Table D4.1.4 (1) Result of Flue Gas Measurement

No.	Name of enterprise	Source No.	Furnace name	Concentration of the exhaust gas								Emission				Emission standard				Velocity m/s	Gas temp. ℃	Dry exhaust gas m3N/h	Fuel consumption			
				SO2 ppm SO2 mg/m3	NOx ppm NOx mg/m3	CO ppm CO mg/m3	NOx ppm (O2 4%)	Dust g/m3	O2 %	CO2 %	HC ppm	SO2 kg/hr	NOx kg/hr	CO kg/hr	Dust kg/hr	SO2 kg/hr	NOx kg/hr	CO kg/hr	Dust kg/hr				Natural gas	Heavy oil	Brown coal	Others
03/0	EMO. TEGLA ES CSEREPIPARI VALLALAT PUTNOKI TEGLAGYAR	P002	No. 2 furnace	345 986	44 90	771 964	440	0.012	19.3	2.3	1,365	38.1	3.50	37.3	0.46	500	200	10,000	160	12.0	70	38,700	-	-		-
		P014	No. 1 furnace	50 143	10 21	720 900	106	0.025	19.4	1.1	-	3.90	0.561	24.6	0.68	0.75	70	3,500	56	14.7	80	27,300	-	-		-
04/1	BORSODCHEM RT.	P062	Incinerator (Waste solvent)	ND ND	308 633	6 8	4,028	0.0023	19.7	0.9	75	ND	4.60	0.055	0.017	200 mg/Nm3	400 mg/Nm3	100 mg/Nm3	30 mg/Nm3	6.7	177	7,280	-	-	-	Waste solvent 35 kg/h
05/0	BORSODI ENERGETIKAI KFT. (BORSODI HOEROMU)	P001-1	No. 1 Water tube boiler 100 t/h	2,016 5,760	126 259	25 31	286	0.50	13.5	5.6	-	1,400	62.9	7.59	120	800	240	12,000	160	17.8	159	243,000	1,100 m3/h	-	*36.80 t/h	-
		P001-3	No. 3 Water tube boiler 100 t/h	2,745 7,843	203 417	15 19	308	-	9.8	8.6	-	1,180	62.9	2.83	-	800	240	12,000	160	11.9	168	151,000	1,200 m3/h	-	*33.95 t/h	-
		P001-3	No. 3 Water tube boiler 100 t/h	2,240 6,400	182 374	30 38	329	0.21	11.6	7.6	ND	1,090	63.9	6.41	40	800	240	12,000	160	14.1	173	171,000	1,500 m3/h	-	*35.91 t/h	-
		P002-1	No. 4 Water tube boiler 100 t/h	1,582 4,520	160 329	60 75	324	0.14	12.6	6.2	7	868	63.1	14.4	27	800	240	12,000	160	16.0	205	192,000	1,300 m3/h	-	*33.78 t/h	-
07/0	PANNONGLAS IPARI RT. SAJOSZENTPETERI UVEGGYAR	P015	No. 1 glass melting tank oven	ND ND	203 417	ND ND	437	0.045	13.1	4.6	ND	-	9.38	-	1.0	-	67	3,333	40	11.5	388	22,500	930 m3/h	-	-	-
		P019	No. 2 glass melting tank oven	8 23	220 452	85 106	430	0.010	12.3	5.3	ND	0.475	9.40	2.21	0.21	-	67	3,333	40	10.2	378	20,800	930 m3/h	-	-	-
08/0	BORSODI ERCELOKESZITO MUZSGORITO KFT.	P001-1	No. 1 Sintering furnace	94 269	144 296	8,833 11,041	699	0.34	17.5	3.6	395	100	111	4,130	130	300	300	10,000	160	16.0	106	374,000	-	-	-	-
09/2	SAGROCHEM KFT.	P001	HLG Smoke tube boiler 20 t/h	557 1,591	192 394	ND ND	261	0.0629	8.5	9.3	ND	26.4	6.55	ND	1.0	87.5	35	1,750	-	9.7	223	16,600	-	0.83 t/h	-	-
		P001	HLG Smoke tube boiler 20 t/h	- -	185 380	ND ND	235	0.055	7.6	10.5	ND	ND	7.48	ND	1.1	87.5	35	1,750	-	10.4	194	19,700	-	*0.91 t/h	-	-
		P055	Incinerator (Waste solvent & solid)	ND ND	196 403	75 94	813	0.040	16.9	2.6	ND	ND	0.962	0.224	0.096	200 mg/Nm3	400 mg/Nm3	100 mg/Nm3	30 mg/Nm3	6.8	35	2,390	-	-	-	Waste solvent & solid
10/0	DECEMBER 4. DROTMUVEK	P033-2	No. 2 Smoke tube boiler 4 t/h	ND ND	65 133	ND ND	65	-	4.0	9.6	ND	ND	0.295	ND	-	-	1.44	72	-	-	223	2,210	215 m3/h	-	-	-
13/0	DIOSGYORI PAPIRGYAR LEANYVALLALAT	P002	No. 1 Smoke tube boiler 5 t/h	ND ND	54 111	ND ND	55	0.0010	4.3	9.7	ND	ND	0.291	ND	0.0026	-	2.7	90	-	-	209	2,620	217 m3/h	-	-	-
15/1	HAMOR RT.	P006-2	No. 5 Heating furnace	ND ND	15 31	ND ND	65	0.0013	17.1	2.2	ND	ND	0.631	ND	0.027	-	1.8	60	-	-	385	20,500	489 m3/h	-	-	-
		P009	No. 3 Forge furnace	ND ND	147 302	ND ND	735	0.0014	17.6	1.8	ND	ND	3.35	ND	0.016	-	0.31	10	-	9.0	103	11,100	213 m3/h	-	-	-
15/2	DIOSGYORI ACEL ES VASONTO KFT.	P014-1	1-A Heating furnace (Car type kiln)	ND ND	22 45	ND ND	68	0.0043	15.5	2.9	ND	ND	0.423	ND	0.040	-	0.31	11	-	6.4	415	9,370	*314 m3/h	-	-	-
15/4	DNM DIOSGYORI NEMESACEL MUVEK FA.	P002-2 -3	Forge furnace	ND ND	22 45	ND ND	101	0.0009	17.3	1.8	ND	-	0.244	-	0.0049	-	6	200	-	4.6	215	5,410	-	-	-	-
		P046	No. 2 pit furnace	ND ND	86 177	ND ND	340	0.0036	16.7	2.0	ND	-	3.09	-	0.063	-	6	200	-	5.0	287	17,500	-	-	-	-
		P095-1	HOK Smoke tube boiler 12 t/h	ND ND	69 142	ND ND	104	0.0029	9.7	12.0	ND	ND	1.67	ND	0.034	-	42	1,400	-	4.7	177	11,800	*480 m3/h	-	-	-
		P097-2	No. 5 Water tube boiler 24 t/h	ND ND	6 12	90 113	10	0.0009	11.2	11.2	ND	-	0.594	5.42	0.043	-	60	2,000	-	-	188	48,200	400 m3/h	-	Blast furnace gas 13,000 m3/h	
17/1	HEJOCSABAI CEMENT- ES MESZIPARI RT.	P010	SP Cement kiln 83 t/h	ND ND	533 1,095	105 131	1,394	0.033	14.5	10.9	ND	ND	325	39.0	9.8	-	120	4,000	40	26.7	107	297,000	7,970 m3/h	300 l/h Waste oil	-	-
		P031	Shaft kiln for lime-stone 19 t/h	5 14	16 33	ND ND	21	0.0048	8.3	22.0	5	0.490	1.13	ND	0.16	40	40	1,333	20	12.2	95	34,300	2,670 m3/h	-	-	-
18/0	STRABAG HUNGARIA EPITO KFT	P001	Dryer for aggregate 60 t/h	23 66	36 74	32 40	185	0.19	17.7	1.7	21	1.75	1.97	1.07	5.1	18	-	360	5.4	20.1	126	26,700	*450 m3/h	-	-	-
21/0	EMO. TEGLA ES CSEREPIPARI VALLALAT MALYI TEGLAGYARA	P001	No. 1 & No. 2 furnace	15 43	56 115	15 19	501	0.0013	19.1	1.5	16	1.45	3.89	0.63	0.044	150	150	5,000	80	4.6	189	33,800	*144 m3/h	-	-	-
22/0	MISKOLCI UTEPITO KFT NYEK ASZFALTKEVERO	P001	Dryer for aggregate 70 t/h	98 280	9 18	400 500	61	0.052	18.5	1.2	-	9.44	0.623	16.9	1.8	9.45	9.45	315	5.4	12.7	87	33,700	480 m3/h	-	-	-

Note. ND: Not Detected. *: Estimated

Table D4.1.4 (2) Result of Flue Gas Measurement

No.	Name of enterprise	Source No.	Furnace name	Concentration of the exhaust gas								Emission				Emission standard				Velocity m/s	Gas temp. ℃	Dry exhaust gas m3N/h	Fuel consumption			
				SO2 ppm SO2 mg/m3	NOx ppm NOx mg/m3	CO ppm CO mg/m3	NOx ppm (O2 4%)	Dust g/m3	O2 %	CO2 %	HC ppm	SO2 kg/hr	NOx kg/hr	CO kg/hr	Dust kg/hr	SO2 kg/hr	NOx kg/hr	CO kg/hr	Dust kg/hr				Natural gas	Heavy oil	Brown coal	Others
23/1	TISZAI VEGYI KOMBINAT RT.	P003-1 -3	Nitric acid manufacturing plant	ND ND	1,606 3,298	ND ND	1,696	-	4.9	ND	ND	ND	210	ND	-	-	400	-	-	9.5	141	63,700	-	-	-	-
		P021-1	Incinerator I-610 (Solid)	ND ND	26 53	15 19	147	0.021	18.0	2.0	24	ND	0.673	0.236	0.26	200 mg/Nm3	400 mg/Nm3	100 mg/Nm3	30 mg/Nm3	8.6	101	12,600	-	-	-	Waste solid 300 kg/h
		P021-2	Incinerator I-620 (Solvent)	ND ND	20 41	ND ND	81	0.013	16.8	2.5	12	ND	0.377	ND	0.12	250	100	5,000	60	22.2	257	9,190	-	-	-	Waste solvent 100 kg/h
		P021-3	Incinerator I-600 (Solvent)	ND ND	18 37	ND ND	87	0.0001	17.5	2.0	14	ND	0.481	ND	0.0013	250	100	5,000	60	24.8	231	13,000	-	-	-	Waste solvent 100 kg/h
		P025-2	No. 2 Water tube boiler 25 t/h	ND ND	72 148	ND ND	122	0.0036	11.0	5.7	ND	ND	3.62	ND	0.088	500	100	5,000	-	9.6	134	24,500	*1,450 m3/h	-	-	-
24/0	MOL RT.	P004	F102 Heat medium boiler	ND ND	59 121	ND ND	68	-	6.2	8.3	- -	ND	0.473	ND	-	500	200	10,000	-	-	60	3,900 *	280 m3/h			
25/1	TISZAI ERONU RT. I. HOEROM	P001-1	No. 1 Water tube boiler 125 t/h	2,468 7,051	236 485	60 75	337	0.18	9.1	9.0	ND	1,100	75.6	11.7	28	375	150	7,500	90	13.1	189	156,000	700 m3/h	-	*33.29 t/h	-
		P001-2	No. 2 Water tube boiler 125 t/h	2,513 7,180	278 571	90 113	422	0.094	9.8	9.0	5	1,270	101	19.9	17	375	150	7,500	90	13.9	175	177,000	900 m3/h	-	*32.85 t/h	-
		P002-1	No. 3 Water tube boiler 125 t/h	2,686 7,674	194 398	350 438	330	0.51	11.0	7.4	ND	1,350	70.1	77.0	90	375	150	7,500	90	14.9	190	176,000	700 m3/h	-	*39.46 t/h	-
		P002-2	No. 4 Water tube boiler 125 t/h	2,593 7,409	196 403	630 788	292	0.82	9.6	8.3	ND	1,190	64.8	127	130	375	150	7,500	90	12.8	180	161,000	700 m3/h	-	*48.69 t/h	-
		P003-1	No. 5 Water tube boiler 125 t/h	2,049 5,854	264 542	40 50	488	0.12	11.8	7.1	11	995	92.2	8.5	20	375	150	7,500	90	12.5	163	170,000	700 m3/h	-	*30.11 t/h	-
25/2	TISZAI II HOEROMU	P001	No. 1 Water tube boiler 670 t/h	914 2,611	325 667	9 10	333	0.25	4.4	12.8	ND	2,300	587	8.80	220	1,875	750	37,500	-	34.2	135	880,000	- m3/h	40.0 t/h	-	Inert gas 19,300m3/h
		P003	No. 3 Water tube boiler 670 t/h	700 2,000	230 472	ND ND	279	0.16	7.0	11.5	ND	1,810	428	ND	140	1,875	750	37,500	-	34.6	131	906,000	- m3/h	38.7 t/h	-	Inert gas 36,700m3/h
-	OZD GOMORHUS KAZAUK	P001	Smoke tube boiler (Marine boiler)	182 520	52 107	1,385 1,731	184	0.0579	16.2	4.5	- -	1.87	0.384	6.23	0.208	0.27	0.27	9	0.12	2.4	125	3,600			0.13 t/h	0.093 t/h(wood)
-	BEFAG LADI FATELEP	P001	Smoke tube boiler (Locomotive boiler)	ND ND	76 156	5,669 7,086	137	0.543	11.6	9.2	- -	ND	0.749	34	2.61	-	42	1,400	21	7.2	232	4,800				0.5 t/h(wood)
-	BORSODI SORGYAR RT. BOCS	P001	No. 5 Smoke tube boiler 20 t/h	ND ND	99 203	5 6	89	-	2.1	1.2	- -	ND	3.05	0.094	-	-	70	3,500	-	-	200	15,000 *	1,422 m3/h			
02/1	OZDI KOHASRATI UZEMEK	P036	No. 10 Water tube boiler 20 t/h	24 69	3.2 7	262 328	26	7.89	18.9	4.0	- -	11.0	1.06	52.7	1,270	8.2	6.0	428.6	2.9	-	90	161,000 *	980 m3/h		2 t/h	
12/0	EAEV. MUNKASSZALLO	P001	Cast iron boiler	2 6	6 12	267 334	-	0.0047	21.0	0.6	- -	0.037	0.08	2.20	0.031	5.4	5.4	180	2.7	3.5	50	6,500			0.056 t/h	
14/1	DIGEP II TELEP	P002	Water tube boiler	ND ND	57 117	ND ND	156	-	14.8	3.6	- -	ND	16.74	ND	-	-	21	700	-	-	157	143,000 *	4,200 m3/h			
17/2	HEJOCSABAI CEMENT- ES MESZIPARI RT. KOBANYA UZEM	P030	Cast iron boiler	92 263	68 140	13 16	68	-	3.9	13.5	- -	0.034	0.018	0.002	-	0.18	0.18	6	0.02	-	199	130 *				0.015 t/h(Lightoil)
26/0	MISKOLCI HOSZOLGALTATO V. KILIAUI KAZANHAZA	P001	No.2 Smoker tube boiler (hot water)	ND ND	65 133	690 863	63	-	3.5	9.8	- -	ND	0.32	2.07	-	-	2.7	90	-	-	-	2,400 *	207.5 m3/h			
26/3	MISKOLCI HOSZOLGALTATO V. KOROSI CS. UTI KAZANHAZA	P001	Cast iron boiler (hot water)	5 14	33 68	663 829	128	0.182	16.6	3.2	- -	0.073	0.346	4.23	0.928	21	21	700	10.5	4.2	121	5,100			0.208 t/h	Czecho·Poland ·Ural/coal
26/4	MISKOLCI HOSZOLGALTATO V. FUTOUTI KAZANHAZ	P001	Smoke tube boiler	ND ND	48 99	68 85	61	-	7.7	7.9	- -	ND	0.187	0.162	-	-	2.7	90	-	-	190	1,900 *	130 m3/h			
26/6	MISKOLCI HOSZOLGALTATO V. DIOSGYORI KAZANHAZA	P001	No.1 Water tube boiler (hot water)	ND ND	35 72	ND ND	52	0.0575	9.5	6.4	- -	ND	0.553	ND	0.443	-	5.4	180	-	3.9	121	7,700	300 m3/h			
27/0	MISKOLCI FUTOMU KFT	P002	FK4 water tube boiler (hot water)	390 1,114	139 285	ND ND	134	-	3.3	13.1	- -	43.5	11.1	ND	-	1,800	1,800	60,000	-	-	178	39,000 *	1,000 m3/h	3 t/h		
		P002	FK3 water tube boiler (hot water)	21 60	97 199	ND ND	85	-	1.5	11.3	- -	3.54	11.8	ND	-	1,800	1,800	60,000	-	-	190	59,000 *	5,700 m3/h			
31/0	MISKOLC EGYETEM FUTOMU	P001	No. 1 Smoke tube boiler 7 t/h	996 2,846	287 589	1 1	287	0.0977	4.0	13.7	- -	15.4	3.18	0.007	0.528	120	120	4,000	60	5.8	218	5,400		265 t/h(F60/130)		

Note. ND: Not Detected. *: Estimated

Table D4.1.5 (1) Flue Gas Measurement Results

No 03 / 0		Source No.P 002			Product Building bricks					
Name of company		EMO TEGLA ES CSEREPIPARI VALLALAT PUTNOKI TEGLAGYAR								
Name of combustion facility		No. 2 ring kiln								
Types of fuel used		Brown coal and sawdust				Fuel Consumption -				
Rated load of furnace		2250 units/h				Load at time of measurement 1600 units/h				
Burner type and rating		-				Number. of burners -				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		345	44	771	12	19.3	2.3	70	38,700	-
O2 18 %	ppm	609	78	1360	-					
conversion value	mg/m3	1740	160	1700	21					
Emission	kg/h	38.1	3.5	37.3	0.46					
Emission standard	kg/h	500	200	10000	160					

Outline of facility and of measurements

Facility

A Hoffman-type ring kiln is used for burning bricks. The right and left sides of the ring-shaped furnace were cut away and rebuilt into two tunnel furnaces so that trucks could be used. Among the raw materials, the brown coal and sawdust undergo self-sustained combustion and burning. At the ceiling of the burning chamber of the kiln there is a portal for loading pulverized coal, and coal is loaded as required while this portal is monitored by naked eye observation.

In order to conserve energy, the facility uses exhaust gas in the brick drying process.

Location of measurement

A measurement site installed on the lateral flue attached to the induced draft fan and the smokestack was used.

Problems and Countermeasures

As a measure against exhaust gases, imported coal of low sulfur was introduced on an experimental basis to replace brown coal, but its use was abolished because many defective items came as a result of its calorific value and ash melting point. Moreover, since the natural gas piping was laid out close to the plant, the plant side is studying the possibilities for changing fuels.

Since flourine is contained in the raw material clay, there is the problem that it decomposes during burning and is discharged into the exhaust gases. In addition, exhaust gas leaks into the building, and the flouride dust is dangerous to the human body. Consequently, strict regulations on exhausts are required to protect working environments.

Estimated effects of countermeasures

-

Table D4.1.5 (2) Flue Gas Measurement Results

No 03 / 0	Source No.P 014	Product Building bricks								
Name of company	EMO TEGLA ES CSEREPIPARI VALLALAT PUTNOKI TEGLAGYAR									
Name of combustion facility	No. 1 tunnel kiln									
Types of fuel used	Brown coal and sawdust				Fuel Consumption	-				
Rated load of furnace	2250 units/h				Load at time of measurement	1600 units/h				
Burner type and rating	-				Number. of burners	-				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	℃	Nm3/h	%
		50	10	720	25	19.4	1.1	80	27,300	-
O2 18 %	ppm	94	19	1350	-					
conversion value	mg/m3	269	54	3857	47					
Emission	kg/h	3.9	0.561	24.6	0.68					
Emission standard	kg/h	0.75	70	3500	56					

Outline of facility and of measurements

Facility

This facility uses a tunnel kiln developed with Italian technology. Raw materials and procedures are the same as for the No. 2 furnace.

The height of the smokestack when this furnace was completed was 20 meters. Complaints about it were raised by local inhabitants. As a countermeasure, a duct was used to connect the smokestack to a 54-meter smokestack which had been abolished.

Location of measurement

A measurment site installed on the lateral flue in front of the smokestack was used.

Problems and Countermeasures

The SO2 content exceeds the standard value and corrective measures must be taken.

Conversion to natural gas has already been accomplished at the MALYI plant of the EMO Company. What is more, such conversion is easy because piping has been laid out close to the plant, so total fuel conversion to natural gas should be made.

Estimated effects of countermeasures

Significant reductions in SO2 and dust will be made possible.

Table D4.1.5 (3) Flue Gas Measurement Results

No 04 / 1	Source No.P 062									
Name of company	BORSODCHEM RT.									
Name of combustion facility	Liquid waste incinerator									
Types of incinerated items	Waste solvent									
Rated load of furnace	35 kg/h				Load at time of measurement	35 kg/h				
Burner type and rating	-				Number. of burners	-				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	308	6	2.3	19.7	0.9	177	7,280	-
conversion value	mg/m3	ND	633	8	2.3					
Emission	kg/h	ND	4.60	0.055	0.017					
Emission standard	kg/h	200	400	100	300					

Outline of facility and of measurements

Facility

The furnace here is a waste-oil incinerator made in Japan. An air cooling vent has been installed at the furnace outlet for protection of the smokestack.

Location of measurement

A measuring site installed at the center of the smokestack was used.

Problems and Countermeasures

The volume of NOx exceeds the standard value by a wide margin. At O2 of 4% conversion, the reading is 4028 ppm, and it is suspected that nitrogen is contained in the products of incineration. To counter this situation, a two-stage combustion burner must be introduced. In such a system, reduction combustion takes place at a primary air ratio of about 0.7, and full combustion occurs with secondary air.

Estimated effects of countermeasures

With two-stage combustion, the reading at O2 of 4% conversion can be reduced to anywhere from 150 to 200 ppm.

Table D4.1.5 (4) Flue Gas Measurement Results

No 05 / 0	Source No.P 001-1		Product Steam for power generation and for processing							
Name of company	BORSODI ENERGETIKAT KFT.									
Name of combustion facility	No. 1 water tube boiler									
Types of fuel used	Brown coal and natural gas				Fuel Consumption		brown coal * 36.8 t/h natural gas 1500 m3/h			
Rated load of furnace	100 t/h 495°C				Load at time of measurement		74 t/h 479°C			
Burner type and rating	Pulverized coal burner (natural gas-oil burner attached)				Number. of burners		4			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2016	126	25	500	135	5.6	159	243,000	-
O2 6 %	ppm	4032	252	50	-					
conversion value	mg/m3	11520	720	143	1000					
Emission	kg/h	1400	62.9	7.59	120					
Emission standard	kg/h	800	180	12000	160					

Outline of facility and of measurements

Facility

A pulverized coal combustion boiler for power generation is used. Brown coal mined in the BORSOD area is used as fuel, and natural gas is used as supplementary fuel. The burner is installed by the tangential combustion method. A superheater, economizer and air preheater have been attached for energy conservation, and an electric dust collector is provided for dust removal.

There are 10 boilers of the same model at this power station, but at present, numbers 1 through 4 are mainly operated.

Location of measurement

The measurement site installed at the rear of the electric dust collector was used. Since air gets into the exhaust gas from the air preheater and from the dust collector, the oxygen concentration was high.

Problems and Countermeasures

Since sulfur is contained in the fuel, the SO2 content far exceeds the standard value.
If the current fuel continues to be used henceforth, desulfurization will become necessary.
Details are presented separately.

Estimated effects of countermeasures

-

* Estimated values

Table D4.1.5 (5) Flue Gas Measurement Results

No 05 / 0	Source No.P 002-1	Product Steam for power generation and for processing
Name of company	BORSODI ENERGETIKAT KFT.	
Name of combustion facility	No. 4 water tube boiler	
Types of fuel used	Brown coal and natural gas	Fuel Consumption: brown coal * 33.78 t/h; natural gas 1300 m3/h
Rated load of furnace	100 t/h 495°C	Load at time of measurement: 72 t/h 497°C
Burner type and rating	Pulverized coal burner (natural gas-oil burner attached)	Number. of burners: 4

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	℃	Nm3/h	%
		1582	160	60	140	12.6	6.2	205	192,000	-
O2 6 %	ppm	2825	286	107	-					
conversion value	mg/m3	8071	587	134	250					
Emission	kg/h	868	63.1	14.1	27					
Emission standard	kg/h	800	180	12000	160					

Outline of facility and of measurements

Facility

Same as P001-1.

Location of measurement

Same as P001-1.

Problems and Countermeasures

Same as P001-1.

Estimated effects of countermeasures

-

* Estimated values

Table D4.1.5 (6) Flue Gas Measurement Results

No 05 / 1		Source No.P 001-3		Product	Steam for power generation and for processing					
Name of company		BORSODI ENERGETIKAT KFT.								
Name of combustion facility		No. 3 water tube boiler								
Types of fuel used		Brown coal and natural gas			Fuel Consumption			brown coal * 35.9 t/h natural gas 1500 m3/h		
Rated load of furnace		100 t/h 495°C			Load at time of measurement			76 t/h 495°C		
Burner type and rating		Pulverized coal burner (natural gas-oil burner attached)			Number. of burners			4		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	℃	Nm3/h	%
		2240	182	30	210	11.6	7.6	173	171,000	-
O2 6 %	ppm	3574	290	48	-					
conversion value	mg/m3	10211	829	137	335					
Emission	kg/h	1090	63.9	6.41	40					
Emission standard	kg/h	800	180	12000	160					
Outline of facility and of measurements										
Facility Same as P001-1.										
Location of measurement Same as P001-1.										
Problems and Countermeasures Same as P001-1.										
Estimated effects of countermeasures -										

* Estimated values

Table D4.1.5 (7) Flue Gas Measurement Results

No 07 ／ 0	Source No.P 015		Product Product: Glass containers							
Name of company	PANNONGALAS IPARI RT.									
Name of combustion facility	No. 1 glass melting tank oven									
Types of fuel used	Natural gas				Fuel Consumption		930 m3/h			
Rated load of furnace	100 t/h				Load at time of measurement		70 t/h			
Burner type and rating	Pair-type natural gas burner				Number. of burners		6 sets of 2 burners each			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	203	ND	45	13.1	4.6	388	22,500	-
O2 8 %	ppm	ND	334	ND	-					
conversion value	mg/m3	ND	686	ND	7.4					
Emission	kg/h	ND	9.38	ND	1.0					
Emission standard	kg/h	-	67	3.333	40					

Outline of facility and of measurements

Facility

A tank type glass melting tank oven rated at 100 t/h is used. At a melting temperature of 1500°C (by pyrometer), a regenerator of 1380 to 1430°C is installed for energy conservation so heat collection takes place. Switchover time is 20 minutes.

The natural gas burner was developed by the company. It comes in sets of two burners each, and six sets are installed.

A German-made computer is used to control the oven.

Location of measurement

The smokestack intake behind the regenerator was used. Residual oxygen concentration at the measuring point is high because a regenerator is used.

Problems and Countermeasures

Dust, SO2, NOx, and CO all fall below the exhaust standard, but the NOx concentration at 8% 02 is high at 334 ppm. An oxygen burner is recommended because the conventional low-NOx burner is not effective for adding heat to 1500°C. Air pressurized to about 3 kg/cm2g is separated into N2 and O2 by zeolite; O2 alone is collected and burnt by an oxygen burner.

Estimated effects of countermeasures

Thanks to oxygen-enriched combustion, NOx will not exceed 10 ppm.

Table D4.1.5 (8) Flue Gas Measurement Results

No 07 / 0	Source No.P 019		Product Glass containers							
Name of company	PANNONGALAS IPARI RT.									
Name of combustion facility	No. 1 glass melting tank oven									
Types of fuel used	Natural gas				Fuel Consumption	930 m3/h				
Rated load of furnace	100 t/h				Load at time of measurement	70 t/h				
Burner type and rating	Pair-type natural gas burner				Number. of burners	6 sets of 2 burners each				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		8	220	85	10	12.3	5.3	378	20,800	-
O2 8 %	ppm	13	329	127	-					
conversion value	mg/m3	37	676	158	15					
Emission	kg/h	0.475	9.4	2.21	0.21					
Emission standard	kg/h	-	67	3.333	40					

Outline of facility and of measurements

Facility

Same as P015.

Location of measurement

Same as P015.

Problems and Countermeasures

Same as P015.

Estimated effects of countermeasures

Same as P015.

Table D4.1.5 (9) Flue Gas Measurement Results

No 08 / 0	Source No.P 001-1	Product Sintered ore for steel making								
Name of company	BORSODI ERCELOKESZITO MUZSGORITO KFT.									
Name of combustion facility	D.L. type sintering furnace									
Types of fuel used	Coal, coke, natural gas				Fuel Consumption		Coal + coke 5.9 t/h Natural gas 493 m3/h			
Rated load of furnace	88 t/h				Load at time of measurement		88 t/h			
Burner type and rating	Natural gas burner for ignition				Number. of burners		1			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		94	144	8833	340	17.5	3.6	106	374,000	-
O2 6 %	ppm	403	617	37860	-					
conversion value	mg/m3	1151	1267	30400	1460					
Emission	kg/h	100	111	4130	130					
Emission standard	kg/h	300	300	10000	160					

Outline of facility and of measurements

Facility

Four sintering furnace systems are available, but only one system is currently in operation. And this one system operates for three consecutive days, then is shut down for one day. A natural gas burner is used for firing the raw material. After firing, the coal and coke in the raw material undergoes self-sustained combustion while traveling over a belt and turns into the product. Equipment at the facility has undergone aging and deterioration. Plans call for introduction of a Japanese-made firing oven, but it is suspected that this process will be abolished because the government resolved in January 1994 to abolish the DNM blast furnace sometime in 1994. Consequently, studies are being made to determine how to reapply the system for other purposes such as melting and treatment of scrap iron, or pretreatment.

Location of measurement

Measurement sites installed on the lateral flue at the outlet of the multicyclone were used.

Problems and Countermeasures

A multicyclone has been introduced as an environmental countermeasure, but it is poor in efficiency and produces 1.46 g/m3 of dust. Items such as an electric dust collector must be introduced for the treatment of scrap.

Estimated effects of countermeasures

Dust will be reduced to about 0.05 to 2 g/Nm3.

Table D4.1.5 (10) Flue Gas Measurement Results

No 09 / 2		Source No.P 001			Product Steam for processing					
Name of company		SAGROCHEM KFT.								
Name of combustion facility		HLG flue and smoke tube boiler								
Types of fuel used		Heavy oil				Fuel Consumption		830 kg/h		
Rated load of furnace		20 t/h 12 bar				Load at time of measurement		16 t/h 9.4 bar		
Burner type and rating		Rotary type oil burner 800 kg/h				Number. of burners		2		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		557	192	ND	62.9	8.5	9.3	223	16,600	80.9
O2 3 %	ppm	802	276	ND	-					
conversion value	mg/m3	2306	566	ND	196					
Emission	kg/h	26.4	6.55	ND	1.0					
Emission standard	kg/h	87.5	35	1750	60					

Outline of facility and of measurements

Facility

This facility has one 20 t/h boiler and three 30 t/h boilers used to produce steam for processing. The unit measured was the 20 t/h boiler. This is a smoke tube boiler made by the LANG Company. It has two flues, each of which is equipped with a rotary burner rated at 800 kg/h and made by the SAACKE Company of Germany. This boiler has a triple-pass structure, and a super heater is attached at the outlet of the second pass. The fuel is heated by an oil heater to 100°C and burnt at 6000 rpm. Air preheating takes place by having the air pass over the boiler side wall, but there is no recuperator.

Both imports and domestically-produced heavy oil is used, at market prices. At the time of the survey, the oil used was produced in Slovakia at 2.06% sulfur content and 39.5 MJ/kg. In the past, desulfurized oil at a sulfur content of 1.01% was used, but it is not used now because of 1000 Ft, which is high.

Location of measurement

Directly behind boiler outlet.

Problems and Countermeasures

1. Reduction of oxygen concentration so that smoke is not produced (3 to 4%).
2. Conversion of fuel to low-sulfur heavy oil or gas oil.

Estimated effects of countermeasures

About 4% savings in energy by having the concentration of residual O2 in the exhaust gas at 4%.

Table D4.1.5 (11) Flue Gas Measurement Results

No 09 / 2	Source No.P 055									
Name of company	SAGROCHEM KFT.									
Name of combustion facility	Incinerator for wastes									
Types of incinerated items	Solids and waste solvents									
Rated load of furnace	Solids 60 kg/h, Liquids 100 kg/h				Load at time of measurement		Solids 60 kg/h, Liquids 100 kg/h			
Burner type and rating	Company-made liquid treatment burner				Number. of burners		-			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	196	75	40	16.9	2.6	35	2,390	-
conversion value	mg/m3	ND	403	94	40					
Emission	kg/h	ND	0.962	0.224	0.096					
Emission standard	kg/h	200	400	100	30					

Outline of facility and of measurements

Facility

This is a company-made furnace made for incinerating liquid and solid wastes generated by processing.

Solids are burnt by a liquid treatment burner. These solids are paper and urethane foam. The liquids are organic solvents and processing waste fluids. The exhaust gas undergoes water cleaning treatment and air dilution, then is released into the atmosphere.

Location of measurement

Measurements were taken at locations where water cleansing and air dilution had been completed. Hence the oxygen concentration was high at 16.9% and the exhaust gas temperature was low at 35°C.

Problems and Countermeasures

Black smoke and CO are produced when solid wastes undergo treatment. This is caused by incomplete combustion when massive lumps of solid waste are incinerated. Steps must be taken to reduce black smoke and CO by preparing solids in appropriate sizes for thorough incineration.

Converted at O2 of 4%, the NOx measures 813 ppm. NOx should be reduced by introducing a two-stage combustion burner since it is suspected that items containing nitrogen are included among incinerated items.

Estimated effects of countermeasures

It should be possible to reduce NOx to anywhere from 150 to 200 ppm at O2 of 4%.

Table D4.1.5 (12) Flue Gas Measurement Results

No 10 / 0	Source No.P 033-2	Product Steam for processing								
Name of company	DECEMBER 4. DROTMUVEK									
Name of combustion facility	No. 2 flue and smoke tube boiler									
Types of fuel used	Natural gas				Fuel Consumption	215 m3/h				
Rated load of furnace	4 t/h 12 bar				Load at time of measurement	3.4 t/h 8.8 bar				
Burner type and rating	Block type 460 m3/h				Number. of burners	1				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	65	ND	-	4.0	9.6	223	2,210	80.1
O2 3 %	ppm	ND	70	ND	-					
conversion value	mg/m3	ND	144	ND	-					
Emission	kg/h	ND	0.295	ND	-					
Emission standard	kg/h	-	1.44	72	-					

Outline of facility and of measurements

Facility

There are three boilers for processing at a wire factory: one boiler at 7t/h and two at 4 t/h. At the time of measurement, only the No. 2 boiler at 4t/h was operating.

These are triple-pass type, flue and smoke tube boiler and they are equipped with gauges for regulating fuel, steam, water supply, etc. The burner is of the block type with an air blower built in.

Location of measurement

Measurements were taken at the lateral flue by the boiler outlet.

Problems and Countermeasures

Gauges are well provided for regulation of fuel combustion, so favorable combustion takes place, but O2 should be further reduced to about 2%.

Estimated effects of countermeasures

-

Table D4.1.5 (13) Flue Gas Measurement Results

No 13 / 0	Source No.P 002	Product Steam for processing								
Name of company	DIOSGYORI PADIRGYAR LEANYVALLALAT									
Name of combustion facility	Flue and smoke tube boiler									
Types of fuel used	Natural gas	Fuel Consumption	430 m3/h, 217 m3/h							
Rated load of furnace	5 t/h 12 bar	Load at time of measurement	2.9 t/h 9.66 bar							
Burner type and rating	Block-type natural gas burner	Number. of burners	1							
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	54	ND	10	4.3	9.7	2.09	2,620	80.5
O2 3 % conversion value	ppm	ND	58	ND	-					
	mg/m3	ND	119	ND	11					
Emission	kg/h	-	133	-	-					
Emission standard	kg/h	-	2.7	90	-					

Outline of facility and of measurements

Facility

A triple-pass type, flue and smoke tube boiler is used to generate processing steam for making paper from pulp. A block-type, natural gas burner is attached.

Gauges are well provided for regulating boiler operation.

Another boiler of the same model is available so that the two units are operated alternately.

Location of measurement

At a ground point 10 meters from the 21-meter smokestack.

Problems and Countermeasures

None in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (14) Flue Gas Measurement Results

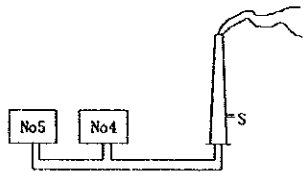
No 15 / 1		Source No.P 006-2			Product	Heat treatment of steel ingots				
Name of company		HAMOR RT.								
Name of combustion facility		No. 5 metal heating furnace								
Types of fuel used	Natural gas				Fuel Consumption	489 m3/h				
Rated load of furnace	* 24GJ/h				Load at time of measurement	Undetermined				
Burner type and rating	Natural gas burner 15 m3/h				Number. of burners	5				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	15	ND	1.3	17.1	2.2	385	20,500	-
O2 3 %	ppm	ND	69	ND	-					
conversion value	mg/m3	ND	142	ND	6					
Emission	kg/h	ND	0.631	ND	0.027					
Emission standard	kg/h	-	1.8	60	-					

Outline of facility and of measurements

Facility

A truck type, metal heating furnace made in 1958 is available, with a recuperator attached, but it is not currently in use because it has deteriorated. The burner has the same specifications as that for DIMAG.

Maximum steel temperature is 1200°C and it takes 12 hours to reach this temperature.



Location of measurement

Measurements were taken at the compound smokestack for two truck-type, heat treating furnaces. There is a massive influx of air from other furnaces, which are currently not in use, so the concentration of residual oxygen is high.

Problems and Countermeasures

There are no problems with pollutants but energy loss is great.

When the specific heat of the exhaust gas is 1.38 KJ/Nm3, the increment (385-200) which lowers the exhaust gas to 200°C multiplied by 1.38 KJ/Nm3 x 20500 = 6.826500 KJ/h. In other words, when the calorification volume of natural gas is 34358 KJ/m3, the gas can be reduced by 199 m3/h.

Countermeasures include reduction of incoming air through furnace maintenance and heat recovery by recuperator.

This furnace was once operated by the former DIMAG Company, but it has deteriorated through use by all the company affiliates, so there is a great loss of heat due to its deformation and to inadequate servicing. A heat regulation department must therefore be established to realize extensive energy savings.

Estimated effects of countermeasures

NOx will be lowered about 40% through fuel reductions, but there will be a slight increase of NOx due to air preheating, so the final reduction is estimated at about 20%.

* Estimated values

Table D4.1.5 (15) Flue Gas Measurement Results

No 15 / 1	Source No.P 009	Product Heat treatment of steel ingots
Name of company	HAMOR RT.	
Name of combustion facility	No. 3 forging furnace	
Types of fuel used	Natural gas	Fuel Consumption 213 m3/h
Rated load of furnace	* 26 GJ/h	Load at time of measurement -
Burner type and rating	Natural gas burner 250 m3/h	Number. of burners 6; however, 3 units each are used alternately.

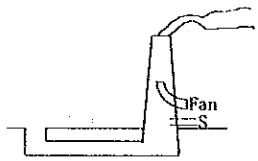
Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	147	ND	1.4	17.6	1.8	103	11,100	-
O2 3 %	ppm	ND	778	ND	-					
conversion value	mg/m3	ND	1595	ND	7.4					
Emission	kg/h	ND	3.35	ND	0.016					
Emission standard	kg/h	-	0.31	10	-					

Outline of facility and of measurements

Facility

A box-type, metal heating furnace made in 1897 is available. A regenerator is attached and air preheating takes place (preheat temperature is 300°C). There are three burners in a set and two sets have been prepared, so fuel combustion is effected by switching these burner sets once every three minutes. Maximum steel temperature is 1200°C.



Location of measurement

Measurements were taken at the base of the smokestack, but there was considerable influx of air because a brick regenerative furnace was used.

Problems and Countermeasures

The NOx concentration is high at 778 ppm (O2 at 3%) and countermeasures are necessary.

Furnance openings and couplings must be repaired so air intake is reduced and combustion takes place at the lowest possible air ratio. In addition, oxygen-enriched combustion and two-stage combustion should be introduced. (However, the furnace must be completely sealed.) Substantial reduction of NOx can be realized by introducing oxygen burners.

Estimated effects of countermeasures

NOx can be reduced by more than 90% by introducing oxygen burners.

* Estimated values

Table D4.1.5 (16) Flue Gas Measurement Results

No 15 / 2	Source No.P 014-1	Product Slab heat treatment
Name of company	DIOSGYORI ACEL ES VASONTO KFT.	
Name of combustion facility	1-A truck-type heat treating furnace	
Types of fuel used	Natural gas	Fuel Consumption *314 m3/h
Rated load of furnace	11.3GJ/h	Load at time of measurement -
Burner type and rating	Natural gas burner 15 m3/h	Number. of burners 27

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	22	ND	4.3	15.5	2.9	3,370	415	-
O2 3 %	ppm	ND	72	ND	-					
conversion value	mg/m3	ND	148	ND	14.9					
Emission	kg/h	ND	0.423	ND	0.040					
Emission standard	kg/h	-	0.31	11	-					

Outline of facility and of measurements

Facility

Twenty-seven natural gas burners are used with a truck-type heat treating furnace. Heating takes place at a speed of 80°C/h up to 900°C. Temperature is controlled by turning the burners on and off.

Location of measurement

The smokestack base was used as the measurement site. The concentration of residual oxygen was high because a large volume of air came from the truck furnace door.

Problems and Countermeasures

Since the temperature of the exhaust gas is high at 415°C, a recuperator should be introduced.

Energy savings of about 10% can be gained when the preheating air is raised to 300°C by heat recovery.

Since the concentration of oxygen in the exhaust gas is high, air was restricted to the lowest value of 15.5%. When it was restricted further, combustion became unstable.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (17) Flue Gas Measurement Results

No 15 / 4	Source No.P 002-2~3	Product Heat treatment of steel ingots								
Name of company	DNM DIOSGYORI NEMESACEL MUVEK FA.									
Name of combustion facility	Box-type soaking pit									
Types of fuel used	Natural gas	Fuel Consumption -								
Rated load of furnace	1.0 GJ/h	Load at time of measurement -								
Burner type and rating	Natural gas burner 25 m3/h	Number. of burners 2								
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	22	ND	0.9	17.3	1.8	215	5,410	-
O2 3 % conversion value	ppm	ND	107	ND	-					
	mg/m3	ND	220	ND	4.4					
Emission	kg/h	ND	0.244	ND	0.0049					
Emission standard	kg/h	-	6	200	-					

Outline of facility and of measurements

Facility

Three box-type soaking pits and two underground soaking pits are available. At the time of measurement, two box-type soaking pits were in operation. These furnaces have two natural gas burners attached. Steel is heated to a temperature of 1150°C. No gas meters are attached.

Location of measurement

The measurement site established at the base of the centralized smokestack for five furnaces was used. A large volume of air came from the furnaces not in use.

Problems and Countermeasures

The furnace doors are deformed and should be repaired so that the volumes of air getting into the furnaces can be reduced.

Estimated effects of countermeasures

-

Table D4.1.5 (18) Flue Gas Measurement Results

No 15 / 4	Source No.P 046	Product Heat treatment of steel ingots								
Name of company	DNM DIOSGYORI NEMESACEL MUVEK FA.									
Name of combustion facility	No. 2 underground soaking pit									
Types of fuel used	Natural gas	Fuel Consumption	230 m3/h							
Rated load of furnace	9.4 GJ/h	Load at time of measurement	85%							
Burner type and rating	Natural gas burner 250 m3/h	Number. of burners	1							
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	86	ND	3.6	16.7	2.0	287	17,500	-
O2 3 %	ppm	ND	360	ND	-					
conversion value	mg/m3	ND	738	ND	16.0					
Emission	kg/h	ND	3.09	ND	0.063					
Emission standard	kg/h	-	6	200	-					

Outline of facility and of measurements

Facility

Underground soaking pits are used, with one burner for combustion at the upper portion. Seven steel ingots each weighing six tons are loaded into the pits and processed at 1100 to 1200°C.

There is a radial-type recuperator in the pit, and air is preheated from 400 to 420°C.

The six furnaces are arranged in parallel so that exhaust gas is directed to one smokestack.

No gas meters are attached.

Location of measurement

Samples were taken from the measuring site established at the bottom of the smokestack. Since only three furnaces were in operation during measurements, it is suspected that considerable air came from the other non-operating its.

Problems and Countermeasures

Lids are attached at the tops of the furnaces, but they have deteriorated so that flames blow out, and must be repaired.

NOx concentration is high because of air preheating, and low NOx burners should be introduced.

Estimated effects of countermeasures

NOx concentration could be lowered about 50% by introducing low-NOx burners.

* Estimated value

Table D4.1.5 (19) Flue Gas Measurement Results

No 15 / 4	Source No.P 095-1	Product Air for processing
Name of company	DNM DIOSGYORI NEMESACEL MUVEK FA.	
Name of combustion facility	HOK flue and smoke tube boiler	
Types of fuel used	Natural gas	Fuel Consumption *480 m3/h
Rated load of furnace	12 t/h 12 bar	Load at time of measurement 5.1 t/h 8.6 bar
Burner type and rating	Block-type natural gas burner 600 m3/h	Number. of burners 1

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	69	ND	2.9	9.7	12.0	177	11,800	78.4
O2 3 %	ppm	ND	116	ND	-					
conversion value	mg/m3	ND	238	ND	4.8					
Emission	kg/h	ND	0.594	ND	0.043					
Emission standard	kg/h	-	42	1400	-					

Outline of facility and of measurements

Facility

A triple-pass, flue and smoke tube boiler made in 1978 is used. Fuel was changed from heavy oil to natural gas in 1981. Air combustion adjustment takes place automatically, but the flame is orange in color, and if O2 is restricted to 4 percent, black smoke is produced.

Water for the boiler is preheated to 95°C by a steam-type economizer while deoxidization also takes place. Air is preheated up to 75 to 85°C by passing air for combustion over pipe surface.

Another boiler of the same type is available, and they are operated either alternately or simultaneously.

Location of measurement

The measuring site on the lateral flue directly in front of the smokestack was used.

Problems and Countermeasures

It is suspected that there are problems with the air and fuel mixtures because the flame exhibited an orange color, and black smoke is produced with O2 at 4 percent. The burners should be replaced and the concentration of residual oxygen reduced to about 2 percent.

Estimated effects of countermeasures

Fuel could be reduced about 4 percent by lowering the air ratio from the current value of 1.86 to 1.16.

* Estimated value

Table D4.1.5 (20) Flue Gas Measurement Results

No 15 / 4	Source No.P 097-2		Product Air for processing							
Name of company	DNM DIOSGYORI NEMESACEL MUVEK FA.									
Name of combustion facility	No. 2 water tube boiler									
Types of fuel used	Natural gas; blast furnace gas		Fuel Consumption	natural gas 2400 m3/h blast furnace gas 13000 m3/h						
Rated load of furnace	24 t/h 32 bar 420°C		Load at time of measurement	15 t/h 32 bar						
Burner type and rating	Undetermined		Number. of burners	4						
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	6	90	0.9	11.2	11.2	188	48,200	-
O2 3 %	ppm	ND	11	174	-					
conversion value	mg/m3	ND	23	218	1.7					
Emission	kg/h	-	0.594	5.42	0.043					
Emission standard	kg/h	-	60	2000	-					

Outline of facility and of measurements

Facility

Steam for processing in steel-production plants is produced.

A water tube boiler made in 1953 is used. In the past, pulverized coal and blast furnace gas were consumed as fuel, but in 1990 these were replaced by a mixture of natural gas and blast furnace gas. The burner arrangement is tangential. In the past electric power was also generated, but it is not being produced at present.

Location of measurement

The measurement site established directly behind the suction fan was used. Since the facilities have deteriorated, a large volume of air enter, and it is suspected that the concentration of O2 at the combustion chamber outlet varies considerably from the measured concentration.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

Table D4.1.5 (21) Flue Gas Measurement Results

No 17 / 1		Source No.P 010			Product Cement					
Name of company		HEJOCSABAI CEMENT-ES MENSZIPARI RT.								
Name of combustion facility		SP cement kiln (rotary kiln)								
Types of fuel used		Natural gas				Fuel Consumption		7970 m3/h Liquid wastes 300 kg/h		
Rated load of furnace		83 t/h				Load at time of measurement		73.7 t/h		
Burner type and rating		Kiln burner 10000 m3/h Precalciner 2000 m3/h				Number. of burners		1		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	533	105	33	14.5	10.9	107	297,000	-
O2 6 %	ppm	ND	976	185	-					
conversion value	mg/m3	ND	2004	231	58					
Emission	kg/h	ND	325	39	9.8					
Emission standard	kg/h	-	120	4000	40					

Outline of facility and of measurements

Facility

This furnace is a rotary kiln for producing cement clinker. It has a suspension preheater and precalciner attached. The precalciner was installed in 1981. It did not result in increased output because it did not balance well with the processing capabilities of the mill and other peripheral equipment, but it did yield improved quality. Consequently, it is now being used for waste oil incineration. Approximately one-third of the exhaust gas is used in the raw material drying furnace. The cooling air for clinker is also used as combustion air (200°C).

The two kiln systems are rated at 1,500,000 tons per year, but only one system is now in operation, at 500,000 tons per year. Everything is shut down during the winter when there is no demand.

Location of measurement

The measurement site behind the electric dust collector was used. Oxygen concentration is high because exhaust gas from the raw material drying furnace is included.

Problems and Countermeasures

The NOx concentration is high because of combustion air preheating and because the cross sectional heat load in the furnace is high. To correct this situation, low-NOx burners should be introduced.

Estimated effects of countermeasures

NOx could be reduced about 60 percent by introducing low-NOx burners.

Table D4.1.5 (22) Flue Gas Measurement Results

No 17 / 1	Source No.P 03		Product Burnt lime							
Name of company	HEJOCSABAI CEMENT-ES MESZIPARI RT.									
Name of combustion facility	Shaft kiln for burning lime									
Types of fuel used	Natural gas				Fuel Consumption		2670 m3/h			
Rated load of furnace	19 t/h				Load at time of measurement		13.9 t/h			
Burner type and rating	Natural gas burner 170 m3/h				Number. of burners		Sets of 16 burners used alternately			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		5	16	ND	4.8	8.3	22.0	95	34,300	-
O2 6 %	ppm	5.9	19	ND	-					
conversion value	mg/m3	17	39	ND	5.7					
Emission	kg/h	0.490	1.13	ND	0.16					
Emission standard	kg/h	40	40	1333	20					

Outline of facility and of measurements

Facility

Completed in 1992, this is a shaft kiln made in Germany for burning lime. There are two shafts, each containing 18 burners, and burning and cooling take place alternately every 15 minutes. In order to recover heat, cooling air is used for burning. Raw materials are rendered into products in about 17 to 20 hours.

A bag filter is used to collect dust.

Location of measurement

The measurement site behind the bag filter was used.

Problems and Countermeasures

The volumes of dust discharged from the smokestacks of both cement kilns and shaft kilns are low, but the volumes of finished and semi-finished products which have leaked and accumulated in the factory are large. Hence the problem of rescattering emerges. Greenery has been planted around the factory compound and other measures have been taken to prevent scattering, but to prevent rescattering to surrounding areas, all areas in the factory compound should be cleaned.

Estimated effects of countermeasures

-

Table D4.1.5 (23) Flue Gas Measurement Results

No 18 / 1	Source No.P 001	Product Asphalt mix
Name of company	STRABAG HUNGARIA EPITO KFT.	
Name of combustion facility	Rotary kiln for aggregate drying	
Types of fuel used	Natural gas	Fuel Consumption *450 m3/h
Rated load of furnace	60 t/h	Load at time of measurement 60 t/h
Burner type and rating	Natural gas burner 450 m3/h	Number. of burners 1

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		23	36	32	190	17.7	1.7	126	26,700	-
O2 18 %	ppm	21	33	29	-					
conversion value	mg/m3	60	74	40	172					
Emission	kg/h	1.75	1.97	1.07	5.1					
Emission standard	kg/h	18	-	360	5.4					

Outline of facility and of measurements

Facility

Completed in 1993, this is a rotary kiln for aggregate drying.
A bag filter is used to collect dust.

Location of measurement

The measurement site behind the bag filter was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (24) Flue Gas Measurement Results

No 21 / 0	Source No.P 001			Product Building bricks						
Name of company	EMO. TEGLA ES CSEREPIPARI VALLALAT MALYI TEGLAGYARA									
Name of combustion facility	No. 1 & No. 2 ring kiln (Improved models of Hoffman kiln)									
Types of fuel used	Natural gas				Fuel Consumption		* 144 m3/h			
Rated load of furnace	1970 bricks/h				Load at time of measurement		1970 bricks/h			
Burner type and rating	Natural gas burner 6 m3/h				Number. of burners		Four sets of 6 burners each			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		15	56	15	1.3	19.1	1.5			
O2 18 %	ppm	24	88	24	-					
conversion value	mg/m3	69	181	30	2.0					
Emission	kg/h	1.45	3.89	0.63	0.044					
Emission standard	kg/h	150	150	5,000	80					

Outline of facility and of measurements

Facility

This is an improved version of the Hoffman-type ring kiln. The curved portions to the right and left of the elliptical, doughnut-shaped ovens have been cut away, and the two ovens have been arranged in parallel. The unit was renovated so that a forklift can be used to load and unload material in the kiln. Four sets of six mobile-type natural gas burners have been arranged in series on the kiln ceiling. These burners move in accordance with the brick burning process. Under heating by natural gas, the raw material clay mixed with sawdust undergoes self-combustion, and burning of brick interior progresses. Part of the exhaust gas is used in the product drying process.

Location of measurement

The measurement site attached to the underground flue from the kiln to the smokestack was used. The concentration of residual oxygen was high because exhaust gas from the cooling process was also included.

Problems and Countermeasures

Nothing in particular since the shift to natural gas has already been completed.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (25) Flue Gas Measurement Results

No 22 / 0	Source No.P 001	Product Asphalt mix
Name of company	MISKOLCI UTEPITO KFT NYEKI ASZFALTKEVERO	
Name of combustion facility	Rotary kiln for aggregate drying	
Types of fuel used	Natural gas	Fuel Consumption 480 m3/h
Rated load of furnace	70 t/h	Load at time of measurement 70 t/h
Burner type and rating	500 m3/h	Number. of burners 1

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		98	9	400	52	18.5	1.2	87	33,700	-
O2 18 %	ppm	118	11	480	-					
conversion value	mg/m3	337	23	600	62					
Emission	kg/h	9.44	0.623	16.9	1.8					
Emission standard	kg/h	9.45	9.45	315	5.4					

Outline of facility and of measurements

Facility

This is an aggregate drying rotary kiln used for making asphalt mix. It is equipped with a bag filter to collect dust.

Location of measurement

The measurement site attached to the smokestack was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (26) Flue Gas Measurement Results

No 23 / 1	Source No.P 003-1~3	Product Nitric acid
Name of company	TVK	
Name of combustion facility	Ammonia oxidation furnace(reaction layer)	
Types of fuel used -	Fuel Consumption -	
Rated load of furnace 18 t/h	Load at time of measurement 6 t/h	
Burner type and rating -	Number. of burners -	

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	1606	ND	-	4.9	ND	141	63,700	-
O2 3 %	ppm	ND	1796	ND	-					
conversion value	mg/m3	ND	3681	ND	-					
Emission	kg/h	ND	210	ND	-					
Emission standard	kg/h	-	400	-	-					

Outline of facility and of measurements

Facility

Built by the former Soviet Union, this furnace burns ammonia to produce nitric acid.

There are nine furnace units, but only three were operating when measurements were taken. Of these, a denitration unit by ammonia additive was attached on a experimental basis to the No. 1 furnace.

The exhaust gas exhibits a brown color because of its high concentration of NOx.

NO2: 409 ppm (O2 · 3%)

Location of measurement

The measurement site attached to the lateral flue directly in front of the smokestack was used. The exhaust gas from 9 furnaces is concentrated and directed to one smokestack.

Problems and Countermeasures

The NOx concentration in exhaust gas is 1,796 ppm (O2 · 3%) and countermeasures are required. The method of ammonia additive, which is currently being applied experimentally, is the normal method of denitration, but its efficiency is only about 70 percent. On the other hand, with the Pura Siv N method in which an oxidation catalyst function has been added to a molecular sieve, NOx concentration can be reduced to around 10 ppm by adsorption of NO2.

Estimated effects of countermeasures

Denitration of about 95% becomes possible.

Table D4.1.5 (27) Flue Gas Measurement Results

No 23 / 1	Source No.P 021-1	
Name of company	TVK	
Name of combustion facility	Solid waste incinerator I-610	
Types of incinerated items	Solid wastes	
Rated load of furnace	500 kg/h	Load at time of measurement 300 kg/h
Burner type and rating	-	Number. of burners -

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	26	15	21	18.0	2.0	101	12,600	-
conversion value	mg/m3	ND	53	19	21					
Emission	kg/h	ND	0.636	0.236	0.26					
Emission standard	kg/h	200	400	100	30					

Outline of facility and of measurements

Facility

This unit is a counterpart of the I-600 and I-620 incinerators , all three of which were made in Japan. The incineration wastes are polyethylene and polypropylene.

A waste heat boiler is attached which collects heat as processing steam.

A multicyclone is installed to collect dust.

Location of measurement

The measurement site attached to the lateral flue directly in front of the central smokestack was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (28) Flue Gas Measurement Results

No 23 / 1	Source No.P 021-2									
Name of company	TVK									
Name of combustion facility	Solvent waste incinerator I-620									
Types of incinerated items	Waste solvents									
Rated load of furnace	100 kg/h				Load at time of measurement	100 kg/h				
Burner type and rating	-				Number. of burners	-				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	20	ND	13	16.8	2.5	257	9,190	-
conversion value	mg/m3	ND	41	ND	13					
Emission	kg/h	ND	0.377	ND	0.12					
Emission standard	kg/h	250	100	5000	60					

Outline of facility and of measurements

Facility

This unit is the I-620 model, which is used to incinerate waste solvents from the process called TK466. A multicyclone has been installed to collect dust.

Location of measurement

The measurement site attached to the lateral flue directly in front of the central smokestack was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (29) Flue Gas Measurement Results

No 23 / 1	Source No.P 021-3									
Name of company	TVK									
Name of combustion facility	Solvent waste incinerator I-600									
Types of incinerated items	Waste solvents									
Rated load of furnace	100 kg/h				Load at time of measurement	100 kg/h				
Burner type and rating	-				Number. of burners	-				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	18	ND	0.1	17.5	2.0	231	13,000	-
conversion value	mg/m3	ND	37	ND	0.1					
Emission	kg/h	ND	0.481	ND	0.0013					
Emission standard	kg/h	250	100	5000	60					

Outline of facility and of measurements

Facility

This unit is the I-600 model, which is used to incinerate waste solvents from the process called TK55. A multicyclone has been installed to collect dust.

Location of measurement

The measurement site attached to the lateral flue directly in front of the central smokestack was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (30) Flue Gas Measurement Results

No 23 / 1	Source No.P 025-2	Product Steam for processing								
Name of company	TVK									
Name of combustion facility	No. 2 water tube boiler									
Types of fuel used	Natural gas; heavy oil				Fuel Consumption		Natural gas * 1450 m3/h			
Rated load of furnace	25 t/h 40 bar				Load at time of measurement		21 t/h 38 bar			
Burner type and rating	Gas oil burner				Number. of burners		2			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	72	ND	3.6	11.0	5.8	134	24,500	-
O2 3 %	ppm	ND	130	ND	-					
conversion value	mg/m3	ND	267	ND	6.5					
Emission	kg/h	ND	3.62	ND	0.088					
Emission standard	kg/h	500	100	5000	-					

Outline of facility and of measurements

Facility

Made in 1992, this is a water tube boiler located inside a petrochemical plant. It is equipped with two burners for natural gas and oil mixture. A superheater, economizer and air preheater are also attached.

Although mixed fuel burners are used, combustion of mixed fuel by the same burner does not take place. Use of gas and oil is divided up between two burners. At the time of measurement, only natural gas was being used. At a preheat temperature of 100°C, oil is atomized with 11 bar of steam.

The oil burner is also used to burn waste oil generated from the process of manufacturing olefin.

Location of measurement

The measurement site attached to the lateral flue behind the air preheater was used. Oxygen concentration is high in the exhaust gas because air leaks from the air preheater.

Problems and Countermeasures

All the measured values satisfy exhaust standards, but the NOx at 3% O2 conversion was 130 ppm, which is high for natural gas burning. An exhaust gas recirculator (E. G. R.) should be introduced as a countermeasure.

Estimated effects of countermeasures

In the case of natural gas combustion, NOx can be reduced to about 40 to 60 ppm by setting the exhaust gas recirculation volume at 10 to 14%.

* Estimated value

Table D4.1.5 (31) Flue Gas Measurement Results

No 24 ／ 0		Source No.P 004			Product Heating medium oil					
Name of company		MOL RT.								
Name of combustion facility		F102 heat medium boiler								
Types of fuel used		Natural gas			Fuel Consumption			280 m3/h		
Rated load of furnace		3.65 Gcal/h			Load at time of measurement			277 Gcal/h		
Burner type and rating		Natural gas burner 450 m3/h			Number. of burners			1		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	59	ND	-	6.2	8.3	60	*3,900	86.3
O2 3 %	ppm	ND	72	ND	-					
conversion value	mg/m3	ND	148	ND	-					
Emission	kg/h	ND	0.473	ND	-					
Emission standard	kg/h	500	200	1000	-					

Outline of facility and of measurements

Facility

This boiler is used for preheating of oil product storage tanks. It heats dowtherm oil to 120°C in order to keep the tank interior at 70°C.

A natural gas burner of 450 m3/h rating is installed at the ceiling of this upright boiler. It is structured so that oil in a spiral tube is heated.

Location of measurement

The measurement site at the boiler outlet was used.

Problems and Countermeasures

Since the concentration of O2 in the exhaust gas is high, it must be lowered to about 2 to 3 percent by adjusting the air volume.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (32) Flue Gas Measurement Results

No 25 / 1	Source No.P 001-1		Product Steam for power generation and processing							
Name of company	TISZAI EROMU RT. I. HOEROMU									
Name of combustion facility	No. 1 water tube boiler									
Types of fuel used	Brown coal; Natural gas			Fuel Consumption			Brown coal * 33.29 t/h; Natural gas 700 m3/h			
Rated load of furnace	125 t/h 515°C			Load at time of measurement			97 t/h 502°C			
Burner type and rating	Pulverized coal burner; Natural gas burner			Number. of burners			4 pulverized coal burners; 2 natural gas burners			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2468	236	60	180	9.1	9.0	189	156,000	-
O2 6 %	ppm	3111	297	76	-					
conversion value	mg/m3	8889	610	95	225					
Emission	kg/h	1100	75.6	11.7	28					
Emission standard	kg/h	375	112	7500	90					

Outline of facility and of measurements

Facility

This power station has eight units of the same type of boiler. One smokestack is used with two boilers, and these stacks are designated from P001 to P004.

These boilers are water-tube type units rated at 125 t/h. They are used to make steam for power generation and for processing. These boilers have four pulverized coal burners at the furnace top, and two natural gas burners on the side surface of the furnace. A superheater, economizer and air preheater have been installed to conserve energy, and an electric dust collector to remove dust.

Location of measurement

Gaseous substances were measured at the induced draft fan outlet behind the electric dust collector, and dust was measured at the electric dust collector outlet. The concentration of O2 in the exhaust gas was high because of air entering from the air preheater and elsewhere.

Problems and Countermeasures

The volume of SO2 exhausts is about three times the standard value, and a desulfurization unit must be introduced.

Estimated effects of countermeasures

Desulfurization of 95 percent is possible.

* Estimated value

Table D4.1.5 (33) Flue Gas Measurement Results

No 25 / 1	Source No.P 001-2	Product Steam for power generation and processing
Name of company	TISZAI EROMU RT. I. HOEROMU	
Name of combustion facility	No. 2 water tube boiler	
Types of fuel used	Brown coal; Natural gas	Fuel Consumption: Brown coal * 32.85 t/h; Natural gas 900 m3/h
Rated load of furnace	125 t/h 515°C	Load at time of measurement: 101 t/h 515°C
Burner type and rating	Pulverized coal burner; Natural gas burner	Number. of burners: 4 pulverized coal burners; 2 natural gas burners

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2513	278	90	94	9.8	9.0	175	177,000	-
O2 6 %	ppm	3366	372	121	-					
conversion value	mg/m3	9617	764	248	126					
Emission	kg/h	1270	101	19.9	17					
Emission standard	kg/h	375	112	7500	90					

Outline of facility and of measurements

Facility

Same as P001-1.

Location of measurement

Same as P001-1.

Problems and Countermeasures

Same as P001-1.

Estimated effects of countermeasures

Same as P001-1.

* Estimated value

Table D4.1.5 (34) Flue Gas Measurement Results

No 25 / 1	Source No.P 002-1		Product Steam for power generation and processing							
Name of company	TISZAI EROMU RT. I. HOEROMU									
Name of combustion facility	No. 3 water tube boiler									
Types of fuel used	Brown coal; Natural gas			Fuel Consumption			Brown coal * 39.46 t/h; Natural gas 700 m3/h			
Rated load of furnace	125 t/h 515°C			Load at time of measurement			120 t/h 510°C			
Burner type and rating	Pulverized coal burner; Natural gas burner			Number. of burners			4 pulverized coal burners; 2 natural gas burners			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2686	194	350	510	11.0	7.4	190	176,000	-
O2 6 %	ppm	4029	291	523	-					
conversion value	mg/m3	11511	598	654	765					
Emission	kg/h	1350	70.1	77.0	90					
Emission standard	kg/h	375	112	7500	90					
Outline of facility and of measurements										
Facility Same as P001-1.										
Location of measurement Same as P001-1.										
Problems and Countermeasures Same as P001-1.										
Estimated effects of countermeasures Same as P001-1.										

* Estimated value

Table D4.1.5 (35) Flue Gas Measurement Results

No 25 / 1	Source No.P 002-2	Product Steam for power generation and processing
Name of company	TISZAI EROMU RT. I. HOEROMU	
Name of combustion facility	No. 4 water tube boiler	

Types of fuel used	Brown coal; Natural gas	Fuel Consumption	Brown coal * 48.69 t/h; Natural gas 700 m3/h
Rated load of furnace	125 t/h 515°C	Load at time of measurement	118 t/h 504°C
Burner type and rating	Pulverized coal burner; Natural gas burner	Number. of burners	4 pulverized coal burners; 2 natural gas burners

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2593	196	630	820	9.6	8.3	180	161,000	-
O2 6 %	ppm	3412	258	829	-					
conversion value	mg/m3	9749	530	1036	1079					
Emission	kg/h	1190	64.8	127	130					
Emission standard	kg/h	375	112	7500	90					

Outline of facility and of measurements

Facility

Same as P001-1.

Location of measurement

Same as P001-1.

Problems and Countermeasures

Same as P001-1.

Estimated effects of countermeasures

Same as P001-1.

* Estimated value

Table D4.1.5 (36) Flue Gas Measurement Results

No 25 / 1	Source No.P 003-1	Product Steam for power generation and processing								
Name of company	TISZAI EROMU RT. I. HOEROMU									
Name of combustion facility	No. 5 water tube boiler									
Types of fuel used	Brown coal; Natural gas				Fuel Consumption		Brown coal * 30.11 t/h; Natural gas 700 m3/h			
Rated load of furnace	125 t/h 515°C				Load at time of measurement		90 t/h 508°C			
Burner type and rating	Pulverized coal burner; Natural gas burner				Number. of burners		4 pulverized coal burners; 2 natural gas burners			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2049	264	40	120	11.8	7.1	163	170,000	-
O2 6 % conversion value	ppm	3341	430	65	-					
	mg/m3	9546	883	133	196					
Emission	kg/h	995	92.2	8.5	20					
Emission standard	kg/h	375	112	7500	90					

Outline of facility and of measurements

Facility

Same as P001-1.

Location of measurement

Same as P001-1.

Problems and Countermeasures

Same as P001-1.

Estimated effects of countermeasures

Same as P001-1.

* Estimated value

Table D4.1.5 (37) Flue Gas Measurement Results

No 25 / 2	Source No.P 001			Product Steam for power generation						
Name of company	TISZAI II									
Name of combustion facility	No.1 water tube boiler									
Types of fuel used	Natural gas; Inert gas; Heavy oil				Fuel Consumption			Heavy oil 40 t/h Inert gas 19300 m3/h		
Rated load of furnace	670 t/h 545°C				Load at time of measurement			593 t/h 545°C		
Burner type and rating	See column below.				Number. of burners			See column below.		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		914	325	8	250	4.4	12.8	135	880,000	-
O2 3 %	ppm	991	352	9	-					
conversion value	mg/m3	2831	723	11	271					
Emission	kg/h	2300	587	8.80	220					
Emission standard	kg/h	1875	562	37500	-					

Outline of facility and of measurements

Facility

At this power station there are four boilers of the same type. Three types of fuel are used: residual oil from the neighboring oil refining plant, natural gas obtained from the Ukraine and domestically-produced inert gas (43% CO2). There are eight mixed gas and oil combustion burners, and four of them burn inert gas mixtures. The ratings are as follows: oil, 7.5 t/h; natural gas, 8000 m3/h; inert gas, 11000 m3/h. These burners are arranged in two rows of four burners each at the bottom of the boiler. At the time of measurement, oil and inert gas were mixed together and burnt. A superheater, economizer and air preheater were attached for energy conservation, but there were no measures against exhaust gas.

Location of measurement

Gas substance was measured from the lateral flue, and the measuring site installed near the top of the smokestack was used for measuring dust.

Problems and Countermeasures

SO2 and NOx exceed the standard values. With respect to NOx, given the arrangement of burners, combustion at variable concentration must be used, or a denitration unit must be attached. With respect to SO2, the sulfur component in heavy oil fuel must be further reduced or a desulfurization unit must be introduced.

Estimated effects of countermeasures

Desulfurization and denitration of 90 to 95 percent are possible with introduction of desulfurization and denitration devices.

Table D4.1.5 (38) Flue Gas Measurement Results

No 25 / 2		Source No.P 003			Product Steam for power generation					
Name of company		TISZAI II								
Name of combustion facility		No.3 water tube boiler								
Types of fuel used		Natural gas; Inert gas; Heavy oil			Fuel Consumption			Heavy oil * 38.7 t/h Inert gas 38700 m3/h		
Rated load of furnace		670 t/h 545°C			Load at time of measurement			-		
Burner type and rating		See column below.			Number. of burners			See column below.		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		700	230	ND	160	7.0	11.5	131	906,000	-
O2 3 %	ppm	900	296	ND	-					
conversion value	mg/m3	2571	608	ND	206					
Emission	kg/h	1810	428	ND	140					
Emission standard	kg/h	1875	562	37500	-					
Outline of facility and of measurements										
Facility Same as P001.										
Location of measurement Same as P001.										
Problems and Countermeasures Same as P001.										
Estimated effects of countermeasures Same as P001.										

Table D4.1.5 (39) Flue Gas Measurement Results

No -/	Source No.P 001	Product Meat processing plants								
Name of company	OZD GOMORHUS KAZAUK									
Name of combustion facility	Marine boiler									
Types of fuel used	Brown coal; Firewood				Fuel Consumption		Brown coal 0.13 t/h Firewood 0.093 t/h			
Rated load of furnace	2 t/h 13.5 bar				Load at time of measurement		0.6 t/h 4.5 bar			
Burner type and rating	Hand firing				Number. of burners		-			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		182	52	1385	57.9	16.2	4.5	125	3,600	-
O2 6 % conversion value	ppm	569	163	4328	-					
	mg/m3	1.626	335	5410	181					
Emission	kg/h	1.87	0.384	6.23	0.208					
Emission standard	kg/h	0.27	0.27	9	0.12					

Outline of facility and of measurements

Facility

Made in 1959, this is a cargo vessel boiler used to produce steam for processing in meat processing plants. It was taken from a ship after the ship had been scrapped. There is another boiler of the same type, and the two are used alternately. Complaints have been received on numerous occasions from nearby residents, so the volume of brown coal used has been reduced and firewood is used as a supplement. Studies are being made to introduce natural gas.

Location of measurement

The measuring site installed at the bottom of the stone smokestack was used. Residual oxygen concentration was high because of air entering from the soot door and from the boiler not in operation.

Problems and Countermeasures

Since the smokestack is low at 16 meters, exhaust standards have been strictly set. Consequently, SO2, NOx and dust all exceeded the standards.

Since construction of natural gas piping has been completed, fuel conversion will be the best countermeasure.

Estimated effects of countermeasures

SO2, CO and dust can be reduced to near zero and NOx can be lowered to about 100 ppm at 3% oxygen.

Table D4.1.5 (40) Flue Gas Measurement Results

No -/	Source No.P 001		Product Steam for processing							
Name of company	BEFAG LADI FATELEP									
Name of combustion facility	locomotive boiler									
Types of fuel used	Sawdust, wood chips				Fuel Consumption		Dried wood 190 kg/h			
Rated load of furnace	3 t/h 12 bar				Load at time of measurement		1.5 t/h 3 bar			
Burner type and rating	Hand firing				Number. of burners		-			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	76	5669	543	11.6	9.2	232	4,800	-
O2 6 %	ppm	ND	121	9046	-					
conversion value	mg/m3	ND	249	11308	848					
Emission	kg/h	ND	0.749	34	2.61					
Emission standard	kg/h	-	42	1400	21					

Outline of facility and of measurements

Facility

This is a steam locomotive boiler made in 1943. In 1974 it was used again for processing and for heating. Sawdust and wood chips produced at a lumber factory are used as fuel. The boiler has no heat insulation material, and its outer surface becomes about 88°C. Since it is used for incineration of wastes, it cannot be replaced by a new model boiler and no energy conservation measures can be taken. The flue has been completely replaced and two boilers are used alternately.

Location of measurement

The measurement site established at the boiler outlet was used.

Problems and Countermeasures

By preserving the temperature of the outer surface, the fuel consumption per production can be reduced. And by processing surplus sawdust, etc., into bio-briquette for example, added value could be escalated and marketed.

Estimated effects of countermeasures

-

Table D4.1.5 (41) Flue Gas Measurement Results

No /	Source No.P 001			Product Steam for processing						
Name of company	BORSODI SORGYAR RT. BOCS									
Name of combustion facility	No.5 flue and smoke tube boiler									
Types of fuel used	Natural gas				Fuel Consumption		1422 m3/h			
Rated load of furnace	20 t/h 12 bar				Load at time of measurement		16 t/h 9.5 bar			
Burner type and rating	Block type natural gas burner 1000 m3/h				Number. of burners		2			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	99	5	-	2.1	1.2	200	*15,000	81.7
O2 3 %	ppm	ND	94	5	-					
conversion value	mg/m3	ND	193	6	-					
Emission	kg/h	ND	3.05	0.094	-					
Emission standard	kg/h	-	70	3500	-					

Outline of facility and of measurements

Facility

This is a processing boiler for producing beer and carbonated drinks. It is a triple-pass type, flue and smoke tube boiler with a superheater installed at the second pass. Burners are of the block type and portions of the flame are orange in color, perhaps because oxygen is restricted to 2.1 percent. Traces of CO are also detected. Air for combustion is preheated to 20°C by steam. Since the return water is 113°C, an economizer has not been installed.

Location of measurement

The boiler outlet.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

* Estimated value

Table D4.1.5 (42) Flue Gas Measurement Results

No 02 / 0	Source No.P 036			Product Steam for heating						
Name of company	OZDI KOHASRRTI VZEMEK									
Name of combustion facility	No.10 water tube boiler									
Types of fuel used	Coal and natural gas				Fuel Consumption		Coal 2 t/h Natural gas 980 m3/h			
Rated load of furnace	20 t/h 28 bar				Load at time of measurement		16 t/h 15 bar			
Burner type and rating	See column below.				Number. of burners		See column below.			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		24	3.2	263	7890	18.9	4.0	90	*161,00	-
O2 6 %	ppm	171	23	1879	-					
conversion value	mg/m3	489	47	2349	56257					
Emission	kg/h	11.0	1.05	52.7	1270					
Emission standard	kg/h	8.2	6.0	428.6	2.9					

Outline of facility and of measurements

Facility

Located in the OZD steel plant, this is a boiler for regional heating made in 1950. When the blast furnace was in operation, blast furnace gas was used, but now natural gas is used. This boiler is equipped with four pulverized coal burners and with four pulverized coal and gas mixture burners. Because of deterioration, the boiler cannot operate at high loads. The coal and gas fuels are used at a heat volume ratio of 50 percent each. Ukrainian coal and coal of low sulfur content from Poland are used; at the time of measurement, the sulfur content was 0.58 percent. An air preheater, economizer and superheater have been added for energy conservation. A cyclone has been installed to collect dust.

Even if the No. 9 boiler of the same type is used, the heat volume is still inadequate for heating, so a used container-type gas boiler has been introduced as a supplement.

Location of measurement

The measuring site installed at the cyclone outlet was used. Residual oxygen concentration was high because of substantial leakage of air from throughout the unit.

Problems and Countermeasures

Dust and SO2 exceed the standards. The ideal countermeasure is to shift 100 percent to natural gas.

Estimated effects of countermeasures

By introducing natural gas, NOx can be lowered to around 80 to 100 ppm (3% oxygen) and SO2 and dust could be reduced to zero.

* Estimated value

Table D4.1.5 (43) Flue Gas Measurement Results

No 12 / 0	Source No.P 001	Product Steam for heating
Name of company	EAEV. MUNKASSZALLO	
Name of combustion facility	Cast iron boiler	
Types of fuel used	Coal, Brown coal	Fuel Consumption 0.056 t/h
Rated load of furnace	undetermined	Load at time of measurement undetermined
Burner type and rating	Hand firing	Number. of burners -

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		2	6	267	4.7	*20.7	0.6	50	6,500	-
O2 - %	ppm	-	-	-	-					
conversion value	mg/m3	-	-	-	-					
Emission	kg/h	0.037	0.08	2.20	0.031					
Emission standard	kg/h	5.4	5.4	180	2.7					

Outline of facility and of measurements

Facility

Manufactured in Poland, these are cast iron boilers for heating buildings. Of the seven boilers available, only three are in operation. Coal mined in Poland is used as fuel. These boilers are scheduled to be shut down on April 15, 1994.

Location of measurement

The measuring site attached to the smokestack was used for measuring. Oxygen concentration of 20.7 percent was recorded because of large volumes of air entering from the boilers not in operation and elsewhere.

Problems and Countermeasures

Nothing in particular. (Scheduled for closure.)

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (44) Flue Gas Measurement Results

No 14 / 1		Source No.P 002		Product Steam for heating						
Name of company		DIGEP II TELEP								
Name of combustion facility		Water tube boiler								
Types of fuel used		Natural gas				Fuel Consumption		4200 m3/h		
Rated load of furnace		28 t/h 27 bar				Load at time of measurement		22 t/h 22 bar		
Burner type and rating		Natural gas burner 1200 m3/h				Number. of burners		3		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	57	ND	-	14.8	3.6	157	*143,000	-
O2 3 %	ppm	ND	165	ND	-					
conversion value	mg/m3	ND	339	ND	-					
Emission	kg/h	ND	16.74	ND	-					
Emission standard	kg/h	-	21	700	-					

Outline of facility and of measurements

Facility

Built in 1944, this is a brick construction boiler for regional heating. In 1969 it was renovated in order to shift from pulverized coal to natural gas. A superheater, economizer and air preheater are provided for energy conservation.

Location of measurement

The measurement site attached to the smokestack was used. The concentration of residual oxygen was high because air leaks from the inoperative boiler and from sundry devices.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (45) Flue Gas Measurement Results

No 17 / 2	Source No.P 030	Product Steam for heating
Name of company	HEJOCSABAI CEMENT-ES MESTIPARI RT. KOBANYA UZEM	
Name of combustion facility	Cast iron boiler	
Types of fuel used	Light oil	Fuel Consumption 0.015 t/h
Rated load of furnace	360 Mcal/h 50 kg/h	Load at time of measurement 210 Mcal/h
Burner type and rating	Mechanical atomizer burner	Number. of burners 1

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		93	68	13	-	3.9	13.5	199	*130	81.1
O2 3 % conversion value	ppm	98	72	14	-					
	mg/m3	280	148	18	-					
Emission	kg/h	0.034	0.018	0.002	-					
Emission standard	kg/h	0.18	0.18	6	0.02					

Outline of facility and of measurements

Facility

This is a cast iron boiler for heating factory interiors. A block-type, mechanical atomizer burner is used. Although CO is generated, NOx is kept low.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (46) Flue Gas Measurement Results

No 26 / 0		Source No.P 001			Product Hot water for heating					
Name of company		MISKOLCI HOSZOLGALTATO V KILIAUI KAZANHAZA								
Name of combustion facility		No. 2 water tube boiler								
Types of fuel used		Natural gas				Fuel Consumption		207.5 m3/h		
Rated load of furnace		180 t/h (hot water)				Load at time of measurement		180 t/h (hot water)		
Burner type and rating		Block-type burner 400 m3/h				Number. of burners		1		
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	65	690	-	3.5	9.8	-	*2,400	-
O2 3 %	ppm	ND	67	710	-					
conversion value	mg/m3	ND	138	888	-					
Emission	kg/h	ND	0.32	2.07	-					
Emission standard	kg/h	-	2.7	90	-					

Outline of facility and of measurements

Facility

This is a hot water boiler for regional heating which is assembled inside a container. The burner is the block type with an air blower built in. There are no air preheaters or other equipment for energy conservation.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

Since the concentration of CO in the exhaust gas is high, the burner must be adjusted. In particular, the air register must be inspected.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (47) Flue Gas Measurement Results

No 26 / 3	Source No.P 001	Product Hot water for heating								
Name of company	MISKOLCI HOSZOLGALTATO V KOROSI CS. UTI KAZANHAZA									
Name of combustion facility	No. 1 ~ 3 cast iron boilers									
Types of fuel used	Coal				Fuel Consumption	0.208 t/h				
Rated load of furnace	5 t/h				Load at time of measurement	* 5 t/h				
Burner type and rating	Hand firing				Number. of burners	-				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		5	33	663	182	16.6	3.2	121	5,100	-
O2 6 %	ppm	17	113	2260	-					
conversion value	mg/m3	49	232	2825	620					
Emission	kg/h	0.073	0.346	4.23	0.928					
Emission standard	kg/h	21	21	700	10.5					

Outline of facility and of measurements

Facility

Built in 1958, these are hot water boilers for regional heating. At the time of measurement, four of these five boilers were in operation. About 5 t/day of coal is used, although the amount varies with ambient temperature. Coal is supplied about once every two hours. The boiler has a coal storage room, and coal can be supplied by lever. There have been complaints from local residents. Domestically-produced brown coal is mixed with coals from Czechoslovakia, Poland and the Ural Mountains and burnt.

Location of measurement

The measurement site established on the smokestack was used.

Problems and Countermeasures

Conversion to natural gas is scheduled for the summer of 1994.

Estimated effects of countermeasures

-

Table D4.1.5 (48) Flue Gas Measurement Results

No 26 / 4	Source No.P 001	Product Steam for heating
Name of company	MISKOLCI HOSZOLGALTATO V. FUTOUTI KAZANHAZA	
Name of combustion facility	Water tube boiler	
Types of fuel used	Natural gas	Fuel Consumption 130 m3/h
Rated load of furnace	1.63 t/h 12 bar	Load at time of measurement 0.8 t/h 4 bar
Burner type and rating	Block-type burner 235 m3/h	Number. of burners 1

Measurement data

Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	48	68	-	7.7	7.9	190	*1900	79.3
O2 3 %	ppm	ND	65	92	-					
conversion value	mg/m3	ND	133	115	-					
Emission	kg/h	ND	0.187	0.162	-					
Emission standard	kg/h	-	2.7	90	-					

Outline of facility and of measurements

Facility

A combination water tube and flue boiler for regional heating is used here.

The facility has three boilers of the same type, but only one was operating. A simplified economizer is attached at the boiler outlet.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

Since the load at the time of measurement was low at 50 percent, it was inevitable that the concentration of oxygen in the exhaust gas under normal conditions would be high. With combustion of natural gas, even though the oxygen concentration in the exhaust gas was 7.7 percent, CO was also produced and this poses as a problem. The burner must be checked.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (49) Flue Gas Measurement Results

No 26 / 6	Source No.P 001		Product Hot water for heating							
Name of company	MISKOLCI HOSZOLGALTATO V. DIOSGYORI KAZANHAZA									
Name of combustion facility	No. 1 flue and smoke tube boiler									
Types of fuel used	Natural gas				Fuel Consumption	300 m3/h				
Rated load of furnace	6 Gcal /h				Load at time of measurement	* 4.2 Gcal/h				
Burner type and rating	Block-type burner 700 m3/h				Number. of burners	1				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		ND	35	ND	5.75	9.5	6.3	121	7,700	-
O2 3 %	ppm	ND	55	ND	-					
conversion value	mg/m3	ND	113	ND	9.00					
Emission	kg/h	ND	0.187	ND	0.443					
Emission standard	kg/h	-	5.4	180	-					

Outline of facility and of measurements

Facility

This is a hot water boiler for regional heating. It is a triple-pass type, flue and smoke tube boiler.
The facility has six boilers of the same type and four were in operation at the time of the survey.
At a temperature of 75°C, the hot water is circulated at 500 m3 /h.

Location of measurement

The measurement site established on the underground lateral flue was used.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

* Estimated value

Table D4.1.5 (50) Flue Gas Measurement Results

No 27 / 0	Source No.P 002		Product Hot water for heating							
Name of company	MISKOLCI FUTOMU KFT									
Name of combustion facility	FK4 water tube boiler									
Types of fuel used	Natural gas; Heavy oil				Fuel Consumption		Natural gas 1000 m3/h Heavy oil 3 t/h			
Rated load of furnace	100 Gcal/h				Load at time of measurement		-			
Burner type and rating	See column below.				Number. of burners		See column below.			
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		390	139	ND	-	3.3	13.1	178	39,000	-
O2 3 %	ppm	397	141	ND	-					
conversion value	mg/m3	1134	290	ND	-					
Emission	kg/h	43.5	11.1	ND	-					
Emission standard	kg/h	1800	1800	60000	-					

Outline of facility and of measurements

Facility

There are 16 natural gas and oil mixture burners, consuming 800 m3/h of natural gas and 800 kg/h of heavy oil.

These gas and oil mixture burners are used with a hot water boiler for regional heating. These burners cannot be finely adjusted because they are controlled by being turned on or off according to water temperature. Consequently, plans call for a changeover to proportional control burners. Fuel oil is purchased from the MOL Company, with 2.64 percent sulfur component and 42,000 kJ/kg. Steam is heated to 135°C and atomized under pressure. There is no air preheating.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (51) Flue Gas Measurement Results

No 27 / 0	Source No.P 002	Product Hot water for heating								
Name of company	MISKOLCI FUTOMU KFT									
Name of combustion facility	FK3 water tube boiler									
Types of fuel used	Natural gas				Fuel Consumption	Natural gas 5700 m3/h				
Rated load of furnace	100 Gcal/h				Load at time of measurement	-				
Burner type and rating	See column below.				Number. of burners	See column below.				
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		21	97	ND	-	1.5	11.3	190	*59,000	82.4
O2 3 %	ppm	19	90	ND	-					
conversion value	mg/m3	54	184	ND	-					
Emission	kg/h	3.54	11.8	ND	-					
Emission standard	kg/h	1800	1800	60000	-					

Outline of facility and of measurements

Facility

There are 16 natural gas and oil mixture burners, consuming 800 m3/h of natural gas and 800 kg/h of oil. With a boiler of the same type as the FK4 model, natural gas exclusively was being burnt at the time of measurement.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

Nothing in particular.

Estimated effects of countermeasures

-

Table D4.1.5 (52) Flue Gas Measurement Results

No 31 / 0	Source No.P 001		Product Steam for heating							
Name of company	MISKOLC EGYETEM FUTOMU									
Name of combustion facility	No. 1 flue and smoke tube boiler									
Types of fuel used	Heavy oil			Fuel Consumption	480 m3/h					
Rated load of furnace	7 t/h 12 bar			Load at time of measurement	4.2 t/h 8 bar					
Burner type and rating	Mechanical atomizer burner 600 kg/h			Number. of burners	1					
Measurement data										
Item		SO2	NOx	CO	DUST	O2	CO2	Exhaust gas temperature	Exhaust gas flow volume	Combustion efficiency
Measurement value		ppm	ppm	ppm	mg/m3	%	%	°C	Nm3/h	%
		996	287	1	97.7	4.0	13.7	281	5,400	83.8
O2 3 %	ppm	1055	304	1	-					
conversion value	mg/m3	3014	624	1	104					
Emission	kg/h	15.4	3.18	0.007	0.528					
Emission standard	kg/h	120	120	4000	60					

Outline of facility and of measurements

Facility

This is a triple pass flue and smoke tube boiler for heating at MISKOLC University.
The heavy oil is heated to 130°C by steam and electricity and atomized at a hydraulic pressure of 32 bar.
Since it is used for heating, the boiler is operated from October 15th to April 15th of the following year.

Location of measurement

Measurements were taken at the boiler outlet.

Problems and Countermeasures

All the measured values cleared the standard values, but SO2 and NOx were high.
Huge reductions in NOx could be realized by shifting to natural gas, but if heavy oil continues to be used, a two-stage combustion burner should be introduced to lower NOx.

Estimated effects of countermeasures

-

Table D4.1.6 Breakdown of Samples of Questionnaire on Home Heating

Respondent	Tenant	Owner	School office	Total
	8	148	3	159

Type of building	Residence	School office	Home office	Workshop residence	Shop and residence or apartment	Total
	154	1	1	1	2	159

Number of stories	1	2	3	4 or more	Total
	106	42	9	2	159

Floor area (m^2)	$50m^2$ and less	$51 \sim 100m^2$	$101 \sim 150m^2$	$151 \sim 200m^2$	$201m^2$ or more	Total
	12	94	38	10	5	159

Building structure	Brick Mortar	Silica brick Mortar	Concrete Panel	Stone Loam	Total
	102	47	2	8	159

Number of families	1	2 ~ 3	4 ~ 6	7 or more	Total
	136	22	0	1	159

Number of occupants	1 ~ 2	3 ~ 5	6 ~ 10	11 or more	Total
	40	101	16	2	159

Table D4.1.7 Result of Questionnaire on Home Heating
Amount of Fuel Consumption by Heating Facilities and Fuel Type (From Nov. 1992 to Mar. 1993)

Heating system	Type of heating facilities	Type of fuel	Amount of fuel consumption*
Indivisual heating (54)	Stove(26)	Diesel(1)	1,420l
		Firewood(6)	26,350kg
		Firewood & diesel(1)	1,080kg、 630l
		Coal & diesel(1)	2,000kg、2,000l
		Coal & Firewood(17)	75,820kg、36,860kg
	Small-sized hot-water heating(20)	Natural gas(20)	28,536m3
	Electrical heating(3)	Electric power(3)	29,232KWh
	Tailed stove(1)	Natural gas(1)	1,543m3
	Boiler(1)	Natural gas(1)	1,600m3
	Stove & Small-sized hot-water heating(1)	Coal, Firewood & Natural gas(1)	2,500kg、1,000kg、317m3
	Boiler & Small-sized hot-water heating(2)	Coal & Natural gas(1)	1,000kg、 675m3
	Stove & Electrical heating(1)	Coal & Electric power(1)	9,000kg、7,300KWh
Central heating (104)	Boiler(104)	LPG gas(1)	1,620m3
		Diesel(1)	2,000l
		Firewood(1)	4,800kg
		Firewood & Wood dust(1)	2,600kg、15,000kg
		Coal(12)	109,930kg
		Coal & Firewood(29)	233,480kg、71,840kg
		Natural gas(57)	136,787m3
		Coal & Natural gas(2)	6,500kg、3,180m3
Both(1)	Boiler & Stove(1)	Coal & Firewood(1)	90,000kg、35,000kg

Note) Numbers in parenthesis show the number of sample.

Coding for Tables D4.1.8 through D4.1.10

The Tables include quality parameters of each type of fuels and their places of origin which are referred by codes as follows.

a) Physical condition: the first two digits

11 - 14 solid: 11 black coal
12 brown coal
13 lignite
14 coke

21 - 28 liquid: 21 industrial heating oil (diesel oil)
22 medium heavy heating oil
23 heavy heating oil
24 residue oil
25 diesel oil (in the summer) (gas oil)
26 communal heating oil (kerosine)
27 leaded petrol - No.92 (gasoline)
28 leaded petrol - No.98 (gasoline)

31 - 33 gas: 31 gas pipe "Testveriseg"
32 gas pipe at Hajduszoboszlo
33 inner gas

b) Area of origin: the third, fourth and fifth digits

100 - 170 domestic: from 110: Sajo valley
from 120: South Borsod
from 130: Matra region
from 140: Nograd county
from 150: North Dunantul
from 160: Middle Dunantul
from 170: South Dunantul
from 180: Hajdu county
from 190: Szolnok county

200 - 250 imported: from 210: Czench Republic
from 220: Slovac Republic
from 230: Poland
from 240: Russia
from 250: Belorussia
from 260: Ukraine

c) Grain dimension: the sixth digit (in mm)

0: liquid - gas

1: +40

2: 40 - 80

3: +20

4: 20 - 40

5: 15 -20

6: 10 - 20

7: 0 - 40

8: 0 - 20

9: 0 - 10

d) Standard calorific value [GJ/t; GJ/m^3]

e) Standard SO2 [kg/t; kg/m^3]

Table D4.1.8 (1) Result of Fuel Analysis - Solid Fuels (1)

NUMBER	CODE abc d e	LOCATION OF EXCAVATING OR SELECTION	carbon C%	hydrogen H%	nitrogen N%	fixed carbon %	voletile matter %	ash %	moisture %	SULFUR CONTENTS combustible %	in-combustible %	total %	net calorific value kcal/kg	kJ/kg	ash softening point C	ash melting point C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	121101 - 14 - 43	Berente	36.51	3.26	0.62	28.38	29.84	15.30	26.48	2.15	0.72	2.87	3405	14257	1040	1260
2	121103 - 14 - 40	Berente	36.43	3.25	0.68	28.41	29.58	15.36	26.65	2.02	0.76	2.78	3413	14290	1050	1265
3	121104 - 15 - 42	Berente	35.93	3.34	0.67	28.68	30.82	14.58	25.92	2.08	0.73	2.81	3480	14572	1045	1265
4	121106 - 15 - 38	Berente	35.78	3.35	0.71	29.66	30.12	12.54	27.68	1.91	0.70	2.61	3564	14920	1040	1265
5	121107 - 12 - 33	Berente	31.56	2.73	0.68	24.84	25.13	23.78	26.25	1.65	0.73	2.38	2923	12236	1095	1265
6	121108 - 9 - 27	Berente	26.82	2.27	0.63	18.02	22.13	35.23	24.62	1.36	0.73	2.09	2248	9414	1125	1260
7	121109 - 8 - 27	Berente	20.26	1.97	0.61	15.16	20.07	39.78	24.99	1.33	0.68	2.01	1862	7795	1160	1235
8	121111 - 14 - 43	Feketevolgy	35.47	3.19	0.75	28.09	28.72	15.84	27.35	2.14	0.75	2.89	3323	13911	1090	1270
9	121113 - 14 - 42	Feketevolgy	35.13	3.11	0.73	28.01	27.45	20.31	24.23	2.08	0.80	2.88	3231	13529	1095	1290
10	121117 - 12 - 41	Feketevolgy	33.48	2.74	0.70	25.31	23.57	26.12	25.00	2.04	0.79	2.83	2773	11612	1100	1280
11	121118 - 9 - 33	Feketevolgy	25.56	2.23	0.68	17.51	22.42	33.68	26.39	1.66	0.69	2.35	2220	9294	1150	1275
12	121121 - 15 - 48	Rudolf	37.58	3.42	0.83	29.53	31.53	12.19	26.75	2.42	0.83	3.25	3512	14706	1100	1280
13	121123 - 14 - 47	Rudolf	36.97	3.40	0.83	28.69	31.18	13.05	27.08	2.33	0.79	3.12	3397	14223	1100	1280
14	121127 - 11 - 40	Rudolf	26.78	2.57	0.71	22.72	23.06	25.78	28.44	1.98	0.69	2.67	2565	10738	1130	1300
15	121131 - 14 - 60	Edeleny	37.46	3.39	0.68	29.72	30.78	14.73	24.77	3.01	0.81	3.82	3433	14375	1120	1200
16	121134 - 13 - 58	Edeleny	35.05	3.25	0.65	27.89	29.62	18.96	23.53	2.88	0.79	3.67	3213	13452	1125	1230
17	121137 - 11 - 48	Edeleny	27.05	3.01	0.61	23.59	22.56	25.93	27.92	2.41	0.54	2.95	2641	11056	1150	1240
18	121141 - 16 - 44	Putnok	40.15	3.63	0.83	35.35	29.50	10.54	24.61	2.22	0.85	3.07	3864	16176	1140	1275
19	121144 - 14 - 46	Putnok	38.33	3.34	0.82	30.99	28.58	14.62	25.81	2.29	0.71	3.00	3453	14458	1140	1280
20	121146 - 14 - 37	Putnok	37.19	3.16	0.83	28.87	27.56	19.95	23.62	1.85	0.73	2.58	3247	13594	1080	1280
21	121147 - 12 - 33	Putnok	33.38	2.82	0.80	25.28	25.06	27.44	22.22	1.65	0.66	2.31	2881	12062	1090	1290
22	121148 - 11 - 30	Putnok	29.03	2.55	0.75	24.34	21.12	35.58	18.96	1.52	0.65	2.17	2594	10859	1080	1280
23	121149 - 10 - 29	Putnok	28.93	2.37	0.73	22.23	20.18	38.20	19.39	1.46	0.60	2.06	2376	9947	1090	1300
24	121151 - 16 - 39	Vadna	34.18	3.51	0.61	32.50	30.12	13.99	23.39	1.93	0.75	2.68	3777	15813	1095	1265
25	121154 - 13 - 35	Vadna	32.16	3.35	0.62	31.54	27.12	18.22	23.12	1.76	0.70	2.46	3072	12863	1095	1270
26	121157 - 11 - 31	Vadna	29.06	2.54	0.59	20.81	24.56	28.99	25.64	1.55	0.69	2.24	2587	10831	1100	1290
27	121161 - 15 - 35	Lyuko	39.86	3.44	0.85	31.13	30.36	13.37	25.14	1.76	0.68	2.44	3578	14982	1100	1200
28	121164 - 14 - 31	Lyuko	36.42	3.14	0.82	27.60	28.52	20.26	23.62	1.55	0.71	2.26	3249	13602	1105	1200
29	121167 - 12 - 28	Lyuko	32.08	2.69	0.65	25.66	25.98	22.53	25.83	1.40	0.71	2.11	2958	12386	1130	1235
30	121168 - 10 - 28	Lyuko	27.52	2.32	0.62	17.96	22.56	34.68	24.80	1.39	0.70	2.09	2269	9501	1165	1240
31	131201 - 7 - 18	Bukkabrany	22.06	2.05	0.42	18.02	22.53	16.52	42.93	0.89	0.72	1.61	1651	6912	1150	1320
32	131207 - 7 - 18	Bukkabrany	20.83	1.83	0.43	11.55	20.53	24.20	43.72	0.92	0.81	1.73	1583	6628	1170	1380
33	131301 - 8 - 17	Visonta	19.33	2.14	0.42	14.72	23.45	15.77	46.06	0.83	0.71	1.54	1848	7736	1160	1360
34	131307 - 7 - 16	Visonta	18.46	1.99	0.35	13.63	22.18	17.36	46.83	0.81	0.74	1.55	1750	7328	1165	1370
35	121401 - 14 - 41	Nagybatony	38.56	2.58	0.98	38.55	22.83	18.46	20.16	2.03	0.65	2.68	3405	14256	1090	1260
36	121407 - 9 - 39	Nagybatony	28.53	2.14	0.61	19.51	18.71	45.76	16.02	1.93	0.49	2.42	2207	9241	1210	1460
37	121501 - 20 - 62	Oroszlany	50.25	4.20	0.60	27.04	42.35	14.00	16.61	3.10	0.95	4.05	4700	19680	1180	1205
38	121504 - 18 - 60	Oroszlany	49.18	4.05	0.63	26.77	41.53	14.65	17.05	3.00	0.88	3.88	4368	18290	1180	1190
39	121506 - 18 - 63	Oroszlany	48.98	4.00	0.60	25.75	39.55	17.50	17.20	3.15	0.80	3.95	4316	18070	1195	1220
40	121507 - 10 - 36	Oroszlany	38.15	2.22	0.41	10.07	31.10	44.52	14.31	1.81	0.52	2.33	2398	10040	1200	1225
41	121508 - 16 - 56	Oroszlany	40.53	3.62	0.59	21.28	37.80	24.20	16.72	2.80	0.75	3.55	3872	16210	1250	1275
42	121509 - 15 - 48	Oroszlany	39.16	3.10	0.50	18.80	35.50	29.20	16.50	2.40	0.60	3.00	3475	14550	1175	1210
43	121511 - 21 - 64	Tatabanya	53.21	4.05	0.80	33.10	39.24	14.51	13.15	3.21	0.90	4.11	4907	20546	1180	1290

Table D4.1.8 (2) Result of Fuel Analysis - Solid Fuels (2)

NUMBER	CODE abc d e	LOCATION OF EXCAVATING OR SELECTION	carbon C%	hydrogen H%	nitrogen N%	fixed carbon %	volatile matter %	ash %	moisture %	FUR CONTENTS combustible %	in-combustible %	total %	net calorific value kcal/kg	kJ/kg	ash softening point C	ash melting point C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
44	121514 - 17 - 46	Tatabanya	43.18	3.63	0.64	26.24	31.13	28.13	14.50	2.30	0.81	3.11	4016	16813	1195	1275
45	121516 - 19 - 61	Tatabanya	52.86	4.31	0.83	31.42	36.00	17.52	15.06	3.05	0.83	3.88	4550	19052	1200	1285
46	121519 - 17 - 47	Tatabanya	40.07	3.64	0.62	25.18	29.08	27.53	18.21	2.34	0.71	3.05	3996	16732	1205	1265
47	121521 - 19 - 57	Dorog	50.96	3.95	1.25	38.12	34.16	15.16	12.56	2.85	0.52	3.37	4599	19256	1280	1305
48	121523 - 19 - 56	Dorog	51.08	3.95	1.25	39.29	33.25	15.08	12.38	2.81	0.55	3.36	4504	18859	1280	1300
49	121524 - 19 - 55	Dorog	50.62	3.87	1.23	40.47	30.12	16.34	13.07	2.76	0.53	3.29	4450	18632	1285	1300
50	121526 - 18 - 59	Dorog	49.83	3.75	1.20	37.27	29.82	18.52	14.39	2.97	0.47	3.44	4305	18026	1250	1290
51	121527 - 11 - 49	Dorog	26.53	2.56	0.91	20.54	25.05	40.81	13.60	2.47	1.21	3.68	2620	10968	1200	1250
52	121529 - 10 - 53	Dorog	26.10	2.51	0.95	20.08	24.68	42.30	12.94	2.65	1.14	3.79	2472	10349	1200	1250
53	121601 - 17 - 61	Ajka	43.70	3.15	0.63	31.79	31.20	12.87	24.14	3.05	0.92	3.97	4094	17142	1180	1240
54	121604 - 15 - 59	Ajka	40.05	2.65	0.60	29.70	28.30	18.77	23.23	2.95	0.89	3.84	3638	15232	1180	1240
55	121606 - 14 - 57	Ajka	38.08	2.69	0.52	28.35	28.20	21.10	22.35	2.86	0.90	3.76	3415	14300	1190	1250
56	121607 - 8 - 27	Ajka	25.30	2.48	0.53	17.99	26.25	35.57	20.19	1.36	0.85	2.21	1980	8290	1200	1280
57	121611 - 17 - 79	Balinka	42.08	3.11	0.62	32.77	31.83	12.52	22.88	3.95	1.23	5.18	4144	17352	1150	1230
58	121614 - 16 - 77	Balinka	41.11	3.08	0.62	31.62	32.05	14.05	22.28	3.87	1.18	5.05	3854	16136	1150	1230
59	121616 - 15 - 80	Balinka	41.63	3.05	0.63	32.26	31.56	14.35	21.83	3.98	1.07	5.05	3633	15210	1155	1230
60	121617 - 12 - 40	Balinka	26.40	2.80	0.48	21.62	28.36	32.21	17.81	1.98	1.69	3.67	2790	11682	1100	1120
61	121618 - 10 - 41	Balinka	24.00	2.47	0.43	15.87	28.17	39.22	16.74	2.06	1.46	3.52	2443	10230	1100	1115
62	121621 - 16 - 70	Dudar	38.06	3.08	0.51	32.85	33.56	10.51	23.08	3.48	0.80	4.28	3888	16280	1180	1210
63	121624 - 17 - 70	Dudar	39.96	3.12	0.51	33.29	32.18	11.08	23.45	3.52	0.82	4.34	3956	16563	1180	1210
64	121627 - 12 - 50	Dudar	24.05	2.85	0.45	22.82	28.13	29.09	19.96	2.52	0.65	3.17	2772	11607	1105	1130
65	121628 - 10 - 46	Dudar	22.68	2.54	0.45	17.62	27.75	34.74	19.89	2.30	0.70	3.00	2497	10453	1110	1130
66	111707 - 16 - 43	Pecs	32.51	2.86	0.82	20.82	28.03	46.02	5.13	2.16	0.58	2.74	3723	15586	1140	1180
67	112111 - 24 - 7	Czech Rep.	64.40	4.02	1.00	50.31	27.42	13.12	9.15	0.35	0.21	0.56	5841	24456	1220	1390
68	112116 - 24 - 7	Czech Rep.	62.06	3.83	1.02	48.82	26.62	13.91	10.65	0.35	0.20	0.55	5672	23748	1220	1400
69	112114 - 21 - 21	Czech Rep.	50.16	4.07	1.16	33.52	39.19	6.99	20.30	1.05	0.53	1.58	5021	21024	1250	1420
70	112119 - 19 - 15	Czech Rep.	46.53	3.75	0.97	32.39	20.56	24.12	22.93	0.73	0.45	1.18	4454	18650	1280	1450
71	112115 - 24 - 9	Czech Rep.	68.18	3.56	1.02	50.10	25.61	20.98	3.31	0.45	0.48	0.93	5851	24499	1270	1460
72	142213 - 27 - 4	Slovac Rep.	85.06	4.81	0.08	84.57	1.36	13.06	1.01	0.20	0.12	0.32	6526	27322	1280	1430
73	122211 - 15 - 14	Slovac Rep.	39.52	4.56	1.12	24.95	33.78	11.84	29.43	0.72	0.69	1.41	3600	15074	1190	1260
74	122212 - 18 - 11	Slovac Rep.	37.12	3.67	1.06	29.16	36.30	12.23	22.31	0.53	0.49	1.02	4239	17746	1150	1320
75	122217 - 16 - 5	Slovac Rep.	43.62	2.98	0.97	32.26	25.16	25.83	16.75	0.27	0.48	0.75	3878	16235	1180	1350
76	122218 - 10 - 16	Slovac Rep.	27.86	3.62	1.11	20.09	20.53	35.32	24.06	0.81	0.52	1.33	2331	9760	1210	1290
77	122214 - 17 - 17	Slovac Rep.	36.12	3.08	1.02	25.63	36.81	11.63	25.93	0.85	0.68	1.53	3945	16516	1160	1230
78	112315 - 26 - 10	Poland	65.68	3.78	0.97	49.23	30.96	9.63	10.18	0.52	0.21	0.73	6200	25958	1290	1440
79	122411 - 13 - 6	Russia	34.53	3.72	1.53	21.25	20.86	51.16	6.73	0.28	0.45	0.73	3166	13256	1150	1320
80	112414 - 22 - 5	Russia	53.16	2.53	1.58	41.10	26.48	28.19	4.23	0.25	0.41	0.66	5172	21654	1250	1380
81	122418 - 18 - 3	Russia	40.28	4.25	1.18	28.89	36.41	8.52	26.18	0.15	0.25	0.40	4359	18250	1100	1300
82	122412 - 15 - 8	Russia	38.16	3.98	0.95	24.48	35.18	8.91	31.43	0.39	0.29	0.68	3586	15012	1160	1320
83	122413 - 15 - 14	Russia	71.15	5.21	0.93	8.15	48.16	9.53	34.16	0.68	1.05	1.73	3654	15299	1100	1480
84	122511 - 17 - 9	Belorussia	42.39	3.39	1.13	34.07	26.41	28.93	10.59	0.43	0.58	1.01	3949	16533	1250	1310
85	122611 - 14 - 11	Ukrainian	33.15	2.99	1.23	29.69	23.67	37.81	8.83	0.56	0.65	1.21	3366	14093	1160	1250

Table D4.1.8 (3) Result of Fuel Analysis - Solid Fuels (3)

(Mercury Concentration in Coal Samples)

Number	Code			Location of Excavating or Selection	Mercury	Average
	a	b	c		Hg (ng/g)	Hg (ng/g)
1	12	110	1	Berente	93.3	
2	12	110	4	Berente	97.1	
3	12	110	4	Berente	110.0	
4	12	110	4	Berente	100.0	99.8
5	12	110	4	Berente	106.0	
6	12	110	8	Berente	100.0	
7	12	110	8	Berente	85.7	
8	12	110	9	Berente	106.0	
9	12	110	1	Feketevolgy	69.6	69.6
10	12	110	3	Rudolf	100.0	96.8
11	12	110	1	Rudolf	93.5	
12	12	110	7	Edeleny	113.0	113.0
13	12	110	8	Vadna	100.0	100.0
14	12	110	4	Putnok	92.5	
15	12	110	7	Putnok	71.0	83.0
16	12	110	8	Putnok	96.4	
17	12	110	9	Putnok	72.1	
18	12	110	1	Lyuko	97.4	
19	12	110	4	Lyuko	93.2	100.5
20	12	110	3	Lyuko	111.0	
21	12	150	1	Oroszlany	93.1	
22	12	150	4	Oroszlany	103.0	
23	12	150	8	Oroszlany	156.0	
24	12	150	5	Oroszlany	111.0	138.2
25	12	151	9	Oroszlany	188.0	
26	12	150	7	Oroszlany	127.0	
27	12	150	9	Oroszlany	189.0	
28	12	152	4	Dorogi briquet	192.0	192.0
29	12	161	7	Balinka	125.0	141.0
30	12	161	8	Balinka	157.0	
31	12	161	8	Dudar	94.8	94.8
32	12	161	1	Jager briquet	34.3	49.3
33		161	1	German briquet	64.3	
34	11	211	4	Czech coke	35.3	35.3
35	11	211	2	Czech	53.6	
36	11	211	4	Czech	72.0	
37	12	211	4	Czech	171.0	114.9
38	12	211	1	Czech	93.0	
39	11	211	5	Czech	197.0	
40	11	211	9	Czech	103.0	
41	12	221	2	Slovak	67.6	50.9
42	14	221	4	Slovak	34.2	
43	11	231	4	Polish	48.1	
44	11	231	5	Polish	32.5	45.4
45	11	231	6	Polish	55.6	
46	12	241	1	Russian	32.3	31.5
47	11	241	2	Russian	30.6	

Note Analysis of Hg is Made With Vaporization by Heating and Atomic Absorption Photometry Method.

Table D4.1.9 Result of Fuel Analysis - Liquid Fuels

NUMBER	CODE abc	d	e	PRODUCT	specific gravity g/cm3	pour point C	flash point C	viscosity kinematic V C mm2/s	ash %	Conradson %	nitrogen N%	carbon C%	sulfur S%	hydrogen H%	vanadium V ppm	potassium K ppm	natrium Na ppm	nickel Ni ppm	net calorific value kJ/kg
1	2			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	211000 -	41 -	3	INDUSTRIAL HEATING OIL (Diesel Oil)	0.8453	-29.2	64.6	V/100 14.3	0.01	0.15	0.1	83.10	0.17	13.52	30	12	10	20	41250
2	221000 -	41 -	48	MEDIUM-HEAVY HEATING OIL	0.9514	18.5	159.5	V/100 74.4	0.33	0.08	0.2	76.20	2.51	14.54	96	12	15	20	40525
3	231000 -	40 -	58	HEAVY HEATING OIL	0.9763	19.0	162.2	V/100 155.4	0.38	0.11	0.2	82.75	2.95	12.65	102	11	16	38	40150
4	241000 -	40 -	58	GUDRON (Residue Oil)	0.9882	29.3	279.3	V/100 362.0	0.38	0.09	0.2	85.02	2.91	11.51	186	29	32	47	40125
5	251000 -	41 -	3	FUEL (SUMMER-TYPE) (Gas Oil)	0.8434	5.2	65.0	V/15 5.1	0.08	0.08	CBM	73.10	0.16	13.55	CBM	CBM	CBM	CBM	41218
6	261000 -	42 -	4	COMMUNAL OIL (Kerosin)	0.8454	-8.3	69.2	V/15 4.6	0.09	0.04	CBM	75.20	0.22	15.36	CBM	CBM	CBM	CBM	41910
7	271000 -	44 -	4	PETROL 92 (Gasoline)	0.7506	—	—	—	CBM	CBM	—	—	0.04	CBM	CBM	CBM	CBM	CBM	43610
8	281000 -	43 -	1	PETROL 98 (Gasoline)	0.7535	—	—	—	CBM	CBM	—	—	0.04	CBM	CBM	CBM	CBM	CBM	42860

Lead concentration in gasoline:(Petro/92)0.15g/l

CBM = CANNOT BE MEASURED

Table D4.1.10 Result of Fuel Analysis - Gas Fuels

NUMBER	CODE abc	d	e	PRODUCT	net calorific value (C=15) kcal/Nm3	kJ/Nm3	density (C=0) kg/m3	molecular weight	methane CH4%	ethane C2H6%	propane C3H8%	carbonite dioxide CO2%	nitrogen N%	vanadium V%	total sulfur S mg/m3	sulfur hydrogene H2S mg/m3
1	2			3	4	5	6	7	8	9	10	11	12	13	14	15
1	311800 -	34 -	0.0070	NATIONAL SOURCE AT "Hajdúszoboszló"	8118	33989	0.734	16.39	97.65	0.76	0.19	0.13	1.17	CBM	2.8	1.4
2	322500 -	34 -	0.0074	GAS LINE "TESTVÉRISÉG"	8565	35858	0.731	16.27	98.35	0.43	0.17	0.05	0.90	CBM	3.9	1.4
3	331900 -	16 -	0.0044	INERT	3860	16159	1.346	29.98	43.94	0.81	0.31	44.16	10.46	CBM	2.2	1.3

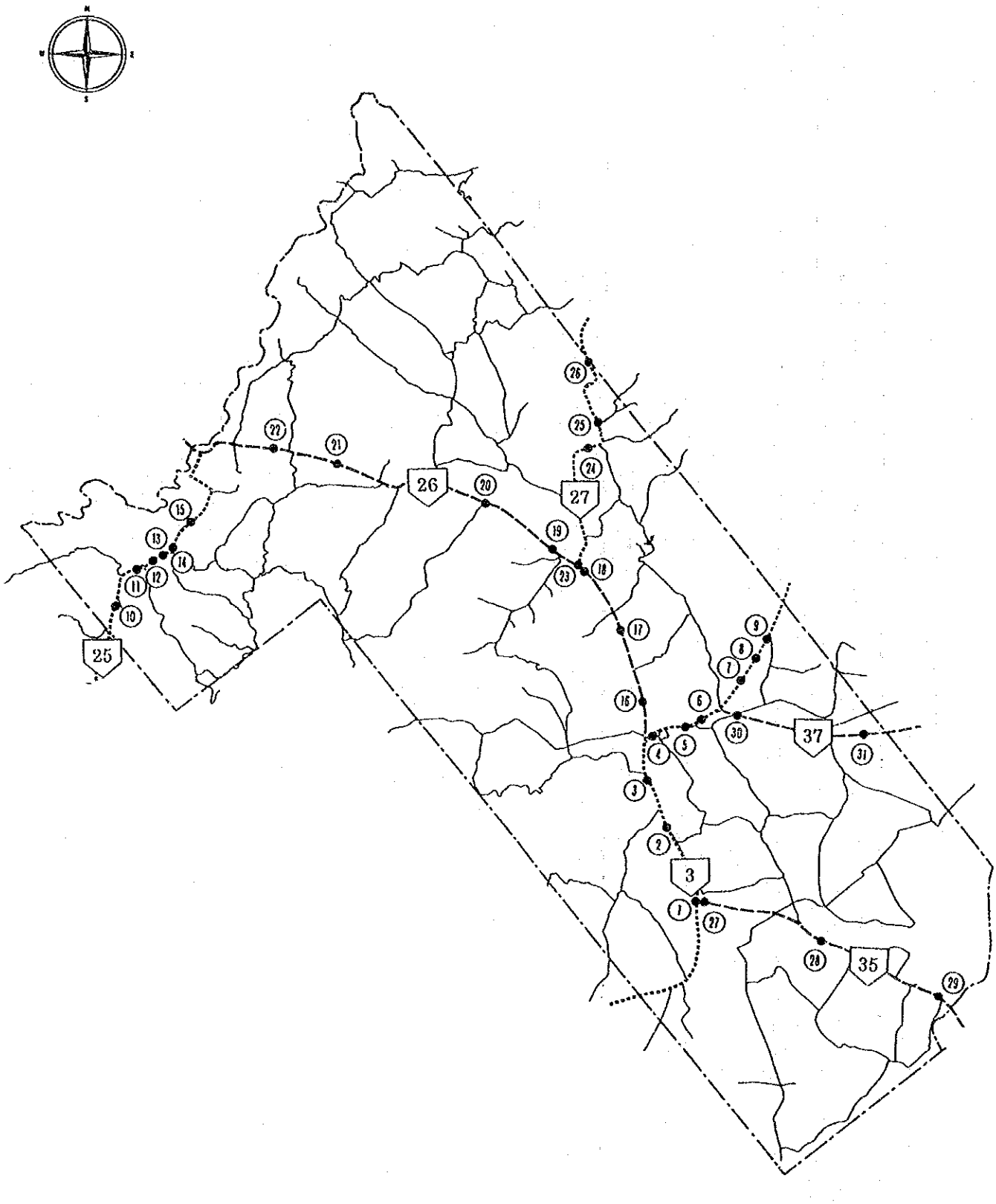


Figure D4.2.1 Road Network and Existing Traffic Survey Points

Table D4.2.1 Traffic Volume (in the year 1990) in Study Area

Road Name	Counting Station (km)	Junction (km)		Lenth (km)	Number of lains	Traffic Volume (units/day)							Fig.4.2.1.1 point No.
		initial	final			Code	Passenger Car	Bus	Truck			TOTAL	
									Light	Heavy	Trailer		
3	128.940	127.554	131.080	3.526	2*1	4461	4,858	334	444	1,037	1,140	7,813	
	131.970	131.080	132.768	1.688	2*1	3024	7,022	457	707	1,203	1,353	10,742	
	134.030	132.768	138.236	5.468	2*1	4462	6,647	246	499	1,155	1,185	9,732	
	140.850	138.236	140.858	2.622	2*1	2025	7,610	240	396	1,308	1,385	10,939	
	154.860	140.858	157.118	16.260	2*1	7691	***	***	***	***	***	***	
	163.535	157.118	163.646	6.528	2*1	7692	8,697	192	1,120	2,179	2,551	14,739	①
	172.500	163.646	173.045	9.399	2*2	2026	16,172	582	561	2,202	1,282	20,799	②
	175.400	173.045	177.274	4.229	2*2	3027	16,413	571	574	2,984	748	21,290	③
	179.063	177.274	179.063	1.789	2*1	4463	13,974	797	466	1,919	903	18,059	④
	180.450	179.063	181.205	2.142	2*1	4464	15,790	683	388	1,651	808	19,320	⑤
	182.390	181.205	183.000	1.795	2*1	3028	9,276	830	844	1,400	790	13,140	⑥
	188.800	183.000	190.245	7.245	2*1	4465	4,101	125	105	317	140	4,788	⑦
	191.800	190.245	193.803	3.558	2*1	7694	4,187	159	58	442	153	4,999	⑧
	195.230	193.803	201.337	7.534	2*1	3029	3,842	97	88	365	93	4,485	⑨
	212.080	201.337	218.714	17.377	2*1	7695	2,756	80	54	235	95	3,220	
	223.270	218.714	225.832	7.118	2*1	4466	1,737	69	86	163	7	2,062	
	235.620	225.832	239.010	13.178	2*1	7696	1,083	59	47	47	9	1,245	
	240.373	239.010	240.373	1.363	2*1	3	1,117	40	0	16	0	1,173	
25	55.000	50.987	55.770	4.783	2*1	3379	1,464	90	70	234	96	1,954	⑩
	61.800	55.770	62.438	6.668	2*1	4467	2,333	151	132	232	145	2,993	⑪
	64.800	62.438	64.984	2.546	2*1	7697	2,640	130	114	212	122	3,218	⑫
	65.950	64.984	66.174	1.190	2*1	2105	4,473	167	125	268	82	5,115	⑬
	67.000	66.174	69.632	3.458	2*1	4468	3,388	163	122	231	102	4,006	⑭
	72.800	69.632	81.483	11.851	2*1	7698	2,528	85	115	371	136	3,235	⑮
26	2.000	0.000	2.992	2.992	2*2	4469	16,526	889	505	1,316	696	19,932	⑯
	8.000	2.992	9.484	6.492	2*1	4470	7,436	641	221	1,654	1,291	11,243	⑰
	13.000	9.484	15.694	6.210	2*1	3106	8,652	803	884	1,636	1,134	13,109	⑱
	17.600	15.694	21.136	5.442	2*1	7699	4,773	434	604	633	530	6,974	⑲
	23.000	21.136	29.355	8.219	2*1	4471	3,957	284	373	675	445	5,734	⑳
	33.500	29.355	38.241	8.886	2*1	3380	2,845	194	524	561	217	4,341	㉑
	38.870	38.241	45.130	6.889	2*1	7701	3,514	217	494	596	191	5,012	㉒
27	1.000	0.000	5.685	5.685	2*1	7702	2,350	145	116	413	128	3,152	㉓
	9.500	5.685	10.930	5.245	2*1	2108	2,080	279	395	296	129	3,179	㉔
	12.800	10.930	15.420	4.490	2*1	7703	1,544	99	94	256	70	2,063	㉕
	17.000	15.420	24.910	9.490	2*1	7704	1,640	80	65	235	53	2,073	㉖
	26.000	24.910	26.500	1.590	2*1	7705	1,436	106	74	294	64	1,974	
	29.400	26.500	30.220	3.720	2*1	3381	1,641	111	85	242	77	2,156	
	35.200	30.220	35.458	5.238	2*1	7706	***	***	***	***	***	***	
	38.400	35.458	38.572	3.114	2*1	7707	1,010	76	51	124	25	1,286	
	39.700	38.572	42.622	4.050	2*1	4472	527	31	42	89	26	715	
	45.400	42.622	46.522	3.900	2*1	7708	539	51	43	107	17	757	
	53.963	46.522	53.963	7.441	2*1	4930	112	2	3	6	0	123	
	54.178	53.963	54.178	0.215	2*1	14	74	1	0	0	0	75	
35	1.500	0.000	6.106	6.106	2*1	4473	6,361	169	529	1,236	919	9,214	㉗
	10.000	6.106	18.520	12.414	2*1	3119	6,730	159	412	866	1,545	9,712	㉘
	18.640	18.520	22.885	4.365	2*2	4474	5,240	519	348	1,721	2,402	10,230	㉙
37	1.500	0.000	8.465	8.465	2*1	3382	6,458	146	103	866	530	8,103	㉚
	13.800	8.465	15.677	7.212	2*1	4475	4,401	85	167	633	633	5,919	㉛
	27.600	15.677	27.770	12.096	2*1	4476	4,903	107	466	950	409	6,835	
	38.000	27.770	39.771	12.001	2*1	3378	2,894	82	295	574	483	4,328	
	46.000	39.771	49.956	10.185	2*1	7709	2,537	82	248	465	382	3,714	
	53.000	49.956	58.981	9.025	2*1	7710	2,789	77	275	394	306	3,841	
	60.050	58.981	64.451	5.470	2*1	4477	2,751	87	175	331	172	3,516	
	65.000	64.451	75.726	11.275	2*1	3123	2,350	65	155	328	159	3,057	
	76.500	75.726	78.296	2.570	2*1	3124	4,650	169	98	226	31	5,174	
	80.341	78.296	80.341	2.045	2*1	15	773	15	0	7	0	795	

Table D4.2.2 Hourly Traffic Volume by Direction and Vehicle Type (No.1)

measuring point : 1026,2026(R3) date : 1993/6/17-18 (weekday)

time		Budapest→Miskolc(1026)				Miskolc→Budapest(2026)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	373	28	121	522	456	20	95	571	829	48	216	1093
7:00~	8:00	541	17	120	678	551	29	158	738	1092	46	278	1416
8:00~	9:00	491	15	153	659	566	98	190	854	1057	113	343	1513
9:00~	10:00	519	32	155	706	538	35	201	774	1057	67	356	1480
10:00~	11:00	522	23	152	697	622	46	157	825	1144	69	309	1522
11:00~	12:00	470	22	119	611	635	66	162	863	1105	88	281	1474
12:00~	13:00	590	11	144	745	518	31	169	718	1108	42	313	1463
13:00~	14:00	460	12	119	591	507	18	136	661	967	30	255	1252
14:00~	15:00	444	15	98	557	588	21	128	737	1032	36	226	1294
15:00~	16:00	463	7	99	569	596	41	134	771	1059	48	233	1340
16:00~	17:00	606	4	74	684	608	7	73	688	1214	11	147	1372
17:00~	18:00	495	10	91	596	646	16	79	741	1141	26	170	1337
18:00~	19:00	386	7	54	447	402	2	37	441	788	9	91	888
19:00~	20:00	520	11	70	601	299	2	33	334	819	13	103	935
20:00~	21:00	300	12	55	367	259	2	43	304	559	14	98	671
21:00~	22:00	252	7	45	304	161	2	20	183	413	9	65	487
22:00~	23:00	139	6	19	164	103	1	27	131	242	7	46	295
23:00~	0:00	103	4	21	128	99	0	22	121	202	4	43	249
0:00~	1:00	29	9	8	46	26	0	21	47	55	9	29	93
1:00~	2:00	33	1	7	41	24	2	15	41	57	3	22	82
2:00~	3:00	34	1	14	49	23	12	15	50	57	13	29	99
3:00~	4:00	42	4	13	59	25	4	30	59	67	8	43	118
4:00~	5:00	91	4	27	122	81	5	28	114	172	9	55	236
5:00~	6:00	137	7	74	218	193	3	34	230	330	10	108	448
Total		8040	269	1852	10161	8526	463	2007	10996	16566	732	3859	21157

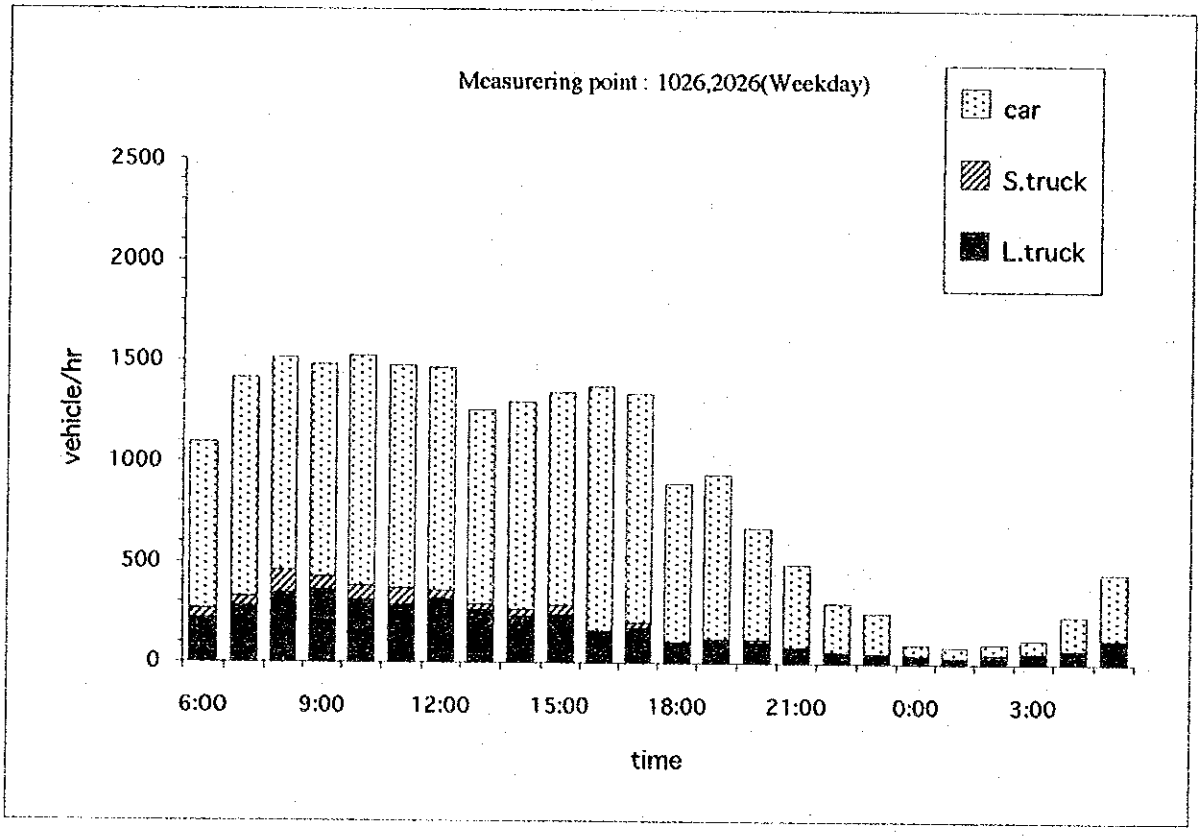


Figure D4.2.2 Hourly Traffic Volume by Vehicle Type (No.1)

Table D4.2.3 Hourly Traffic Volume by Direction and Vehicle Type (No.1)

measuring point : 1026,2026(R3) date : 1993/6/20-21 (Holiday)

time		Budapest→Miskolc(1026)				Miskolc→Budapest(2026)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	173	4	31	208	182	3	42	227	355	7	73	435
7:00~	8:00	291	3	77	371	408	1	36	445	699	4	113	816
8:00~	9:00	426	3	17	446	693	3	31	727	1119	6	48	1173
9:00~	10:00	581	2	74	657	847	2	50	899	1428	4	124	1556
10:00~	11:00	841	5	69	915	1204	11	62	1277	2045	16	131	2192
11:00~	12:00	554	6	55	615	680	2	29	711	1234	8	84	1326
12:00~	13:00	446	5	46	497	633	4	42	679	1079	9	88	1176
13:00~	14:00	502	7	52	561	552	7	30	589	1054	14	82	1150
14:00~	15:00	539	7	39	585	691	12	38	741	1230	19	77	1326
15:00~	16:00	642	8	72	722	683	6	33	722	1325	14	105	1444
16:00~	17:00	691	7	49	747	739	8	41	788	1430	15	90	1535
17:00~	18:00	1049	5	31	1085	811	7	31	849	1860	12	62	1934
18:00~	19:00	1086	9	51	1146	772	2	30	804	1858	11	81	1950
19:00~	20:00	973	2	33	1008	588	4	21	613	1561	6	54	1621
20:00~	21:00	663	3	31	697	436	0	12	448	1099	3	43	1145
21:00~	22:00	189	3	10	202	200	0	7	207	389	3	17	409
22:00~	23:00	152	1	23	176	93	0	7	100	245	1	30	276
23:00~	0:00	123	1	24	148	58	0	11	69	181	1	35	217
0:00~	1:00	45	0	10	55	46	3	8	57	91	3	18	112
1:00~	2:00	20	0	9	29	30	4	22	56	50	4	31	85
2:00~	3:00	41	7	21	69	27	1	17	45	68	8	38	114
3:00~	4:00	24	4	13	41	29	3	20	52	53	7	33	93
4:00~	5:00	46	10	27	83	71	6	26	103	117	16	53	186
5:00~	6:00	76	19	58	153	56	21	53	130	132	40	111	283
Total		10173	121	922	11216	10529	110	699	11338	20702	231	1621	22554

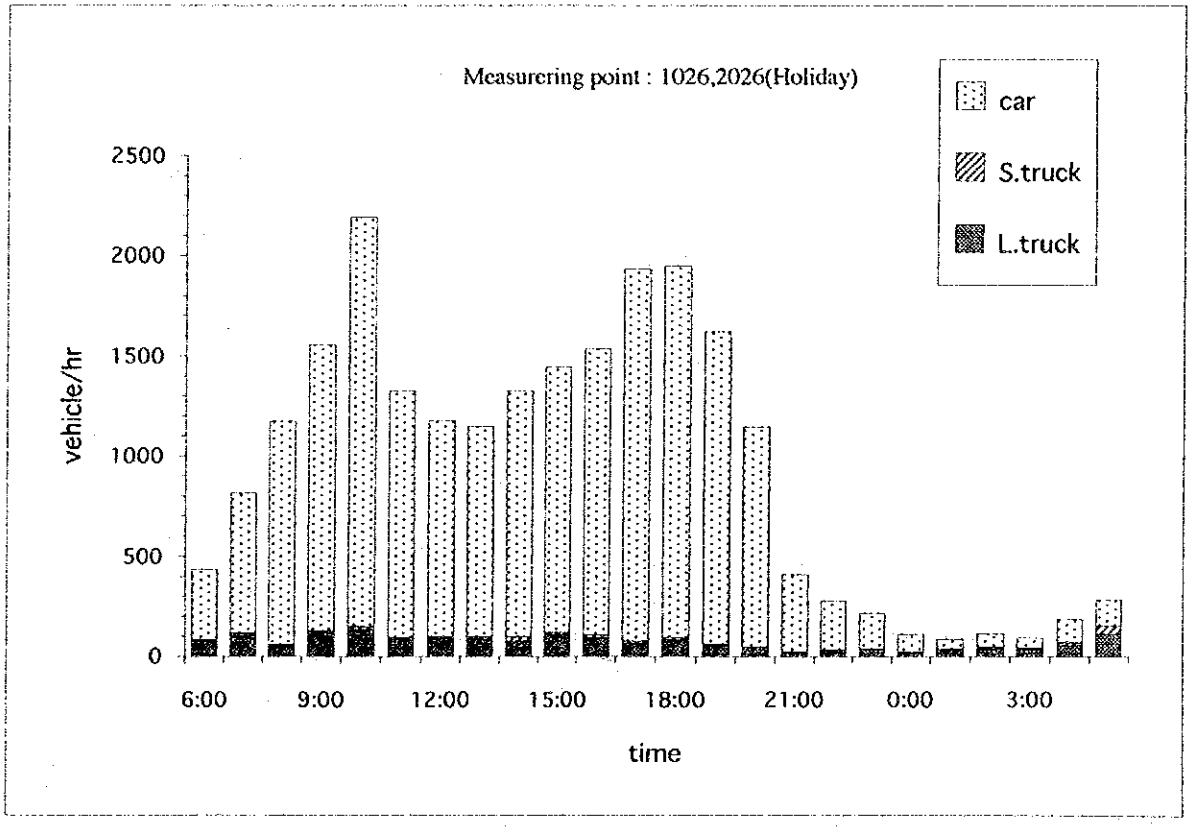


Figure D4.2.3 Hourly Traffic Volume by Vehicle Type (No.1)

Table D4.2.4 Hourly Traffic Volume by Direction and Vehicle Type (No.2)

measuring point : 1463,2463(R3) date : 1993/6/17-18 (weekday)

time		Miskolc→Szikso(1463)				Szikszo→Miskolc(2463)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	331	8	94	433	398	15	127	540	729	23	221	973
7:00~	8:00	450	9	116	575	495	12	120	627	945	21	236	1202
8:00~	9:00	451	9	109	569	458	20	98	576	909	29	207	1145
9:00~	10:00	485	11	120	616	454	24	107	585	939	35	227	1201
10:00~	11:00	486	17	124	627	515	13	83	611	1001	30	207	1238
11:00~	12:00	450	11	87	548	495	6	105	606	945	17	192	1154
12:00~	13:00	425	10	112	547	448	23	92	563	873	33	204	1110
13:00~	14:00	422	11	124	557	564	30	116	710	986	41	240	1267
14:00~	15:00	473	11	123	607	561	19	85	665	1034	30	208	1272
15:00~	16:00	510	11	92	613	487	9	51	547	997	20	143	1160
16:00~	17:00	462	6	68	536	473	10	67	550	935	16	135	1086
17:00~	18:00	449	6	53	508	307	8	43	358	756	14	96	866
18:00~	19:00	342	7	43	392	267	3	24	294	609	10	67	686
19:00~	20:00	276	1	41	318	311	7	27	345	587	8	68	663
20:00~	21:00	230	2	28	260	190	1	21	212	420	3	49	472
21:00~	22:00	171	2	17	190	167	6	34	207	338	8	51	397
22:00~	23:00	90	1	15	106	65	2	13	80	155	3	28	186
23:00~	0:00	70	2	9	81	53	1	15	69	123	3	24	150
0:00~	1:00	58	1	17	76	52	0	16	68	110	1	33	144
1:00~	2:00	34	0	11	45	31	0	11	42	65	0	22	87
2:00~	3:00	21	0	6	27	14	3	9	26	35	3	15	53
3:00~	4:00	40	0	9	49	68	3	19	90	108	3	28	139
4:00~	5:00	72	2	22	96	140	7	40	187	212	9	62	283
5:00~	6:00	183	5	75	263	251	15	81	347	434	20	156	610
Total		6981	143	1515	8639	7264	237	1404	8905	14245	380	2919	17544

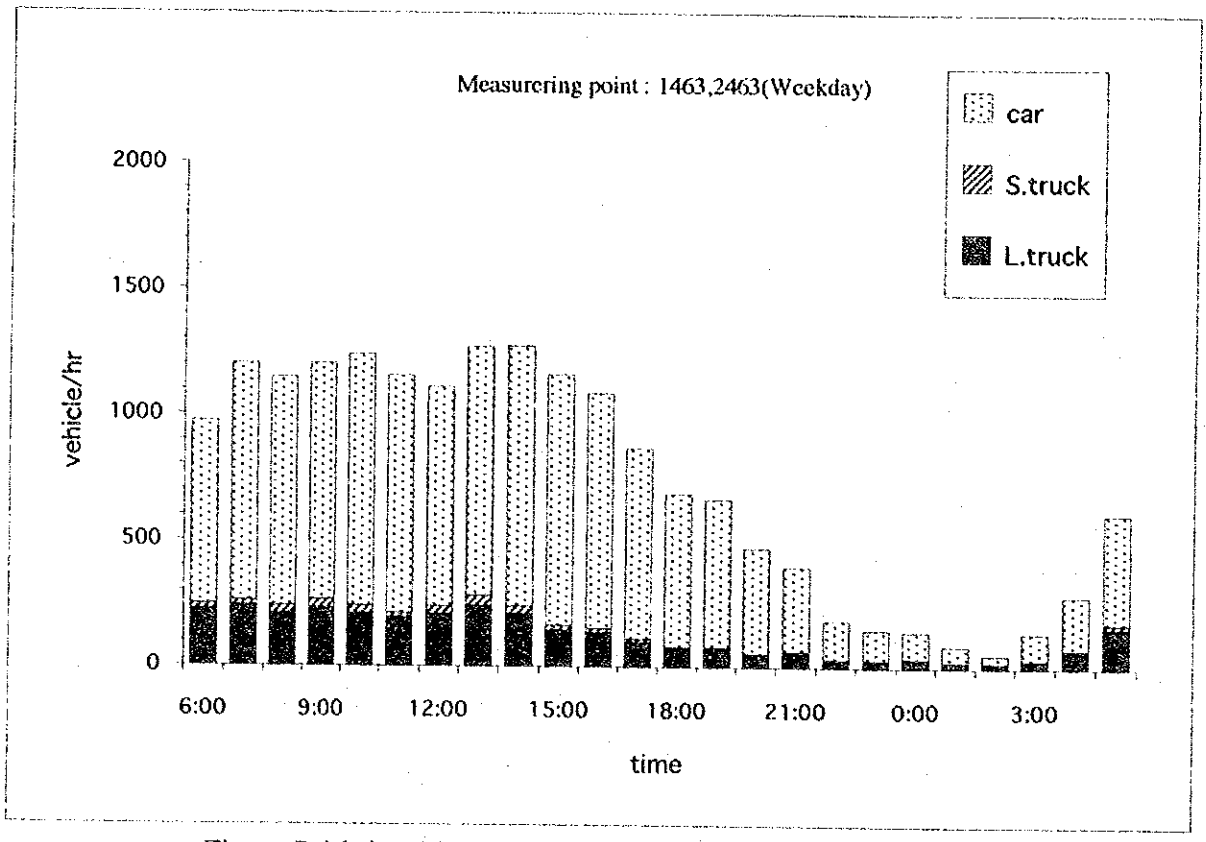


Figure D4.2.4 Hourly Traffic Volume by Vehicle Type (No.2)

Table D4.2.5 Hourly Traffic Volume by Direction and Vehicle Type (No.2)

measuring point : 1463,2463(R3) date : 1993/6/20-21 (Holiday)

time		Miskolc→Szikso(1463)				Szikszo→Miskolc(2463)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	191	1	32	224	168	4	26	198	359	5	58	422
7:00~	8:00	254	4	33	291	241	5	29	275	495	9	62	566
8:00~	9:00	393	3	29	425	319	4	23	346	712	7	52	771
9:00~	10:00	433	3	24	460	393	4	22	419	826	7	46	879
10:00~	11:00	378	4	17	399	275	0	15	290	653	4	32	689
11:00~	12:00	381	5	25	411	375	0	18	393	756	5	43	804
12:00~	13:00	349	7	25	381	347	2	20	369	696	9	45	750
13:00~	14:00	319	6	30	355	434	2	29	465	753	8	59	820
14:00~	15:00	296	2	28	326	300	1	17	318	596	3	45	644
15:00~	16:00	391	6	26	423	471	0	16	487	862	6	42	910
16:00~	17:00	374	2	23	399	552	1	22	575	926	3	45	974
17:00~	18:00	354	5	24	383	582	3	17	602	936	8	41	985
18:00~	19:00	343	2	35	380	483	3	20	506	826	5	55	886
19:00~	20:00	305	2	18	325	525	2	17	544	830	4	35	869
20:00~	21:00	187	0	20	207	321	3	14	338	508	3	34	545
21:00~	22:00	139	4	16	159	203	1	25	229	342	5	41	388
22:00~	23:00	72	0	12	84	118	1	19	138	190	1	31	222
23:00~	0:00	47	3	5	55	50	1	8	59	97	4	13	114
0:00~	1:00	13	1	5	19	26	3	13	42	39	4	18	61
1:00~	2:00	31	3	12	46	23	0	12	35	54	3	24	81
2:00~	3:00	30	2	21	53	26	5	15	46	56	7	36	99
3:00~	4:00	20	0	10	30	35	1	9	45	55	1	19	75
4:00~	5:00	41	2	8	51	80	2	26	108	121	4	34	159
5:00~	6:00	178	8	54	240	213	12	77	302	391	20	131	542
Total		5519	75	532	6126	6560	60	509	7129	12079	135	1041	13255

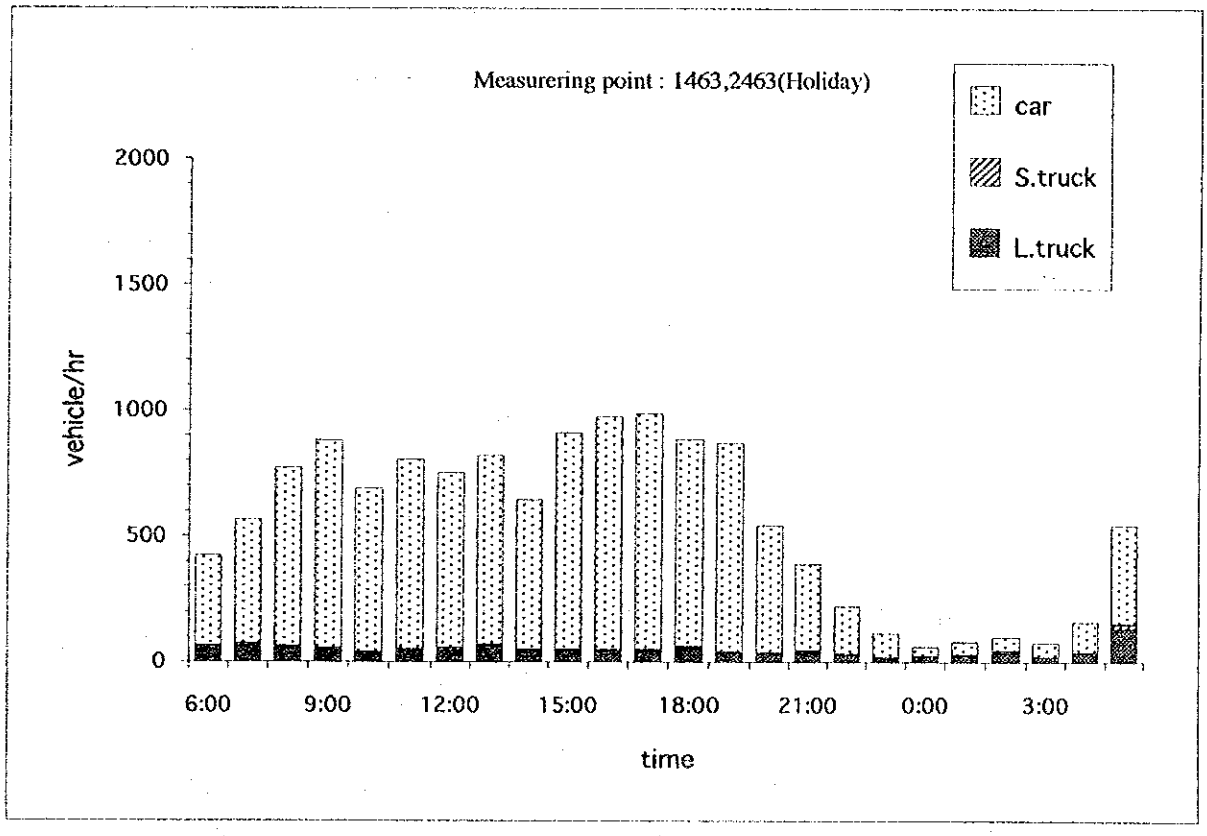


Figure D4.2.5 Hourly Traffic Volume by Vehicle Type (No.2)

Table D4.2.6 Hourly Traffic Volume by Direction and Vehicle Type (No.3)

measuring point : 4469,6469(R26) date : 1993/6/17-18 (weekday)

time		Sajosentpeter→Miskolc(4469)				Miskolc→Sajosentpeter(6469)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	351	14	99	464	641	22	117	780	992	36	216	1244
7:00~	8:00	542	14	133	689	862	30	118	1010	1404	44	251	1699
8:00~	9:00	622	17	119	758	710	18	119	847	1332	35	238	1605
9:00~	10:00	662	7	116	785	670	19	106	795	1332	26	222	1580
10:00~	11:00	691	11	110	812	702	23	99	824	1393	34	209	1636
11:00~	12:00	757	17	114	888	698	43	47	788	1455	60	161	1676
12:00~	13:00	622	15	90	727	645	13	104	762	1267	28	194	1489
13:00~	14:00	685	18	114	817	618	13	100	731	1303	31	214	1548
14:00~	15:00	602	8	92	702	601	12	96	709	1203	20	188	1411
15:00~	16:00	808	9	98	915	492	16	83	591	1300	25	181	1506
16:00~	17:00	610	6	78	694	369	6	76	451	979	12	154	1145
17:00~	18:00	440	4	60	504	403	7	59	469	843	11	119	973
18:00~	19:00	338	5	50	393	496	6	54	556	834	11	104	949
19:00~	20:00	283	1	49	333	273	3	45	321	556	4	94	654
20:00~	21:00	209	0	31	240	183	1	32	216	392	1	63	456
21:00~	22:00	97	2	27	126	123	2	25	150	220	4	52	276
22:00~	23:00	48	0	27	75	67	0	30	97	115	0	57	172
23:00~	0:00	40	0	18	58	36	0	16	52	76	0	34	110
0:00~	1:00	25	0	8	33	28	0	13	41	53	0	21	74
1:00~	2:00	21	0	8	29	18	0	3	21	39	0	11	50
2:00~	3:00	20	0	5	25	11	0	7	18	31	0	12	43
3:00~	4:00	39	4	7	50	29	7	14	50	68	11	21	100
4:00~	5:00	90	5	31	126	97	11	34	142	187	16	65	268
5:00~	6:00	173	4	61	238	323	6	84	413	496	10	145	651
Total		8775	161	1545	10481	9095	258	1481	10834	17870	419	3026	21315

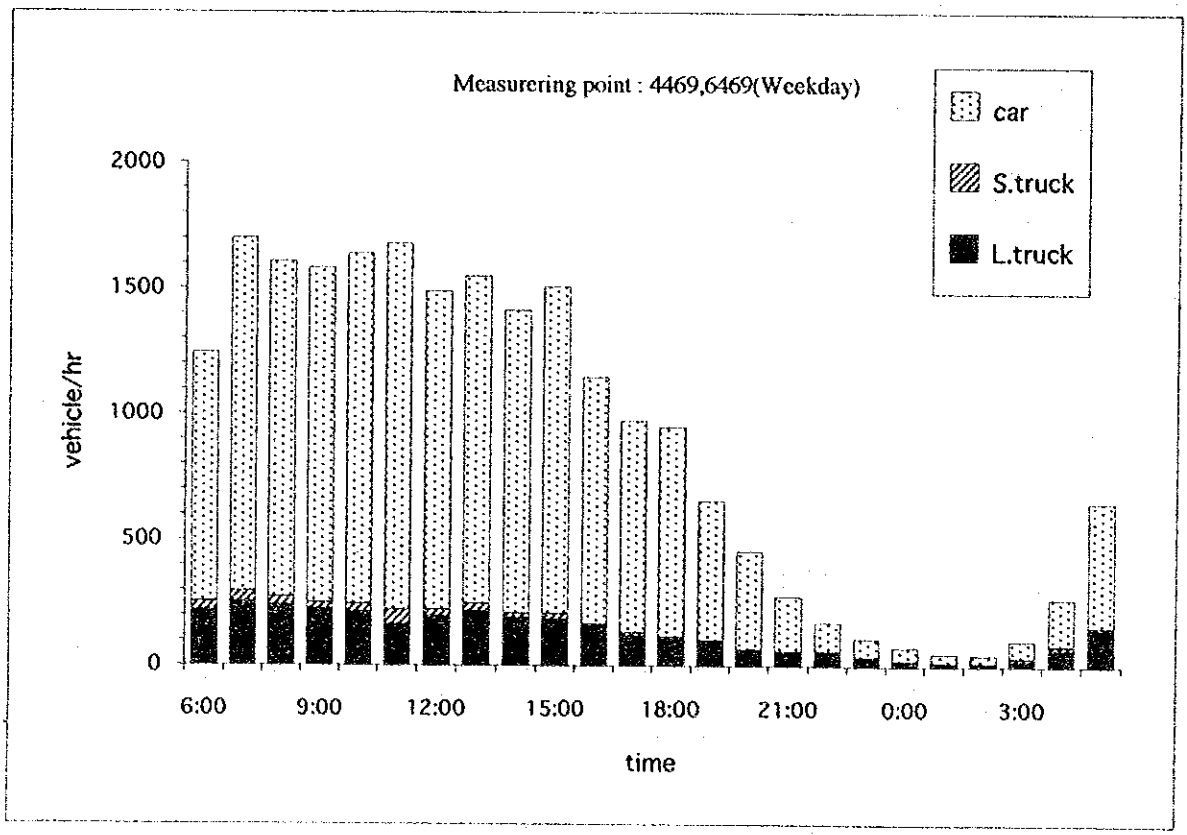


Figure D4.2.6 Hourly Traffic Volume by Vehicle Type (No.3)

Table D4.2.7 Hourly Traffic Volume by Direction and Vehicle Type (No.3)

measuring point : 4469,6469(R26) date : 1993/6/20-21 (Holiday)

time		Sajosentpeter→Miskolc(4469)				Miskolc→Sajosentpeter(6469)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	136	1	33	170	247	1	36	284	383	2	69	454
7:00~	8:00	216	3	34	253	434	3	37	474	650	6	71	727
8:00~	9:00	342	2	30	374	519	0	23	542	861	2	53	916
9:00~	10:00	458	0	26	484	521	1	26	548	979	1	52	1032
10:00~	11:00	461	6	21	488	461	0	26	487	922	6	47	975
11:00~	12:00	511	1	34	546	334	1	30	365	845	2	64	911
12:00~	13:00	469	1	23	493	289	3	24	316	758	4	47	809
13:00~	14:00	357	1	35	393	427	1	21	449	784	2	56	842
14:00~	15:00	327	2	24	353	354	1	25	380	681	3	49	733
15:00~	16:00	479	4	32	515	274	2	33	309	753	6	65	824
16:00~	17:00	368	0	25	393	313	1	26	340	681	1	51	733
17:00~	18:00	324	2	27	353	358	0	29	387	682	2	56	740
18:00~	19:00	371	3	23	397	448	0	22	470	819	3	45	867
19:00~	20:00	319	0	20	339	334	0	21	355	653	0	41	694
20:00~	21:00	209	0	12	221	223	1	19	243	432	1	31	464
21:00~	22:00	145	0	19	164	142	1	18	161	287	1	37	325
22:00~	23:00	65	0	12	77	79	0	21	100	144	0	33	177
23:00~	0:00	38	0	13	51	38	0	17	55	76	0	30	106
0:00~	1:00	19	0	8	27	28	0	6	34	47	0	14	61
1:00~	2:00	11	0	16	27	7	0	6	13	18	0	22	40
2:00~	3:00	19	1	14	34	11	0	6	17	30	1	20	51
3:00~	4:00	39	4	14	57	14	6	10	30	53	10	24	87
4:00~	5:00	61	8	24	93	42	9	32	83	103	17	56	176
5:00~	6:00	153	4	62	219	223	16	77	316	376	20	139	535
Total		5897	43	581	6521	6120	47	591	6758	12017	90	1172	13279

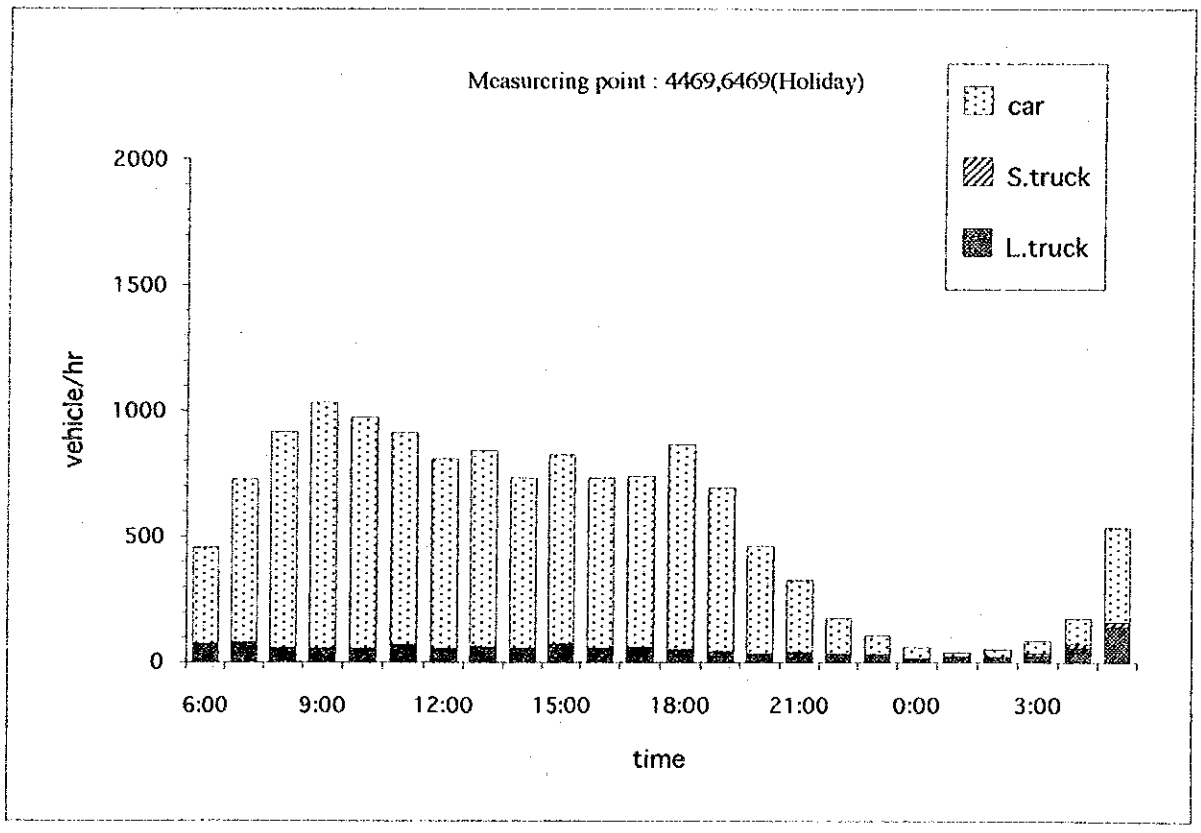


Figure D4.2.7 Hourly Traffic Volume by Vehicle Type (No.3)

Table D4.2.8 Hourly Traffic Volume by Direction and Vehicle Type (No.4)

measuring point : 3119,6119(R35) date : 1993/6/17-18 (weekday)

time		Miskolc→Debrecen(3119)				Debrecen→Miskolc(6119)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	158	38	128	324	200	30	105	335	358	68	233	659
7:00~	8:00	130	32	107	269	165	47	73	285	295	79	180	554
8:00~	9:00	176	36	88	300	151	36	58	245	327	72	146	545
9:00~	10:00	175	27	58	260	152	27	81	260	327	54	139	520
10:00~	11:00	152	38	85	275	138	27	71	236	290	65	156	511
11:00~	12:00	149	25	70	244	141	32	88	261	290	57	158	505
12:00~	13:00	159	47	99	305	165	36	60	261	324	83	159	566
13:00~	14:00	174	26	86	286	155	36	84	275	329	62	170	561
14:00~	15:00	164	34	82	280	195	22	84	301	359	56	166	581
15:00~	16:00	184	37	69	290	213	31	66	310	397	68	135	600
16:00~	17:00	212	46	54	312	169	24	41	234	381	70	95	546
17:00~	18:00	203	31	47	281	196	51	47	294	399	82	94	575
18:00~	19:00	136	2	29	167	133	3	15	151	269	5	44	318
19:00~	20:00	167	4	24	195	117	2	28	147	284	6	52	342
20:00~	21:00	136	2	20	158	86	1	15	102	222	3	35	260
21:00~	22:00	83	1	12	96	70	2	14	86	153	3	26	182
22:00~	23:00	38	0	10	48	29	1	19	49	67	1	29	97
23:00~	0:00	29	0	15	44	26	1	10	37	55	1	25	81
0:00~	1:00	31	1	12	44	15	2	6	23	46	3	18	67
1:00~	2:00	18	2	6	26	20	0	8	28	38	2	14	54
2:00~	3:00	19	0	7	26	18	1	16	35	37	1	23	61
3:00~	4:00	24	2	15	41	24	3	25	52	48	5	40	93
4:00~	5:00	28	4	18	50	35	2	40	77	63	6	58	127
5:00~	6:00	86	2	47	135	89	5	56	150	175	7	103	285
Total		2831	437	1188	4456	2702	422	1110	4234	5533	859	2298	8690

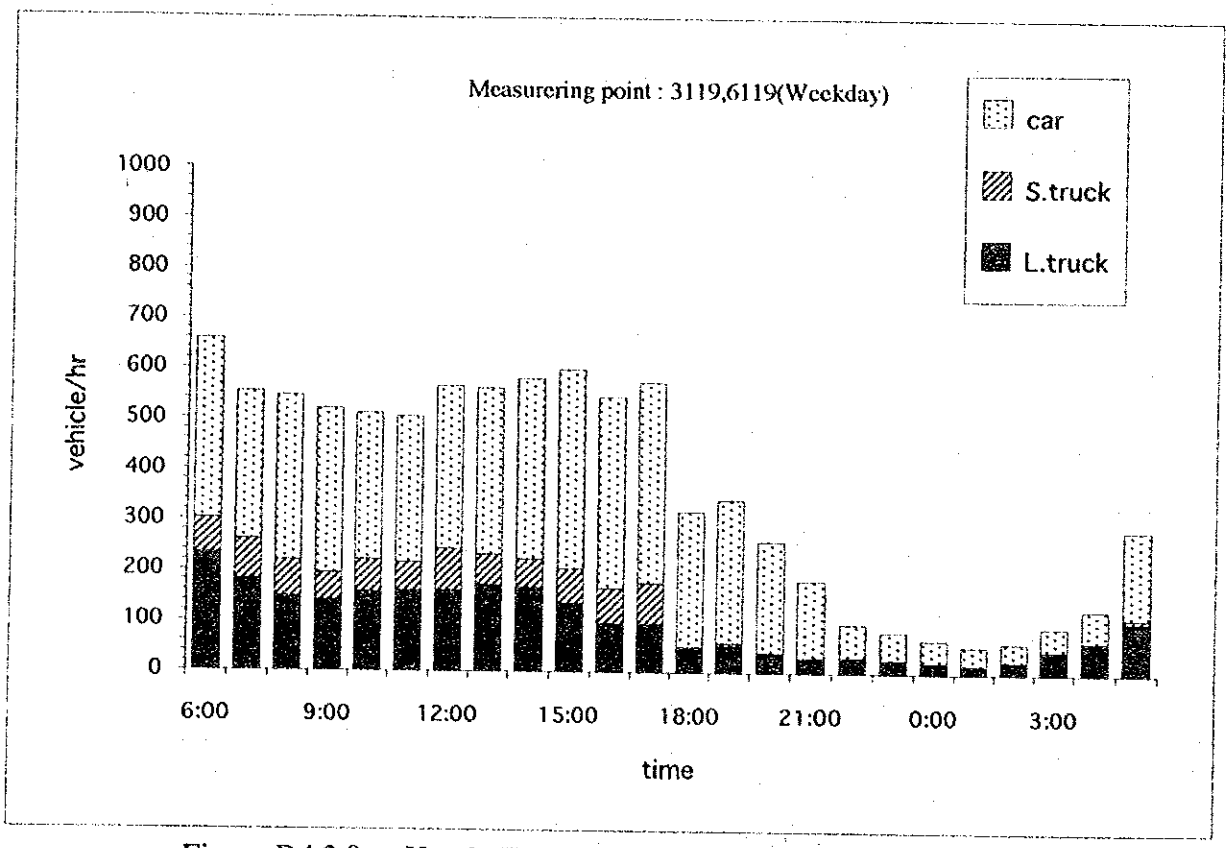


Figure D4.2.8 Hourly Traffic Volume by Vehicle Type (No.4)

Table D4.2.9 Hourly Traffic Volume by Direction and Vehicle Type (No.4)

measuring point : 3119,6119(R35) date : 1993/6/20-21 (Holiday)

time		Miskolc→Debrecen(3119)				Debrecen→Miskolc(6119)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	90	5	21	116	105	3	18	126	195	8	39	242
7:00~	8:00	105	7	29	141	145	4	17	166	250	11	46	307
8:00~	9:00	138	0	13	151	198	0	17	215	336	0	30	366
9:00~	10:00	190	4	10	204	213	5	11	229	403	9	21	433
10:00~	11:00	208	1	8	217	223	1	15	239	431	2	23	456
11:00~	12:00	212	0	10	222	185	1	18	204	397	1	28	426
12:00~	13:00	183	2	8	193	164	5	8	177	347	7	16	370
13:00~	14:00	147	0	11	158	219	0	5	224	366	0	16	382
14:00~	15:00	240	0	7	247	222	0	10	232	462	0	17	479
15:00~	16:00	194	0	15	209	255	0	16	271	449	0	31	480
16:00~	17:00	282	0	11	293	284	2	12	298	566	2	23	591
17:00~	18:00	365	2	15	382	380	2	14	396	745	4	29	778
18:00~	19:00	303	0	5	308	285	2	19	306	588	2	24	614
19:00~	20:00	320	0	7	327	300	3	11	314	620	3	18	641
20:00~	21:00	200	1	11	212	180	1	30	211	380	2	41	423
21:00~	22:00	112	1	9	122	97	0	10	107	209	1	19	229
22:00~	23:00	37	0	6	43	54	2	12	68	91	2	18	111
23:00~	0:00	32	1	15	48	26	1	14	41	58	2	29	89
0:00~	1:00	23	3	10	36	26	1	11	38	49	4	21	74
1:00~	2:00	38	0	11	49	18	1	9	28	56	1	20	77
2:00~	3:00	33	3	14	50	25	0	14	39	58	3	28	89
3:00~	4:00	40	5	24	69	27	2	18	47	67	7	42	116
4:00~	5:00	74	5	27	106	95	4	40	139	169	9	67	245
5:00~	6:00	150	9	42	201	173	10	64	247	323	19	106	448
Total		3716	49	339	4104	3899	50	413	4362	7615	99	752	8466

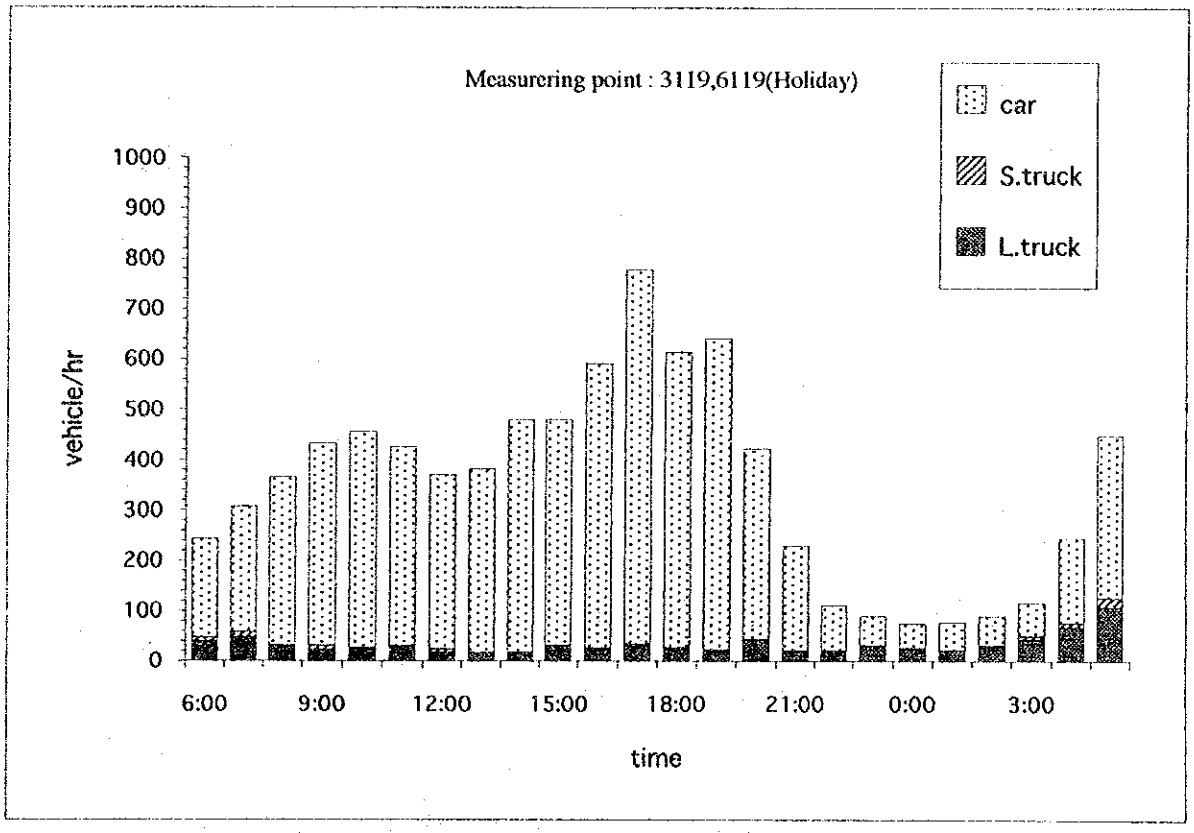


Figure D4.2.9 Hourly Traffic Volume by Vehicle Type (No.4)

Table D4.2.10 Hourly Traffic Volume by Direction and Vehicle Type (No.5)

measuring point : 1001,2001(R2505) date : 1993/6/17-18 (weekday)

time		Lillafured→Miskolc(1001)				Miskolc→Lillafured(2001)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	107	1	15	123	114	1	18	133	221	2	33	256
7:00~	8:00	135	3	24	162	139	2	30	171	274	5	54	333
8:00~	9:00	120	7	35	162	96	2	29	127	216	9	64	289
9:00~	10:00	122	10	19	151	148	3	38	189	270	13	57	340
10:00~	11:00	105	2	22	129	135	6	41	182	240	8	63	311
11:00~	12:00	114	9	24	147	121	8	26	155	235	17	50	302
12:00~	13:00	85	5	18	108	108	3	19	130	193	8	37	238
13:00~	14:00	93	4	27	124	123	5	26	154	216	9	53	278
14:00~	15:00	116	0	24	140	127	6	24	157	243	6	48	297
15:00~	16:00	125	2	21	148	138	8	20	166	263	10	41	314
16:00~	17:00	91	3	19	113	125	6	22	153	216	9	41	266
17:00~	18:00	147	0	9	156	168	1	11	180	315	1	20	336
18:00~	19:00	95	0	2	97	117	0	8	125	212	0	10	222
19:00~	20:00	79	0	7	86	118	0	6	124	197	0	13	210
20:00~	21:00	52	0	6	58	88	0	3	91	140	0	9	149
21:00~	22:00	16	0	2	18	32	0	4	36	48	0	6	54
22:00~	23:00	15	0	4	19	24	0	3	27	39	0	7	46
23:00~	0:00	7	0	1	8	7	0	0	7	14	0	1	15
0:00~	1:00	7	0	2	9	8	0	0	8	15	0	2	17
1:00~	2:00	3	0	1	4	5	0	1	6	8	0	2	10
2:00~	3:00	3	0	0	3	4	0	1	5	7	0	1	8
3:00~	4:00	5	1	4	10	9	0	1	10	14	1	5	20
4:00~	5:00	7	3	5	15	17	0	3	20	24	3	8	35
5:00~	6:00	38	1	12	51	63	1	12	76	101	2	24	127
Total		1687	51	303	2041	2034	52	346	2432	3721	103	649	4473

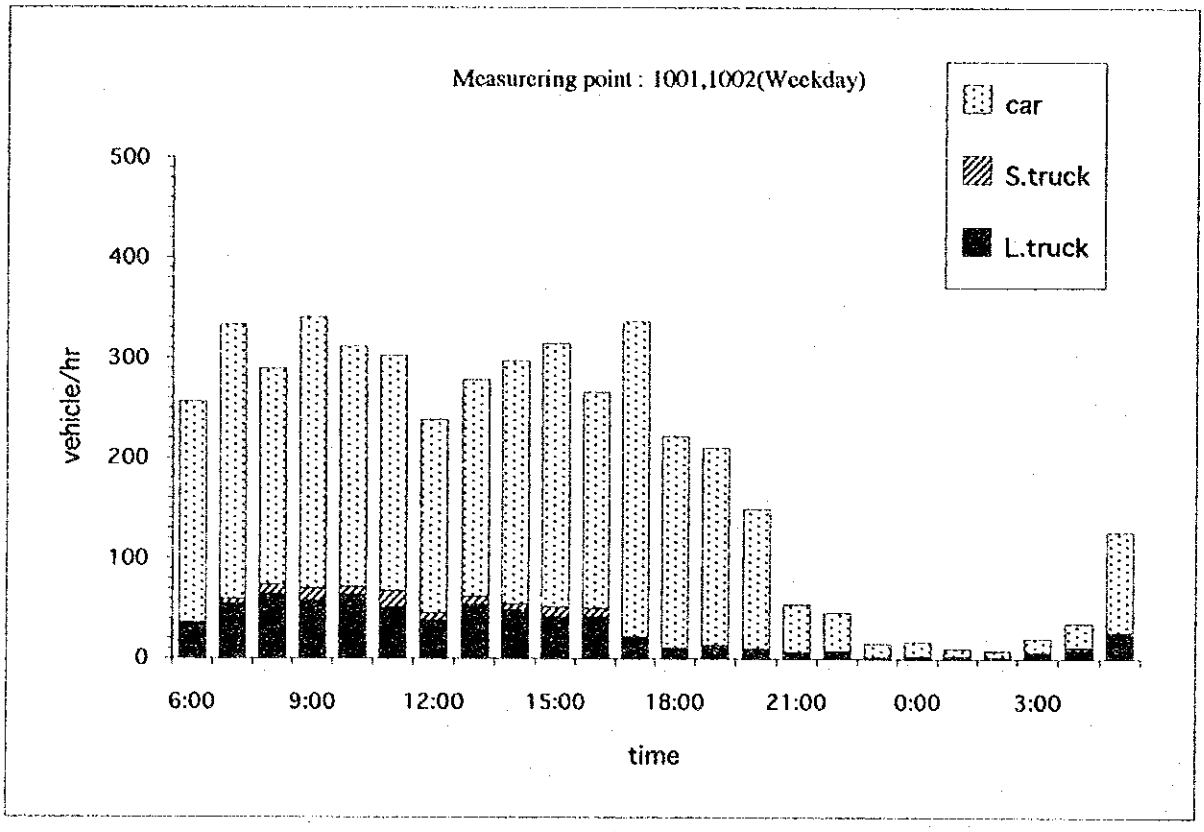


Figure D4.2.10 Hourly Traffic Volume by Vehicle Type (No.5)

Table D4.2.11 Hourly Traffic Volume by Direction and Vehicle Type (No.5)

measuring point : 1001,2001(R2505) date : 1993/6/20-21 (Holiday)

time		Lillafured→Miskolc(1001)				Miskolc→Lillafured(2001)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	42	0	5	47	46	0	5	51	88	0	10	98
7:00~	8:00	71	1	5	77	58	0	5	63	129	1	10	140
8:00~	9:00	130	0	8	138	85	0	6	91	215	0	14	229
9:00~	10:00	150	1	6	157	111	1	4	116	261	2	10	273
10:00~	11:00	171	4	8	183	122	0	7	129	293	4	15	312
11:00~	12:00	144	1	5	150	97	1	6	104	241	2	11	254
12:00~	13:00	109	1	5	115	123	0	4	127	232	1	9	242
13:00~	14:00	131	0	6	137	128	0	7	135	259	0	13	272
14:00~	15:00	134	0	5	139	142	0	5	147	276	0	10	286
15:00~	16:00	129	1	7	137	136	0	7	143	265	1	14	280
16:00~	17:00	150	0	5	155	200	0	4	204	350	0	9	359
17:00~	18:00	145	1	7	153	216	0	2	218	361	1	9	371
18:00~	19:00	153	0	3	156	238	3	3	244	391	3	6	400
19:00~	20:00	117	0	5	122	222	0	3	225	339	0	8	347
20:00~	21:00	70	0	1	71	112	1	2	115	182	1	3	186
21:00~	22:00	41	0	4	45	66	0	2	68	107	0	6	113
22:00~	23:00	22	0	1	23	27	0	2	29	49	0	3	52
23:00~	0:00	14	0	1	15	6	0	0	6	20	0	1	21
0:00~	1:00	6	0	0	6	5	0	0	5	11	0	0	11
1:00~	2:00	4	0	0	4	3	0	0	3	7	0	0	7
2:00~	3:00	3	0	0	3	3	0	0	3	6	0	0	6
3:00~	4:00	3	0	0	3	7	0	0	7	10	0	0	10
4:00~	5:00	6	1	1	8	13	0	3	16	19	1	4	24
5:00~	6:00	27	0	13	40	51	2	14	67	78	2	27	107
Total		1972	11	101	2084	2217	8	91	2316	4189	19	192	4400

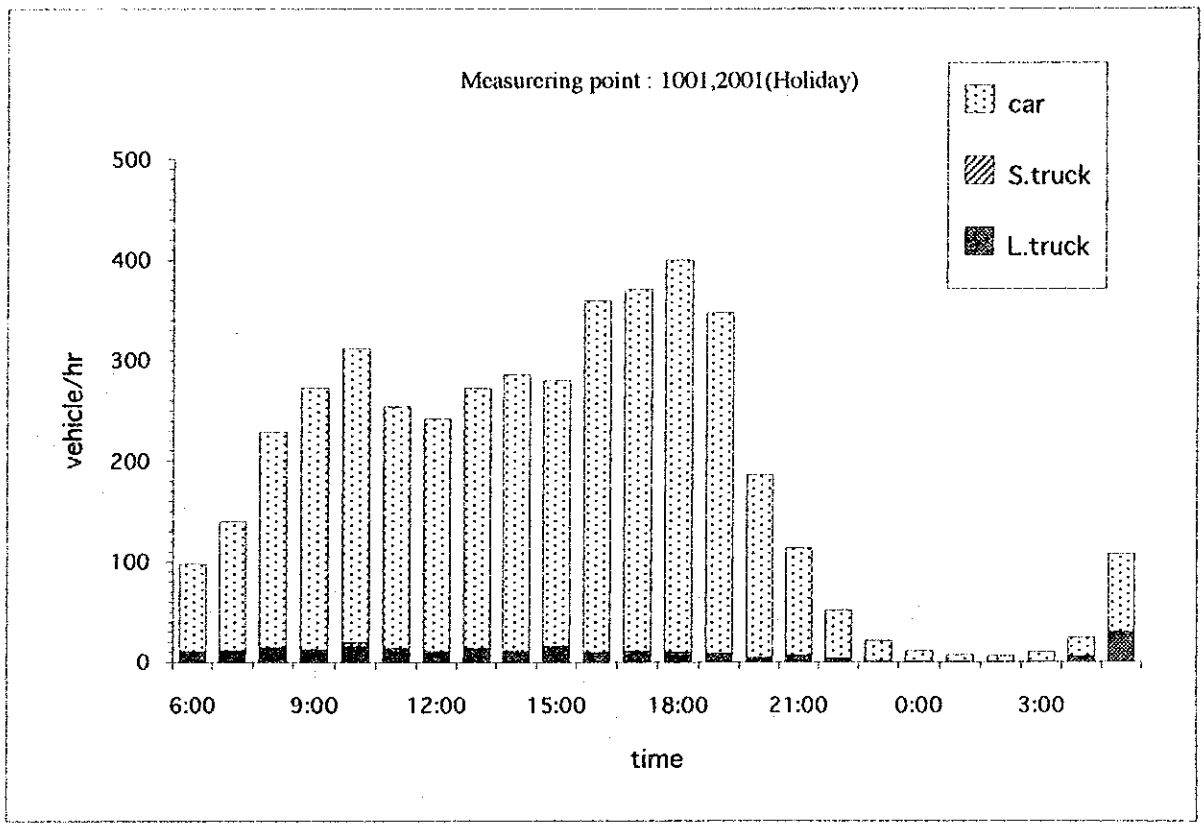


Figure D4.2.11 Hourly Traffic Volume by Vehicle Type (No.5)

Table D4.2.12 Hourly Traffic Volume by Direction and Vehicle Type (No.6)

measuring point : 1002,2002(R3604) date : 1993/6/17-18 (weekday)

time	Miskolc→Kistokaj(1002)				Kistokaj→Miskolc(2002)				Two-direcution total			
	car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~ 7:00	317	10	24	351	245	20	37	302	562	30	61	653
7:00~ 8:00	375	3	27	405	225	30	44	299	600	33	71	704
8:00~ 9:00	416	9	34	459	458	71	72	601	874	80	106	1060
9:00~ 10:00	468	16	21	505	327	64	66	457	795	80	87	962
10:00~ 11:00	420	13	30	463	385	72	71	528	805	85	101	991
11:00~ 12:00	235	8	30	273	330	55	64	449	565	63	94	722
12:00~ 13:00	376	15	30	421	352	57	95	504	728	72	125	925
13:00~ 14:00	487	13	29	529	350	27	42	419	837	40	71	948
14:00~ 15:00	337	16	32	385	337	37	58	432	674	53	90	817
15:00~ 16:00	560	5	31	596	520	19	20	559	1080	24	51	1155
16:00~ 17:00	352	2	28	382	349	11	31	391	701	13	59	773
17:00~ 18:00	277	2	20	299	395	8	22	425	672	10	42	724
18:00~ 19:00	202	5	13	220	205	7	25	237	407	12	38	457
19:00~ 20:00	178	1	12	191	195	7	12	214	373	8	24	405
20:00~ 21:00	98	1	11	110	65	0	8	73	163	1	19	183
21:00~ 22:00	52	1	10	63	38	1	10	49	90	2	20	112
22:00~ 23:00	18	0	8	26	22	0	4	26	40	0	12	52
23:00~ 0:00	20	0	11	31	16	0	2	18	36	0	13	49
0:00~ 1:00	18	0	4	22	17	0	0	17	35	0	4	39
1:00~ 2:00	17	0	3	20	18	0	0	18	35	0	3	38
2:00~ 3:00	8	0	1	9	16	3	0	19	24	3	1	28
3:00~ 4:00	6	0	2	8	17	0	1	18	23	0	3	26
4:00~ 5:00	57	2	12	71	73	1	7	81	130	3	19	152
5:00~ 6:00	143	1	13	157	170	4	18	192	313	5	31	349
Total	5437	123	436	5996	5125	494	709	6328	10562	617	1145	12324

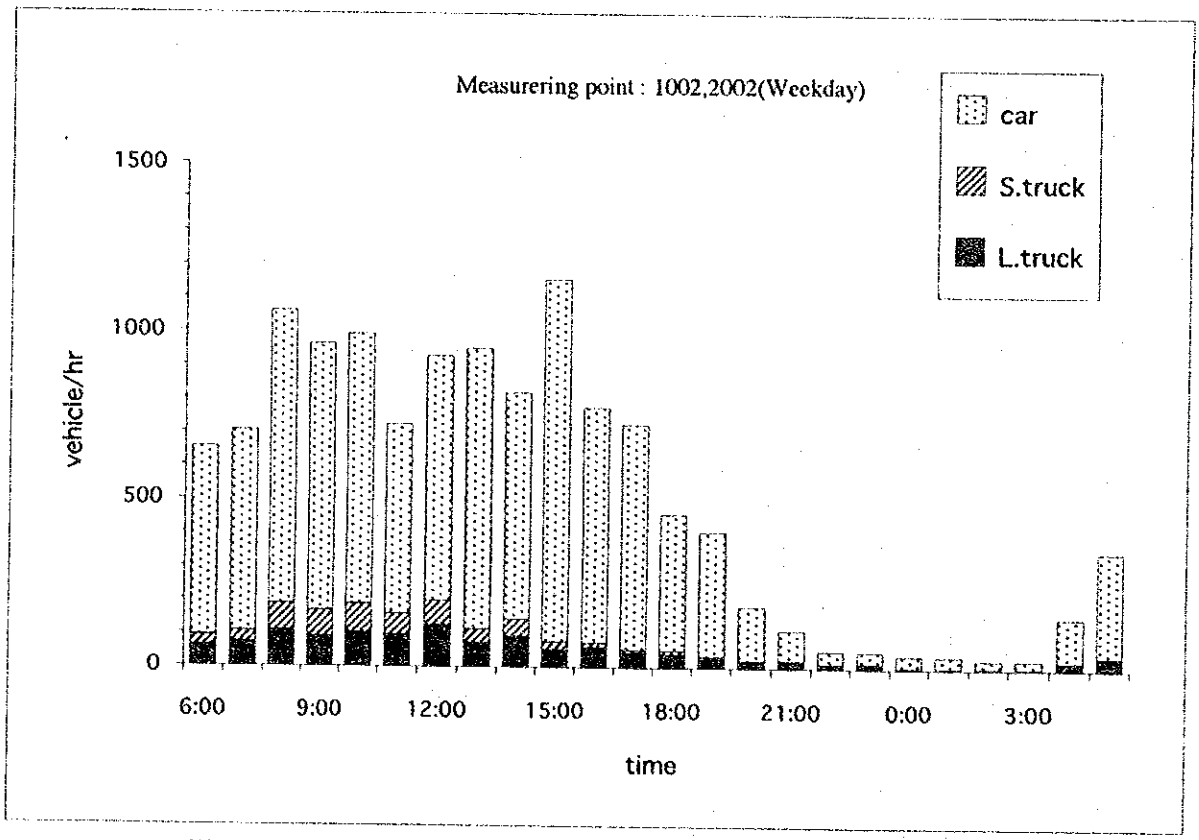


Figure D4.2.12 Hourly Traffic Volume by Vehicle Type (No.6)

Table D4.2.13 Hourly Traffic Volume by Direction and Vehicle Type (No.6)

measuring point : 1002,2002(R3604) date : 1993/6/20-21 (Holiday)

time		Miskolc→Kistokaj(1002)				Kistokaj→Miskolc(2002)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	59	2	7	68	102	2	8	112	161	4	15	180
7:00~	8:00	67	0	8	75	57	2	4	63	124	2	12	138
8:00~	9:00	93	1	5	99	61	2	5	68	154	3	10	167
9:00~	10:00	146	0	10	156	99	0	5	104	245	0	15	260
10:00~	11:00	114	3	8	125	71	1	5	77	185	4	13	202
11:00~	12:00	96	4	8	108	82	6	5	93	178	10	13	201
12:00~	13:00	6	1	11	18	86	2	6	94	92	3	17	112
13:00~	14:00	87	1	8	96	63	1	6	70	150	2	14	166
14:00~	15:00	98	0	8	106	68	3	8	79	166	3	16	185
15:00~	16:00	157	4	11	172	150	3	6	159	307	7	17	331
16:00~	17:00	142	6	7	155	193	6	7	206	335	12	14	361
17:00~	18:00	168	1	10	179	210	6	10	226	378	7	20	405
18:00~	19:00	249	8	10	267	232	3	9	244	481	11	19	511
19:00~	20:00	195	3	6	204	192	0	5	197	387	3	11	401
20:00~	21:00	176	2	10	188	110	2	8	120	286	4	18	308
21:00~	22:00	78	2	7	87	64	0	6	70	142	2	13	157
22:00~	23:00	42	0	4	46	53	0	6	59	95	0	10	105
23:00~	0:00	21	0	4	25	40	0	5	45	61	0	9	70
0:00~	1:00	28	0	3	31	40	0	0	40	68	0	3	71
1:00~	2:00	8	0	1	9	36	0	0	36	44	0	1	45
2:00~	3:00	6	0	3	9	21	0	0	21	27	0	3	30
3:00~	4:00	17	0	4	21	22	0	4	26	39	0	8	47
4:00~	5:00	21	2	7	30	37	2	10	49	58	4	17	79
5:00~	6:00	77	6	13	96	80	7	15	102	157	13	28	198
Total		2151	46	173	2370	2169	48	143	2360	4320	94	316	4730

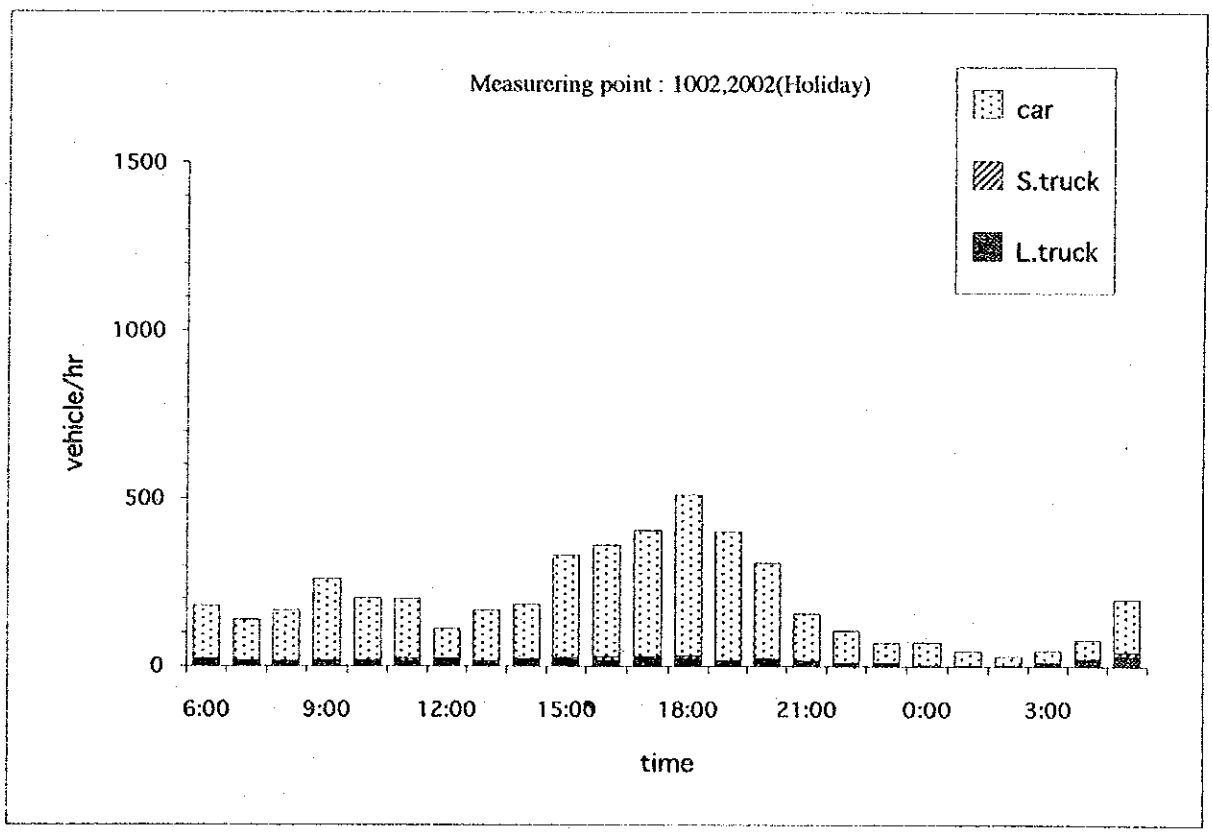


Figure D4.2.13 Hourly Traffic Volume by Vehicle Type (No.6)

Table D4.2.14 Hourly Traffic Volume by Direction and Vehicle Type (No.7)

measuring point : 1003,2003(Miskolc) date : 1993/6/17-18 (weekday)

time		from Repter (1003)				to Repter (2003)				Two-direcution total			
		car	S.truck	L.truck	total	car	S.truck	L.truck	total	car	S.truck	L.truck	total
6:00~	7:00	140	7	46	193	146	5	29	180	286	12	75	373
7:00~	8:00	182	6	49	237	194	6	52	252	376	12	101	489
8:00~	9:00	225	11	36	272	215	3	46	264	440	14	82	536
9:00~	10:00	249	3	36	288	183	7	28	218	432	10	64	506
10:00~	11:00	304	5	41	350	213	5	39	257	517	10	80	607
11:00~	12:00	415	7	35	457	165	11	37	213	580	18	72	670
12:00~	13:00	147	5	42	194	117	2	28	147	264	7	70	341
13:00~	14:00	128	3	43	174	111	5	28	144	239	8	71	318
14:00~	15:00	126	0	23	149	116	2	36	154	242	2	59	303
15:00~	16:00	112	3	18	133	106	3	25	134	218	6	43	267
16:00~	17:00	84	1	10	95	78	2	13	93	162	3	23	188
17:00~	18:00	79	1	4	84	70	2	12	84	149	3	16	168
18:00~	19:00	57	1	4	62	48	1	10	59	105	2	14	121
19:00~	20:00	32	0	4	36	40	0	3	43	72	0	7	79
20:00~	21:00	21	0	4	25	26	0	2	28	47	0	6	53
21:00~	22:00	17	0	6	23	19	0	5	24	36	0	11	47
22:00~	23:00	10	0	3	13	8	1	5	14	18	1	8	27
23:00~	0:00	3	0	1	4	3	0	1	4	6	0	2	8
0:00~	1:00	1	0	0	1	8	0	3	11	9	0	3	12
1:00~	2:00	4	0	1	5	7	0	0	7	11	0	1	12
2:00~	3:00	2	0	1	3	5	1	1	7	7	1	2	10
3:00~	4:00	1	0	1	2	7	0	5	12	8	0	6	14
4:00~	5:00	11	1	1	13	53	0	8	61	64	1	9	74
5:00~	6:00	54	1	23	78	176	3	35	214	230	4	58	292
Total		2404	55	432	2891	2114	59	451	2624	4518	114	883	5515

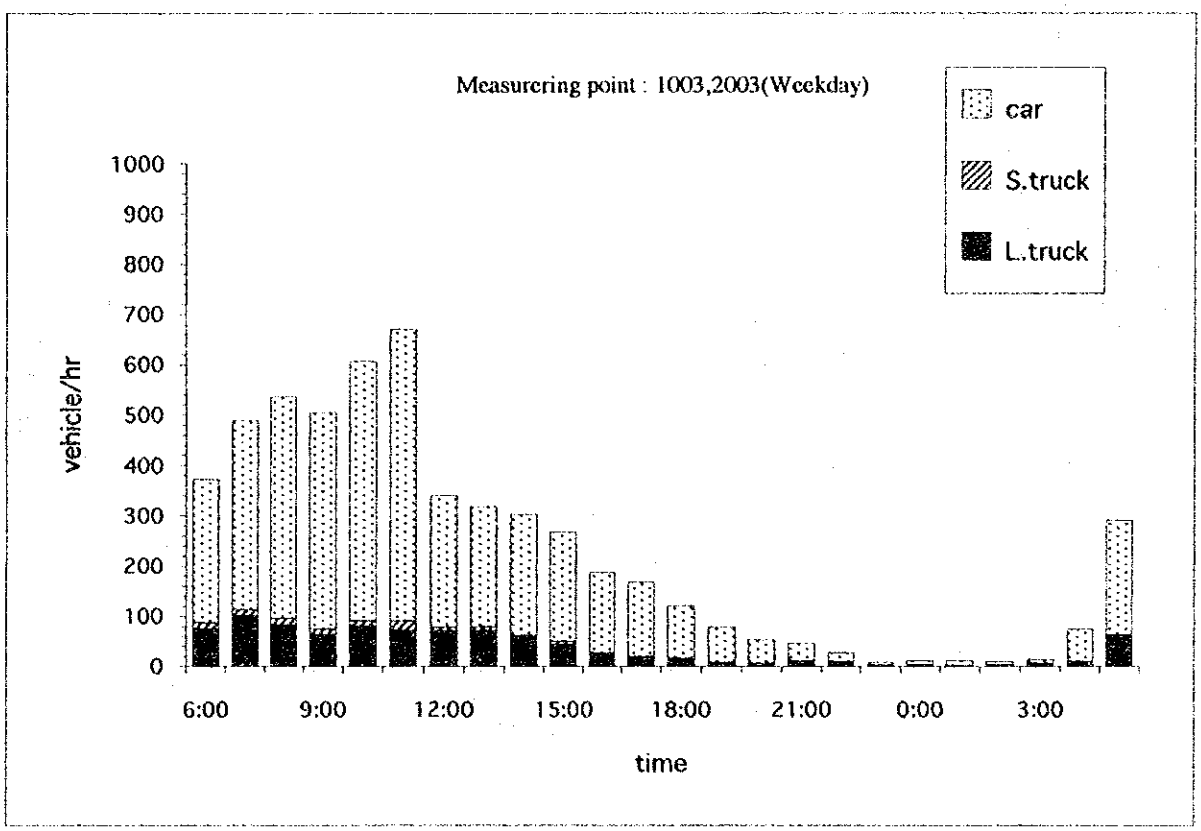


Figure D4.2.14 Hourly Traffic Volume by Vehicle Type (No.7)