Table D4.2.15 Hourly Traffic Volume by Direction and Vehicle Type (No.7)

measuring point : 1003,2003(Miskolc) date : 1993/6/20-21 (holiday)

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	30	0	8	38	165	0	10	175	195	0	18	213
7:00~ 8:00	94	0	8	102	299	1	7	307	393	1	15	409
8:00~ 9:00	175	0	7	182	361	3	11	375	536	3	18	557
9:00~ 10:00	161	3	4	168	384	2	5	391	545	5	9	559
10:00~ 11:00	453	4	5	462	240	1	11	252	693	5	16	714
11:00~ 12:00	508	4	13	525	121	1	6	128	629	5	19	653
12:00~ 13:00	447	10	12	469	48	1	9	58	495	11	21	527
13:00~ 14:00	124	0	5	129	48	0	3	51	172	0	8	180
14:00~ 15:00	61	0	4	65	31	0	4	35	92	0	8	100
15:00~ 16:00	60	0	4	64	48	0	3	51	108	0	7	115
16:00~ 17:00	44	0	0	44	62	0	4	66	106	0	4	110
17:00~ 18:00	39	0	2	41	63	0	1	64	102	0	3	105
18:00~ 19:00	55	0	2	57	79	0	2	81	134	0	4	138
19:00~ 20:00	41	0	4	45	64	0	1	65	105	0	5	110
20:00~ 21:00	25	0	1	26	36	0	3	39	61	0	4	65
21:00~ 22:00	15	0	6	21	21	0	4	25	36	0	10	46
22:00~ 23:00	11	0	4	15	14	2	4	20	25	2	8	35
23:00~ 0:00	0	0	1	1	7	0	1	8	7	0	2	9
0:00~ 1:00	0	0	1	1	5	0	1	6	5	0	2	7
1:00~ 2:00	1	0	1	2	0	0	1	1	1	0	2	3
2:00~ 3:00	1	0	0	1	2	0	0	2	3	0	0	3
3:00~ 4:00	2	1	0	3	5	1	1	7	7	2	1	10
4:00~ 5:00	10	0	3	13	11	0	5	16	21	0	8	29
5:00~ 6:00	65	2	17	84	53	1	28	82	118	3	45	166
Total	2422	24	112	2558	2167	13	125	2305	4589	37	237	4863

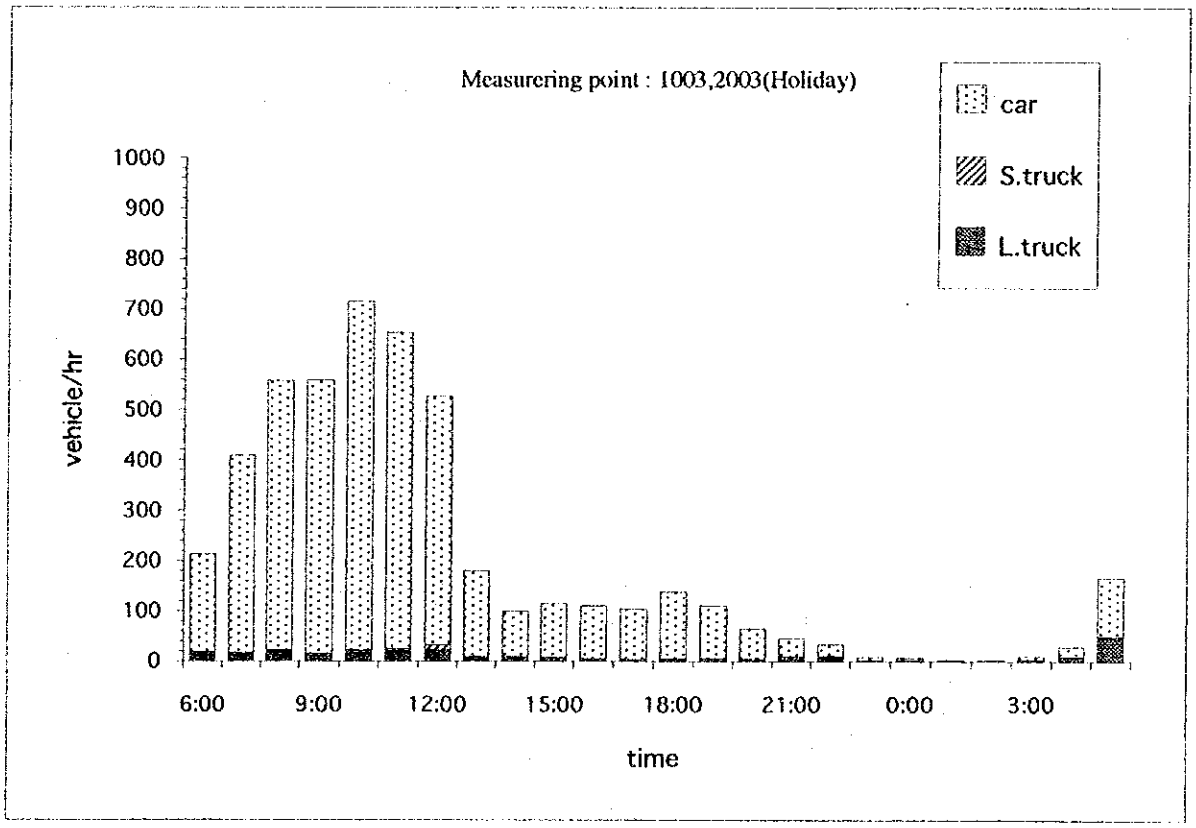


Figure D4.2.15 Hourly Traffic Volume by Vehicle Type (No.7)

Table D4.2.16 Hourly Traffic Volume by Direction and Vehicle Type (No.8)

measuring point : 1004,2004(Miskolc) date : 1993/6/17-18 (weekday)

time	to Diosgyor (1004)				from Diosgyor (2004)				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	267	2	30	299	390	5	45	440	657	7	75	739
7:00~ 8:00	416	17	52	485	640	3	53	696	1056	20	105	1181
8:00~ 9:00	537	17	43	597	678	7	42	727	1215	24	85	1324
9:00~ 10:00	578	21	41	640	623	52	31	706	1201	73	72	1346
10:00~ 11:00	640	13	42	695	668	29	39	736	1308	42	81	1431
11:00~ 12:00	570	35	39	644	654	9	42	705	1224	44	81	1349
12:00~ 13:00	526	23	54	603	612	3	21	636	1138	26	75	1239
13:00~ 14:00	510	30	55	595	690	2	48	740	1200	32	103	1335
14:00~ 15:00	611	17	50	678	719	5	46	770	1330	22	96	1448
15:00~ 16:00	632	2	38	672	703	17	37	757	1335	19	75	1429
16:00~ 17:00	665	4	31	700	736	3	28	767	1401	7	59	1467
17:00~ 18:00	569	3	27	599	575	1	30	606	1144	4	57	1205
18:00~ 19:00	480	0	27	507	457	1	26	484	937	1	53	991
19:00~ 20:00	412	11	29	452	416	8	18	442	828	19	47	894
20:00~ 21:00	340	8	23	371	330	3	17	350	670	11	40	721
21:00~ 22:00	245	1	19	265	257	0	14	271	502	1	33	536
22:00~ 23:00	149	0	6	155	146	0	11	157	295	0	17	312
23:00~ 0:00	82	0	5	87	71	0	4	75	153	0	9	162
0:00~ 1:00	41	0	3	44	53	0	2	55	94	0	5	99
1:00~ 2:00	31	1	0	32	21	0	3	24	52	1	3	56
2:00~ 3:00	30	0	1	31	28	0	3	31	58	0	4	62
3:00~ 4:00	17	2	7	26	16	1	1	18	33	3	8	44
4:00~ 5:00	42	3	21	66	31	4	9	44	73	7	30	110
5:00~ 6:00	142	2	40	184	122	5	25	152	264	7	65	336
Total	8532	212	683	9427	9636	158	595	10389	18168	370	1278	19816

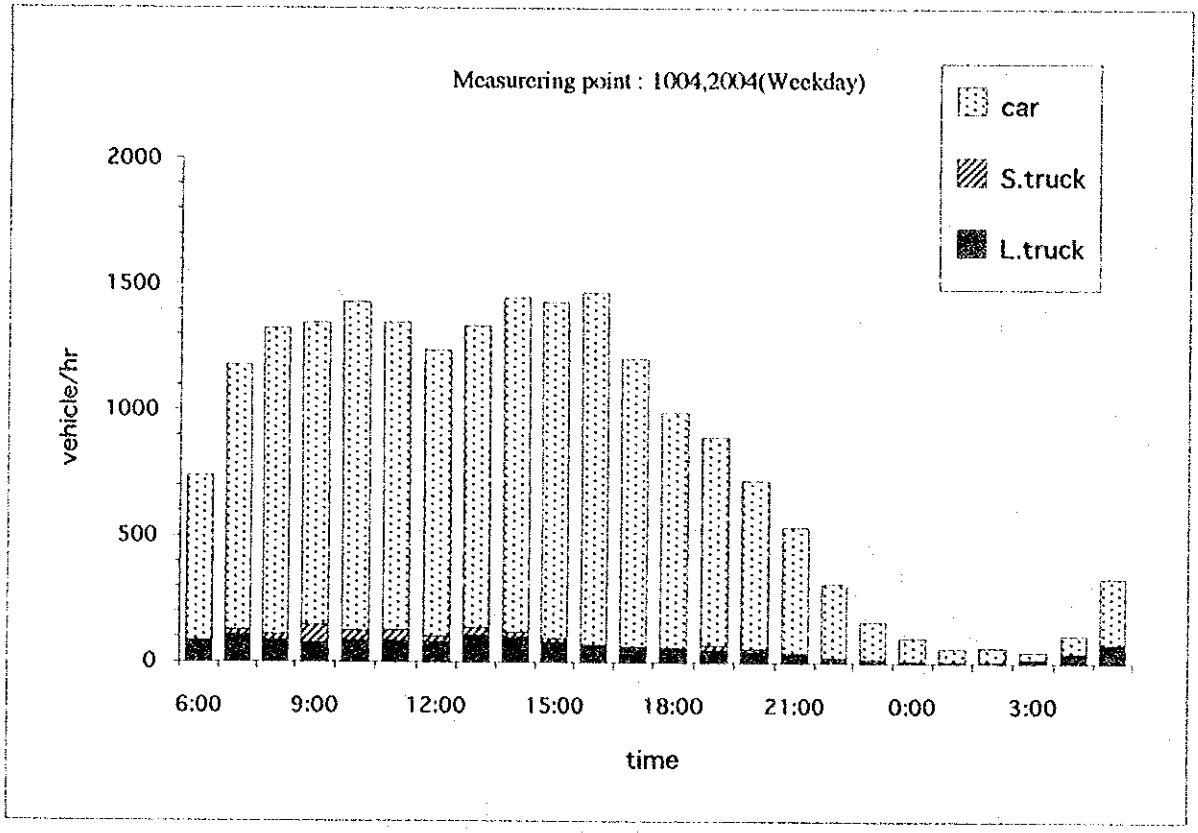


Figure D4.2.16 Hourly Traffic Volume by Vehicle Type (No.8)

Table D4.2.17 Hourly Traffic Volume by Direction and Vehicle Type (No.8)

measuring point : 1004,2004(Miskolc) date : 1993/6/20-21 (holiday)

time	to Diosgyor (1004)				from Diosgyor (2004)				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	82	0	13	95	134	2	16	152	216	2	29	247
7:00~ 8:00	135	0	14	149	159	2	15	176	294	2	29	325
8:00~ 9:00	217	1	8	226	250	2	11	263	467	3	19	489
9:00~ 10:00	250	0	11	261	377	0	12	389	627	0	23	650
10:00~ 11:00	262	1	15	278	316	4	11	331	578	5	26	609
11:00~ 12:00	205	3	12	220	311	1	12	324	516	4	24	544
12:00~ 13:00	250	4	10	264	290	3	15	308	540	7	25	572
13:00~ 14:00	215	3	15	233	222	2	14	238	437	5	29	471
14:00~ 15:00	214	2	14	230	296	1	14	311	510	3	28	541
15:00~ 16:00	280	0	12	292	356	3	16	375	636	3	28	667
16:00~ 17:00	269	1	11	281	271	1	12	284	540	2	23	565
17:00~ 18:00	348	1	11	360	275	0	10	285	623	1	21	645
18:00~ 19:00	441	2	13	456	529	1	12	542	970	3	25	998
19:00~ 20:00	415	2	10	427	384	5	9	398	799	7	19	825
20:00~ 21:00	320	1	10	331	324	0	10	334	644	1	20	665
21:00~ 22:00	162	0	10	172	188	1	10	199	350	1	20	371
22:00~ 23:00	104	3	6	113	97	1	9	107	201	4	15	220
23:00~ 0:00	38	0	2	40	47	0	4	51	85	0	6	91
0:00~ 1:00	27	0	0	27	31	0	2	33	58	0	2	60
1:00~ 2:00	15	0	0	15	16	0	0	16	31	0	0	31
2:00~ 3:00	7	1	0	8	7	0	2	9	14	1	2	17
3:00~ 4:00	11	1	0	12	16	0	0	16	27	1	0	28
4:00~ 5:00	19	2	12	33	26	6	5	37	45	8	17	70
5:00~ 6:00	130	3	35	168	147	11	26	184	277	14	61	352
Total	4416	31	244	4691	5069	46	247	5362	9485	77	491	10053

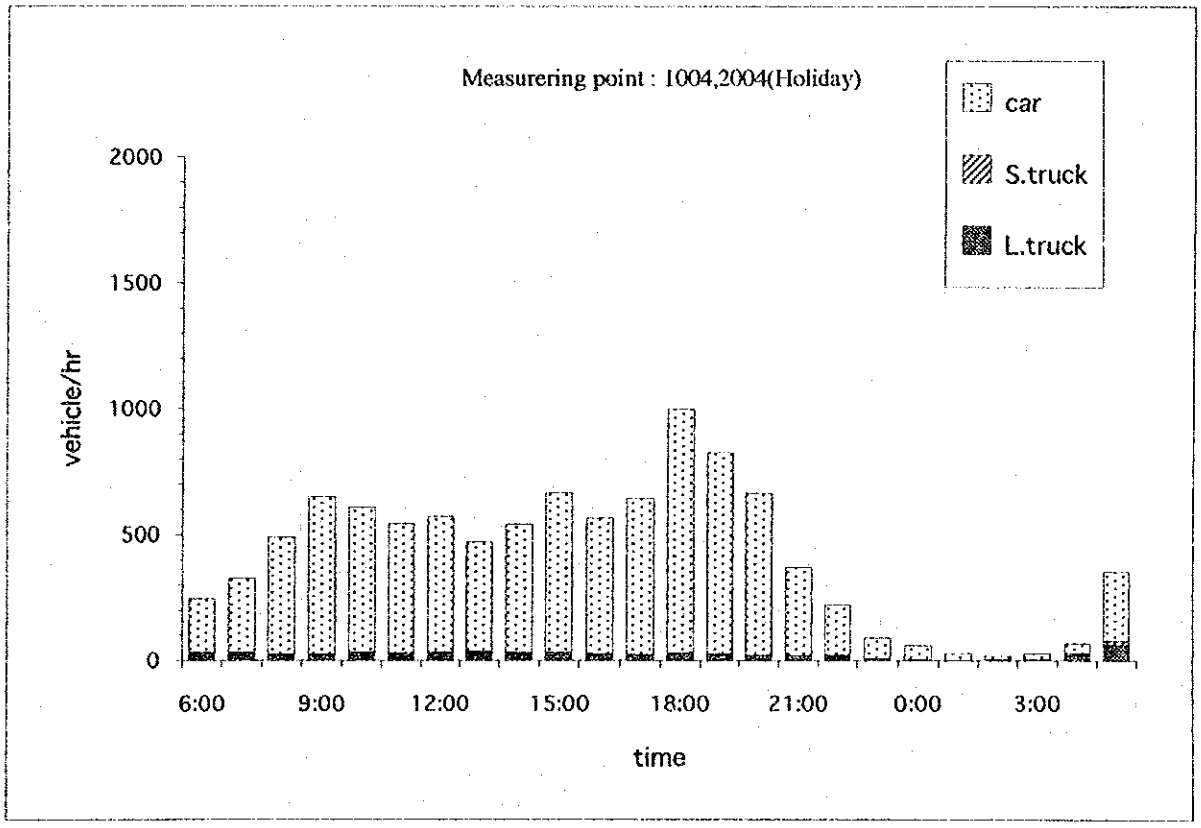


Figure D4.2.17 Hourly Traffic Volume by Vehicle Type (No.8)

Table D4.2.18 Result of Driving Speed Measurement (Weekday)

direction	No.1		No.2		No.3		No.4		No.5		No.6		No.7		No.8	
time	1026	2026	1463	2463	4469	6469	3119	6119	1002	2002	1001	2001	1003	2003	1004	2004
6-7	59.0	56.9	40.5	52.1	47.3	53.5	47.9	67.0	50.6	52.7	57.2	62.4	38.7	39.0	30.5	40.3
7-8	57.4	54.9	41.4	50.3	45.6	53.7	50.1	48.7	53.5	60.3	61.3	63.9	38.4	40.1	30.6	40.0
8-9	57.3	56.6	39.3	45.9	46.4	57.9	57.1	54.4	50.9	51.1	67.0	59.3	54.0	38.0	27.9	36.8
9-10	57.8	53.8	38.1	37.6	47.3	54.1	53.5	53.5	60.7	61.6	59.5	64.1	36.0	39.3	30.5	35.0
10-11	57.7	58.9	47.9	47.0	41.2	54.4	49.8	54.8	58.6	59.8	53.9	68.6	36.9	38.7	32.4	41.8
11-12	61.3	61.5	37.8	41.0	39.3	56.4	50.7	56.4	57.9	71.5	60.5	55.7	37.9	37.4	32.9	40.4
12-13	56.0	55.7	42.2	46.0	44.7	52.4	50.1	65.0	57.0	58.5	59.0	62.0	38.6	39.7	35.2	36.2
13-14	63.5	60.0	40.9	44.0	45.9	52.8	53.9	59.9	56.1	54.2	61.5	56.7	38.8	41.1	27.9	35.9
14-15	59.4	56.3	46.5	42.8	45.9	57.1	61.1	59.7	68.6	66.9	57.9	66.1	40.5	39.9	32.5	38.0
15-16	63.3	57.2	39.2	35.9	45.1	54.7	51.3	58.2	55.7	66.5	58.2	63.0	38.2	40.5	34.7	39.9
16-17	57.0	62.3	34.1	35.3	42.5	54.5	58.7	58.4	49.8	55.8	52.9	53.9	33.1	38.7	26.9	38.2
17-18	61.5	59.4	36.2	46.9	54.6	56.5	58.9	52.4	53.7	60.8	54.6	57.2	30.6	38.8	35.8	41.1
18-19	64.9	58.8	43.9	50.4	54.0	61.9	60.7	57.0	63.8	54.6	71.0	53.7	37.9	42.4	30.8	40.2
19-20	67.4	57.7	38.8	51.0	54.9	56.5	57.6	68.6	64.4	68.4	58.4	54.2	31.2	42.2	29.3	42.9
20-21	62.5	59.5	37.3	41.5	54.9	57.7	56.7	73.0	57.1	70.7	58.7	56.0	34.7	43.2	33.6	45.8
21-22	60.3	64.3	42.5	34.5	56.1	54.7	62.6	72.9	57.2	50.5	60.4	57.3	33.0	40.0	32.2	43.1
22-23	67.3	69.6	36.8	42.8	58.3	56.7	56.4	58.8	56.3	57.8	55.7	64.4	29.2	36.0	37.4	42.8
23-24	58.5	63.8	37.7	45.0	62.6	57.2	61.1	73.0	52.6	62.8	56.6	57.6	31.6	35.8	35.2	48.3
00-01	57.7	65.6	42.7	40.6	55.9	56.0	53.7	61.7	59.5	67.0	67.3	55.6	41.9	39.6	36.5	43.2
01-02	64.4	64.3	38.8	38.6	65.1	67.5	57.1	58.8	64.2	65.6	0.0	61.6	37.4	35.3	36.9	42.9
02-03	62.3	62.7	48.5	54.4	61.5	62.9	56.2	57.3	52.4	53.9	0.0	54.1	0.0	41.2	36.1	0.0
03-04	60.7	58.8	44.2	50.2	57.9	58.0	59.5	61.9	52.9	47.6	0.0	57.7	32.7	48.0	40.2	45.6
04-05	64.8	62.1	41.8	48.7	53.6	53.8	50.5	65.9	61.1	63.7	52.8	61.8	39.0	36.5	35.2	46.6
05-06	65.8	69.7	46.9	47.5	52.1	56.9	59.3	70.9	70.0	54.2	60.6	58.1	36.5	38.7	40.4	43.8

Table D4.2.19 Result of Driving Speed Measurement (Holiday)

direction	No.1		No.2		No.3		No.4		No.5		No.6		No.7		No.8	
time	1026	2026	1463	2463	4469	6469	3119	6119	1002	2002	1001	2001	1003	2003	1004	2004
6-7	65.1	60.5	35.0	37.4	51.1	53.1	41.2	48.1	64.1	67.1	64.4	61.1	32.3	41.4	35.1	42.4
7-8	63.6	60.2	36.1	41.1	50.3	52.3	34.1	38.6	65.1	71.4	59.8	57.6	32.3	38.4	38.9	40.3
8-9	53.7	68.8	42.6	46.3	49.7	52.7	48.0	37.2	63.9	66.7	63.1	61.1	33.5	35.5	37.9	38.2
9-10	60.1	58.5	46.4	43.1	50.2	53.9	42.7	45.0	53.0	65.9	67.4	57.5	34.2	38.2	38.6	49.7
10-11	69.5	56.2	47.9	47.0	48.4	52.6	29.0	38.2	62.8	76.1	57.0	56.7	29.8	30.7	31.4	33.8
11-12	62.9	59.5	46.7	41.0	51.2	55.0	44.2	45.3	56.3	67.3	65.8	60.0	31.4	38.4	35.3	39.4
12-13	60.1	59.1	43.5	43.3	54.3	59.2	38.8	44.8	61.2	62.8	69.3	60.9	30.2	40.8	36.2	38.4
13-14	63.2	63.7	39.8	44.0	48.5	58.5	39.9	41.2	65.6	62.8	70.0	65.4	33.5	31.7	40.0	38.1
14-15	67.3	62.3	43.9	47.0	47.7	54.8	44.5	45.5	57.8	59.7	60.8	66.0	38.4	41.4	34.7	36.9
15-16	65.1	64.2	42.7	48.7	50.4	55.2	45.8	46.0	64.4	55.6	63.6	58.4	36.6	44.4	38.1	41.2
16-17	65.0	60.9	38.1	40.2	51.7	55.4	45.7	45.7	60.3	55.2	64.5	63.7	39.4	47.6	34.0	37.5
17-18	63.8	59.1	38.1	36.1	54.2	54.3	38.7	44.6	60.0	55.5	68.4	60.1	37.2	47.4	38.6	37.9
18-19	68.7	65.9	45.5	34.2	50.7	55.3	47.1	41.3	58.2	52.9	61.9	74.4	38.3	45.4	36.8	39.6
19-20	68.2	65.5	46.3	42.6	52.6	54.3	39.5	32.5	76.0	62.5	63.0	68.4	36.5	43.7	36.2	35.5
20-21	65.9	67.7	45.3	45.0	54.2	57.1	43.8	35.2	56.4	58.3	62.2	71.4	44.6	46.9	40.1	37.5
21-22	63.6	68.5	39.2	40.3	55.1	60.9	46.2	35.3	56.0	56.3	58.9	74.5	38.8	45.8	33.4	38.9
22-23	63.5	66.2	39.5	42.0	54.6	59.6	48.6	40.8	63.6	58.7	60.6	56.8	43.5	46.4	38.2	36.3
23-24	66.3	67.5	41.1	41.2	57.2	58.0	48.2	42.6	59.1	55.7	59.2	63.5	37.9	46.2	35.8	43.4
00-01	63.9	66.1	40.4	40.3	59.6	58.6	40.8	42.9	61.6	59.9	56.9	64.9	49.3	0.0	35.7	41.0
01-02	64.7	66.7	39.8	38.6	63.9	60.0	50.4	47.5	63.9	67.2	56.8	53.1	36.6	0.0	35.9	40.8
02-03	64.2	64.5	39.4	39.5	55.0	59.0	51.1	49.0	59.4	62.9	52.3	61.1	46.9	50.2	42.1	45.0
03-04	63.1	67.5	43.4	39.4	57.8	59.0	52.9	47.1	64.1	60.8	55.8	55.8	45.2	0.0	40.0	44.5
04-05	65.5	66.2	39.1	41.5	53.7	51.5	50.7	45.1	64.5	60.9	56.8	58.1	38.8	32.5	37.8	42.6
05-06	67.8	67.7	40.8	41.6	51.5	52.7	50.0	45.4	55.3	54.4	60.5	51.8	33.3	32.8	36.2	39.9

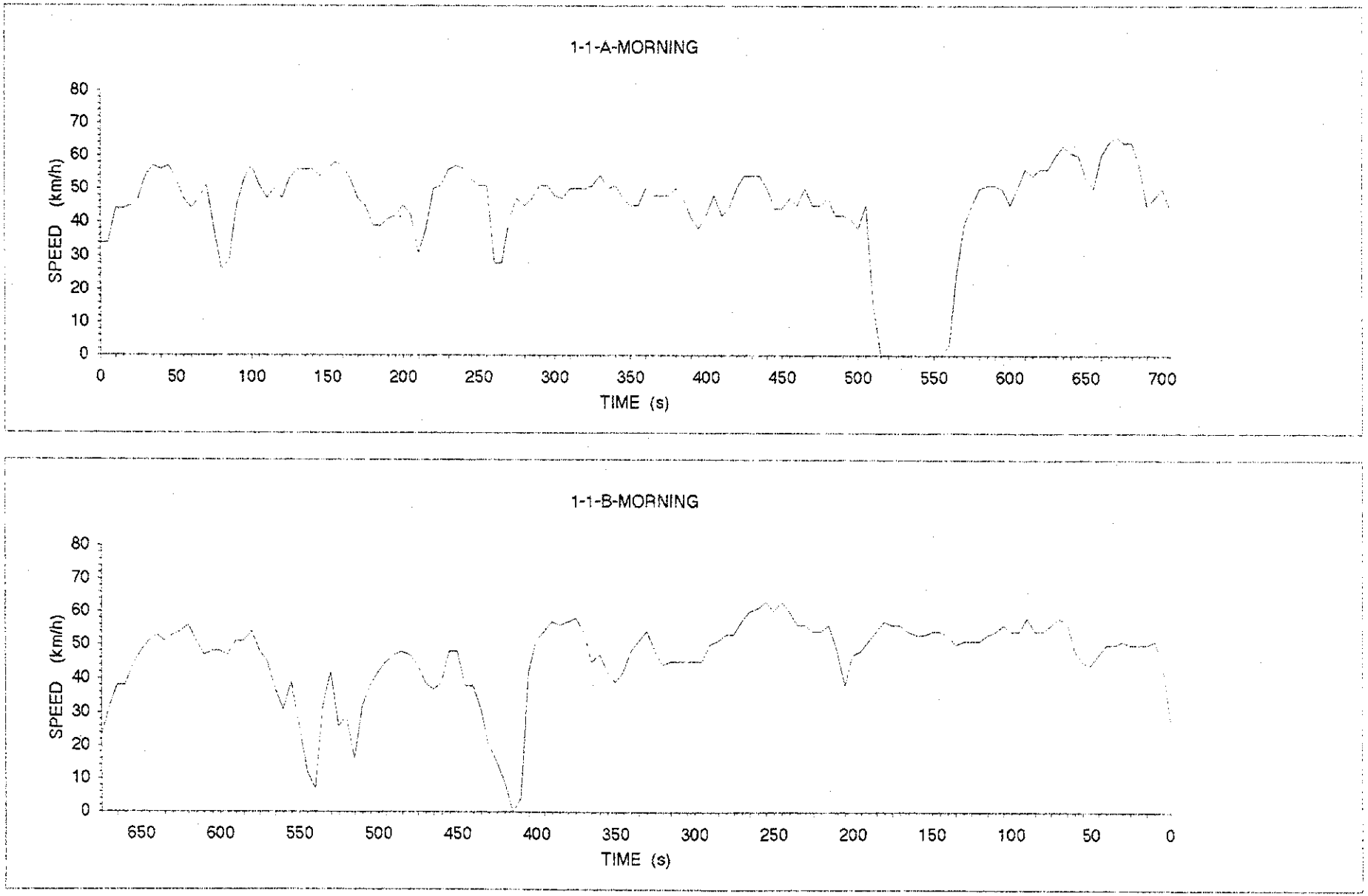


Figure D4.2.18 Example of Result of Driving Speed Test (Route 1)

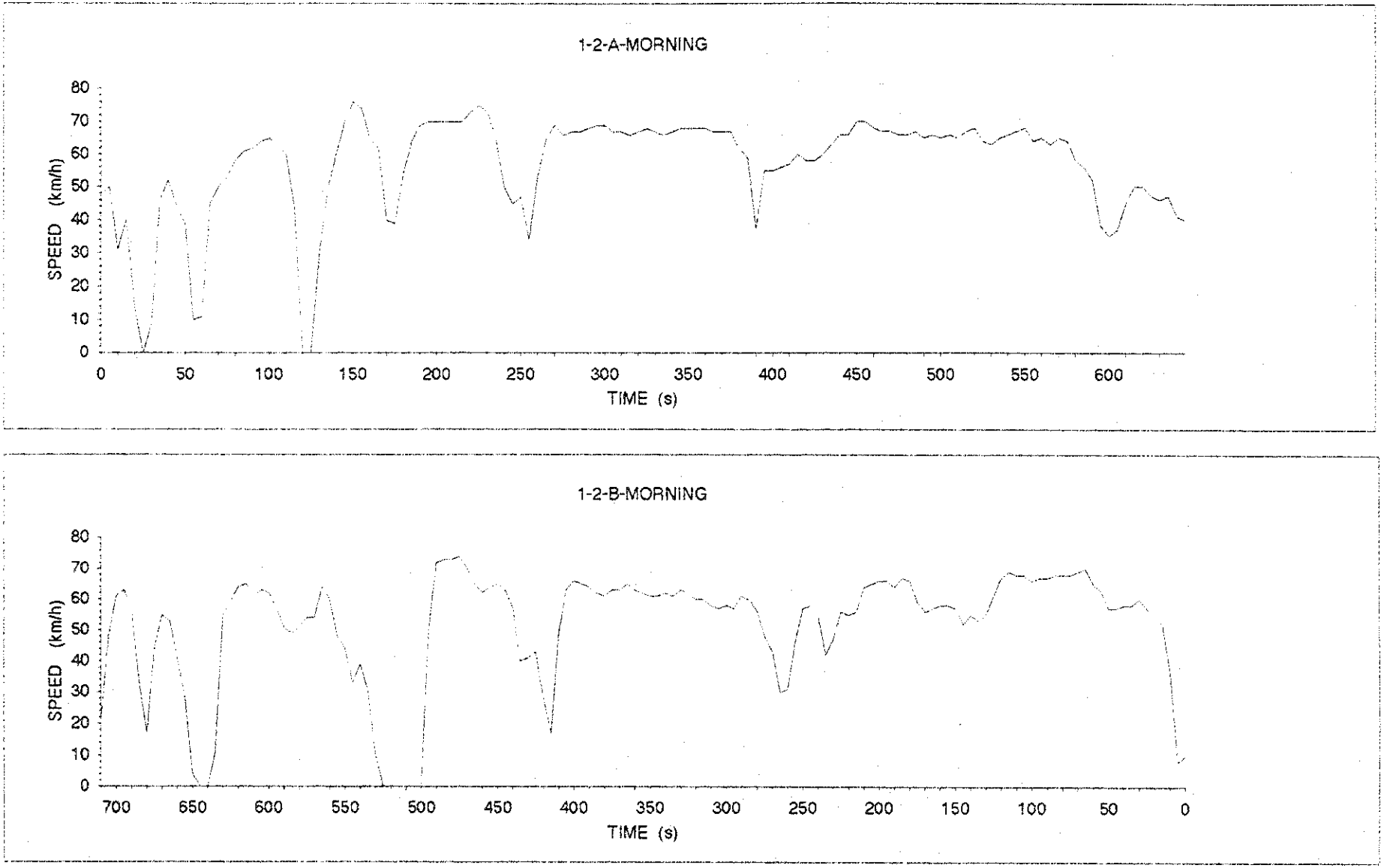


Figure D4.2.19 Example of Result of Driving Speed Test (Route 2)

Table D4.2.20 Distribution of Frequency of Speeds (Mode No.1)

speed range	frecuency	frecuency(%)	accumulate(%)
0 km/h	79	3.2%	3.2%
0～5	34	1.4%	4.6%
5～10	26	1.1%	5.6%
10～15	19	0.8%	6.4%
15～20	31	1.3%	7.7%
20～25	44	1.8%	9.5%
25～30	62	2.5%	12.0%
30～35	89	3.6%	15.6%
35～40	168	6.8%	22.4%
40～45	206	8.4%	30.8%
45～50	397	16.1%	46.9%
50～55	721	29.3%	76.2%
55～60	311	12.6%	88.8%
60～65	145	5.9%	94.7%
65～70	93	3.8%	98.5%
70～75	32	1.3%	99.8%
75～80	3	0.1%	99.9%
80 ～	3	0.1%	100.0%
total	2463	100.0%	

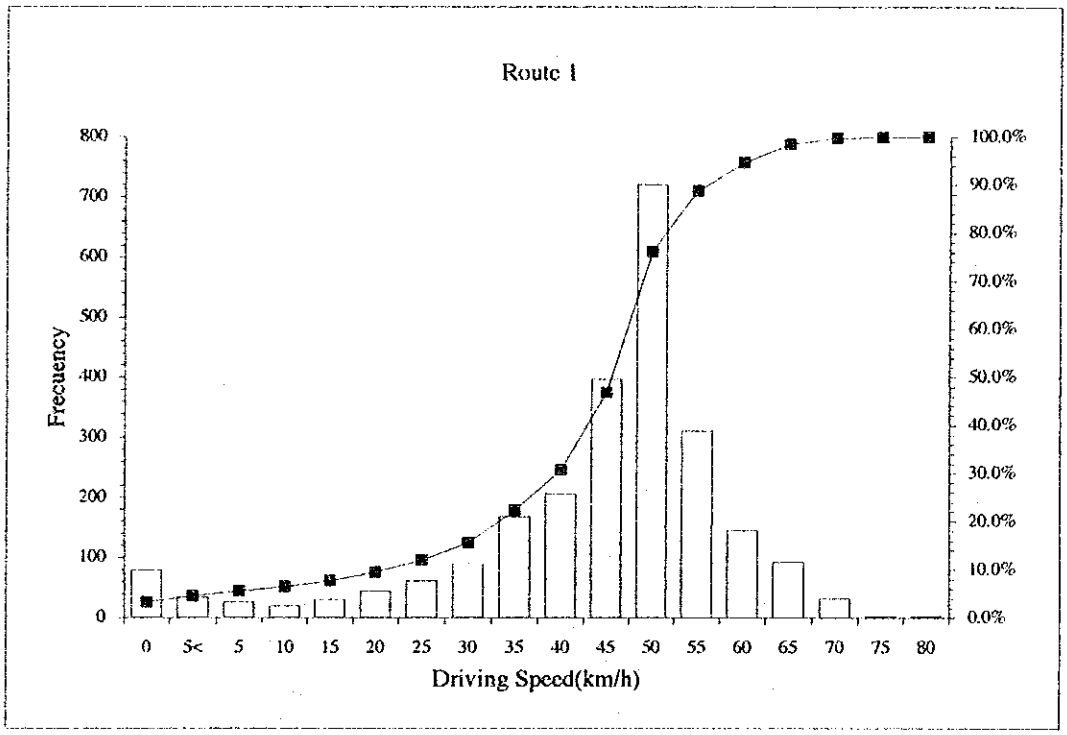


Figure D4.2.20 Distribution of Frequency of Speeds (Mode No.1)

Table D4.2.21 Distribution of Frequency of Speeds (Mode No.2)

speed range	frecuency	frecuency(%)	accumulate(%)
0 km/h	494	8.0%	8.0%
0~ 5	110	1.8%	9.8%
5~10	79	1.3%	11.1%
10~15	101	1.6%	12.7%
15~20	184	3.0%	15.7%
20~25	161	2.6%	18.3%
25~30	297	4.8%	23.1%
30~35	352	5.7%	28.9%
35~40	623	10.1%	39.0%
40~45	682	11.1%	50.0%
45~50	828	13.4%	63.5%
50~55	1334	21.7%	85.1%
55~60	561	9.1%	94.2%
60~65	230	3.7%	98.0%
65~70	95	1.5%	99.5%
70~75	27	0.4%	100.0%
75~80	3	0.0%	100.0%
80 ~	0	0.0%	100.0%
total	6161	100.0%	

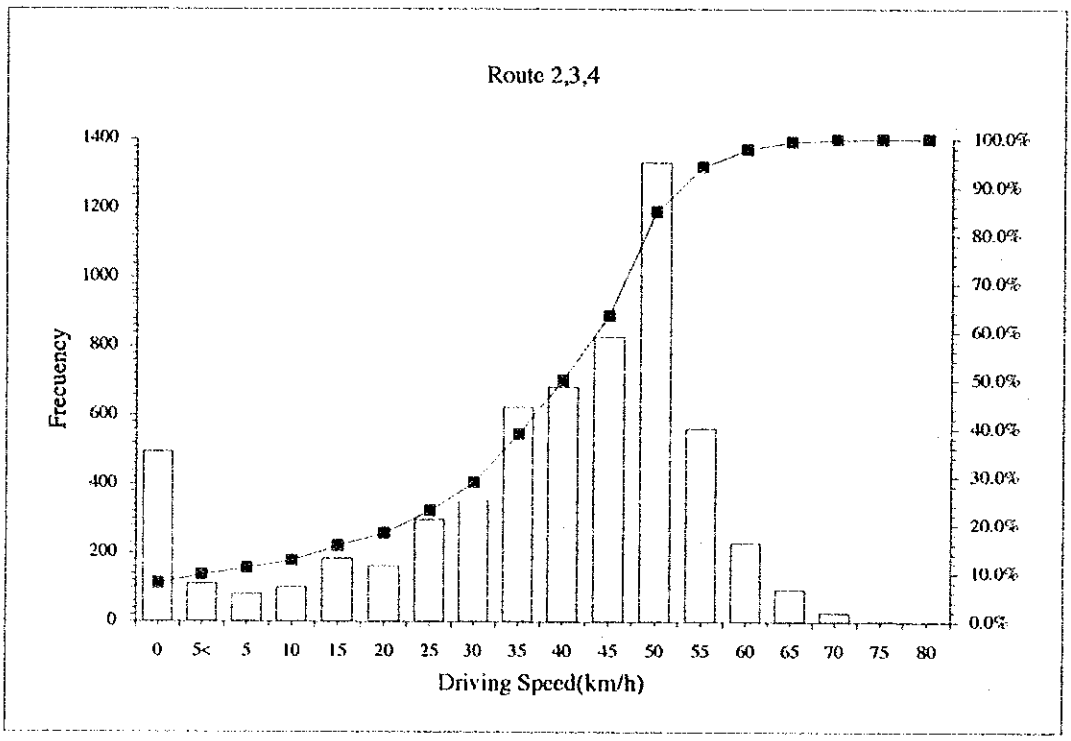


Figure D4.2.21 Distribution of Frequency of Speeds (Mode No.2)

Table D4.2.22 Distribution of Frequency of Speeds (Route 2)

speed range	frecuency	frecuency(%)	accumulate(%)
0 km/h	232	8.2%	8.2%
0~ 5	65	2.3%	10.5%
5~10	45	1.6%	12.1%
10~15	55	1.9%	14.0%
15~20	93	3.3%	17.3%
20~25	91	3.2%	20.5%
25~30	139	4.9%	25.5%
30~35	166	5.9%	31.3%
35~40	255	9.0%	40.3%
40~45	313	11.1%	51.4%
45~50	377	13.3%	64.7%
50~55	558	19.7%	84.5%
55~60	235	8.3%	92.8%
60~65	106	3.7%	96.5%
65~70	75	2.7%	99.2%
70~75	20	0.7%	99.9%
75~80	3	0.1%	100.0%
80 ~	0	0.0%	100.0%
total	2828	100.0%	

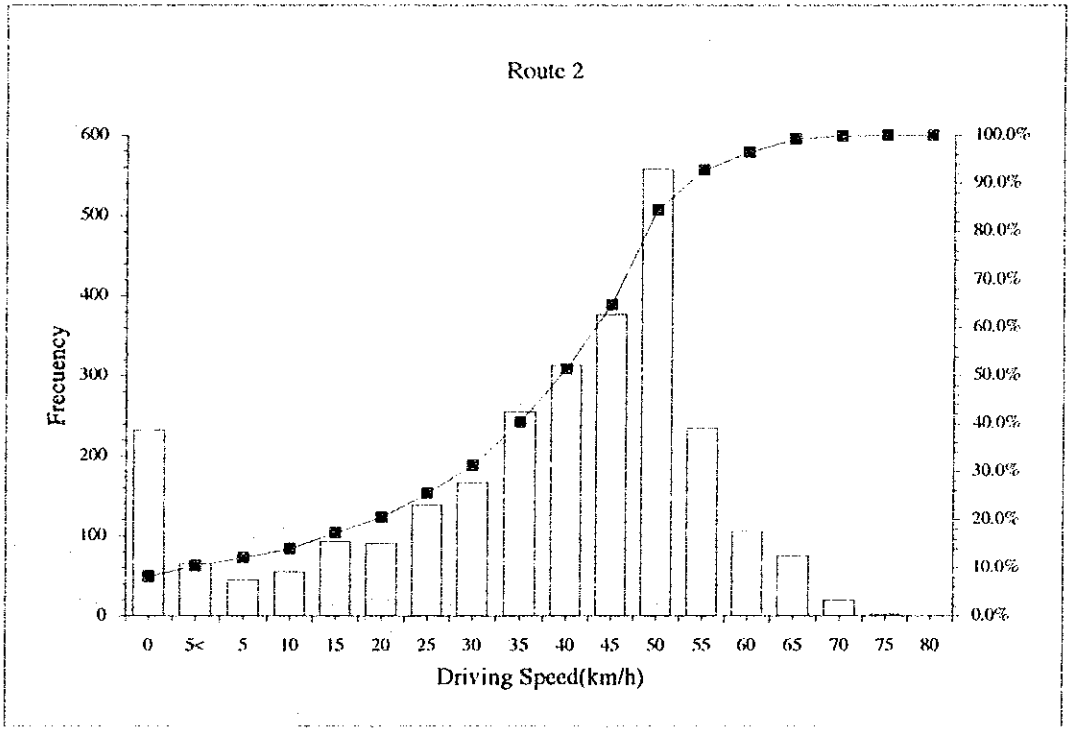


Figure D4.2.22 Distribution of Frequency of Speeds (Route 2)

Table D4.2.23 Distribution of Frequency of Speeds (Route 3)

speed range	frecuency	frecuency(%)	accumulate(%)
0 km/h	28	2.7%	2.7%
0~ 5	18	1.7%	4.4%
5~10	15	1.4%	5.8%
10~15	16	1.5%	7.4%
15~20	35	3.3%	10.7%
20~25	27	2.6%	13.3%
25~30	45	4.3%	17.6%
30~35	51	4.9%	22.5%
35~40	94	9.0%	31.5%
40~45	111	10.6%	42.1%
45~50	172	16.5%	58.6%
50~55	308	29.5%	88.0%
55~60	88	8.4%	96.5%
60~65	27	2.6%	99.0%
65~70	10	1.0%	100.0%
70~75	0	0.0%	100.0%
75~80	0	0.0%	100.0%
80 ~	0	0.0%	100.0%
total	1045	100.0%	

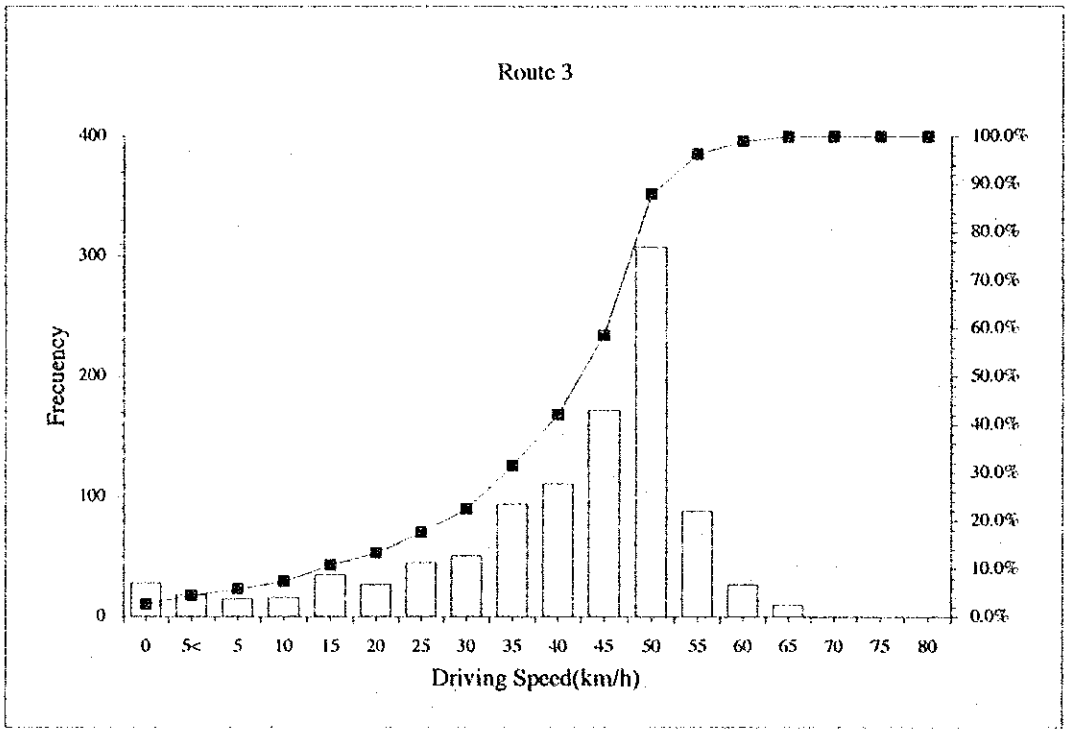


Figure D4.2.23 Distribution of Frequency of Speeds (Route 3)

Table D4.2.24 Distribution of Frequency of Speeds (Route 4)

speed range	frecuency	frecuency(%)	accumulate(%)
0 km/h	234	10.2%	10.2%
0~ 5	27	1.2%	11.4%
5~10	19	0.8%	12.2%
10~15	30	1.3%	13.5%
15~20	56	2.4%	16.0%
20~25	43	1.9%	17.9%
25~30	113	4.9%	22.8%
30~35	135	5.9%	28.7%
35~40	274	12.0%	40.7%
40~45	258	11.3%	52.0%
45~50	279	12.2%	64.2%
50~55	468	20.5%	84.6%
55~60	238	10.4%	95.0%
60~65	97	4.2%	99.3%
65~70	10	0.4%	99.7%
70~75	7	0.3%	100.0%
75~80	0	0.0%	100.0%
80 ~	0	0.0%	100.0%
total	2288	100.0%	

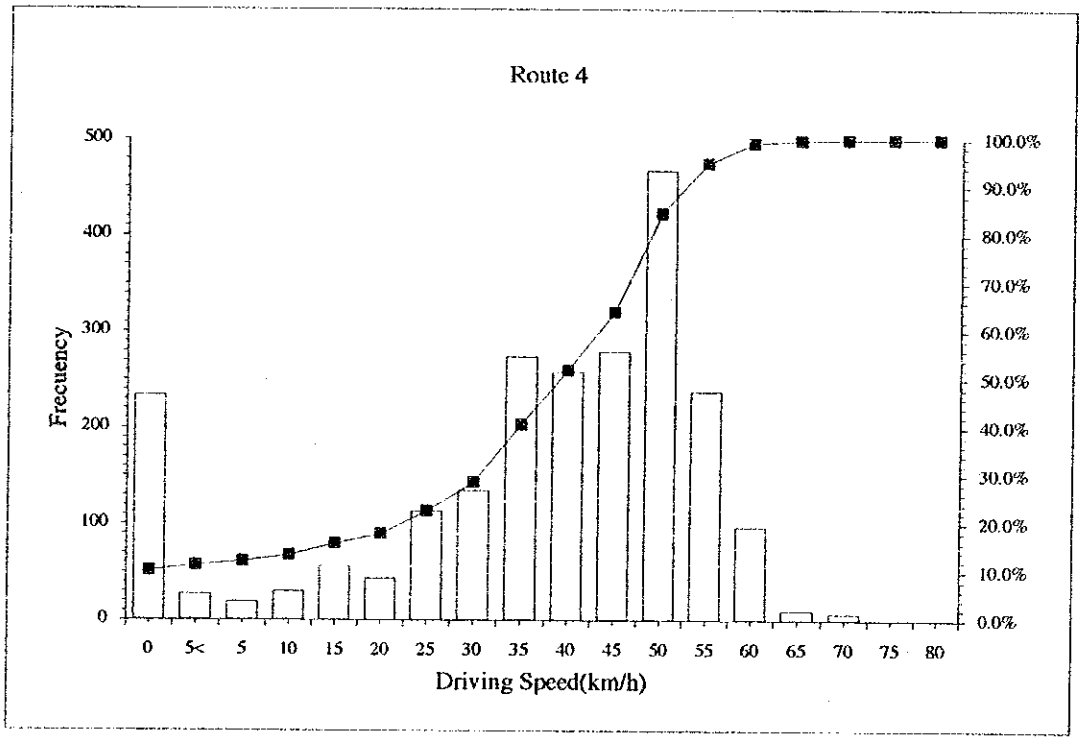
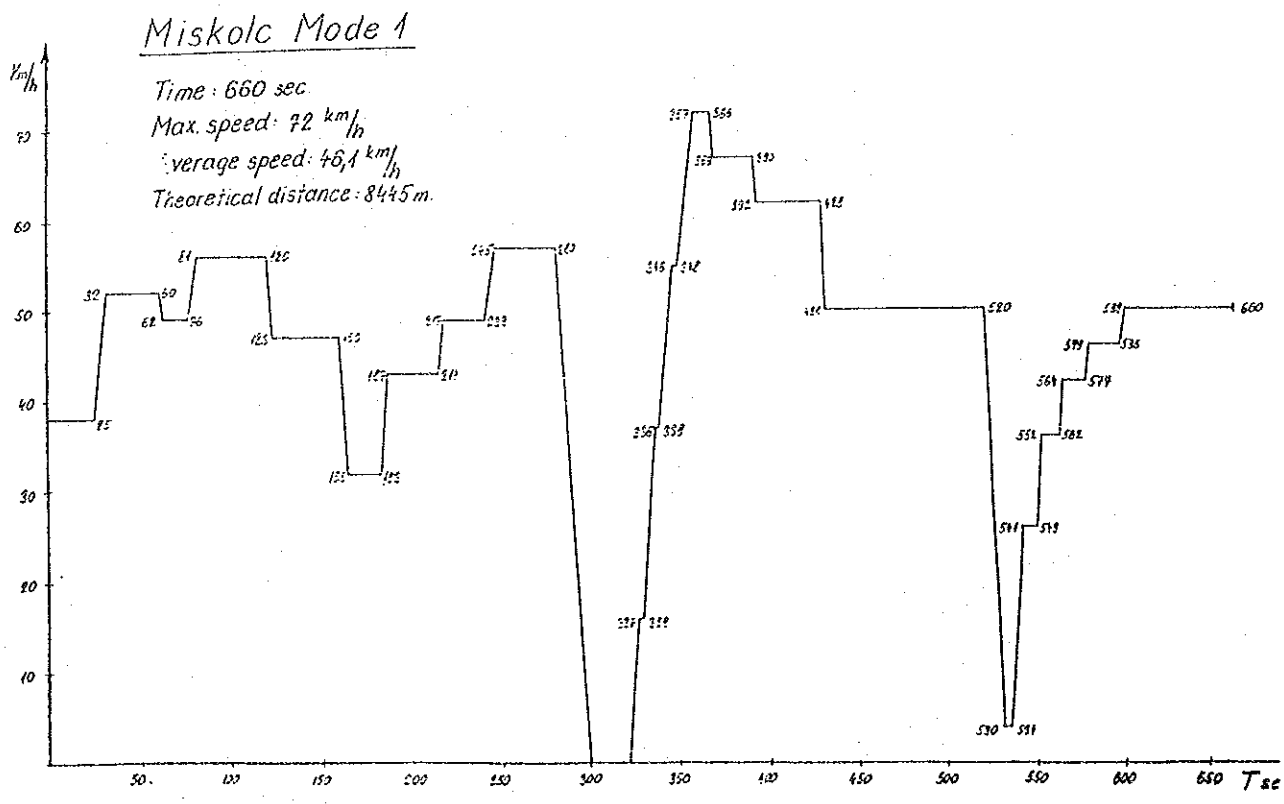


Figure D4.2.24 Distribution of Frequency of Speeds (Route 4)



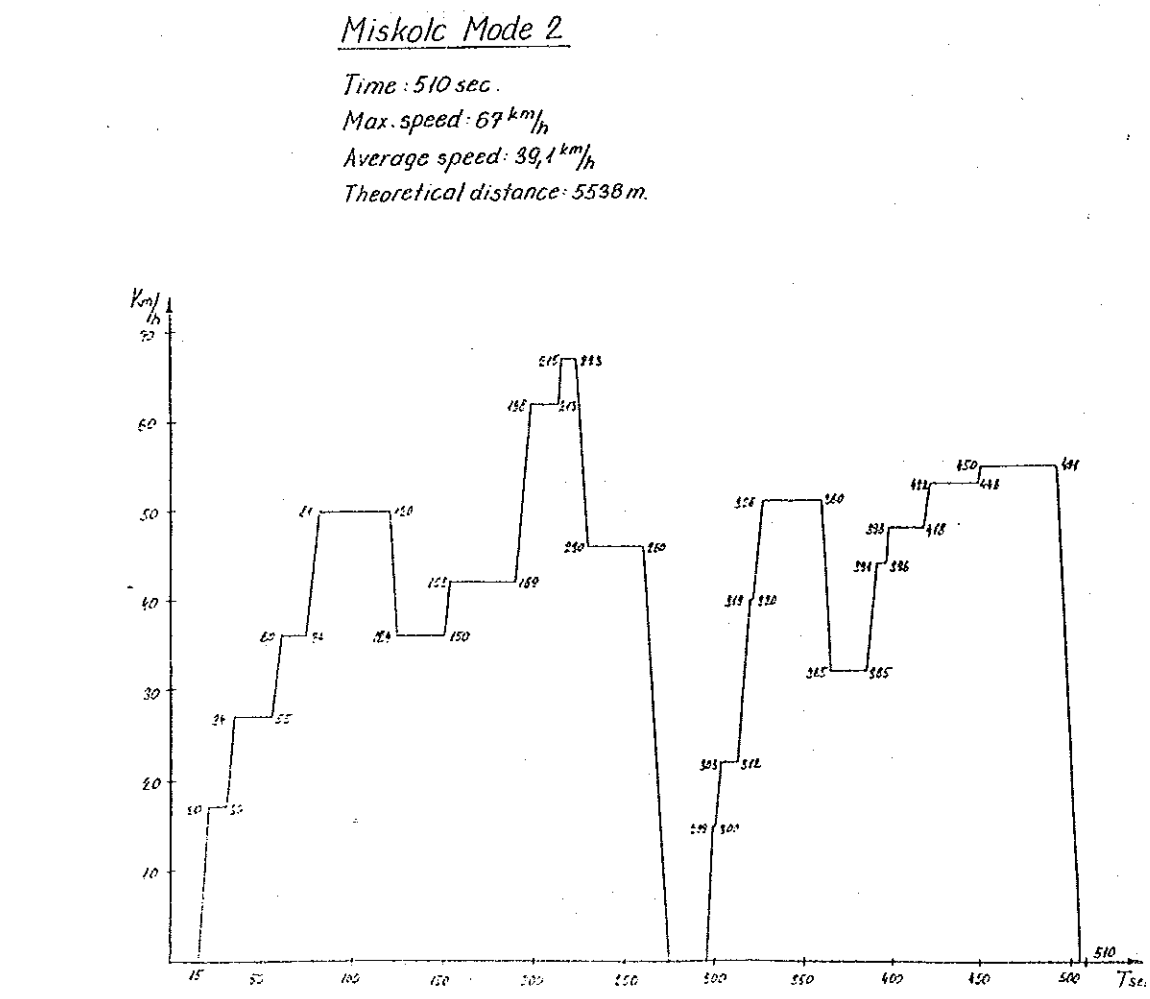


Figure D4.2.25 Representative Driving Modes in Miskolc

Table D4.2.25 (1) Result of Chassis Dynamometer Test

Emission results / 1

UN/ECE N° 15.04.

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	14.710	0.144	18.32	116.2	0.10997	8.86
2.	Wartburg 353W	15.236	0.163	5.87	165.1		10.62
3.	Dácia 1310	3.137	1.715	12.67	182.6		9.45
4.	Lada 21053 (1500 cm³)	2.521	1.470	4.750	215.2		10.57
5.	Wartburg 1.3	2.004	1.024	9.94	170.5		9.1
6.	Skoda 105	2.622	1.053	11.69	155.0	0.12722	8.55
7.	Opel Astra 1.4i	0.149	0.011	0.49	214.9		9.21
8.	Ford Escort 1.6D	0.158	0.706	0.51	161.0	0.0668	6.27
9.	Lada 2104 (1300 cm³)	4.059	0.990	44.61	203.2		11.89
	Type of trucks						
10.	Barkas B1000 Unladen weight	15.526	0.292	13.71	211.1		13.03
	Gross vehicle weight	17.271	1.080	14.39	243.6		14.53
11.	Mazda E2200 D Unladen weight	0.135	0.868	0.42	232.0	0.07609	8.69
	with 60 % loading	0.146	0.889	0.48	250.1	0.11408	9.89

Emission results / 2

EUDC

(1): max.speed 90 km/h
(2): max.speed 120 km/h

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601(1)	5.951	0.465	5.67	100.1	0.31766	6.02
2.	Wartburg 353W(1)	4.814	0.301	1.58	143.0	0.10195	7.15
3.	Dácia 1310(2)	4.087	3.162	5.79	132.2		6.69
4.	Lada 21053(2)	0.794	3.061	1.76	160.2		7.08
5.	Wartburg 1.3(2)	0.95	2.166	4.46	148.0		6.69
6.	Skoda 105(1)	0.966	1.839	6.25	111.7	0.09842	5.85
7.	Opel Astra 1.4i(2)	0.049	0.012	0.42	146.0		6.25
8.	Ford Escort 1.6D(2)	0.073	0.459	0.42	124.4	0.12499	4.62
9.	Lada 2104(2)	1.83	2.315	17.76	160.2		8.06
	Type of trucks						
10.	Barkas B1000(1) Unladen weight	6.246	1.227	4.37	195.7		9.63
	Gross vehicle weight	8.24	1.741	2.39	207.8		10.84
11.	Mazda E2200 D(1) Unladen weight	0.072	0.728	0.43	221.3	0.10610	8.49
	with 60 % loading	0.074	0.763	0.56	247.7	0.13778	9.67

Emission results / 3

Miskolc Mode 1

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	5.547	0.195	5.16	87.4	0.10393	5.36
2.	Wartburg 353W	7.247	0.146	3.33	121.5	0.09164	6.97
3.	Dácia 1310	1.025	1.406	4.58	114.3		5.79
4.	Lada 21053	0.776	1.168	2.07	131.2		6.09
5.	Wartburg 1.3	1.114	1.533	4.44	112.4		5.35
6.	Skoda 105	0.96	1.002	7.45	102.8	0.07569	5.52
7.	Opel Astra 1.4i	0.012	0.015	0.14	130.3		5.56
8.	Ford Escort 1.6D	0.063	0.445	0.18	98.9	0.03162	3.92
9.	Lada 2104 (1300 cm³)	1.624	0.865	19.60	127.9		6.97
	Type of trucks						
10.	Barkas B1000 Unladen weight	6.355	0.432	6.93	155.2		8.44
	Gross vehicle weight	7.574	0.885	7.94	167.4		9.28
11.	Mazda E2200 D Unladen weight	0.072	0.598	0.30	165.5	0.04706	6.44
	with 60 % loading	0.074	0.617	0.34	175.7	0.07515	6.81

Emission results / 4

Miskolc Mode 2

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	6.379	0.177	6.27	90.0	0.06821	5.65
2.	Wartburg 353W	8.239	0.143	3.77	126.4	0.12724	7.40
3.	Dácia 1310	1.154	1.416	4.73	123.2		6.13
4.	Lada 21053	0.907	1.334	2.20	140.3		6.53
5.	Wartburg 1.3	1.247	1.328	6.95	114.7		5.68
6.	Skoda 105	1.167	0.954	7.41	106.9	0.06190	5.71
7.	Opel Astra 1.4i	0.036	0.003	0.31	143.4		6.13
8.	Ford Escort 1.6D	0.064	0.489	0.23	109.5	0.03413	4.27
9.	Lada 2104 (1300 cm³)	2.046	0.902	20.97	1330.0		7.39
	Type of trucks						
10.	Barkas B1000 Unladen weight	8.016	0.437	10.13	162.9		9.16
	Gross vehicle weight	8.714	0.992	8.41	180.9		9.95
11.	Mazda E2200 D Unladen weight	0.078	0.636	0.31	173.0	0.04766	6.49
	with 60 % loading	0.074	0.637	0.36	182.2	0.07799	6.98

Table D4.2.25 (2) Result of Chassis Dynamometer Test

Emission results / 5

40 km/h (4. gear)

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	6.663	0.040	2.79	76.9		4.73
2.	Wartburg 353W	7.553	0.054	3.2	101.0		6.09
3.	Dácia 1310	0.673	0.49	0.64	91.9		4.42
4.	Lada 21053	0.535	0.589	0.56	104.7		4.83
5.	Wartburg 1.3	0.914	0.383	7.82	91.7		5.12
6.	Skoda 105	0.659	0.286	3.25	89.0	0.02817	4.56
7.	Opel Astra 1.4i	0.073	0.004	0.46	106.0		4.56
8.	Ford Escort 1.6D	0.056	0.382	0.18	83.5	0.01779	3.33
9.	Lada 2104 (1300 cm³)	1.085	0.495	4.97	103.8		5.4
	Type of trucks						
10.	Barkas B1000 Unladen weight	8.235	0.074	15.67	128.9		8.31
	Gross vehicle weight	9.189	0.079	9.89	149.7		8.62
11.	Mazda E2200 D Unladen weight	0.056	0.514	0.17	124.6	0.02508	4.79
	Gross vehicle weight	0.056	0.558	0.18	129.6	0.02791	4.97

Emission results / 6

60 km/h

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	4.686	0.076	3.96	85.8		4.73
2.	Wartburg 353W	5.636	0.072	1.69	120.2		6.34
3.	Dácia 1310	0.669	1.385	4.77	104.0		5.15
4.	Lada 21053	0.448	1.035	0.75	123.2		5.5
5.	Wartburg 1.3	0.675	1.268	0.82	117.7		5.27
6.	Skoda 105	0.679	1.006	6.30	91.9	0.0514	4.94
7.	Opel Astra 1.4i	0.044	0.001	0.08	104.4		4.61
8.	Ford Escort 1.6D	0.036	0.388	0.10	83.8	0.01765	3.31
9.	Lada 2104 (1300 cm³)	1.116	0.743	6.67	122.2		6.16
	Type of trucks						
10.	Barkas B1000 Unladen weight	3.767	0.141	3.88	150.4		7.53
	Gross vehicle weight	4.265	0.207	3.37	167.6		8.12
11.	Mazda E2200 D Unladen weight	0.051	0.572	0.28	154.4	0.3782	6.00
	Gross vehicle weight	0.050	0.609	0.29	158.6	0.04621	6.25

Emission results / 7

80 km/h

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601	4.764	0.246	1.75	100.6		5.31
2.	Wartburg 353W	2.619	0.118	1.0	135.9		6.51
3.	Dácia 1310	0.744	2.189	8.95	115.3		6.05
4.	Lada 21053	0.489	2.474	0.74	142.9		6.23
5.	Wartburg 1.3	0.644	1.857	1.26	131.6		6.15
6.	Skoda 105	0.659	1.629	6.99	103.9	0.08425	5.56
7.	Opel Astra 1.4i	0.057	0.002	0.08	112.6		5.01
8.	Ford Escort 1.6D	0.046	0.410	0.14	92.0	0.03415	3.64
9.	Lada 2104 (1300 cm³)	1.311	1.743	7.29	142.8		7.05
	Type of trucks						
10.	Barkas B1000 Unladen weight	3.322	0.589	1.7	173.8		8.39
	Gross vehicle weight	4.025	0.938	2.07	192.1		9.0
11.	Mazda E2200 D Unladen weight	0.059	0.730	0.40	214.6	0.05645	8.38
	Gross vehicle weight	0.058	0.748	0.40	220.6	0.07321	8.91

Emission results / 8

100 km/h

N°	Type of cars	HC g/km	NOx g/km	CO g/km	CO_2 g/km	particulates g/km	fuel consumption l/100 km
1.	Trabant 601*	5.713*	0.423*	3.69*	111.0*		6.12*
2.	Wartburg 353W	2.958	0.492	1.7	163.7		7.79
3.	Dácia 1310	0.848	4.683	6.28	147.6		7.33
4.	Lada 21053	0.471	3.867	0.83	167.5		7.38
5.	Wartburg 1.3	0.666	2.443	2.78	156.0		7.38
6.	Skoda 105	0.543	3.084	5.04	129.5	0.25416	6.63
7.	Opel Astra 1.4i	0.088	0.008	0.09	135.3		5.79
8.	Ford Escort 1.6D	0.082	0.477	0.19	114.4	0.1171	4.61
9.	Lada 2104 (1300 cm³)	1.586	2.799	8.2	166.9		8.46
	Type of trucks						
10.	Barkas B1000 Unladen weight						
	Gross vehicle weight						
11.	Mazda E2200 D Unladen weight						
	Gross vehicle weight						

* Measurement at 90 km/h (max. speed of these type is 100 km/h)

Table D4.3.1 (1) Emission Factors of Passenger Cars and Small Trucks

Pollutant : SO_2 Unit :g/km

No.	Test Modes: Type of Cars	Vehicle Age	1 ECE No. 15.04	2 EUDC	3 Miskolc Mode 1	4 Miskolc Mode 2	5 40km/h Const.	6 60km/h Const.	7 80km/h Const.	8 100km/h Const
1.	Trabant 601	4Y	0.066	0.045	0.040	0.042	0.035	0.035	0.040	0.046
2.	Wartburg 353w	6Y	0.078	0.053	0.051	0.054	0.045	0.047	0.048	0.057
3.	Wartburg 1.3	3Y	0.067	0.049	0.039	0.042	0.038	0.039	0.045	0.054
4.	Dacia 1410	5Y	0.070	0.050	0.043	0.046	0.033	0.038	0.045	0.055
5.	Lada 2104(1300cc)	7Y	0.087	0.029	0.051	0.054	0.040	0.045	0.052	0.062
6.	Lada 21053(1500cc)	3M	0.078	0.052	0.045	0.048	0.036	0.040	0.046	0.054
7.	Skoda 105	5Y	0.064	0.044	0.041	0.043	0.034	0.037	0.041	0.049
8.	Opel Astra 1.4I	4M	0.068	0.046	0.041	0.045	0.034	0.034	0.037	0.043
9.	Ford Escort 1.6D	8Y	0.206	0.152	0.129	0.140	0.109	0.109	0.119	0.151
MEAN OF PASSENGER CARS			0.073	0.050	0.044	0.047	0.037	0.040	0.045	0.053
TYPE OF TRUCKS (S)										
10	Barkas B1000 Unladen Weight 1360kg	13Y	0.096	0.071	0.062	0.067	0.061	0.055	0.062	
	Gross Vehicle Weight 2040kg		0.107	0.080	0.068	0.073	0.063	0.060	0.066	
11	Mazda E2200D Unladen Weight 1590kg	5M	0.285	0.278	0.211	0.213	0.157	0.197	0.275	
	With 60% Loading 2270%		0.324	0.317	0.233	0.229	0.163	0.205	0.292	

Table D4.3.1 (2) Emission Factors of Passenger Cars and Small Trucks

Pollutant : NOx Unit :g/km

No.	Test Modes: Type of Cars	Vehicle Age	1 ECE No. 15.04	2 EUDC	3 Miskolc Mode 1	4 Miskolc Mode 2	5 40km/h Const.	6 60km/h Const.	7 80km/h Const.	8 100km/h Const
1.	Trabant 601	4Y	0.144	0.465	0.195	0.177	0.140	0.076	0.246	0.423
2.	Wartburg 353w	6Y	0.163	0.601	0.146	0.143	0.054	0.072	0.118	0.492
3.	Wartburg 1.3	3Y	1.024	2.166	1.533	1.328	0.383	1.268	1.857	2.443
4.	Dacia 1410	5Y	1.715	3.162	1.406	1.416	0.490	1.385	2.189	4.683
5.	Lada 2104(1300cc)	7Y	0.990	2.315	0.865	0.902	0.495	0.743	1.743	2.799
6.	Lada 21053(1500cc)	3M	1.470	3.061	1.168	1.334	0.589	1.035	2.474	3.867
7.	Skoda 105	5Y	1.053	1.839	1.002	0.954	0.286	1.006	1.629	3.084
8.	Opel Astra 1.4I	4M	0.011	0.012	0.015	0.003	0.004	0.001	0.002	0.008
9.	Ford Escort 1.6D	8Y	0.706	0.459	0.445	0.489	0.382	0.388	0.410	0.477
MEAN OF PASSENGER CARS			0.852	1.758	0.797	0.802	0.310	0.696	1.350	2.323
TYPE OF TRUCKS (S)										
10	Barkas B1000 Unladen Weight 1360kg	13Y	0.292	1.227	0.432	0.437	0.074	0.141	0.589	
	Gross Vehicle Weight 2040kg		1.080	1.741	0.885	0.992	0.079	0.207	0.938	
11	Mazda E2200D Unladen Weight 1590kg	5M	0.868	0.728	0.598	0.636	0.514	0.572	0.730	
	With 60% Loading 2270%		0.889	0.810	0.617	0.637	0.558	0.609	0.748	

Table D4.3.1 (3) Emission Factors of Passenger Cars and Small Trucks

Pollutant : CO Unit :g/km

No.	Test Modes: Type of Cars	Vehicle Age	1 ECE No. 15.04	2 EUDC	3 Miskolc Mode 1	4 Miskolc Mode 2	5 40km/h Const.	6 60km/h Const.	7 80km/h Const.	8 100km/h Const
1.	Trabant 601	4Y	18.32	5.67	5.16	6.27	2.79	3.96	1.75	3.69
2.	Wartburg 353w	6Y	5.87	1.58	3.33	3.77	3.20	1.69	1.00	1.70
3.	Wartburg 1.3	3Y	9.94	4.46	4.44	6.95	7.82	0.82	1.26	2.78
4.	Dacia 1410	5Y	12.67	5.79	4.58	4.73	0.64	4.77	8.95	6.28
5.	Lada 2104(1300cc)	7Y	44.61	17.76	19.60	20.97	4.97	6.67	7.29	8.20
6.	Lada 21053(1500cc)	3M	4.75	1.76	2.07	2.20	0.56	0.75	0.74	0.83
7.	Skoda 105	5Y	11.69	6.25	7.45	7.41	3.25	6.30	6.99	5.04
8.	Opel Astra 1.4I	4M	0.49	0.42	0.14	0.61	0.46	0.18	0.08	0.09
9.	Ford Escort 1.6D	8Y	0.51	0.42	0.18	0.23	0.18	0.10	0.14	0.19
MEAN OF PASSENGER CARS			16.93	6.58	6.99	7.76	3.04	3.84	3.84	4.13
TYPE OF TRUCKS (S)										
10	Barkas B1000 Unladen Weight	13Y 1360kg	13.71	4.37	6.93	10.13	15.67	3.88	1.70	
	Gross Vehicle Weight	2040kg	14.39	7.39	7.94	8.41	9.89	3.37	2.07	
11	Mazda E2200D Unladen Weight	5M 1590kg	0.42	0.43	0.30	0.31	0.17	0.28	0.40	
	With 60% Loading	2270%	0.48	0.56	0.34	0.36	0.18	0.29	0.40	

Table D4.3.2 Number of the Registered Passenger Cars

Year 1990

Car Type	Borsod-Abaúj-Zemplén County	
	Units	Percentage
Zsiguli, Lada	30,318	28.1
Trabant	25,317	23.4
Wartburg	15,053	13.9
Skoda	14,321	13.3
Dacia	9,274	8.6
Opel	555	0.5
Ford	625	0.6
Total	95,463	88.3
Others	12,616	11.7
County Total	108,079	100.0

Table D4.3.3 Hungarian Standards of Fuels

Quarily Grades	Diesel Fuel 0.2	Gasoline	
		Unleaded EN-91	Leaded AB-92
Density at 15°C (g/cc)	0.82	0.735	0.745
Sulphur Content (Mass %)	0.2	0.05	0.05
SO2 Content (g/l)	3.28	0.735	0.745
Related Cars	Passenger Cars		
	Ford	Wartburg Lada Opel	Trabant Dacia Skoda
	Small Trucks		
	Mazda	Barkas	
	Engines		
	Rabaman Kamaz		

Table D4.3.4 Emission Factors of Large Truck and Bus (Engines)

Pollutant	No.	Type of Engines	Emission Factor (g/kg/ton)
SO2	1	RABA MAN	0.16
	2	KAMAZ	0.19
	Mean		0.17
NOx	1	RABA MAN	1.80
	2	KAMAZ	1.94
	Mean		1.84
CO	1	RABA MAN	0.77
	2	KAMZ	0.96
	Mean		0.82

Test mode : UN/ECE No.49

Outline of Activities of Factories in the Sajó Valley Area

A Result of Questionnaire and Visiting Survey

1) R/N: 02/1

Company Name: OZDI KOHASZATI TORZSGYAR (OZD metallurgical works)

Industrial Process: Heating, energy

A bankrupt company in reorganization. The reorganization term expires on June 15, 1994.

The company is engaged in the transportation business and providing services such as sales and supply of energy. Energy sales include supply of steam, hot water, compressed air, etc.

Eight boilers belonging to the company currently supply steam and heat to the head office and company dormitories as well as a part of the housing complex in the town of Ozd partly. Boilers 3 and 4 are at 8.5 bar, and boilers 5 through 10 at 28 bar. The rate of operation varies with the demand of the town and the company. (Three units are operating currently.) Coal and natural gas are burned.

Coal and blast furnace gas were burned in 1985; they are now burning coal and natural gas. The town consumes 165 GJ/h energy, of which the company supplies 100 GJ/h.

1992:	EKF data	Questionnaire data	
Brown coal consumption:	18,009.12 tons	Coal consumption:	34,824.6 tons
Natural gas:	19,806,635 Nm3	Natural gas:	19,095,000 Nm3
Electric power generated:	4,835.184 MWh		
Steam:	855,195 GJ		
Hot water:	176,155 GJ		

Table 1.1.1 shows fuel consumption in 1993 (as of September) for reference.

Boiler energy is shown in the flow chart in Figure 1.1.1.

The boiler in the garage in the town of Farkaslyuk is garage heating and warm water supply only. The only fuel is coal. Note that this facility was closed in September 1993.

1992:

Brown coal used: 700 tons

Hot water: 7,350 GJ

Table 1.1.1 Fuel Consumption in 1993 (as of September) for Reference

Name of facility	Kind of fuel	Unit	I Jan.-Mar.	II Apr.-Jun.	III Jul.-Sep.		No. of stack
III BW Boiler	Natuarl gas	1000 m3	694	367	0		P-033
		Hour	2089	1283	0		
IV BW Boiler	Natural gas	1000 m3	766	615	0		P-033
		Hour	2147	1042	0		
V BW Boiler	Coal	ton	0	0	0		P-034
	Natural gas	1000 m3	0	0	0		
		Hour	0	0	0		
VI BW Boiler	Coal	ton	2050	450	2244		P-034
	Natural gas	1000 m3	1282	217	768		
		Hour	2057	402	1385		
VII BW Boiler	Coal	ton	0	0	0		P-035
	Natural gas	1000 m3	0	0	0		
		Hour	0	0	0		
VIII BW Boiler	Coal	ton	0	0	0		P-035
	Natural gas	1000 m3	373	110	648		
		Hour	762	232	1245		
IX LB Boiler	Coal	ton	3450	1173	0		P-036
	Natural gas	1000 m3	1339	655	0		
		Hour	2047	1047	0		
X LB Boiler	Coal	ton	2378	1791	1521		P-036
	Natural gas	1000 m3	1294	1107	321		
		Hour	1515	1567	836		

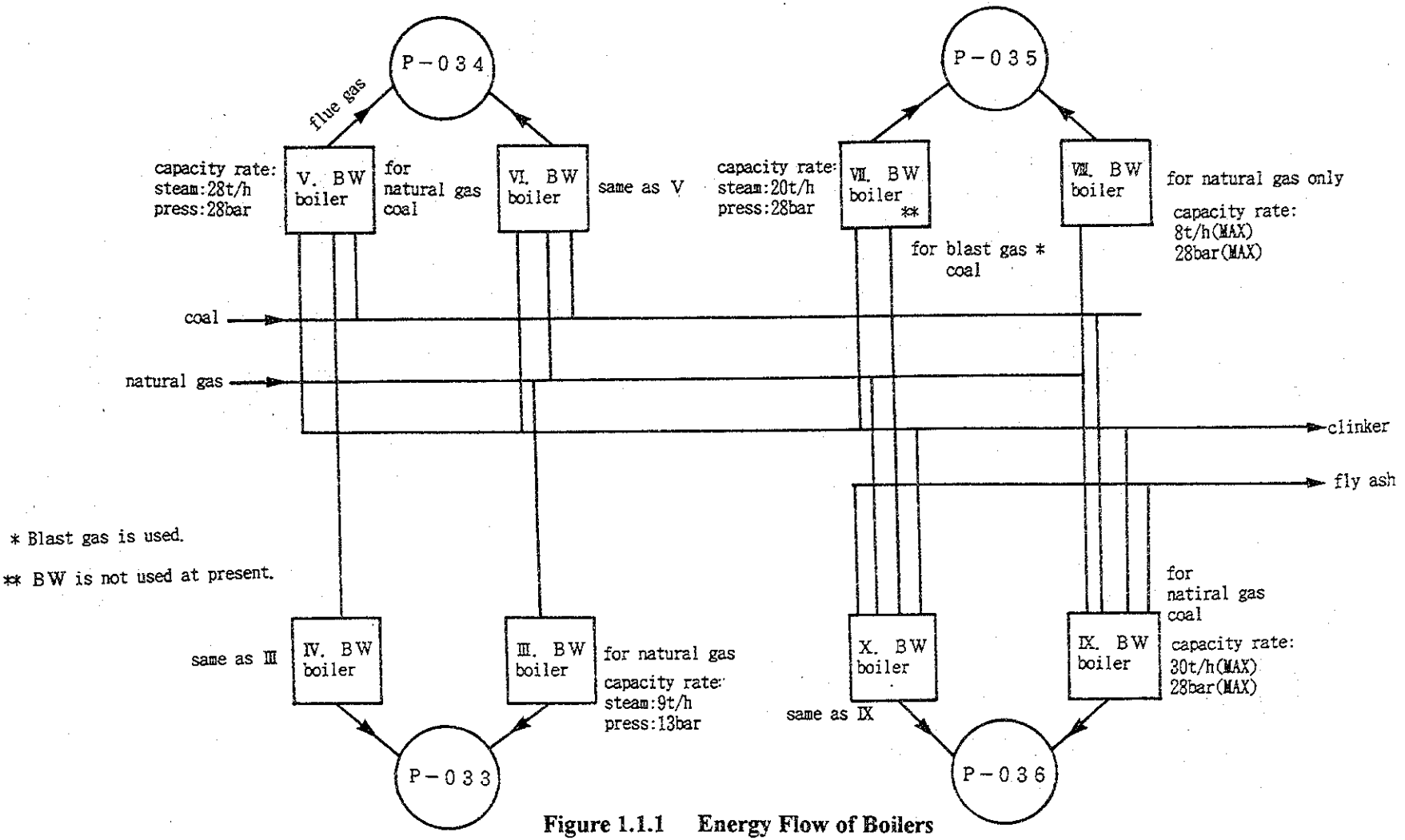


Figure 1.1.1 Energy Flow of Boilers

2) R/N: 02/3

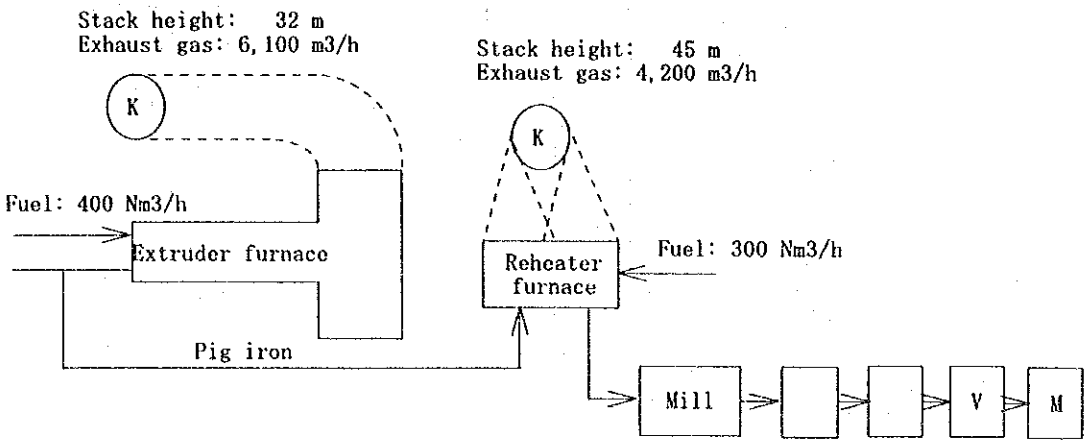
Company Name: PEKO ACELIPARI MUEVK (PEK Steel Works)

Industrial Process: Hot rolling

The company restarted as a private company on January 1, 1990, now running a hot rolling plant.

Pig iron is preheated in two stages for hot rolling. It is heated to 900 to 1000℃ in an auxiliary heater furnace in the first stage, transported to a regenerative reheater furnace via a crane, heated to 1200 to 1250℃ rolling temperature, and transported to mills. Pig iron is finally rolled, cut with a hot saw, and cooled on a cooling bed. The cooled iron and steel are made of good shape on a rolling machine, cut, packed and stored in the warehouse.

Flow Sheet



Steels are (120 to 180 mm) produced 30,000 to 50,000 tons per year.

Extruder furnace: Inside furnace 18 m x 4.5 m, natural gas-fired, calorific value 33.4 MJ/m3

Natural gas consumption: 350 to 400 m3/h (they used to burn blast furnace gas, which was replaced by natural gas on May 20, 1991).

They use a spear-head type burner for blast furnace gas. The spiral shape is used to input air. Furnace temperature is 1100 to 1200℃. This furnace is used only for preheating.

Iron ingot temperature is 800-900℃. The front burner in the heater chamber is an impulse type natural gas burner. Five burners each of 150 m3/h capacity are mounted. The furnace is provided with five side burners.

Exhaust gas from the extruder furnace is used to preheat combustion air to 250 to

400℃ with four recuperator. The exhaust gas is exhausted from a stack 32 meters high. Reheater furnace: Iron ingot preheated by the extruder furnace is transported to the reheater furnace over a distance of 50 meters, heated to 1200℃ with three burners (alternately used for every 30 minutes). (Initially designed for blast furnace gas, which has been replaced by natural gas which is currently used.)

Exhaust gas is exhausted from a stack 45 meters high.

A new reheater furnace is under construction. The old furnace will be demolished when the new one is complete. The burner type is TUKI B-7. Maximum natural gas consumption is 130 m3/h, or 280 to 320 m3/h when three units are operated simultaneously.

The upper limit return system is effective for the use of natural gas. This company has filed 800 m3/h, currently using 700 m3/h. The upper limit may not be changed in mid-year, and it is the responsibility of the boiler man to distribute 800 m3/h between two furnaces.

Basic tariff for 800 m3/h natural gas is 6,000,000 FT. They additionally pay 7 FT/m3 according to the actual consumption. A fine is imposed when the returned upper limit is exceeded. They currently pay 11 FT/m3 including the basic rate.

When the new reheater furnace is put into operation, the natural gas consumption increases to 1000 m3/h.

The company's full operation capacity is 60,000 tons/year. The performance in 1992 was 33,700 tons (56 %). Actual production for the current year is 32,457 tons as of the end of August, averaging 4,000 tons/month (48,000 tons/year). Expected rate of operation is 80 %.

3) R/N: 02/4

Company Name: OZDI ACELMU RT. (OZD steel making plant)

Industrial Process: Continuous steel production

The company, a bankrupt, is not allowed to use its facilities except RDH (bar and wire rolling).

The data below are for the equipment actually used in 1992, source of generation and the number of employees.

Outline of continuous steel production process:

Ozd steel was manufactured with a Maerz furnace of the oxygen reinforced SM system. (They do not intend to reopen production in the near future.) The capacity of the furnace is 110 tons per charge. Thermal energy derives from fuel oil and natural gas which are burned on Brickmann burners with Laval nozzles.

Production stages are described below:

* Charging and heating

Composition of reserves (1992)

60% scrap iron, 40% solid white pig iron, 3 tons alloys and charge materials.

Thermal input: 23,000,000 kcal/h at 900 m3/h oxygen consumption via burners.

* Refining

Thermal input: 5 - 7 million kcal/h, maximum oxygen supply 750 m3/h / (pilot flame). Pilot flame exists twice.

* Finish

Generation of dross and change in structure.

Tapping.

Resultant steels are poured into a pre-heated and fire-resistant ladle and transported to a pot furnace with a "transport cart."

Ingots are cast in charge materials via continuous casting. Exhaust gas is sent to a recuperator and a boiler which uses waste heat (steam production), passes through a Lurgi electric dust collector and a bag filter to remove dust, and finally exhausted from a stack 85 meters high. Exhaust gas from the pot furnace and alloy packing passes through a bag filter before exhausted to the atmosphere.

Industrial Process: Bar and wire rolling

Outline of FA, bar and wire rolling process:

The outline of the industrial process is shown in Figure 1.1.2. An ingot of a cross section of 120 x 120 mm and 10 meters long is input into an OFAG type tunnel furnace.

The ingot is heated to the rolling temperature (1100 to 1200℃) by burning oil. The tempered ingot is reduced to a suitable size, fed into booming rolls, sent to a bar and wire rolling mill for rolling, and transported to the Schloemann block to produce fine and thin wires. The wires are further enhanced in a controlled cooling unit, and sent to the area where hoisting procedures are performed. As for bar rolling, the wires are cooled on a fork-shaped cooling table, and cut to a suitable size with a cutter. Final products (wires 5.5 to 14 mm in diameter, reinforced steel wires, and twisted steel rods 10 to 40 mm in diameter) are bundled and sent to the finishing course. Flue gas is exhausted into the atmosphere from through a 55 m stack.

Outline of FA RDH boiler:

The natural gas-fired boiler supplies warm water to both heating system and warm water supply system in the community. Flue gas is exhausted into the atmosphere via a stack 15 m high.

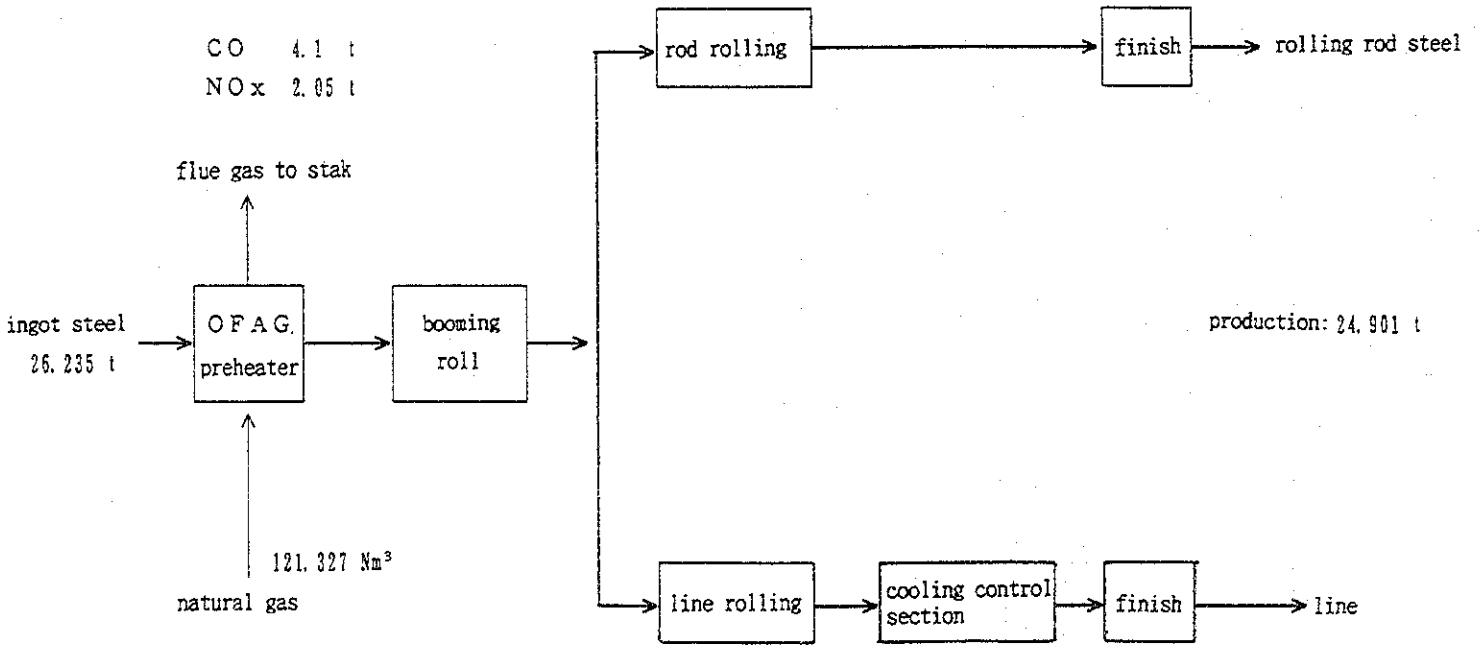


Figure 1.1.2 Process flow for Rod and Line Rolling (RDH) (data in 1992)

4) R/N: 02/7

Company Name: FINOMHENGERMU MUNKAS KFT (FHM sheet rolling plant)

Industrial Process: Hot rolling

Established on July 27, 1991, the company employs 700 workers (may vary in the 650 to 700 range). It is a rolling plant separated from OKU iron works, and operates on a capital of 2,100,000 FT.

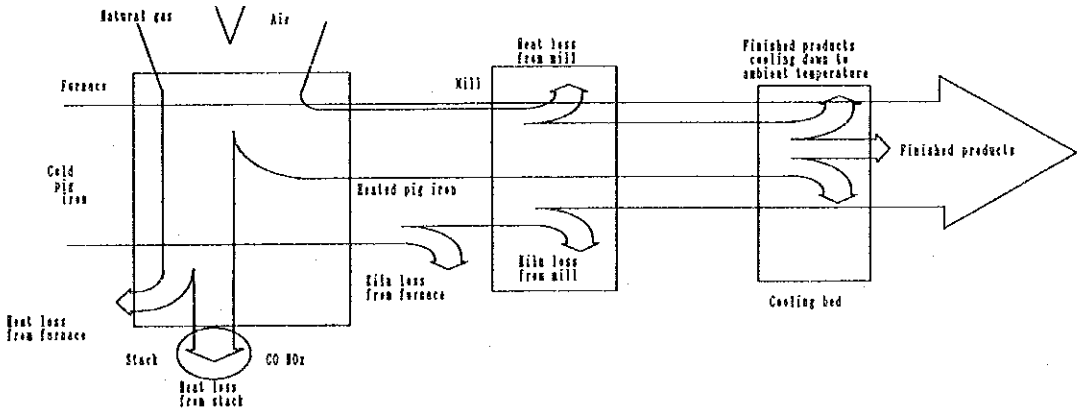
This plant runs four rolling lines and produces more than 1,000 different sizes of products. Production was 30,000 tons (29,691 tons) in 1992. The plant produced 500,000 tons in 1975 when it belonged to the former company (OKU). The current maximum capacity is 300,000 to 350,000 tons (1200 workers are required). Operates on three shifts a day with four groups. Production increased in 1993, close to 40,000 tons. The equipment is old and productivity is low, but the company wishes to increase production by several times. The company does not like to cut the number of employees considering possible production increase in the future. Rate of operation is 10% (1992). They sell in the domestic market primarily, and exports only a few percent. Export prices are low.

They concluded an export contract with a customer in China in 1992, and shipped the goods early this year. Customers in the Near and Middle East countries are also interested in their products.

There are five carrier table type reheater furnaces, of which Nos. 1, 3 and 5 are in use. Natural gas is exclusively used for each furnace. Some furnaces burn heavy oil but are not used. Four days in a year are maintenance days.

They wish to improve the furnace with German aids (Germany offers coal which they sell to raise funds). (They want to improve No. 3 unit.)

Nos.1,2 and 5 furnaces are operated to a same technical system. A brief flow sheet is shown below.



Brief technical explanation of the process:

The sheet rolling plant manufactures various sizes of bar and section steels from rolled and cast iron using the technique called hot rolling.

Pig iron is put on a roller conveyor and pushed into a reheater furnace with a hydraulic extruder. Natural gas is defined via four Haan burners to heat pig iron to a specified temperature. Pig iron is continuously forwarded in the furnace, and is pushed on to the roller conveyors one by one. The roller conveyors feed pig iron to a rolling mill where profile type and size are determined as the material passes between several rolls. The material is cooled on a cooling bed to become the final product. Air pollutants exhausted from the stack are primarily CO and NOx.

Production in 1992

Alloy ingot heated to rolling temperature:	29,691 tons
Total working hours:	8,415 hours
Alloy ingot used:	42,785.85 tons
Natural gas:	3,803,795.5 Nm3

5) R/N: 03/0

Company Name: ESZAKMAGYAROSZAGI TEGLA ES CSEREPIPAKI VALLALAT PUTNOKI TEGLAGYAR

(PUTNOKI brick factory)

Industrial Process: Bricks

The company was founded in 1896. The older facility was constructed in 1967 and the newer one in 1985. The company employs 115 workers (10 clerks and 105 laborers). Rate of operation is between 30 and 35 %.

Process:

Clay and coal are crushed into a uniform particle size, mixed with combustible materials (sawdust) and water, and formed. Wet bricks are dried by hot air from a tunnel furnace. The material burns by itself in the tunnel furnace using coal in the raw material and sawdust to burn the bricks.

1992

Input		Output	
Coal:	8,081 tons	Wet bricks:	25,887,000 pieces (bricks)
			6756 hours/1992
Sawdust:	2,673 tons	Finished product:	24,573,000 pieces (bricks)
			6336 hours/1992
Clay:	72,744 tons		
Oil:	20 tons		
Electricity:	2,690 MW		

Coal:	1,275.4 kg/h
Clay:	11,481 kg/h
Sawdust:	421.9 kg/h

Coal for bricks (S content 3 %)

Sajomercse dora (grits):	2647 tons
Sajomercse dio (Valnut size):	50 tons
Waste coal dust:	2425 tons
Czech coal mud:	1504 tons
Sovjet brown coal dust:	155 tons
Berent "A" grits:	844 tons
Russian antracite dust:	844 tons

Total:	8081 tons

Coal for boiler (S content 3 %)	
Sajomercse dio (Valnut size):	206 tons
Borsod dio (Valnut size):	69 tons
Sajomercse grits:	5 tons
Czech brown valnut:	26 tons
Imported cube grits:	4 tons
Total:	310 tons

Heat quantity production:	4,526 GJ

6) R/N: 04/1

Company Name: BORSODCHEM RT. (Borsod Chemical)

Borsod Chemical employed 4100 workers in 1992. Major products are PVC, CPE, C12 and MDI. Production and rate of operation are shown below.

Production (tons/year) and Rate of Operation (%) at Borsod Chemical

Item	Capacity (tons/y)	1987	1988	1989	1990	1991	1992	1993 thru Sep.
CPE	3,500	332.685	925.507	1,149.500	567.463	508.165	454.448	334.840
	(%)	9.5	26.4	32.8	16.2	14.5	13.0	9.6
PVC	30,000	27,173	33,046	33,169	30,847	28,062	23,100	(*)130,373
(old)	(%)	90.6	110.2	110.6	102.8	93.5	77.0	72.4
PVC	150,000	152,342	153,196.3	151,698.9	154,722	146,758	153,934	
(new)	(%)	101.6	102.1	101.1	103.1	97.8	102.6	
C12	121,000	10,6761	121,752.9	7,099	106,580	100,484	77,025.9	58309
	(%)	88.2	100.6	5.9	88.1	83.0	63.7	48.2
MDI	25,000	-	-	-	-	6,797	5,846	8,512.4
	(%)	-	-	-	-	27.2	23.4	34.0

*: indicates the total for old and new.

7) R/N: 05/0

Company Name: BORSODI ENERGETIKAI KFT. BORSODI HUEROMU (BORSOD ENERGY LTD., Borsod Steam Power Plant)

Industrial Process: Electric power, Steam, Hot water

Borsod Steam Power Plant is located near Kazincbarcika. Operation started in 1955-1957. Major plants include 100 t/h, ten fine coal combustion boilers, and six 30 MW turbines.

The installed capacity is 200 MWe. Electricity is supplied to the state-operated transmission network. Heat and steam are supplied to the regional heating system in Kazincbarcika and to Borsodchem, a chemical company. Employs 800 workers. The equipment is obsolete. Rate of operation of the boilers is decreasing every year. It was 45.1 % in 1991, 40.5 % in 1992, and 28.4 % in October 1993.

Flue gases from the boilers are exhausted from a stack via an electric dust collector.

1992

INPUT		OUTPUT	
Brown coal:	1,174,307 tons	Electric power generated:	599 GWh
Natural gas :	31,857,000 m3	Thermal energy:	3,167,737 GJ
Oil:	118 tons		

Facility improvement:

One external circulation type fluidized bed boilers. Four old boilers to be restructured to hybrid boilers (their problem: SOx removal efficiency).

8) R/N: 06/0

Company Name: YTONG HUNGARY Plant (Borsod Building Materials Manufactory)

Industrial Process: Building materials

The plant was formerly the state-operated Koszig, which was purchased by Ytong on July 1, 1992. It is now a 100 % owned German affiliate. Production was reportedly transferred to the new management smoothly without interruption.

Borsod Building Materials Manufactory, located near Kazincbarcika, manufactures small-sized building materials using the technology of Unipol in Poland, in 1963. Raw materials are fly ash from Borsod Steam Power Plant, burning lime as binder, aluminum paste. Fly ash is pneumatically transported from the power plant and stored in eight 290 m3 EPGEP silos (with a vibrating bag filter) made in Hungary. Burning lime, transported by trucks and stored in a lime warehouse, is granulated into 15 mm particles on a mill, and stored in a warehouse. Lime and fly ash are further ground on three mills (one is wind sorting and the other two are ring balls).

Lime, fly ash, water, mud and aluminum paste are blended in a mixer and cast in a mold. The product is aged in a 12-bar high pressure kiln at 190℃ and stored in a warehouse ready for shipment. The duct of each mill and mixer is provided with a TOKAJ type vibrating bag filter to prevent dust diffusion.

Foam concrete production process is shown in Figure 1.1.3.

Steam required for production is supplied from Borsod Steam Power Plant; they do not burn fuels by themselves. There is no air pollution due to combustion exhaust gas, but fly ash and lime are emitted from the production process.

1992: The 3rd and 4th quarter

INPUT		OUTPUT	
Fly ash:	24,603 tons	Aerated concrete:	69,131 m3
Lime:	7,431 tons	Lime:	2,880 hours

Production continues since 1988 without interruption as follows:

	1988	1989	1990	1991	1992	1993 Jan.-Sept.
Foam concrete (m3)	455,506	430,069	440,481	210,748	144,190 (*)	90,632

(*) Management changed

Foam concrete : 1 block = 20 kg , 32 blocks = 1 m3, 1 m3 = 640kg

Fly ash purchasing price is 185 FT/t (1993).

Recent fly ash delivery performance is shown below.

1993	May	June	July	August
(tons)	4,874	4,265	4,190	4,175

They purchase lime from BECEM RT. and HCM RT., about 30 km and 20 km away from them, respectively.

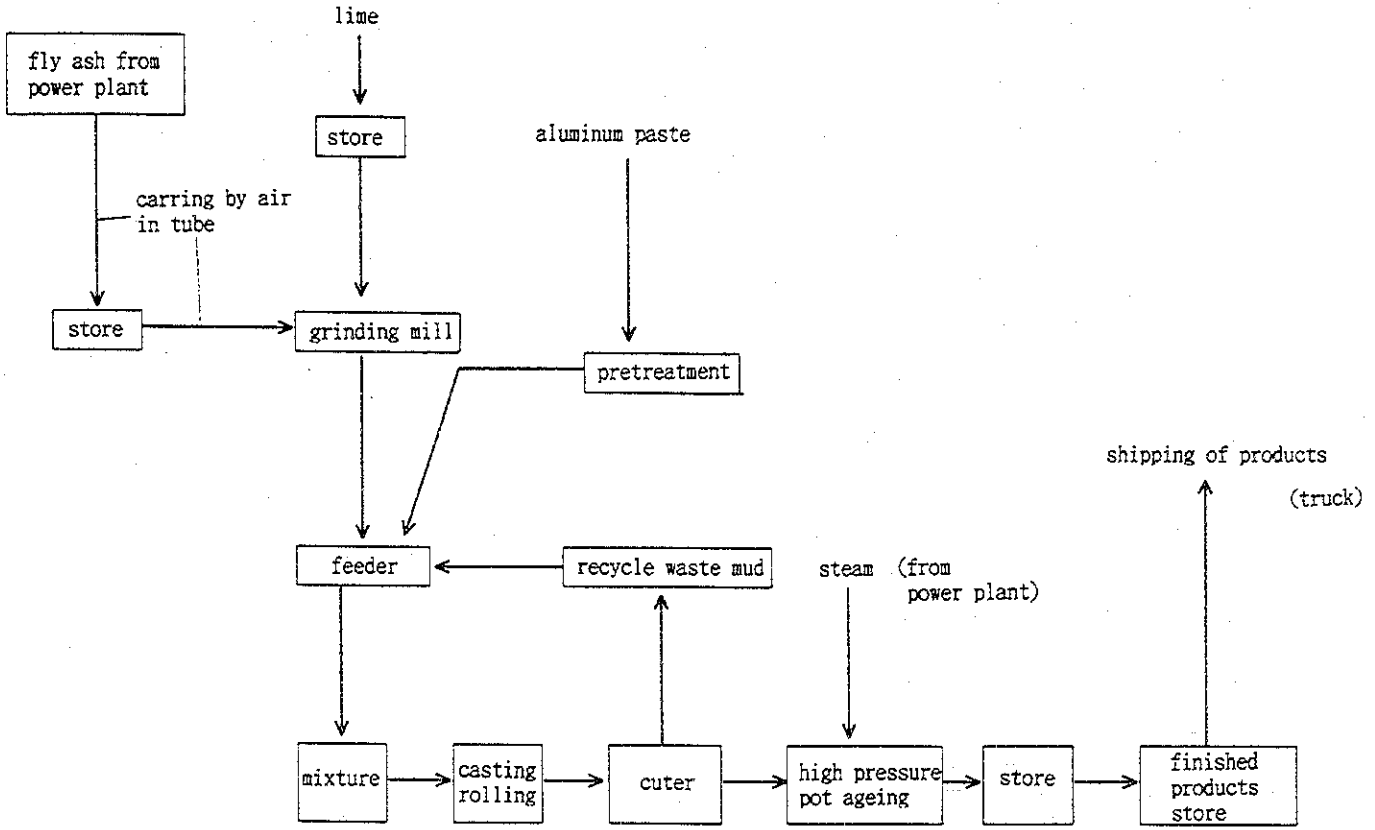


Figure 1.1.3 Flow Chart of Foam Concrete

9) R/N: 07/0

Company Name: PANNONGLAS IPARI RT. (glass manufactory)

Industrial Process: Glass

The glass manufacturing plant, founded in 1894, modernized its production process in 1951 through 1956. Production machines are in use since 1956. They use natural gas since 1966. Main products are bottles. They used to produce at 100 % operation 400 million bottles/year, 160,000 tons/year, but the production started to decrease in 1990 until the rate of operation was 20 % in both 1991 and 1992. The rate of operation started to improve at the end of 1992, and is about 30 % in 1993.

The company employed 1700 workers in 1990, now employing 900 in 1993.

The company, originally a state-run concern, went bankrupt in June 1, 1992, and is now being reorganized. The reorganization was originally expected to be complete in June 1994, but a longer time would be required according to the current reschedule. The future of the company is affected by market economy and is determined by the demand in the 200-km area surrounding the company. The company supplies necessities to the surrounding area. The market has a good possibility of expansion in the future. Raw materials are available in the surrounding area.

Raw materials and furnace improvement are necessary but no funds are available. The company is a bankrupt now, and the next manager must be elected before any improvement is planned and carried out.

Relation with air pollution:

The melting furnace uses natural gas and has four stacks emitting dust, CO, and NOx. Other production machines use cooling emulsion in the glass cutting and distribution areas. Lubricant and emulsion vapor is exhausted into the atmosphere.

1992:

Three glass melting furnaces are operated constantly consuming gas at the rate of 750 to 800 m3/h per melting furnace or 10,316 KJ per 1 kg of dissolved glass, 13,695 KJ per 1 kg of finished glass and 70 MW power per day.

Table 1.1.2 shows fuel consumption by every quarter.

Glass production

Materials used (tons/hour)/1992

SiO2:	3.816
Na2CO3:	1.330
CaCO3:	0.486
CaCO3 x MgCO3:	0.644
Scrap glass:	3.624
Chromium ore:	0.015
Iron oxide:	0.006
CaSO4:	0.034

Sand dry

Sand:	10.0 tons/h
Natural gas:	160.0 Nm3/h

Table 1.1.2 Fuel Consumption by Every Quarter (1000m3)

Kind of facility	Stack Number	1992 I Jan.-Mar.	1992 II Apr.-Jun.	1992 III Jun.-Sep.	1992 IV Oct-Dec.	1993 I	1993 II	1993 III	Total in 1992
Glass melting furnace	P-010	- -	- -	- -	- -	456 648	1334 2184	1547 2208	0
--ditto--	P-015	1794 2184	2540 2184	3337 2208	2985 2208	3049 2160	1839 2184	3394 2208	10656
--ditto--	P-019	1279 2184	1086 2184	1199 2208	1378 2208	1384 2160	1316 2184	1365 2208	4942
Furnaces	P-011,12 13,14,16, 17,21,22	648 2184	691 2184	821 2208	842 2208	1012 2160	829 2184	1013 2208	3002
Cylinder sand-drier	P-001	113 700	64 900	79 1200	83 1200	108 800	78 1000	101 1200	339
GTG Therm generators	P-038,39 040	100 6552	16 1080	- -	28 5400	100 6550	16 1080	- -	144
Total		3934	4397	5436	5316	6109	5412	7420	19083

Upper is consumption
Lower is hours in use

10) R/N: 08/0

Company Name: BORSODI ERCELOKESZITO MU ZSUGORITO KFT. (Borsod Sintering Plant)

Industrial Process: Sintering

Full production capacity is 3,000,000 tons/year. Production in 1992 was 460,000 tons or approximately one sixth to seventh of the full production capacity. Production recovered to one-third of the full capacity today. Seven hundred and fifty-one workers are employed. The facility has been used for 26 years and is obsolete now. Four sintering furnaces are installed and two units each are used in pairs.

Fe 50 % products are produced by mixing lime, cokes and coal (fuel) with iron ores. Freight cars and trucks are used for delivery-in. Raw materials are temporarily stored in a storage warehouse as large as 300 meters. Dust is generated when the raw materials are dumped from the bridge in the storage warehouse to buildings E-051 and E-052. Fuels and lime are crushed under pressure to make a mix. Dust is generated in E-055 and E-054. The raw materials are uniformly mixed with water in an equalizing unit (E-056) and fed to the underground pelletizer on belt conveyors. The raw materials are further mixed with water. To sinter, the mix is ignited, burned, crushed and sieved.

The sintering machine is a Dwight-Lloyd system whose ignition temperature is 1180 to 1250 ℃. The ignition furnace uses natural gas with seven burners. It is provided with an automatic control of heat quantity. The entire mix is burned with discharge air blow. The exhaust gas is fed to the duct via a multi-stage cyclone (rated 420,000 Nm3/h), and further sent to the stack (P-001) via a ventilator P-001 (ordinary 360,000 Nm3/h). The stack is also used to exhaust fume from other three sintering furnaces.

The dust collected in the multi-stage cyclone is added to the mix. To make a product, star breakers and sieves are produced to return particles smaller than 150 mm to the mix again.

Materials used per hour		Consumption per 1 ton product		Production in 1992
Natural gas:	600 Nm3	Electric power:	55 kw	Sintered products: 461,385 tons
Cokes and coal:	7.28 tons	Natural gas:	5.6 Nm3	
Iron ores:	97.7 tons	Cokes and coal:	67 kg	
Quicklime:	0.43 tons	Iron ores:	0.9 tons	
Limestone:	29.3 tons	Quicklime:	4 kg	
		Limestone:	0.27 tons	

Note: The government of Hungary determined the abolition of this sintering furnaces in future (Feb. 1994). They are considering that sintering furnaces are reconstructed to preprocessing plant and reprocessing plant of scraps etc. They will invite international bids for the reconstruction.

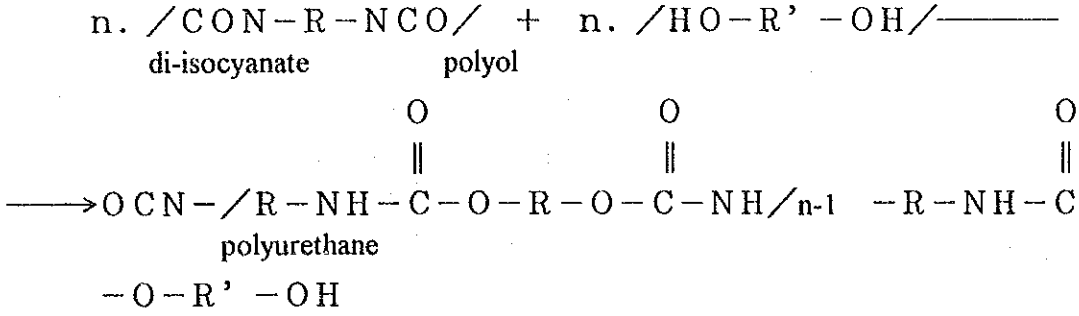
11) R/N: 09/1

Company Name: PORAN POLIURETAN GYARTO ES ERTEKESITO KFT. (Polyurethane Plant)

Industrial Process: Polyurethane

The company, founded in 1952, started to produce polyurethane in 1963. The number of employees is 236. Annual production was 4,000 tons in 1992, and is expected to increase to 5,000 tons in 1993. Production capacity is 10,000 tons/year.

Process:



Basic materials:

TDI:toluene-di-isocyanate

MDI:methylene-diphenyl-di-isocyanate

Polyol

Indirect materials:

H2O

Catalysator

Freon-12

Consumption of specified materials: per 1 ton product

TDI:	0.28 tons
MDI:	0.58 tons
Polyol:	0.74 tons
Freon-12:	0.08 tons
Steam:	5.5 GJ
Electric power:	15.2 kWH
Water:	1.1 m3

They discontinue the use of Freon in the near future.

Future plans include modernization of facilities (warehouse, processes).

Materials used per charge: A-32 type

TDI:	280 kg
Polyol:	735 kg

Catalysator

Water

Production of polyurethane:

1000 kg per charge

Forming time is 2 hours

Capacity of 12 belts:

Maximum 38 tons - 1100 m3/day

A-32 type

The company started operation of the boilers for heating by burning propane-butane gas this year. Operation time is one to two hours in summer except Saturdays and Sundays. The boilers are run continuously in winter when the atmospheric temperature is 0℃ or below. Generation source data are shown below.

Fuel: Propane-butane gas
Fuel consumption: 210 kg/h
Stack height: 10 m
Boiler capacity: rated steam quantity: 3.5 t/h, steam pressure: 4 bar
Steam temperature: 152 ℃

Fuel gas analysis value		Analysis of exhaust gas	
Propane:	32.33 %	CO2:	12.6 %
Isobutane:	65.36 %	O2:	2.1 %
Methane + Ethane:	0.72 %	CO:	50 ppm
Normal butane:	1.56 %	NOx:	138 ppm

12) R/N:09/2

Company name: SAGROCHEM KFT

Production process: Phenyl isocyanate

Sagrochem is a firm which had separated itself from North Hungary Chemical Company to become independent, and is scheduled to become a private company shortly. The present employees are 85 office workers and 690 factory workers. Sagrochem is operating also Saszolg and Intermed which have been recently consolidated under its management. (The formal registration for the consolidation is said to be pending now.)

Operation ratio was at a peak of 100% during the period between 1988 and 1989, but remained at 20% from 1991 to 1993. The main products are agricultural chemicals and medicines for human and animals.

The production volumes of the main products in 1992 were as follows:

Izocyanate:	328.4 tons
Acetanilid:	472.2 tons
Tiolcarbamat gyartas	848.7 tons
Tiolcarbamat:	1141.4 tons
KHME:	374.7 tons

Production process: Central heating, waste incineration and final gas combustion

The company has a central heating facility (boilers), which supplies steam and electric power for the in-house use of the company and for the use in Intermed.

In 1992, 173,000 tons of steam and 3,584 MWh of electric power were generated. In all the boilers, fuel oil (F-60/130) is burned after preheating to 95℃ with steam and subsequent atomization. In the No. 2 and No. 3 boilers, the fuel oil is atomized by steam and in the No. 1 and HLG boilers, it is rotary-atomized for combustion.

The boiler facility is summarized below:

P-001: This boiler is a product of HLG, rated at 20-ton/12bar, equipped with a SAACKE SKV80 burner, with the maximum fuel consumption of 3500 kg/h. The burner was installed in May 1993.

Although varies with time, the fuel consumption is normally 1 ton per hour.

At present, this boiler is running at a rate of 15 ton/h, and at a pressure of 10 bar. The steam temperature is 250℃ and the hot water temperature is 110℃. The exhaust gas is discharged into the air through stack P-001.

P-002: The No. 1 boiler is a Czechoslovakian product rated at 30-ton/38bar, equipped with a SAACKE SKV250 burner, with a maximum fuel consumption of 3500 kg/h, that has been installed in 1990.

The actual fuel consumption varies with time.

The No. 2 and No. 3 boilers are CKD DUKLA 30-ton/38-bar equipped with OKTK 7550-56 burners, (max fuel consumption: 3200 kg/h). Each boiler is equipped with four burners on the front, each with maximum fuel consumption of 800 kg/h, installed in 1964.

The fuel consumption varies with time.

The No. 1 through No. 3 boilers produce steam at 38 bar, 450℃ to feed the steam pipeline after reduction to 8 bar. The exhaust gas is discharged into the air through stack P-002.

Both the P-001 and P-002 stacks are not equipped with an air pollution control unit.

Note) The fuel consumption for each boiler is indicated on the attached sheet.

There are incinerators respectively for waste liquid and for the end gas.

Waste liquid incinerator:

The waste liquid is burned at a rate of 55kg/h with oil and compressed air, at 1200℃, and then, the exhaust gas is flushed out with water and Ca(OH)2.

The concentration (mg/Nm3) of the waste gas is as follows:

CO:	8.0	HCl:	20.0
NOx:	250.0	Flue dust:	9.0
CH/C:	3.0		

End gas incinerator: At present out of operation because of low requirement.

The hourly input in normal operation is as follows:

End gas:	200 Nm3	Oil:	25 - 30 kg
Air:	60 Nm3		

The end gas is mixed with oil and air, burned in the incinerator at 900 - 1100 ℃, and the heat is utilized to produce steam at 1-ton/h, 1 MPa in a boiler. The exhaust gas at 200 to 250℃ is cooled in a cooler to 100℃ and discharged after wet-washing. The

washing water is discharged to the sewer system.

The discharge rate (kg/h) of P-053 is as follows:

SO2: 0.78
NOx: 0.21
HCl: 1.00
CO: 0.01
Cl2: 0.003

The fuel consumption of the boilers (1, 2, 3 and HLG)

(ton)

Month	1992								
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.
Monthly consumption	2,285.9	1,815.9	1,561.0	1,040.4	543.1	473.7	475.2	438.7	526.1
Dairy average	73.7	62.6	50.3	34.7	17.5	15.8	15.3	14.5	17.5

Month	1992			1993				
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr	May.
Monthly consumption	1,067.8	1,419.7	1,750.0	1,971.3	1,750.4	1,186.9	832.9	656.8
Dairy average	34.5	47.3	56.5	63.4	62.5	38.3	27.8	21.1

Total in 1992: 13,396.9 tons

13) R/N:09/4

Company name: INTERMED Kft

Production process: Formaldehyde

Intermed Kft is now under the management of Sagrochem, although the formal registration for the consolidation has not been made. The number of employees is 267.

The operation ratio during the years from 1991 to 1993 has been 20%. The main products are formaldehyde and Diuron.

The steam needed for production is supplied by Sagrochem, and no fuel is consumed in the company. Although some combustion-free production processes produce dust and chemical substances, they are collected by bag filters and water absorbers installed at key locations.

Process:

$$2\,CH_3OH + O_2 \xrightarrow[670^{\circ}C]{} 2\,HCHO + 2\,H_2O$$

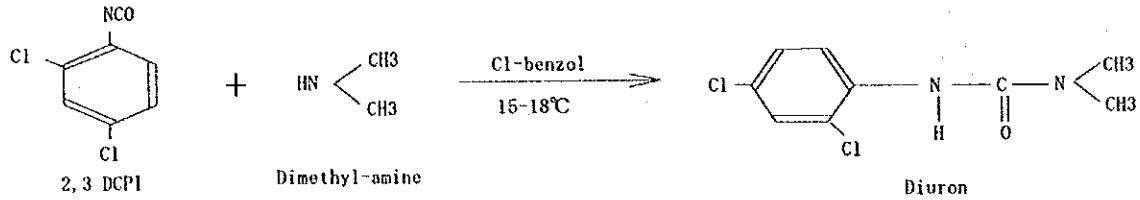
Material consumption per ton of formaldehyde

Electric power:	75 kWh	Steam:	0.5 GJ
Water:	6 m3	CH3OH:	490 kg

The formaldehyde (37 w/w%) production in 1992: 9,426 tons

Production process: Diuron

Process:



The consumption of specific materials required for the production of one ton of Diuron is as follows:

Material consumption per ton of Diuron:

Electric power:	1265 kWh
Steam:	43 GJ
Water:	160 m3
2, 3 DCPI:	0.85 tons
Di-methyl-amine:	0.43 tons
Cl-benzol:	0.12 tons
Diuron production in 1992:	480 tons

14) RN/:10/0

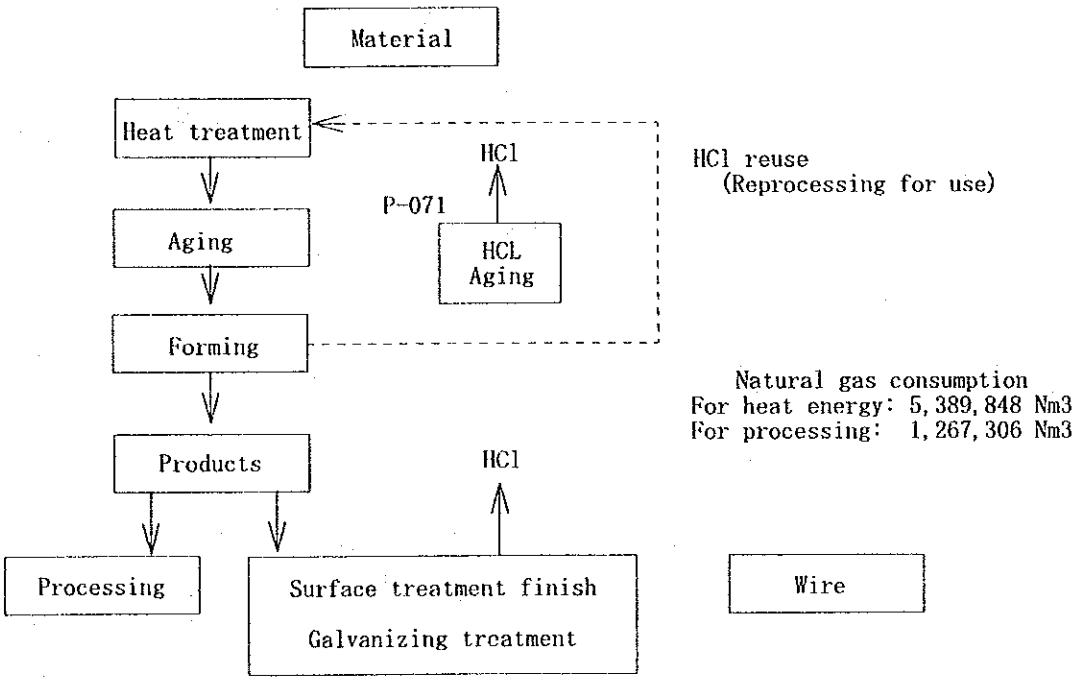
Company name: 'DECEMBER 4' DROTMUVEK

Production process: Wire

The company was established in 1912. It was under the control of Germany before the war, and of the USSR after the war. It was returned to Hungary in 1953. Three years ago, 2200 employees were working to produce 90,000 tons of product annually, but at present, the operation ratio dropped to 30% to produce 27,000 tons of products with 1,100 employees.

During the full operation years, the annual production was 25,000 tons of steel bar wire, 20,000 tons of structural wire netting, 15,000 tons of wire, 12,000 tons of electric wire, and 10,000 to 13,000 tons of plated cable.

The process flow is as shown below:



According to the measurement on the stationary source of Ruthner type HCl re-processing P-017 (May 14, 1992), the HCl generation rate is as follows:

Measured value	Standard value	Excess
5.8 kg/h	3.5 kg/h	2.3 kg/h

The Ruthner type re-processing HCl regeneration process is as shown in Figure 1.1.4.

A HCl fume control measure must be taken.

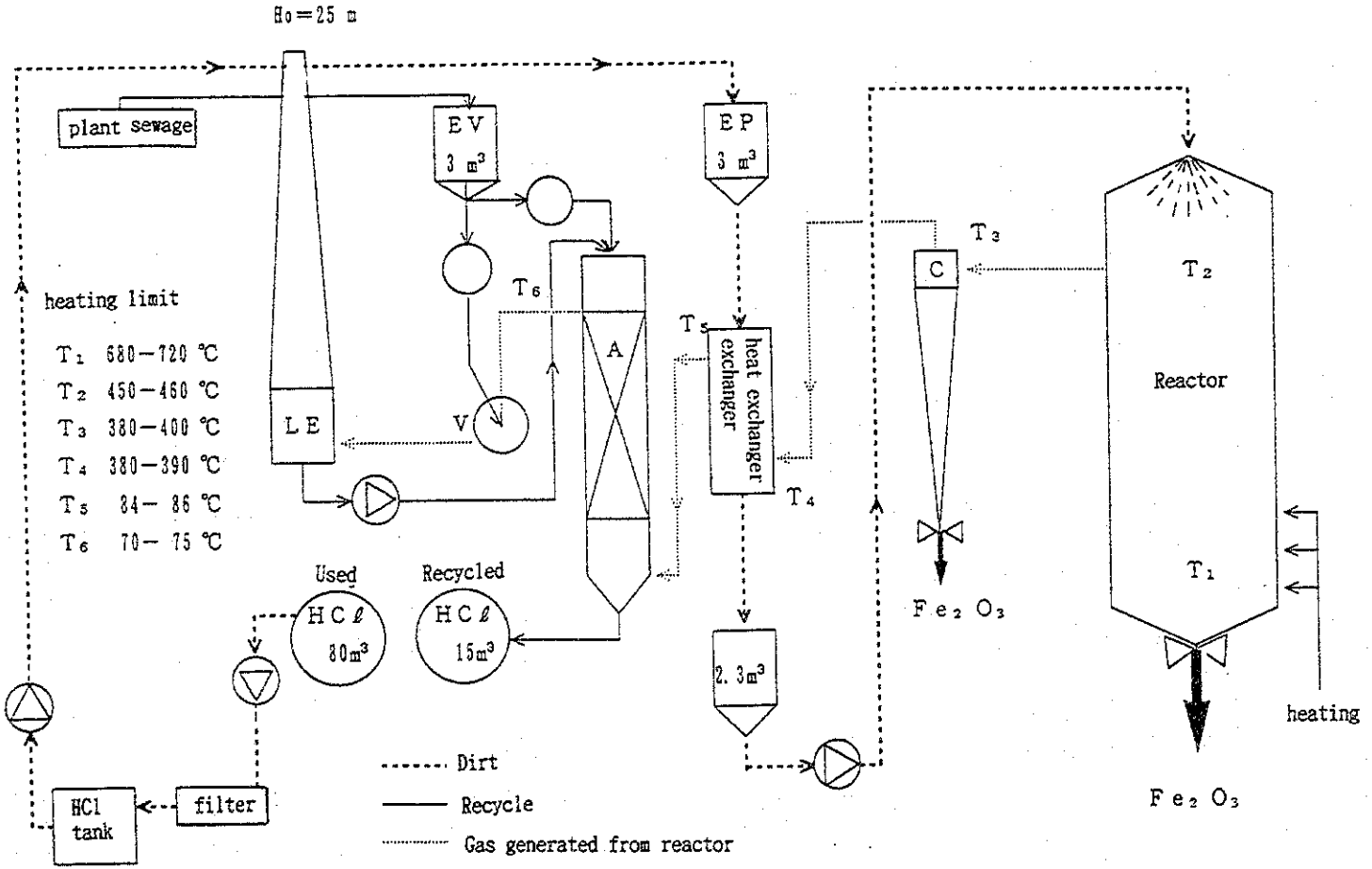


Figure 1.1.4 Ruth Type Recycleing Process for retreated HCl

Production process: Steel wire heat treatment

The method of using polyvinyl alcohol, instead of lead, in heat-treating steel wire to reduce pollution:

The use of lead as a coolant in heat treating steel wire, causes pollution. The use of pollution-free coolant instead of lead is under plan.

Mixture of polyvinyl alcohol (PVAL) and water is to be used as the coolant. The chemical formula for PVAL is (-CH2CH(OH)2)n. It mixes easily with water but is insoluble in organic solvents. It is harmless to health, and requires no special caution in control after preparation. The mixture of hot water at 98-100℃ and PVAL is used in place of lead bath. It cools the wire in the same way as lead. Because of the PVAL bath hotter than 100℃, much water evaporates, so that the bath surface need be covered, and water must be added. Water evaporates, but PVAL does not.

The surface of the wire thus patented may be better picked when it is immersed in a hydrochloric acid bath, because in this way, only iron oxide is solved from the surface, which is, by such a method, not stained also by spots of lead. In all these cases, they have had adequate results.

15) R/N:11/0

Company name: MIHIG KFT (Miskolci Mezogep)

Production process: Mechanical parts

This company is a mechanical parts manufacturer. It was reorganized as a limited liability company, and changed name from Miskolci Mezogep to MIHIG kft on June 1, 1993. (Approved, but formal registration has not been made, as of June 1.) Within a year, rationalization in company organization and facility may take place, but there is also a possibility of bankruptcy.

Although the schedule production rate is 400 million FT annually, the actual result is only 50%. The number of employees is 240. It is manufacturing 100 FT worth of parts receiving orders from the national railway of Hungary.

The main products are SKL, hydraulic cylinders, telescope cylinders, and truck brake valves.

The daily operation time is 8 hours, quarterly working time is 450 hours, and the annual working time is around 1800 hours. Products are painted, and monthly paint and rust preventive consumption is 150 to 200 kg, top coat paint consumption is 400 kg (at full capacity). During the painting process, factory air is pumped out through ducts P-012 and P-013.

During the cutting and welding process, the plant air is extracted with a 6 kW motor fan through P-016.

Natural gas consumption: 800,000 m3/year

Power consumption: 800 MWh/year

16) R/N:12/0

Company name: BAUMAS EAEV EPITESGEPESITO ES SZOLGALTATO KFT

Production process: Lease for construction machinery

The construction company has gone bankrupt, and BAUMAS EAEU (lease company) is operating with the building and the boiler.

The boiler is a small interior warming boiler.

There are two boilers, hot water room heating boilers made in Poland in 1970. These boilers had been rebuilt for oil combustion from the initial coal combustion. The heat transfer area is 41 m2, and the operating pressure is 0.7 kg/m2.

The fuel consumption of light oil is 300 lit. per week.

The boiler is operated for 2 to 3 hours from 6:00 in the morning. During the period is 7 months starting from September 20.

Similar boilers are in operation in other locations under the control of other companies.

17) R/N:13/0

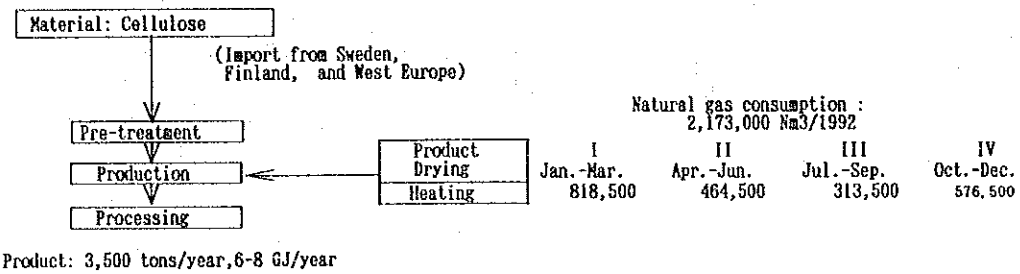
Company name: DIOSGYORIPAPIRGYAR LEANYVALLALAT (paper mill)

Production process: Paper mill

This paper mill was established in 1782, and has been under state management since the war-end. The company manufactures fine quality paper (production capacity: 5000 to 6000 tons/year), but at present, it is operating at 60% of the capacity. The number of employees is 270.

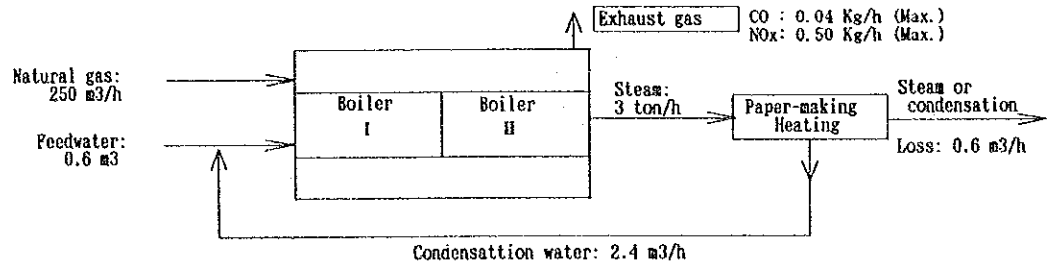
It switched the fuel from coal to natural gas 4 years ago, and at present, it uses only natural gas. At present, its discharge levels for CO and NOx are within the specified pollution control limits.

Factory production process



Product: 3,500 tons/year,6-8 GJ/year

Boiler facility flow chart



The material cellulose is imported from Sweden, Finland, and West Europe.
The material is pre-treated and production-processed, and in the course of processing, the product is dried by heating.

Note) The availability of European Development Bank loan was studied mainly for effluent processing, and was able to use the low-interest aid fund from PHARE (EC).
Beside the air pollution, the importance of effluent and noise control is well recognized, and the noise pollution problem had been solved with the expenses paid by the company itself.

18) R/N:14/1

Company name: DIOSGYORI GEPGYAR I-II TELEP

Production process: Machine building

This company was established in 1915, and up to 1945, had been building machines for Hungary. After World War II, it started to build reparation machines to be delivered to the USSR. It was a major builder of cable and wire manufacturing machines, presses, hammers and pumps in Hungary. The company has a hot rolling mill the products of which are exported to western countries.

From 1985 to 1987, the company manufactured artillery guns for defense. With the reparation to the USSR terminated, machine building for that purpose stopped. In 1987, the number of employees was 7800. Under various causes in and out of the country, the company applied for bankruptcy on November 27, 1990. No proposal for purchasing of the company has been received.

It is now a limited liability company consisting of 4 divisions; pump manufacture; hot rolling; tool manufacturing; and service-transport-energy. At the end of October, the dismissal of 319 employees is scheduled.

There are reports of the possibilities of foreign company's partnership; The tool division with an Ukrainian company, the hot rolling division with an Austrian and Swiss company, and the pump machine division with an Italian company.

In 1987, the operation ratio was roughly 95% and the income was FT 5200 million (employees: 7800), but in 1992, the operation ratio dropped to 30 - 40%, and the income, to FT 2200- 2400 million. In 1993, although the hot rolling division is operating at 90%, other divisions are operating at 20 - 40 %.

As the air pollution sources, the rolling mill, the energy and heating operations can be named, and especially, the furnaces are obsolete and in poor conditions. Natural gas is used as the fuel.

The summary of the boilers and the burners is as follows:

No. 12

Boiler: rated steam: 35 t/h, 48 bar, 445℃, made in 1971

Burner: BNG x 4, 7 Gcal/unit/h x 4, radiation type,

heat conduction area = 1102m2

No. 13

Boiler: rated steam: 12 t/h, 15 bar, 300℃, made in 1976

Burner: D4 x 1, 10 Gcal/unit/h, frame type,

heat conduction area = 303.4m2

No. 14

The same type of boiler as above. In 1969, the fuel was switched from coal to natural gas.

No. 15

Boiler: rated steam: 30 t/h, 29 bar, 400℃, made in 1949
Burner: D4 x 3, 10 Gcal/unit/h x 3, radiation type,
heat conduction area = 1140m2

The No. 12 and No. 13 boilers discharge smoke through the P-001 (86 m) stack, and the No. 14 and No. 15 boilers, through the P-002 (44 m) stack.

The natural gas consumption:	17,772,000 m3 (1992)
For boilers:	13,240,839 m3 (1992)
	10,746,883 m3 (1993, Jan. - Sept.)
For furnace (1):	4,515,280 m3 (1992)
	2,663,889 m3 (1993, Jan. - Sept.)
For furnace (2):	15,881 m3 (1992)
	30,331 m3 (1993, Jan. - Sept.)

19) R/N:14/2

Company name: DIOSGYORI GEPGYAR III, TELEP

This company had been transferred on July 1, 1993 from DIOSGYORI GEPGYAR III TELEP to ARMY COOP KFT, complete with the personnel of 450. It includes factories for grinding, surface finishing, toolmaking and welding.

20) R/N:15/1

Company name: HAMOR RESZVENYTARSASAG (Foundry)

Production process: Formed products

This company was originally a DIMAG group company, and in 1989, was reorganized into a 51:49 joint venture between Germany and Hungary. The main product lines are forming, rolling and metallurgy.

When only the casting processes related to air pollution are given attention, the pig iron for the formed products are brought from DNM and DAV. It is heated to 1200℃ in the No. 4, No. 5 and No. 6 glow emission furnaces, pressed into the forms with a 3000-ton press, reheated to 900℃ in the No. 16, No. 17, No. 18, No. 19 and No. 20 heat treatment furnaces and an electric furnace, and formed into semi-products.

1992:	Input (through all processes)		Output (through all processes)	
	Material steel:	7360 tons	Furnace steel:	8820 tons
	Natural gas:	4690000 Nm3	Other furnace steel:	1010 ton
	Electric power:	3058 MWh	Production hours:	6144 hours

Note) The entire processes comprise forming, wheel and shaft processes.

Production process: Wheel

The material "log" for making wheels, brought from DNM, is heated to 1250℃ in the No. 3 glow emission furnace, forged in the 15-ton hammer and the 850-ton press, heated to 1200℃, rolled in the wheel mill into wheels, heated to 900℃ (max) in the electric furnace, and aged in the oil age-hardening bath into the products.

Production process: Shaft

The shaft material is heated to 1200℃ in the No. 12, No. 14 and No. 15 furnaces, forged by the 6-ton hammer, and heat treated through heating to 900℃ in the No. 16 through No. 20 furnaces.

Otherwise, there is no possibility of air pollution in the production processes for bearing rings, etc.

Note: The furnaces have been in use about 30 years. It causes large energy losses. Improvements of a furnace will yield energy saving by 30 to 35% as achieved in an example of the RATH system applied to natural gas combustion. One alternative is to change energy source from natural gas to electricity. It is said that some of the new products can only be produced by electric arc furnaces.

21) R/N:15/2

Company name: DAV (DIOSGYORI ACEL ES VASOXJTO KFT) (Iron and steel foundry)

Production process: Casting-mold making, sand pre-treatment, casting, electric furnace casting

The company was established in 1879, and in 1990, became an independent company jointly owned by DIMAG (10%) and DAV (90%). It went bankrupt in May 1993, and at present is in the process of liquidation. Operation is maintained towards new start. The operation ratio in 1992 was 11%, and in 1993 was roughly 20%. The number of employees is 413.

This company has the following four facilities:

- Mold making

  For making sand mold and cores, cutting, shaping, assembling, bonding, paint-coating, racking, etc. are performed. First, master patterns are made, and from them, negative and positive molds are made.

- Sand pre-treatment

  Fresh sand is dried in a rotary drum drying oven, the dried sand is brought to the underground storage by the elevator, where it is mixed with bonding agent in a mixer. Used sand can be reused after screening.

- Casting

  Molds and cores are formed with sand and patterns, dried in a furnace, and assembled for casting. The steel (iron) for casting is prepared in the electric furnace. After demolding and sand-removing, the castings are heat-treated and finished.

- Metal melting in electric furnace

  Scraps and alloys are melted in the arc furnace into pig iron and ingots.

Note) The electric furnace is the source of the heaviest dust particles, 40 kg/h, so that its control is important.

1992:

Sand pre-treatment

Input		Output	
Industrial sand:	4,400 tons	Mold sand:	4,350 tons
Natural gas :	87,000 Nm3	Operation time:	2,016 hour/1992

Casting

Input		Output	
Electric furnace steel:	4,929 tons	Casting & casting block:	2,843 tons
Natural gas:	1,145,000 Nm3	Iron casting:	664 tons
Blast furnace gas:	252,000 Nm3	Operation time:	2,520 hour/1992

Electric furnace steel

Input		Output	
Steel scrap:	5,215 tons	Produced electric steel:	4,929 tons
Alloy:	385 tons	Operation time:	1,489 hour/1992
Electric power:	4,252,000 KWh		
Natural gas:	238,000 Nm3		

22) R/N:15/3

Company name: CSAVAR ES HUZOTTARU RT (Bolt and parts factory)

This company was established in 1883 as a screw factory, and in 1935, it started bolt manufacture. It remained a small factory, and on January 1, 1988, it reorganized itself into a screw and bolt manufacturer. In the middle of December 1989, the company reformed itself into a joint stock company, with the stock owned by DIMAG, Metalling Trade Company in Budapest, and individual holders. The screw company is a joint venture with a British firm.

The nominal annual production for the main products are; screws: 20,000 tons, bar and coil: 60,000 tons, but the actual production in 1992 was screws: 2,500 tons, bar and coil: 10,000 tons.

For 1993, the production of 50,000 tons of screws and 20,000 tons of bar and coil is planned. The operation ratio reached the peak of 100% in 1989, but in 1990, it declined to 30,000 tons (38%), in 1991, to 21-22,000 tons (27%), in 1992, to 12,500 tons (16%), and in 1993, an increase to 25,000 tons (32%) is planned.

The facilities causing air pollution are the heat treatment furnaces, but the natural gas consumption of the screw and bolt works is respectively around 25 m3/h, which is modest. The consumption in the bar works heat treatment furnace is 86 - 430 m3/h.

The obsolete sulfuric acid pickling works in the bar factory is a source of air, water and ground pollution, and its building is in a badly corroded state. The facility is 100-year old, and its hourly sulfuric acid discharge is several kg, without any pollution control unit installed. The wire phosphoric acid works in a separate location is also in the similar state. The sulfuric acid and phosphoric acid ester discharged from these works are dangerous environment polluting waste, of which no safe disposal method has been found.

1992:	Input	Output	
Hot rolled steel bar:	2,450 tons	Bolt, etc.:	2231 tons
Natural gas:	337,100 Nm3	Production time:	1,840 hour/1992
Electric power:	381.6 MWh		
Shape steel:	3,523.3 tons	Shape steel:	2,103 tons
Natural gas:	1,480,000 Nm3	Production time:	1,900 hour/1992
Electric power:	1,235 MWh		
Hot rolled steel bar:	4,882 tons	Steel bar:	4,784 tons
Electric power:	683 MWh	Production time:	1,920 hour/1992
Steam:	543.2 GJ		

23) R/N:15/4

Company name: DNM (DIOSGYORI NEMESACEL MUVEK FA) Iron maker

Production process: Pig iron production

The blast furnace currently in operation is the 3rd blast furnace of 960 m3 built in 1952. The materials for pig iron, i.e., sintered ore, scrap steel, coke, lime stone, etc., are lifted by the elevator to the furnace top for charging. During the charging, the top is open, and at this time, the blast furnace gas escapes to cause serious air pollution.

Through the blast tuyere, blast at 980°C is forced into the furnace to reduce FeO with C. From the bottom of the furnace, the collected slag and pig iron are separately extracted. The pig iron is converted to steel in the LD converter. The blast furnace gas is cleaned through the cyclone, the bag filter and the electrostatic precipitator. The combustible element of the blast furnace gas is utilized in the hot stove and the boiler. The blast furnace is cooled for continuous operation and for furnace wall protection with water, and the high contents of SiO2, CaCO3, and Fe in the cooling water are removed by special processes.

1992:	Input	Output	
Scrap:	480,401 tons	Pig iron production:	257,010.5 tons at 4779h/1992
Coke:	139,377 tons	Generated blast furnace gas:	496,198,875 Nm3/1992
Fe:	543.3 kg/ton	Utilized blast furnace gas:	476,579,100 Nm3
Lime stone:	2,822 tons	Lost blast furnace gas:	19,619,700 Nm3 (discharged)
Natural gas:	319,800 m3		

Production process: LD converter steel production

The converter has a capacity of 80 ton, and in it, molten pig (75 - 85%), scrap (15 - 20%) and slugging material are mixed and the carbon content of pig iron is reduced by the oxygen.

The excess air introduction is limited. The generated converter gas is cooled and dust is removed from it in a BAUMCO type twin venturi gas cleaner. After the converter process, ingots and cast bars are produced, and the continuous casting expanding is executed. Because of the insufficient suction of the converter, much dust is generated above the hole during oxygen blowing.

During the charging of the material into the LD converter, the air in the fuel storage is extracted by pumping.

1992 Input	Output
Molten pig: 255,068 tons	Steel: 284,524 tons at 2735h
Scrap steel: 65,107 tons	Converter gas: dust 50 g/Nm3, CO 0-60%, CO2 0-24%, O2 0-37%
Oxygen: 17,823,930 Nm3	Combustion exhaust gas: 40,000 Nm3/h
Alloy: 5,244 tons	Waste: 1.3 - 1.5 tons/charge
Cooling water: 250 m3	Cooling water: 250 m3
Additives: burnt lime, spar, pellet, dolomit, bauxite	Dust of ASEA, UHP facilities:10.5 kg/h
	2ndary dust from dust building:495.6 tons/1992
	Dust removal
Refractory brick	Pulverized refractory: 75% debris
	10% reused as brick material,
	13% scattered, 2% discarded

Production process: UHP steel production

Cold scrap steel is heated in 80-ton electric arc furnace and fused. Oxygen is blown into the molten steel through a oxygen lance. Dust is removed with the attached cleaning system, and the smoke is discharged through a duct. Although the dust separation efficiency is proper, no gas remover is installed despite the generation of much contaminants (7 to 13 mg/m3). The dust generated in the fuel storage during loading is removed by suction.

1992: Input	Output
Scrap steel: 39,353 tons	Iron and steel: 34,235 tons
Electric power: 16,928,625 KWh	Dust from machine building: 895.8 tons
Natural gas: 2,292,000 Nm3	Other output: slag, slag dump,
Oxygen: 989,200 Nm3	dust-removal in bunkers,
Alloy: 1,096 tons	burnt electrode, burnt electrode,
Additives: burnt lime, spar,	carbon material, cooling water
ore, dolomite, coke, cooling water,	
refractories	

Production process: ASEA vacuum metallurgy process

The steel made in the converter and in the electric furnace is further processed in the

ASEA vacuum metallurgy facility. Through alloying, oxygen suction, arc heating, and vacuuming, the equality and the temperature of the products are raised, and the gas in the steel is reduced. During the heating, the system discharges much air pollutants. Although a suction unit is connected, its suction is insufficient, and nearly half the air pollutants are discharged into the air. The pollutants contain heavy metals, which are especially dangerous. The fuel storage is provided with a suction system.

1992:	Input	Output
Molten pig:	75,721 tons	Steel: 72,566 tons
Electric power:	4,321,520 KWh	Slag dump: 253 tons

Production process: Refractry brick production

Clay and quartzite are milled separately. Milled materials are formed to pulp and burned at 1320-1340℃ in the furnace.

1992:	Input	Output
Clay:	4,229 tons	Refractory brick: 2,936 tons
Refractory brick:	1,549 tons	
Chrome, ceramic brick:	4,229 tons	
Natural gas:	284,600 Nm3	

Production process: Energy generation

The boiler of the east power station produces steam by burning natural gas and blast furnace gas.

1992:	Input	Output	
Blast furnace gas:	22,055,400 Nm3	Steam:	158,383 tons
Natural gas:	37,054,000 Nm3	Hot water:	115,634 GJ
		Electric power:	7,242 MWh

Production process: Rolling mill

The underground furnace and the shaft furnace for low quality rolling, the pusher furnace for medium quality rolling, and the Heurtey furnace for high quality steel heat ingots for hot rolling, all use mixed gas (natural gas and blast furnace gas) and straight natural gas. The combustion air is preheated in a piped preheater, and the U-flame type underground furnace red-heats the ingots. To heat the ingots coming out of the casting machine, two pushing furnaces and two step beam furnaces are installed. To heat the cast

half-hot and hot ingots again, four post-heating furnaces are used. To slowly cool the rolled products, four underground furnaces are used. For heat treating the products, a twin and OFU furnace are used.

With the heating units, attention must be given to the NOx discharge from large thermal capacity furnaces using natural gas. (Actual measured data: 177 ppm)

1992: used resources

Iron and steel semi-products:	178,343 tons
Natural gas:	23,960,000 Nm3
Electric power:	30,058,278 KWh
Blast furnace gas:	18,769,400 Nm3
Production time:	5215 hours/1992

Production process: Cold rolling

Product scrap treatment and grinding are performed by machines (ingot grinding).

The old ingot grinding machine produces much dust (230 mg/m3).

1992

Production:	54,457 tons
Production time:	6,536 hours/1992
Utilized unprocessed steel and iron:	54,457 tons
Utilized electric power:	1,254,433 KWh

DNM has two metallurgy waste storage, of which one is located in the east site of Miskolc, and close to it, a group of 20,000 residences is located. The dust (from the blast furnace gas electrostatic precipitator), sludge, refractory and other industrial waste, iron-containing dust are brought there. The waste produces dust in varying intensity depending on weather.

The other waste storage is on the plant field, within the fence, occupying nearly 35% of the total factory premises. It is close to the residential area, and is roughly 20 m in height.

Most of the waste consists of the large amount of fused metal waste from the foundry including the steel-making impurities collected in 10 years. The steel-making impurities brought there is a major source of air pollution.

Note) The government of Hungary determined the abolition of DNM blast furnace. They will stop the operation of Blast furnace in future.

At the same time of the abolition of blast furnace, electric furnace are planned to be installed in DNM. A new electric furnace will be installed in OZD, too. Annual production of both DIMG and OZD will be 500,000 tons.

24) R/N:16/0

Company name: CHINOIN RT. DIOSGYORI TELEP (Chemicals)

Production process: Chemicals manufacture

The company was established in 1942, and in 1991, it became a joint venture with SENOFI of France. With US and UK firms also joining in the venture, 51% of the stocks are possessed by overseas share holders.

The headquarters is in Budapest, and one branch is in Diosgyori.

CHINOIN is the largest chemicals manufacturer and marketer in the middle Europe, with 3200 employees in the country, including 53 at this site. The full production capacity is 50 tons per year, but at present, the operation ratio is 60%. The main product is a diuretic.

This operation establishment is scheduled for closing in October 1993, until which time, operation will be continued.

At present, air pollution is slight in both fluid and gas, due to the years of efforts. Although a fine of 1,000 FT was imposed for air pollution by NOx, other pollutants are below the specified levels. The 1,000 FT fine was due to the absence of measured NOx data.

Energy and material requirement for unit ton of product:

Electric power:	2,000 kWh,	Natural gas:	7,500 Nm3,
Disulfonamide:	1.1 tons,	Paraformaldehyde:	0.12 tons.

Materials used per unit charge:

Water or stock solution:	2,000 lit.,	Disulfonamide:	55 kg,
Paraformaldehyde/HCHO/n:	6.2 kg,	Active carbon:	7.0 kg,
Dry air product:	50 kg,	Production time per charge:	16 hrs.

1992 production

Dihidrochlorarit:	12,000 kg
Acetildeseptyl:	23,788 kg
PAMM:	63,950 kg
TMA:	30,825 kg
Total:	130,563 kg

Used natural gas: 809,423 m3/8090 h/1992

Thermal energy production: 21,830 GJ

25) R/N:17/1

Company name: HEJOCSABA CEMENT (cement factory) Kozpont

This company was established in 1975, and at present, 33% of the stocks are owned by a Swiss bank, and the remaining stocks are owned by Hungarian Government. For the complete private control, the stocks of the company are offered for public tender. The future plan is therefore up to the new owner.

The production capacity of the facilities is 1.5 million ton/year, but at present, the operation ratio is roughly 50%. The annual production in 1990 was 1.2 million ton, in 1991, 0.6 - 0.7 million ton, in 1992, 0.52 million ton, and in 1993, it is expected to exceed 0.6 million ton.

At present, there are two clinker kilns, and one of them (rotary kiln) is in operation. This kiln is provided with an electrostatic precipitator. The pretreatment and heat treatment are executed, and after that to the planetary type cooler. The three cement kilns utilizes the circulation type powder mill. The clinker kiln is rated at 20,000 ton/day, the mill, at 200 ton/day, and the cement mill, 100 ton/day. The materials are brought from Kobanya, roughly 6 km away, on a belt conveyer. Clay is brought to the factory from the yielding site, 1.5 km away, by trucks. The products are shipped by trucks and by rail.

In the lime plant, a MAERZ kiln (twin kiln) was introduced from Germany last year. The annual lime production is 550 ton. The facility is provided with bag filters.

The plant process control and monitoring are totally automatically controlled by computers.

Although the future pollution control plans are up to the future owners, the concept of the present management are as follows:

- Although natural gas is advantageous in pollution control, coal is more attractive as the fuel, because of its lower cost, and any pollution control measures to become required by the use of coal may be planned in the future.
- Waste disposal: Both the pretreatment and heat utilization are quantitatively insufficient.
- For dust control, since already bag filters, conveyor hoods and water sprinkler cars are used, supplemented by forestation around the factory, no further measures are thought to be required.
- For air pollution control, in addition to the existing electrostatic precipitators, nothing is further planned.
- Energy-saving: The existing MEARZ type kiln incorporates energy-saving

features already.

- Already 3 years ago, the integrated computer control system for monitoring and controlling the facilities and the processes has been introduced, which has achieved, for example, 5% and 5-10% energy-saving in oil etc. in the clinker production and in the cement mill respectively.

1992

Quarry production: 832,880 t/year(2541h)

Electric power consumption: 1,059,000 KWh/year
Fuel oil: 77.64 t/3379h
Power requirement per ton of quarry: 1.27 KWh/t

Lime calcination: 78,180 t/year(5612h)

Electric power consumption: 2,418,000 KWh/year
Power requirement per ton of product: 33 KWh/t
Natural gas: 9360,480 Nm3

Consumed clinker: 352,173 ton/4884 h/1992

Consumed Natural gas: 39,537,972 Nm3
Consumed Lime: 466,764 t
Consumed Clay : 112,500 t
Consumed Sand : 17,694 t
Consumed Iron ore: 19,006 t

Clinker production: 352,172 t/year

Electric power consumption: 25,484,000 KWh/year
Power requirement per ton of clinker: 73 KWh/t(clinker)
Natural gas: 3,759 KJ/kg(clinker)

Cement production: 497,481 t/year

Electric power consumption: 28,086,000 KWh/year
Power requirement per ton of cement: 54 KWH/t(cement)

Cement transportation: 518,962 t/year

Power consumption in the factory: 60,134,000 KWh/year
Energy per ton of cement: 12 KWh/t(cement)

Amount of material use per hour

CaCO3: 95.6 t
Clay: 23.0 t
Sand: 3.62 t
Iron ore sintering: 3.89 t
Natural gas: 8,095 Nm3

26) R/N:18/0

Company name: STRABAG HUNGARIA EPITO KFT (Strabag Construction Co.)

Production process: Asphalt manufacture

Strabag Co. bought the existing facilities in July, 1992, built completely new facilities, and started full-scale operation from July, 1993. sixty employees are working as of April - December. The main product is asphalt, the production capacity is 60 t/h, the working hours are from 06:00 to 16:00 in one shift, the operation time is 6 to 8 hours daily, sometimes 11 hours, depending on seasons. Monthly operation time is long in summer, 170 hours/month, but the factory remains out of operation from December 15 to the beginning of April. The operation ratio is 60 to 80%.

Bag filters are used to control air pollution, and the collected dust is reused. The aggregate drying furnace uses Beninnhaven burners. The natural gas consumption is 450m3/h. The monthly natural gas consumption for 10,000 ton of manufactured asphalt is 80,000 m3.

During the time from July 7 to October 5, 22,000 tons of products has been manufactured.

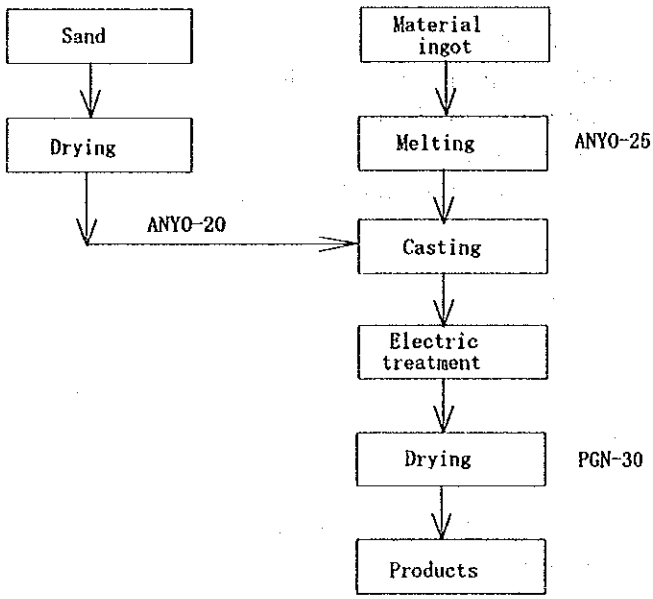
27) R/N:19/0

Company name: FELSOZSOLCAL MEZOGEP VALLALAT (Agricultural machine factory)

This factory is a machine factory of the agricultural association. It was established in 1949, nationalized in 1967, and as of 1993, it is in the process of transfer to private ownership. The factory is manufacturing agricultural machines and parts (roughly 10%) and pump (90%) from aluminum block or aluminum.

The boilers require 78 ton of oil per year. After complete transfer to private ownership, natural gas may be used in place of petroleum.

Process:



Manufacturing process 1:

The hot water needed for heating and washing is supplied by two oil-burning hot water boilers.

Manufacturing process 2:

In the foundry, the sand for sand molds and cores is dried as the required pretreatment. The raw sand containing 20 to 25% moisture is dried in a manually fueled oil-burning rotary drum furnace until the moisture content is reduced to 7 to 8 %.

Manufacturing process: 3:

The cores are dried in an oil-burning furnace.

Manufacturing process 4:

The basic material is melted in an oil-burning crucible. The molten metal is ladled out of the crucible, and is cast into molds and sand molds. Above the melting furnace, exhaust fans are installed.

Manufacturing process 5:

The castings are cleaned with the Model PBO16 sand blaster. In a sealed box, silica sand is blasted onto the casting by compressed air.

Chart:

Production process 1:
Input material:
Fuel oil: 83 ton
Water:

Hot water production:
↓ output semi-product, product
Hot water, 1000 m3
↓ Air pollutant
SO2, CO, NOx, solid particle

Production process 2:
Input material:
Fuel oil: 2 ton
sand:

Dry sand
↓ output semi-product, product
Dry sand, 16 tons
↓ Air pollutant
SO2, CO, solid particle

Production process 3:
Input material:
Fuel oil: 2 ton
sand core

Dry core
↓ output semi-product, product
Dry core, 6 tons
↓ Air pollutant
SO2, CO, solid particle

Production process 4:
Input material:
Fuel oil: 2 ton
Aluminum ingot

Molten aluminum
↓ output semi-product, product
Aluminum casting 87 tons
↓ Air pollutant
SO2, CO, solid particle

Production process 5:
Input material:
Crushed sand: 1.8 ton
Various mold

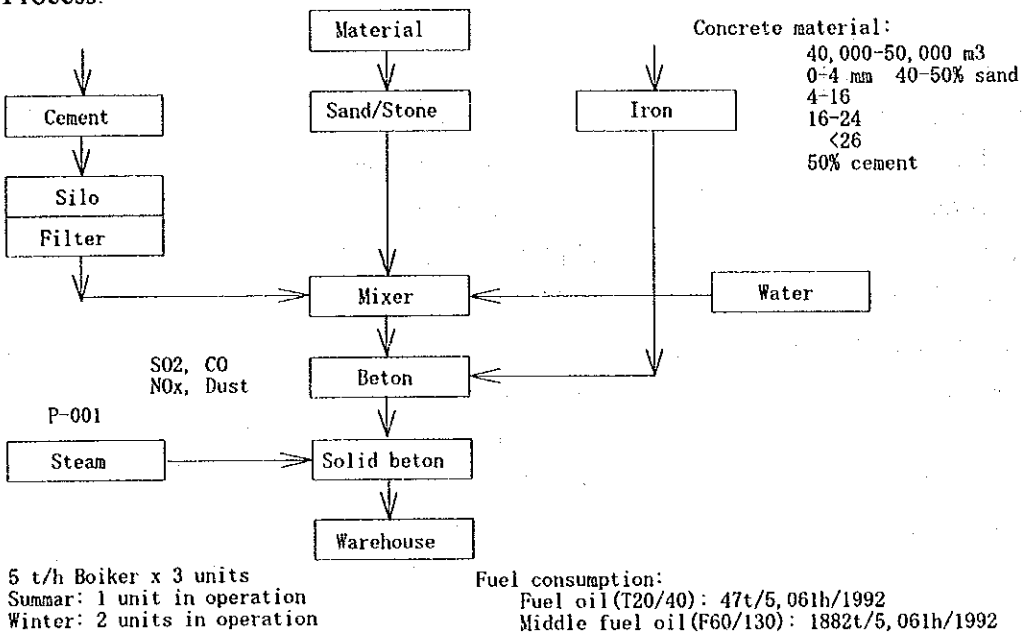
Sand blasting
↓ output semi-product, product
Sand-blasted castings 28 tons
↓ Air pollutant
Solid particle

28) R/N:20/0

Company name: ALSOZSOLCAI VASBETONIPARI VALLALAT(Steel frame building company)

This company manufactures steel towers for electric power lines, roofing tiles, roof panels, etc. The company was nationalized in 1963 and was reorganized into private-owned limited liability company on July 1, 1993. The present operation ratio is roughly 30%, 538 employees are working at present, but the number is expected to be reduced to 340 towards the end of 1993. (1,300 between 1967 and 1970, and 1100 in 1990)

Process:



Description of facility:

Fuel oil is brought on rail, at a temperature not exceeding 50℃, pumped into the underground insulated fuel intermediate tank, and maintained warm by steam. Then, it is transferred to the daily tank where it is maintained at 60 - 80℃. Then, it is pumped to the preheater and circulation-heated to 95℃ (min.). The heated oil is forced into the rotary cup type oil burner under a pressure of 1 bar. Combustion air is forced to the heater with a fan and then to the burner for atomizing and burning the oil. The exhaust smoke is discharged through the stack by means of a 10-20 mmV.O. suction fan. For heating and aging with steam, heat exchangers are used.

The condensate is almost entirely returned to the boiler, and utility water treated with ion-exchange softener is used to makeup for the evaporation loss.

29) R/N:21/0

Company name: EMO. TEGLA ES CSEREPIPARI VALLALAT MALYI TEGLAGYARA

(Brick factory MALYI)

Production process: Brick manufacture

This brick factory was established in 1952, and at present, it is operating at 30 to 35% of its capacity, employing 119 workers. The bricks are dried, and then, fired in the Hoffman Mixture furnace by natural gas.

Since the facility is fully up to date, no change is possible now.

According to 1992 data:

Total product bricks during drying:	39,864,000 pieces/6144h
Finished bricks:	38,226,000 pieces/5040h
Coal consumption:	121 ton/year
Natural gas:	2,923,000 m3/year
Natural gas for boiler:	80,000 m3
Natural gas for central heating:	60,000 m3
Wood powder:	4,770 tons/year
Clay:	78,833 tons
Electric power:	4,471 MW/year
Unit heat consumption:	4 MJ/brick

Material consumption per hour

Clay:	15.64 tons/h
Wood powder:	0.95 tons/h
Natural gas:	232 Nm3/h

30) R/N:22/0

Company name: MISKOLCI UTEPITO KFT NYEKI ASZFALTKEVERO (asphalt factory)

This factory started operation in 1968, and thereafter, expanded gradually by adding facilities. After 1985, efforts were made to improve the facilities, installed bag filters (Hungarian, with the filters made by Zetler in Germany) in 1985, and two years ago, the facilities were nearly completely refreshed by a major maintenance work.

Process:

The quarried stone, sand and gravel are brought into the drying drum on belt conveyors. These materials are mixed in the drying drum, and dried by the heating with natural gas at 240℃. Then, roughly 8% of heated bitumen and 8 to 12% of lime are added to the dried and heated base materials. The bitumen is heated with natural gas. The whole is mixed in the mixer, and the mixed product, asphalt, is shipped via the silo.

Process flow:

No. 1 Pretreatment in mixer
No. 2 Drying drum
No. 3 Separation
No. 4 Weighing
No. 5 Mixer
Forwarding

Material mixing proportion	
Bitumen (SZB90):	6 %
Lime:	10 %
Sand (0-1, 0-2):	18 %
Stone (0-5):	30 %
Andezit stone (5-12):	36 %
Total:	100 %

Consumption per unit ton of product	
Natural gas:	9.4 Nm3
Electric power:	4.6 KWh
Bitumen:	60 kg
Lime:	70 kg

1992 production

Type	Production (ton)
AB 12	33,493 tons
JU 35	11,252 tons
MKEK 35	10,147 tons
K 20	7,981 tons
AB 8	3,150 tons
MA 12	3,796 tons
KAB 12	1,177 tons
Total	70,996 tons

31) R/N:23/1

Company name: TISZAI VEGYI KOMBINAT (TVK) (TISZAI Chemical Complex)

Production process: Olefin

Having been established in 1961, the complex was reorganized as a joint stock company in 1992, and the main products are petrochemical products, olefin (gasoline and oil processing), ethylene, propylene, and polyethylene. The number of employees is 5,500.

Process:

A. Thermal decomposition

Gasoline --------Thermal decomposition gas (820-840℃) Ethane ---------- Ethylene (950℃)

B. Heating and rectification

Thermal decomposition gas--------Olefin/C2H4, C3H6, C4H8, C5-, C6-/gasoline, H2

Heating: fluid ethylene, fluid propylene

Steam production:250-27- ton/h, 11MPa, 530℃

40 ton of steam is purchased from power company (15 to 20% of total)

For the production of 1 ton of ethylene, 242 kWh of power and 3.5 ton of gasoline are required.

Hourly production (tons)

Ethylene: 31.3

Propylene: 15.63

Thermal decomposition gasoline: 25.0

C4-: 10.0

Hydrogen: 1.25

1992 production

Ethylene: 280,906 tons

Polyethylene: 139,642 tons

(Note) With this factory, soil contamination is a problem.

It is the issue of soil contamination by HC, which is 20-year old. The factorypurchased an ethylene plant from the USSR in the 1990s, and after 4 years of operation, the soil became contaminated. No effluent treatment system was present, and the effluent was all discharged into the water reservoir pond. A study in 1991 revealed that the soil below 3m from the surface was contaminated. Several thousands ton of soil is contaminated. The factory is working out a concrete remedial plan, according to the factory.

Production process: Ammonium nitrate

Process: Reaction formula of Ammonium nitrate

$$HNO3 + NH3 = NH4NO3$$

For the production of 1 ton, required energy, nitric acid and ammonia are follows:

Steam: 0.37 tons

Electric power: 15 KWh

NH3: 0.42 tons

HNO3: 0.79 tons

Material consumption	Hourly production	1992 production
NH3: 25.0 tons/h	NH4NO3 : 62.5 tons/h	72,164 tons/year
HNO3: 49.4 tons/h		

Demisters and filters are used as elimination of ammonia nitrate. Absorption ratio is 70-80 %.

Production process: Nitric acid

The 100 m stack of this factory is discharging yellow smoke. The current operation ratio is 30%. (500,000 tons/y x 0.30=150,000 tons/year) for 1993. There are nine production lines in the factory, but actual operating lines are four.

Process: 800 - 820℃ (Pt. Cat)

$4NH3 + 5O2 \text{----------} 4NO + 6H2O$, $2NO + O2 \text{-------} 2NO2$

$4NO2 + O2 + 2H2O \text{--------} 4HNO3$

Energy and power required to produce 1 ton of 100% v/v HNO3 :

Steam:	0.14 ton
Electric power:	227 KWh
NH3:	0.5 tons
Maximum NH3 consumption per hour:	20,000 Nm3/h
HNO3 100 v/v% production:	Max. 50.0 tons/h
1992 production:	63,945 tons

Measures for NO, NO2:

Denitration equipment was installed in 1993. The other three lines are planned to be installed denitration equipment, because the first installed shows good result.

Process: 230-300℃

$$NO + NO2 + 2NH3 \text{ ---------- } 2N2 + 3H2O$$

(Cat. V2O5/Al2O3)

The emission of exhaust gas is 18,000 - 20,000 Nm3/h. NOx concentration reduced from 0.2 % to 0.05 %. Catalyst is imported from overseas. Ammonia cost is 100 US$/t (from Russia), 130-140 US$/t (from Europe). All costs of three lines equipment (containing catalyst) is 31,000,000 FT.

Production process: incinerator

The factory seems to be intending to modernize the incinerator. Whole same facility is planned to be installed in present facility side. Object materials are the only same waste as the present. It is also possible to treat other company's waste. Now (Mar.3.1994) TVK is talking over with EKF. Environment funds is proposed, the proposal is planned to be executed as soon as decision of it.

New incinerator will be completely established in Sep.1.1995. Total cost is 500 million FT. It is applied to the standard based on 1991. It is satisfaction for concentration limit value of 11/1991 law.

Plan concept:

Treatment capacity: 5,000-6,000 t/year

Operation hour: 24 hour/day

Additional equipment: Reheater

Fuel: Natural gas for ignition and assisting combustion

Stack height: not decided

Waste content: Sulfur caused by production of polypropylene.

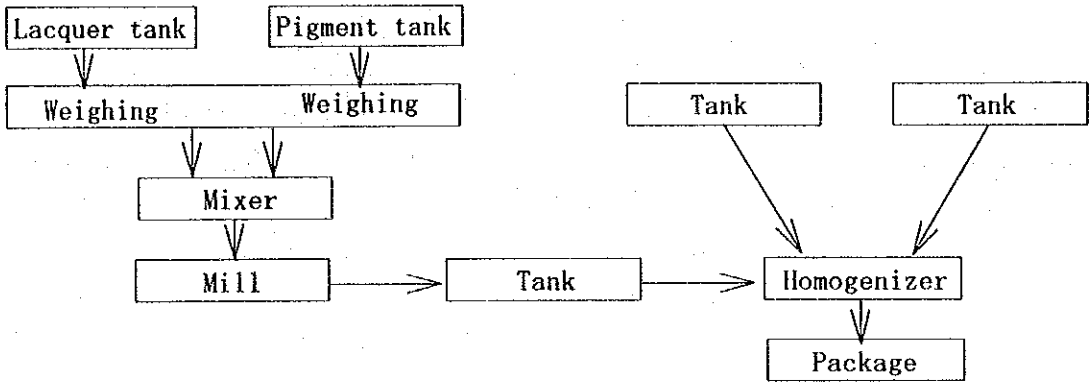
Dissolution amount:Sludge of HC, solid plastics, paper, packing materials, waste of semi-products, etc. Whole amount of waste is 4,000 -4,500 tons/yea. Further the treatment capacity of existing facilities(3 units) is 6,500 tons/year. The treatment exhaust gas (HCl, fly ash, dioxin, etc.) is not decided.

32) R/N:23/2

Company name: AKZO-TVK FESTEKGYARTO ES KERESKEDELMI RT(Paint factory)

The company was established in 1960, and on May 1, 1990, it became an independent joint venture company between Holland (51%)and TVK (49%). It is the largest paint company in Hungary. The factory is located in the premises of the TVK Chemical's works. The current operation ratio is roughly 30%, and 382 workers are in the employment.

Process:



Total production in 1992: 19,400 ton

Natural gas consumption: 425,708 m3/1992

Exhaust gas (P-058)

xylene:	0.358 kg/h	ethyl benzol:	0.0067 kg/h
n-buthyl benzol:	0.086 kg/h	ethyl acetone:	0.0208 kg/h
petrol:	0.0701 kg/h		

Change of annual production (ton/year)

Year	Total	Synthetic resin	Paint+lacquer	Adhesive+solvent
1987	46,953	-	46,953(total)	-
1988	82,723	20,417	42,306	20,000
1989	51,419	17,169	24,508	9,742
1990	38,113	13,051	17,089	7,904
1991	23,639	7,955	9,694	5,990
1992	19,401	5,711	7,746	5,944
1993	12,000	4,000	5,000	3,000

Note) Annual production in 1993 is inference value.

33) R/N:24/0

Company name: MOL RT (Hungary Oil Gas Co.)

This oil refinery started construction in 1972 and started operation from 1979 through the 1980s. Its oil refining capacity is 3 million ton per year, producing gasoline, gas oil, fuel oil, propane and butane. It has a million m3 tank. In 1982, its annual production was 3 million ton. The refinery is capable of increasing the gasoline production by adding additives and also to produce isobutylene (IB) by MTBE-separation. It remained TRUST until 1991, and then reorganized itself into a joint stock company under the name of MOL. It has 700 employees, up-to-date facilities, and its pollution control facilities are newly designed ones, including extra-high stacks. On the other hand, the oil price did not rise as expected, and the production decreased, although consumption trend is as predicted. At present, the refinery is only producing at an annual rate of one million ton.

With respect to pollution, among the initially installed boilers, those which were burning high-sulfur fuel oil were remodeled, so that now no more high-sulfur fuel oil is used, and only generation gas and natural gas are burned.

The warehouse tanks are of the floating top type. The pipeline (90%) is well equipped, and leak during the tanker loading is minimized. Incinerators have been completed in 1982, and there is also an ash storage. In addition, there are monitors wells in 12 locations.

Resources required for a unit ton of products:

Electric power:	24 KWh
Steam:	66.6 kg
Crude oil:	1.1 tons
Crude oil consumption:	115.7 tons/h
1992 annual production:	672,400 tons

(Fuel oil:285,000ton, diesel oil:246,000 tons, gasoline:138,000 tons, S:3,400 tons)

Annual product hour: 5927 h/year

Material consumption

Crude oil:	686,000 tons
Heating oil and other:	549,000 tons
Hydrogen:	2,900 tons

Natural gas and generation gas: 26,910,028 m3/year

Incinerator

Burned rubbish:	3163 tons/5580 h/1992
Oily sediment	1713 tons
Oily sediment:	1286 tons
Solid waste:	163 tons

Pollutants

SO2:	1 - 4.6 kg/h	Exhaust gas:	23760 m3
CO:	0.7 - 1.22 kg/h	Temperature:	55 ℃
NOx:	0.95 - 1.94 kg/h		
Dust:	1.8 kg/h		

34) R/N:25/1

Company name: TISZAI EROMU RT. I. HOEROMU (TISZAI Thermal Power Station 1)

Production process: Electric power

This thermal power station was constructed for the purpose of supplying electric power and heat, and started operation during 1957 to 58. The installed capacity was 230 MWe. The main facilities include 8 units of 125-tons/h powder coal combustion boilers.

The electric power is supplied to the national grid, and the heat (in hot water and steam) is supplied to the community residence heating, chemical plants, TVK and oil refinery in Tiszai.

The coal is brought from borsodo and western Hungary, and is pulverized in hammer mills for feeding into the boiler banker with conveyors. The flue gas of the boilers is discharged through the stacks after passing through the electrostatic precipitators. The separated ash is discharged by the water system in the form of slurry.

1992

Input		Output	
Coal:	1,328,871 tons	Electric power:	932.46 GWh
Natural gas:	39,307,400 m3	Thermal energy:	2,422,451 GJ
Oil:	476 tons		

Facility improvement plan:

Introduction of continuous discharge monitoring system for boilers.

35) R/N:25/2

Company name: TISZAI EROMU RT II HOEROMU (TISZAI Thermal Power Station 2)

Production process: Electric power

This power station was constructed for the purpose of electric power generation, and started operation during 1977 to 78. The station is located close to TISZAI 1 station, 3 km from Tiszaujvaros. It has 4 blocks consisting of oil and gas mixed combustion boilers. The installed capacity is 860 MWe, and the generated power is supplied to the national grid.

The flue gas from the boilers is discharged through the stacks without electrostatic precipitators. At present, no special pollution control facility nor unit is in use. Preheating of fuel oil by heat exchange with the exhaust gas, containing high level of SO2, may corrode the system. Preheating with electric power or steam is under consideration as a solution. (Preheating is for energy-saving.)

1992

Input	Output
Natural gas: 282,938,000 Nm3	Power generation: 2,615.66 GW
Inert gas: 491,524,000 Nm3	
Fuel oil: 181,230 tons	

Future plan for remedial measure

Installation of continuous discharge monitoring system with calculation and data collection functions.

36) R/N:26/0 --- 26/9

Company name: MISKOLCI HOSZOLGALTO VALLALAT(Miskolc District Heating Center)

In 1979, a prefectural central heating company was established, and in the city of Miscolc, 10 districts were centrally heated. In 1990, the heat supply was covering 62% of the city, consisting of 5,500 households. In June 30, 1992, a new autonomous community law was introduced, to disorganize the prefectural central heating company, and to establish Miskolic Heating Company on October 1 in the year. At present, the company is supplying heat to 32,000 households, 50% of the Miskolc city residents. The total heated building volume is 6 million m3, of which 1/4 is public buildings and 3/4 is private residences.

The 83% of the consumed energy is being purchased from an outside company (Miskolci Futomu Kft), and 17% is generated by the 10 boiler houses of the company's heating center. At present, these 10 boiler houses are not using oil as the fuel; One only using coal. The coal-burning boiler house is planning for conversion into natural gas combustion during 1994-1995, but since its heat receivers are only 160 households, with the other 9 boiler houses burning natural gas, air pollution is slight as a whole. The operation ratio is 60%.

Charge rate system:

The room temperature is maintained at 20℃, and the charge is based on the room volume. In Miskolc City, of the total charge of 1454.3 ft, citizens pay 35 ft. In Miskolc City, central heating is 50%, and otherwise, no subsidy is given. The basic rate for heating is 85 ft/m3/year, and the winter rate is 97ft/m3. The basic rate for hot water is 19 ft/m3/year, and the consumption rate is 92 ft/m3.

Figure 1.1.5 shows the locations of the 10 boiler houses of the heating center, and Table1.1.3 shows the monthly fuel consumption. Figure 1.1.5 shows the number of buildings, the heated building volume, the boiler types in use, the number of boilers, the total boiler capacity, and the number of stacks for the respective centers.

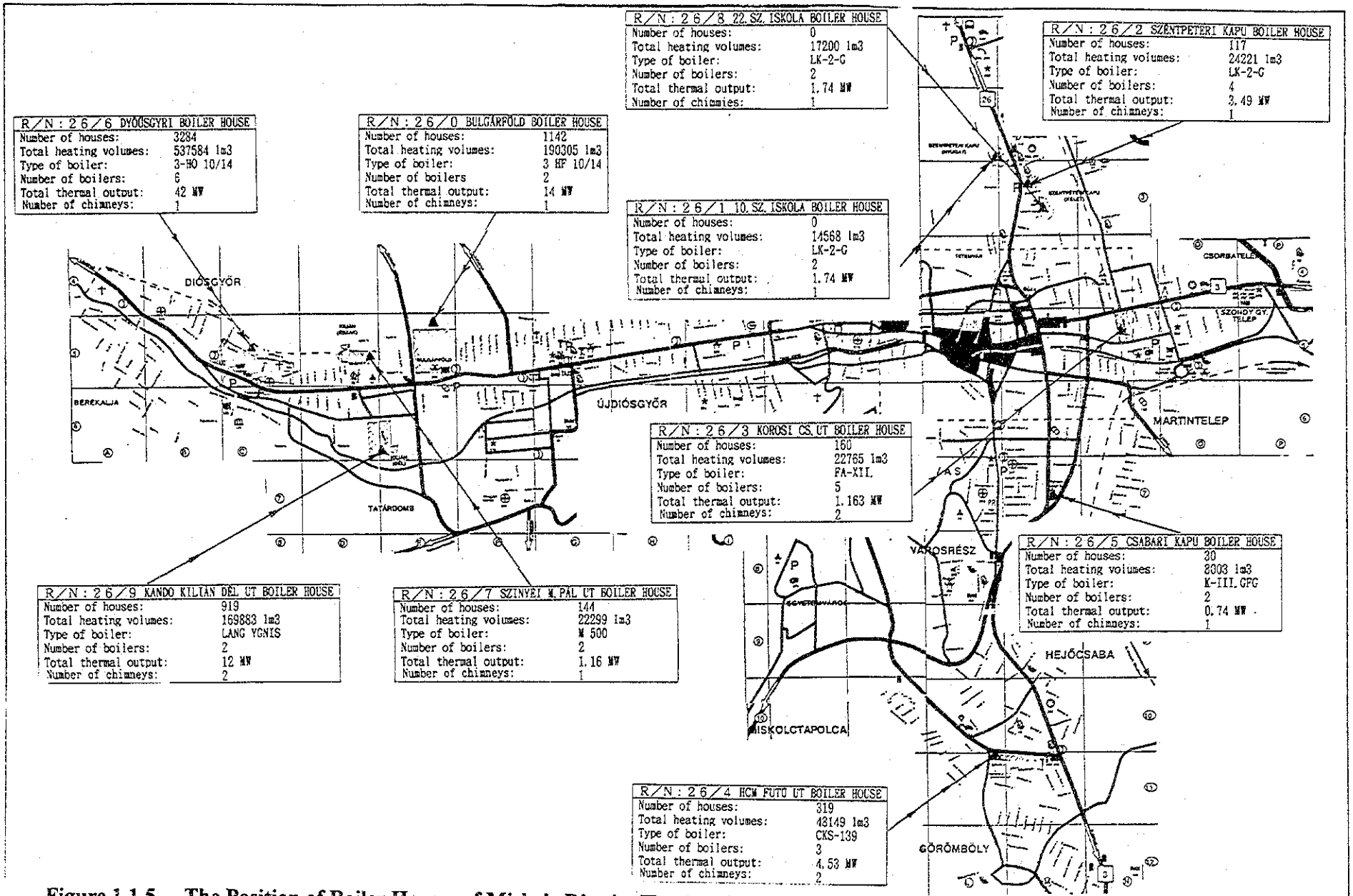


Figure 1.1.5 The Position of Boiler Houses of Miskolc District Heating Center

Table1.1.3 Energy and Fuel Consumption by Miskolc District Heating Center

	1992	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
		GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ
	Miskolc C.	180,699	153,221	133,295	73,604	23,700	19,866	21,672	20,865	22,588	81,011	126,855	172,091	2,119,672,553
	Avas-D	161,293	131,067	114,201	65,653	21,387	17,476	18,889	17,690	20,765	74,499	116,113	151,695	1,874,278,224
	Total	341,992	284,288	247,496	139,257	45,087	37,342	40,561	38,555	43,353	155,510	242,968	323,786	3,993,950,777
	N.Gas	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
R/N:26/0	BULGARFOLD	451,821	360,727	316,580	202,238	70,188	63,182	53,828	51,571	66,604	179,662	350,086	424,869	2,591,356
R/N:26/1	10- ISKOLA	26,111	19,634	15,991	7,266	0	0	0	0	0	10,486	15,458	22,365	117,311
R/N:26/2	SZENTP. K	64,899	53,297	44,511	23,770	8,904	8,201	7,527	6,956	8,001	29,952	45,726	60,359	362,103
R/N:26/4	HCM FUTU	122,580	100,950	88,785	51,976	21,527	17,649	16,131	15,861	15,861	4,443	78,573	108,916	643,252
R/N:26/5	CSABAI K.	20,852	17,284	15,760	7,559	0	0	0	0	0	9,912	15,856	20,285	107,508
R/N:26/6	DIOSGYOR	1,346,773	1,204,857	955,960	590,753	217,488	221,928	157,427	152,212	178,764	598,713	987,387	1,292,791	7,905,053
R/N:26/7	SZINYEI M.	49,071	48,117	33,645	19,353	0	0	0	0	0	17,722	36,280	51,907	256,095
R/N:26/8	22-ISKOLA	38,856	26,896	23,743	10,103	7	0	0	0	0	12,310	20,358	30,656	162,929
R/N:26/9	KILIAN	310,000	287,970	231,568	118,889	1,602	1,849	911	911	900	96,388	229,286	305,177	1,585,451
	TOTAL	2,430,963	2,119,732	1,726,543	1,031,907	319,716	312,809	235,824	227,511	270,130	959,588	1,779,010	2,317,325	13,731,058
	Coal	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
R/N:26/3	KOROSI	190,000	168,400	99,300	50,900	0	0	0	0	0	60,000	113,900	120,000	802,500

	1993	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
		GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ	GJ
	Miskolc C.	175,737	162,388	138,215	71,102	23,061	18,204	21,041	22,370	21,380				1,222,533,401
	Avas-D	154,165	140,618	119,240	62,104	20,129	16,439	18,571	17,979	19,680				1,059,240,919
	Total	329,902	303,006	257,455	133,206	43,190	34,643	39,612	40,349	41,060				2,281,774,320
	N.Gas	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
R/N:26/0	BULGARFOLD	451,847	400,076	353,841	200,062	63,046	56,791	54,254	55,050	59,358				1,694,325
R/N:26/1	10- ISKOLA	24,941	20,802	16,209	7,314	0	0	0	0	0				69,266
R/N:26/2	SZENTP. K	64188	57,500	47,907	22,833	7,675	7,503	6,800	6,315	7,243				163,776
R/N:26/4	HCM FUTU	111,344	90,457	86,827	44,865	19,165	18,667	18,005	17,627	17,617				424,574
R/N:26/5	CSABAI K.	21,338	17,361	14,626	6,082	0	0	0	0	0				59,407
R/N:26/6	DIOSGYOR	1,320,439	1,191,882	998,458	535,239	184,274	159,807	146,086	152,264	162,198				4,850,647
R/N:26/7	SZINYEI M.	51,110	44,939	43,601	22,477	0	0	0	0	0				162,127
R/N:26/8	22-ISKOLA	34,658	28,717	22,021	8,339	0	0	0	0	0				93,735
R/N:26/9	KILIAN	337,945	285,818	263,979	140,595	1,057	584	603	507	626				1,031,714
	TOTAL	2,417,810	2,137,552	1,847,469	987,806	275,217	243,352	225,748	231,763	247,042				8,613,759
	Coal	kg	kg	kg	kg	kg	kg	kg	kg	kg				
R/N:26/3	KOROSI	120,200	125,000	116,000	406,000	0	0	0	0	0				767,200

37) R/N:27/0

Company name: MISKOLCI FUTOMU KFT (District Heating Center)

Production process: Hot water, steam

Miskolc District Center Heating Limited Liability Company was established in 1978. The company is supplying heat and hot water to the users in the city of Miskolc and the town of Avas. The number of employees is at present 121.

The heat generation in 1991 was 2,161,178 GJ, and in 1992 was 2,183,794 GJ, indicating the steady generation. The operation ratio of the facilities is roughly 20%.

Hot water:

It has two PTVM100 (100 Gcal/h) hot water boilers and two PTVM50 (50 Gcal/h) boilers. The two PTVM100 boilers are connected to a 150 m stack, and the two PTVM50 boilers, to a 80 m stack, for smoke discharge. All the four are for natural gas and fuel oil combustion, but fuel oil (S: 2-4%, max. 4.5%) is used only seldom by two PTVM boilers. The PTVM50 boilers are equipped with 12 burners, and the PTVM100 boilers, with 16 burners, with the number of burners in combustion adjusted according to the load. The oxygen concentration for combustion is adjusted at 3 to 4%. For combustion analysis, an O2 gauge, a CO gauge and a CO2 gauge are installed. The NOx concentration is measured by an outside agent twice a year. (The value is below the Hungarian official level.)

Steam:

Steam is supplied to various facilities, for degassing processes, for oil preheating and for pressure stabilization. For degassing and preheating, a 12 t/h boiler LANG-TGNIS (made in Hungary) is installed, and this boiler also covers other two companies (TUKI and KIPSZER) with heating. When this boiler is brought out of operation, there is an emergency pipeline for receiving steam from DNM East Power Station. For stabilizing the system, one 2 t/h boiler was installed in the last quarter of 1991. The fuel natural gas consumption in 1992 was 56,795,600 m3. The monthly fluctuation of consumption is large, ranging from the maximum of 11,000,000 m3 in January and December to the minimum of 1,310,000 m3 in August. Fuel oil consumption is 3,720.8 ton per year.

The heat and hot water supply to the city of Miskolc is as shown in Table 1.1.4.

April to October: Hot water only. In other months, to the hot water supplying to private residences, and heating.

Table 1.1.4 Fuel Consumption

Year	Month	PTVM50 Avas Boiler for hot water		PTVM50 Belvaros Boiler for hot water		PTVM100 Avas Boiler for hot water			PTVM100 Belvaros Boiler for hot water			YGNIS 12 t/h Boiler for steam		HDK 2 t/h Boiler for steam			
	Name	Natural gas	Operation	Natural gas	Operation	Natural gas	Heavy oil	Operation	Natural gas	Heavy oil	Operation	Natural gas	Operation	Natural gas	Operation		
		1000 m3	hour	1000 m3	hour	1000 m3	ton	hour	1000 m3	ton	hour	1000 m3	hour	1000 m3	hour		
1992	Jan.	-	-	1023.0	312	4806.5	-	741	5180.9	-	742	558.8	743	32.8	743		
	Feb.	-	-	47.1	24	3974.1	-	693	3789.2	713.870	695	416.6	570	53.0	696		
	Mar.	297.1	67	162.5	76	1676.6	1407.506	674	1644.6	1076.746	665	369.5	492	57.7	738		
	Apr.	-	-	787.7	474	1598.0	444.110	720	404.0	10.350	246	390.5	720	61.9	720		
	May.	-	-	49.5	38	554.8	68.220	544	8.9	-	6	331.3	738	67.5	738		
	Jun.	440.9	441	190.3	205	26.3	-	28	304.7	-	391	231.3	552	49.5	552		
	Jul.	516.1	744	515.9	744	-	-	-	-	-	-	314.5	731	54.5	741		
	Aug.	458.9	744	458.9	744	-	-	-	-	-	-	341.6	740	50.6	744		
	Sep.	549.0	458	46.0	38	-	-	-	-	-	-	241.0	576	41.0	720		
	Oct.	3329.4	645	1238.9	240	-	-	-	-	-	-	-	-	39.7	744		
	Nov.	1058.1	202	823.2	195	3050.0	-	518	3121.8	-	525	-	-	44.1	720	Natural gas	Heavy oil
	Dec.	-	-	-	-	5375.0	-	732	5456.4	-	743	-	-	47.9	744	Total(m3)	Total(ton)
	Total	6649.5	3301	5343.0	3090	21061.3	1919.836	4650	19910.5	1800.966	4013	3195.1	5862	600.2	8600	56,759,600	3,720.802
1993	Jan.	-	-	-	-	5,182.5	-	744	5,415.8	-	744	-	-	51.7	744		
	Feb.	-	-	-	-	4,738.2	-	6722	5,051.3	-	672	-	-	49.0	672		
	Mar.	524.4	168	817.8	240	3,280.6	-	624	3,004.0	-	509	-	-	52.8	744		
	Apr.	227.6	274	1891.9	706	1,953.2	-	435	-	-	-	-	-	53.5	720		
	May.	531.5	527	490.6	527	-	-	-	-	-	-	-	-	45.3	744		
	Jun.	438.4	459	146.1	153	-	-	-	-	-	-	-	-	35.4	620		
	Jul.	468.3	527	210.4	204	-	-	-	-	-	-	-	-	48.1	744		
	Aug.	412.0	527	546.1	527	-	-	-	-	-	-	-	-	48.7	744		
	Sep.	484.0	559	284.3	255	-	-	-	-	-	-	-	-	44.4	720		

38) R/N:28/0

Company name: MISCOLCI EGYETEM EROMU (Miscolci University)

Miskolc University, with a campus area of 90 ha, including 40 ha of park, consists of 5 colleges, and 4,500 students are studying under 1600 professors and other faculty members. The total building volume is 800,000 m3, including 600,000 m3 requiring heating, of which 60% is centrally heated, and 30%, individually heated. The monthly hot water requirement is 4,000 m3, and most of this is received from the district heating center in the city.

The university was established in 1949, and at that time, coal heating was planned, and still today, 3 coal-burning boilers are remaining, of which one is serving as an emergency boiler. The three coal-burning boilers consist of one 3.5 ton unit and two 7.5 ton units. At present, one each oil-burning boiler rated for 10 t/h steam generation and for 7 t/h generation are operational, and the 7 t/h unit covers 30% of the demand. Mainly this 7 t/h boiler is used, burning standard F60/130 oil. The total facility capacity is 35.5 t/h, but the 7 t/h boiler is mainly used, the operation ratio is only 20%.

The heating period is from October 15 to April 15. Since 1984, the university is purchasing 65% of the heat from District Heating Center in the city.

The energy sources of the university in 1992 are as follows:

Sources	Consumption/year	Cost/yea	MJ/unit	Ft/MJ
Heating oil	1,228 t	14,830,000 FT	40,200 MJ/t	0.30
Natural gas	113,081 m3	1,308,000 FT	34,000 MJ/1000m3	0.34
District heating center	45,451,000 MJ	41,741,000 FT	-	0.92
Electric energy	3,838,728 KWh	19,639 FT	3,600 MJ/1000KWh	1.42

39) R/N:29/1 --- 29/4

Company name: SAJOSZENTPETERI HOSZOLGATATO VALLALAT (District Heating Center)

Sajoszentpeter is a town, with a population of 14,500 in 4,500 households. The total town budget is 470,000,000 ft a year.

The town public service department is providing such services as sewer, street repair, pedestrians' walk expansion, and district heating center. The least adequate of all the public service is district heating center.

The district heating center became separated from the public service department, and started self-paying operation with four boilers supplying heat and hot water to 348 households. All the boilers are installed on the top of the collective housing buildings. It is a district heating center operated by one head and 7 employees.

The heating period is from October 15 to April 15, 24 hours a day, and supplying hot water all the time.

The four facilities and fuel consumption are outlined in Table 1.1.5. Figure 1.1.6 shows the locations of four facilities for district heating.

Table 1.1.5 The Fascilities and Fuel Consumption for District Heating Center

No. R/N	Site	Boiler			Fuel		No. ofreceivers	No. of Stacks
		Unit	Capacity	Output	Kind	Consumption	Households Publ. bldg.	
29/1	S-szentpeter Petofi u.	2	0.348 MW/pc. 0.696 MW	5025 GJ	Natural gas Natural gas	191103 m3/8784h/1992 170785 m3/8540h/1992	80 -	1 (1)
29/2	S-szentpeter Kossuth	4	0.290 MW/pc. 1.16 MW	7681 GJ	Natural gas Natural gas	281091 m3/8784h/1992 261172 m3/8540h/1992	116 12	1 (3)
29/3	S-szentpeter Mora F. 24	2	0.174 MW/pc. 0.348 MW	3310 GJ	Natural gas Natural gas	124731 m3/8784h/1992 112540 m3/8540h/1992	48 -	1 (1)
29/4	S-szentpeter Mora.F.u.30	2	0.348 MW/pc. 0.696 MW	6338 GJ	Natural gas Natural gas	248913 m3/8784h/1992 215509 m3/8540h/1992	104 -	1 (1)

Upper row: Questionnaire data
Lower row: EKF data

Note) Entry in () is inactive.

No. R/N	Site	Boiler Unit	1992				1993		
			I	II	III	IV	I	II	III
			Jan.-Mar.	APr.-Jun.	Jul.-Sep.	Oct.-Dec.	Jan.-Mar.	Apr.-Jun.	Jul.-Sep.
29/1	S-szentpeter Petofi u.	2	29218 m3/ month 24 h	9479 m3/ month 24 h	3733 m3/ month 24 h	21271 m3/ month 24 h	28350 m3/ month 24 h	10600 m3/ month 24 h	3450 m3/ month 24 h
29/2	S-szentpeter Kossuth	4	41185 m3/ month 24 h	11466 m3/ month 24 h	4846 m3/ month 24 h	36200 m3/ month 24 h	39600 m3/ month 24 h	12000 m3/ month 24 h	4538 m3/ month 24 h
29/3	S-szentpeter Mora F. 24	2	19313 m3/ month 24 h	6033 m3/ month 24 h	3065 m3/ month 24 h	13166 m3/ month 24 h	18900 m3/ month 24 h	6200 m3/ month 24 h	3309 m3/ month 24 h
29/4	S-szentpeter Mora.F.u.30	2	37541 m3/ month 24 h	12992 m3/ month 24 h	5624 m3/ month 24 h	26814 m3/ month 24 h	35900 m3/ month 24 h	13500 m3/ month 24 h	6050 m3/ month 24 h

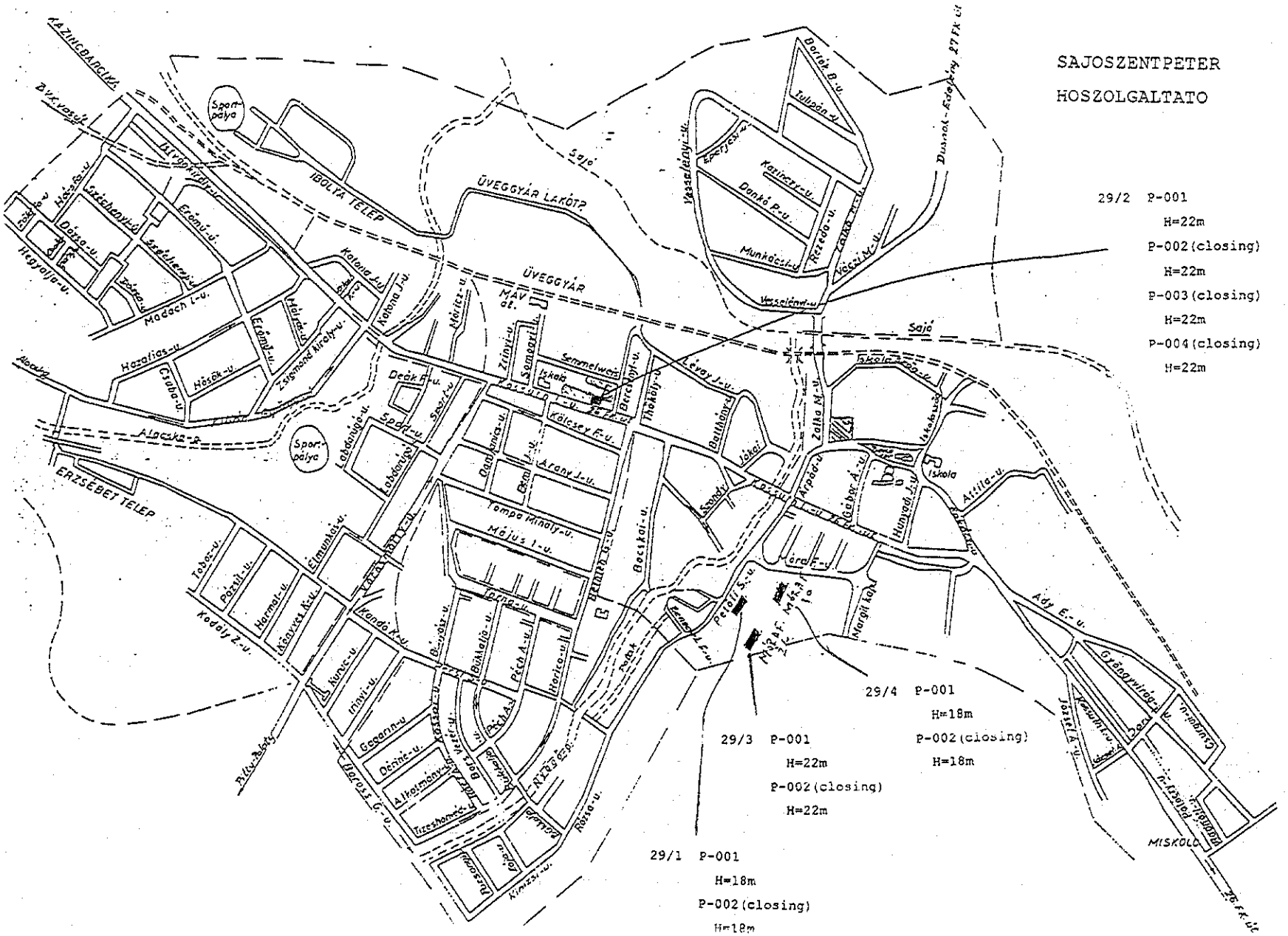


Figure 1.1.6 The Position of Sajoszentpeter District Heating Center

40) R/N:30/0

Company name: EMOD NAGYKOZSEG GONDNOKSAGA(Emod District Heating Center)

Emod District Heating Center is under the management of the city of Emod. It is a very small center supplying heat to 42 private residences and two public buildings. The heating period is from October 15 to April 15, 24 hours a day operation. Every day, two boilers operate 24 hours, and on special cold days, three boilers operate. The boilers burn diesel oil, consuming 25 lit./h per boiler, and when two boilers operate 24 hours, the daily consumption is roughly 800 lit.

The facilities are outlined below:

Site:	Eode Vorosmarty Ut. 2
Boiler:	4 units
Boiler capacity:	0.326 MW/pc. (1.304 MW/4 boilers)
Production:	5,040 J
Fuel kind:	Heating oil
Fuel consumption:	125.41 t/4728h/1992
Receiver:	42 (Households) and 2 (Public building)
Stack:	1 unit

41) R/N:31/0

Company name: PUTNOK VAROSI HOSZOLGALTATO UZEM(Putnok District Heating Center)

The town of Putnok, with a population of roughly 8,000, in 2500 households was born 10 years ago. The former nationally operated heating center is now operated by the town government, and is supplying hot water to 456 households and five public facilities (kindergartens and banks). The supply households has increased from 290 in 1978-1985 to 456 during 1985-1993, but the number of public facilities remained at 5.

The breakdown of the 456 households into districts is as follows:

District	No.of households	Building heated volume (m3)	(%)
I	290	55,324	68.19
II	166	25,806	31.81
Total	456	81,130	100.00

When the center started operation in 1978, three fuel oil-burning boilers were in operation. In consideration of pollution control, a wood-burning 1.75 MW boiler was installed in 1986, and fuel oil was partly replaced by wood.

From October 1993, the use of fuel oil is scheduled to be switched to the use of natural gas. Because the pollution source is closely located with the service area, the company is making efforts to control air pollutant discharge.

The operation conditions for the fuel and boilers vary with the season and the ambient temperature. During the summer period, from April 15 to October 15, wood is used as the fuel. and during the winter period, from October 16 to April 14, the following fuels are selectively used according to the temperature.

Ambient temperature:

1) Above 0℃, one boiler is used burning natural gas.
2) Above -8℃, two boilers are used burning natural gas.
3) Below -8℃, one wood-burning boiler and two natural gas-burning boilers are used together.

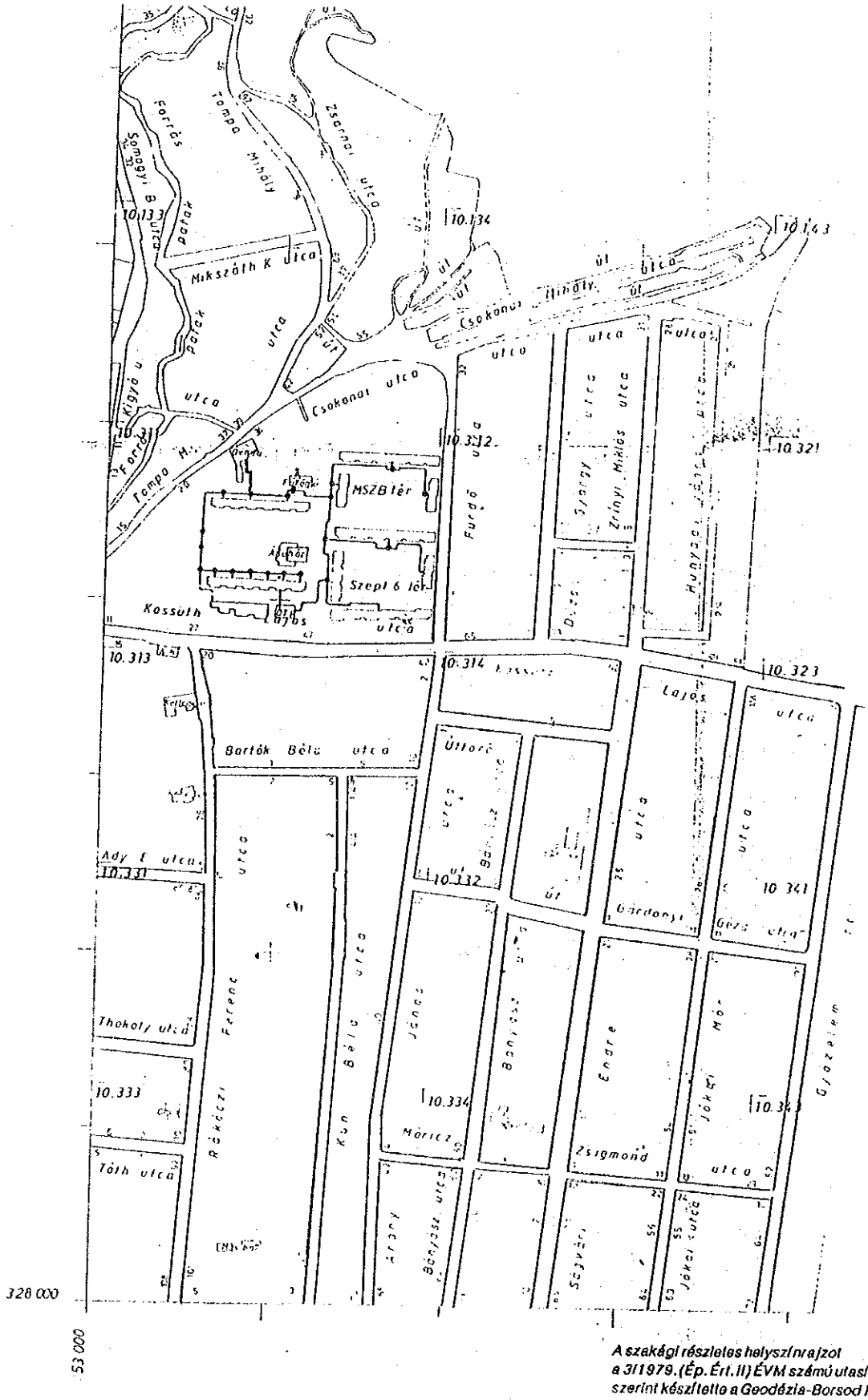
The total capacity is 4,75 MW, but only 2.5 MW is used (roughly 52% in operation ratio). When fuel oil is switched to natural gas, the operation ratio declines slightly below 50%. The facility and fuel consumption is summarized in Table 1.1.6. Figure 1.1.7 shows the position of Putnok district heating.

Table 1.1.6 The Facility and Fuel consumption for District Heating Center

No. R/N	Site	Boiler			Fuel		No. of receivers	No. of Stacks
		Unit	Capacity	Output	Kind	Consumption	Households Publ. bldg.	
R/N:31/0	Putnok kossuth ut	3	1 MW/pc. 3 MW		Oil N.gas**	156075 L/8520h*	456 5	1
		1	1.75 MW/pc 1.75 MW		Wood chip	2698.3 t/8520h*		
		Total:	4.75 MW	52000 GJ				

* 1992(quarter IV) - 1993(till quarter III)
** Only in case of gas burnig :800000 m3
/from 1993 Oct. 15 - to 1994 Oct. 15

No. R/N	Site	Boiler		Calorific Value	1992	1993		
		Unit	Capacity		IV Oct.-Dec.	I Jan.-Mar.	II Apr.-Jun	III Jul.-Sep.
R/N:31/0	Putnok kossuth ut	3	1 MW/pc. 3 MW	Oil (0.035 GJ/L)	29312 L	81583 L	31100 L	14080 L
		1	1.75 MW/pc 1.75 MW	Wood chip (8-12 GJ/t)	1062.4 t	1200.8 t	288.8 t	146.3 t
				Natural gas (0.034 GJ/m3)	---	---	---	---



A szakági részletes helyszínrajzot a 3/1979.(Ép.Ért.II) ÉVM számú utasítás szerint készítette a Geodézia-Borsod Kft. 1992 év aug. hó 7 -i állapot.

Figure 1.1.7 The Postion of Putnok District Heating

42) R/N:32/0

Company name: OZDI TAVHO TERMELO HOSZOLGALTATOVALLALT

(District Heating Center)

This company is a new district heating center established on August 1, 1992 pursuant to the Regional Heating Regulation of Borsod Prefecture. Previously, OZDI KOHASZATI UZEMEK TORZSGYAR (OZD metallurgy firm) was supplying hot water and heating to the 5600 households in OZD City. The population of OZD City is 47,000. In response to the demand of the citizens, the new company and OZDI KOHASZATI made an agreement that OZD KOHASZAT supplies hot water and heating to the users, and the service is undertaken by the new company. The energy requirement is 115 to 120 GJ/h, but the capacity is insufficient, so that whenever the consumption exceeds 100 GJ/h, the new company starts to supplement the deficit, for the benefit of the citizens.

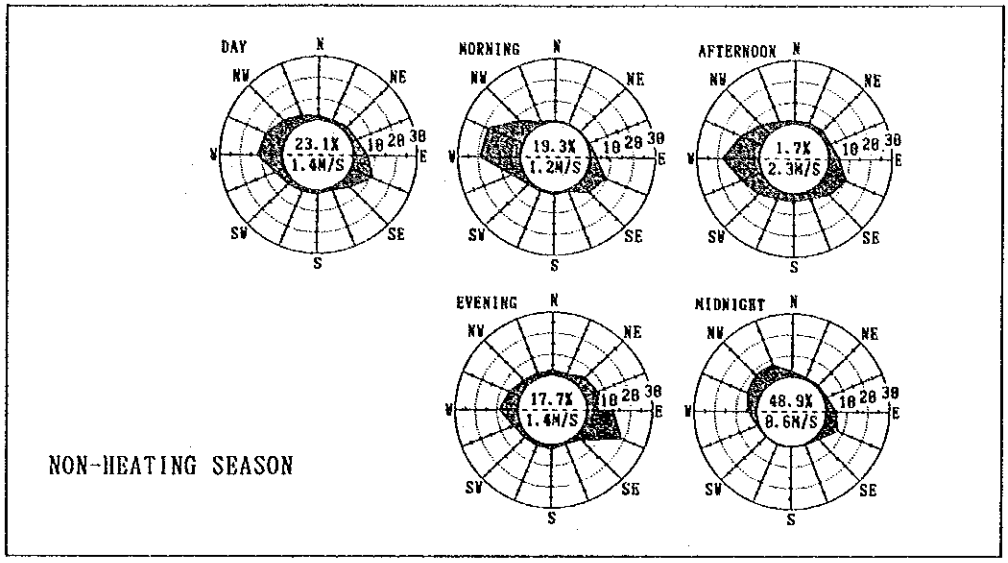
Because of the suggestion of National Government, the district heating center is now under the jurisdiction of the new company. The number of company employees is 67, working in 4 shifts in three changes. Each group consists of 8 members.

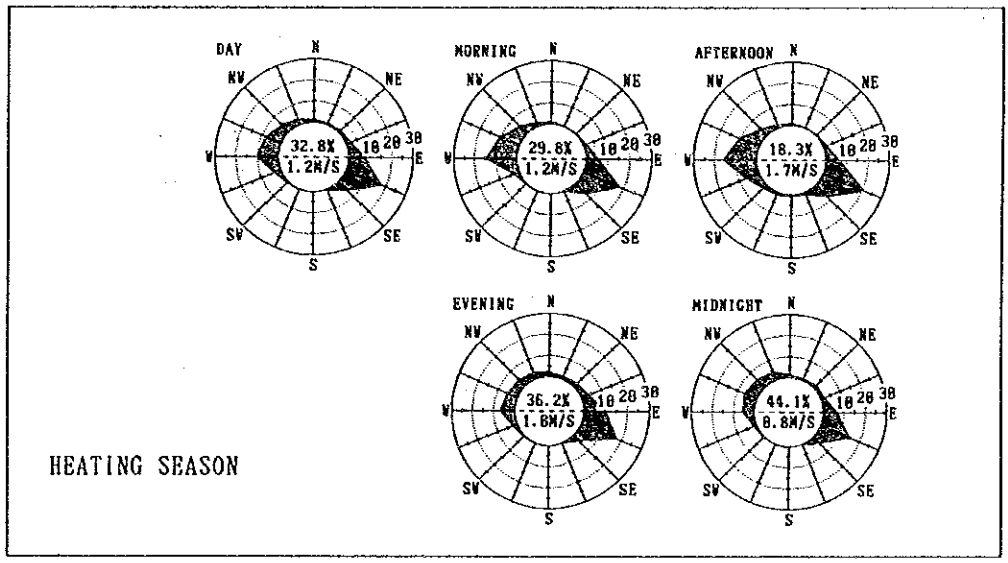
The facility is summarized as follows:

Site:	OZD GYRTELEP UT.6
Boiler:	6 units
Boiler capacity:	27.9 KW/6 boilers
Production:	95,600 GJ/3672h/1992
Fuel kind:	Natural gas
Fuel consumption:	3,188,000 m3/3672h/1992
Receiver:	5,600 (Households) and 2 (Public building)
Stack:	6 unit

Note) There are new four container boilers in the ground of OKU temporarily (18.6MW/4 boilers).

DATA FOR CHAPTER 5





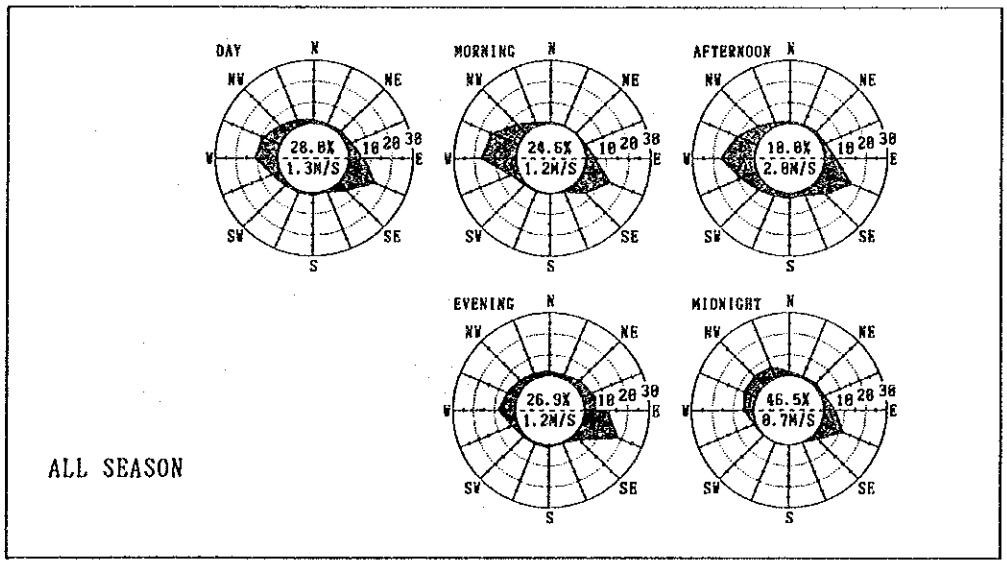
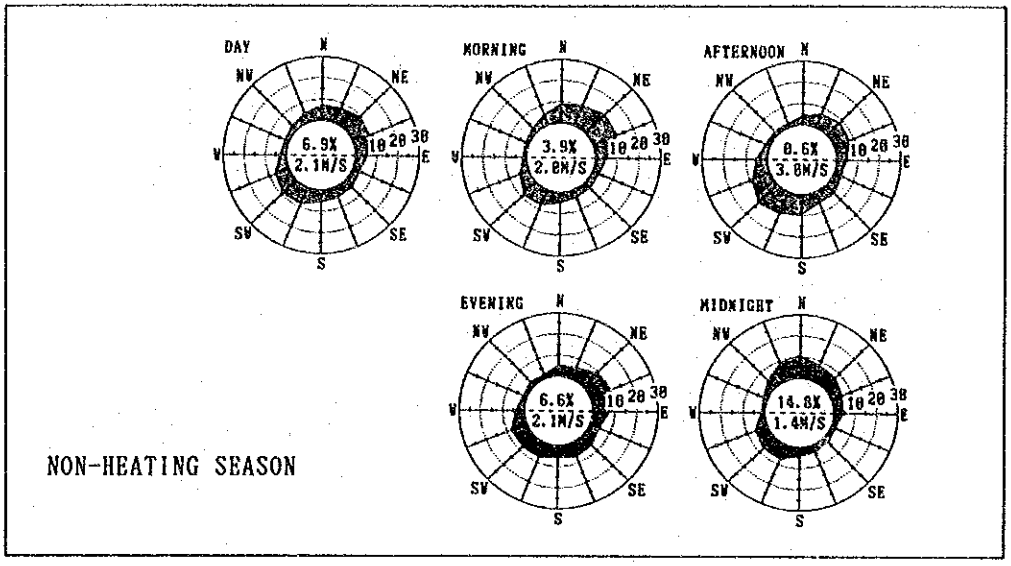
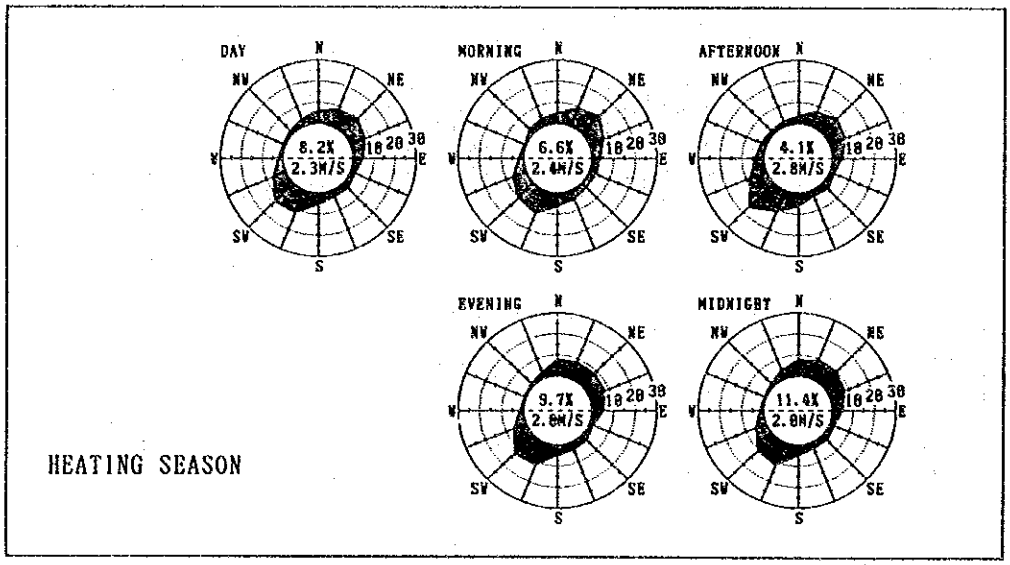


Figure D5.1.1 Wind Roses at 10m Height (JF1)





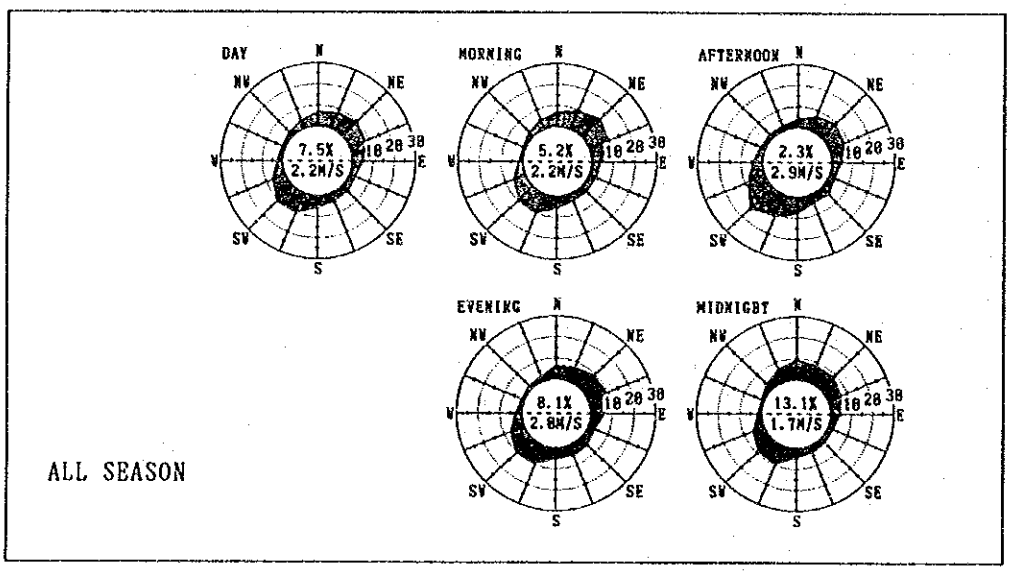
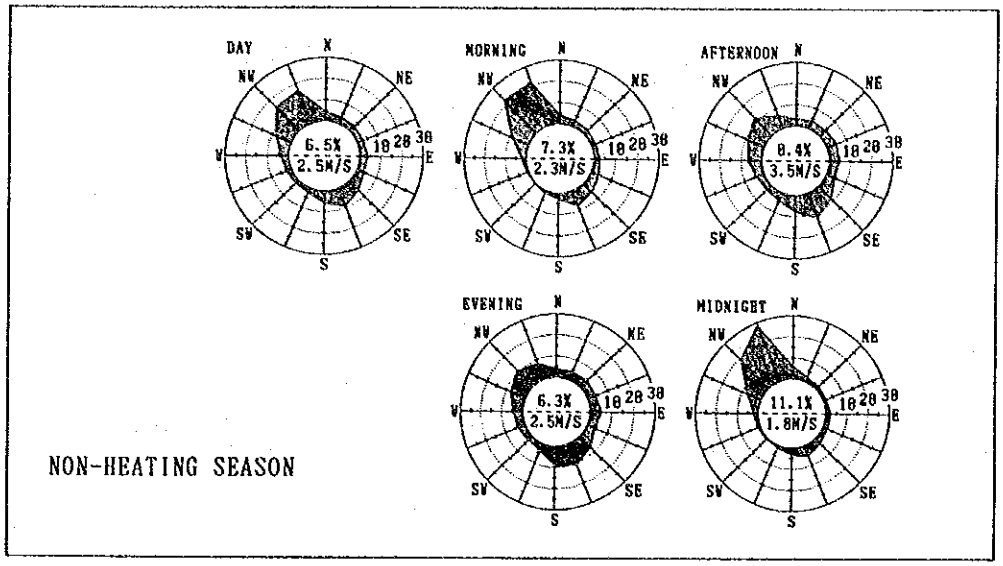
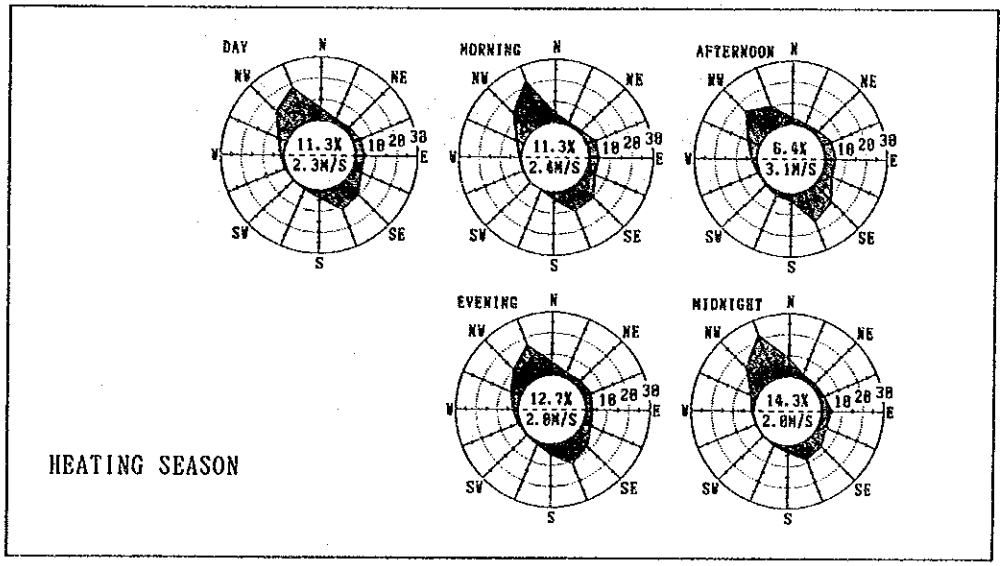


Figure D5.1.2 Wind Roses at 10m Height (JF2)





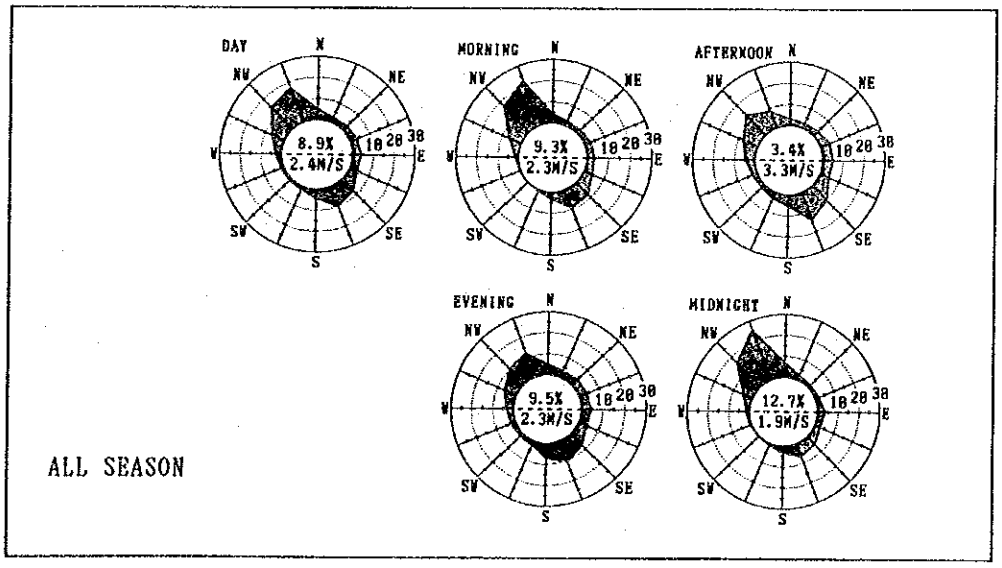
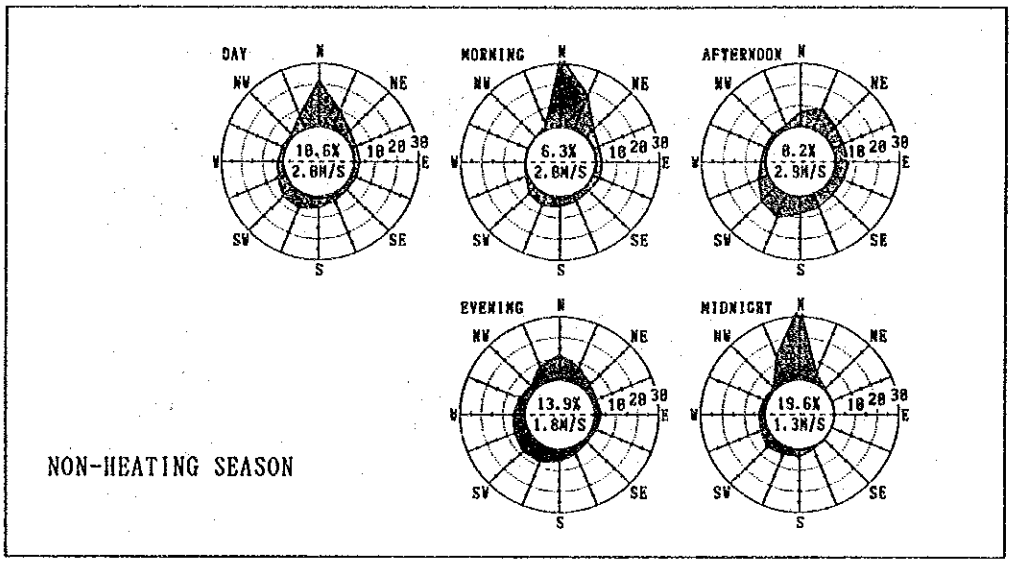
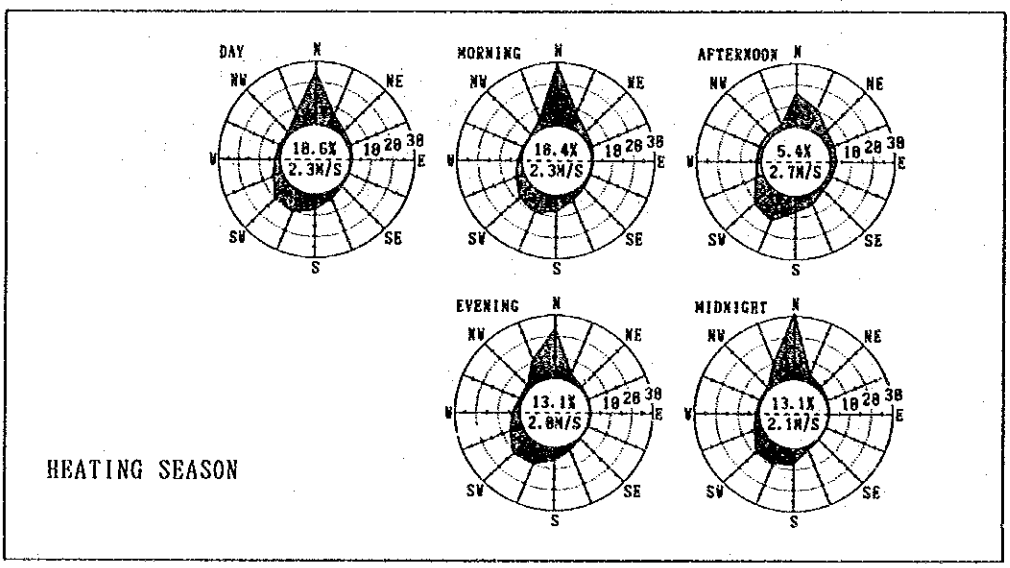


Figure D5.1.3 Wind Roses at 10m Height (JM1)





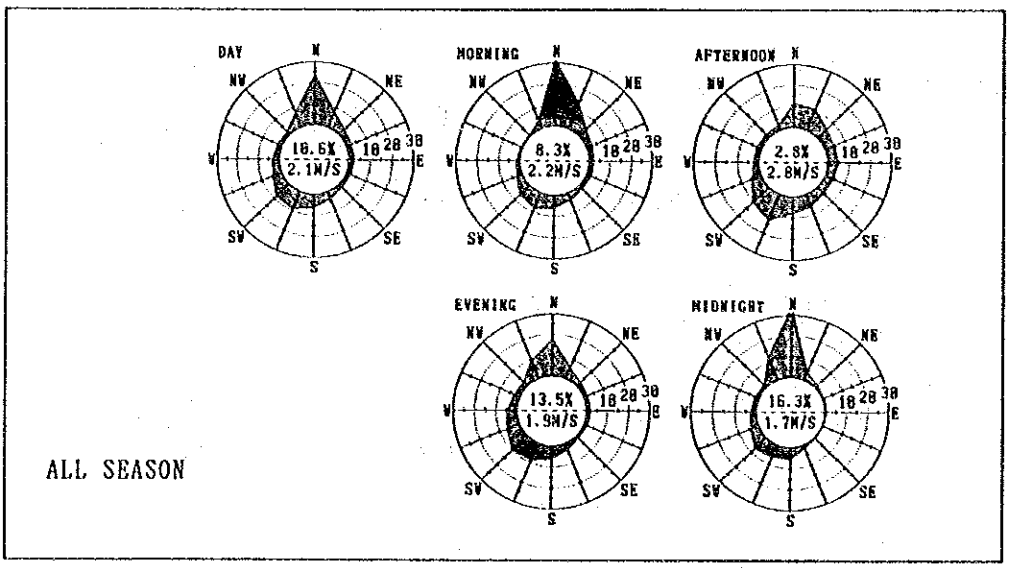
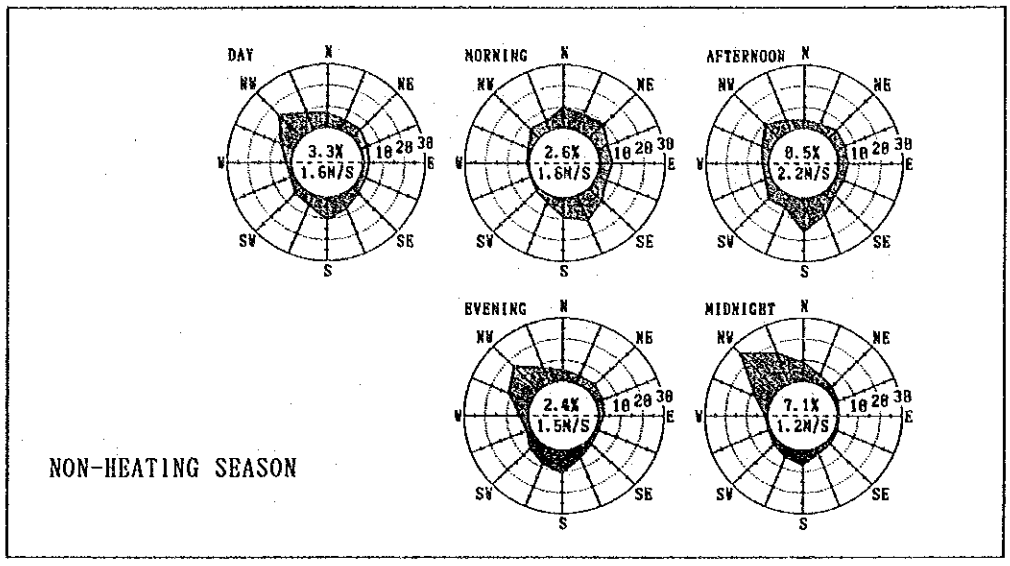
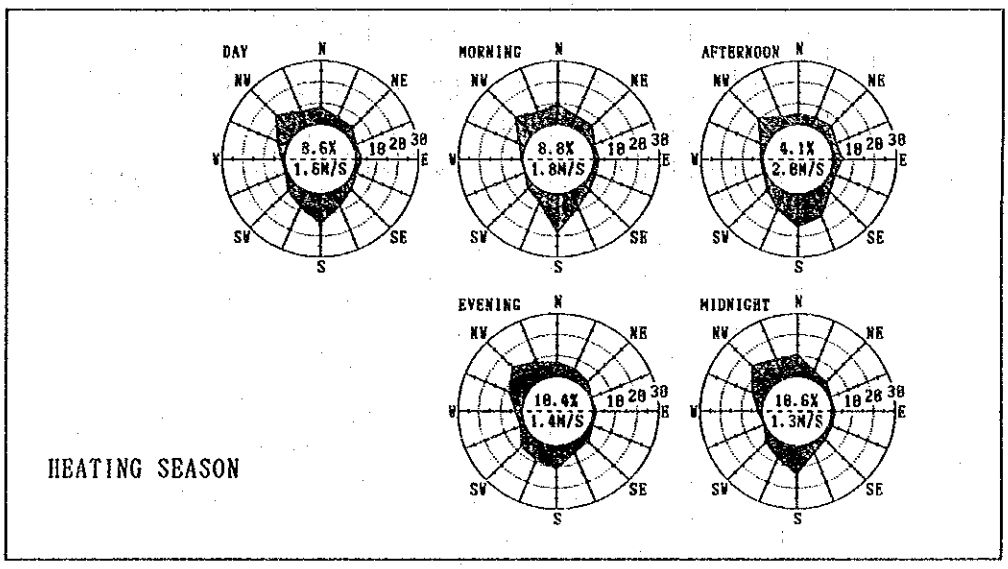


Figure D5.1.4 Wind Roses at 10m Height (JM2)





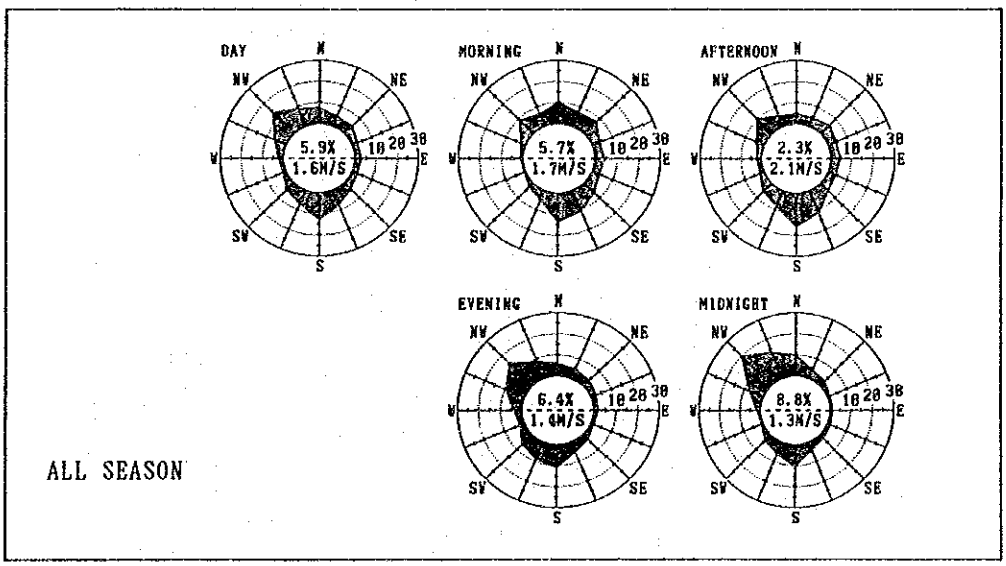


Figure D5.1.5 Wind Roses at 10m Height (MISKOLC)

Table D5.1.1 Wind Direction Distribution

STATION : JF1

PERIOD : 1993/5/16～1994/5/15

PERIOD		WIND DIRECTION (%)																CLM	A-WS
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	(%)	(M/S)
NON-HEATING SEASON	MORNING	0.7	0.6	0.6	1.2	3.4	9.6	6.8	1.2	1.3	1.3	1.9	5.8	19.1	18.3	7.4	1.5	19.3	1.2
	AFTERNOON	1.5	1.8	2.4	2.2	5.2	10.5	7.7	3.7	3.9	4.1	7.2	10.8	17.6	11.2	5.9	2.4	1.7	2.3
	EVENING	2.7	1.9	5.5	6.5	12.3	18.9	3.3	1.1	2.1	1.8	2.1	3.6	8.9	6.0	3.4	2.2	17.7	1.4
	MIDNIGHT	2.7	0.9	1.4	1.8	4.9	7.5	2.1	0.4	0.3	0.7	0.7	1.3	4.3	6.4	8.0	7.5	48.9	0.6
	DAY	2.0	1.3	2.5	3.0	6.5	11.5	4.8	1.5	1.9	2.0	2.9	5.2	11.9	10.0	6.2	3.7	23.1	1.4
HEATING SEASON	MORNING	1.0	0.3	0.3	1.3	5.7	18.2	7.0	0.3	0.3	0.4	0.8	2.9	14.3	10.2	5.1	2.0	29.8	1.2
	AFTERNOON	0.8	0.2	0.3	1.6	6.5	21.1	7.7	1.0	0.9	1.5	2.3	6.4	15.6	10.1	4.0	1.7	18.3	1.7
	EVENING	1.9	1.4	2.0	3.6	10.0	17.8	3.4	0.2	0.3	0.4	0.8	2.3	7.0	5.3	4.1	3.2	36.2	1.0
	MIDNIGHT	1.5	0.7	1.8	1.8	6.6	15.1	4.3	0.3	0.2	0.3	0.4	1.5	5.4	6.6	5.2	4.1	44.1	0.8
	DAY	1.3	0.7	1.2	2.1	7.3	17.9	5.5	0.5	0.4	0.6	1.1	3.2	10.2	7.9	4.6	2.8	32.8	1.2
ALL SEASON	MORNING	0.8	0.5	0.5	1.2	4.6	13.9	6.9	0.7	0.8	0.9	1.4	4.4	16.7	14.2	6.2	1.8	24.6	1.2
	AFTERNOON	1.2	1.0	1.4	1.9	5.8	15.8	7.7	2.4	2.4	2.8	4.8	8.6	16.6	10.7	5.0	2.0	10.0	2.0
	EVENING	2.3	1.6	3.8	5.0	11.2	18.3	3.4	0.6	1.2	1.1	1.4	3.0	8.0	5.6	3.8	2.7	26.9	1.2
	MIDNIGHT	2.1	0.8	1.6	1.8	5.8	11.3	3.2	0.3	0.3	0.5	0.6	1.4	4.9	6.5	6.6	5.8	46.5	0.7
	DAY	1.6	1.0	1.9	2.5	6.9	14.7	5.1	1.0	1.2	1.3	2.0	4.2	11.0	8.9	5.4	3.2	28.0	1.3

Table D5.1.2 Wind Direction Distribution

STATION : JF2

PERIOD : 1993/5/16～1994/5/15

PERIOD		WIND DIRECTION (%)																CLM	A-WS
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	(%)	(M/S)
NON-HEATING SEASON	MORNING	8.5	10.0	12.5	11.6	4.8	3.4	3.6	3.6	5.0	7.8	8.7	4.6	1.8	2.1	2.8	5.2	3.9	2.0
	AFTERNOON	4.0	6.9	8.4	7.7	4.6	3.5	5.7	5.5	9.3	11.2	12.3	8.9	5.1	2.2	2.1	2.0	0.6	3.0
	EVENING	4.9	5.5	9.0	10.1	7.8	4.4	6.2	6.9	5.6	7.2	7.7	7.7	4.0	1.9	2.4	1.9	6.6	2.1
	MIDNIGHT	10.7	7.8	7.3	5.3	4.1	2.1	2.9	3.5	3.9	7.4	7.3	5.9	1.6	2.0	4.9	8.6	14.8	1.4
	DAY	7.1	7.5	9.1	8.4	5.3	3.3	4.6	4.9	5.9	8.4	8.9	6.8	3.1	2.1	3.1	4.6	6.9	2.1
HEATING SEASON	MORNING	5.0	8.9	11.8	7.1	3.7	3.6	3.1	4.3	6.5	11.9	10.3	7.0	2.4	1.0	3.0	3.9	6.6	2.4
	AFTERNOON	3.6	7.4	9.8	8.2	4.6	2.3	3.8	2.9	6.4	11.0	16.3	8.1	4.2	2.6	2.2	2.6	4.1	2.8
	EVENING	7.7	8.5	8.5	8.0	5.5	2.0	3.4	3.8	4.9	11.4	12.8	6.1	1.7	1.0	1.6	3.2	9.7	2.0
	MIDNIGHT	7.8	9.1	9.5	7.7	4.9	2.2	3.3	3.1	4.8	11.5	10.8	5.3	1.8	1.0	1.6	4.3	11.4	2.0
	DAY	6.2	8.5	9.8	7.8	4.7	2.5	3.4	3.4	5.6	11.4	12.5	6.5	2.5	1.4	2.0	3.6	8.2	2.3
ALL SEASON	MORNING	6.8	9.5	12.2	9.4	4.3	3.5	3.4	3.9	5.7	9.8	9.5	5.8	2.1	1.5	2.9	4.6	5.2	2.2
	AFTERNOON	3.8	7.1	9.1	7.9	4.6	2.9	4.8	4.2	7.9	11.1	14.3	8.5	4.6	2.4	2.2	2.3	2.3	2.9
	EVENING	6.3	7.0	8.8	9.1	6.7	3.2	4.8	5.3	5.3	9.3	10.2	6.9	2.9	1.5	2.0	2.6	8.1	2.0
	MIDNIGHT	9.3	8.4	8.4	6.5	4.5	2.2	3.1	3.3	4.4	9.4	9.0	5.6	1.7	1.5	3.3	6.5	13.1	1.7
	DAY	6.7	8.0	9.4	8.1	5.0	2.9	4.0	4.2	5.7	9.9	10.7	6.7	2.8	1.7	2.6	4.1	7.5	2.2

Table D5.1.3 Wind Direction Distribution

STATION : JM1 PERIOD : 1993/5/16～1994/5/15

PERIOD		WIND DIRECTION (%)																CLM	A-WS
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	(%)	(M/S)
NON-HEATING SEASON	MORNING	4.1	2.8	2.5	1.9	2.7	4.0	5.8	7.7	2.9	1.2	0.6	0.9	2.4	8.9	22.0	22.3	7.3	2.3
	AFTERNOON	3.2	4.0	4.2	4.9	4.7	4.4	8.5	12.7	7.7	4.2	3.2	3.8	7.0	8.9	11.9	6.4	0.4	3.5
	EVENING	3.9	3.9	4.4	3.8	5.3	4.1	7.4	10.8	9.0	3.3	2.8	3.8	4.6	7.8	10.5	8.2	6.3	2.5
	MIDNIGHT	5.9	2.2	1.7	1.5	2.5	2.2	3.6	5.5	3.2	1.1	0.7	1.4	2.2	7.1	19.3	28.6	11.1	1.8
	DAY	4.4	3.2	3.2	3.0	3.8	3.6	6.2	9.1	5.7	2.4	1.9	2.5	4.0	8.1	15.8	16.7	6.5	2.5
HEATING SEASON	MORNING	4.4	1.6	1.8	4.7	4.7	4.7	10.3	10.8	3.6	0.2	0.7	0.6	1.2	3.9	12.9	22.8	11.3	2.4
	AFTERNOON	3.3	1.5	2.3	4.9	5.4	5.2	12.1	15.9	3.4	2.4	1.1	1.3	2.9	6.7	15.0	10.2	6.4	3.1
	EVENING	6.3	2.7	3.1	4.1	3.4	4.4	8.2	11.1	4.8	1.4	1.1	1.5	2.8	5.4	10.3	16.7	12.7	2.0
	MIDNIGHT	8.5	2.1	2.0	2.8	5.1	4.1	7.3	8.5	3.3	1.1	0.6	0.6	1.6	2.9	12.8	22.6	14.3	2.0
	DAY	5.8	2.0	2.3	4.0	4.7	4.6	9.4	11.5	3.8	1.3	0.8	1.0	2.1	4.7	12.7	18.1	11.3	2.3
ALL SEASON	MORNING	4.2	2.2	2.1	3.3	3.7	4.4	8.1	9.2	3.3	0.7	0.6	0.7	1.8	6.4	17.4	22.6	9.3	2.3
	AFTERNOON	3.2	2.7	3.2	4.9	5.1	4.8	10.3	14.3	5.5	3.3	2.1	2.6	4.9	7.8	13.5	8.3	3.4	3.3
	EVENING	5.1	3.3	3.8	4.0	4.4	4.2	7.8	10.9	6.9	2.3	1.9	2.6	3.7	6.6	10.4	12.4	9.5	2.3
	MIDNIGHT	7.2	2.1	1.8	2.1	3.8	3.1	5.4	7.0	3.2	1.1	0.6	1.0	1.9	5.0	16.1	25.6	12.7	1.9
	DAY	5.1	2.6	2.7	3.5	4.2	4.1	7.8	10.3	4.7	1.9	1.3	1.7	3.1	6.4	14.3	17.4	8.9	2.4