GENERAL DIRECTORATE OF FORESTRY

Summary Report

REPUBLIC OF TURKEY

PILOT SURVEY FOR DISSEMINATING SMALL AND MEDIUM ENTERPRISES TECHNOLOGIES FOR COUNTERMEASURES AGAINST AVALANCHE HAZARDS

September, 2016

Japan International Cooperation Agency

PROTEC ENGINEERING, INC.

1. BACKGROUND

Due to heavy snow in the winter, increasing cases of avalanche hazards in the mountainous area of Turkey has caused loss of lives as well as tremendous economic losses due to road blockades.

Through the field visit to Turkey conducted by PROTEC ENGINEERING, INC. in March 2013, the necessity for taking action against avalanche and concerning issues were recognized as follows:

(a) Shortage of engineers who are specialized in avalanche management

(b) Lack of companies that can construct effective anti-avalanche structures based on constructional analysis

To solve these problems, PROTEC ENGINEERING, INC. recognized the possibility of contributing its technologies of countermeasures against avalanche hazards that have been accumulated and demonstrated in heavy snowfall areas in Japan in collaboration with researchers who are specialized in avalanche management.

2. OUTLINE OF THE PILOT SURVEY FOR DISSEMINATING SME'S TECHNOLOGIES

(1) Purpose

(a) To examine the effectiveness of avalanche prevention fences and avalanche monitoring system as countermeasures against avalanche hazards in Turkey

(b) To provide educational training including trainings in Japan to the staff from GENERAL DIRECTORATE OF FORESTRY who are in charge of avalanche hazards prevention

(2) Activities

[Test construction and demonstration]

(a) Determine the avalanche prevention fence construction site based on the discussion between PROTEC ENGINEERING, INC. and GENERAL DIRECTORATE OF FORESTRY

(b) Carry out site survey of the construction site

(c) Design the avalanche prevention fences according to the condition of the construction site

(d) Construct the avalanche prevention fences and avalanche monitoring system at avalanche hazardous areas in Turkey

(e) Monitor and examine the effectiveness of the avalanche prevention fence and provide the result to GENERAL DIRECTORATE OF FORESTRY

[Technology transfer and dissemination]

(a) Carry out workshops in Turkey, trainings in Japan and share reference materials

(b) Support the Turkish government to build the management system for countermeasures against avalanche

(c) Inspect avalanche hazardous sites to propose appropriate avalanche prevention methods

(d) Promote dissemination of proposed products in Turkey

(3) Information of Product/ Technology to be Provided

[Product 1: avalanche prevention fence "ARC Fence S (Snow) Type"]

(a) Mainly installed on a slope to protect buildings and highways against avalanche

(b) Capable of sustaining maximum snow accumulation depth of 3m

(c) Capable of sustaining maximum rock fall energy of 50KJ

(d) Designed to withstand snow pressure on a basis of mechanical analysis and simulation, and structural calculation of components

[Product 2: avalanche monitoring system]

Monitor the snow fall in the project implementation site on the internet and examine the effects of avalanche prevention fences as well as predicting avalanche

(4) Counterpart Organization

General Directorate of Forestry (OGM: Orman Genel Müdürlüğü)

(5) Target Area and Beneficiaries

Target Area is Mountainous area of Turkey

Beneficiaries are residents of avalanche hazardous area and road users passing through the avalanche hazardous area in Turkey

(6) Duration

36 months start from October 2013

(7) Progress Schedule

(a) Construction of the avalanche prevention fences

Place	Time	Implementation matters
Turkey	Nov, 2013	Carry out site survey of the construction site
		Select local construction company
	Dec, 2013	Create survey drawing of the site

Japan	Feb, 2014	Design the avalanche prevention fences
Turkey	May, 2014	Determine the installation position of the fences
Japan	June, 2014	Manufacture products and prepare construction equipment
	July-Aug, 2014	Export products and equipment
Turkey	Sep-Dec, 2014	Discuss and make contract with local construction company
	Apr-June, 2015	Construct the avalanche prevention fences

(b) Demonstration of the avalanche prevention fences

Place	Time	Implementation matters
Japan	Dec,2015～ May,2016	Monitor and examine the effectiveness of the avalanche prevention fence with avalanche monitoring system
Japan Turkey	June,2016	Summarize measurement results and provide to General Directorate of Forestry

(c) Technology transfer about countermeasure against avalanche

Place	Time	Implementation matters
Turkey	Sep, 2015 Feb, 2016 May, 2016	Workshops about "avalanche and countermeasure against avalanche " [The first time (Sep, 2015)] Structure of ARC-S and construction method [The second time (Feb, 2016)] Design and integration of countermeasure against avalanche [The third time (May, 2016)] Maintenance of avalanche prevention fence
Japan	Oct, 2014	Training in Japan (Turkish local construction company)
Japan	Jan, 2015	Training in Japan (Government officials and academics)

(8) Manning Schedule

Please refer to attached sheet

(9) Implementation System

(a) Contractor and external human resources

Name	Belonging	Role
Junichiro Aizawa	PROTEC ENGINEERING,INC.	Operational chief
Chihori Tatebe	PROTEC ENGINEERING,INC.	Operational assistant

Yoichi Nishita	PROTEC ENGINEERING,INC.	Technical chief
Michiaki Yamamoto	PROTEC ENGINEERING,INC.	Technical chief
Takahiro Harada	PROTEC ENGINEERING,INC.	Technical assistant
Minoru Watanabe	PROTEC ENGINEERING,INC.	Technical assistant
Hirotaka Fukuta	PROTEC ENGINEERING,INC.	Construction chief
Tomohide Obata	PROTEC ENGINEERING,INC.	Construction assistant
Kazunari Hasegawa	PROTEC ENGINEERING,INC.	Administrative specialist
Kaoru Izumi	Niigata University	Chief Advisor
Toshichika Takechi	KOEI CO.,LTD	Monorail technician
Takahiro Matsuda	KOEI CO.,LTD	Monorail technician
Taketo Kimura	KOEI CO.,LTD	Monorail technician
Tatsunori Iriyama	IRIYAMA CO.,LTD	Footstep technician
Kyohei Tanaka	IRIYAMA CO.,LTD	Footstep technician
Jun Mishima	IRIYAMA CO.,LTD	Footstep technician
Masahiro Fuse	IRIYAMA CO.,LTD	Footstep technician
Koichi Hanyuda	IRIYAMA CO.,LTD	Footstep technician
Kazunari Nakamura	IRIYAMA CO.,LTD	Footstep technician
Junichi Netsu	MIYAZAWA CO.,LTD	Construction technician
Kenji Kawamura	MIYAZAWA CO.,LTD	Construction technician

(b)Counterpart

Name	Belonging	Role
Yusuf Ziya Ergene	GENERAL DIRECTORATE OF FORESTRY	Chief
Sıtkı Eraydın	GENERAL DIRECTORATE OF FORESTRY	Practitioners
Özgür Alaçam	GENERAL DIRECTORATE OF FORESTRY	Practice assistance

3. ACHIEVEMENT OF THE SURVEY

(1) Outputs and Outcomes of the Survey

(a) Installation of avalanche protection facilities

- On the result of discussion with General Directorate Forestry, we decided that Bolu Province Ayıkaya to be the site of demonstration project. (Nov, 2013)
- Using result of field survey we designed the product and determined the product

installation position on the site. (May, 2014)
- Procured product material and equipment for the installation and exported from Japan to Turkey. (Jul-Aug, 2014)
- Selected Turkish local construction company and carried out the preparations for the construction. (Nov, 2014 - Mar, 2015)
- Installed the avalanche prevention fence and monitoring system. (Apr-Jun, 2015)

(b) Technology transfer
- Carried out training in Japan for the local construction company concerning how to construct avalanche prevention fence and equipment for construction. (Oct, 2014)
- Carried out training in Japan for government officials and academics concerning Japanese method of countermeasure against avalanche. (Jan, 2015)
- Carried out first workshop in Turkey for government officials and academics concerning construction method of avalanche prevention fence. (Sep, 2015)
- Carried out second workshop in Turkey for government officials and academics concerning planning of avalanche measures, the design and integration of avalanche prevention fence. (Feb, 2016)
- Carried out third workshop in Turkey for government officials and academics concerning the maintenance of avalanche prevention fence. (May-Jun, 2016)

(c) Measurement of effect and provide results
-Observed weather, snow accumulation, occurrence of avalanche and situation of fence from autumn 2015 until spring 2016.
The maximum snow accumulation was about 1.0m.
Snow accumulation was relatively small but avalanche didn't occur and crack also didn't occur.
-Provided data about measurement of effect and Yedigöller National Park utilization index which show tourists increase during winter to GENERAL DIRECTORATE OF FORESTRY.
-Explained effectiveness of the avalanche prevention facilities to GENERAL DIRECTORATE OF FORESTRY.

(2) Self-reliant and Continual Activities to be Conducted by Counterpart Organization
-GENERAL DIRECTORATE OF FORESTRY obtained basic knowledge of avalanche measures through this project.
Therefore while processing actual projects they will gradually get used to plan

countermeasure against avalanche autonomously.
-GENERAL DIRECTORATE OF FORESTRY needs to make Turkish Standard for countermeasure against avalanche and they can use knowledge and documents obtained through training in Japan and workshops in Turkey.
-PROTEC ENGINEERING,INC. will continue co-operate with GENERAL DIRECTORATE OF FORESTRY concerning countermeasure against avalanche and try to deal in some projects in Turkey.
-It takes a few years to master specific design method and construction method. Therefore PROTEC ENGINEERING, INC. hired Turkish staff in Japan and started nurturing in a planned manner.
-Forming a plan to provide human resources that can contribute to the Turkish development of countermeasure against avalanche.

4. FUTURE PROSPECTS

(1) Impact and Effect on the Concerned Development Issues through Business Development of the Product/ Technology in the Surveyed Country

(a) Prevention of human suffering caused by avalanche

-By installing ARC-S in this project, we prevented occurrence of avalanche.
Highest snow accumulation was about 1.0m on snow season from 2015 fall to 2016 spring. It was less snow than usual and less than designed capable snow depth of 3.0m. Therefore we will continue observing next year.
-The road under the site was not paved and snow removal has not done in winter, so people could not go through in winter and there was no accident caused by avalanche. However the road was paved and ARC-S was installed in 2015 and snow removal was carried out, so many people go through in winter and enjoy beautiful view of Yedigöller. It is expected that ARC-S will contribute to safe passage of the road.

(b) Economic effect by utilizing Yedigöller National Park

-As stated on 4. (1) (a) the road under the site was not paved and snow removal has not done in winter, so people could not go through and could not enjoy Yedigöller National Park in winter.
-Following table is the utilization index of the park during three-and-a-half years from 2013 until Jun, 2016.
-The number of users has increased significantly from Aug, 2015 when the pavement of the road has been started.
-There were little snow on Dec, 2015 and because of pavement snow was easy to melt,

there was no hindrance to the passage of the vehicle, the number of users has recorded the most in three years.

-Snow has increased from early January to mid-February 2016 and snow removal has not carried out. They removed snow in mid-February and it was very smooth because avalanche has not occurred and there were no snow-mountain on the road.

-During the project period we can observe only one season after installing fence, but the economic effect should be judged over multiple seasons after the end of this project and we will continue observing.

Yedigöller National Park utilization index (2013-Jun, 2016)[1]

	Number of cars (Thousand cars)				Number of people (Thousand people)				Entrance fee (Thousand TL)			
year	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
Jan	0	0	0	0	0.3	0.4	0.3	0	0.7	1.0	1.2	0.0
Feb	0	0.1	0	0.2	0	0.5	0.1	0.6	0.0	1.3	0.5	2.4
Mar	0.1	0	0	1.5	0.5	0.2	0.1	5.4	1.2	0.5	0.5	19.7
Apr	0.4	0.5	0.3	4.7	2.0	2.3	1.4	17.7	4.9	5.7	4.5	63.7
May	1.6	1.2	2.1	4.6	8.2	6.1	9.2	20.0	20.2	15.0	31.2	68.3
Jun	0.8	0.5	0.8	1.6	4.0	2.4	3.8	5.6	9.8	5.9	12.2	21.1
Jul	0.7	1.3	2.0		2.9	5.6	7.1		7.2	13.9	26.0	
Aug	1.6	1.5	3.7		7.2	6.4	12.4		17.9	15.9	46.8	
Sep	0.7	0.4	3.2		3.3	2.0	10.9		8.1	4.9	40.8	
Oct	1.7	1.7	4.7		8.5	8.8	17.1		21.0	21.7	62.3	
Nov	0.6	1.5	5.5		3.9	7.9	22.5		9.4	19.5	78.1	
Dec	0	0.3	6.2		0.2	1.3	24.8		0.5	3.3	86.8	

(c)Human resource development

-Through training in Japan and workshops in Turkey we provided Japanese way of planning, designing, constructing about countermeasure against avalanche to the government officials and academics. Through these guidance, they obtained basic knowledge of countermeasure against avalanche. Therefore while processing actual projects they will gradually get used to plan countermeasure against avalanche autonomously.

-As we carry out construction in collaboration with a local construction company, we

[1] Obtained from Bolu Tourism Directorate General

could teach construction technology to the local construction company and we could develop human resources related to avalanche prevention fence installation.

-There are few companies that can construct on the slope in Turkey and it is one of the barriers to disseminate the countermeasure against avalanche in Turkey.

In this project we carried out training in Japan for Turkish local construction company. So they could understand necessary equipment, work flow, safety management and quality management of construction on the slope.

Therefore we could complete construction relatively smoothly together with local construction company.

-However these construction methods could not be mastered only one time experience. In addition to that, the way of construction and necessary equipment differ depend on situation of the site.

-PROTEC ENGINEERING will continue providing training for Turkish engineers and contribute to the human resource development.

(2) Lessons Learned and Recommendation through the Survey

-Snow depth data accumulation is very important for designing countermeasure for avalanche. However in Turkey, snow depth measurement and data accumulation has not been carried out in the past. It is difficult to design countermeasure against avalanche precisely without snow depth data. Therefore it is desirable that the measurement and data accumulation of snow depth will be carried out in a planned manner in the future.

-In order to get to understand the necessity and effectiveness of the avalanche measures to each local government of snowfall region, it is desirable to carry out the Awareness campaign for each municipality in the future.

ATTACHMENT: OUTLINE OF THE SURVEY, MANNING SCHEDULE

ATTACHMENT: OUTLINE OF THE SURVEY

PILOT SURVEY FOR DISSEMINATING SMALL AND MEDIUM ENTERPRISES TECHNOLOGIEDFOR COUNTERMEASURE AGAINST AVALANCHE HAZARDS

GENERAL INFORMATION

- PROPOSAL COMPANY: PROTEC ENGINEERING,INC.
- COMPANY ADDRESS: KITAKANBARAGUN SEIRO-MACHI NIIGATA JAPAN
- PROJECT SITE: BOLU PROVINCE TURKEY
- COUNTER PART: GENERAL DIRECTORATE OF FORESTRY
- IMPLEMENTATION PERIOD: OCT, 2013 - SEP, 2016

● DEVELOPMENT ISSUES OF TURKEY● ⟷ **MATCH** ⟷ **●PROPOSED TECHNOLOGY AND PRODUCTS●**

➢ **DAMAGE FROM AVALANCHE**
Due to heavy snow in the winter, increasing cases of avalanche hazards in the mountainous area of Turkey has caused loss of lives as well as tremendous economic losses due to road blockades.

➢ **HUMAN RESOUCE DEVELOPMENT**
There is shortage of engineers who are specialized in avalanche management in Turkey. In addition to that there is no company that can construct effective anti-avalanche structures based on constructional analysis in Turkey.

➢ **AVALANCHE COUNTERMEASURE TECHNOLOGIES AND PRODUCTS THAT HAVE BEEN DEVELOPED BASED ON THE EXPERIENCE GAINED IN HEAVY SNOWFALL REGION NIIGATA JAPAN**
-Avalanche prevention fence is designed to withstand snow pressure on a basis of mechanical analysis and simulation, and structural calculation of components.
-Avalanche monitoring system makes it possible to monitor the situation of site on time using internet.
-Accumulated stock of research results and know-how related to avalanches and countermeasure against avalanche.

Preparations of the proposed company

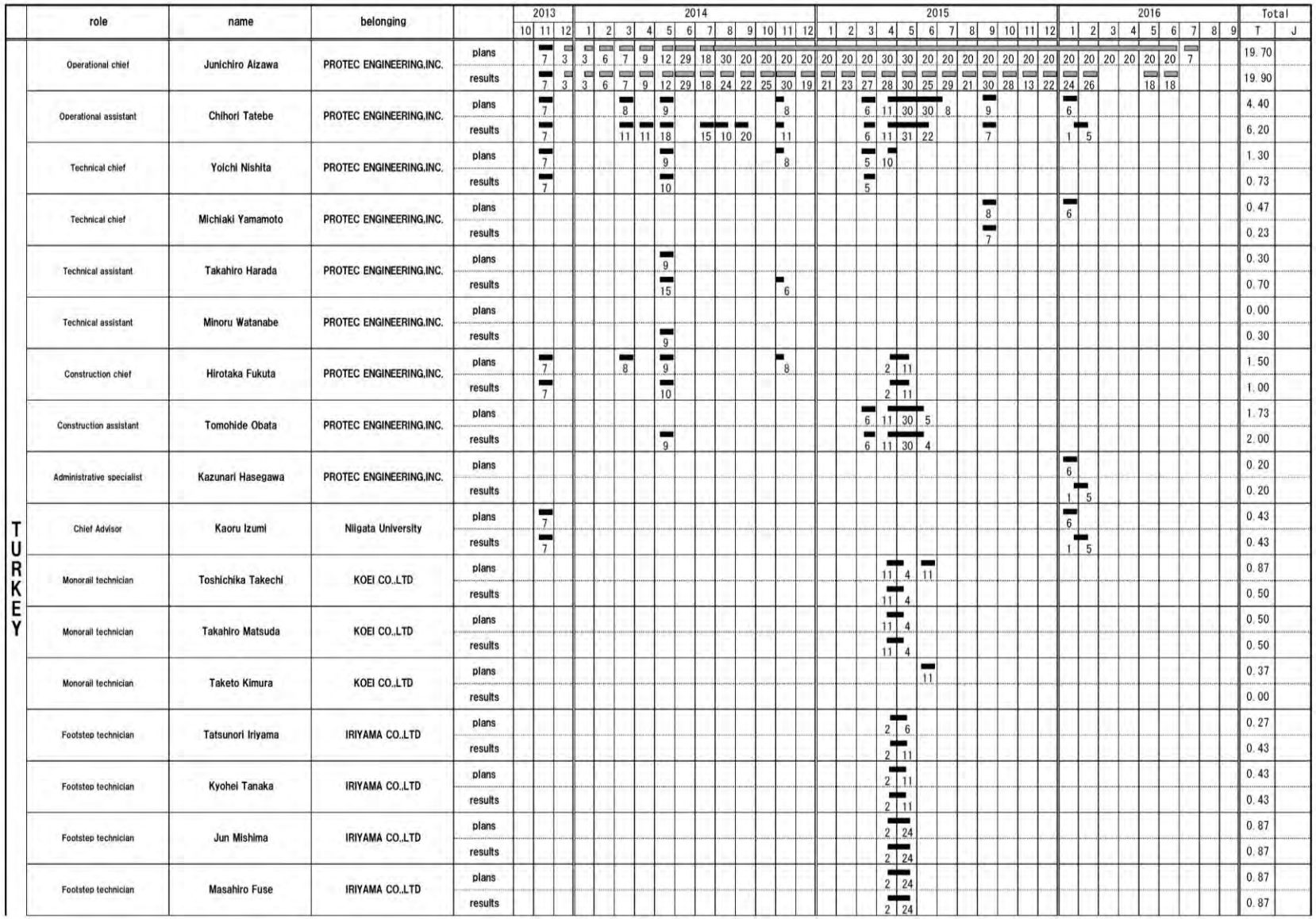
- Visit Turkey in March 2013 and carried out interview with Turkish government and also carried out site survey where avalanche occur often.
- Confirmed the needs for avalanche countermeasure technology and products in Turkey.

Contents of the project (JICA project)

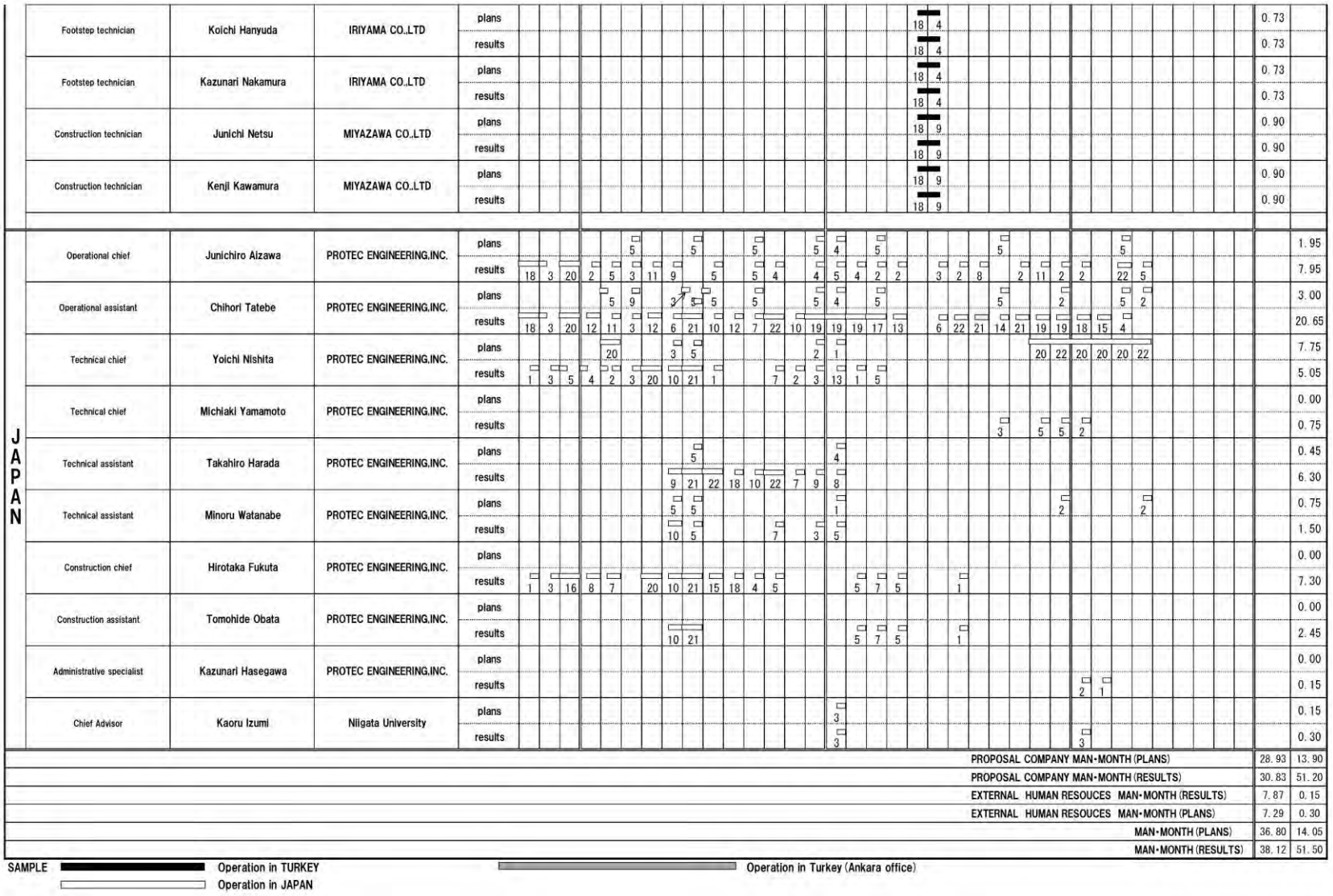
- Design and construction of avalanche prevention fence in accordance with the construction site.
- Monitor and examine the effectiveness of the avalanche prevention fence with avalanche monitoring system.
- Through training in Japan and workshops in Turkey, transfer technology about "avalanche and countermeasure against avalanche".
- Carry out site visit of avalanche danger area and implement the dissemination activities.

- Taking advantage of the network built through this project, expand business to whole countermeasures against slope disaster. (avalanche,rockfall and slopefailure.)

ATTACHMENT: MANNING SCHEDULE



	role	name	belonging		2013 10	11	12	2014 1	2	3	4	5	6	7	8	9	10	11	12	2015 1	2	3	4	5	6	7	8	9	10	11	12	2016 1	2	3	4	5	6	7	8	9	Total T	J
TURKEY	Operational chief	Junichiro Aizawa	PROTEC ENGINEERING,INC.	plans		7	3	3	6	7	9	12	29	18	30	20	20	20	20	20	20	20	30	30	20	20	20	20	20	20	20	20	20	20	20	20	7			19.70	
				results		7	3	3	6	7	9	12	29	18	24	22	25	30	19	21	23	27	28	30	25	29	21	30	28	13	22	24	26			18	18				19.90	
	Operational assistant	Chihori Tatebe	PROTEC ENGINEERING,INC.	plans		7				8		9						8				6	11	30	30	8		9				6									4.40	
				results		7				11	11	18		15	10	20		11				6	11	31	22			7				1	5								6.20	
	Technical chief	Yoichi Nishita	PROTEC ENGINEERING,INC.	plans		7						9						8				5	10																		1.30	
				results		7						10										5																			0.73	
	Technical chief	Michiaki Yamamoto	PROTEC ENGINEERING,INC.	plans																								8				6									0.47	
				results																								7														0.23	
	Technical assistant	Takahiro Harada	PROTEC ENGINEERING,INC.	plans								9																													0.30	
				results								15						6																							0.70	
	Technical assistant	Minoru Watanabe	PROTEC ENGINEERING,INC.	plans																																					0.00	
				results								9																													0.30	
	Construction chief	Hirotaka Fukuta	PROTEC ENGINEERING,INC.	plans		7				8		9						8					2	11																	1.50	
				results		7						10											2	11																	1.00	
	Construction assistant	Tomohide Obata	PROTEC ENGINEERING,INC.	plans																		6	11	30	5																1.73	
				results								9										6	11	30	4																2.00	
	Administrative specialist	Kazunari Hasegawa	PROTEC ENGINEERING,INC.	plans																												6									0.20	
				results																												1	5								0.20	
	Chief Advisor	Kaoru Izumi	Niigata University	plans		7																										6									0.43	
				results		7																										1	5								0.43	
	Monorail technician	Toshichika Takechi	KOEI CO.,LTD	plans																			11	4	11																0.87	
				results																			11	4																	0.50	
	Monorail technician	Takahiro Matsuda	KOEI CO.,LTD	plans																			11	4																	0.50	
				results																			11	4																	0.50	
	Monorail technician	Taketo Kimura	KOEI CO.,LTD	plans																					11																0.37	
				results																																					0.00	
	Footstep technician	Tatsunori Iriyama	IRIYAMA CO.,LTD	plans																			2	6																	0.27	
				results																			2	11																	0.43	
	Footstep technician	Kyohei Tanaka	IRIYAMA CO.,LTD	plans																			2	11																	0.43	
				results																			2	11																	0.43	
	Footstep technician	Jun Mishima	IRIYAMA CO.,LTD	plans																			2	24																	0.87	
				results																			2	24																	0.87	
	Footstep technician	Masahiro Fuse	IRIYAMA CO.,LTD	plans																			2	24																	0.87	
				results																			2	24																	0.87	



	Footstep technician	Koichi Hanyuda	IRIYAMA CO.,LTD	plans	0.73	
				results	0.73	
	Footstep technician	Kazunari Nakamura	IRIYAMA CO.,LTD	plans	0.73	
				results	0.73	
	Construction technician	Junichi Netsu	MIYAZAWA CO.,LTD	plans	0.90	
				results	0.90	
	Construction technician	Kenji Kawamura	MIYAZAWA CO.,LTD	plans	0.90	
				results	0.90	
JAPAN	Operational chief	Junichiro Aizawa	PROTEC ENGINEERING,INC.	plans		1.95
				results		7.95
	Operational assistant	Chihori Tatebe	PROTEC ENGINEERING,INC.	plans		3.00
				results		20.65
	Technical chief	Yoichi Nishita	PROTEC ENGINEERING,INC.	plans		7.75
				results		5.05
	Technical chief	Michiaki Yamamoto	PROTEC ENGINEERING,INC.	plans		0.00
				results		0.75
	Technical assistant	Takahiro Harada	PROTEC ENGINEERING,INC.	plans		0.45
				results		6.30
	Technical assistant	Minoru Watanabe	PROTEC ENGINEERING,INC.	plans		0.75
				results		1.50
	Construction chief	Hirotaka Fukuta	PROTEC ENGINEERING,INC.	plans		0.00
				results		7.30
	Construction assistant	Tomohide Obata	PROTEC ENGINEERING,INC.	plans		0.00
				results		2.45
	Administrative specialist	Kazunari Hasegawa	PROTEC ENGINEERING,INC.	plans		0.00
				results		0.15
	Chief Advisor	Kaoru Izumi	Niigata University	plans		0.15
				results		0.30
				PROPOSAL COMPANY MAN-MONTH (PLANS)	28.93	13.90
				PROPOSAL COMPANY MAN-MONTH (RESULTS)	30.83	51.20
				EXTERNAL HUMAN RESOUCES MAN-MONTH (RESULTS)	7.87	0.15
				EXTERNAL HUMAN RESOUCES MAN-MONTH (PLANS)	7.29	0.30
				MAN-MONTH (PLANS)	36.80	14.05
				MAN-MONTH (RESULTS)	38.12	51.50

SAMPLE Operation in TURKEY Operation in Turkey (Ankara office)
Operation in JAPAN