BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR IMPROVEMENT OF

ROAD MAINTENANCE EQUIPMENT

IN

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

DECEMBER 2000

JAPAN INTERNATIONAL COOPERATION AGENCY

CONSTRUCTION PROJECT CONSULTANTS, INC.

G R 3
CR(1)
00-240

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR IMPROVEMENT OF ROAD MAINTENANCE EQUIPMENT IN THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA DECEMBER 2000

PREFACE

In response to a request from the Government of the Former Yugoslav Republic of Macedonia the Government of Japan decided to conduct a basic design study on the Project for Improvement of Road Maintenance Equipment and entrusted the study to the Japan International Cooperation Agency (JICA).

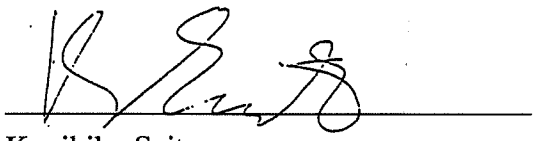
JICA sent to Macedonia a study team from August 21 to September 21, 2000.

The team held discussions with the officials concerned of the Government of Macedonia, 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 Macedonia 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 Former Yugoslav Republic of Macedonia for their close cooperation extended to the teams.

December, 2000



Kunihiko Saito
President
Japan International Cooperation Agency

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Road Maintenance Equipment in the Former Yugoslav Republic of Macedonia.

This study was conducted by Construction Project Consultants, Inc., under a contract to JICA, during the period from August 17, 2000 to January 16, 2001. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Macedonia 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,

T. Shinada

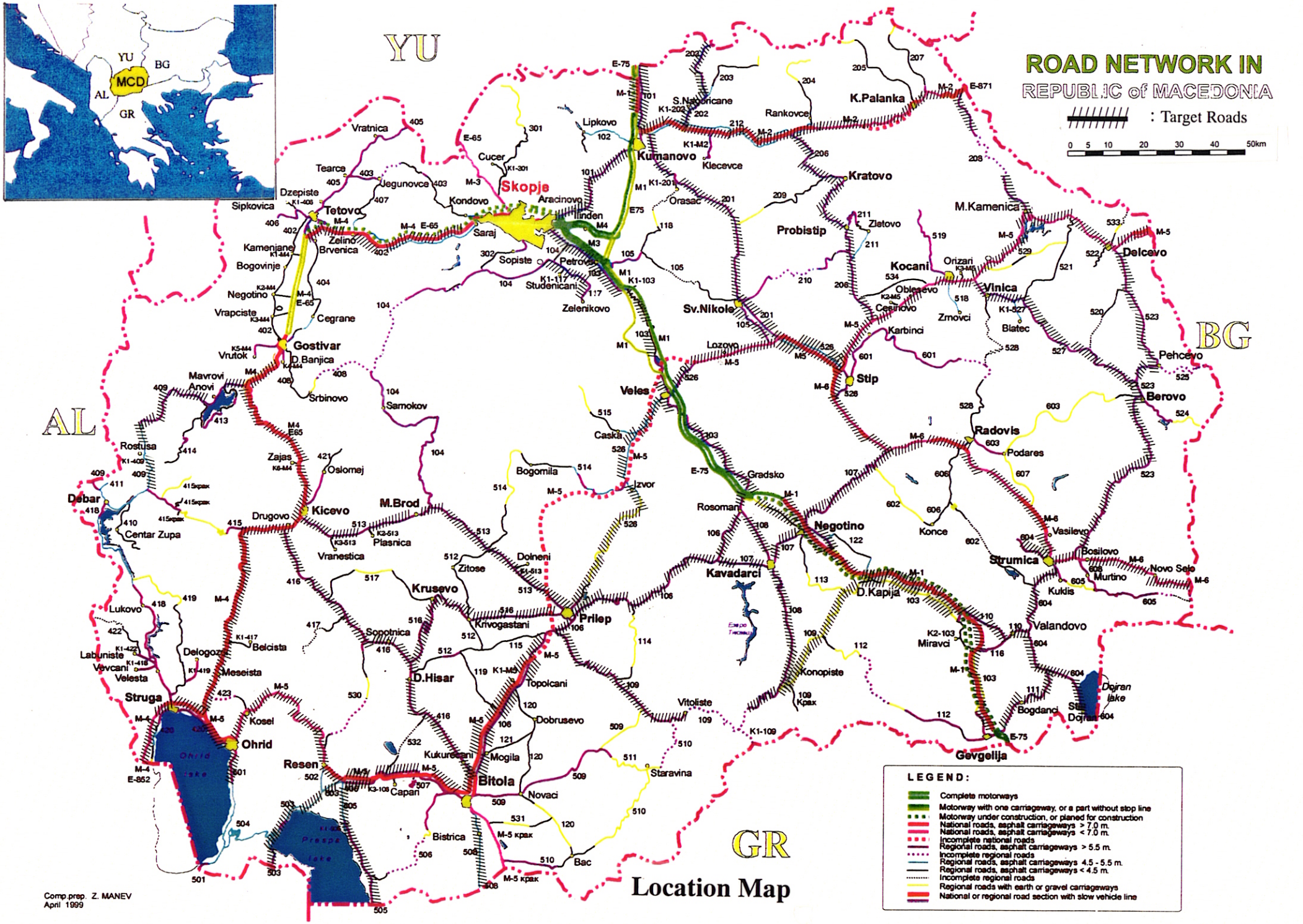
Tamio Shinada
Project Manager,
Basic Design Study Team on
the Project for Improvement of Road
Maintenance Equipment
Construction Project Consultants, Inc.

Basic Design Study Report on
The Project for Improvement of Road Maintenance Equipment in
Macedonia

Table of Contents

Appendices

1. Member List of the Survey Team
2. Survey Schedule
3. List of the Party Concerned in Macedonia
4. Minutes of Discussions
5. Estimation of Cost to be Borne by the Macedonian Side


ROAD NETWORK IN
REPUBLIC of MACEDONIA
: Target Roads
0 5 10 20 30 40 50km
YU
AL
GR
BG
MCD
Skopje
Kumanovo
Tetovo
Gostivar
Kicevo
Debar
Struga
Ohrid
Resen
Bitola
Prilep
Krusevo
D.Hisar
Veles
Sv.Nikole
Probistip
K.Palanka
Kratovo
Kocani
Vinica
Delcevo
Berovo
Pehcevo
Stip
Radovis
Strumica
Negotino
Kavadarci
Gevgelija
D.Kapija
Valandovo
Dojran lake
Ohrid lake
Prespa lake
LEGEND:
Complete motorways
Motorway with one carriageway, or a part without stop line
Motorway under construction, or planed for construction
National roads, asphalt carriageways > 7.0 m.
National roads, asphalt carriageways < 7.0 m.
Incomplete national roads
Regional roads, asphalt carriageways > 5.5 m.
Incomplete regional roads
Regional roads, asphalt carriageways 4.5 - 5.5 m.
Regional roads, asphalt carriageways < 4.5 m.
Incomplete regional roads
Regional roads with earth or gravel carriageways
National or regional road section with slow vehicle line
Location Map
Comp.prep. Z. MANEV
April 1999

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

Since independence in 1991 Macedonia has endeavored to establish an open market economy, and it has enlarged economic ties with its neighbors and EU. In the transportation sector the road network in Macedonia plays the most important role not only for domestic transportation (approximately 69% and 61% of the total freight and passenger, respectively) but also for international transportation in the Balkan region. With the recovery of political stability in the region, it is becoming increasingly important as a significant traffic increase is anticipated.

The Government of Macedonia gives the highest priority to the construction of motorway, i.e. East-West and North-South corridors, and rehabilitation/maintenance of the existing trunk roads. In the Public Investment Program 1999 ~ 2002 approximately 43% of the total amount is allocated to the road sector, of which approximately 5.4% is to the road maintenance program.

The network of trunk roads in Macedonia comprises 4,369km, of which 909km are classified as National, 3,384km are Regional and 76km are short accesses between National and Regional roads. Of the total network, some 3,485km or about 79.8% are asphalt-paved. However, it can be said that the existing road pavements are in condition that require rehabilitation. This is mainly due to insufficient maintenance budget during the transition period after independence in 1991.

The Public Company of Macedonian Roads (hereinafter referred to as "Makedonija Pat") under the Ministry of Transport and Communications is the only organ in Macedonia for the execution of maintenance of the national and regional road network. Maintenance work is executed on a force account basis through its 5 branches covering all over the country.

Regarding Makedonija Pat's executing capacity, shortage of appropriate road maintenance equipment is considered the most serious problem for the effective implementation of the road maintenance program. Also, as most of the existing equipment are being used far beyond their economic life their maintenance and repair costs are oppressing the road maintenance budget thereby affecting the progress of road maintenance program. Particularly the existing asphalt plants are not only low capacity but also causing air pollution problem because of old-fashioned filtering system.

Under these circumstances, the Government of Macedonia requested the Government of Japan to supply road maintenance equipment for Makedonija Pat.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2.1 Objectives of the Project

The objectives of the Project for Improvement of Road Maintenance Equipment (hereinafter referred to as "The Project") are to accelerate the implementation of the National and Regional road maintenance program of asphalt road by improving the road maintenance equipment of the Makedonija Pat's four branches, i.e. Skopje, Veles, Bitola and Stip. The target road length under the Project covers 555km for 4 years implementation from 2002 to 2005.

2.2 Basic Concept of the Project

2.2.1 Preparation of Road Maintenance Program under the Project

(1) Pavement Management System (PMS)

For the purpose of establishing an effective and economical road maintenance system for the existing road network, the Fund for National and Regional Roads (hereinafter referred to as "Roads Fund"), and Makedonija Pat introduced a computerized pavement management system, i.e. Rosy System in 1997 with the technical assistance of the World Bank. Priority sections for maintenance and the most appropriate method and time schedule of maintenance intervention based on the life cycle cost of the pavement are put out by the system.

Regarding the establishment of data bank of road conditions, visual observations, deflection and roughness data for some 650km of the most important trunk roads were complete as of September 2000. Visual data for 3000km of trunk roads will be completed by December 2000.

(2) Target Roads

The whole road network is coded by road link / section / subsection under PMS, where the road length of the subsections varies from 2 to 5km. Detailed condition data, e.g. the areas with potholes, rutting, cracks are compiled by subsections, and after processing the data necessary maintenance intervention are put out. The system is still on its way to becoming fully operational, however, currently the planning of road maintenance program is being prepared according to this system. The target roads under the Project, i.e. the highest priority sections for maintenance were selected based on the PMS data.

A total of 555km was selected for the target roads, which represents about 28.5% of the PMS priority roads of 1,945km, and 13.1% of the National and Regional road network of 4,238km out of the Motorway. Target length by road link is shown in Table 2.1.

The roads, which the Government of Macedonia claimed NATO damaged and is asking for compensation, were omitted form the target roads under the Project.

(3) Method of Maintenance Intervention

Four maintenance types, i.e. pothole repair, patching, overlay and base course repair are the dominant methods of maintenance work on asphalt concrete road being executed by Makedonija Pat. The equipment under the Project will be selected according to their appropriateness for those methods. Work volume required was estimated based on the PMS data.

Landslide recovery works, e.g. removal of boulders or earth, which are also important annual works carried out by Makedonija Pat, were taken into account. However, as earth-moving machinery for pavement repair use may be applicable for such recovery work no particular equipment will be considered.

(4) Work Productivity Required for Maintenance Program

Productivity of the asphalt plant is the prevailing factor for establishing a maintenance program and for determining the work schedule, accordingly. For establishing maintenance program a replacement of the asphalt plant of Skopje branch with a new plant with 60t/h capacity was taken into account due to the following reason:

Annual productivity of the existing Skopje branch plant is estimated at around 20,000t per year (achievement in 1999), which corresponds to 168,000m^2 of asphalt pavement work with 5cm of thickness. A plant with 60t/h capacity makes it possible to undertake around 400,000m^2 of asphalt pavement work per year.

Comparison of the existing asphalt plants' productivity of the 4 branches and that of the supposed 60t/h plant of Skopje are shown in Table 2.2 and Table 2.3.

(5) Preparation of the 2002~2005 Year Program

Based on the estimates of the plants' productivity, i.e. new plant for Skopje and the existing ones for the other 3 branches, the annual maintenance work productivity by

branch was calculated. Then, work volumes for the four-year term from 2002 to 2005, i.e. the anticipated Project term, were calculated.

Annual program by branch during the 2002~2005 period is indicated in Table 2.4. Approximately 56.3% (3,713,299m^2) of PMS priority sections will be maintained by the said 4-year program. Expected achievements by branch is: Skopje 81.8% (1,280,077m^2), Veles 53.3% (513,410m^2), Bitola 40.8% (941,151m^2) and Stip 55.6% (978,661m^2).

Details of the 2000 ~ 2005 year program is shown in Table 2.5.1 ~ Table 2.5.6.

Table 2.1 Annual Work Schedule for Target Roads by Makedonija Pat

Item	Target Roads	Total Length Km	PMS Length Km	Target Length Km	Type of Surface	
					Asphalt Km	Gravel Km
National Roads						
1	M1	174.2	86.8	33.9	33.9	0.0
2	M2	73.8	73.8	57.1	57.1	0.0
3	M4	194.1	164.2	58.7	58.7	0.0
4	M5	332.3	252.3	90.0	90.0	0.0
5	M6	94.4	94.4	59.2	59.2	0.0
Total		868.8	671.5	298.9	298.9	0.0
Regional Roads						
1	R101	40.1	40.1	15.9	15.9	0.0
2	R103	160.2	128.7	10.7	10.7	0.0
3	R105	46.6	22.5	4.1	4.1	0.0
4	R106	122.9	122.9	21.1	21.1	0.0
5	R107	51.9	51.9	9.6	9.6	0.0
6	R108	42.4	42.4	1.8	1.8	0.0
7	R109	132.9	132.9	11.9	11.9	0.0
8	R110	15.0	15.0	3.5	3.5	0.0
9	R111	19.0	19.0	4.2	4.2	0.0
10	R117	15.0	15.0	7.9	7.9	0.0
11	R201	55.2	55.2	35.1	35.1	0.0
12	R202	19.3	19.3	2.9	2.9	0.0
13	R206	54.6	54.6	24.5	24.5	0.0
14	R208	28.0	20.0	1.8	1.8	0.0
15	R409	60.7	60.7	31.7	31.7	0.0
16	R416	67.8	67.8	8.9	8.9	0.0
17	R501	32.4	32.4	4.5	4.5	0.0
18	R503	24.2	24.2	0.7	0.7	0.0
19	R505	25.9	25.9	3.2	3.2	0.0
20	R508	15.4	15.4	2.0	2.0	0.0
21	R513	64.3	64.3	10.9	10.9	0.0
22	R516	51.1	51.1	8.2	8.2	0.0
23	R523	84.3	84.3	11.9	11.9	0.0
24	R526	95.0	20.5	4.0	4.0	0.0
25	R527	43.6	43.6	4.2	4.2	0.0
26	R604	44.1	44.1	10.4	10.4	0.0
Total		1,411.9	1,273.8	255.6	255.6	0.0
Total of the 4-Branch						
Total		2,280.7	1,945.3	554.5	554.5	0.0

Table 2.2 Productivity of the asphalt plants of Makedonija Pat - 1999 -

Description	Skopje	Veles	Bitola	Stip
(1) Nominal capacity	40 t/hour	40 t/hour	40 t/hour	40 t/hour
(2) Achievement in 1999	20,000 t/year	15,000 t/year	27,000 t/year	26,000 t/year
(3) Work months per year	8 month/year	8 month/year	8 month/year	8 month/year
(4) Work days per month	24 days	24 days	24 days	24 days
(5) Work hours per day	6 hours	6 hours	6 hours	6 hours
(6) Work hours per year	1,152 hours	1,152 hours	1,152 hours	1,152 hours
(7) Productivity per hour	17.4 t/hour	13.0 t/hour	23.4 t/hour	22.6 t/hour
(8) Efficiency	43 %	33 %	59 %	56 %
(9) Productivity of maintenance works average thickness 5cm, density 2.4 (overlay, patching, pothole repair)	166,667 m^2/year	125,000 m^2/year	225,000 m^2/year	216,667 m^2/year

Table 2.3 Productivity of new asphalt plant for Skopje branch

Description	New plant
(1) Nominal capacity	60 t/hour
(2) Annual productivity	48,000 t/year
(3) Work months per year	8 month/year
(4) Work days per month	24 days
(5) Work hours per day	6 hours
(6) Work hours per year	1,152 hours
(7) Required productivity per hour	41.7 t/hour
(8) Efficiency	70 %
(9) Productivity of maintenance work average thickness 5cm, density 2.4 (overlay, patching, pothole repair)	400,000 m^2/year

Table 2.4 Annual program by branch during 2002~2005

Year	Skopje			Veles			Bitola			Stip			Total		
	National road m^2	Regional road m^2	Total m^2	National road m^2	Regional road m^2	Total m^2	National road m^2	Regional road m^2	Total m^2	National road m^2	Regional road m^2	Total m^2	National road m^2	Regional road m^2	Total m^2
2002	164,284	159,053	323,337	51,463	75,704	127,167	145,883	89,818	235,701	180,663	64,327	244,990	542,293	388,902	931,195
2003	159,633	159,567	319,200	51,463	77,297	128,760	145,883	89,456	235,339	180,663	64,972	245,635	537,642	391,292	928,934
2004	159,633	159,221	318,854	51,463	77,319	128,782	145,883	89,570	235,453	180,663	63,355	244,018	537,642	389,465	927,107
2005	159,633	159,053	318,686	51,463	77,238	128,701	145,883	88,775	234,658	180,663	63,355	244,018	537,642	388,421	926,063
Total	643,183	636,894	1,280,077	205,852	307,558	513,410	583,532	357,619	941,151	722,652	256,009	978,661	2,155,219	1,558,080	3,713,299
Required maintenance area by PMS	928,100	636,892	1,564,992	205,848	756,585	962,433	1,244,431	1,063,091	2,307,522	1,161,742	598,674	1,760,416	3,054,121	3,055,242	6,595,363
% of the maintenance requirement to PMS	69.3	100.0	81.8	100.0	40.7	53.3	46.9	33.6	40.8	62.2	42.8	55.6	70.6	51.0	56.3
Possible maintenance area according to plant capacity			400,000			125,000			225,000			217,000			967,000

Table 2.5.1 2002~2005 program – Skopje branch –

Annual Work Schedule for Target Roads by Each Branch of Makedonija Pat **Branch: SKOPJE**

Item	Target Road	PMS Length Km	Target Length Km	Type of Surface: Asphalt Km	Gravel Km	Type of Work: Pothole repair, Patching (m^2) 2002	2003	2004	2005	Total	Overlay (m^2) 2002	2003	2004	2005	Total	Base course repair (m^2) 2002	2003	2004	2005	Total	Total 2002～2005
National Roads																					
1	M1	7.0	5.1	5.1	0.0	150	0	0	0	150	8,351	8,351	8,351	8,351	33,404	0	0	0	0	0	33,554
2	M2	73.8	57.1	57.1	0.0	2,766	2,766	2,766	2,766	11,064	92,711	92,711	92,711	92,711	370,844	4,501	0	0	0	4,501	386,409
3	M3	38.8																			
4	M4	67.5	33.6	33.6	0.0	1,243	1,243	1,243	1,243	4,972	54,562	54,562	54,562	54,562	218,248	0	0	0	0	0	223,220
										0					0					0	0
										0					0					0	0
	Total	187.1	95.8	95.8	0.0	4,159	4,009	4,009	4,009	16,186	155,624	155,624	155,624	155,624	622,496	4,501	0	0	0	4,501	643,183
Regional Roads																					
1	R101	40.1	15.9	15.9	0.0	853	853	853	853	3,412	21,888	21,888	21,888	21,888	87,552	0	0	0	0	0	90,964
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
2	R117	15.0	7.9	7.9	0.0	472	472	472	472	1,888	10,883	10,883	10,883	10,883	43,532	0	0	0	0	0	45,420
3	R201	27.1	28.9	28.9	0.0	1,263	1,263	1,263	1,263	5,052	39,693	39,693	39,693	39,693	158,772	0	0	0	0	0	163,824
4	R202	19.3	2.9	2.9	0.0	0	514	0	0	514	3,929	3,929	3,929	3,929	15,716	0	0	0	0	0	16,230
5	R206	27.0	20.2	20.2	0.0	1,090	1,090	1,090	1,090	4,360	27,789	27,789	27,789	27,789	111,156	0	0	0	0	0	115,516
6	R208	7.5	0.8	0.8	0.0	0	0	168	0	168	1,086	1,086	1,086	1,086	4,344	0	0	0	0	0	4,512
7	R409	60.7	31.7	31.7	0.0	6,580	6,580	6,580	6,580	26,320	43,527	43,527	43,527	43,527	174,108	0	0	0	0	0	200,428
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
	Total	196.7	108.3	108.3	0.0	10,258	10,772	10,426	10,258	41,714	148,795	148,795	148,795	148,795	595,180	0	0	0	0	0	636,894
Total of the Branch SKOPJE																					
	Total	383.8	204.1	204.1	0.0	14,417	14,781	14,435	14,267	57,900	304,419	304,419	304,419	304,419	1,217,676	4,501	0	0	0	4,501	1,280,077

Table 2.5.2 2002~2005 program –Veles branch –

Annual Work Schedule of Each Branch of Makedonija Pat **Branch: VELES**

Item	Target Road	PMS Length Km	Target Length Km	Type of Surface: Asphalt Km	Type of Surface: Gravel Km	Type of Work: Pothole repair, Patching (m^2) 2002	2003	2004	2005	Total	Overlay (m^2) 2002	2003	2004	2005	Total	Base course repair (m^2) 2002	2003	2004	2005	Total	Total 2002～2005
National Roads																					
1	M1	79.8	28.8	28.8	0.0	4,631	4,631	4,631	4,631	18,524	46,832	46,832	46,832	46,832	187,328	0	0	0	0	0	205,852
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
	Total	79.8	28.8	28.8	0.0	4,631	4,631	4,631	4,631	18,524	46,832	46,832	46,832	46,832	187,328	0	0	0	0	0	205,852
Regional Roads																					
										0					0					0	0
1	R103	128.7	10.7	10.7	0.0	1,145	1,145	1,145	1,145	4,580	14,720	14,720	14,720	14,720	58,880	0	0	0	0	0	63,460
										0					0					0	0
2	R106	25.5	5.2	5.2	0.0	610	610	610	610	2,440	7,125	7,125	7,125	7,125	28,500	0	0	0	0	0	30,940
3	R107	40.9	7.8	7.8	0.0	1,001	1,001	1,001	1,001	4,004	10,736	10,736	10,736	10,736	42,944	0	0	0	0	0	46,948
4	R108	42.4	1.8	1.8	0.0	867	0	0	0	867	2,504	2,504	2,504	2,504	10,016	0	0	0	0	0	10,883
5	R109	132.9	11.9	11.9	0.0	0	2,460	0	0	2,460	16,428	16,428	16,428	16,428	65,712	0	0	0	0	0	68,172
6	R110	15.0	3.5	3.5	0.0	1,337	1,337	1,337	1,337	5,348	4,864	4,864	4,864	4,864	19,456	0	0	0	0	0	24,804
7	R111	19.0	4.2	4.2	0.0	0	0	2,482	0	2,482	5,719	5,719	5,719	5,719	22,876	0	0	0	0	0	25,358
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
8	R604	29.1	6.3	6.3	0.0	0	0	0	2,401	2,401	8,648	8,648	8,648	8,648	34,592	0	0	0	0	0	36,993
	Total	433.5	51.4	51.4	0.0	4,960	6,553	6,575	6,494	24,582	70,744	70,744	70,744	70,744	282,976	0	0	0	0	0	307,558
Total of the Branch: VELES																					
	Total	513.3	80.2	80.2	0.0	9,591	11,184	11,206	11,125	43,106	117,576	117,576	117,576	117,576	470,304	0	0	0	0	0	513,410

Table 2.5.3 2002~2005 program –Bitola branch –

Annual Work Schedule of Each Branch of Makedonija Pat **Branch: BITOLA**

Item	Target Road	PMS Length Km	Target Length Km	Type of Surface: Asphalt Km	Type of Surface: Gravel Km	Pothole repair, Patching (m²) 2002	2003	2004	2005	Total	Overlay (m²) 2002	2003	2004	2005	Total	Base course repair (m²) 2002	2003	2004	2005	Total	Total 2002～2005
National Roads																					
										0					0					0	0
										0					0					0	0
										0					0					0	0
1	M4	96.7	25.1	25.1	0.0	4,753	4,753	4,753	4,753	19,012	40,825	40,825	40,825	40,825	163,300	4,847	4,847	4,847	4,847	19,388	201,700
2	M5	128.0	56.2	56.2	0.0	4,104	4,104	4,104	4,104	16,416	91,354	91,354	91,354	91,354	365,416	0	0	0	0	0	381,832
										0					0					0	0
	Total	224.7	81.3	81.3	0.0	8,857	8,857	8,857	8,857	35,428	132,179	132,179	132,179	132,179	528,716	4,847	4,847	4,847	4,847	19,388	583,532
Regional Roads																					
										0					0					0	0
										0					0					0	0
										0					0					0	0
1	R106	97.4	15.9	15.9	0.0	6,099	6,099	6,099	6,099	24,396	21,884	21,884	21,884	21,884	87,536	0	0	0	0	0	111,932
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
2	R416	67.8	8.9	8.9	0.0	1,267	1,267	1,267	1,267	5,068	12,235	12,235	12,235	12,235	48,940	0	0	0	0	0	54,008
3	R501	32.4	4.5	4.5	0.0	1,427	1,427	1,427	1,427	5,708	6,173	6,173	6,173	6,173	24,692	0	0	0	0	0	30,400
4	R503	24.2	0.7	0.7	0.0	1,043	0	0	0	1,043	975	975	975	975	3,900	0	0	0	0	0	4,943
5	R505	25.9	3.2	3.2	0.0	0	681	0	0	681	4,362	4,362	4,362	4,362	17,448	0	0	0	0	0	18,129
6	R508	15.4	2.0	2.0	0.0	0	0	795	0	795	2,812	2,812	2,812	2,812	11,248	0	0	0	0	0	12,043
7	R513	64.3	10.9	10.9	0.0	2,164	2,164	2,164	2,164	8,656	14,959	14,959	14,959	14,959	59,836	0	0	0	0	0	68,492
8	R516	51.1	8.2	8.2	0.0	3,195	3,195	3,195	3,195	12,780	11,223	11,223	11,223	11,223	44,892	0	0	0	0	0	57,672
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
	Total	378.5	54.3	54.3	0.0	15,195	14,833	14,947	14,152	59,127	74,623	74,623	74,623	74,623	298,492	0	0	0	0	0	357,619
Total of the Branch: BITOLA																					
	Total	603.2	135.6	135.6	0.0	24,052	23,690	23,804	23,009	94,555	206,802	206,802	206,802	206,802	827,208	4,847	4,847	4,847	4,847	19,388	941,151

Table 2.5.4 2002~2005 program –Stip branch –

Annual Work Schedule of Each Branch of Makedonija Pat **Branch: STIP**

Item	Target Road	PMS Length Km	Target Length Km	Type of Surface		Type of Work															Total 2002～2005
						Pothole repair, Patching (m^2)					Overlay (m^2)					Base course repair (m^2)					
				Asphalt Km	Gravel Km	2002	2003	2004	2005	Total	2002	2003	2004	2005	Total	2002	2003	2004	2005	Total	
National Roads																					
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
1	M5	124.3	33.8	33.8	0.0	7,244	7,244	7,244	7,244	28,976	54,887	54,887	54,887	54,887	219,548	16,619	16,619	16,619	16,619	66,476	315,000
2	M6	94.4	59.2	59.2	0.0	5,739	5,739	5,739	5,739	22,956	96,174	96,174	96,174	96,174	384,696	0	0	0	0	0	407,652
Total		218.7	93.0	93.0	0.0	12,983	12,983	12,983	12,983	51,932	151,061	151,061	151,061	151,061	604,244	16,619	16,619	16,619	16,619	66,476	722,652
Regional Roads																					
										0					0					0	0
										0					0					0	0
1	R105	22.5	4.1	4.1	0.0	799	0	0	0	799	5,578	5,578	5,578	5,578	22,312	0	0	0	0	0	23,111
										0					0					0	0
2	R107	11.0	1.8	1.8	0.0	0	1,617	0	0	1,617	2,523	2,523	2,523	2,523	10,092	0	0	0	0	0	11,709
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
3	R201	28.1	6.2	6.2	0.0	1,936	1,936	1,936	1,936	7,744	8,475	8,475	8,475	8,475	33,900	0	0	0	0	0	41,644
4										0					0					0	0
5	R206	27.6	4.3	4.3	0.0	1,053	1,053	1,053	1,053	4,212	5,948	5,948	5,948	5,948	23,792	0	0	0	0	0	28,004
6	R208	12.5	1.0	1.0	0.0	173	0	0	0	173	1,398	1,398	1,398	1,398	5,592	0	0	0	0	0	5,765
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
										0					0					0	0
7	R523	84.3	11.9	11.9	0.0	926	926	926	926	3,704	16,322	16,322	16,322	16,322	65,288	0	0	0	0	0	68,992
8	R526	20.5	4.0	4.0	0.0	752	752	752	752	3,008	5,492	5,492	5,492	5,492	21,968	0	0	0	0	0	24,976
9	R527	43.6	4.2	4.2	0.0	1,016	1,016	1,016	1,016	4,064	5,708	5,708	5,708	5,708	22,832	0	0	0	0	0	26,896
10	R604	15.0	4.1	4.1	0.0	561	561	561	561	2,244	5,667	5,667	5,667	5,667	22,668	0	0	0	0	0	24,912
Total		265.1	41.6	41.6	0.0	7,216	7,861	6,244	6,244	27,565	57,111	57,111	57,111	57,111	228,444	0	0	0	0	0	256,009
Total of the Branch: STIP																					
Total		483.8	134.6	134.6	0.0	20,199	20,844	19,227	19,227	79,497	208,172	208,172	208,172	208,172	832,688	16,619	16,619	16,619	16,619	66,476	978,661

Table 2.5.5 2002~2005 program –Summary by road link–

Annual Work Schedule for Target Roads by Makedonija Pat Total of the 4-Branch: SKOPJE, VELES, BITOLA, STIP

Item	Target Road	Total Length Km	PMS Length Km	Target Length Km	Type of Surface		Type of Work															Total 2002～2005
					Asphalt Km	Gravel Km	Pothole repair, Patching (m^2)					Overlay (m^2)					Base course repair (m^2)					
							2002	2003	2004	2005	Total	2002	2003	2004	2005	Total	2002	2003	2004	2005	Total	
National Roads																						
1	M1	174.2	86.8	33.9	33.9	0.0	4,781	4,631	4,631	4,631	18,674	55,183	55,183	55,183	55,183	220,732	0	0	0	0	0	239,406
2	M2	73.8	73.8	57.1	57.1	0.0	2,766	2,766	2,766	2,766	11,064	92,711	92,711	92,711	92,711	370,844	4,501	0	0	0	4,501	386,409
3	M3	40.3	38.8	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	M4	194.1	164.2	58.7	58.7	0.0	5,996	5,996	5,996	5,996	23,984	95,387	95,387	95,387	95,387	381,548	4,847	4,847	4,847	4,847	19,388	424,920
5	M5	332.3	252.3	90.0	90.0	0.0	11,348	11,348	11,348	11,348	45,392	146,241	146,241	146,241	146,241	584,964	16,619	16,619	16,619	16,619	66,476	696,832
6	M6	94.4	94.4	59.2	59.2	0.0	5,739	5,739	5,739	5,739	22,956	96,174	96,174	96,174	96,174	384,696	0	0	0	0	0	407,652
Total		909.1	710.3	298.9	298.9	0.0	30,630	30,480	30,480	30,480	122,070	485,696	485,696	485,696	485,696	1,942,784	25,967	21,466	21,466	21,466	90,365	2,155,219
Regional Roads																						
1	R101	40.1	40.1	15.9	15.9	0.0	853	853	853	853	3,412	21,888	21,888	21,888	21,888	87,552	0	0	0	0	0	90,964
2	R103	160.2	128.7	10.7	10.7	0.0	1,145	1,145	1,145	1,145	4,580	14,720	14,720	14,720	14,720	58,880	0	0	0	0	0	63,460
3	R105	46.6	22.5	4.1	4.1	0.0	799	0	0	0	799	5,578	5,578	5,578	5,578	22,312	0	0	0	0	0	23,111
4	R106	122.9	122.9	21.1	21.1	0.0	6,709	6,709	6,709	6,709	26,836	29,009	29,009	29,009	29,009	116,036	0	0	0	0	0	142,872
5	R107	51.9	51.9	9.6	9.6	0.0	1,001	2,618	1,001	1,001	5,621	13,259	13,259	13,259	13,259	53,036	0	0	0	0	0	58,657
6	R108	42.4	42.4	1.8	1.8	0.0	867	0	0	0	867	2,504	2,504	2,504	2,504	10,016	0	0	0	0	0	10,883
7	R109	132.9	132.9	11.9	11.9	0.0	0	2,460	0	0	2,460	16,428	16,428	16,428	16,428	65,712	0	0	0	0	0	68,172
8	R110	15.0	15.0	3.5	3.5	0.0	1,337	1,337	1,337	1,337	5,348	4,864	4,864	4,864	4,864	19,456	0	0	0	0	0	24,804
9	R111	19.0	19.0	4.2	4.2	0.0	0	0	2,482	0	2,482	5,719	5,719	5,719	5,719	22,876	0	0	0	0	0	25,358
10	R117	15.0	15.0	7.9	7.9	0.0	472	472	472	472	1,888	10,883	10,883	10,883	10,883	43,532	0	0	0	0	0	45,420
11	R201	55.2	55.2	35.1	35.1	0.0	3,199	3,199	3,199	3,199	12,796	48,168	48,168	48,168	48,168	192,672	0	0	0	0	0	205,468
12	R202	19.3	19.3	2.9	2.9	0.0	0	514	0	0	514	3,929	3,929	3,929	3,929	15,716	0	0	0	0	0	16,230
13	R206	54.6	54.6	24.5	24.5	0.0	2,143	2,143	2,143	2,143	8,572	33,737	33,737	33,737	33,737	134,948	0	0	0	0	0	143,520
14	R208	28.0	20.0	1.8	1.8	0.0	173	0	168	0	341	2,484	2,484	2,484	2,484	9,936	0	0	0	0	0	10,277
15	R409	60.7	60.7	31.7	31.7	0.0	6,580	6,580	6,580	6,580	26,320	43,527	43,527	43,527	43,527	174,108	0	0	0	0	0	200,428
16	R416	67.8	67.8	8.9	8.9	0.0	1,267	1,267	1,267	1,267	5,068	12,235	12,235	12,235	12,235	48,940	0	0	0	0	0	54,008
17	R501	32.4	32.4	4.5	4.5	0.0	1,427	1,427	1,427	1,427	5,708	6,173	6,173	6,173	6,173	24,692	0	0	0	0	0	30,400
18	R503	24.2	24.2	0.7	0.7	0.0	1,043	0	0	0	1,043	975	975	975	975	3,900	0	0	0	0	0	4,943
19	R505	25.9	25.9	3.2	3.2	0.0	0	681	0	0	681	4,362	4,362	4,362	4,362	17,448	0	0	0	0	0	18,129
20	R508	15.4	15.4	2.0	2.0	0.0	0	0	795	0	795	2,812	2,812	2,812	2,812	11,248	0	0	0	0	0	12,043
21	R513	64.3	64.3	10.9	10.9	0.0	2,164	2,164	2,164	2,164	8,656	14,959	14,959	14,959	14,959	59,836	0	0	0	0	0	68,492
22	R516	51.1	51.1	8.2	8.2	0.0	3,195	3,195	3,195	3,195	12,780	11,223	11,223	11,223	11,223	44,892	0	0	0	0	0	57,672
23	R523	84.3	84.3	11.9	11.9	0.0	926	926	926	926	3,704	16,322	16,322	16,322	16,322	65,288	0	0	0	0	0	68,992
24	R526	95.0	20.5	4.0	4.0	0.0	752	752	752	752	3,008	5,492	5,492	5,492	5,492	21,968	0	0	0	0	0	24,976
25	R527	43.6	43.6	4.2	4.2	0.0	1,016	1,016	1,016	1,016	4,064	5,708	5,708	5,708	5,708	22,832	0	0	0	0	0	26,896
26	R604	44.1	44.1	10.4	10.4	0.0	561	561	561	2,962	4,645	14,315	14,315	14,315	14,315	57,260	0	0	0	0	0	61,905
Total		1,411.9	1,273.8	255.6	255.6	0.0	37,629	40,019	38,192	37,148	152,988	351,273	351,273	351,273	351,273	1,405,092	0	0	0	0	0	1,558,080
Total of the 4-Branch																						
Total		2,321.0	1,984.1	554.5	554.5	0.0	68,259	70,499	68,672	67,628	275,058	836,969	836,969	836,969	836,969	3,347,876	25,967	21,466	21,466	21,466	90,365	3,713,299

Table 2.5.6 2002~2005 program –Summary by branches–

Total area of asphalt concrete work of the Branch: SKOPJE

Year	National roads (m^2)					Regional roads (m^2)					Total of the Branch (m^2)				
	Target Km	Pothole Patching	Overlay	Base course	Total	Target Km	Pothole Patching	Overlay	Base course	Total	Target Km	Pothole Patching	Overlay	Base course	Total
2002	23.9	4,159	155,624	4,501	164,284	27.1	10,258	148,795	0	159,053	51.0	14,417	304,419	4,501	323,337
2003	23.9	4,009	155,624	0	159,633	27.1	10,772	148,795	0	159,567	51.0	14,781	304,419	0	319,200
2004	23.9	4,009	155,624	0	159,633	27.1	10,426	148,795	0	159,221	51.0	14,435	304,419	0	318,854
2005	23.9	4,009	155,624	0	159,633	27.1	10,258	148,795	0	159,053	51.0	14,267	304,419	0	318,686
Total	95.6	16,186	622,496	4,501	643,183	108.4	41,714	595,180	0	636,894	204.0	57,900	1,217,676	4,501	1,280,077

Total area of asphalt concrete work of the Branch: VELES

2002	7.2	4,631	46,832	0	51,463	12.9	4,960	70,744	0	75,704	20.1	9,591	117,576	0	127,167
2003	7.2	4,631	46,832	0	51,463	12.9	6,553	70,744	0	77,297	20.1	11,184	117,576	0	128,760
2004	7.2	4,631	46,832	0	51,463	12.9	6,575	70,744	0	77,319	20.1	11,206	117,576	0	128,782
2005	7.2	4,631	46,832	0	51,463	12.9	6,494	70,744	0	77,238	20.1	11,125	117,576	0	128,701
Total	28.8	18,524	187,328	0	205,852	51.6	24,582	282,976	0	307,558	80.4	43,106	470,304	0	513,410

Total area of asphalt concrete work of the Branch: BITOLA

2002	20.3	8,857	132,179	4,847	145,883	13.6	15,195	74,623	0	89,818	33.9	24,052	206,802	4,847	235,701
2003	20.3	8,857	132,179	4,847	145,883	13.6	14,833	74,623	0	89,456	33.9	23,690	206,802	4,847	235,339
2004	20.3	8,857	132,179	4,847	145,883	13.6	14,947	74,623	0	89,570	33.9	23,804	206,802	4,847	235,453
2005	20.3	8,857	132,179	4,847	145,883	13.6	14,152	74,623	0	88,775	33.9	23,009	206,802	4,847	234,658
Total	81.2	35,428	528,716	19,388	583,532	54.4	59,127	298,492	0	357,619	135.6	94,555	827,208	19,388	941,151

Total area of asphalt concrete work of the Branch: STIP

2002	23.2	12,983	151,061	16,619	180,663	10.4	7,216	57,111	0	64,327	33.6	20,199	208,172	16,619	244,990
2003	23.2	12,983	151,061	16,619	180,663	10.4	7,861	57,111	0	64,972	33.6	20,844	208,172	16,619	245,635
2004	23.2	12,983	151,061	16,619	180,663	10.4	6,244	57,111	0	63,355	33.6	19,227	208,172	16,619	244,018
2005	23.2	12,983	151,061	16,619	180,663	10.4	6,244	57,111	0	63,355	33.6	19,227	208,172	16,619	244,018
Total	92.8	51,932	604,244	66,476	722,652	41.6	27,565	228,444	0	256,009	134.4	79,497	832,688	66,476	978,661

Total area of asphalt concrete work by Work type

Year	National roads (m^2)					Regional roads (m^2)					Total of the 4-Branch (m^2)				
	Target Km	Pothole Patching	Overlay	Base course	Total	Target Km	Pothole Patching	Overlay	Base course	Total	Target Km	Pothole Patching	Overlay	Base course	Total
2002	74.7	30,630	485,696	25,967	542,293	63.9	37,629	351,273	0	388,902	138.6	68,259	836,969	25,967	931,195
2003	74.7	30,480	485,696	21,466	537,642	63.9	40,019	351,273	0	391,292	138.6	70,499	836,969	21,466	928,934
2004	74.7	30,480	485,696	21,466	537,642	63.9	38,192	351,273	0	389,465	138.6	68,672	836,969	21,466	927,107
2005	74.7	30,480	485,696	21,466	537,642	63.9	37,148	351,273	0	388,421	138.6	67,628	836,969	21,466	926,063
Total	298.8	122,070	1,942,784	90,365	2,155,219	255.6	152,988	1,405,092	0	1,558,080	554.4	275,058	3,347,876	90,365	3,713,299

Total area of asphalt concrete work by Branch

Year	Skopje			Veles			Bitola			Stip			Total		
	National m^2	Regional m^2	Total m^2	National m^2	Regional m^2	Total m^2	National m^2	Regional m^2	Total m^2	National m^2	Regional m^2	Total m^2	National m^2	Regional m^2	Total m^2
2002	164,284	159,053	323,337	51,463	75,704	127,167	145,883	89,818	235,701	180,663	64,327	244,990	542,293	388,902	931,195
2003	159,633	159,567	319,200	51,463	77,297	128,760	145,883	89,456	235,339	180,663	64,972	245,635	537,642	391,292	928,934
2004	159,633	159,221	318,854	51,463	77,319	128,782	145,883	89,570	235,453	180,663	63,355	244,018	537,642	389,465	927,107
2005	159,633	159,053	318,686	51,463	77,238	128,701	145,883	88,775	234,658	180,663	63,355	244,018	537,642	388,421	926,063
Total	643,183	636,894	1,280,077	205,852	307,558	513,410	583,532	357,619	941,151	722,652	256,009	978,661	2,155,219	1,558,080	3,713,299
Required maintenance	928,100	636,892	1,564,992	205,848	756,585	962,433	1,244,431	1,063,091	2,307,522	1,161,742	598,674	1,760,416	3,054,121	3,055,242	6,595,363
% to the requirement	69.3	100.0	81.8	100.0	40.7	53.3	46.9	33.6	40.8	62.2	42.8	55.6	70.6	51.0	56.3
Max plant Productivity			400,000			125,000			225,000			217,000			967,000

2.2.2 Examination of the Contents of the Project

(1) Methodology

Methodology of the examination is summarized as follows:

- Original request from the Government of Macedonia covers Makedonija Pat's five branches. However, as Avtopat branch is uniquely assigned to the maintenance of motorway, i.e. toll way it shall be omitted form the Project. The reason of omission is that the maintenance of motorway may be financed by the Roads Fund reserve from the toll charges. The branches to be covered under the Project shall be Skopje, Veles, Bitola and Stip, accordingly.

- Equipment under the Project shall be basically the type for the use of asphalt pavement maintenance.

- Equipment number under the Project shall be derived from the quantitative analysis, i.e. annual workload, required number to meet the said workload and subtracting the existing number of equipment from it.

(2) Examination of the Request

For examination of the request, usability of the existing equipment, performance and maintenance frequencies were strictly evaluated.

Particular reasons for the selection of major equipment, i.e. wheel loader, asphalt finisher, asphalt plant and dump truck, for which there were in deep discussions between the Basic Design Team and the Macedonian side, is as follows:

- Wheel loader
  Makedonija Pat has a total of 6 wheel loaders for its 4 branches, of which 2 are not reliable due to frequent engine trouble. As at least one wheel loader shall be attached continuously to each asphalt plant, wheel loaders necessary for road works are rented from local contractors at present. To reduce the rental cost the request for 4 additional wheel loaders is reasonable.

- Asphalt finisher
  Makedonija Pat has a total of 4 asphalt finishers for its four branches, of which 3 have far exceeded their economic life, and are absolutely not reliable. Since their repair costs increase year-by-year the request for total replacement is reasonable. Regarding the remaining one of the Skopje branch, it is in rather

good condition, but considering the workload of this branch, the request for an additional one is reasonable.

- Asphalt plant

  Productivity of the existing Skopje branch asphalt plant, i.e. nominal 40t/h with work efficiency of 43% (achievement in 1999: 20,000t/year), does not meet the road maintenance requirement of this branch. Being more than 30 years of age and far exceeding its economic life is the main reason for this low efficiency. It had a fire accident in 1999 caused by corrosion of the pipe system. Regarding the environment, the existing plant not equipped with a secondary dust collector, causes serious air pollution.

  For smooth implementation of the 2002 ~ 2005 year program, the required volume of asphalt concrete from the Skopje plant is estimated at around 44,000t/year. Considering the plant being closed in the winter (4 months), 60t/hour capacity is required. The air pollution problem can be resolved by the new plant with appropriate standards.

  The existing plant will be dismantled after the operation of the new plant, and its parts can be re-used for maintenance of the plants of other branches.

  < Examination of the required asphalt plant capacity >

  Required capacity of the Skopje asphalt plant was examined as follows:

  Annual maintenance area by asphalt concrete required for each branch during the 2002 to 2005 period is shown in Table 2.6.1.

Table 2.6.1 Annual maintenance surface required

Unit: m^2

Year	Skopje	Veles	Bitola	Stip	Total
2002	323,337	127,167	235,701	244,990	931,195
2003	319,200	128,760	235,339	245,635	928,934
2004	318,854	128,782	235,453	244,018	9127,107
2005	318,686	128,701	234,658	244,018	926,063
Total	1,280,077	513,410	941,151	978,661	3,713,299
% the Total	34.5%	13.8%	25.3%	26.4%	100%
PMS requirement	1,564,992	962,433	2,307,522	1,760,416	6,595,363
% to PMS requirement	81.8%	53.3%	40.8%	55.6%	56.3%

Assuming an asphalt concrete thickness of a repair to be 5cm in average the asphalt concrete volume (metric ton) required for the above workload was calculated as shown in Table 2.6.2.

Table 2.6.2 Asphalt concrete volume required

Unit: metric ton

Year	Skopje	Veles	Bitola	Stip	Total
2002	38,800	15,260	28,284	29,399	111,743
2003	38,304	15,451	28,241	29,476	111,472
2004	38,262	15,454	28,254	29,282	111,253
2005	38,242	15,444	28,159	29,282	111,128

As indicated in Table 2.6.2 the annual total volume required for all the 4 branches is estimated at around 120,000ton/year. As shown in Table 2.6.3 the capacity of a new plant at Skopje branch should be 44,000 t/year. A 40t/h new plant with annual productivity estimated at 32,000t is not sufficient for this project. Accordingly, 60t/h capacity was recommended.

Table 2.6.3 Estimation of asphalt concrete production with the replacement of Skopje plant

Unit: metric ton

Year	Skopje	Veles	Bitola	Stip	Total
Production required /year	39,000	15,000	28,500	29,500	112,000
Current production/year	20,000	15,000	27,000	26,000	88,000
Estimated production through replacement of Skopje plant	44,000 (new)	15,000 (existing)	27,000 (existing)	26,000 (existing)	112,000
Contribution to the total requirement	38.2%	13.6%	24.6%	23.6%	100%

Note) Skopje branch asphalt plant will cover the shortages of the Bitola and Stip plants.

- Dump truck

  The number of existing dump trucks of the 4 branches is: Skopje 8, Veles 9, Bitola 16 and Stip 8. Their mileages are 100,000~400,000km, which far exceeds normal use, causing frequent engine troubles. Shortage is being covered by rental from local contractors. Maintenance and rental cost for dump trucks in 1999 accounted for 57% of total maintenance and rental cost of Makedonija Pat, which corresponds to 5.4% of total running cost of Makedonija Pat.

  To economize the current maintenance and rental cost, supplying appropriate number of dump trucks is reasonable. Considering total unit•days of rental, a

total of 1,920 unit•days of dump truck were rented in 1999. If each branch is supplied with 2 nos. additional dump trucks, i.e. a total of 8 nos. for 4 branches, this will reduce the annual rental cost of Makedonija Pat significantly.

Table 2.6.4 Equipment maintenance and rental cost of Makedonija Pat (1999)

Unit:1000 DEN

Item	Amount	% to the total running cost	For dump trucks	% to the total of the item
Equipment rental	30,149	4.2%	12,964	43.0%
Spare parts	22,865	3.2%	16,063	70.0%
Personnel for repair	14,123	2.0%	9,180	65.0%
Total of the above	67,136	9.4%	38,206	57.0%
Total of running cost	712,900	100%	38,206	5.4%

Through the discussions between the Basic Design Team and the Macedonian side, the requested equipment confirmed by the Macedonian side is shown in Tables 2.7, 2.8 and Table 2.9. Table 2.7 also gives brief description of the reason for the selection. The dump trucks were included as a result of analysis in Japan.

(3) Examination of the equipment required

Annual workload of each branch by work type and the necessary equipment type and number required for the said works are calculated as shown in Table 2.10.1 to Table 2.10.4. The additional equipment required was derived by subtracting the existing number from the required number.

The result of the examination is shown in Table 2.11.

Table 2.7 Examination of the request

Truck, Buses, Pickup

No	Equipment type	Specification	Request				Use purpose	Reason of selection
			Original	PF study	BD survey	**DF mission**		
(1)	Lorry-4WD	16-20t, 250HP, 6-8m^3	10	-	-	-	Transportation of equipment and material	Understand the necessity. But being not frequently used compared to the other requested equipment, rental may be possible. Not included.
(2)	Three way dump truck	16-20t, 400HP, 16m^3	5	4	-	-	Transportation of asphalt concrete, aggregates, and anti-freezing material	Understand the necessity for transportation use of asphalt concrete and aggregates. Included 8 dump trucks of 8t-class for 4 branches to minimize the current rental costs. 3-way type and greater horsepower not suitable.
-	Dump truck	200HP, 10m^3	5	6	-	-		
-	**Dump truck**	**8t**	-	-	-	**8**		
(3)	Pickup	3.5-5t, 100-120HP	10	5	-	-	Transportation of small equipment. Supervision of road work	Understand the necessity. Considered self-sustainable. Not included.

Road Construction Machinery

No	Equipment type	Specification	Request				Use purpose	Reason of selection
			Original	PF study	BD survey	**DF mission**		
(1)	**Bulldozer**	**175-200HP**	2	2	2	**2**	Scarifying existing pavement, excavation, pushing soil, embankment, removal of landslide boulders or soil	Greater horsepower not suitable. 2 pieces with middle class for 4 branches.
(2)	Bulldozer	200-240HP	2	-	-	-		
(3)	Bulldozer	260-320HP	2	-	-	-		
-	**Motor grader**	**135HP、3.7m**	-	5	4	**4**	Spreading of material for base course repair, grading for shoulder and side ditch	4 pieces for 4 branches.
(4)	Wheel loader	0.8-1.0m^3, 60HP	2	-	-	-	Loading or feeding materials for asphalt plant. Loding of base course material.	4 pieces for 4 asphalt plants.
(5)	**Wheel loader**	**2.5m^3, 140-160HP**	2	5	4	**4**		
(6)	Wheel loader	2.1-3.2m^3, 160HP	2	-	-	-		
(7)	Hydraulic excavator	Wheel Type 0.8m^3, 130HP	1	-	-	-	Breaking of existing pavement, excavation of side ditch or drainage, removal of landslide boulders or soil. Wheel type for use of small repair work in spreading sites.	1 piece of crawler type and 1 piece of wheel type for 4 branches. For wheel type greater horsepower not suitable.
-	**Hydraulic excavator (Crawler type)**	**0.8m^3**	-	1	1	**1**		
-	**Hydraulic excavator (Wheel type)**	**0.4m^3**	-	1	1	**1**		
-	Hydraulic excavator (Crawler type)	0.6m^3	-	1	-	-		
(8)	**Vibration roller**	**10t**	4	4	4	**4**	Compaction of base course and asphalt pavement	4 pieces of each 10t and 4t for 4 branches. For 2t considered self-sustainable, not included.
(9)	**Vibration roller**	**3.5-4.0t**	4	4	4	**4**		
(10)	Vibration roller	2t	5	-	-	-		
-	Plate compactor	15PS	-	15	-	-	Compaction of pothole repair	Understand the necessity. Considered self-sustainable. Not included.
(11)	**Pneumatic roller**	**8-13t**	4	4	4	**4**	Compaction of base course and asphalt pavement	4 pieces for 4 branches.
(12)	Asphalt finisher	3m-5.5m	4	-	-	-	Spreading and compaction of asphalt concrete	4 pieces with 3.5m for 4 branches.
(13)	Asphalt finisher	3-5.75m, 18t	2	-	-	-		
-	**Asphalt finisher**	**2.5-6.0m**	-	5	4	**4**		
(14)	Asphalt re-mixer	2.5-4m	1	-	-	-	Automatic asphalt recycling machine	Understand the necessity. Not frequently used compared to the other requested equipment. Not include.
(15)	**Asphalt distributor**	**4,000 ltr, 2.3-3.5m**	1	-	1	**1**	Spraying asphalt for prime coat or tack coat	1 piece for 4 branches.
(16)	Asphalt recycle heater	2.46-4.15m	1	-	-	-	Asphalt surface heating machine prior to re-mixing.	Understand the necessity. Not frequently used compared to the other requested equipment. Not included.
(17)	Asphalt plant	72~100 t/h	2	-	-	-	Mixing and production of asphalt concrete	1 plant with 60t/h capacity for Skopje branch
-	Asphalt plant	36~48 t/h	-	1	-	-		
-	**Asphalt plant**	**60 t/h**	-	-	1	**1**		

Other Equipment

No	Equipment type	Specification	Request				Use purpose	Reason of selection
			Original	PF study	BD survey	**DF mission**		
(1)	Computer system	Personal computer, software, printer, etc.	10	-	-	-	For computerized inventory control system	Considered self-sustainable. Not included.
(2)	Lathe	Dia.600mm, length 1500mm	4	5	-	-	Reproduction of parts	Understand the necessity. Not high priority compared to the other requested equipment.
(3)	Universal milling machine	320x1,250mm, ISO 50	5	-	-	-		
(4)	Vertical boring machine	Dia.20mm	4	5	-	-		
(5)	Mobile electric generator	30kW	5	5	-	-		
(6)	Mobile workshop with appurtenant machinery and accessory		5	-	-	-		
-	**Workshop tools**		-	5	4	**4 set**	Tools and small equipment for routine and periodic maintenance of machinery	4 sets for 4 branches
-	**Spare parts**		-	5	4	**1 set**	For routine and periodic maintenance	Limited to routine and periodic maintenance

Table 2.8 Requested Equipment

No.	Equipment type	Specification	Request			
			Original	PF study	BD survey	**DF mission**
Truck, Buses, Pickup						
(1)	Lorry-4WD	16-20t, 250HP, 6-8m^3	10	-	-	-
(2)	Three way dump truck	16-20t, 400HP, 16m^3	5	4	-	-
(-)	Dump truck	200HP, 10m^3	5	6	-	-
(-)	**Dump truck**	**8t**	-	-	-	**8**
(3)	Pickup	3.5-5t, 100-120HP	10	5	-	-
Road Construction Machinery						
(1)	**Bulldozer**	**175-200HP**	2	2	2	**2**
(2)	Bulldozer	200-240HP	2	-	-	-
(3)	Bulldozer	260-320HP	2	-	-	-
(-)	**Motor grader**	**135HP, 3.7m**	-	5	4	**4**
(4)	Wheel loader	0.8-1.0m^3, 60HP	2	-	-	-
(5)	**Wheel loader**	**2.5m^3, 140-160HP**	2	5	4	**4**
(6)	Wheel loader	2.1-3.2m^3, 160HP	2	-	-	-
(7)	Hydraulic excavator	Wheel Type 0.8m^3,	1	-	-	-
(-)	**Hydraulic excavator (Crawler type)**	**0.8m^3**	-	1	1	**1**
(-)	**Hydraulic excavator (Wheel type)**	**0.4m^3**	-	1	1	**1**
(-)	Hydraulic excavator (Crawler type)	0.6m^3	-	1	-	-
(8)	**Vibration roller**	**10t**	4	4	4	**4**
(9)	**Vibration roller**	**3.5-4.0t**	4	4	4	**4**
(10)	Vibration roller	2t	5	-	-	-
(-)	Plate compactor	6PS	-	15	-	-
(11)	**Pneumatic roller**	**8-13t**	4	4	4	**4**
(12)	Asphalt finisher	3m, 5.5-20m^3	4	-	-	-
(13)	Asphalt finisher	3-5.75m, 18t, 65m^3	2	-	-	-
(-)	**Asphalt finisher**	**2.5m-6.0m**	-	5	4	**4**
(14)	Asphalt re-mixer	2.5-4m	1	-	-	-
(15)	**Asphalt distributor**	**4000 ltr, 2.3~3.5m**	1	-	1	**1**
(16)	Asphalt recycle heater	Width 2.46-4.15m	1	-	-	-
(17)	Asphalt plant	NP1200 NIITA 72-100t/h	2	-	-	-
(-)	Asphalt plant	40t/h	-	1	-	-
(-)	**Asphalt plant**	**60t/h**	-	-	1	**1**
Other Equipment						
(1)	Computer system		1	-	-	-
	Server, personal computer with network accessory and soft ware		10	-	-	-
	Printer		10	-	-	-
(2)	Lathe	Dia.600mm, length 1500mm	4	4	-	-
(3)	Universal milling machine	320x1250mm, ISO50	5	-	-	-
(4)	Vertical boring machine	Dia.20mm	4	-	-	-
(5)	Mobile electric generator	30kw	5	-	-	-
(6)	Mobile workshop with appurtenant machinery and accessory		5	-	-	-
(-)	**Workshop tools**		-	5set	4set	**4set**
(-)	**Spare parts**		-	1lot	1lot	**1lot**

Finally confirmed with the Macedonian side

Note: Dump trucks were included as a result of analysis in Japan.

Table 2.9 Summary of the requested equipment

No	Name	Specification	Unit	BD survey		**DF mission**
				Q'ty	Priority	
1.	Bulldozer with ripper	175~200HP	Piece	2	A	**2**
2.	Motor grader	135H, 3.7m	Piece	4	A	**4**
3.	Wheel loader	2.5m^3, 140-160HP	Piece	4	A	**4**
4.	Hydraulic excavator with breaker (Crawler type)	0.8m^3	Piece	1	A	**1**
5.	Hydraulic excavator with breaker (Wheel type)	0.4m^3	Piece	1	A	**1**
6.	Vibration roller	10t	Piece	4	A	**4**
7.	Vibration roller	3.5-4.0t	Piece	4	B	**4**
8.	Pneumatic roller	8-13t	Piece	4	A	**4**
9.	Asphalt finisher	2.5-6.0m	Piece	4	A	**4**
10.	Asphalt distributor	4000ltr, 2.3-3.5m	Piece	1	B	**1**
11.	Asphalt plant	60t/h	Unit	1	A	**1**
12.	Dump truck	8t	Piece	-	-	**8**
13.	Workshop tools		Set	4	C	**4**
14.	Spare parts	For the above equipment	Lot	1	B	**1**

Priority: A/Most needed, B/Highly needed, C/Needed

Note: Dump trucks were included as a result of analysis in Japan.

Table 2.10.1 Examination on required number of equipment –Skopje branch –

Examination of the equipment schedule Branch SKOPJE

Area of asphalt paving per year 323,500 m^2

Work month/year:		**8**	**8**	**month**
Work days/month:	**asphalt plant, dump truck**	**24**		**day**
	other equipment		**21**	**day**
Work days/year	**asphalt plant, dump truck**	**192**		**day**
	other equipment		**168**	**day**

Work Item	Description		Equipment Type	Equipment Spec.	Work volume (1)	Unit	Productivity (volume/u/hour) (2)	Work hours needed (3)=(1)/(2)	Workhour per Day (4)	Needed day per Year (5)=(3)/(4)	Needed Mon. Per Year (6)=(5)/24or20	Workable month (7)	Number needed (6)/(7)
Asphalt Surface	Overlay	Tack coat	Distributor	4000ltr	308,500	m^2	793.7	389	4.00	97	4.6	8	0.6
		Transport of mix	Dump truck	10t	37,020	t	4.1	9,029	6.00	1,505	62.7	8	7.8
		Paving	Asphalt finisher	2.4-4.5m	**308,500**	**m^2**	250.0	1,234	4.00	309	14.7	8	1.8
		Compaction	Vibration roller	10t	308,500	m^2	250.0	1,234	4.00	309	14.7	8	1.8
		Compaction	Tire roller	5-15t	308,500	m^2	250.0	1,234	4.00	309	14.7	8	1.8
	Pothole repair Patching	Prime coat	Distributor	4000ltr	15,000	m^2	476.2	32	4.00	8	0.4	8	0.0
		Transport of mix	Dump truck	10t	1,763	t	4.1	430	6.00	72	3.0	8	0.4
		Paving	Manual	-	**15,000**	**m^2**	-	-	-	-	-	8	-
		Compaction	Vibration roller	4t	15,000	m^2	75.0	200	4.00	50	2.4	8	0.3
		Compaction	Tamper	60-100kg	15,000	m^2	12.5	1,200	4.00	300	14.3	8	1.8
Asphalt concrete Production	Plant operation	Loading & feeding	Wheel loader	2.4m^3	25,733	m^3	25.8	997	6.00	166	7.9	8	1.0
		Mixing	Asphalt plant	60t/h	38,783	t	42.0	923	6.00	154	6.4	8	0.8
Base course repair	Removal of exist-ing pavement	Ripping & excavation	Bulldozer	18t	1,350	m^3	35.0	39	4.00	10	0.5	8	0.1
		Loading	Wheel loader	2.4m^3	1,350	m^3	35.0	39	4.00	10	0.5	8	0.1
		Disposing	Dump truck	10t	1,350	m^3	8.3	163	6.00	27	1.1	8	0.1
	Base course	Material loading	Wheel loader	2.4m^3	1,495	m^3	35.0	43	4.00	11	0.5	8	0.1
		Material transport	Dump truck	10t	1,495	m^3	8.3	180	6.00	30	1.3	8	0.2
		Spreading & grading	Motor grader	3.7m	4,500	m^2	125.0	36	4.00	9	0.4	8	0.1
		Compaction	Vibration roller	10t	4,500	m^2	125.0	36	4.00	9	0.4	8	0.1
		Compaction	Tire roller	5-15t	4,500	m^2	125.0	36	4.00	9	0.4	8	0.1
		Watering	Water tanker	5.5-6.5kl	189	t	4.0	47	6.00	8	0.3	8	0.0
Land slide recovery	Removal of earth	Pushing	Bulldozer	18t	9,278	m^3	35.0	265	4.00	66	3.1	8	0.4
		Loading	Wheel loader	2.4m^3	9,278	m^3	35.0	265	4.00	66	3.1	8	0.4
		Disposing	Dump truck	10t	9,278	m^3	8.3	1,118	6.00	186	7.8	8	1.0
		Grading	Motor grader	3.7m	16,700	m^2	300.0	56	4.00	14	0.7	8	0.1
Shoulder		Shaping & grading	Motor grader	3.7m	300,000	m^2	300.0	1,000	4.00	250	11.9	8	1.5
		Compaction	Vibration roller	4t	150,000	m^2	150.0	1,000	4.00	250	11.9	8	1.5
Side ditch		Excavation	Excavator	0.4m^3	9,150	m^3	25.0	366	4.00	92	4.4	8	0.5
		Disposing	Dump truck	10t	9,150	m^3	8.3	1,102	6.00	184	7.7	8	1.0
Drainage & structures Repair	Excavation	Excavation	Excavator	0.8m^3	5,719	m^3	45.0	127	4.00	32	1.5	8	0.2
		Disposing	Dump truck	10t	5,719	m^3	8.3	689	6.00	115	4.8	8	0.6
	Backfilling	Borrow excavation	Excavator	0.8m^3	4,448	m^3	75.0	59	4.00	15	0.7	8	0.1
		Transport of borrow	Dump truck	10t	4,448	m^3	8.3	536	6.00	89	3.7	8	0.5
		Backfilling	Excavator	0.8m^3	4,003	m^3	25.0	160	4.00	40	1.9	8	0.2
		Compaction	Vibration roller	0.8-1.1t	4,003	m^3	14.3	280	4.00	70	3.3	8	0.4
		Compaction	Tamper	60-100kg	4,003	m^3	83.3	48	5.00	10	0.5	8	0.1
Transport		Fuel	Fuel tanker	6000ltr	-	-	-	-	-	168	8.0	8	1.0
		Water	Water tanker	5.5-6.5kl	-	-	-	-	-	168	8.0	8	1.0
		Oil & lubricant	Cargo truck	6t	-	-	-	-	-	168	8.0	8	1.0
		Equipment	Trailer truck	32t	-	-	-	-	-	168	8.0	8	1.0
Supervision			Pickup		-	-	-	-	-	168	8.0	8	2.0

	Equipment type	Spec.	Number needed		Equipment type	Spec.	Number needed
1	Bulldozer	18t	0.45	12	Dump truck	10t	11.50
2	Motor grader	3.7m	1.63	13	Water tanker	5.5-6.5kl	1.04
3	Wheel loader	2.4m^3	1.51	14	Tamper	60-100kg	1.85
4	Excavator	0.8m^3	0.52	15	Vibration roller	1t	0.42
5	Excavator	0.4m^3	0.55	16	Fuel tanker	6000l	1.00
6	Vibration roller	10t	1.89	17	Cargo truck	6t	1.00
7	Vibration roller	4t	1.79	18	Trailer truck	32t	1.00
8	Tire roller	5-15t	1.89	19	Pickup		2.00
9	Asphalt finisher	2.4-4.5m	1.84				
10	Distributor	4000l	0.63				
11	Asphalt plant	60t/h	0.80				

Table 2.10.2 Examination of required number of equipment –Veles branch –

Examination of the equipment schedule Branch VELES

Area of asphalt paving per year 128,700 m^2

Workable month per year:		**8**	**8**	**months**
Work day per month:	**for asphalt plant & trucks**	**24**		**days**
	for other equipment		**21**	**days**
Workable day per year:	**for asphalt plant & trucks**	**192**		**days**
	for other equipment		**168**	**days**

Work Item	Description		Equipment Type	Equipment Spec.	Work volume (1)	Unit	Productivity (volume/u/hour) (2)	Work hours Needed (3)=(1)/(2)	Workhour per Day (4)	Needed day per Year (5)=(3)/(4)	Needed Mon. per Year (6)=(5)/24or20	Workable month (7)	Number needed (6)/(7)
Asphalt Surface	Overlay	Tack coat	Distributor	4000ltr	117,500	m^2	793.7	148	4.00	37	1.8	8	0.2
		Transport of mix	Dump truck	10t	14,100	t	4.1	3,439	6.00	573	23.9	8	3.0
		Paving	Asphalt finisher	2.4-4.5m	**117,500**	**m^2**	250.0	470	4.00	118	5.6	8	0.7
		Compaction	Vibration roller	10t	117,500	m^2	250.0	470	4.00	118	5.6	8	0.7
		Compaction	Tire roller	5-15t	117,500	m^2	250.0	470	4.00	118	5.6	8	0.7
	Pothole repair	Prime coat	Distributor	4000ltr	11,200	m^2	476.2	24	4.00	6	0.3	8	0.0
	Patching	Transport of mix	Dump truck	10t	1,344	t	4.1	328	6.00	55	2.3	8	0.3
		Paving	Manual	-	**11,200**	**m^2**	-	-	-	-	-	8	-
		Compaction	Vibration roller	4t	11,200	m^2	75.0	149	4.00	37	1.8	8	0.2
		Compaction	Tamper	60-100kg	11,200	m^2	12.5	896	4.00	224	10.7	8	1.3
Asphalt concrete production	Plant operation	Loading & feeding	Wheel loader	2.4m^3	10,248	m^3	25.8	397	6.00	66	3.1	8	0.4
		Mixing	Asphalt plant	60t/h	15,444	t	13.0	1,188	6.00	198	8.3	8	1.0
Base course repair	Removal of exist-ing pavement	Ripping & excavation	Bulldozer	18t	0	m^3	35.0	0	4.00	0	0.0	8	0.0
		Loading	Wheel loader	2.4m^3	0	m^3	35.0	0	4.00	0	0.0	8	0.0
		Disposing	Dump truck	10t	0	m^3	8.3	0	6.00	0	0.0	8	0.0
	Base course	Material loading	Wheel loader	2.4m^3	0	m^3	35.0	0	4.00	0	0.0	8	0.0
		Material transport	Dump truck	10t	0	m^3	8.3	0	6.00	0	0.0	8	0.0
		Spreading & grading	Motor grader	3.7m	0	m^2	125.0	0	4.00	0	0.0	8	0.0
		Compaction	Vibration roller	10t	0	m^2	125.0	0	4.00	0	0.0	8	0.0
		Compaction	Tire roller	5-15t	0	m^2	125.0	0	4.00	0	0.0	8	0.0
		Watering	Water tanker	5.5-6.5kl	0	t	4.0	0	6.00	0	0.0	8	0.0
Land slide recovery	Removal of earth	Pushing	Bulldozer	18t	12,833	m^3	35.0	367	4.00	92	4.4	8	0.5
		Loading	Wheel loader	2.4m^3	12,833	m^3	35.0	367	4.00	92	4.4	8	0.5
		Disposing	Dump truck	10t	12,833	m^3	8.3	1,546	6.00	258	10.8	8	1.3
		Grading	Motor grader	3.7m	23,099	m^2	300.0	77	4.00	19	0.9	8	0.1
Shoulder		Shaping & grading	Motor grader	3.7m	100,000	m^2	300.0	333	4.00	83	4.0	8	0.5
		Compaction	Vibration roller	4t	50,000	m^2	150.0	333	4.00	83	4.0	8	0.5
Side ditch		Excavation	Excavator	0.4m^3	3,000	m^3	25.0	120	4.00	30	1.4	8	0.2
		Disposing	Dump truck	10t	3,000	m^3	8.3	361	6.00	60	2.5	8	0.3
Drainage & structures repair	Excavation	Excavation	Excavator	0.8m^3	1,875	m^3	45.0	42	4.00	10	0.5	8	0.1
		Disposing	Dump truck	10t	1,875	m^3	8.3	226	6.00	38	1.6	8	0.2
	Backfilling	Borrow excavation	Excavator	0.8m^3	1,458	m^3	75.0	19	4.00	5	0.2	8	0.0
		Transport of borrow	Dump truck	10t	1,458	m^3	8.3	176	6.00	29	1.2	8	0.2
		Backfilling	Excavator	0.8m^3	1,313	m^3	25.0	53	4.00	13	0.6	8	0.1
		Compaction	Vibration roller	0.8-1.1t	1,313	m^3	14.3	92	4.00	23	1.1	8	0.1
		Compaction	Tamper	60-100kg	1,313	m^3	83.3	16	5.00	3	0.1	8	0.0
Transport		Fuel	Fuel tanker	6000ltr	-	-	-	-	-	168	8.0	8	1.0
		Water	Water tanker	5.5-6.5kl	-	-	-	-	-	168	8.0	8	1.0
		Oil & lubricant	Cargo truck	6t	-	-	-	-	-	168	8.0	8	1.0
		Equipment	Trailer truck	32t	-	-	-	-	-	168	8.0	8	1.0
Supervision			Pickup		-	-	-	-	-	168	8.0	8	2.0

	Equipment type	Spec.	Number needed		Equipment type	Spec.	Number needed
1	Bulldozer	18t	0.55	12	Dump truck	10t	5.28
2	Motor grader	3.7m	0.61	13	Water tanker	5.5-6.5kl	1.00
3	Wheel loader	2.4m^3	0.94	14	Tamper	60-100kg	1.35
4	Excavator	0.8m^3	0.17	15	Vibration roller	1t	0.14
5	Excavator	0.4m^3	0.18	16	Fuel tanker	6000l	1.00
6	Vibration roller	10t	0.70	17	Cargo truck	6t	1.00
7	Vibration roller	4t	0.71	18	Trailer truck	32t	1.00
8	Tire roller	5-15t	0.70	19	Pickup		2.00
9	Asphalt finisher	2.4-4.5m	0.70				
10	Distributor	4000l	0.26				
11	Asphalt plant	60t/h	1.03				

Table 2.10.3 Examination of required number of equipment –Bitola branch –

Examination of the equipment schedule Branch BITOLA

Area of asphalt paving per year 235,900 m^2

Workable month per year: 8 8 months
Work day per month: for asphalt plant & trucks 24 days
for other equipment 21 days
Workable day per year: for asphalt plant & trucks 192 days
for other equipment 168 days

Work Item	Description		Equipment Type	Equipment Spec.	Work volume (1)	Unit	Productivity (volume/u/hour) (2)	Work hours needed (3)=(1)/(2)	Workhour per Day (4)	Needed day per Year (5)=(3)/(4)	Needed Mon. per Year (6)=(5)/24or20	Workable month (7)	Number needed (6)/(7)
Asphalt Surface	Overlay	Tack coat	Distributor	4000ltr	211,900	m^2	793.7	267	4.00	67	3.2	8	0.4
		Transport of mix	Dump truck	10t	25,428	t	4.1	6,202	6.00	1,034	43.1	8	5.4
		Paving	Asphalt finisher	2.4-4.5m	**211,900**	**m^2**	250.0	848	4.00	212	10.1	8	1.3
		Compaction	Vibration roller	10t	211,900	m^2	250.0	848	4.00	212	10.1	8	1.3
		Compaction	Tire roller	5-15t	211,900	m^2	250.0	848	4.00	212	10.1	8	1.3
	Pothole repair	Prime coat	Distributor	4000ltr	24,000	m^2	476.2	50	4.00	13	0.6	8	0.1
	Patching	Transport of mix	Dump truck	10t	2,880	t	4.1	702	6.00	117	4.9	8	0.6
		Paving	Manual	-	**24,000**	**m^2**	-	-	-	-	-	8	-
		Compaction	Vibration roller	4t	24,000	m^2	75.0	320	4.00	80	3.8	8	0.5
		Compaction	Tamper	60-100kg	24,000	m^2	12.5	1,920	4.00	480	22.9	8	2.9
Asphalt concrete production	Plant operation	Loading & feeding	Wheel loader	2.4m^3	18,783	m^3	25.8	728	6.00	121	5.8	8	0.7
		Mixing	Asphalt plant	60t/h	28,308	t	23.4	1,210	6.00	202	8.4	8	1.1
Base course repair	Removal of exist-ing pavement	Ripping & excavation	Bulldozer	18t	1,470	m^3	35.0	42	4.00	11	0.5	8	0.1
		Loading	Wheel loader	2.4m^3	1,470	m^3	35.0	42	4.00	11	0.5	8	0.1
		Disposing	Dump truck	10t	1,470	m^3	8.3	177	6.00	30	1.3	8	0.2
	Base course	Material loading	Wheel loader	2.4m^3	1,628	m^3	35.0	47	4.00	12	0.6	8	0.1
		Material transport	Dump truck	10t	1,628	m^3	8.3	196	6.00	33	1.4	8	0.2
		Spreading & grading	Motor grader	3.7m	4,900	m^2	125.0	39	4.00	10	0.5	8	0.1
		Compaction	Vibration roller	10t	4,900	m^2	125.0	39	4.00	10	0.5	8	0.1
		Compaction	Tire roller	5-15t	4,900	m^2	125.0	39	4.00	10	0.5	8	0.1
		Watering	Water tanker	5.5-6.5kl	206	t	4.0	51	6.00	9	0.4	8	0.0
Land slide recovery	Removal of earth	Pushing	Bulldozer	18t	15,080	m^3	35.0	431	4.00	108	5.1	8	0.6
		Loading	Wheel loader	2.4m^3	15,080	m^3	35.0	431	4.00	108	5.1	8	0.6
		Disposing	Dump truck	10t	15,080	m^3	8.3	1,817	6.00	303	12.6	8	1.6
		Grading	Motor grader	3.7m	27,144	m^2	300.0	90	4.00	23	1.1	8	0.1
Shoulder		Shaping & grading	Motor grader	3.7m	160,000	m^2	300.0	533	4.00	133	6.3	8	0.8
		Compaction	Vibration roller	4t	80,000	m^2	150.0	533	4.00	133	6.3	8	0.8
Side ditch		Excavation	Excavator	0.4m^3	4,800	m^3	25.0	192	4.00	48	2.3	8	0.3
		Disposing	Dump truck	10t	4,800	m^3	8.3	578	6.00	96	4.0	8	0.5
Drainage & structures repair	Excavation	Excavation	Excavator	0.8m^3	3,000	m^3	45.0	67	4.00	17	0.8	8	0.1
		Disposing	Dump truck	10t	3,000	m^3	8.3	361	6.00	60	2.5	8	0.3
	Backfilling	Borrow excavation	Excavator	0.8m^3	2,333	m^3	75.0	31	4.00	8	0.4	8	0.0
		Transport of borrow	Dump truck	10t	2,333	m^3	8.3	281	6.00	47	2.0	8	0.2
		Backfilling	Excavator	0.8m^3	2,100	m^3	25.0	84	4.00	21	1.0	8	0.1
		Compaction	Vibration roller	0.8-1.1t	2,100	m^3	14.3	147	4.00	37	1.8	8	0.2
		Compaction	Tamper	60-100kg	2,100	m^3	83.3	25	5.00	5	0.2	8	0.0
Transport		Fuel	Fuel tanker	6000ltr	-	-	-	-	-	168	8.0	8	1.0
		Water	Water tanker	5.5-6.5kl	-	-	-	-	-	168	8.0	8	1.0
		Oil & lubricant	Cargo truck	6t	-	-	-	-	-	168	8.0	8	1.0
		Equipment	Trailer truck	32t	-	-	-	-	-	168	8.0	8	1.0
Supervision			Pickup		-	-	-	-	-	168	8.0	8	2.0

	Equipment type	Spec.	Number needed		Equipment type	Spec.	Number needed
	Bulldozer	18t	0.71	12	Dump truck	10t	8.96
	Motor grader	3.7m	0.99	13	Water tanker	5.5-6.5kl	1.05
	Wheel loader	2.4m^3	1.50	14	Tamper	60-100kg	2.89
	Excavator	0.8m^3	0.27	15	Vibration roller	1t	0.22
	Excavator	0.4m^3	0.29	16	Fuel tanker	6000l	1.00
	Vibration roller	10t	1.32	17	Cargo truck	6t	1.00
	Vibration roller	4t	1.27	18	Trailer truck	32t	1.00
	Tire roller	5-15t	1.32	19	Pickup		2.00
	Asphalt finisher	2.4-4.5m	1.26				
	Distributor	4000l	0.48				
	Asphalt plant	60t/h	1.05				

Table 2.10.4 Examination of required number of equipment –Stip branch –

Examination of the equipment schedule Branch STIP

Area of asphalt paving per year 244,000 m^2

Workable month per year:		**8**	**8**	**months**
Work day per month:	**for asphalt plant & trucks**	**24**		**days**
	for other equipment		**21**	**days**
Workable day per year:	**for asphalt plant & trucks**	**192**		**days**
	for other equipment		**168**	**days**

Work Item	Description		Equipment Type	Equipment Spec.	Work volume (1)	Unit	Productivity (volume/u/hour) (2)	Work hours needed (3)=(1)/(2)	Workhour per Day (4)	Needed day per Year (5)=(3)/(4)	Needed Mon. per Year (6)=(5)/24or20	Workable month (7)	Number needed (6)/(7)
Asphalt Surface	Overlay	Tack coat	Distributor	4000ltr	224,000	m^2	793.7	282	4.00	71	3.4	8	0.4
		Transport of mix	Dump truck	10t	26,880	t	4.1	6,556	6.00	1,093	45.5	8	5.7
		Paving	Asphalt finisher	2.4-4.5m	**224,000**	**m^2**	250.0	896	4.00	224	10.7	8	1.3
		Compaction	Vibration roller	10t	224,000	m^2	250.0	896	4.00	224	10.7	8	1.3
		Compaction	Tire roller	5-15t	224,000	m^2	250.0	896	4.00	224	10.7	8	1.3
	Pothole repair Patching	Prime coat	Distributor	4000ltr	20,000	m^2	476.2	42	4.00	11	0.5	8	0.1
		Transport of mix	Dump truck	10t	2,350	t	4.1	573	6.00	96	4.0	8	0.5
		Paving	Manual	-	**20,000**	**m^2**	-	-	-	-	-	8	-
		Compaction	Vibration roller	4t	20,000	m^2	75.0	267	4.00	67	3.2	8	0.4
		Compaction	Tamper	60-100kg	20,000	m^2	12.5	1,600	4.00	400	19.0	8	2.4
Asphalt concrete production	Plant operation	Loading & feeding	Wheel loader	2.4m^3	19,395	m^3	25.8	751	6.00	125	6.0	8	0.7
		Mixing	Asphalt plant	60t/h	29,230	t	21.7	1,348	6.00	225	9.4	8	1.2
Base course repair	Removal of exist-ing pavement	Ripping & excavation	Bulldozer	18t	16,000	m^3	35.0	457	4.00	114	5.4	8	0.7
		Loading	Wheel loader	2.4m^3	16,000	m^3	35.0	457	4.00	114	5.4	8	0.7
		Disposing	Dump truck	10t	16,000	m^3	8.3	1,928	6.00	321	13.4	8	1.7
	Base course	Material loading	Wheel loader	2.4m^3	5,516	m^3	35.0	158	4.00	39	1.9	8	0.2
		Material transport	Dump truck	10t	5,516	m^3	8.3	665	6.00	111	4.6	8	0.6
		Spreading & grading	Motor grader	3.7m	16,600	m^2	125.0	133	4.00	33	1.6	8	0.2
		Compaction	Vibration roller	10t	16,600	m^2	125.0	133	4.00	33	1.6	8	0.2
		Compaction	Tire roller	5-15t	16,600	m^2	125.0	133	4.00	33	1.6	8	0.2
		Watering	Water tanker	5.5-6.5kl	697	t	4.0	174	6.00	29	1.2	8	0.2
Land slide recovery	Removal of earth	Pushing	Bulldozer	18t	12,095	m^3	35.0	346	4.00	86	4.1	8	0.5
		Loading	Wheel loader	2.4m^3	12,095	m^3	35.0	346	4.00	86	4.1	8	0.5
		Disposing	Dump truck	10t	12,095	m^3	8.3	1,457	6.00	243	10.1	8	1.3
		Grading	Motor grader	3.7m	21,771	m^2	300.0	73	4.00	18	0.9	8	0.1
Shoulder		Shaping & grading	Motor grader	3.7m	145,000	m^2	300.0	483	4.00	121	5.8	8	0.7
		Compaction	Vibration roller	4t	72,500	m^2	150.0	483	4.00	121	5.8	8	0.7
Side ditch		Excavation	Excavator	0.4m^3	4,350	m^3	25.0	174	4.00	44	2.1	8	0.3
		Disposing	Dump truck	10t	4,350	m^3	8.3	524	6.00	87	3.6	8	0.5
Drainage & structures repair	Excavation	Excavation	Excavator	0.8m^3	2,719	m^3	45.0	60	4.00	15	0.7	8	0.1
		Disposing	Dump truck	10t	2,719	m^3	8.3	328	6.00	55	2.3	8	0.3
	Backfilling	Borrow excavation	Excavator	0.8m^3	2,115	m^3	75.0	28	4.00	7	0.3	8	0.0
		Transport of borrow	Dump truck	10t	2,115	m^3	8.3	255	6.00	42	1.8	8	0.2
		Backfilling	Excavator	0.8m^3	1,903	m^3	25.0	76	4.00	19	0.9	8	0.1
		Compaction	Vibration roller	0.8-1.1t	1,903	m^3	14.3	133	4.00	33	1.6	8	0.2
		Compaction	Tamper	60-100kg	1,903	m^3	83.3	23	5.00	5	0.2	8	0.0
Transport		Fuel	Fuel tanker	6000ltr	-	-	-	-	-	168	8.0	8	1.0
		Water	Water tanker	5.5-6.5kl	-	-	-	-	-	168	8.0	8	1.0
		Oil & lubricant	Cargo truck	6t	-	-	-	-	-	168	8.0	8	1.0
		Equipment	Trailer truck	32t	-	-	-	-	-	168	8.0	8	1.0
Supervision			Pickup		-	-	-	-	-	168	8.0	8	2.0

	Equipment type	Spec.	Number needed		Equipment type	Spec.	Number needed
1	Bulldozer	18t	1.19	12	Dump truck	10t	10.67
2	Motor grader	3.7m	1.02	13	Water tanker	5.5-6.5kl	1.15
3	Wheel loader	2.4m^3	2.17	14	Tamper	60-100kg	2.41
4	Excavator	0.8m^3	0.24	15	Vibration roller	1t	0.20
5	Excavator	0.4m^3	0.26	16	Fuel tanker	6000l	1.00
6	Vibration roller	10t	1.53	17	Cargo truck	6t	1.00
7	Vibration roller	4t	1.12	18	Trailer truck	32t	1.00
8	Tire roller	5-15t	1.53	19	Pickup		2.00
9	Asphalt finisher	2.4-4.5m	1.33				
10	Distributor	4000l	0.49				
11	Asphalt plant	60t/h	1.17				

Table 2.11 Required number of equipment –Total of the 4 branches –

Examination of the number of equipment

	Equipment type	Spec.	Branch SKOPJE			Branch VELES			Branch BITOLA			Branch STIP			4-Branch			
			Required	Existing	Additional	Required	Existing	Additional	Required	Existing	Additional	Required	Existing	Additional	Required (1)	Existing (2)	(1)-(2)	Additional
1	Bulldozer	18t	0.45		1	0.55		0	0.71	0.6	1	1.19		0	2.90	0.6	2.3	2
2	Motor grader	3.7m	1.63		1	0.61		1	0.99	0.2	1	1.02		1	4.24	0.2	4.0	4
3	Wheel loader	2.5m^3	1.51	0.8	1	0.94	0.6	1	1.50	0.6	1	2.17	0.6	1	6.11	2.6	3.5	4
4	Excavator	0.8m^3	0.52		1	0.17		0	0.27		0	0.24		0	1.20	0.0	1.2	1
5	Excavator	0.4m^3	0.55		0	0.18		0	0.29		1	0.26		0	1.27	0.0	1.3	1
6	Vibration roller	10t	1.89	0.6	1	0.70	0.4	1	1.32		1	1.53		1	5.45	1.0	4.4	4
7	Vibration roller	4t	1.79		1	0.71		1	1.27		1	1.12		1	4.89	0.0	4.9	4
8	Tire roller	8-13t	1.89		1	0.70	0.4	1	1.32		1	1.53		1	5.45	0.4	5.0	4
9	Asphalt finisher	2.5-6.0m	1.84	0.4	1	0.70	0.2	1	1.26	0.2	1	1.33	0.4	1	5.14	1.2	3.9	4
10	Distributor	4000l	0.63		0	0.26		1	0.48		0	0.49		0	1.85	0.0	1.8	1
11	Asphalt plant	60t/h	0.80	(1)	1	1.03	1.0	0	1.05	1.0	0	1.17	1.0	0	4.06	3.0	1.1	1
12	Dump truck	8t	11.50	4.8	2	5.28	4.8	2	8.96	9.4	2	10.67	5.2	2	36.40	24.2	12.3	8
13	Water tanker	5.5-6.5kl	1.04	-	0	1.00	-	0	1.05	-	0	1.15	-	0	4.24	-	-	0
14	Tamper	60-100kg	1.85	-	0	1.35	-	0	2.89	-	0	2.41	-	0	8.49	-	-	0
15	Vibration roller	1t	0.42	-	0	0.14	-	0	0.22	-	0	0.20	-	0	0.97	-	-	0
16	Fuel tanker	6000l	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-	0	4.00	-	-	0
17	Cargo truck	6t	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-	0	4.00	-	-	0
18	Trailer truck	32t	1.00	-	0	1.00	-	0	1.00	-	0	1.00	-	0	4.00	-	-	0
19	Pickup		2.00	-	0	2.00	-	0	2.00	-	0	2.00	-	0	8.00	-	-	0
	Total			6.6	11		7.4	9		12.0	10		7.2	8		33.2		38

Note 1) The following factors were applied to the numbers of existing equipment: for the equipment out of asphalt plant and dump truck “usable” 0.6, “occasionally not usable” 0.4, “occasionally usable” 0.2. Those for dump truck “usable” 0.65, “occasionally not usable” 0.55, “occasionally usable” 0.45.
For asphalt plant 1.0. That of Skopje branch 0.

2.3 Basic Design

2.3.1 Design Concept

(1) Natural Conditions

One of the conditions to be considered for the determination of equipment specification is the significant temperature difference between summer and winter. Altitude of the site does not influence the equipment performance.

1) Temperature varies from –25℃ to 45℃, thus all the equipment with cabins shall be equipped with air conditioners.
2) Regarding topographic condition maximum altitude is 1,500m, so that particular consideration is not required for specification.

(2) Environmental aspect

1) Asphalt plant shall pass the current air pollution law in Macedonia.
2) Dump trucks shall pass the EURO 2 standards for gas emission, and EURO 1 standards for noise.

(3) Work execution and equipment maintenance capability of Makedonija Pat

Through examination of the achievements of Makedonija Pat in road maintenance in the recent years, its capability in the execution of the 2002~2005 program is adequate. Particularly through observation of the road conditions of the National and Regional roads, it was found that these roads were repaired adequately in spite of budget constraints, and this indicates that the management is well organized.

Equipment maintenance, the management, technical level and experience of Makedonija Pat are adequate, thus specific training for this Project purpose is not required. There are no particular maintenance techniques specific to the equipment under the Project, however, if there are any specific skills needed to complement the general maintenance skills of the staff they can be acquired through the normal services of the manufacturer's agent.

(4) Criteria for determination of specifications

Specifications of the equipment were determined based on the criteria indicated in Table 2.12.

Table 2.12 Examination of specification

Equipment	Examination of specification
Bulldozer	Considering lane width (3m~3.5m), middle class 175~200HP was adopted. At least 175HP is need for ripping work.
Motor grader	Considering lane width (3m~3.5m) blade width of 3.7m with 135HP was adopted. Front blade was annexed.
Wheel loader	As main purpose is for asphalt plant use 2.5m^3 was adopted. 140~160HP is need for this bucket class. Also for the removal of landslide boulder bucket with ripper was adopted.
Hydraulic excavator (crawler type)	Considering lane width (3m~3.5m) middle class with 0.8m^3 bucket was adopted. For breaking existing pavement or landslide boulder annexed hydraulic breaker.
Hydraulic excavator(wheel type)	Considering lane width (3m~3.5m), and small repair purpose small class with 0.4m^3 bucket was adopted. For breaking existing pavement or landslide boulder annexed hydraulic breaker.
Vibration roller	For large scale repair such as asphalt overlay 10t was adopted, and for patching work 4t was adopted.
Tire roller	Considering the combination with 10t vibration roller 8-13t class was adopted.
Asphalt finisher	Considering lane width (3m~3.5m) and also narrow carriageway section, where total width around 5m, 2.5~6m blade was adopted.
Asphalt distributor	Considering lane width (3m~3.5m) 4,000 ltr was adopted.
Asphalt plant	Considering the workload 60t/h was adopted. To clear the current air pollution law (ISO), bag-filter type was adopted.
Dump truck	Considering the characteristic of work (maintenance of asphalt pavement) 8 ton was adopted for transportation of asphalt concrete and aggregates.
Workshop tools	For minor repair on site and branch workshop, welding machine, air compressor, and tool kit were adopted as minimum requirement.
Spare parts	Adopted only for periodic maintenance and routine maintenance spare parts for 2,000 hours use.

(5) Criteria for spare parts selection

Spare parts shall be limited to periodic maintenance and routine maintenance use. A 2000 hour use of the Project equipment was selected. Main items of the spare parts for road construction machinery (bulldozer, motor grader, wheel loader, hydraulic excavator, vibration roller, tire roller), asphalt pavement machinery (asphalt finisher, asphalt distributor) and asphalt plant are as follows:

- Road maintenance machinery

  Fuel filter, engine oil filter, transmission filter, hydraulic filter, corrosion resister, air cleaner element, V-belt, lamp, fuse, cutting edge, end bit, radiator hose, O-ring kit, seal kit, engine gasket, etc.

- Asphalt pavement machinery

  Fuel filter, engine oil filter, hydraulic filter, air cleaner element, V-belt, lamp, fuse, radiator hose, hydraulic hose, O-ring kit, seal kit, engine gasket, etc.

- Asphalt plant

  Liner and chip (for rotary), screen mesh, V-belt, bush, bearing, seal, lamp, volt, nut, etc.

(6) Criteria on country of origin of the equipment

Considering the reliability, quality, acquisition cost, after service system, facility of spare parts procurement, time for supply, and familiarity of the equipment by the Macedonian side Japanese products were adopted. But with equipment for which number of the applicable Japanese manufacturers is limited, that of third country origin was included.

(7) Criteria for port of disembarkation and inland transportation

Thessaloniki, Greece is considered the most appropriate port of disembarkation for the import from Japan from the viewpoint of port facilities and inland transportation after disembarkation.

The distance from Thessaloniki to Gevgelija (the border city in Macedonia) and that of from Gevgelija to Skopje is 60km and 170km, respectively, i.e. the total distance is 230km. From Gevgelija to Skopje is partly motorway..

(8) Criteria for the place of hand-over

For all the equipment under the Project except asphalt plant Makedonija Pat Avtopat branch was adopted as the place of hand-over due to the following reasons:

1) Facilities are well equipped for the equipment loading/unloading, and have enough space: stockyard, garage and warehouses.
2) Inspection, initial operation and training workshop are anticipated at this branch to cater for trainees from all the relevant branches.

3) There are no appropriate loading/unloading facilities at the border crossing points of Macedonia.
4) Custom clearance can be processed at this branch.

Note) The asphalt plant will be directly transported up to the place of installation, i.e. Makedonija Pat Skopje plant yard, and custom clearance can be processed there.

(9) Criteria for procurement schedule

All the equipment under the Project shall be handed over by January 2002. Particularly, initial operation of the asphalt plant shall not be delayed beyond January to avoid low temperatures. As the installation of asphalt plant is the responsibility of the Macedonian side, the completion schedule of preparatory works, e.g. land preparation, construction of foundation, power supply work, water supply work, etc. shall be strictly respected. All the preparatory works shall be completed by the end of August at latest. Anticipated schedule of the asphalt plant installation is shown in Table 2.13.

Table 2.13 Installation Schedule of Asphalt Plant

2000	2001												2002
12	1	2	3	4	5	6	7	8	9	10	11	12	1
▼ Cabinet meeting													
	E/N ▼				Tender								
						Contract							
							Manufacturing						
										Transport (Maritime and Inland)			
				Preparatory works								Assembling and erection	
											Operation and hand over		

2.3.2 Basic Design

(1) Design policy

Design policy is to strengthen the existing maintenance brigades of the 4 branches to enable each branch to effectively and self-sufficiently perform the road maintenance.

The equipment, which is not allocated to every branch, i.e. bulldozer, hydraulic excavator and distributor, shall be effectively used by the 4 branches. Makedonija Pat head office shall make concrete schedule for operation of all the equipment under the Project.

(2) Equipment plan

The allocation schedule to the 4 branches of the equipment under the Project is shown in Table 2.14. Reasons for the allocation of bulldozer, hydraulic excavator and distributor to the relevant branches are as follows:

- Bulldozer
  One of the important purposes of the use of the bulldozer is for landslide recovery work. Skopje and Bitola branches cover many mountainous roads, thus the bulldozers will be allocated to these 2 branches. As for the Stip branch, which also has many mountainous roads, the bulldozer of Skopje branch will be used when it maintains the roads in the northern area and that of Bitola for the southern area.

- Hydraulic excavator
  For the same reason as stated above for the bulldozers, hydraulic excavators will be allocated to Skopje and Bitola branches. The wheel type will be allocated to Bitola branch because of the high mobility of this type of equipment.

- Distributor
  Because Veles branch is located in the middle of the 4 branches, the distributor will be allocated to Veles branch because of mobility to other branches.

(3) Procurement plan

The eligible source country and the reason for the procurement of the equipment under the Project from them is summarized in Table 2.15.

Table 2.14 Equipment plan

No.	Equipment	Specification	Skopje	Veles	Bitola	Stip	Total
1	Bulldozer	175~200HP	1	-	1	-	2
2	Motor grader	135HP, 3.7m	1	1	1	1	4
3	Wheel loader	140~160HP, 2.5m^3	1	1	1	1	4
4	Hydraulic excavator (crawler type)	0.8m^3	1	-	-	-	1
5	Hydraulic excavator (wheel type)	0.4m^3	-	-	1	-	1
6	Vibration roller (10t)	10ton	1	1	1	1	4
7	Vibration roller (4t)	3.5~4.0ton	1	1	1	1	4
8	Tire roller	8~13ton	1	1	1	1	4
9	Asphalt finisher	3.5~6.0m	1	1	1	1	4
10	Asphalt distributor	4,000 ltr	-	1	-	-	1
11	Asphalt plant	60ton/h	1	-	-	-	1
12	Dump truck	8ton	2	2	2	2	8
13	Workshop tools	4 set	1	1	1	1	4
14	Spare Parts	1 lot	1	1	1	1	4

Table 2.15 Eligible source plan

No.	Equipment	Specification	Country of origin	Reasons
1	Bulldozer	160~200HP	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
2	Motor grader	135HP, 3.7m	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
3	Wheel loader	140~160HP, 2.5m^3	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
4	Hydraulic excavator	0.8m^3 crawler type	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
5	Hydraulic excavator	0.4m^3 wheel type	Japan・Third countries	As the number of Japanese manufacturer applicable be limited to include Germany.
6	Vibration roller (1)	10ton	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
7	Vibration roller (2)	3.5~4ton	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
8	Tire roller	8~15ton	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
9	Asphalt finisher	3.5~6m	Japan・Third countries	As the number of Japanese manufacturer applicable be limited to include Germany.
10	Asphalt distributor	4,000 ltr 2.3~3.6m	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
11	Asphalt plant	60ton/h	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
12	Dump truck	8ton	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply
13	Workshop tools	1 set	Japan	High quality, good after service system, facility of spare parts procurement, short time of supply

CHAPTER 3

IMPLEMENTATION PLAN

Chapter 3. Implementation Plan

3.1 Implementation Plan

3.1.1 Implementation Concept

(1) Project Implementing Agency

In the implementation of the project under Japan's Grant Aid, the relationship between the organizations concerned shall be as illustrated in Fig. 3.1.

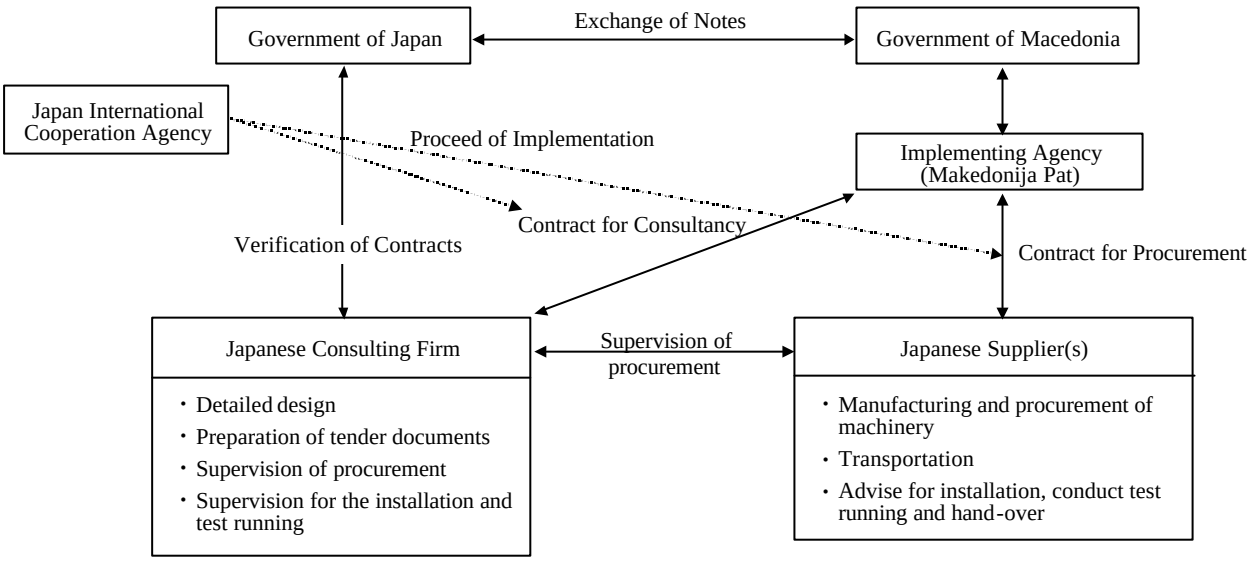


Fig. 3.1 Mechanism of Project Implementation

Implementing agency of the Project in Macedonia is the Makedonija Pat under the Ministry of Transport and Communication.

In accordance with Japan's Grant Aid Scheme, a Japanese consulting firm will undertake the detailed design and supervision of the Project, and Japanese trading firm(s) will undertake the supply of machinery under the Project.

(2) Consultant

After Exchange of Notes (E/N) between the Government of Japan and the Government of Macedonia, Makedonija Pat will conclude speedily a contract with a Japanese consulting firm for the procurement of consultancy services.

The said firm will provide engineering services for the procurement of machinery including detailed design, preparation of tender documents, assistance for tender(s) and contract(s), and supervision of procurement, in accordance with the contract until the completion of hand over of the machinery under the Project.

(3) Supplier(s)

Makedonija Pat will conclude contract(s) for the supply of machinery under the Project with the Japanese trading firm(s) who has (have) been awarded the tender(s) after having passed successfully the examination of the quality being required at the competitive tender with limited qualification.

The said firm(s) has (have) the obligation to deliver the machinery requested by Makedonija Pat and carry out its initial operation diligently within the delay stipulated in the contract.

3.1.2 Implementation Conditions

The unloading port of the machinery to be procured from Japan and third countries is Thessaloniki, Greece. Equipment from Germany, if any, will be directly transported to Skopje by road.

All the equipment under the Project except asphalt plant shall be transported to the Makedonija Pat's Avtopat Branch in Skopje as bonded cargo and shall clear customs there. The machinery that have cleared customs shall be handed over to the Macedonian side after the initial operation and maintenance guidance.

As for the asphalt plant it shall clear customs at the Skopje asphalt plant yard, be installed there, and undertaken initial operation and maintenance guidance, then handed over.

The supplier(s) of machinery should take necessary measures for avoiding issues with the Macedonian side with regard to the responsibilities for the damages or loss of cargoes, which may occur during inland transport.

3.1.3 Scope of Work

Equipment and Inland Transport

The cost of procurement of machinery including the cost of inland transport to the place of hand over shall be borne by the Japanese side.

Installation of Asphalt Plant

The cost of installation of asphalt plant shall be borne by the Macedonian side, but the cost of dispatching a technical instructor for the installation shall be borne by the Japanese side.

Imposition of Duties and Taxes

The Macedonian side shall take necessary measures for the exemption of all duties and taxes including VAT imposed in Macedonia in relation to the procurement of the equipment under the Project.

Transport after the hand-over of the equipment under the Project

All transport and installation costs for the equipment under the Project after their hand-over are to be borne by the Macedonian side.

3.1.4 Consultant's Supervision

(1) Principles of Procurement Supervision

For the implementation of the project under Japan's Grant Aid Scheme, the consultant shall carry out the detailed design and supervision of procurement with a thorough understanding of the following:

1) Background of the implementation program
2) Contents of the basic design report
3) System of Japan's grant aid
4) Contents of the Exchange of Notes between the two governments

Based on the above understanding, the contents, division of responsibilities, and special notes for detailed design and supervision of procurement are explained below.

(2) Scope of Consulting Services

After Exchanges of Notes (E/N), the consultant concludes a contract for consulting services with the implementing agency within the scope of services specified in the Exchange of Notes (E/N).

The scope of services can be summarized as follows,

1. Detailed Design

    1) Consultancy agreement (in Macedonia) and verification (in Japan)
    2) Prompting the issuance of the Authorization to Pay (A/P) (Macedonia)
    3) Site survey, detailed design and preparation of tender documents (Macedonia, Japan)
    4) Obtaining approval of tender documents from the Macedonian side (Macedonia)
    5) Announcement of tender and distribution of tender documents (Japan)
    6) Execution of tender(s), evaluation of tenders, preparation of evaluation report, obtaining approval of the report (Japan)
    7) Witness of the contract(s) for the supply of machinery (Japan), and obtaining verification of the supply contract(s) (Japan)
    8) Confirmation of the obligations of the Macedonian side (Macedonia/Japan)

2. Supervision of the Procurement of Machinery

    1) Confirmation of the procurement order
    2) Follow-up of the procurement
    3) Ex-factory inspection
    4) Inspection before shipment
    5) Progress report
    6) Witness of final hand-over
    7) Preparation of completion note and final report

3. Initial Operation of the Machinery

    It will be necessary for supplier(s) engineers to provide instructions for installation of asphalt plant, initial operation, preventive maintenance and routine maintenance under the supervision of the consultant.

(3) Special Remarks

1. It is necessary to check if the procurement conditions fixed by the basic design have not changed.
2. Tender and contract documents should be in accordance with the Japan's Grant Aid System. It is necessary to discuss these documents fully with the Macedonian side during the field survey of the Detailed Design and get from the Macedonian side approval of the tender documents including the Detailed Design.

3.1.5 Procurement Plan

(1) Countries eligible for procurement

Procurement of machinery from Japan, Macedonia and third countries shall be done according to the following plan:

(i) Procurement from Japan

At present, more than 100 units of Japanese construction machines are in operation in Macedonia. According to the inquiries to various local construction companies, they are all planning to study the introduction of Japanese equipment with excellent quality. For keeping the delivery term, Japanese products are highly reliable. Japanese products are also considered to be at satisfactory levels in-terms of price. Makedonija Pat, the implementing agency of the Project, does not own Japanese construction machinery at present but has a good knowledge of their technical characteristics. Therefore, there is no fear of misunderstanding the specifications of the Project equipment.

The procurement of spare parts for Japanese products shall not pose particular problems as they can be procured from neighboring countries without difficulty. There is also a movement to transfer the base station of service agent of Japanese machinery from Belgrade to Skopje, which will strengthen further the structure of after service.

(ii) Procurement in Macedonia

There are no products procurable locally for the project.

(iii) Procurement from third countries

The Macedonian side wishes to procure Japanese products for the reason of quality, early delivery of equipment, facility of procurement routes of spare parts, etc. But regarding hydraulic excavator (wheel type) and asphalt finisher, for which number of Japanese manufacturers are limited, German product are also digible for procurement as there are products technically adaptable and capable of providing after service.

For the above reasons, Japanese products are recommended for procurement under the Project due to their quality of machine, delivery time and supply of spare parts. Regarding hydraulic excavator (wheel type) and asphalt finisher, German products are also eligible for procurement.

3.1.6 Implementation Schedule

The project shall be implemented according to the following schedule based on Japan's Grant Aid System.

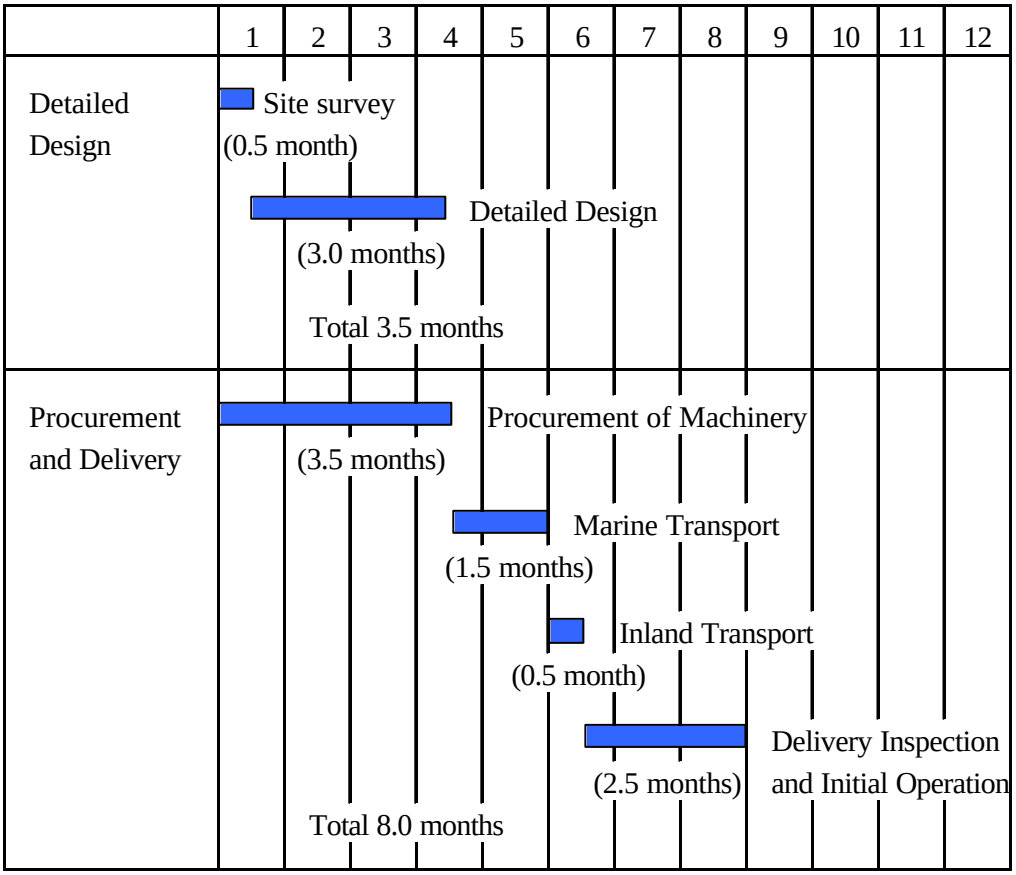


Fig. 3.2 Implementation Schedule

3.1.7 Obligations of the Recipient Country

In case the Project is implemented under Japan's Grant Aid Scheme, the following obligations are to be fulfilled by the Macedonian side.

(1) Payment of the following commissions to a bank of Japan for the banking services based on the banking arrangement (B/A) for the Project.

1) Commission for the advising of A/P
2) Commission for payments

(2) Speedy unloading and customs clearance of the machinery procured under the Project at the place of hand over.

1) Exemption from import duties and all taxes including VAT.
2) All expenses for the transport of machinery after their hand over.

(3) Obtaining permission for entering and staying in Macedonia and providing assistance to the Japanese personnel engaged in the Project based on the contract verified by the Japanese Government.

(4) Exemption from customs duties, internal taxes and other fiscal levies in Macedonia for the Japanese firms and personnel engaged in the Project based on the contract verified by the Japanese Government.

(5) Proper and effective use and maintenance of the machinery to be provided under the Grant Aid.

(6) Payment of all expenses for transport, installation, operation, maintenance etc. of the machinery except other than those to be borne by the Japanese side under the Grant Aid for the Project.

3.2 Project Cost Estimation

Project cost to be borne by the Macedonian side is estimated as follows:

1)	Transportation of the equipment from Avtopat branch to the relevant 4 branches	3,200,000 Yen
2)	Preparatory work for the installation of asphalt plant (land preparation, construction of foundation, power supply work, water supply work, etc.)	6,700,000 Yen
3)	Erection and initial operation of the asphalt plant	4,200,000 Yen
	Total	14,100,000 yen

Exchange rate: as at November 2000
US$ 1.0 = Yen 107.58
Denar 1.0 = US$ 0.015
Denar 1.0 = Yen 1.61

3.3 Plan for the Operation, Maintenance and Management of Machinery

(1) The Implementing Agency's Plan for the operation, maintenance and Management of construction machinery

Workshop Department of each branch of Makedonija Pat has a high level of technical ability and, as mentioned earlier, manages to operate old machines with their mechanical skill and workmanship. However, there is a tendency to over rely on the technical ability of the skilled workers and a lack of cost consciousness.

Therefore, in-terms of modern management of machinery workshop, it is necessary to pursuit efficiency through the systematization of works and establishment of manuals.

General standard organization of a repair workshop and flow of repair work are explained below. All staff need to master such work processes and ensure the smooth running of the workshop operation after the procurement of the equipment under the Project.

1) Organization

The proposed organization is based on the present one, but defines clearly the responsibilities of each division and section.

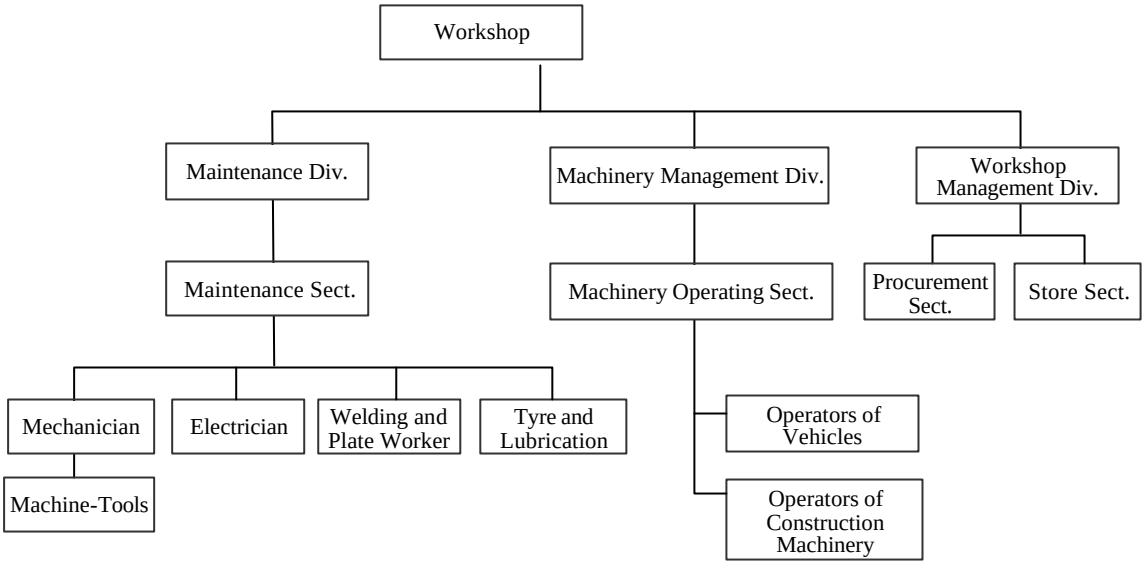


Fig. 3.3 Proposed Organization of Workshop

2) Check and Repair

Daily check

Daily check of machinery shall be carried out according to the daily checklist to be prepared based on the manual of the machinery to be newly procured. Operators record operating hours on the check list every day and the consumption volume of fuel and lubrication oil each time of their refilling. The result of check-up is reported daily to the site supervisor together with the report on the anomalies noticed during the operation of machinery. Then the site supervisor reports to the manager of the Machinery Management Division of respective branch.

Periodic Maintenance

Periodic maintenance of machinery shall be carried out based on the daily checklist submitted by the manager of Machinery Management Division of each workshop to the manager of the Maintenance Division. The manager of the Maintenance Division follows the condition and operating hours of each machine, decides the periodic replacement parts, contents of maintenance work, and the maintenance schedule, and requests the Store Section, the Procurement Section and the Maintenance Section to prepare for the periodic maintenance. Responsibilities of each section in charge are described below.

(a) Store Section

The Store Section checks the availability of required parts and requests the Procurement Section to procure the parts out of stock.

(b) Procurement Section

The Procurement Section obtains the price estimate of the required parts and requests their procurement to the Chief Mechanical Engineer of the Headquarters through the manager of Workshop Management Division and the Workshop Manager. The spare parts procured upon the instruction of the Chief Mechanical Engineer of headquarter shall be stored through the Store Section.

(c) Maintenance Section

Maintenance Section receives spare parts from the Store Section according to the schedule and carries out periodic maintenance. The result of periodic maintenance shall be recorded on the periodic maintenance checklist and submitted to the manager of the Maintenance Division. Then, the checklist is submitted by the manager of the Maintenance Division to the manager of the Machinery Management Division.

3) Procedure for the Repair Work

(a) Request for repair works

In case operators find abnormal conditions such as the leakage of fuel, oil, water etc., or high consumption of fuel, they shall request the mechanics of Maintenance Division for a check-up through the manager of Machinery Management Division.

(b) Repair Record Sheet

The mechanics dispatched to work sites investigate causes of trouble, record the results of the investigation on the repair record sheets (causes of trouble, repair method, replaced parts and their quantity, required man-hours, repair period etc.) and inform the manager of Machinery Management Section of their findings.

If the cause of trouble cannot be identified at the work site or the repair at work site is judged difficult, the machines out of order are brought to the workshop and repaired there on the judgment of Workshop Manager based on mechanics' report.

(c) Repair

Repair work at workshop is carried out according to the "Repair process sheet" issued by the chief of Maintenance Section. The process sheet is to be filled with such information as number and date of reception, name of machine, machine number, plausible cause of trouble, presumed parts required, parts number, quantity of the parts required, staff/section in charge of repair, repair completion schedule etc. The process sheet that has been filled up at each stage of the repair process comes back to the chief of Maintenance Section after completion of repair.

The chief of Maintenance Section checks the items filled in the process sheet and transfers the sheet to the chief of Mechanical Division after approval by the Workshop Manager.

The chief of Mechanical Division keeps this repair process sheet after having filled in the repair cost and having registered the repair record on the machine history book.

The components such as fuel injection pump, hydraulic units, and torque converter that cannot be repaired at the workshop, need to be repaired at specialized repair shops until the repairing facilities of the workshop become ready for such repair.

(d) Management of spare parts

Spare parts are managed by means of a card system using manufacturer's name, parts number, name of parts, quantity in stock, place of storage etc. Adoption of a computer system for spare parts management including parts order is under study. It is being studied to limit the stock parts to routine maintenance parts because periodic replacement parts may be ordered timely from manufacturers' local agents according to the equipment's operation record.

(2) Operation and Maintenance Cost

The annual costs of fuel and oil, and maintenance of equipment for the new equipment under the Project are estimated as follows:

-	Fuel and oil	DEN 21,000,000
-	Maintenance	DEN 15,500,000
	Total	DEN 36,479,000

Details are shown in Table 2.1 and Table 2.2.

On the other hand a large expenditure for spare parts required for the operation of aged machines and a high rental fee being paid to private companies for supplementing the shortage of equipment could be reduced substantially after the procurement of the Project equipment.

Suppose Makedonija Pat's expenditure in FY 1999 for fuel and oil, i.e. DEN 60,500,000 can be economized by abandonment of old equipment, say about 10%, the total cost of fuel and oil after introduction of new equipment will be DEN 15,500,000, i.e. (21,000,000-60,500,000x0.1).

Regarding expenditure for equipment maintenance and rental, it was DEN 67,300,000 in FY1999, can be reduced by approximately DEN 21,000,000 and DEN 25,000,000 for maintenance and rental respectively, by introduction of the new equipment.

Estimation of the total expenditure of Makedonija Pat for operation and maintenance of its brigades after introduction of the new equipment is shown in Table 3.3. As indicated in the Table, some DEN 31,000,000 in total can be economized annually.

Table 3.1 Estimation of Costs of Fuel and Oil

Unit: ltr

No	Designation	Specification (kW)	Quantity	Fuel and Oil Consumption (ltr•Day/Unit)	Fuel and Oil Consumption (ltr•Day/Total number of Units)
1	Bull dozer	134	2	0.188x134x 4H= 101	202
2	Motor grader	101	4	0.110x101x 4H= 44	176
3	Wheel Loader	112	4	0.156x112x 4H= 70	280
4	Hydraulic Excavator (Crawler type)	97	1	0.188x97x 4H= 73	73
5	Hydraulic Excavator (Wheel type)	82	1	0.188x82x 4H= 62	62
6	Vibration Roller (10t)	82	4	0.155x82x 4H= 51	204
7	Vibration Roller (4t)	30	4	0.155x30x 4H= 19	76
8	Tyre Roller	67	4	0.102x67x 4H= 27	108
9	Asphalt Finisher	75	4	0.155x75x 4H + 2.0= 49	196
10	Asphalt Distributor	150	1	0.094x150x 4H= 56	56
11	Asphalt Plant (60t/h)	157.5	1	126kW/h x 6H = 756kW Light oil: 7 ltr/ton x 41.7ton x 6H = 1,751	Electricity: 756kW Light oil: 1,751
12	Dump Truck (8t)	179	8	0.054 x 179 x 6H = 58	464
Total					Diesel oil: 1,433 ltr Light oil: 1,751 ltr Electricity: 756kW

Basis of Cost Estimation

1) Annual Working Days : Construction Machinery: 20 days x 8 months = 160 days
   Asphalt Plant: 24 days x 8 months = 192 days
2) Annual Working Hours : Construction Machinery: 4H (Asphalt Plant: 6H/Dump Truck: 6H)
3) Fuel Efficiency per hour of operation (ltr/kW-H): (Including oils and consumable parts necessary for daily maintenance) (Based on the standard coefficients of the Ministry of Construction, of Japan.)
4) Price of diesel oil : 33 DEN/ltr (¥49.5/ltr)
5) Price of light oil : 29 DEN/ltr (¥44.0/ltr) (for asphalt plant)
6) Electricity charge : 5 DEN / kWh (¥8.8/kWh)
7) Annual Costs :

Fuel and oil for Construction machinery	1,433 ltr x 33 DEN x 160 days	=	7,566,000 DEN
Light oil for asphalt plant.....	1,751 ltr x 29 DEN x 192 days	=	9,749,000 DEN
Fuel and Oil for Dump Truck.....	464 ltr x 33 DEN x 192 days	=	2,939,000 DEN
Electricity for asphalt plant	756 kW x 5 DEN x 192 days	=	725,000 DEN
Total			20,979,000 DEN

Note: The costs of light oil and electricity above are those required for the new plant, and not the additional amount : the existing plant is to be replaced with the new one.

Table 3.2 Estimation of Maintenance and Repair Costs

Unit: ¥1,000

No	Designation	Specification (kW)	Quantity (1)	Coefficient of Maintenance and Repair per 1 unit・year (2)	Maintenance and Repair Costs per 1 unit・year (3)	Annual Maintenance and Repair Cost (4) = (1) x (3)
1	Bull dozer	134	2	0.55/14.9=0.037*	931	1,862
2	Motor grader	101	4	0.35/16.7=0.021	362	1,448
3	Wheel Loader	112	4	0.60/11.9=0.050	1,023	4,092
4	Hydraulic Excavator (Crawler type)	97	1	0.45/10.7=0.042	1,023	1,023
5	Hydraulic Excavator (Wheel type)	82	1	0.45/16.4=0.027	660	660
6	Vibration Roller (10t)	82	4	0.40/14.7=0.027	348	1,392
7	Vibration Roller (4t)	30	4	0.40/14.7=0.027	112	448
8	Tyre Roller	67	4	0.45/17.1=0.026	271	1,084
9	Asphalt Finisher	75	4	0.45/17.3=0.026	610	2,440
10	Asphalt Distributor	150	1	0.50/15.2=0.033	498	498
11	Asphalt Plant (60t/h)	-	1	0.55/12.9=0.043	6,718	6,718
12	Dump Truck (8t)	179	8	0.50/9=0.056	392	3,136
Total				-	-	24,801

Note)

1. Maintenance and repair cost : Based on the machine cost calculation formula of the Ministry of Construction of Japan
2. Service life : Considering the number of years of operation of the existing machines, service life of the machinery has been set at 1.5 times of those of the construction machinery's cost calculation table being applied in Japan. (*: denominator indicates service life)
3. Maintenance and repair cost per unit・year : Estimated cost of machinery (PIC price) x Coefficient of maintenance and Repair.

Table 3.3 Estimation of the total expenditure after introduction of the new equipment

Unit: DEN

Item	Equipment operation and maintenance cost		Difference
	Expenditure FY1999	After the Project	
Fuel and oil	60,500,000	75,500,000	+15,000,000
Maintenance	37,000,000	16,000,000	-21,000,000
Rental	30,300,000	5,300,000	-25,000,000
Total	127,800,000	96,700,000	-31,000,000

Note) Maintenance cost saving borne by the supply of spare parts under the Project, which is for two years use of the new equipment, is not considered for the above estimation. Accordingly, the above estimation indicates on and after the third year of the implementation of the Project.

CHAPTER 4

PROJECT EVALUATION AND RECOMMENDATION

Chapter 4 Project Evaluation and Recommendation

4.1 Project Effect

Since independence in 1991, Macedonia has endeavored to establish an open market economy, and it has enlarged economic ties with its neighbors and EU. For the economic development of Macedonia, it is essential to maintain reliable access to the seaports in the neighboring countries, upgrade serviceability of road network, minimize road transport costs and achieve price stability through effective road maintenance. As a significant international traffic increase in Macedonia, Bulgaria, Albania and Yugoslavia is anticipated, secured road network of Macedonia is becoming increasingly important.

The target roads under the Project are important trunk roads of Macedonia, mostly connecting main regional centers and border points. Through the Project a total of 555km of road sections on National and Regional roads, all of which are high priority sections, will be maintained during the period 2002~2005. The target length represents some 13.1% of the total length of National and Regional road network of 4,238km. Thus all the population of Macedonia, i.e. 1.95 million will benefit from the Project. Expected effects of the Project are summarized as follows:

1) Direct effects

- A 555km of priority sections on National and Regional roads will be maintained during the period 2002~2005.

2) Indirect effects

- To attain effective road maintenance,
- To save vehicle operation costs by improvement of serviceability of the road,
- To save traveling time by improvement of driving speed from 40km/h~50km /h to 50km/h~60km/h in average,
- To enable effective logistic by avoiding cargo damage and simplifying packing,
- To decrease duration of road closure and traffic accidents by swift recovery works after landslides,
- To contribute to price stability as a result of minimizing transport costs by saving vehicle operation costs and traveling time, and effective logistic,
- To stimulate social and economic activities of the regions by facilitating transport in the country,
- To contribute to development of national economy and stability of Balkan States by facilitating international transport between the countries.

The present situation and problems of the road sub-sector, the measures to be taken under the Project and the positive impacts and extent of the Project are summarized in Table 4.1.

Table 4.1 Project Evaluation

Present situation	Measures to be taken under the Project	Positive impact and extent of the Project
1) Ensuring smooth road transportation and savings in transport costs are given the highest priority to realize open market economy in Macedonia. 2) Most of the road network of the country is in condition requiring maintenance and rehabilitation as a result of shortage of budget allocation to the road maintenance program since Macedonia's independence in 1991. 3) Maintenance of the trunk roads, which connect main regional centers and border points, and play an important role for international traffic, is urgently required. 4) The equipment possessed by Makedonija Pat, only organ in Macedonia for execution of road maintenance of National and Regional roads, are not only short of type and number but also aged and old fashioned, therefore their effectiveness of operation is very low. 5) The costs for equipment rental and repair account for some 9.4% of Makedonija Pat's annual expenditure, which hindering road maintenance program.	1) Provide necessary road maintenance equipment for 4 branches of Makedonija Pat, i.e., Skopje, Veles, Bitola and Stip, and replace the existing asphalt plant of Skopje branch by new one.	1) To maintain a 555km of priority sections on National and Regional roads during the period 2002~2005. 2) To improve road maintenance capacity of Makedonija Pat. 3) To save traveling time by improving driving speed from 40km/h~50km/h to 50km/h~60km/h. 4) To save vehicle operation costs by improving serviceability of road, and to minimize transport cost, accordingly. 5) To decrease duration of road closure and traffic accidents by swift recovery works after landslides. 6) To contribute to price stability as a result of minimizing transport costs by savings in vehicle operation costs and traveling time, and effective logistics. 7) To stimulate social and economic activities of the regions by facilitating transport in the country. 8) To contribute to development of national economy and stability of Balkan states by facilitating international transport between the countries.

4.2 Recommendation

(1) The target roads under the Project were selected from the priority road link/section determined by the pavement management system (PMS), which was introduced in Roads Fund for effective and economic planning and execution of road maintenance program with technical assistance of the World Bank. As the equipment under the Project shall be used for the maintenance of the part of PMS roads and complement the PMS program, thus implementation of 2002~2005 year program intended by the Project shall be monitored and evaluated annually in the context of PMS.

(2) The Macedonian side hopes for training in Japan in the fields of equipment maintenance and management. Training in the field of management of workshop for equipment repair maintenance is recommended.

APPENDICES

Appendix 1 Member List of the Survey Team

Basic Design Study Survey

	Name	Field of Charge	Present Position
	Mr. Satoshi NAKANO	Leader	Deputy Director, Third Project Management Division, Grant Aid Management Dept., JICA
	Mr. Tamio SHINADA	Chief Consultant Road Development Planner	Construction Project Consultants, Inc.
	Mr. Hiroyuki SASAKI	Equipment Planner	Construction Project Consultants, Inc.
	Mr. Akira ANDO	Procurement Planner Cost Estimation	Construction Project Consultants, Inc.

Draft Report Explanatory Mission

	Name	Field of Charge	Present Position
1	Ms. Masami OISHI	Leader	Official Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs
2	Mr. Tamio SHINADA	Chief Consultant/ Road Development Planner	Construction Project Consultants, Inc.
3	Mr. Hiroyuki SASAKI	Equipment Planner	Construction Project Consultants, Inc.

Appendix 2 Survey Schedule

Basic Design Study Survey

No.	Date	Activities		Stay
		Official member	Consultant	
1	Aug. 20 Sun	Leave Tokyo 13:00 (JL407) Arrive Vienna 21:30	Leave Tokyo 12:00 (SR169) Arrive Vienna 21:35	Vienna
2	21 Mon	Courtesy call to JICA and the Embassy of Japan in Vienna (EOJ) Leave Vienna 13:30 (OS863), Arrive Skopje 15:10		Skopje
3	22 Tue	Courtesy call to the Ministry of Transport and Communications and Makedonija Pat. Discussion with Makedonija Pat.		Skopje
4	23 Wed	Discussion with Makedonija Pat		Skopje
5	24 Thu	Site survey: Skopje branch, Skopje asphalt plant, Stip branch, Greece border crossing facilities, target roads		Skopje
6	25 Fri	Site survey: Avtopat branch, Veles branch, Bitola branch, target roads		Ohrid
7	26 Sat	Site survey: Target roads		Skopje
8	27 Sun	Internal meeting		Skopje
9	28 Mon	Discussion with Makedonija Pat		Skopje
10	29 Tue	Discussion with Makedonija Pat, Roads Fund and PHARE		Skopje
11	30 Wed	Discussion with World Bank and EBRD		Skopje
12	31 Thu	Sign on the Minutes of Discussions Leave Skopje 16:10 (OS864) Arrive Vienna 18:00	Attend signing of the M/D Discussion with Makedonija Pat	Skopje
13	Sep1 Fri	Report to JICA and EOJ Leave Vienna 17:40 (OS8555) Arrive Tokyo 14:55	Discussion with Makedonija Pat	Skopje
14	2 Sat		Data analysis	Skopje
15	3 Sun		Internal meeting	Skopje
16	4 Mon		Discussion with Makedonija Pat	Skopje
17	5 Tue		Site visit Skopje asphalt plant	Skopje
18	6 Wed		Site visit workshop	Skopje
19	7 Thu		Discussion with Makedonija Par	Skopje
20	8 Fri		-Ditto-	Skopje
21	9 Sat		Data analysis	Skopje
22	10 Sun		Internal meeting	Skopje
23	11 Mon		Discussion with Makedonija Pat	Skopje
24	12 Tue		Local maintenance services, garage	Skopje
25	13 Wed		Local construction company	Skopje
26	14 Thu		Local transportation company	Skopje
27	15 Fri		Private asphalt plant site visit	Skopje
28	16 Sat		Data analysis	Skopje
29	17 Sun		Internal meeting, preparation of report	Skopje
30	18 Mon		Discussion with Makedonija Pat	Skopje
31	19 Tue		-Ditto-	Skopje
32	20 Wed		Site visit: road maintenance work site	Skopje
33	21 Thu		Report to the Ministry of Transport and Communications and Makedonija Pat Leave Skopje 16:10 (OS864) Arrive Vienna 18:00	Vienna
34	22 Fri		Report to JICA and the EOJ Leave Vienna 12:00 (SR215) Arrive Zurich 13:15 Leave Zurich 14:00 (SR168)	Flight
35	23 Sat		Arrive Tokyo 08:40	

Draft Report Explanatory Mission

No.	Date	Activities		Stay
		Official member	Consultant	
1	10/22 Sun.		Leave Tokyo 12:00 (SR169) Arrive Zurich 17:30 Leave Zurich 20:15 (SR210) Arrive Vienna 21:35	Vienna
2	10/23 Mon.		Courtesy call to JICA and the Embassy of Japan in Vienna (EOJ) Leave Vienna 13:30 (OS863) Arrive Skopje 15:10	Skopje
3	10/24 Tue.		Courtesy call and discussion with the Ministry of Transport and Communications (MOTC), Roads Fund and Makedonija Pat	Skopje
4	10/25 Wed.		Discussion with Makedonija Pat Specifications for asphalt plant and dump trucks, and Draft Report	Skopje
5	10/26 Thu.		- Ditto-	Skopje
6	10/27 Fri.		- Ditto-	Skopje
7	10/28 Sat.	Leave Tokyo 11:10 (JL451) Arrive Zurich 16:40	Data collection and arrangement	Official member: Vienna Consul: Skopje
8	10/29 Sun.	Leave Zurich 10:05 (SR474) Arrive Skopje 12:10		Skopje
		Internal meeting		
9	10/30 Mon.	Courtesy call to: 9:00 Makedonija Pat 10:00 Ministry of Transport and Communications 11:00 Ministry of Finance 12:15 Ministry of Foreign Affairs 13:00 World Bank 14:00 Roads Fund 15:00 Makedonija Pat	Discussion with Makedonija pat	Skopje
10	10/31 Tue.	Site visit; Makedonija Pat's Avtopat branch, asphalt plant site, target roads		Skopje
11	11/1 Wed.	Site visit: Target roads.		Skopje
12	11/2 Thu.	Sign on the Minutes of Discussions	Attend signing of the M/D	Vienna
		Leave Skopje 16:20 (OS864) Arrive Vienna 18:05		
13	11/3 Fri.	Report to JICA and EOJ		Flight
		Leave Vienna 16:20 (KL1846) Arrive Amsterdam 18:15 Leave Amsterdam 20:15 (JL412)		
14	11/4 Sat.	Arrive Tokyo 15:30		

Appendix 3 List of the Party Concerned in Macedonia

1) Public Company Makedonia - PAT

Mr. Djordjevski Spasen	Director
Mr. Masai Nuhi	Chief Engineer, Mechanical
Mr. Ilcho Andreevski	Chief Engineer, Operation
Mr. Stojman Jovcevski	Consultant for Makedonia - PAT
Skopje Branch	
Mr. Jobicha Labidobik	General Manager
Mr. Kreto Genchov	Mechanical Manager

2) Ministry of Transport and Communications

Mr. Ljupco Balkoski	Minister
Mr. Dimitar Elimov	Assistant Minister (when BD survey mission)
Mr. Zoran Lapevski	Assistant Minister (when DFR explanatory mission)
Mr. Zoran Crvenkovski	Head of International Road Transport Dept.

3) Fund for National and Regional Roads

Mr. Vulnet Palloshi	Director
Mr. Enver Zenku	Deputy Director
Mr. Ljubomir Cvetkovski	Financial Director
Mr. Tasevski Dimitrioa	Chief Engineer, Highway Maintenance
Mr. Drakulovski Boris	Engineer, Road Maintenance

4) Ministry of Finance

Mrs. Jakovleva Dadica	Head of Division, International Finance Dept.
Mrs. Zendelska Veda	Head of Division, Tax Dept.
Mrs. Janevska Svetrana	Assistant to Minister, Tax Dept.

5) Ministry of Foreign Affairs

Mr. Risto Blazevski	Assistant Minister
Mr. Jordan T. Panev	Special Advisor

6) International Organizations

Mr. Zarko Bogoev	The World Bank, Infrastructure Operation Officer
Mr. Zoran Petrovski	European Union, Programme Officer Assistant Secretary
Mrs. Elena Urumovska	European Bank for Reconstruction and Development (EBRD) Financial Analyst

7) Embassy of Japan in Austria

Mr. Hiroshi Honjo	Third Secretary
Mr. Idemitsu Aya	Special Assistant/Balkan Division
Dr. Kosta Balabanov	Honorary Consul General
Ms. Kazu Lesnikovska	Administrative Staff, Skopje Liaison Office

8) JICA, Austria Office

Mr. Ikufumi Tomimoto	Resident Representative
Ms. Akiko Nanami	Assistant Resident Representative
Mr. Nakai Masahiro	Assistant Resident Representative
Mr. Ladislav Lesmikovski	Technical Coordinator, Skopje Office

Appendix 4 Minutes of Discussion

Skopje, August 31, 2000

Mr. Dimitar ELIMOV
Assistant Minister
Ministry of Transport and Communications

Dear Mr. ELIMOV

I have the honor to refer to our recent discussions regarding the Project for Improvement of Road Maintenance Equipment in the former Yugoslav Republic of Macedonia (hereinafter referred to as "the Project").

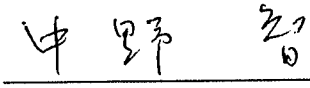
In response to the request of the Government of the former Yugoslav Republic of Macedonia (hereinafter referred to as "Macedonia"), the Government of Japan decided to conduct a Basic Design Study on the Project and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent to Macedonia a study team headed by myself for examining the viability of the Project from August 21 to Septembr 21, 2000.

The team held intensive discussions with the officials concerned and also conducted field surveys at the study area with the helpful assistance of the Ministry of Transport and Communications.

In the course of discussions and field surveys, I believe that the main items described on the attached sheets have been confirmed. The team will proceed to further works and prepare the Basic Design Study Report.

On behalf of all the members of the team, I wish to express my sincere appreciation to the officials concerned of your government for their kind assistance and close cooperation extended to the team. I hope that the Project will contribute to the enhancement of friendly relations between our two countries.

Yours Sincerely,



Satoshi NAKANO
Leader
Basic Design Study Team
JICA

REPUBLIC OF MACEDONIA
MINISTRY OF TRANSPORT AND COMMUNICATIONS
- DEPARTMENT FOR ROAD TRANSPORT AND ROADS -
SKOPJE

Our ref: 07- 7801
Date: 31.08.2000

Mr. Satoshi NAKANO
Leader
Basic Design Study Team
JICA

Dear Mr. Nakano,

I have herein acknowledged your letter dated August 31, 2000 and have confirmed the contents of the attachment of the letter.

Yours Sincerely,

Dimitar Elimov
Assistant Minister

91000 Skopje , Plostad Crvena Skopska Opstina No. 4,
Tel: ++ 389 91 109 604 ; ++ 389 91 117 072 fax : ++ 389 91 230 877

Attachment

1. Objective of the Project

The objective of the Project is that the existing roads in Macedonia will be properly rehabilitated and maintained by improving road maintenance equipment of the Public Company "Makedonija Pat".

2. Project Sites

The sites of the Project are shown in Annex-1.

3. Responsible Ministry and Implementing Agency

3.1 The responsible Ministry is the Ministry of Transport and Communications.

3.2 The implementing agency is Makedonija Pat.
The organization charts are shown in Annex-2.

4. Items Requested by the Government of Macedonia

After discussions with the Team, the items described in Annex-3 were finally requested by the Macedonian side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5.1 The Macedonian side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-4.

5.2 The Macedonian side will take the 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 studies in Macedonia until September 21, 2000.

6.2 JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around the end of October 2000.

6.3 In case that the contents of the report is accepted in principle by the Government of Macedonia, JICA will complete the final report and send it to the Government of Macedonia by January 2001.

7. Other Relevant Issues

7.1 Makedonija Pat shall not be privatized in the foreseeable future.

7.2 The equipment to be procured under the Grant Aid (hereinafter referred to as "the Equipment") shall be used only for rehabilitation and maintenance of national (motorways are excluded) and primary regional asphalt-paved roads under the responsibility of the following four Makedonija Pat's branch offices, i.e. Skopje, Veles, Stip and Bitola.
The target road links and sections shall be prioritized and selected according to the following criteria:

- Deterioration level, which falls into the rehabilitation and maintenance criteria set out by the Makedonija Pat's standards,
- Traffic volume,
- Economic and social benefit.

The final target road links and sections will be decided through the analysis in Japan.

7.3 The Macedonian side requested that the delivery condition should be CIF Skopje, Makedonija Pat's Avtopat branch office, in order to receive joint initial training by the Equipment's manufacturing companies, which is covered by the Grant Aid, for necessary engineers of all the branch offices.

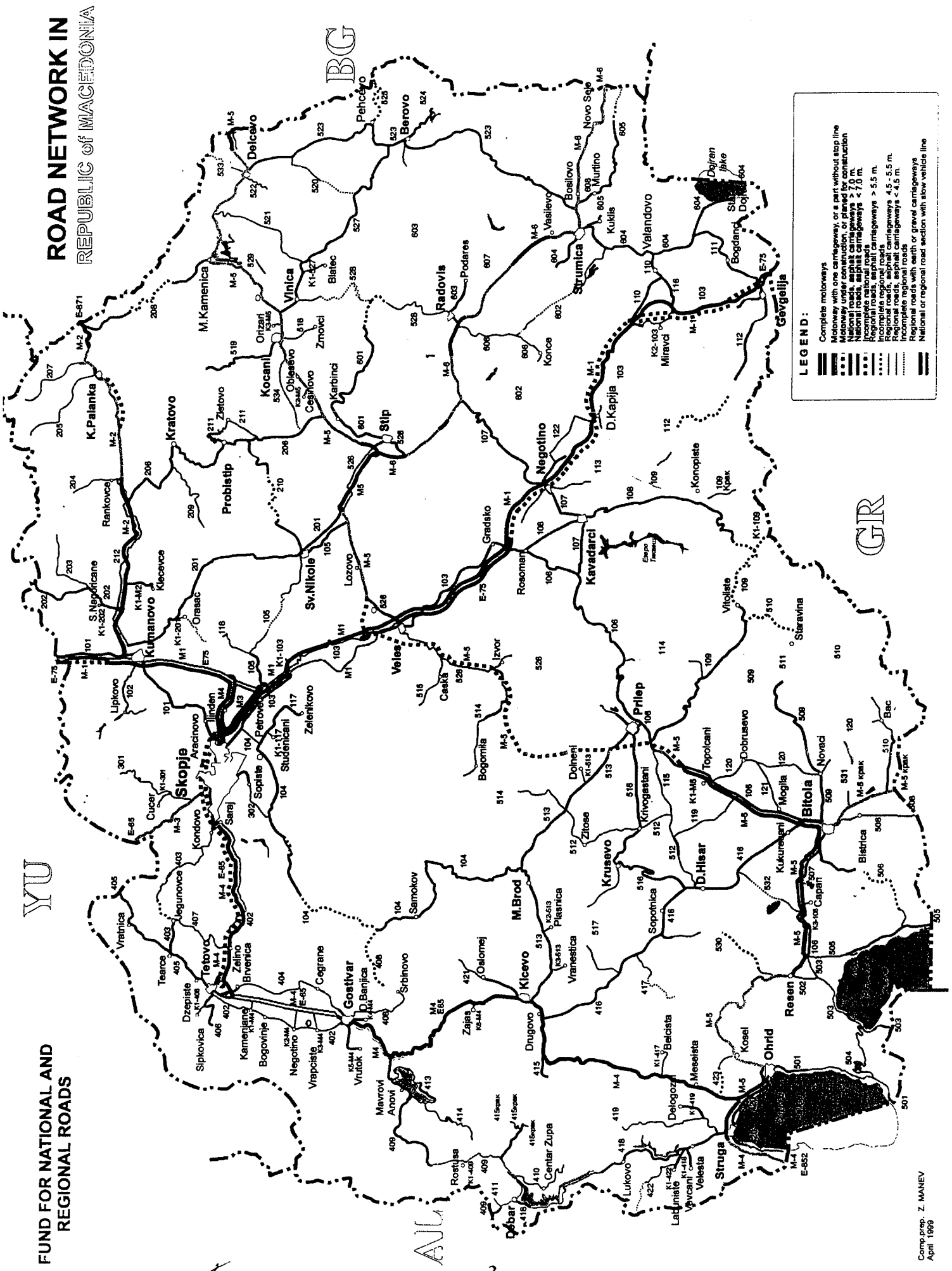
7.4 The Macedonian side shall secure storage yard for the Equipment before its delivery, and land cleared and leveled before the commencement of the construction of the asphalt plant.

7.5 The Macedonian side shall take all the necessary measures to clear environmental regulations according to the laws of Macedonia concerning the asphalt plant before the commencement of its construction.

7.6 The Macedonian side shall secure all the necessary budget and personnel for the operation and maintenance of the Equipment.

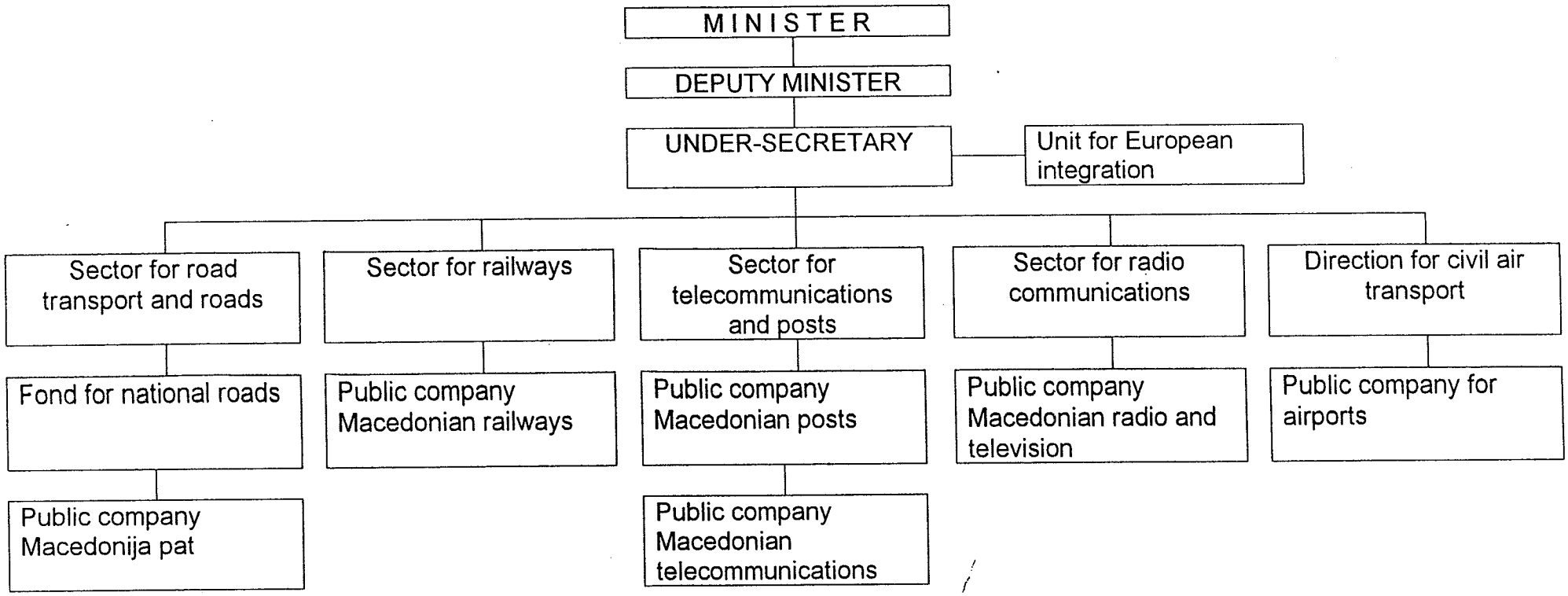
7.7 The Ministry of Transport and Communications shall take all the necessary measures for the tax exemption, including VAT, concerning the Project.

Annex-1 Project Sites

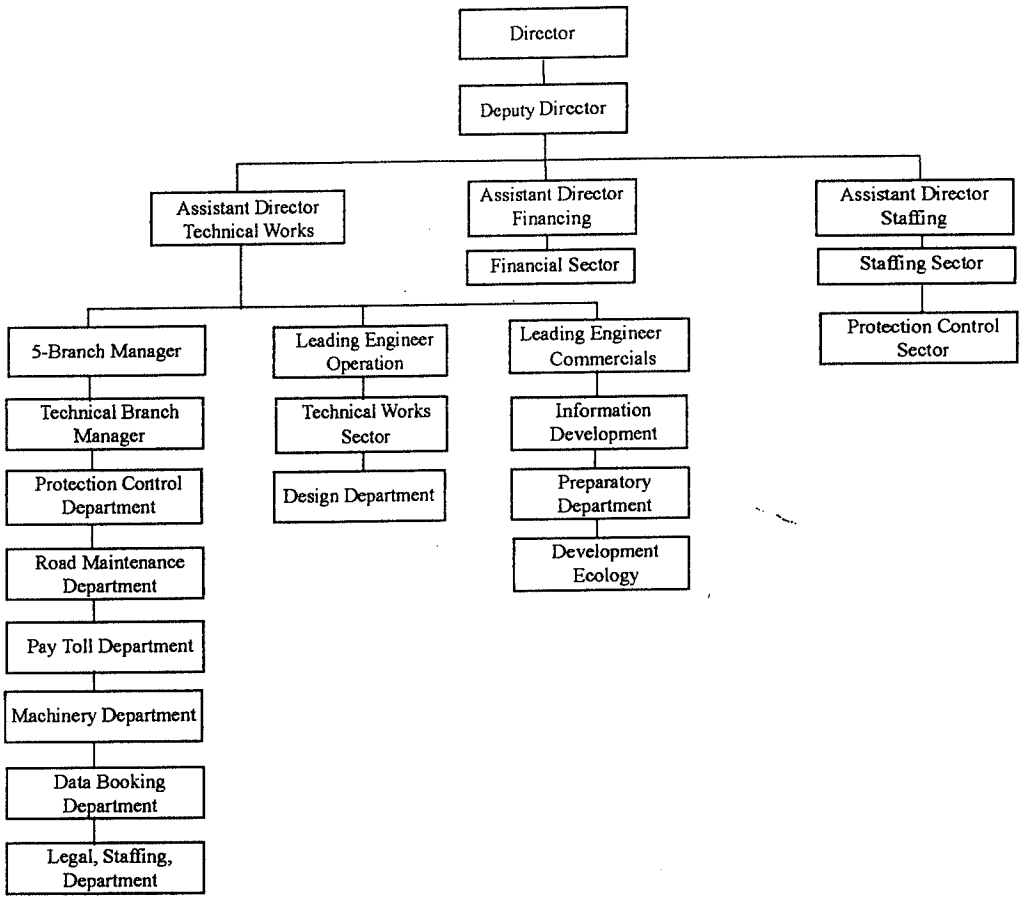


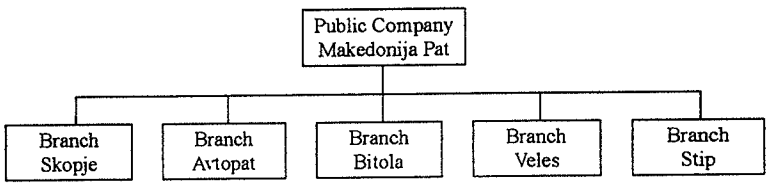
Annex - 2 Organization Charts

Ministry of Transport and Communications



Public Company Makedonija Pat





Annex-3 Items Requested by the Government of Macedonia

No	Name	Tentative Spec	Unit	Q'ty	Priority
1.	Bulldozer with ripper	160~200HP	Piece	2	A
2.	Motor grader	135H, 3.7m	Piece	4	A
3.	Wheel loader	150HP, 1.8~2.5m3	Piece	4	A
4.	Hydraulic excavator with breaker	Crawler type, 0.8m3	Piece	1	A
5.	Hydraulic excavator with breaker	Wheel type, 0.4m3	Piece	1	A
6.	Vibration roller	10t	Piece	4	A
7.	Vibration roller	4t	Piece	4	B
8.	Pneumatic roller	5~15ton	Piece	4	A
9.	Asphalt finisher	3.5~6.0m	Piece	4	A
10.	Asphalt distributor	4000ltr, 2.3~3.6m	Piece	1	B
11.	Asphalt plant	60t/h	Unit	1	A
12.	Workshop tools		Set	4	C
13.	Spare parts	For the above equipment	Lot	1	B

Priority: A/Most needed, B/Highly needed, C/Needed

Note: Final equipment for the Project will be decided through the analysis in Japan.

Japan's Grant Aid

1. Grant Aid Procedures

(1) Japan's Grant Aid project 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)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

(2) Firstly, the application or 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 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.

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

(4) 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.

(5) 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.

(6) 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

(1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the 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 Study are as follows:

1) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of the agencies concerned in the recipient country necessary for the Project's implementation,

2) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid scheme from a technical, social and economic point of view,

3) Confirmation of items agreed on by both parties concerning the basic concept of the Project,

4) Preparation of a basic design of the Project,

5) Estimation of costs of the Project.

The contents of the original requests are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed following 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 the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is to be confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on the 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 Study is(are) recommended by JICA to the recipient country to work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

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

(2) Exchange of Notes (E/N)

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

(3) "The period of the Grant Aid" means the one fiscal year that the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes,

concluding contracts with (a) consultanting 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 weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year by mutual agreement between the two Governments.

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

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

However, the prime contractors, namely, consulting, construction 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.)

(5) Necessity of "Verification"

The Government of 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.

(6) Undertakings required by the Government of the Recipient Country

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

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

3) To secure buildings prior to the procurement in the case of installation of the equipment.

4) To ensure all the expenses for and prompt execution of unloading, customs clearance at the port of disembarkation and inland transportation of the goods purchased under the Grant Aid.

5) 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 Contract.

6) 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.

7) "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 expenses other than those covered by the Grant Aid.

8) "Re-export"

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

9) 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.

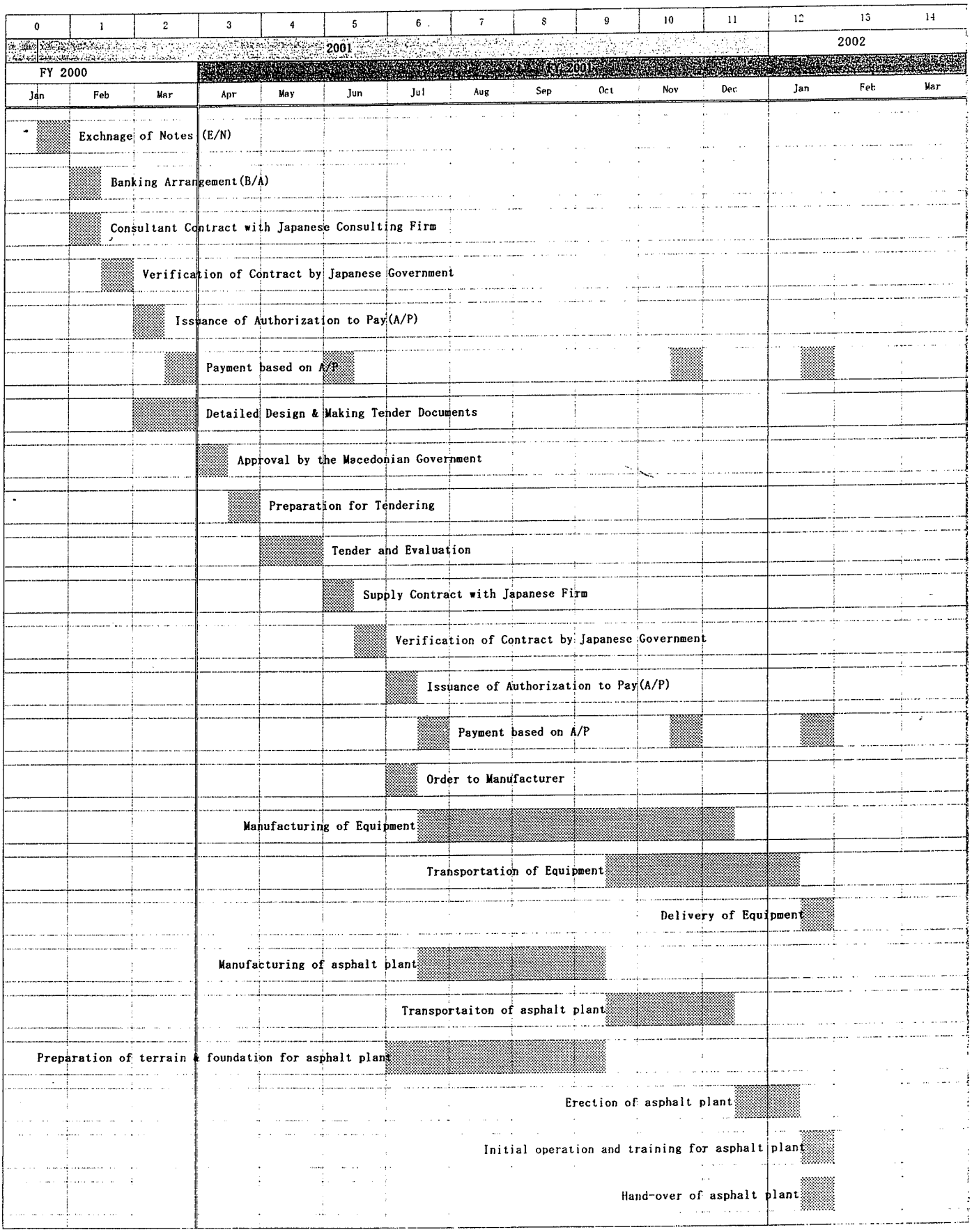
Annex-5

Major Undertakings to be Taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Country
1	To bear the following commissions to a bank of Japan for the 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 place of disembarkation in the Recipient Country.		
	1) Marine (Air) transportation of the products from Japan or third country to the Recipient Country.	●	
	2) Tax exemption and custom clearance of the products at the place of disembarkation		●
	3) Internal transportation from the place 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 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 including the operation and maintenance costs.		●

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

The Project for Improvement of Road Maintenance Equipment



Skopje, November 2, 2000

Mr. Zoran LAPEVSKI
Assistant Minister
Ministry of Transport and Communications

Dear Mr. LAPEVSKI:

I have the honor to refer to our recent discussions regarding the Project for Improvement of Road Maintenance Equipment (hereinafter referred to as "the Project") in the Former Yugoslav Republic of Macedonia (hereinafter referred to as "Macedonia").

In August 2000, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project to Macedonia, and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult the Macedonian side on the components of the draft report, JICA sent to Macedonia the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by myself, Official, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affaires, from October 22 to November 6, 2000.

As a result of discussions, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

On behalf of all the members of the Team, I wish to express my sincere appreciation to the officials concerned of your government for their kind assistance and close cooperation extended to the Team. I hope that the Project will contribute to the enhancement of friendly relations between our two countries.

Yours sincerely,

大石 雅美

Masami OISHI
Leader
Draft Report Explanation Team
JICA

REPUBLIC OF MACEDONIA
MINISTRY OF TRANSPORT AND COMMUNICATIONS
- DEPARTMENT FOR ROAD TRANSPORT AND ROADS -
SKOPJE

Our ref: 07- 7801/1
Date: 01.11.2000

TO
Ms. Masami OISHI
Leader
Draft Report Explanation Team
JICA

Dear Ms. Oishi,

I have herein acknowledged your letter dated November 2, 2000 and have confirmed the content of the attachment of the letter.

Yours sincerely,

Zoran Lapevski
Assistant Minister

91000 Skopje , Plostad Crvena Skopska Opstina No. 4,
Tel: ++ 389 91 109 604 ; ++ 389 91 117 072 fax : ++ 389 91 230 877

ATTACHMENT

1. **Components of the Draft Report**

The Government of Macedonia agreed to and accepted in principle the components of the Draft Report explained by the Team.

2. **Japan's Grant Aid Scheme**

The Macedonian side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Macedonia as explained by the Team and described in Annex-4 and Annex-5 of the Minutes of Discussions signed by both parties on August 31, 2000.

3. **Schedule of the Study**

JICA will complete the Final Report in accordance with the confirmed items and send it to the Government of Macedonia by January 2001.

4. **Other Relevant Issued**

4.1 The Makedonija Pat shall not be privatized in the foreseeable future.

4.2 The final target road links and sections of the Project are as Annex-1 and don't contain the road links and sections that the Macedonian side is requesting the compensation by NATO.

4.3 Both sides confirmed that the delivery condition should be CIP Skopje, the Makedonija Pat's Avtopat branch office, for the Equipment except components of asphalt plant, and that the delivery cost between the Avtopat branch office and other branch offices shall be borne by the Macedonian side.

Regarding the components of asphalt plant, both sides confirmed that the delivery condition should be CIP Skopje, the Skopje branch office's existing asphalt plant site, where the asphalt plant under the Project shall be installed.

4.4 The Macedonian side shall secure storage yard for the Equipment before its delivery and land cleared and leveled before the commencement of the construction of the asphalt plant under the Project, i.e. not later than August 2001.

4.5 The Macedonian side shall acquire permission form the relevant authority of Macedonia regarding environmental conservation law for installation of asphalt plant under the Project soon after the technical specifications of the said asphalt plant be verified by the Government of Japan.

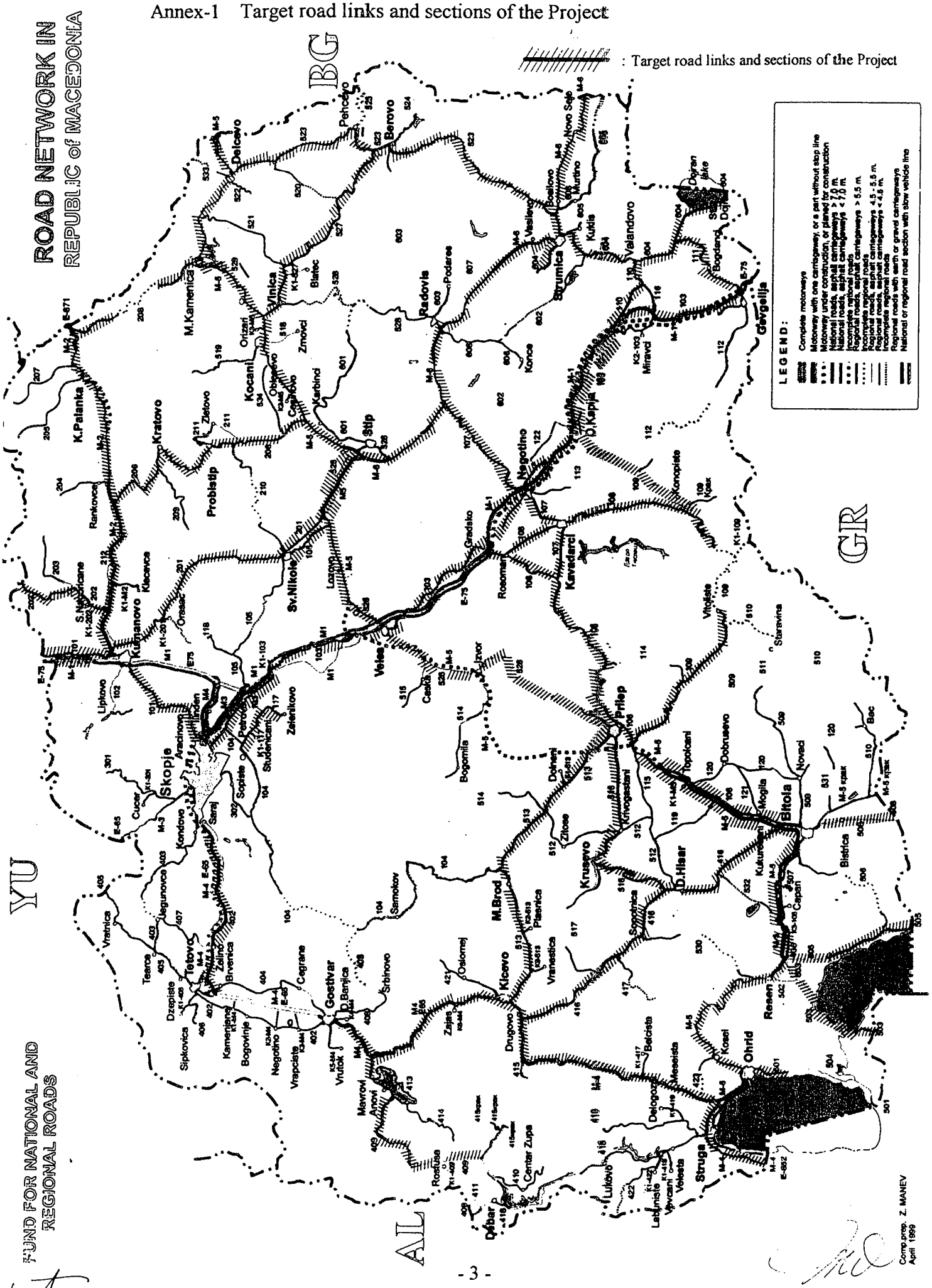
4.6 The Macedonian side shall complete all the preparatory works, including construction of foundation, necessary for installation and operation of the asphalt plant under the Project in time, as shown in Annex-2.

4.7 The Macedonian side shall bear the costs for installing the asphalt plant under the Project.

4.8 The Macedonian side shall secure all the necessary budget and personnel for the operation and maintenance of the equipment under the Project.

4.9 The Ministry of Transport Communications shall take all the necessary measures for the tax exemption, including VAT, concerning the Project.

Annex-1 Target road links and sections of the Project



Annex-2 Schedule of Asphalt Plant Installation at Makedonija Pat's Skopje Branch

Item	2001												2002		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Custom clearance												▼			
Preparatory works by Makedonija Pat				◄	—	—	►								
Geotechnical investigation				—											
levelling of terrain				—											
Installation of power line, water					—										
line & drainage facilities															
Construction of access road						—									
Construction of foundation						—	—								
Erection of asphalt plant by												◄	—	►	
Makedonija Pat under supervision															
of manufacturer's engineer(s)															
Unpacking of the components												▼			
Checking of the foundation												▼			
Erection of the structure												—	—		
Piping for fuel & asphalt													—		
Electric cable work													—		
Test operation													—		
Initial training													—		
Hand over														▼	

Appendix 5 Estimation of Cost to be Borne by the Macedonian Side

Item	Description		Spec.	Volume	Unit	Unit Price	Amount	Remarks
1.	Preparatory works				msq		21,500.00	
	Topographic survey			1	LS		25,500.00	
	Boring and sounding test			75	m	3,650	273,750.00	
						Total 1:	**320,650.00**	
2.	Foundation work							
	Material	Concrete	24kN	150	m3	7,770.00	1,165,500.00	
		Cruched stone aggregates	40-0mm	200	m3	1,642.20	328,440.00	
		Steelbar	13mm	15,000	kg	44.03	660,450.00	
	Equipment	Excavator	0.6m3	7x8=56	unit/hour	3,064.0	171,612.00	with operator, fuel, etc.
		Dump truck	10ton	7x8=56	unit/hour	4,240.00	237,440.00	with driver, fuel etc.
		Vibration roller	1ton	7x8=56	unit/hour	2,407.50	39,984.00	1*7days
	Labor	Foreman		7x8=56	person/hour	714	39,984.00	1*7days
		Skilled labor		21x8=168	person	446.25	74,970.00	3*7days
		Common labor		8x70=560	person	375	210,000.00	10*7days
	Others	Scaford, curing		1	LS	185,000.00	185,000.00	
						Total 2:	**3,208,216.00**	
3.	Assemble							
	Equipment	Truck crane	30t	14x8=112	unit/hour	10,495.50	1,175,496.00	with operator, fuel, etc.
		Trailer truck	20t	14x8=112	unit/hour	6,250.60	700,067.00	with operator, fuel, etc.
	Labor	Foreman		14x8=112	person/hour	530	59,360.00	1*14days
		Skilled labor		56x8=448	person/hour	446.25	199,920	4*14days
		Welder		28x8=224	person/hour	446.25	99,960.00	2*14days
		Common labor		8x140=112	person/hour	375	420,000	10*14days
	Others	Tools, consumable		1	LS	38,000.00	38,000.00	
						Total 3:	**2,692,803.20**	

Item	Description		Spec.	Volume	Unit	Unit Price	Amount	Remarks
4.	Piping work							
	Equipment	Truck with crane		7x8=56	unit/hour	1,952.50	109,340.00	with operator, fuel, etc.
	Labor	Foreman		7x8=56	person/hour	714	39,984.00	1*7days
		Plumber		28x8=224	person/hour	446.25	99,960	4*7days
		Common labor		70x8=560	person/hour	375	210,000.00	10*7days
	Others	Tools, consumable		1	LS	34,500	34,500.00	
						Total 4:	**493,784.00**	
5.	Electric cable work							
	Labor	Foreman		7x8=56	person/hour	714	39,984.00	1*7days
		Electrician		28x8=224	person/hour	446.25	99,960.00	4*7days
		Common labor		35x8=280	person/hour	375	105,000.00	5*7days
	Others	Tools, consumable		1	LS	33,000.00	33,000.00	
						Total 5:	**277,944.00**	
						All Total:	**6,993,397.20**	

Note: The unit prices from the item 1 to 5 shall include labor transportation, engineering cost, company's profit, social costs, and all other costs required for the works, excluding VAT and other taxes.