4-2 Explanation of the Summary of the Basic Design

Minutes of Discussions
on the Basic Design Study on the Project for Improvement of
Fire Fighting Equipment in Yerevan City
(Explanation on Draft Final Report)

In March 2008, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Improvement of Fire Fighting Equipment in Yerevan City (hereinafter referred to as "the Project") to the Government of the Republic of Armenia (hereinafter referred to as "GORA"), and through discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft final report of the study. In order to explain and to consult with concerned officials of the GORA on the components of the draft final report, JICA sent to the GORA the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Shumon YOSHIARA, Deputy Director General for Economic Infrastructure Development, Grant Aid and Loan Support Department, JICA from July 15 to 24, 2008.

In the course of the discussions, both sides confirmed the main items described on the attached sheet.

Yerevan, July 23, 2008


Shumon YOSHIARA
Leader
Draft Final Report Explanation Team
Japan International Cooperation Agency


Edik BARSEGHYAN
Director
Armenia Rescue Service
Republic of Armenia

ATTACHMENT

1. Components of the Draft Final Report

The GORA side agreed to and accepted in principle the components of the draft final report explained by the Team.

2. Japan's Grant Aid Scheme

The GORA side understood the Japan's Grant Aid scheme and the necessary undertakings to be taken by the GORA as explained by the Team and described in Annex-4 and Annex-5 of the Minutes of Discussions signed by both sides on March 5, 2008.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the GORA by the end of November, 2008.

4. Other Relevant Issues

4-1 Both sides agreed to the components of the Project as shown in **Annex 1**.

4-2 The GORA side strongly requested the Japanese side to provide breathing apparatuses as ARS owns only 27 apparatuses in total in Yerevan and all of them are superannuated, which makes further maintenance impossible.

4-3 The GORA side confirmed to reallocate the appropriate number of staff to each fire station based on the draft final report as shown in **Annex 2**.

4-4 The GORA side confirmed to secure necessary budgets to operate and maintain the equipment to be procured under the Project properly and effectively. The GORA side also explained that it could maintain fire tank engines and ladder trucks procured under the Project by the current personnel and facilities.

4-5 The GORA side requested the Team to provide guidance on specific fire fighting tactics and maintenance techniques for fire tank engines and ladder trucks procured under the Project. Both sides confirmed the necessity of the guidance for effective use and maintenance of those vehicles. The GORA side confirmed that it would provide necessary places and assign necessary staff including instructors for receiving guidance upon arrival of the equipment.



- 4-6 Both sides confirmed that the following undertakings should be taken by the GORA side at its expense.
- Advising commission of A/P
 - Payment commission
 - Vehicle registration for fire tank engines and ladder trucks procured under the Project
 - Securing equipment necessary for diesel engine maintenance
 - Transportation of vehicles within Yerevan.
- 4-7 Both sides agreed that the draft detailed specifications of equipment are confidential and should not be duplicated or released to other parties in order to secure the fairness of the tender of the Project.
- 4-8 Both sides agreed that the Project Cost Estimation, as attached in **Annex 3**, should never be duplicated or released to other parties before the signing of all the Contract(s) for the Project.
- 4-9 Both sides agreed that the Project title is "The Project for Improvement of Fire Fighting Equipment in Yerevan City" for the sake of simplicity and brevity.

Annex 1 Component of the Project
Annex 2 Personnel Allocation
Annex 3 Project Cost Estimation



Component of the Project

Fire Station	Vehicle Type	3,500 Litre Fire Tank Engine		10,000 Litre Fire Tank Engine	1,000 Litre Small Fire Truck	Ladder Truck	Remarks
		Rear Drive	4 x 4				
No. 1 FRD		1		1			
No. 2 FRD		2					
No. 3 FRD		2					
No. 4 FRD		2					
No. 5 FRD		1		1			
No. 6 FRD		1					
No. 7 FRD			2				
No. 8 FRD		1		1	1	1	
No. 9 FRD			1	1			
No. 10 FRD		1					
No. 11 FRD		2					
No. 12 FRD			2		1		
SFD			1	1		1	
By Type of Drive System		13	6				
By Vehicle Type		19		5	2	2	
Total				28			

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Personnel Allocation

Fire station	Deployment of the fire truck			Current personnel			Redeployed personnel			Remarks
	Water Tank Engine (3,500 Lit. or 10,000 Lit. Tank)	Small Fire Truck	Ladder Truck	Senior Officers	Fire -fighters	T o t a l	Senior Officers	Fire -fighters	T o t a l	
No. 1 FRD	2	-	-	6	48	54	6	48	54	
No. 2 FRD	2	-	-	6	48	54	6	48	54	
No. 3 FRD	2	-	-	6	52	58	6	48	54	4(move-out)
No. 4 FRD	2	-	-	6	52	58	6	48	54	4(move-out)
No. 5 FRD	2	-	-	6	48	54	6	48	54	
No. 6 FRD	1	-	-	6	28	34	6	24	30	4(move-out)
No. 7 FRD	2	-	-	6	52	58	6	48	54	4(move-out)
No. 8 FRD	2	1	1	6	59	65	6	68	74	9(move-in)
No. 9 FRD	2	-	-	6	52	58	6	48	54	4(move-out)
No. 10 FRD	1	-	-	6	24	30	6	24	30	
No. 11 FRD	2	-	-	6	48	54	6	48	54	
No. 12 FRD	2	1	-	6	48	54	6	60	66	12(move-in)
SFD	2	-	1	6	61	67	6	56	62	5(move-out)
Total	24	2	2	78	620	698	78	616	694	4(margin)

Fire stations with blank remarks column can operate new fire trucks to be deployed with current fire personnel.

pieces

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5. Soft Component Plan

**THE PROJECT FOR IMPROVEMENT
OF
FIRE FIGHTING EQUIPMENT IN YEREVAN CITY**

SOFT COMPONENT PLAN

JULY, 2008

**JAPAN INTERNATIONAL COOPERATION AGENCY
FIRE EQUIPMENT AND SAFETY CENTER OF JAPAN**

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1. Background

(1) Present Situation

In Yerevan City, the capital of the Republic of Armenia (hereinafter referred to as “Armenia”), there has been a rapid increase of the number of fires and traffic accidents due to the increase of the number of medium to high buildings and road traffic, in turn caused by economic development in recent years. It is now essential to properly deal with these disasters.

There is also a growing necessity in the city to improve the firefighting system, particularly fire vehicles because of the significant deterioration. Most of the existing fire tank engines have lost their original functions/performance. Despite the considerable insufficiency of the fire vehicles in both the qualitative and quantitative aspects, the stringent state of government finance means that the Armenia Rescue Service (ARS) is unable to procure new fire vehicles.

Under these circumstances, the Government of Armenia has identified improvement of the fire vehicles in Yerevan, where the risk of disaster is steadily increasing, as an important issue and has formulated the “Project for Improvement of Fire Fighting Equipment in Yerevan City” (the Project) and made a request to the Government of Japan for assistance for the implementation of the Project.

In connection with the planned implementation of the Project under Japan’s grant aid scheme, the following requirements must be met by the ARS to ensure effective fire prevention.

- ① Effective response to the rapid increase of incidents requiring firefighting and/or rescue activities
- ② Introduction of effective firefighting and rescue activities to deal with fires and other disasters involving an ever increasing number of medium to high buildings
- ③ Renewal of fire tank engines and other firefighting equipment, all of which are highly deteriorated and insufficient in number
- ④ Effective use of fire tank engines and ladder trucks using the latest operating techniques
- ⑤ Renewal of ladder trucks capable of dealing with fires involving high rise buildings
- ⑥ Introduction of small fire trucks capable of dealing with fires in dense residential areas with narrow roads
- ⑦ Establishment of firefighting techniques to deal with special types of fires

(2) Reasons for Planning of the Soft Component

The Project plans the deployment of new fire tank engines and ladder trucks. However, any satisfactory solution to above requirements②, ④ and ⑦ will demand the skilful handling of the fire vehicles, the ability to properly judge the situation of a disaster and operation of the fire vehicles in an efficient manner. Guidance on the mechanical operation of the fire vehicles by the manufacturer cannot be expected to teach the ability to properly judge situations and to operate the fire vehicles in response to the structure of buildings in flame, the situation of fire and the presence of people trapped by fire, etc. To ensure the sustainability of the positive outcomes of the assistance, technical guidance on firefighting and rescue activities using fire tank engines and ladder trucks is required in addition to guidance on the handling of such vehicles by the manufacturer. This guidance should be provided in the form of a soft component by an expert(s) with rich experience of the operation of ladder trucks and other types of fire vehicles so that these will be permanently used in an efficient and effective manner.

(3) Matters Requiring Concrete Technical Guidance

Since 1990, ARS has not procured/renewed any of its fire vehicles and is still using old vehicles which have entirely or partially lost their original functions and/or performance capability. The fire vehicles owned by the ARS are, therefore, unable to conduct swift and efficient firefighting activities on arrival at the scene of a fire compared to their counterparts in Japan. At present, it takes the fire tank engines some 10 minutes to commence the discharge of water on arrival at a fire scene in addition to the long travelling time required to reach a fire scene because of their deteriorated state. A fire can rapidly spread in the meantime, causing much damage to people and their property. The protection of firefighters engaged in firefighting or rescue activities is insufficient and 17 firefighters were injured in the three year period from 2005 to 2007. Compared to the existing ladder trucks which are more than 30 years old, the new ladder trucks are capable of conducting the raising, extension and swivelling of the ladder simultaneously. These actions can be completed much faster and the handling performance is far superior to that of the old ladder trucks. Moreover, the new fire trucks are equipped with a basket at the top end of the ladder for the effective implementation of firefighting and rescue activities in an elevated position. The effective operation of a ladder truck at the scene of a fire where there is much confusion requires a high level of handling skill. Unfortunately, the ARS does not have the latest technical expertise to efficiently conduct swift rescue activities in high places. The proposed soft component offers the teaching of the knowledge and techniques which are essential for efficient firefighting activities using a fire tank engine and/or ladder truck.

2. Goals of the Soft Component

The soft component is expected to achieve the following goals.

- Capability to conduct swift and efficient firefighting activities using the fire tank engines
- Capability to conduct efficient firefighting and rescue activities in high places using ladder trucks

The soft component also has the following higher goal.

- Appropriate firefighting activities in Yerevan, i.e. the target city of the Project, and a resulting reduction of disaster damage to lives and property

3. Outcomes of the Soft Component (Direct Outcomes)

The implementation of the soft component is expected to have the following outcomes.

(1) Fire Tank Engine Operating Techniques and Firefighting Techniques

Firefighters will have the skills required to intake water from a hydrant, etc., to operate the pump, to relay water and to discharge the water in accordance with the type and scale of a fire after arrival at a fire scene, ensuring the efficient use of the fire tank engines and firefighting equipment.

(2) Ladder Truck Operating Techniques

Firefighters will have the skills required to discharge water from the basket at the top end of the ladder, to conduct firefighting activities inside buildings and to quickly rescue people trapped on upper floors, ensuring optimal firefighting activities in accordance with the type, scale and presented risk of a disaster.

(3) Preparation of Manuals in the Armenian Language

Four manuals will be prepared in the Armenian language to ensure the continual education and training of fire personnel. These manuals are “Fire Equipment Operating Manual (Fire Tank Engines)”, “Firefighting Techniques Manual (Fire Tank Engines)”, “Fire Equipment Operating Manual (Ladder Trucks)” and “Firefighting Techniques Manual (Ladder Trucks)”.

4. Achievement Verification Method

The degree of achievement will be verified using the target skill and skill development progress tables included in the manuals.

5. Activities (Input Plan)

(1) Teaching (Guidance) Subjects

The fire vehicles to be deployed under the Project will represent the first introduction of new fire vehicles since Armenia’s independence in 1991. Accordingly, the functions and operational

requirements of the new fire vehicles are quite different from those of the existing fire vehicles. This is why technical guidance (teaching) is required on the following two subjects.

1) Operating and Firefighting Techniques for Fire Tank Engines

In principle, two fire tank engines are dispatched to fight a fire so that the first vehicle on the scene is engaged in water discharge while the second vehicle obtains water from a hydrant or another water source to relay water to the first vehicle. However, the limited number of operable hydrants means that extension of the hoses over several hundred meters may be necessary. As hose extension in the case of ARS is time consuming, some 10 minutes are often required to commence water discharge. Consequently, firefighting is often interrupted because of the exhaustion of the water carried by a fire tank engine. The quick extension of the hoses and continuation of water discharge until the arrival of relayed water are, therefore, essential to prevent the intensification of a fire. During actual firefighting, water should be discharged from the nearest possible point to the source of the fire and firefighters should enter the building to conduct firefighting and rescue activities.

When firefighters enter a building which is filled with dense smoke and heat, they must be protected by a fog stream. However, the existing equipment cannot provide this type of protection. Moreover, the insufficient protective clothing (inferior fire-retardant performance) has led to injuries to firefighters in some cases.

The specifications of the planned fire tank engines allow the efficient extension of the hoses and the discharge of high pressure fog, etc. and guidance will be provided to ensure the effective use of these functions. Guidance will also be provided on safe operation as firefighters should be capable of judging the level of the risk associated with their entry into burning buildings, etc. Technical guidance will also be provided on effective firefighting using rescue equipment, including forcible entry tools, such as hydraulic cutters and rod cutters.

2) Ladder Truck Operating Techniques

Among the new fire vehicles to be deployed under the Project, ladder trucks have a quite different mechanism and functions to those of the existing ladder trucks which were procured some 30 years ago. A ladder truck has a very complicated structure but is required to provide very swift actions and a high level of safety. It is essential that those using a ladder truck have a proper understanding of its limitations and are familiar with the functions of the vehicle. Moreover, fire personnel using a ladder truck must have the capacity to make appropriate judgements in accordance with the specific situations of disasters and sound knowledge of its operating techniques.

As the planned ladder trucks under the Project have a basket at the top of the ladder, technical guidance will be provided on firefighting and rescue activities using the basket in high places to ensure the efficient and effective use of these trucks.

(2) Required Technical Instructors

- 1) Two experts to be responsible for fire tank engine operating techniques and firefighting techniques (these experts must have in-depth knowledge of firefighting tactics through their experience of various firefighting activities)
- 2) Two experts responsible for ladder truck operating techniques (these experts must be familiar with ladder truck operating techniques through their experience of various rescue and firefighting activities using a ladder truck)

(3) Target Persons (in Armenia)

- 1) Fire Tank Engine Operating and Firefighting Techniques
Firefighters, senior commanders and trainers (50 in total)
- 2) Ladder Truck Operating Techniques
Ladder truck crew members, senior commanders and trainers (50 in total)

(4) Guidance Items (Tentative)

- 1) Fire Tank Engine Operating and Firefighting Techniques
Guidance on firefighting techniques and tactics for the coordinated operation of fire trucks
 - ① Inspection and maintenance system for fire tank engines

- ② Coordination method between multiple fire tank engines or between a fire tank engine(s) and a ladder truck
- ③ Guidelines for water discharge corresponding to the specific situation of a fire (use of variable nozzles)
- ④ Guidance on method for the safe entry into buildings and securing safety during firefighting and rescue activities
- ⑤ Guidelines for efficient water relay and discharge (hose extension using a hose car and other issues)
- ⑥ Use of the loaded equipment, including rod cutters and hydraulic cutters, at the scene of disasters

2) Ladder Truck Operating Techniques

Guidance on ladder truck operating techniques corresponding to the type, scale and risk, etc. of disasters

- ① Inspection and maintenance system for ladder trucks
- ② Firefighting and rescue techniques in high places using a ladder truck
- ③ Guidelines to judge the rescue situation at a disaster site with persons who have been unable to escape
- ④ Guidelines to decide the ladder truck parking position and the position for ladder extension (to deal with two places) (in consideration of a specific fire source, strength and inclination of the ground, impediments, such as power cables and trees)
- ⑤ Guidelines for entry into high places and rescue/escape from high places using the basket
- ⑥ Guidelines for firefighting using the monitor nozzle of the ladder truck
- ⑦ Guidelines for coordinated firefighting activities involving a fire tank engine (company) and a ladder truck (company)
- ⑧ Guidelines for coordinated rescue activities involving a ladder truck (company) and a rescue truck (company)
- ⑨ Guidelines for response to emergency situations
- ⑩ Other examples of the use of ladder trucks (rescue by extending the ladder to low places)
- ⑪ Safety measures, taking the operational limits into consideration.

(5) Teaching Resources

< Experts to be dispatched >	< Number >
- Experts (instructors) on fire tank engine operating and firefighting techniques	2
- Experts (instructors) on ladder truck operating techniques	2

(6) Teaching Method

1) Preparation of Manuals and Lecture Tools in Japan

2 persons x 20 day

- Manuals

“Fire Equipment Operating Manual (Fire Tank Engines)”

“Firefighting Techniques Manual (Fire Tank Engines)”

“Fire Equipment Operating Manual (Ladder Trucks)”

“Firefighting Techniques Manual (Ladder Trucks)”

- Lecture Tools (CD for PC presentation)

Illustrations of fire vehicles and equipment and movies showing fire vehicle operating techniques

2) Dispatch of instructors from Japan to provide technique guidance in a lecture room and at a training ground using the new equipment and manuals: to take place in Yerevan

a) Fire tank engine operating and firefighting techniques

2 persons x 15 days

b) Ladder truck operating techniques

2 persons x 36 days

In the case of ladder truck operating techniques, a technical guidance session lasting for 15 days will be provided twice as this training session is designed to cover all ladder truck crew members

3) Employment of Assistants

a) Fire tank engine operating techniques

1 person x 11 days

b) Ladder truck operating techniques

1 person x 32 days

4) Leasing of a Car (with a Driver)

1 person x 43 days

6. Procurement of Teaching Resources

Direct Guidance by Japanese Instructors Type

As the techniques for which guidance/assistance will be provided under the soft component of the Project are not widely used in Armenia, there are no local resources, such as local consultants, who can be used. For this reason, Japanese instructors will be dispatched to Armenia to provide direct guidance. These instructors will be selected from the consultant which has experience of providing technical guidance under a soft component scheme and which will supervise the procurement under the Project.

7. Implementation Schedule

See the Attached Paper

8. Outcome

(1) Completion Report

(2) Fire Personnel Training Materials

- Manuals

“Fire Equipment Operating Manual (Fire Tank Engines)”

“Firefighting Techniques Manual (Fire Tank Engines)”

“Fire Equipment Operating Manual (Ladder Trucks)”

“Firefighting Techniques Manual (Ladder Trucks)”

- Lecture Tool (CD)

Illustrations of fire vehicles and equipment and movies showing fire vehicle operating techniques

(3) Activity Records (business diary and photographs, etc.)

(4) Technical Advancement Table (to check the degree of achievement of the technical training goals)

9. Obligations of the Recipient Organization

(1) Continuity

ARS, the implementation body of the Project, has the Crisis Management State Academy which trains fire personnel using its own training programme. In addition, individual FRDs plan and implement routine training. The technical expertise of fire personnel in Yerevan is maintained through such training. It is highly likely that the positive outcomes of the soft component will be shared by the Academy and FRDs to continually contribute to their training.

(2) Undertakings of the Recipient Organization

- 1) Setting up of a training venue and selection of the target persons
- 2) Supply of water and fuel oil, etc. which are essential for equipment operation (as included in the Minutes dated 5th March, 2008)

Soft Component Implementation Schedule

Attached Paper

Contents		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22				
Contract	Signing of the E/N	★																									
	Consultant Agreement		★																								
Detailed Design	Final Check of Project Contents		■																								
	Preparation and Review of Tender Documents		■																								
	Approval of Tender Documents			■																							
	Announcement of Tender				★																						
	Tender					★																					
	Tender Evaluation						■																				
	Supplier Contract							★																			
	Preparation of Shop Drawings for Fire Vehicles						■																				
Procurement Process	Manufacture of Fire Vehicles						■																				
	Fire Vehicle Inspection (Interim Inspection)																										
	Fire Vehicle Inspection (Shop Final Inspection)																										
	Inspection by Third Party Inspector																										
	Transportation of Fire Vehicles																										
	Adjustment/Installation of Equipment																										
	Acceptance Inspection / Handing Over																										
Soft Component	Fire Tank Engine Operating and Firefighting Techniques	Preparation of Manuals																									
		Lectures & Practical Training																									
		Reporting of Completion																							★		
	Ladder Truck Operating Techniques	Preparation of Manuals																									
		Lectures & Practical Training																									
		Reporting of Completion																							★		

6. Other Relevant Data

Attached Table 1

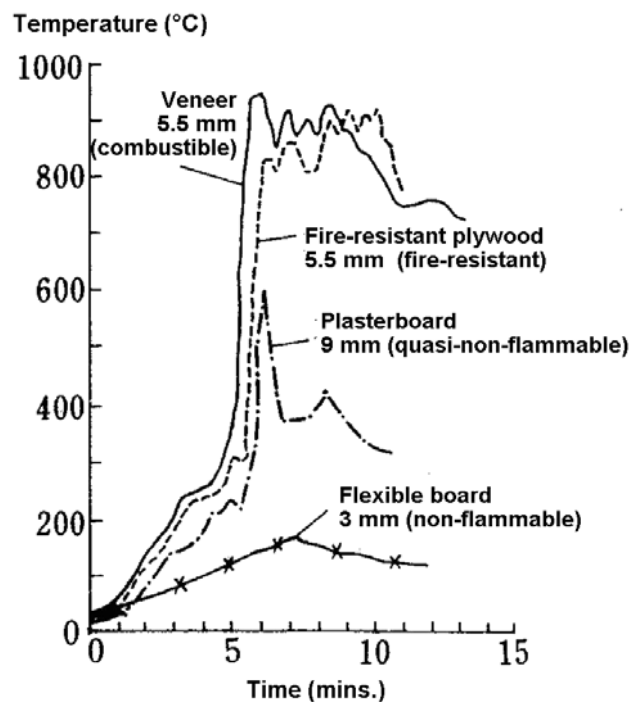
Bridges in Yerevan

	Name or Location	Year of Construction	District	Length (m)	Withstand Load (tons)
			Shengavit		
1	G.Njdeh street	1962		324.3	60
2	Shirak str. N1	1968		11	35
			Qanaqer- Zeitun		
3	Rubinyants street	1968		40	1000
			Davidashen		
4	Davidashen bridge in Yerevan	2000		496	80
5	Davidashen main	2000		40	80
6	Davidashen 2 nd	2001		36	80
7	Davidashen 7 th	2001		36	80
			Ajapnyak		
8	Kevyan big bridge	1956		305	80
			Arabkir		
9	Davidashen bridge Komitas- Vagharshyan	2000		496	80
10	Lambada bridge	1987		180	80
11	Kochar bridge Kochar-Arabkir str.			30	30
			Malatia-Sebastia		
12	Sebastia- Isakov crossroad			33.2	30
13	Isakov- Babajanyan	2002		70	30
			Kentron		
14	Charents str., on the Getar river	1954		30	60
15	Mankyan str., on the Getar river			18	60
16	Mankyan str., on the Getar river			15	35
17	Sayat-Nova str., on the Getar river			20	60
18	Haghtanak bridge, on the Hrazdan river	1945		200.6	60
19	ErHek bridge, on the Hrazdan river	1954		34	35
20	Vardanats str., near oghakadzev park			18	30
21	Under the Kevyan bridge, on the Hrazdan river	1954		34	30
			Nubarashen		
22	Nubarashen- Erebuni	1987			35
			Avan		
23	Myasnikyan av. N1	1973		145	60
24	Myasnikyan av. N2	1973		96	60
25	Yerevan-Sevan	1975		280	100

			Erebuni		
			Mushtakan river		
26	G.Mahari str., beginning of Mushtakan area			30	35
27	Vardashen N6 street			16	35
28	Vardashen N8 street			20	35
29	Vardashen N10 street			20	30
30	Nor-Aresh N48 street			22.2	35
31	Nor-Aresh N 43 street			22	35
			Rostovyan		
32	Muratsan street			28	30
33	Artsax street	1963		30	35
			Artashat		
34	Tigran Mets street			40	30
35	Sasuntsi-David- Tigran Mets			29.4	35
36	Rostovyan street			48	30
37	Erebuni- Artsax			48	35
38	Avazovsku str.- Artsax str.			20.4	30

Flashover

- 1 A large amount of unburned combustible gas generated at the initial stage of a fire is stored in the room in which a fire has started. When the ratio between the concentration of this combustible gas and the amount of air inside the room or entering the room has reached the combustion limit, explosive combustion takes place, engulfing the entire room in a very short time. This phenomenon is called flashover. Generally speaking, flashover occurs when the fire spreads to the ceiling, the amount of unburned combustible gas generated is large and radiation heat from the flames along the ceiling heats up the floor and other items in the room. Once flashover occurs, its explosive strength breaks such weak points as the window glass of the room which was hitherto sealed, transferring huge quantities of heat and smoke from indoors to outdoors.
- 2 The length of time from initial ignition to the occurrence of flashover greatly varies depending on the size of the fire source, types of interior materials, amount of combustible goods inside the room and conditions of the openings of the room but the following yardsticks generally apply.
 - * Combustible interior materials → 3 minutes、 fire-resistant materials → 4~5 minutes、 quasi-non-flammable materials • non-flammable materials → 6~8 minutes



Different Processes to Flashover Reflecting Different Interior Materials

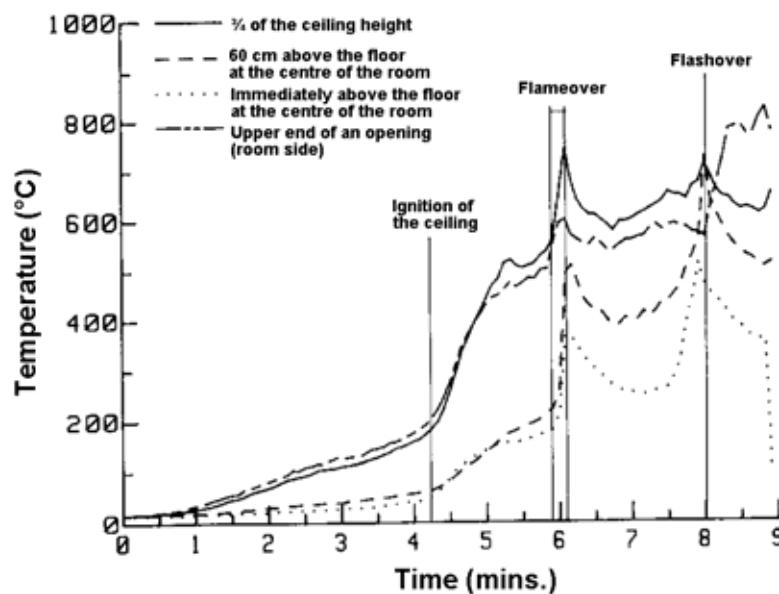
- 3 As the timing of flashover often coincides with the start of firefighting activities by firefighters arriving at the scene, it is quite a dangerous phenomenon for both the dwellers of a burning building and firefighters at this stage of a fire.

4 Visual Observation of Flashover

The amount of generated black smoke rapidly increases when the ceiling starts to burn. The room is progressively filled with smoke, the lower part of the smoke zone descends and black smoke blowing out of the openings becomes yellowish. The air suction from the lower end of openings becomes strong. When the openings are narrow, ejection of the smoke shows a breathing phenomenon and the smoke blowing out of the openings turns into flames quite rapidly. At this time, flames may be temporarily observed in the blowing out smoke before eruption into flames. When the openings are wide, flames come out of the openings before the entire room is engulfed by flames.

5 Temperature Inside the Burning Room

After ignition of the ceiling, a hot gas layer is formed under the ceiling, rapidly raising the temperature immediately below the ceiling to several 100°C. As the thickness of this hot gas layer increases, the temperature in the zone below also increases. The room temperature immediately before the occurrence of flashover is above 150°C – 200°C even at the position just several tens of centimetres above the floor. The temperature of the smoke blowing out of the openings exceeds 500°C – 600°C. When flashover occurs, the temperature inside the burning room is as high as 500°C just above the floor level.



Changes of Temperature Inside a Burning Room
(Experiment by the Tokyo Fire Academy)

6 Concentration of Gases

Prior to flashover, the O₂, CO and CO₂ concentrations reach approximately 0%, 10 – 15% and more than 20% respectively. The concentrations of the gases at the lower part of the smoke layer (near the floor) change with the spread of combustion (rapid changes occur when the smoke and flames temporarily blow out of the openings) after ignition of the ceiling, reaching the same levels as those in the upper part of flashover.

7. References

Region	Asia	Name of Study Team	Project for Improvement of Fire Fighting Equipment in Yerevan City in the Republic of Armenia	Type of Study	Grant Aid	Prepared By	International Cooperation Department, FESC
Country	Armenia			Field Survey Period	February to October, 2008	Person in Charge	Sadahiko NAITO

NO.	Title	Style	Size	Pages	Original/ Copy	Quantity	Source/ Publisher	Donated/ Purchased	Stored by	User	User Section	Planned Date of Delivery	Delivery Confirmation
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2	Republic of Armenia Law On Fire Security (in English)	Data			Copy	1	ARS	Donated	FESC	FESC		Nil	
3	Republic of Armenia Law Rescue Forces And Status Of Rescuers (in English)	Data			Copy	1	ARS	Donated	FESC	FESC		Nil	
4	Value Added Tax (in English)	Data			Copy	1	ARS	Donated	FESC	FESC			