

**PART II**  
**PARTICULARS**

## CHAPTER 1 TUNNEL SURVEY

### 1-1 Purpose

Purpose is to clarify the continuity to a deeper level and geological structure of the ore zone consisting of the No.5 Ore Body and the Southern Deposit by the tunnel survey from the No. 3 Ore Body toward the No. 5 Ore Body at the 1,930 m level in the Altyn-Jylga district.

### 1-2 Location

The coordinates of the mine mouth is  $X = 2318.62$  and  $Y = 1296.81$ . The location map of the tunnel is shown in Fig. I-1-2. The total length of the tunnel excavated is 161.5 m. The length and direction of each tunnel segments are shown in Table I-1-1.

### 1-3 Period

The period of the site survey was from 15 June 1998 to 26 October 1999. The arrival on the site was 20 June 1999 and preparation of the work needed days during 21 June and 6 July. Excavation was started on 7 July. Drilling chambers in the 1850 m level tunnel was excavated while the operation of the preparation work and the tunnel excavation. Drilling chambers II, I and III were completed on 27 June, 3 and 31 July respectively. The survey was broken out by incursion of armed fighters from Tajikistan to the survey site. Four Japanese members and a Kyrghyz interpreter of this project were captured. The survey had been carried out before the incident. Progress of the survey and survey plan are shown on Table II-1-1.

### 1-4 Methods

Facilities and equipment installed last year at the mouth of the 1850 m level tunnel were used. Excavation water was pumped up from the reservoir for flowing water from the 1850 m level tunnel. Steel piping for compressed air was extended from the 1850 m level tunnel. Facilities (rails, steel pipes, air tubes, wires, etc) were prepared and installed in the existed 1930 m level tunnel, because former facilities had been dismantled.

#### 1-4-1 Specification of tunnel

The standard section area of tunnel is  $5.64 \text{ m}^2$ . Three types of supporting was adopted depending on the rock conditions. Every junction had been fixed by

support conforming to the legal obligation.

(i) Type I :Continuous support timbering (Fig. II-1-1).

Adopted for fault-shear zone or strong weathering zone.

(ii) Type II :1.2 m interval support timbering (Fig. II-1-2)

Distance between timbers is 1.2 m. Adopted for fissure and crack zone.

(iii) Type III :Un-supported (Fig. II-1-3).

Adopted for hard and fresh rock zone.

#### 1-4-2 Method of excavation and used equipment

(i) Drilling: jack leg PR63B2. Average hole length is 1.6 m.

(ii) Blasting: ammonia explosives with detonator and fuse. Ventilation takes 30 minutes after explosion.

(iii) Mucking: loader PPN-1C. Sampling of assay after every mucking of the drift.

(iv) Transportation: electric locomotive AK2U using track VO-0.8.

(v) Disposing: ore and waste are disposed to separate places with wheel loader.

For an efficient survey, compressor (PDS700S), generator (SDG25S), welder (BP-400) and engine welder (BLW280SS), loaders (TCM830-2, LS160-FJ2) were brought from Japan (Table II-1-2).

#### 1-4-3 Operation and safety system

##### (1) Operation system

(i) Kyrghyz side: 12 hours/shift × 2 shifts/day - 15 days work at the site and 15 days off

(ii) Japan side : 8 hours/shift × 3 shifts/day. To maintain safety and operation, Japanese team took 3 shifts a day and employed 3 interpreters.

Number of people is shown in Table. II-1-3.

##### (2) Safety system

(i) 24 hours double check system

(ii) Safety meeting with Kyrghyz side every morning

(iii) Training system for foreseeing dangers

(iv) Keeping two 4WD vehicles for an emergency at the site

(v) Equipped with 2 INMARSAT for telecommunication.

## 1-5 Results of survey

Progress of the survey is shown in Table II-1-1 and number of days for the tunnel works is shown in Table II-1-4.

### 1-5-1 Efficiency of excavation

Progress record of the tunnel survey is shown in Fig II-1-4 and efficiency of tunnel survey is shown in Table II-1-5. Efficiency of each tunnel type is as below.

(i) Type II : 1.8 m/day

(ii) Type III : 3.6 m/day

Average : 3.4 m/day

<The reason of low efficiency of type II>

Type II was applied at junction of cross cut tunnel I and side track tunnel I. There is no side track tunnel between the tunnel mouth and the junction. Mine car had to go back and forth between the tunnel mouth and the junction every time. It made efficiency of excavation by type II substantially lower.

### 1-5-2 Rock conditions

The total excavated length was 161.5 m and the length of tunnel type II and type III were 8.8 m and 152.7 m respectively. Tunnel types and its completion dates are shown in Fig. II-1-5.

Rock conditions were good generally. At the junction of cross cut tunnel I and side track tunnel I, type II was applied because of the wide open space. The rest part of the tunnel was maintained without supporting.

(i) Cross cut tunnel I : Granodiorite porphyry dike (starting point to the 25 m point) and massive marble (the 25 m point to the 141.5 m point) intruded by dikes in some points had been excavated.

(ii) Side track tunnel I : Granodiorite porphyry dike (starting point to the 11 m point), skarn (the 11 m point to 16 m point) and massive marble (the 16 m point to the 20 m point) had been excavated.

### 1-5-3 Supply and consumption of materials

Among the main materials, drilling rods and bits are produced in Kyrgyz. Explosives are imported from Tajikistan. Timbers are from Russia and fuel is from Uzbekistan. All materials are gathered at Osh. The distance between Osh and the site is 220 km and poor road conditions between Sokh Village and the site. The inventory of the materials and maintenance of the road were very important for supply of materials. Consumed materials are shown in Table. II-1-6.

#### 1-5-4 Technology transfer

##### (1) Improvement of tunnel work

(i) Excavation of the side track and cross cut tunnel were operated simultaneously to make work efficiency higher.

(ii) Use of laser beams for centering of the tunnel direction. It made survey work for orientation of tunnel accurate and faster.

##### (2) Reinforcement of safety

Kyrgyz side had keen awareness to prevent accidents. Following items were enforced to keep safety.

(i) Daily meeting for safety.

(ii) Training to forecast of danger.

(iii) Periodical scaling for all tunnels.

(iv) Detailed communication to the next shift.

(v) Periodical check for combustion time of fuse.

(vi) Secure run off time from blasting.

Table II-1-1 Progress of the Tunnel Survey

Contents of Study	Quantity	June	July	August	September	October	November	December	January	February	March
1 Trip to Kyrgyz		15—19									
2 Transportation of equipment to Kyrgyz		—									
3 Preparation		20—6									
4 Tunnelling Tunnel I Side track I	141.5m 20.0		7 15—25	..... 22	Plan						
5 Drilling Chamber	3	No.1, 2 21—3	No.3 28—31								
6 Trip to Japan						25,6 —					
7 Report							1				24

Table. II -1-2 Main Equipment of the Tunnel Survey

Equipment	Specifications	Quantity	Note
Compressor	10m <sup>3</sup> /min	2	RPR-10M
Jack-hammer	30Kg class	4	PP63B2
Electric locomotive	2.0ton	2	AK2U
Truck	0.8m <sup>3</sup>	20	VO-0.8
Loading vehicle	12horse power	2	PPN-1C
Fan	5.5Kw	6	VO-5
Generator	200KVA	2	DEA-200
Pump	22Kw	2	ANB-22
<b>Brought from Japan</b>			
Compressor	20m <sup>3</sup> /min	1	PDSG700S
Generator	25KVA	2	SDG25S
Electric welder	400A	1	BP-400
Engine welder	250A	1	BLW280SS
Wheel loader	1.2m <sup>3</sup>	1	TCM830-2
Back hoe	0.25m <sup>3</sup>	1	LS160FJ2
INMARSAT		2	

Table II -1-3 Number of People for the Tunnel Survey

	8 : 00 ~ 20 : 00	20 : 00 ~ 8 : 00	
Foreman	1		
Mine foreman	1	1	
Mine worker	6	6	
Mechanic foreman	1		
Mechanic	2	2	
Geologist	1		
Surveyor	1		
Sample worker	1		
	14	9	
	8 ~ 16	16 ~ 24	24 ~ 8
Japanese	2	1	1
Interpreter	1	1	1

Table II -1-4 Number of the Days Required for the Tunnel Survey

	Preparation	Tunnelling period and days	Road maintenance days
	'99,6,20 ~ 7,6		2
Tunnel I		'99,7,7 ~ 8,22 40	6
Side track I		'99,7,15 ~ 7,25 7	
Total (days)	17	47	8

Table. II -1-5 Efficiency of the Tunnel Survey

	Quantity	Type of tunnel	Working days	Efficiency
Tunnel I	141.5m	Type II 7.2m+Type III 134.3m	40	3.5 m/day
Side track I	20.0m	Type II 1.6m+Type III 18.4m	7	2.9 m/day
Total	161.5m	Type II 8.8m+Type III 152.7m	47	3.4 m/day



Table. II -1-6 Consumed Materials of the Tunnel Survey

Article	Specifications	Quantity	Note
Bit	42m/m $\phi$ R25	143 pieces	
Rod	25m/mHEX L=1,800	199 pieces	
Explosive Ammonite #6 Detonator		5,129 Kg 3,594 pieces	Imported from Tajikistan
Timberings		16 set	
Timber		14 m <sup>3</sup>	Imported from Russia
Sleeper		185 pieces	
Light Oil		61,500 $\ell$	Imported from Uzbekistan

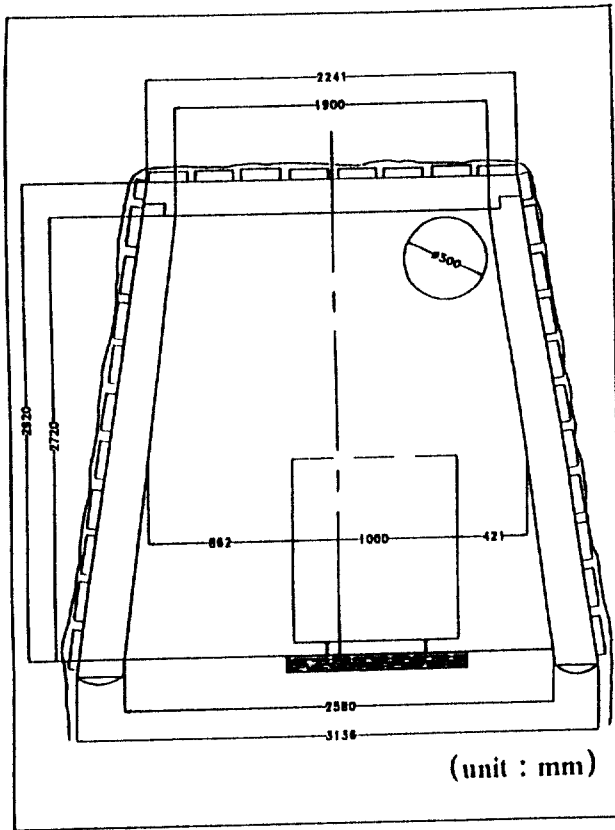


Fig. II-1-1 Section across Tunnel Type I

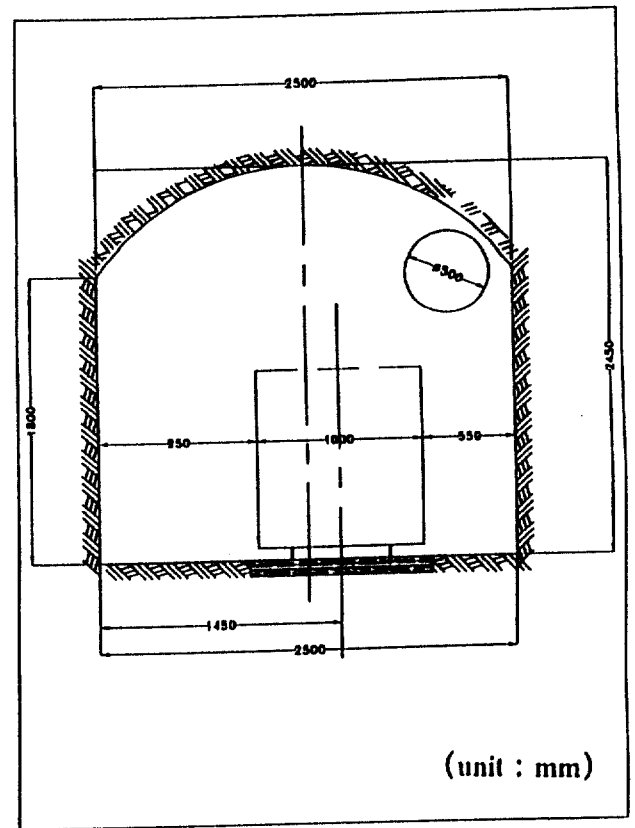


Fig. II-1-3 Section across Tunnel Type III

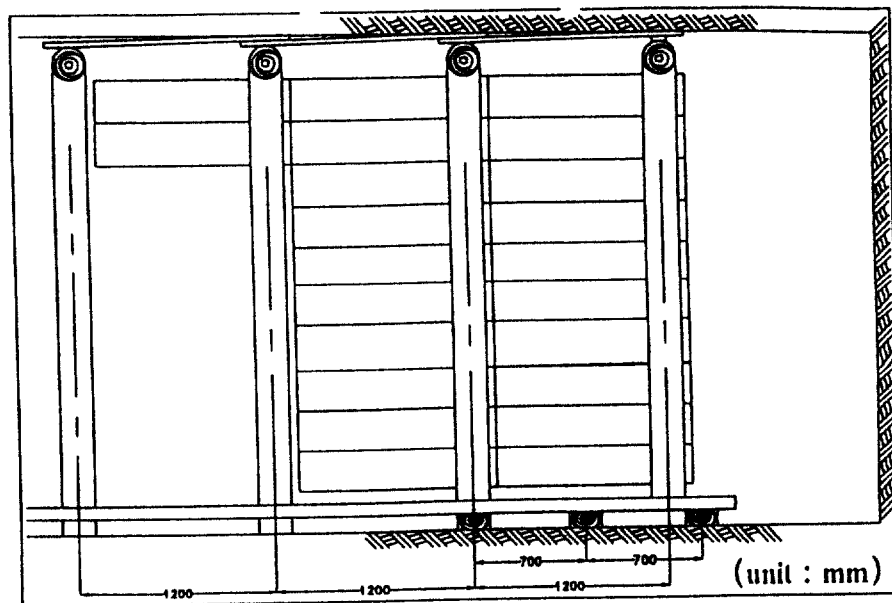


Fig. II-1-2 Section along Tunnel Type II

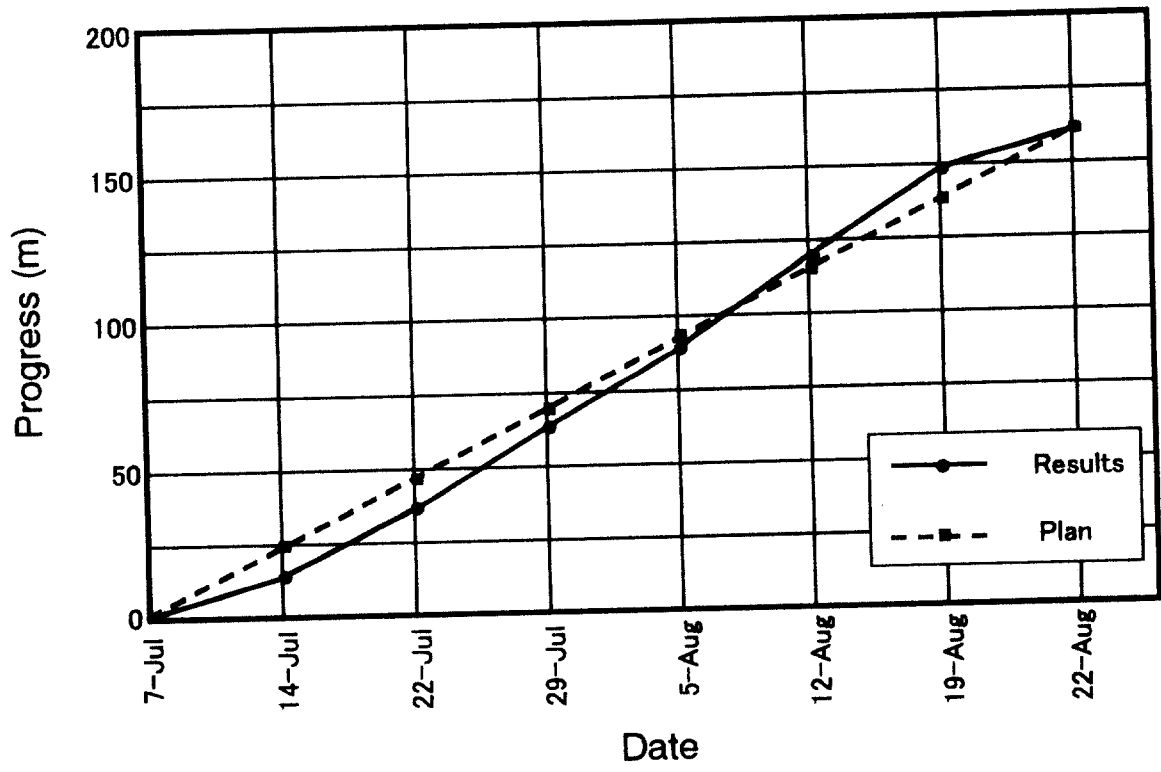


Fig. II-1-4 Progress Record of the Survey

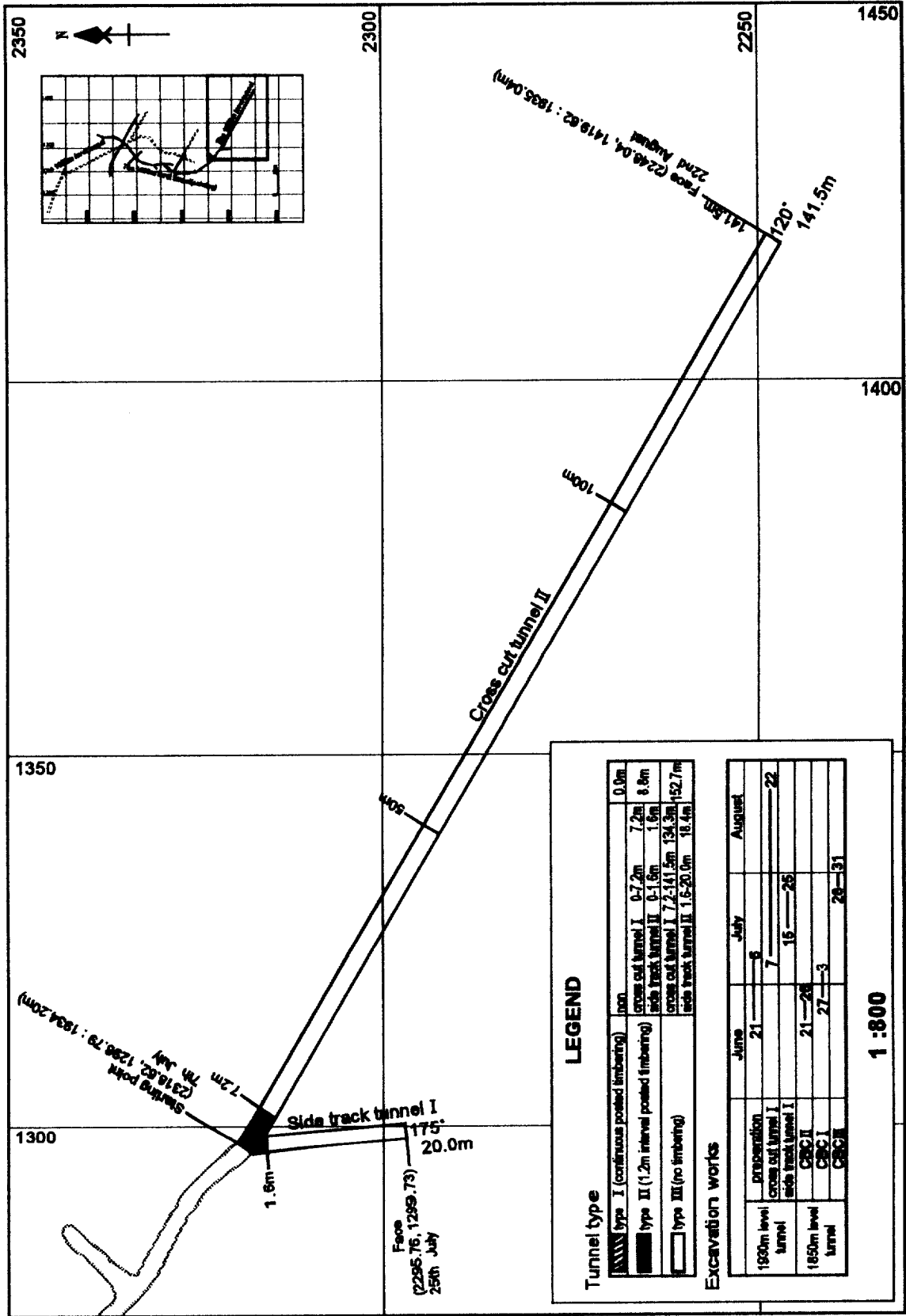


Fig.II-1-5 Tunnel Types and its Completion Date of the 1930 m Level Tunnel