9.2.6. Sales plan

On the basis of production plan, the sales plan is assumed as shown in Table 9.2-14.

Table 9.2-14 Sales Plan

(Unit:1000 t)

Description	1995	1996	1997	1998	1999~
Bar	558.6	559.9	559.9	559.9	559.9
Rod	544.7	463.6	861.4	935.1	938.4
Short length bar	8.2	8.2	8.2	8.2	8.2
Billet	3.6	2.5	43.3	5.6	3.9
Total	1,115.1	1,034.2	1,472.8	1,508.8	1,510.4

Note 1. Including products of the existing facilities
Note 2. Billet includes short length billet.

9.2.7. Analysis and evaluation of financial statement

Analysis and evaluation are made on statements estimated in accordance with the assumptions and conditions below. Financial statements are attached to APPENDIX 1.

1) Cost of products

Cost of products consisting of manufacturing cost described in Section 9.1. Calculation of Manufacturing Costs, general administrative expenses (GAE), and non-operating expenses (NOE) including interest on long-term debts is shown in Table 9.2-15 and Table 9.2-16 as the result of calculation.

Table 9.2-15 Cost of Products
Case 1-1 (Without escalation)

(Unit:US$/ton)

Description	Bar				Rod			
	1995	1998	2005	2010	1995	1998	2005	2010
Variable cost	212	214	213	213	209	211	211	211
Fixed cost	11	10	10	10	14	13	12	12
Sub-total	223	224	223	223	223	224	223	223
GAE	8	6	6	6	8	6	6	6
NOE	21	14	-13	-30	21	14	-13	-30
Total	252	244	216	199	252	244	216	199
Products (1000 t)	568	568	568	568	545	938	938	938

Note : Bar includes short length bar.

Table 9.2-16 Cost of Products
Case 1-2 (With escalation)

(Unit:US$/ton)

Description	Bar				Rod			
	1995	1998	2005	2010	1995	1998	2005	2010
Variable cost	235	243	243	243	232	239	239	239
Fixed cost	11	11	11	11	14	14	14	14
Sub-total	246	254	254	254	246	253	253	253
GAE	9	7	7	7	9	7	7	7
NOE	21	12	-23	-46	21	12	-23	-46
Total	276	273	238	215	276	272	237	214
Products (1000 t)	568	568	568	568	545	938	938	938

Note : Bar includes short length bar.

2) Profit and loss statement

Outline of profit and loss statement as the result of calculation is shown in Table 9.2-17 and Table 9.2-18.

a) Case 1-1 (Without escalation)

Though net profit after the expansion is inferior to the case of no expansion in the year of start-up of the expansion facilities, it dominates from the subsequent year of start-up of the expansion facilities because of remarkable increase of sales quantities of products. And accumulated net profit after the expansion exceeds it in the case of no expansion in the fourth year after the year of start-up of the expansion facilities, that is, the year 2000, against being inferior to the case of no expansion during a period of three years after start-up of the expansion facilities.

As a result of the above position, accumulated net profit at the projection year end is 1.2 times against the case of no expansion.

b) Case 1-2 (With escalation)

Net profit after the expansion is in the same position to the above a). Accumulated net profit after the expansion exceeds it in the case of no expansion in the third year after the year of start-up of the expansion facilities, that is, the year 1999.

As a result of the above position, the accumulated net profit at the projection year end is 1.2 times against the case of no expansion like a) above.

Therefore, the investment for the expansion facilities can be said effective on profit and loss statements.

Table 9.2-17 Outline of Profit and Loss Statement
(Without escalation)

(Unit:1000US$)

Description	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Case 0-1(Existing facilities):																	
Gross profit	97,693	108,914	110,083	110,148	110,140	110,247	111,558	110,270	114,826	121,037	112,471	111,540	111,512	111,525	112,937	111,767	111,521
Operating profit	87,595	99,877	101,367	101,772	101,760	101,869	103,180	101,894	106,450	112,661	104,084	103,164	103,135	103,148	104,558	103,391	103,145
Profit before tax	52,935	71,269	78,066	83,095	86,647	100,409	104,804	106,871	114,779	124,303	120,270	122,269	125,479	128,845	133,773	135,948	139,038
Net profit	52,935	71,269	78,066	83,095	68,080	71,333	74,987	77,177	83,337	90,614	88,577	90,623	93,582	96,675	100,886	103,171	106,075
Accumulated net profit	52,935	124,204	202,270	285,365	353,445	424,778	499,765	576,942	660,279	750,893	839,470	930,093	1,023,675	1,120,350	1,221,236	1,324,407	1,430,482
Case 1-1(After expansion):																	
Gross profit	97,693	108,914	110,083	72,428	138,284	146,455	148,044	146,756	151,273	157,461	148,942	148,016	147,987	148,000	149,412	148,242	147,997
Operating profit	87,595	99,877	101,367	63,467	128,803	136,930	138,519	137,232	141,750	147,937	139,418	138,492	138,463	138,476	139,886	138,719	138,473
Profit before tax	52,935	70,605	77,454	34,011	103,732	116,451	123,268	127,740	137,949	149,859	148,436	153,077	158,689	165,744	171,843	175,186	179,307
Net profit	52,935	70,605	77,454	34,011	75,165	87,375	93,451	98,045	106,507	116,170	116,744	121,431	126,792	133,574	127,778	131,188	135,086
Accumulated net profit	52,935	123,540	200,994	235,005	310,170	397,545	490,996	589,041	695,548	811,718	928,462	1,049,893	1,176,685	1,310,259	1,438,037	1,569,225	1,704,311

Description	2010	2011	2012	2013	2014	2015
Case 0-1(Existing facilities):						
Gross profit	111,525	111,527	111,530	111,622	111,535	112,936
Operating profit	103,149	103,150	103,153	103,245	103,159	104,559
Profit before tax	142,757	146,659	150,671	154,540	158,436	165,813
Net profit	109,517	113,137	116,863	120,427	124,107	130,468
Accumulated net profit	1,539,999	1,653,136	1,769,999	1,890,426	2,014,533	2,145,002
Case 1-1(After expansion):						
Gross profit	148,001	150,668	148,731	148,624	148,538	148,939
Operating profit	138,477	141,144	139,206	139,100	139,014	140,414
Profit before tax	184,088	191,613	194,624	199,277	204,191	213,463
Net profit	139,551	145,917	149,229	153,604	158,265	166,268
Accumulated net profit	1,843,862	1,989,779	2,139,008	2,292,612	2,450,877	2,617,145

Table 9.2-18 Outline of Profit and Loss Statement
(With escalation)

(Unit:1000US$)

Description	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Case 0-2(Existing facilities):																	
Gross profit	107,238	129,028	139,471	153,454	152,956	153,073	154,570	153,103	157,642	164,961	155,821	153,096	152,900	152,913	154,522	153,185	152,911
Operating profit	96,914	119,450	129,881	144,148	143,646	143,766	145,263	143,796	148,336	155,654	146,614	143,790	143,592	143,605	145,213	143,878	143,603
Profit before tax	62,344	91,244	107,559	127,522	141,922	146,871	152,458	155,381	164,335	176,066	172,667	173,903	178,100	182,667	189,028	192,308	196,676
Net profit	62,344	91,244	107,559	127,522	99,903	104,301	109,055	112,127	119,304	128,396	127,116	128,968	132,930	137,185	142,727	146,130	150,281
Accumulated net profit	62,344	153,588	261,147	388,669	488,572	592,873	701,928	814,055	933,359	1,061,755	1,188,871	1,317,839	1,450,769	1,587,954	1,730,681	1,876,811	2,027,092
Case 1-2(After expansion):																	
Gross profit	107,238	129,028	139,471	110,145	193,059	202,993	204,838	203,369	207,895	215,206	206,228	203,408	203,212	203,225	204,835	203,497	203,223
Operating profit	96,914	119,450	129,881	99,999	182,585	192,486	194,331	192,863	197,391	204,702	195,723	192,904	192,707	192,720	194,327	192,993	192,718
Profit before tax	62,344	90,580	106,936	71,465	158,887	174,913	183,517	189,417	201,275	216,000	215,845	220,362	227,598	236,628	244,679	249,608	255,434
Net profit	62,344	90,580	106,936	71,465	116,867	132,343	140,114	146,163	156,244	168,331	170,293	175,427	182,428	191,147	182,693	187,686	193,244
Accumulated net profit	62,344	152,924	259,860	331,325	448,192	580,535	720,649	866,812	1,023,056	1,191,387	1,361,680	1,537,107	1,719,535	1,910,682	2,093,375	2,281,061	2,474,305

Description	2010	2011	2012	2013	2014	2015
Case 0-2(Existing facilities):						
Gross profit	152,914	152,915	152,917	153,039	152,911	154,520
Operating profit	143,606	143,608	143,608	143,732	143,603	145,212
Profit before tax	201,741	207,030	212,468	217,838	223,207	232,593
Net profit	155,026	159,988	165,094	170,103	175,220	183,414
Accumulated net profit	2,182,118	2,342,106	2,507,200	2,677,303	2,852,523	3,035,937
Case 1-2(After expansion):						
Gross profit	203,226	206,157	203,400	203,248	203,120	204,729
Operating profit	192,721	195,652	192,894	192,743	192,615	194,224
Profit before tax	262,000	271,604	275,659	282,179	289,027	300,911
Net profit	199,437	207,743	212,300	218,496	225,040	235,431
Accumulated net profit	2,673,742	2,881,485	3,083,785	3,312,281	3,537,321	3,772,752

3) Cash flow

Outline of cash flow as the result of calculation is shown in Table 9.2-19 and Table 9.2-20.

a) Case 1-1 (Without escalation)

Though cash flow after the expansion in the current year is inferior to the case of no expansion in the year of start-up of the expansion facilities, it dominates from the subsequent year of start-up of the expansion facilities because of remarkable increase of sales revenue of products.
And year end cash balance after the expansion exceeds it in the case of no expansion in the fourth year after the year of start-up of the expansion facilities, that is, the year 2000.

As a result of the above cash position, cash balance after the expansion at the projection year end is 1.2 times against the case of no expansion.

b) Case 1-2 (With escalation)

Case flow after the expansion in the current year is in the same position to the above a). Year end cash balance after the expansion exceeds it in the case of no expansion in the second year after start-up of the expansion facilities, that is, the year 1998.

As a result of the above cash position, year end cash balance after the expansion at the projection year end is 1.2 times against the case of no expansion like a) above.

Therefore, the investment for the expansion facilities can be said effective on cash flow.

Table 9.2-19 Outline of Cash Flow
(Without escalation)

(Unit:1000US$)

Description	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Case U-I(Existing facilities):																	
Sales revenue	325,854	355,674	356,499	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740	356,740
Interest received on short-term deposits		731	2,682	5,318	8,194	10,608	12,917	15,642	18,359	21,137	23,590	25,972	28,667	31,460	34,446	37,244	40,034
Repayment of long-term loans	38,318	48,552	34,523	26,248	22,599	18,216	13,830	13,830	13,830	13,834	15,170	15,170	15,170	15,170	15,170	15,170	15,170
Cash balance	-37,865	48,725	81,344	94,413	97,298	63,660	90,235	91,430	89,709	95,476	68,066	90,781	88,932	97,289	101,805	84,678	101,350
Year end cash balance	9,395	58,120	139,464	233,877	331,175	394,835	485,070	576,500	666,209	761,685	829,751	920,502	1,009,434	1,106,703	1,208,508	1,293,186	1,394,536
Case I-I(After expansion):																	
Sales revenue	325,854	355,674	356,499	330,671	468,551	482,400	483,029	483,029	483,029	483,029	483,029	483,029	483,029	483,029	483,029	483,029	483,029
Interest received on short-term deposits		721	2,623	4,526	6,849	9,806	12,549	15,493	18,346	21,327	24,137	26,950	30,209	33,813	37,932	41,879	45,685
Repayment of long-term loans	38,318	48,552	34,523	26,248	22,599	22,338	32,404	36,984	36,984	36,988	38,324	38,324	34,202	19,751	15,170	15,170	15,170
Cash balance	-37,865	48,061	78,715	48,150	113,015	84,155	98,700	97,582	92,590	106,138	81,184	106,351	110,899	129,412	145,156	118,019	135,679
Year end cash balance	9,395	57,456	136,171	184,321	297,336	381,491	480,191	577,773	670,363	776,501	857,685	964,036	1,074,935	1,204,347	1,349,503	1,467,522	1,603,201

Description	2010	2011	2012	2013	2014	2015
Case U-I(Existing facilities):						
Sales revenue	356,740	356,740	356,740	356,740	356,740	356,740
Interest received on short-term deposits	43,204	46,558	50,022	53,264	56,843	61,514
Repayment of long-term loans	15,170	15,170	15,173	13,782	0	0
Cash balance	109,986	113,610	117,343	98,777	139,803	171,598
Year end cash balance	1,504,522	1,618,132	1,735,475	1,834,252	1,974,055	2,145,653
Case I-I(After expansion):						
Sales revenue	483,029	483,029	483,029	483,029	483,029	483,029
Interest received on short-term deposits	49,900	54,237	58,625	62,830	67,412	73,309
Repayment of long-term loans	15,170	15,170	15,170	13,782	0	0
Cash balance	145,330	143,820	148,687	131,689	173,760	219,336
Year end cash balance	1,748,531	1,892,351	2,041,038	2,172,727	2,346,487	2,565,823

Table 9.2-20 Outline of Cash Flow
(With escalation)

(unit:1000US$)

Description	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Case 0-2(Existing facilities):																	
Sales revenue	341,671	391,031	410,952	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194	431,194
Interest received on short-term deposits		1,109	3,860	7,576	11,790	15,379	18,695	22,456	26,236	30,110	33,687	37,201	41,050	45,042	49,265	53,336	57,434
Repayment of long-term loans	38,318	48,552	34,523	26,248	22,599	18,216	13,830	13,830	13,830	13,834	15,170	15,170	15,170	15,170	15,170	15,170	15,170
Cash balance	-30,770	73,962	109,379	138,363	142,573	96,688	124,394	126,336	125,704	132,555	105,894	128,359	128,264	137,835	143,749	127,607	145,586
Year end cash balance	9,395	83,357	192,736	331,099	473,672	570,360	694,754	821,090	946,794	1,079,349	1,185,243	1,313,602	1,441,866	1,579,701	1,723,450	1,851,057	1,996,643
Case 1-2(After expansion):																	
Sales revenue	341,671	391,031	410,952	399,685	566,414	583,082	583,839	583,839	583,839	583,839	583,839	583,839	583,839	583,839	583,839	583,839	583,839
Interest received on short-term deposits		1,099	3,738	6,681	10,350	14,827	18,935	23,264	27,528	31,969	36,294	40,648	45,493	50,764	56,635	62,337	67,876
Repayment of long-term loans	38,318	48,552	34,523	26,248	22,599	22,586	34,241	39,395	39,395	39,399	40,735	40,735	36,365	20,324	15,170	15,170	15,170
Cash balance	-30,770	73,298	106,625	85,543	169,014	129,426	144,485	144,101	140,124	155,957	132,367	157,935	165,075	186,299	205,135	174,956	194,336
Year end cash balance	9,395	82,693	189,318	274,861	443,875	573,301	717,786	861,887	1,002,011	1,157,968	1,290,335	1,448,270	1,613,345	1,799,644	2,004,779	2,179,735	2,374,071

Description	2010	2011	2012	2013	2014	2015
Case 0-2(Existing facilities):						
Sales revenue	431,194	431,194	431,194	431,194	431,194	431,194
Interest received on short-term deposits	61,951	66,691	71,583	76,295	81,387	87,676
Repayment of long-term loans	15,170	15,170	15,173	13,782	0	0
Cash balance	155,538	160,505	165,622	148,492	190,982	228,290
Year end cash balance	2,152,181	2,312,686	2,478,308	2,626,800	2,817,782	3,046,072
Case 1-2(After expansion):						
Sales revenue	583,839	583,839	583,839	583,839	583,839	583,839
Interest received on short-term deposits	73,877	80,041	86,291	92,410	98,965	106,982
Repayment of long-term loans	15,170	15,170	15,170	13,782	0	0
Cash balance	205,724	205,234	211,393	196,521	240,528	293,949
Year end cash balance	2,579,795	2,785,029	2,996,422	3,192,943	3,433,471	3,727,420

4) Balance sheet

The major financial ratios in balance sheet such as debt equity ratio, fixed assets to net worth ratio (FTNR), current ratio, and quick ratio are shown in Table 9.2-21 and Table 9.2-22.

Table 9.2-21 Major Financial Ratios in Balance Sheet
Case 0-1 and 1-1 (Without escalation)

Description	1995	1998	2005	2010
Case 0-1:				
D/E ratio	51:49	36:64	14:86	6:94
FTNR	98.2%	43.0%	10.4%	5.5%
Current ratio	4767.9%	1580.5%	3072.8%	4209.7%
Quick ratio	2525.3%	1169.8%	2696.1%	3857.5%
Case 1-1:				
D/E ratio	58:42	47:53	13:87	6:94
FTNR	90.4%	73.8%	16.0%	6.6%
Current ratio	3273.4%	1392.1%	2832.1%	3375.9%
Quick ratio	1716.1%	1001.2%	2478.3%	3108.7%

Note:
D/E ratio:
(Debt/Debt+Equity)×100:(Equity/Debt+Equity)×100
FTNR :(Net fixed assets/Equity)×100
Current ratio:(Current assets/Current liabilities)×100
Quick ratio :(Quick assets/Current liabilities)×100

Table 9.2-22 Major Financial Ratios in Balance Sheet
Case 0-2 and 1-2 (With escalation)

Description	1995	1998	2005	2010
Case 0-2:				
D/E ratio	47:53	30:70	11:89	5:95
FTNR	82.0%	32.3%	7.5%	3.9%
Current ratio	5712.0%	1517.7%	3135.0%	4374.1%
Quick ratio	3398.5%	1209.3%	2844.5%	4102.0%
Case 1-2:				
D/E ratio	55:45	41:59	10:90	5:95
FTNR	76.1%	56.5%	11.7%	4.8%
Current ratio	3828.1%	1403.6%	3096.7%	3653.5%
Quick ratio	2262.8%	1099.8%	2814.4%	3443.1%

Note:
D/E ratio:(Debt/Debt+equity)×100:(Equity/Debt+Equity)×100
FTNR :(Net fixed assets/Equity)×100
Current ratio:(Current assets/Current liabilities)×100
Quick ratio :(Quick assets/Current liabilities)×100

9.2.8. Internal rate of return on investment fund

1) Definition of calculation method

The internal rate of return (IRR) on investment fund is defined as discount rate equalizing net present value of investment funds and net present value of returns earned by investments and shown as "R" calculated in the following formula:

$$\sum_{t=0}^{n} \frac{It}{(1+R)^t} = \sum_{t=0}^{n} \frac{St}{(1+R)^t}$$

It: Investment funds in the t-th year

St: Returns in the t-th year

According to the above formula, IRR on the total investment (ROI) and IRR on Equity (ROE) are calculated in the following conditions:

a) ROI

It : Investments in the t-th year

St : Returns in the t-th year

=Profit after tax + depreciation cost + amortization cost of deferred assets + interest expense - interest income - yearly additional working capital fund + book value of fixed assets and inventories at the projection year end + working capital fund at the projection year end

Note 1): The above returns are calculated by deducting returns incurred in the existing facilities.

2): Fixed assets and inventories remaining at the projection year end are assumed to be sold with book value at the projection year end.

b) ROE

It : Paid-up capital in the t-th year

St : Returns in the t-th year
=Profit after tax + depreciation cost + amortization cost of deferred assets + interest expense on short-term debt - interest income - repayment of long-term debt - yearly additional working capital fund + book value of fixed assets and invenories at the projection year end + working capital fund at the projection year end

Note 1): The above returns are calculated by deducting returns incurred in the existing facilities.

2): Fixed assets and inventories remaining at the projection year end are assumed to be sold with book value at the projection year end.

2) IRR

The result of calculation of IRR is shown in Table 9.2-23.

Table 9.2-23 IRR

Description	ROI	ROE
Case 1-1 (Without escalation)	13.15%	16.68%
Case 1-2 (With escalation)	16.15%	22.56%

9.2.9. Sensitivity analysis

The following sensitivity analysis is made to base case described below to examine the change in IRR and the result is shown in Table 9.2-24.

1) Case 1-1 (Without escalation) as base case

a) Increasing the equipment funds by 10% as follows:
--- Simulation A

(Unit:1000US$)

Base case	Simulation A
192,194	211,413

b) Decreasing the equipment funds by 10% as follows:
--- Simulation B

(Unit:1000US$)

Base case	Simulation B
192,194	172,975

c) Increasing the sales price of Bar and Rod by 10% as follows: ---Simulation C

(Unit:US$/ton)

Description	Base case	Simulation C
Bar	320.1	352.1
Rod	320.1	352.1

d) Decreasing the sales price of Bar and Rod by 10% as follows: --- Simulation D

(Unit:US$/ton)

Description	Base case	Simulation D
Bar	320.1	288.1
Rod	320.1	288.1

2) Case 1-2 (With escalation) as base case

Fluctuating the escalation rate as follows:
--- Simulation E

Description	Base case	Simulation E
Domestic cost/exp.	5%	10%
Import	4	7

Table 9.2-24 Sensitivity Analysis

Description	ROI	ROE
Base case 1-1	13.15%	16.68%
Simulation A	-1.28	-2.27
Simulation B	+1.47	+2.63
Simulation C	+4.08	+8.12
Simulation D	-4.61	-8.29

Description	ROI	ROE
Base case 1-2	16.15%	22.56%
Simulation E	+3.77	+7.32

Note: The values in this table show the change against the IRR of base case.

CHAPTER 10. ECONOMIC EFFECTS

As described in CHAPTER 2, the Third Five-year Plan for Economic and Social Development (3rd FYP) started in July 1992 is characterized by the continuous intention to rehabilitate the productive base of national economy by encouraging private sector companies and reducing subsidies so as to finally overcome financial deficits and foreign exchange shortage.

10.1. Construction of an Intergrated Steel Works

One of the major characteristics of steelmaking industry is its capital intensiveness. However, as it requires wide range of suppoting industries, steelmaking offers a most efficient prescription to the Egyption economy with respect to its unemployment problem.

Taking into account other characteristics of the steelmaking and the situation in Egypt as aforementioned, the efficiency of the construction of an integrated steel works could be examined as follows:

10.1.1. Domestic market oriented and import substitute

1) With this project, the market risk is minimum, since it is domestic market oriented and to substitute import goods.

2) The import substitute improves the balance of payment.

10.1.2. Large scale of the steelmaking industry

Among the considerable industrial development projects, it is the advantage of the steelmaking industry that, as a single project, it contributes greatly to the national economy:ANSDK is expected to form a US$500 million industry.

10.1.3. Effective utilization of resources

Natural resources utilized directly by the project are as follows:

	Annual consumption(After expansion)
Natural gas	283 million Nm^3
Limestone	129,800 tons
Ferro-silicon	5,400 tons
Aluminium	160 tons
Coke breeze	26,600 tons

10.1.4. Ripple effect on industry

Promotion of the steel industry, especially integrated steel works, will have ripple effects on the development of industries which consume steel products (forward-linkage effect) as well as those that are suppliers to the steel industry (backward-linkage effect).

As the ripple effect of the project on other industries, promotion of the following industries can be expected.

- Bar and rod fabrication
- Transportation
- Construction
- Piping and other engineering works
- Manufacture of various parts

- Repair and maintenance
- Manufacture and distribution of various materials and office supplies
- Others

10.2. Foreign Currency Saving Effect

For the Without Escalation Case in this study report, the amount of foreign currencies saved by ANSDK by the implementation of the expansion project is studied and the result is shown in Table 10-1.

a) Decrease in the amount of import of steel products

It is assumed that the price of imported steel is based on US$320/ton and that the import amount of steel products is cut by the quantity of production by ANSDK.

b) Foreign currencies required

On the other hand, the initial investment including the equipment fund and the fund for yearly import of raw materials, spare parts and other consumables is assumed as the foreign currencies required for achieving the import substitution.

c) Amount of foreign currencies saved

The difference between the decrease in the amount of import of steel products and the amount of required foreing currencies is the amount of foreign currencies saved by ANSDK as a result of the expansion. The amount of foreign currencies saved is expected to reach US$200 million.

Table 10-1 Balance of Saved Foreign currencies after the Expansion

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Production (1,000 tons)												
Bar	568	568	568	568	568	568	568	568	568	568	568	568
Rod	456	898	938	938	938	938	938	938	938	938	938	938
Commercial billet	—	43	6	4	4	4	4	4	4	4	4	4
Total	1,016	1,509	1,512	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510	1,510
CIF price of imported materials (US$)	320	320	320	320	320	320	320	320	320	320	320	320
Decrease in amount of imported products (US$1,000)	325,120	482,880	483,840	483,200	483,200	483,200	483,200	483,200	483,200	483,200	483,200	483,200
Amount of imported spare parts and other supplies (US$1,000)	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400
Amount of imported raw materials (US$1,000)	101,104	187,748	187,748	187,748	187,748	187,748	187,748	187,748	187,748	187,748	187,748	187,748
Repayment of loan principal in foreign currencies (US$1,000)	26,248	22,599	22,338	32,404	36,984	36,984	36,988	38,324	38,324	34,202	19,751	15,170
Rayment of loan interest in foreign currencies (US$1,000)	17,895	25,039	23,522	21,125	18,459	15,790	13,122	9,471	6,894	4,688	3,783	3,290
Foreign currency balance (US$1,000)	171,473	239,094	241,832	233,523	231,609	234,318	236,942	239,257	241,834	248,162	263,518	268,592

CHAPTER 11. CONCLUSION AND RECOMMENDATION

11.1. Conclusion

With respect to the update of the feasibility study for ANSDK's expansion project conducted by JICA from 1987 to 1988 and reported early 1988, a realistic expansion plan is discovered, which is advantageous not only to ANSDK but also to Egypt, through the field survey conducted by JICA in March 1993, analysis of steel market and developing plan of the domestic industries, evaluation of operation and management in ANSDK, review of the expansion plan, and economic reanalysis.

The aim of the expansion project is to increase rolled products from the present production of over 1.0 million t/y to some 1.5 million t/y by means of minimum investment and maximum utilization of the existing facilities.

According to the economic analysis based on the updated concept of the expansion project to produce more 0.4 million t/y of rolled products than the present rolled production, ROI is about 13%, a very attractive figure.

In addition to this considerable ROI, the amount of the investment for the updated expansion plan is rather small for the steel mill and not difficult to induce finance.

Though some fluctuation of ROI is generated depending upon market price of steel products, overrun of construction cost, etc., the ROI is still attractive.

The implementation of the updated expansion project will also contribute to the improvement of financial condition of ANSDK.

As the conclusion of this feasibility study, early decision to start the expansion project by means of the updated expansion plan is recommended not only to ANSDK but also to Egypt.

Furthermore, it is desired that ANSDK will start planning for further expansion after the present expansion project to increase the production capacity and expand the product mix in El Dikheila Iron and Steel Works by analyzing the market trend of steel products in Egypt with respect to steel demand and trend of requirement for steel grade.

11.2. Recommendation

Although the ROI of the updated expansion project is about 13%, which is a considerable level, the following measures will be recommendable to improve the profit of ANSDK.

1) Lowering the price of natural gas

The price of natural gas is about three times as high as in other oil-producing countries. Though Stage-1 was started aimed at effective use of Abu Qir natural gas, this high price only weakens the competitiveness with other mills.

2) Lowering the charge for the use of mineral jetty and stock yard

The present charge for the use of the mineral jetty and stock yard is as high as US$4.4/pellet-ton (US$6.6/DRI-ton). This high charge has been lowering the cost competitiveness of ANSDK's products.

Therefore it is recommended that ANSDK should take measures to reduce the charge for the use of the mineral jetty and stock yard.

The following are examples of the charge for the use of mineral jetty and stock yard in foreign countries:

a) Mill A in the Middle East

Mill A pays US$3 per pellet ton. This fee consists of basic fee, cleaning fee of pellets dropped in the harbour and painting fee of handrails along the harbour, stevedore fee, etc.

b) Mill B in South America

Mill B pays US$1 per HBI ton including maintenance cost of the unloader and jetty.

3) Minimizing the cost overrun

The investment cost should be kept within the planned values by negotiations with contractors, good engineering and management to avoid additional cost, optimum cooperation between ANSDK, JC and contractors, etc.

Historically, it is obvious that such governmental assistance has greatly contributed to early establishment of the steel industry in a number of countries and has been considered inevitable for the take-off stage of the steel industry. It deserves the fullest consideration again that strong support of the Egyptian Government is essential in carrying out the expansion project of ANSDK.

APPENDIX 2

APPENDIX-2

CONTENTS

APPENDEX 2

REVIEW OF F/S REPORT OF 1988

1. INTRODUCTION

This APPENDIX 2 is the review of the F/S conducted by JICA from 1987 to 1988 and reported in early 1988.

In the above F/S report, the recommended expansion plan consisted of one 600-module direct reduction plant, two 70-ton electric arc furnaces, one 70-ton ladle furnace, one 4-strand billet caster, one 1-strand wire rod mill, and ancillary facilities in order to increase the production of rolled products (mainly rebars) from 745,000 tons per year to 1.2 million tons per year incorporating maximum use of the existing plant facilities and infrastructure.

Through the review of the reported F/S, it has been studied whether or not the previous expansion plan is the optimum method to increase the rebar production by some 400,000 tons per year under the present operational situation in El Dikheila Iron and Steel Works, considering the fact that over 1.0 million tons per year of rolled products has been produced using the original plants and facilities.

The essential points of the previous F/S including the production plan, facilities' expansion plan, implementation schedule, construction cost, and financial analysis are stated in this APPENDIX 2.

2. OUTLINE OF EXPANSION PLAN

Production of the Works after the expansion will be 1.7 million tons per year of crude steel (billets) and 1.5 million tons per year of rolled products as shown in Fig. 2-1. These production amounts will be achieved by using the planned facilities under the present operational conditions in El Dikheila Iron and Steel Works.

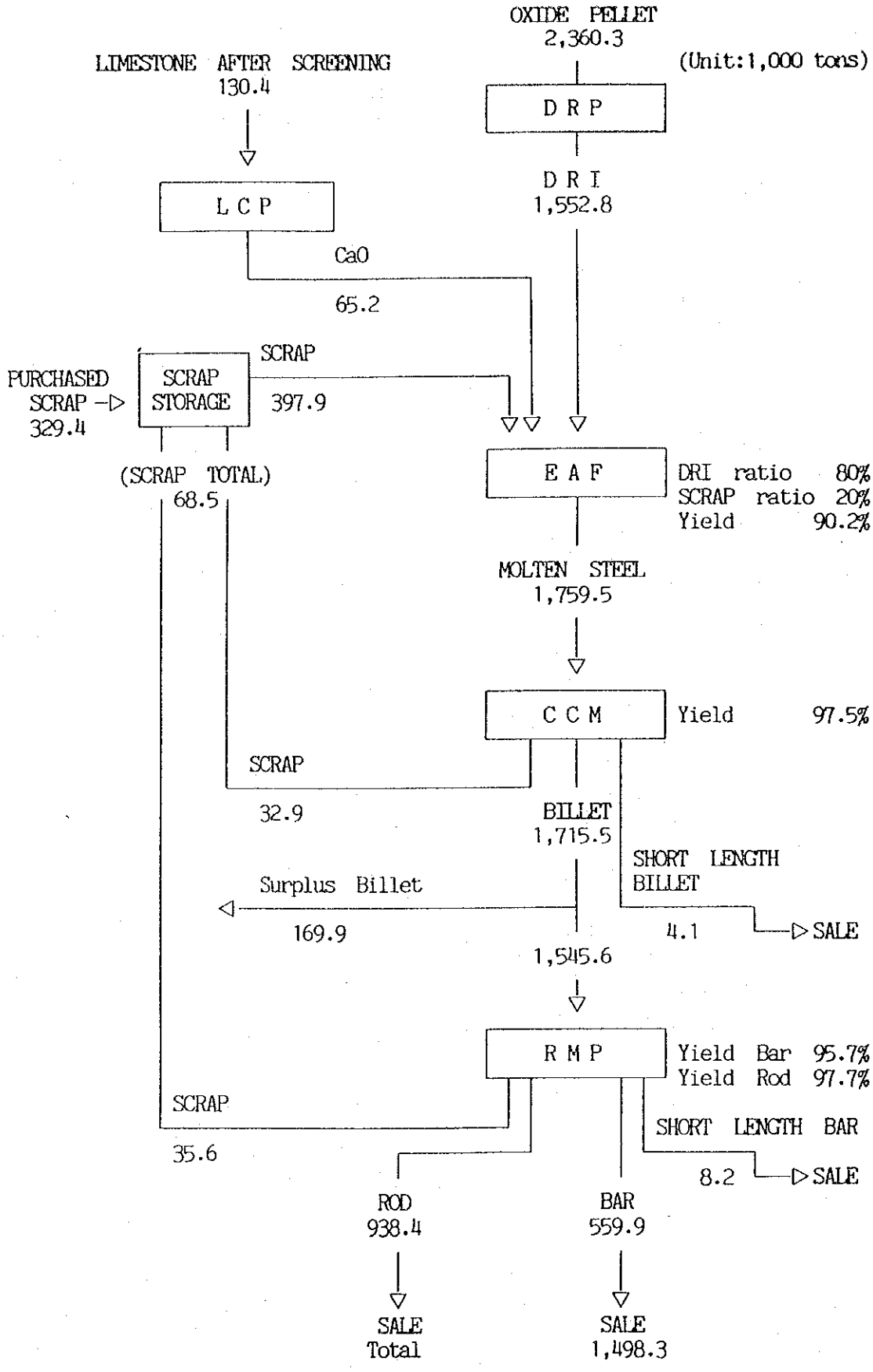


Fig. 2-1 Material Balance Sheet

3. FACILITIES PLAN

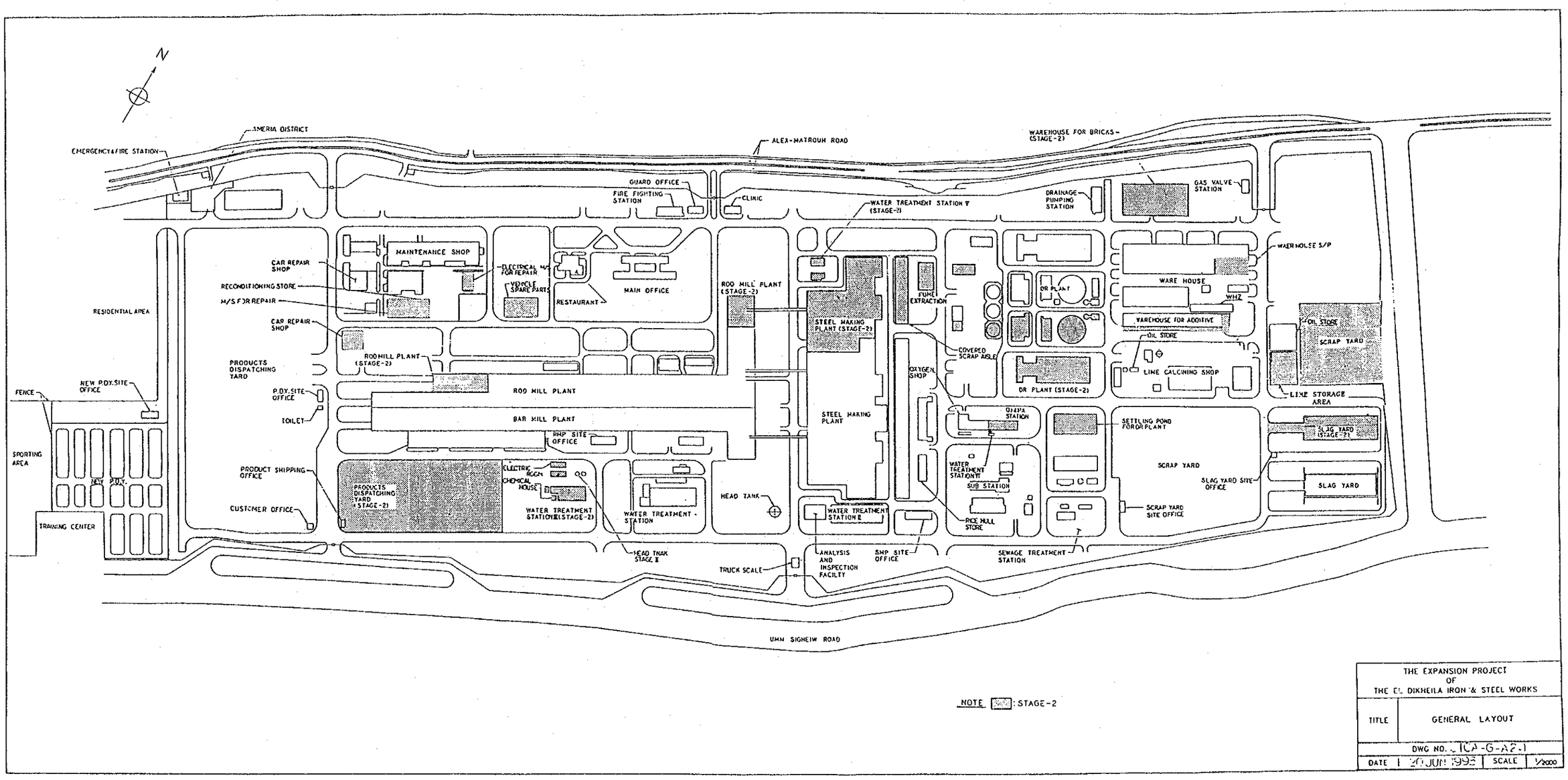
3.1. Facilities to be Expanded

The following facilities were planned in the previous F/S:

- One 600-module direct reduction plant
- Two 70-ton electric arc furnaces
- One 70-ton ladle furnace
- One 4-strand billet caster
- One 1-strand wire rod mill
- One set of ancillary facilities

3.2. General Layout

The facilities planned in the previous F/S were laid out as shown in the attached layout drawing.



THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	GENERAL LAYOUT
DWG NO.	ICP-G-A2-1
DATE : 20 JUN 1993	SCALE 1/2000

3.3. Direct Reduction Plant (DRP)

One module of direct reduction plant, which has the same nominal production capacity as that of the first module, i.e. 716,000 t/h, will be installed.

The new DR plant will be not on HBI basis but on DRI basis, the same as the first module. Considering ANSDK situation, most of the products, i.e. DRI, will be consumed in ANSDK melting shop and only minor portion, if any, will be sold to the outside of ANSDK. In addition, the capital cost and operating cost of HBI basis DR plant is higher than those of DRI basis DR plant.

Basically the new plant will be of the same design as the existing plant except some new development and technology which are beneficial.
Water system will be newly installed adjacent to the existing water system at the south of existing DR plant. At the further south, DR core area (main process facilities) will be newly installed too.
Material handling system will be commonly used as much as possible for the existing module and the new module since the existing module and new module will be of the same MIDREX process.

- Product storage bin : Only an additional bin is required.
- Product screens : Only an additional screen is required.
- Product transfer conveyor : Existing one can be used with minor modification.
- Truck bin : Existing one can be used.
- Truck bin feed conveyor : Existing one can be used.
- Oxide feed conveyors: Existing one can be used from one yard to DR plant.

The existing cold briquetting system is based on 8-hour operation a day. After the expansion, the system can be operated for 16 hours a day to meet the requirement, and so the system will not be expanded.

3.4. Steelmaking Plant (SMP)

1) Outline

a) Basic concept of the expansion project

(1) Production

Production of molten steel at Steelmaking plant (SMP) will be 1,759,500 t/y, up 50% from 1,180,000 t/y at present.

(2) Expansion of facilities

In order to attain the above production target, the following will be expanded or modified.

(a) Building to be expanded to the north of present building

(b) With a view to having commonness in operation, maintenance and building, two units of electric are furnace (EAF) and one unit of continuous casting machine (CCM), both of the same specification and capacity as the existing ones, to be installed in the building mentioned in (a) above

(c) In order to increase handling capacity of direct reduced iron (DRI) as consumption of DRI increases, DRI conveyor lines from storage bins in Direct Reduction Plant (DRI) to hoppers of SMP to be modified

(d) Dust collecting ducts for existing No.3 and 4 EAFs installed on the north side of existing building to be modified so that charging cranes at EAF yard can travel in both the existing and extended buildings

(e) One unit of ladle furnace (LF) to be installed to ensure control of temperature and composition of molten steel tapped and efficient matching between tapping of EAF and casting of CCM and also to expand kinds of steel produced in future

(f) Mold repair shop of CCM to be moved to the north side of extended building

(g) In line with construction of new EAFs and CCM, indoor scrap yard, dust collectors, cranes, raw material handling facilities, molten steel handling facilities, tundish repair shop, ladle repair shop, control room, electric facilities and other related facilities to be expanded

b) Production

Production of molten steel at SMP after the expansion project will be 1,759,500 t/y, which is produced by 6 EAFs and cast to billets by 4 CCMs. Annual production of billets will be 1,715,500 t.

c) Products

Products will be medium & low carbon steel for rebar and size of billets to be 130mm square x 16 long.

d) Main facilities

Major production facilities of SMP are as follows:

Item	Existing	New	Total
EAF:			
Number	4	2	6
Capacity	70 t/ht	Same as left	
Capacity of transformer	46 mVA	-"-	
CCM:			
Number	3	1	4
Number of strands	4	Same as left	16

e) Basic design

(1) EAF

Main raw materials used in EAF, both existing and new, will consist of DRI 80% and scrap 20%, and effective working days of EAF are 320 days/year on three shifts.

(2) CCM

Both existing and new CCMs will employ in principle 3-heat sequence casting.

(3) Specification, capacity and operation

In principle, new facilities will be of the same specification and capacity and operated with the same method as the existing ones.

(4) Increase of kinds of steel

To prepare for increase of kinds in steel in future, one unit of ladle furnace as well as electromagnetic molten steel stirring equipment in the new CCM will be installed.

3.5. Rolling Mill Plant (RMP)

1) Outline

a) Basic concept

(1) Production tonnage

In the expansion project, BAR facilities will be kept as it is and ROD facilities will be increased from one strand to two strands.

After the expansion, production tonnage by BAR will be 559,000 t/y, production by ROD will be 938,000 t/y, and total production of RMP will 1,498,000 t/y.

(2) Expansion of ROD facilities

(a) 2 strands rolling

Rolling line of ROD will be expanded from one strand to two strands.

(b) Expansion of billet yard

In line with increase of billet handling, the area of billet yard will be expanded.

(c) Expansion of coil yard

In line with increase of coil handling, the area of coil yard will be expanded.

(d) Layout

Fig. 6.4.3-1 and Fig. 6.4.3-2 are the layout.
Fig. 6.4.3-1 shows the relation between SMP and RMP, and the expansion building of RMP.
Fig. 6.4.3-2 shows the expansion of ROD.

b) Production

In 1992, production by BAR was 514,000 tons and production by ROD was 520,000 tons. Therefore total production was 1,034,000 tons.

After the expansion, production by BAR will be 559,000 t/y, and production by ROD will be 983,000 t/y. Therefore total production will be 1,498,000 t/y.

c) Steel grade

Steel grade after the expansion will be mainly rebar and partially low carbon steel as in the present stage.

d) Main facilities

The main facilities to be expanded in ROD are as follows.

(1) Billet yard

4 spans of billet yard, 1 billet handling crane

(2) Reheating furnace

Reheating capacity 150 t/h, billet switch plate

(3) Mill equipment (for No.2 strand)

No.2 intermediate mill, finishing mill, cropping and chopping shear

(4) Finishing facilities (for No.2 strand)

Water cooling zone, pinch roll and laying cone, cooling conveyor, reforming tub, coil transportation system including C-hook and ladder, coil compact machine, coil offloading equipment

(5) Other equipment

Lubrication systems, hydraulic systems, water cooling systems, piping for compressed air, natural gas, N2 gas

(6) Coil yard

8 spans of coil yard, 1 coil handling crane

3.6. Lime Calcining Plant (LCP)

Requirement of burnt lime for steelmaking process will be 65,200 t/y. On the other hand, the nominal production of LCP is 52,800 t/y under the conditions of 330 operation days a year.

As stated in Section 4.3.3, this discrepancy of 12,400 t/y between the requirement of 65,200 t/y and nominal production of 52,800 t/y will be conquered by the utilization of marginal capacity of LCP, 120% overload, and ten additional operation days.

Therefore, any new installation or modification of facilities will not be required. No new employment for LCP is needed, either.

However, strict maintenance of equipment including daily, periodic, and scheduled maintenance will be required to secure the required production of burnt lime.

3.7. Power Receeiving and Substation Facilities

1) Distribution scheme

a) Power demand for production

Table 3.7-1 indicates estimated power demand for each plant and works after the expnsion.

The expansion plan features:

(1) 6 new 33 kV lines for new DRP, NO.5 EAF, No.6 EAF,Lade Furnance, SMP Auxiliary, and Rod Mill (One line for each load)

(2) Addition of 2 33 kV feeders for 26 MVA flicker compensator bank (1 for high-impedance transformer, 1 for static condensor)

(3) DRI Plant and Rolling mill (referring to the combination of Bar Mill and Rod Mill) will be equipped with an additional 33kV/6.6kV receiving transformer respectively. This third transformer is considered for back-up purpose in case one of two 33kV/6.6kV working transformers gets out of order.

(4) 6 new 6.6kV lines for new WTS IV, new WTS V and new No.2 Oxygen Plant (dual lines per station).

b) Emergency power

Expansion results in increase of emergency loads as well as normal production loads. Total of required emergency power for the portion of expansion will amount to about 2000 kW, which is equivalent to the unit output of the present emergency generators. A

third generator having the same capacity as the present generators will be employed to meet the load increase.

The new generator will be designed to be connected to the same 6.6kV emergency bus for the present two generators so that all three generators can work in paralell to achieve higher reliability in power supply operation.

Table 3.7-1 Electricity Balance after Expansion

Plant	Unit cons. KWH/T	Production x 10^3T/Y	Operating Hr H/Y	Average Power KW	Load Factor	Demand Power KW
DRI	110	1,552.8	7,680	22,200	0.9	24,700
Lime Calcining	60	65.2	7,680	500	0.9	600
SMP (EAF,CC)	670	1,715.5	7,680	154,100	0.7	220,200
BAR	60.9	559.9	6,398	5,300	0.7	7,600
ROD	100.8	938.5	6,700	14,100	0.7	20,200
Utilities and services			7,680	11,300	0.9	12,500
Total				207,500		285,800

The given diversity factor of total load to demand factor is 1.1,and works overall demand is

$$\frac{285{,}800\ \text{KW}}{1.1} = 259{,}800\ \text{KW}$$

3.8. Utilities

1) Basic concept of the expansion

To study a plan of utility facilities for the expansion, a comparision is provided in Table 3.8-1, which shows the design capacity of existing utility facilities, present consumption of utilities, estimated requirements of utilities for the expansion, and total utility requirements.
The study for the expansion of utility facilities has been made in the following points of view:

- Use the surplus capacity of existing utility facilities as much as possible and effectively.
- Minimize the modification work of existing utility facilities.
- Minimize the construction cost for new utility facilities.

The results of the study for the expansion plan of utility facilities in accordance with the above points of view are shown below.

a) Utility facilities that do not require any modification
   - Raw water treatment station
   - Recirculation water treatment station (Water treatment stations-I, II, III)
   - Sewage treatment station
   - Drainage pumping station
   - Water supply facilities for outdoor fire hydrants

b) Utility facilities that require modification
   - Yard piping

c) Utility facilities that have to be newly installed or expanded
   - New recirculation water treatment station (Water treatment stations-IV, V, VI)
   - Expansion of oxygen shop
   - New nitrogen shop
   - Expansion of air compression station

. Expansion of natural gas station
. New pumping stations No.8 and No.9 for sewage
. New hydrants for fire fighting

The design capacity, utility requirements, and surplus capacity of utility facilities after the expansion are compared in Table 3.8-2.

2) Expansion plan

The expansion plan of utility facilities is summarized below.

a) Water treatment station-IV

Indirect cooling water (ICW) for the new rolling mill plant (RMP) will be supplied and treated in the water treatment station-IV (WTS IV) because the existing water treatment station-I (WTS I) does not have enough capacity for the expansion.

In order to recycle 1,080 m3/h of ICW for new RMP, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

Direct cooing water (DCW) for the new and existing rod mill plants and the existing steelmaking plant (SMP) will be supplied and treated in the existing WTS I and DCW for the existing bar mill plant will be supplied and treated in WTS IV.

In order to recycle 590 m3/h of DCW for the existing bar mill plant, facilities consisting of sedimentation
basin, pressure filters, cooling tower, cold well, pumps, etc. will be installed.

For dehydration of sludge, the existing dehydration system in the WTS I will be used because it has surplus capacity.

These treatment facilities will be installed on the west of the existing WTS I.

b) Water treatment station-V

Since the existing water treatment station-II (WTS II) has no surplus capacity of indirect cooling water (ICW) for the steelmaking plant, water treatment station-V (WTS V) will be installed in the northern part of the existing SMP. Therefore, ICW for SMP will be supplied and treated by WTS II and WTS V.

The existing WTS II will cover the facilities of southern part of SMP consisting of Nos.1, 2 and 3 electric arc furnaces (EAF) and Nos.1 and 2 continuous casting machines (CCM), and WTS V will cover the facilities of northern part of SMP consisting of Nos. 4, 5 and 6 EAF, Nos.3 and 4 CCM, and No.1 LF.

In order to recycle 5,930 m3/h of ICW in WTS V, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

c) Water treatment station-VI

Water treatment station-VI will be installed on the east of the existing water treatment station-I to supply and treat the indirect cooling water for the new nitrogen shop, additional air compressors and new substation because the existing water treatment station-III has no surplus capacity.

In order to recycle 230 m3/h of ICW in WTS VI, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

d) Oxygen shop

The requirement of oxygen gas for the expansion is less than the design capacity of oxygen shop, but one oxygen holder will be added to the existing oxygen shop to prevent fluctuation of oxygen gas pressure because peak oxygen flow rate will be increased by installation of new EAF.

e) Nitrogen shop

New nitrogen shop will be installed on the east of the existing water treatment station-I because the existing nitrogen shop has no surplus capacity. The cryogenic separation process will be applied to the new nitrogen shop.

In order to produce 300 Nm3/h of nitrogen gas, facilities consisting of air compressor, freon refrigeration unit, desiccation and decarbonation unit, low temperature separation unit, nitrogen gas compressor, nitrogen gas holder, etc. will be installed.

f) Air compression station

Two air compressor units will be added to the existing air compression station to supply the compressed air to the expanded plants because the existing air compression station does not have enough capacity for the expansion.

The new air compressor units will have the same capacity of the existing unit in consideration of easy operation.

In order to supply 5,330 Nm3/h of compressed air, facilities consisting of air compressor units and air receiver tank will be installed.

g) Natural gas station

The requirement of natural gas for the expansion is more than the design capacity of the existing natural gas station but this requirement is less than the design capacity of EGPC, so the design capacity of the expanded natural gas station will be able to be increased to 75,000 Nm3/h in consideration of margin. The existing flow meter will be exchanged for new one and new flare stack will be additionally installed to treat the natural gas safely. The capacity of new flare stack will be 25,000 Nm3/h.

h) Pumping stations No.8 and No.9

The pumping stations No.8 and No.9 will be installed around the new nitrogen shop and water treatment station-V to transfer the sewage from the plants to the existing sewage treatment station. The pump pit with rough screen and sewage pump will be installed in the pumping station.

i) Hydrants for fire fighting

Hydrants and piping for fire fighting will be installed around the new RMP and diesel booster pump for the new direct reduction plant will be added.

j) Yard piping

In order to supply utilities to the plants and facilities for the expansion, the following yard piping will have to be modified or installed:

. Potable water
. Make-up water
. Direct cooling water
. Indirect cooling water
. Emergency water
. Sewage
. Drainage
. Oxygen gas
. Nitrogen gas
. Compressed air
. Natural gas
. Fire fighting water

Table 3.8-1 Utility Requirements for Expansion

Station/Shop	Design capacity of existing utility facilities	Present consumption	Estimated requirement for the expansion	Total requirement
1. Raw Water Treatment Station				
· Raw water	930 m3/h	550 m3/h	330 m3/h	880 m3/h
· Make-up water	890 m3/h	500 m3/h	323 m3/h	823 m3/h
· Potable water	50 m3/h	20 m3/h	7 m3/h	27 m3/h
2. Water Treatment Station-Ⅰ				
· Direct cooling water	3,190 m3/h	2,300 m3/h	1,480 m3/h	3,780 m3/h
· Indirect cooling water	2,000 m3/h	1,500 m3/h	1,080 m3/h	2,580 m3/h
3. Water Treatment Station-Ⅱ				
· Indirect cooling water	7,150 m3/h	7,150 m3/h	4,530 m3/h	1 1,680 m3/h
4. Water Treatment Station-Ⅲ				
· Indirect cooling water	284 m3/h	284 m3/h	230 m3/h	514 m3/h
5. Sewage Treatment Station				
· Sewage	500 m3/d	320 m3/d	37 m3/d	357 m3/d
6. Drainage Pumping Station				
· Drainage	1,950 m3/h	290 m3/h	32 m3/h	322 m3/h
7. Oxygen Shop				
· Oxygen gas	400 Nm3/h	200 Nm3/h	62 Nm3/h	262 Nm3/h
· Nitrogen gas	550 Nm3/h	550 Nm3/h	300 Nm3/h	850 Nm3/h
8. Air Compression Station				
· Compressed air	12,800 Nm3/h	10,800 Nm3/h	7,330 Nm3/h	18,130 Nm3/h
9. Natural Gas Station	50,000 Nm3/h	33,000 Nm3/h	28,850 Nm3/h	61,850 Nm3/h
· Natural gas				
10. Outdoor Fire Hydrants				
· Fire water	240 m3/h	0 m3/h	0 m3/h	240 m3/h

Table 3.8-2 Utility Requirements after Expansion

Station/Shop	Design capacity of utility facilities for the expansion	Utility requirement for the expansion	Surplus capacity of utility facilities after the expansion
1. Raw Water Treatment Station			
· Raw water	930 m3/h	880 m3/h	50 m3/h
· Make-up water	890 m3/h	823 m3/h	67 m3/h
· Potable water	50 m3/h	27 m3/h	23 m3/h
2. Water Treatment Station-I			
· Direct cooling water	3,190 m3/h	3,190 m3/h	0 m3/h
· Indirect cooling water	2,000 m3/h	1,500 m3/h	500 m3/h
3. Water Treatment Station-II			
· Indirect cooling water	7,150 m3/h	5,770 m3/h	1,380 m3/h
4. Water Treatment Station-III			
· Indirect cooling water	284 m3/h	284 m3/h	0 m3/h
5. Water Treatment Station-IV			
· Direct cooling water	590 m3/h	590 m3/h	0 m3/h
· Indirect cooling water	1,080 m3/h	1,080 m3/h	0 m3/h
6. Water Treatment Station-V			
· Indirect cooling water	5,930 m3/h	5,930 m3/h	0 m3/h
7. Water Treatment Station-VI			
· Indirect cooling water	230 m3/h	230 m3/h	0 m3/h
8. Nitrogen Shop			
· Nitrogen gas	300 Nm3/h	300 Nm3/h	0 Nm3/h
9. Air Compression Station			
· Compressed air	6,400 Nm3/h	5,330 Nm3/h	1,070 Nm3/h
10. Natural Gas Station			
· Natural gas	75,000 Nm3/h	61,850 Nm3/h	13,150 Nm3/h

3.9 In-works Transportation Facilities

1) Outline

a) Basic concept of the expansion project

In 1992, ANSDK produced 1.035 million tons of rebar, and the handiling amount such as raw materials, by-products and products was more than four times as much as that. Sections in charge of in-works transportation greatly assisted this sharp produntion increase through the material handling. Materials to be handled and tranported within the Works vary greatly in kinds as well as in shape and volume.

Facilities vary in kind or handling quantity of materials, and also working condition varies between facilities.

In the expansion project, facilities of In-works transportation will be expanded in propotion to the production increase, and the actual working ratio of vehicles managed by ANSDK will be referred to.

b) Volume of materials to be handled

Although the amount of each material is proportional to production, the ratio of handling quantity between after and before expansion is corrected by the unit consumption revised when it is different between after and before expansion.

2) Expansion plan of facilities

Considering the material flow after the expansion and the capacity of existing facilities, expansion of facilities is planned as given below.

a) Transport vehicles and related equipment

The required equipment after the expansion is added in accordance with the increase of the production.

b) Scrap yard

As existing scrap yard will not be sufficient for large quantity of purchased scrap, re-arrangement of the existing yard (30,000m^2) and a new scrap yard with space of 14,400m^2 which is located on the north side of slag yard will be provided.

c) Indoor warehouse

With the increase of materials, a new warehouse and expansion of the existing warehouses are planned as mentioned below.

(1)Warehouse for brick

A new warehouse with space 5,290m^2 will be built on the north side of the existing warehouse for brick.

(2) Warehouse for spare parts

To cope with the increase of spare parts of equipment and to be convenient for the inventory control, space of 1,800m^2 will be reserved in the brick wareouse with partition.

(3)Warehouse for additives

As the space for additives will be short, the warehouse will be expanded 3m in width and 25m on east side.

d) Products yard

In line with increase of production, about 20,000m^2 of products yard (capacity about 17,000 tons of rods) will be constructed on the south side of Bar Mill plant.

e) Slag yard

As increased quantity of slag will be generated, a slag yard having the same capacity as that of the existing one will be provided.

f) Truck weighing station

The existing equipment is adequate and no increase will be planned.

g) Vehicle repair shop

Considering the increase in the number of vehicles since the start-up of ANSDK and also the fact that repair of existing vehicles will be more frequent as they get old in years, a new vehicle repair shop will be constructed. The scale and contents of the shop will be the same as those of the existing one.

3.10 Analysis and Inspection Facilities (AI)

As a backup for the production facilities such as DR plant, SMP, and RMP (Bar mill & Rod mill), there are the analysis and inspection facilities which perform analysis and inspection as shown in Tables 5.2.11-1 and 5.2.11-2 in Section 5-2-11.

As various production facilities are expanded and the production increases, frequency of analysis and inspection will increase so much that the existing analysis and inspection facilities cannot cope with the situation. It is considered necessary to add one carbon and sulphur determinator, one emission spectrometer, and one complete set of tools for preparation of samples.

The existing one line of sample transportation system for transporting samples from SMP will be insufficient and one more system will be required.

And it is recommended to provide an oil analyzer of portable type for checking the deterioration of lubrication oils.

The existing 100-ton compression tester will be used exclusively for the bending test and so a 70-ton tensile testing machine should be added for the tensile testing.

In line with increased frequency of analyses, it is considered necessary to permit automatic feedback data communication between the host computer at SMP and the FEP at A&I Dept.

Relocation of the existing equipment in the building will provide the space for the above equipment for the expansion.

The number of the personnel in the analysis and inspection facilities will be increased by 18 after the expansion.

3.11 Maintenance Facilities

1) Facilities

In CHAPTER 5, facilities of maintenance shop of El Dikheila Works and its maintenance system are discussed. By utilizing those facilities and system in full, maintenance work required after the expansion can be performed smoothly with some reinforcement which eliminates the bottlenecks. Outline of the equipment to be reinforced is described below.

a) Mechanical

(1) Existing maintenance shop does not have sufficient space to perform scheduled repairs of spare parts and units taken apart from lines. Therfore, a new maintenance shop (20m×30m) will be built for assembling and/or disassembling of spare parts and units. The building will be located on the south of the fabrication shop, and two 10-ton overhead travelling cranes and necessary machine tools for repairs will be installed.

(2) Machine tools which work at high operation rate and necessary ones for manufacturing spare parts in the Works will be provided.

(3) Purchase of measuring instruments
For checking of spares and units which are maintained in the new shop, and for inspection of purchased spares, some measuring instruments will be purchased.

b) Electrical

(1) A new maintenance shop for electrical maintenance work such as management of electrical spare parts and repair of air-conditioning and communication facilities will be built on the south of existing repair shop. The new building (28m×15m) will be equipped with a five-ton hoist.

(2) A set of spacial tools for maintenance of air conditioning will be provided.

(3) One forklift for cable drum handling will be provided.

3.12 Civil Engineering and Building Work

Civil engineering and building work includes the construction of foundation for buildings and for machinery and equipment, and of culvert, floor, slabs, roads and drainage, and the construction of buildings, which are required for the expansion of production and ancillary facilities.

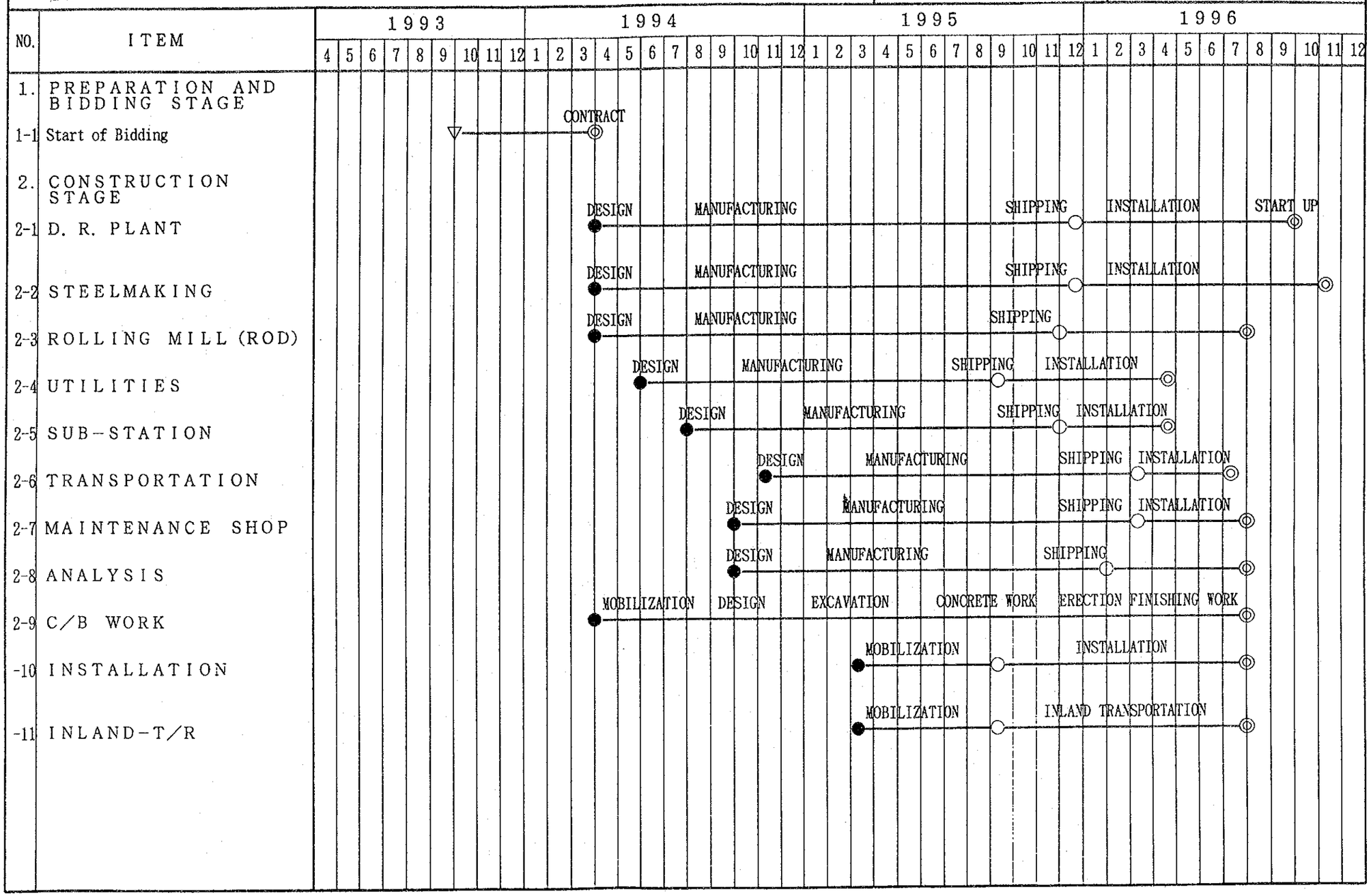
4. IMPLEMENTATION SCHEDULE

As per the attached implementation schedule.

IMPLEMENTATION SCHEDULE
EL DIKHEILA IRON AND STEEL WORKS -EXPANSION PROJECT-

JICA F/S

DATE : 11 JUNE 1993
JICA STUDY TEAM



5. CONSTRUCTION COST

The costs of facilities planned and site work are updated and listed in Table 5.1-1 and Table 5.1-2.

Table 5.1-1 Summary of Capital Cost Estimation (Without Escalation Case)

Unit: 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	L	T	F	L	T	F	L	T	F	L	T
DRP	128,139		128,139	10,812	3,071	13,883	3,258	3,311	6,569	142,209	6,382	148,591
SMP	108,795	3,600	112,395	7,078	2,135	9,213	15,190	6,342	21,532	131,063	12,077	143,140
ROD	29,141	182	29,323	3,085	832	3,917	7,331	1,765	9,096	39,557	2,779	42,336
UT	26,347	1,232	27,579	3,310	897	4,207	1,488	1,570	3,058	31,145	3,689	34,844
PW	2,645	0	2,645	613	151	764	117	156	273	3,375	307	3,682
TR	7,382	0	7,382	93	119	212	2,627	2,370	4,997	10,102	2,489	12,591
MS	1,732	0	1,732	101	34	135	578	730	1,308	2,411	764	3,175
AI	1,751	0	1,751	33	9	42			0	1,784	9	1,793
ADM	804	0	804	0	0	0		1,123	1,123	804	1,123	1,927
Total	306,736	5,014	311,750	25,125	7,248	32,373	30,589	17,367	47,956	362,450	29,629	392,079
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	11,000	0	11,000
Contingency Price C	0	0	0	0	0	0	0	0	0	0	0	0
Physical C	15,337	251	15,588	1,256	362	1,619	1,529	868	2,398	18,123	1,481	19,604
Imp. tax		15,337	15,337	0	0	0		6,115	6,115	0	21,452	21,452
Sales tax		32,708	32,708							0	32,708	32,708
Total	15,337	48,296	63,632	1,256	362	1,619	1,529	6,983	8,513	29,123	55,641	84,764
Grand Total	322,073	53,310	375,382	26,381	7,610	33,992	32,118	24,350	56,469	391,573	85,270	476,843

Table 5.1-2 Summary of Capital Cost Estimation (With Escalation Case)

Unit: 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	L	T	F	L	T	F	L	T	F	L	T
DRP	128,139		128,139	10,812	3,071	13,883	3,258	3,311	6,569	142,209	6,382	148,591
SMP	108,795	3,600	112,395	7,078	2,135	9,213	15,190	6,342	21,532	131,063	12,077	143,140
ROD	29,141	182	29,323	3,085	832	3,917	7,331	1,765	9,096	39,557	2,779	42,336
UT	26,347	1,232	27,579	3,310	897	4,207	1,488	1,570	3,058	31,145	3,699	34,844
PW	2,645	0	2,645	613	151	764	117	156	273	3,375	307	3,682
TR	7,382	0	7,382	93	119	212	2,627	2,370	4,997	10,102	2,489	12,591
MS	1,732	0	1,732	101	34	135	578	730	1,308	2,411	764	3,175
AI	1,751	0	1,751	33	9	42			0	1,784	9	1,793
ADM	804	0	804	0	0	0		1,123	1,123	804	1,123	1,927
Total	306,736	5,014	311,750	25,125	7,248	32,373	30,589	17,367	47,956	362,450	29,629	392,079
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	11,000	0	11,000
Contingency Price C	38,519	751	39,270	3,298	1,201	4,499	3,907	2,316	6,223	45,724	4,268	49,992
Physical C	15,337	251	15,588	1,256	362	1,619	1,529	868	2,398	18,123	1,481	19,604
Imp. tax		15,337	15,337	0	0	0		6,115	6,115	0	21,452	21,452
Sales tax		32,708	32,708							0	32,708	32,708
Total	53,856	49,047	102,902	4,554	1,563	6,118	5,436	9,299	14,736	74,847	59,909	134,756
Grand Total	360,592	54,061	414,652	29,679	8,811	38,491	36,025	26,666	62,692	437,297	89,538	526,835

6. FINANCIAL ANALYSIS

6.1. Schedule of Fund Demand and Raising

Fund demand and raising schedule for the expansion facilities is shown in Table 6.1-1 and Table 6.1-2.

Table 6.1-1 Schedule of Fund Demand and Raising
Case : (Without escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand:															
Equipment	192,194		39,331	107,371	33,359		348	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Pre-production cost	798				798										
Additional working capital	15,752				8,903	5,556	293								
Interest under construction	22,807		2,597	11,701	8,509										
Demand total	231,551	0	41,928	119,072	52,569	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Raising:															
Capital	69,471		13,075	17,909	20,505	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263
Long-term loan	162,080		28,853	101,163	32,064										
Raising total	231,551	0	41,928	119,072	52,569	5,556	641	1,471	1,733	1,733	1,733	1,733	1,733	1,386	263

Table 6.1-2 Schedule of Fund Demand and Raising
Case (With escalation)

(Unit:1000US$)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand:															
Equipment	211,860		41,624	119,204	37,564		371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Pre-production cost	1,057				1,057										
Additional working capital	17,721				11,266	6,455									
Interest under construction	25,007		2,753	12,859	9,395										
Demand total	255,645	0	44,377	132,063	59,282	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Raising:															
Capital	76,693		13,787	19,779	23,204	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299
Long-term loan	176,952		30,590	112,284	36,078										
Raising total	255,645	0	44,377	132,063	59,282	6,455	371	1,625	1,924	1,924	1,924	1,924	1,924	1,553	299

6.2. Internal Rate of Return on Investment Fund

The result of calculation of IRR is shown in Table 6.2-1.

Table 6.2-1 IRR

Description	ROI	ROE
Without escalation	7.48%	7.28%
With escalation	9.83%	11.66%

7. CONCLUSION

The calculated ROI for the facilities planned in the previous F/S under the present operational conditions in El Dikheila Iron and Steel Works is as low as 7.48%.

The calculated ROI is affected by high initial investment cost and production of the low value products like billets due to imbalance of capacity of the steelmaking plant and rolling mills.

ANSDK plans to be a private company in the near future. Therefore it is quite important for ANSDK to increase the competitiveness as the steel mill together with the increase of supply of steel products in the domestic market in order to decrease imported steel products, thus providing local employment opportunities.

Considering the above, the expansion project should be restudied and replanned as stated in this feasibility study report.

APPENDIX 3

APPENDIX-3

POSSIBILITY OF BAR MILL IMPROVEMENT

1. INTRODUCTION

ANSDK Bar mill(BAR) keeps the full production today under the condition of increasing market demand. Therefore ANSDK is now promoting some improvements such as application of new material roll, installation of a new crane to reduce the roll change time, and application of new pass-schedule.

In March 1993 when JICA mission visited ANSDK to perform fact-finding of the plants, the study of possibility of BAR improvement with application of new technology or facility modification was requested by ANSDK to increase the BAR production.

In consideration of above-mentioned background, the possibility for production increase by three-slit rolling is studied as described below.

2. THREE-SLIT ROLLING

Recently the new technology of three-slit rolling becomes to be applied in bar mill for increase of productivity.
For ANSDK BAR, the following items are important matters to apply the three-slit rolling technology.

1) Size

The sizes of D10 and D12 are possible for application of three-slit rolling.
However, the sizes of D14 or more are impossible for application of the three-slit rolling, because the dimension of rake pitch (70mm) at cooling bed is too small to transfer the D14 rebar without interference to fixed rake.

2) Improvement of rolling productivity (t/h)

At present, the rolling productivities of D10, and D12 by two-slit rolling are 66 billet-t/h and 83 billet-t/h.
And those by three-slit rolling are expected to be 83 billet-t/h and 114 billet-t/h.
Therefore, rolling productivity will increase by 1.25 times for D10, and 1.30 times for D12.

In this estimation, the maximum rolling speed at finishing mill is limited to 14 m/sec because of stable tracking for three rebars at the entry table of cooling bed.

3) Dimension of rake pitch

The dimension of rake pitch is 70mm.
Rebars are transferred on the rake with locus of 70mm dia circle.
In this movement, three rebars of D10, D12 are possible to be transferred on the rake without any interference.

However, three rebars of D14 or more are impossible to be transferred on the rake, because the third bar interferes with the top of fixed rake.

4) Facilities modification

a) Facilities to be modified

The new facilities such as loopers, guides, troughs, rolls with new caliber design will be modified for three slit rolling.

b) Facilities to be checked and reviewed

The following capacities will be checked and reviewed severely for three-slit rolling.

(1) Reheating furnace capacity

The existing reheating furnace has capacity of 110 billet-t/h.
This capacity is little lower than that for the increased rolling capacity (114 billet-t/h:D12 three slit rolling).

(2) The mill motor and reducer capacity will be checked and reviewed for new pass schedule by three-slit rolling.

(3) Cold shear and binding capacity

The cold shear and binding capacity will be checked and reviewed for harmony with increased rolling capacity.

3. CONCLUSION

The new technology of three-slit rolling for ANSDK to increase the production is expeted to be effective.

The further refined studies are neccesary for this improvement; however briefly speaking, the three-slit rolling for D10, D12 has the possibility of the application in ANSDK bar mill.

APPENDIX 4

APPENDEX-4

3.1.5

ECONOMIC INDEX RELATING TO STEEL INDUSTRY

	Egypt	Thailand	Philippines
Population (million)	54.7	55.2	60.1
GNP per Capita ($:1985 Year Price)	*935	978	616
Steel Products Consumption(1000 ton)	4407	3047	1818
Steel Consumption** per Capita (kg)	89.7	62.7	39.9
	1991	1989	1989

Source: WORLD BANK, IISI, JISF
Note: *1990Year, **Crude steel

STEEL CONSUMPTION BASED ON PRODUCT CATEGORY

THAILAND 1989

	Long products			Flat Products	Total (%)
	Bars & rods	Others	Total		
Construction	96	99	96	40	61
Buildings	40	50	41	32	37
Civil Eng.	56	49	55	8	24
Cars & Trucks	1	0	1	15	8
Electrical	2	1	2	21	11
Equipment & Industrial Machinery					
Others	1	0			20
Total	100	100	100	100	100

Source: JISF

Philippines 1989

	Long products			Flat Products	Total (%)
	Bars & rods	Others	Total		
Construction	67	96	70	46	58
Cars & Trucks	1	0	1	12	6
Equipment & Industrial Machinery	1	1	1	14	7
Others	31	2	8	28	29
Total	100	100	100	100	100

Source: JISF

3.2.1-2) a)

Forecast of Car Production

1) The third 5-year plan

Production in 1994/1995(unit: 1,000 units)

Tractors for agriculture	6
Buses	3
Trucks	6.5

Ratio of domestic production: 67%

2) passenger cars
(according to the hearing at SUZUKI EGYPT S.A.E.)

The growth rate of car demand is expected at around 10% per year, which is assumed from the inquiries for SWIFT in this year.

Depending on the import trend and if the production cost of domestic cars gets below the import price including import duties, it will be possible to achieve the car production of 25,000 units in the year 2000, which is equal to the past record production in 1983, since there are plans of expanding the domestic car production.
(growthe rate from 1991 to 2000: 9.8% p.a.)
The above growth is reasonable judging from the increase in both the recent car production and the number of registered cars.

3) Forecast of car production in future

(Unit: 1,000 units)

FY	1991	1995	1997	2000	2002
Cars	8.9	12.9	15.6	25.0	29.6
Trucks	1.1	3.6	6.5	7.5	8.3
Buses	1.1	2.1	3.0	3.5	3.8
Total	1.1	18.6	25.1	36.0	41.7

(Note) Car production of 25,000 units in 2000 and the growth rate of 9.8% p.a. near 2000 are applied. The production of trucks and buses is assumed to be 2 years behind the forecast for 1995 in the third 5-year plan, judging from the past production and the recent low production level.

Car Production

(1,000 units)

FY	Cars	Trucks	Buses	Total
1981	18.7	2.2	0.6	21.5
82	17.0	2.5	0.7	20.2
83	25.1	2.7	0.8	28.6
84	20.3	3.3	0.8	24.4
85	20.8	3.1	0.8	24.7
86	19.2	3.3	0.8	23.3
87	17.9	2.6	1.0	21.5
88	19.4	1.7	1.1	22.2
89	13.1	1.5	1.4	16.0
90	9.7	1.4	1.5	12.6
91	8.9	1.1	1.1	11.1

Source: CAPMAS

Number of registered cars

(1,000 units)

CY	Cars	Taxis	Trucks	Buses	Trailer, etc	Total
1985	852.0	172.3	264.6	28.3	52.9	1370.3
86	890.9	166.1	286.8	28.4	61.4	1432.5
87	900.3	175.7	302.4	29.5	61.4	1469.4
88	891.9	184.4	318.5	31.6	62.1	1488.4
89	928.0	191.1	332.2	30.4	60.9	1542.7
90	971.9	95.1	346.9	32.8	63.6	1510.3
90% 85%	2.7	-11.2	5.6	5.2	3.8	2.0

Source: TPA/JICA Report (92.3)

Industrial Production

(L.E. million, current price)

FY	Petroleum Industries	Mining	Chemicals & Pharma-ceuticals	Food Indust-ries	Engineering & Electrical Industries	Spinning Weaving Industries	Building Material Industries
1981	3899	49	698	1692	1204	1568	83
82	3773	90	873	1776	1397	1706	82
83	3691	72	923	2389	1689	1773	83
84	4082	78	1120	2705	1878	1904	113
85	4464	87	1456	3491	2286	2227	198
86	4092	97	1515	3391	2388	2605	235
87	3563	102	1883	4459	2487	2765	294
88	4172	116	2163	5005	3494	3796	349
89	4186	233	2867	6500	4200	4866	355
90	6090	316	3222	7628	4527	5648	402
91	13847	346	3789	9289	4964	6904	538

Source: CAPMAS

3.2.1-2) b)

Cement consumption and bar consumption

The cement consumption is closely related with the bar consumption, since bars are used for reinforcement.

FY	Cement Consumption	Bar Consumption (1000 ton)
1982	7600	1356
83	9600	1482
84	10500	1046
85	13000	1947
86	13900	2159
87	16700	1913
88	15700	1832
89	15600	2159
90	15500	2253
91	15762	2330
92	15500	1998

Source: Cement consumption: Holding Company of Cement & Building Materials, Bar consumption: Table 3.1.4-1

3.4.2

The Steel Industry in the Neighbouring Countries

The major Steel mills in the neighbouring countries are QASCO in Qatar, HADEED in Saudi Arabia and Misurata Steel Complex in Libya, of which details are hereunder.

1. Qatar Steel Company (QASCO)

QASCO is located at Umm Said of the State of Qatar producing reinforcing steel bars of around 550,000 t/y. Its products are being marketed at the Arabian Gulf countries such as Qatar, U.A.E., Saudi Arabia, Oman and Bahrain.

2. Saudi Iron Steel Company (HADEED)

HADEED is located at Al Jubail of the Kingdom of Saudi Arabia producing wire rod and steel bars of around 1,700,000 t/y. Presently, HADEED is constructing a new rolling mill for production of sections/bars of 500,000 t/y which is scheduled to start in 1993. Its products' market is mainly Saudi Arabia and neighbouring Arabian Gulf countries.

3. Iron & Steel Complex-Misurata, Libya

The Misurata Steel Complex started its operation in 1989. The major production facilities are as follows:

Direct Reduction Plant	2 units	1,100,000 t/y
Steel Making Shop		1,324,000 t/y
(Bloom/Billet: 3 EAF and 3 CCM		630,000 t/y)
(Slab: 3 EAF and 2 Slab CCM		611,000 t/y)
Bar & Rod Mills	2 units	400,000 t/y
Light & Medium Section Mill	1 unit	120,000 t/y
Hot Strip Mill	1 unit	580,000 t/y
Cold Rolling Mill	1 unit	120,000 t/y

The Misurata Steel Complex is presently producing steel products of about 800,000 t/y, of which 400,000 t/y is bars and wire rods. The bars and wire rods are destined mainly for the construction use in the domestic market.

The import of steel bars for reinforcement use from the above-mentioned countries in Egypt is shown in the following table.

As shown in the table, it is considered that the import of bars from these countries is very small, not affecting the market of bars in Egypt as well as the Expansion plan of ANDSK.

Import of R/C bar inEgypt from Saudi, Libya and Qatar

(unit: tons)

Year	89/90	90/91	91/92
Saudi Arabia	90	-	-
Libya	-	-	15,138
Qatar	-	-	-
Algeria	1,297	2,749	267

However, it might be advisable to take proper measures to avoid the inflow of bars at an unfair price from overseas including these countries.

APPENDIX 5

APPENDIX-5

CONTENTS

APPENDEX 5

REFERENCE F/S ON PRODUCTION OF 2.0 MILLION T/Y OF LONG PRODUCTS

1. INTRODUCTION

This APPENDIX 5, the reference F/S on production of some 2.0 million tons a year of long products including the present production capacity of El Dikheila Iron and Steel Works, will contribute to ANSDK in planning future expansion when market demand of long products increases in the near future.

To expand the production capacity of long products, the following production facilities are planned: one 600-module direct reduction plant, one 70-ton electric arc furnace, three 70-ton ladle furnaces, one 4-strand billet caster, one 1-strand rod mill, one merchant bar mill, and anicillary facilities.

The essential points of F/S such as the production plan, facilities plan, implementation schedule, construction cost, and financial analysis are stated in this APPENDIX 5.

2. OUTLINE OF EXPANSION PLAN

Production of the Works after the expansion will be 1.9 million tons per year of crude steel (billets) and 1.85 million tons per year of rolled products as shown in Fig. 2-1. These production amounts will be achieved by using the planned facilities under the present operational conditions in El Dikheila Iron and Steel Works.

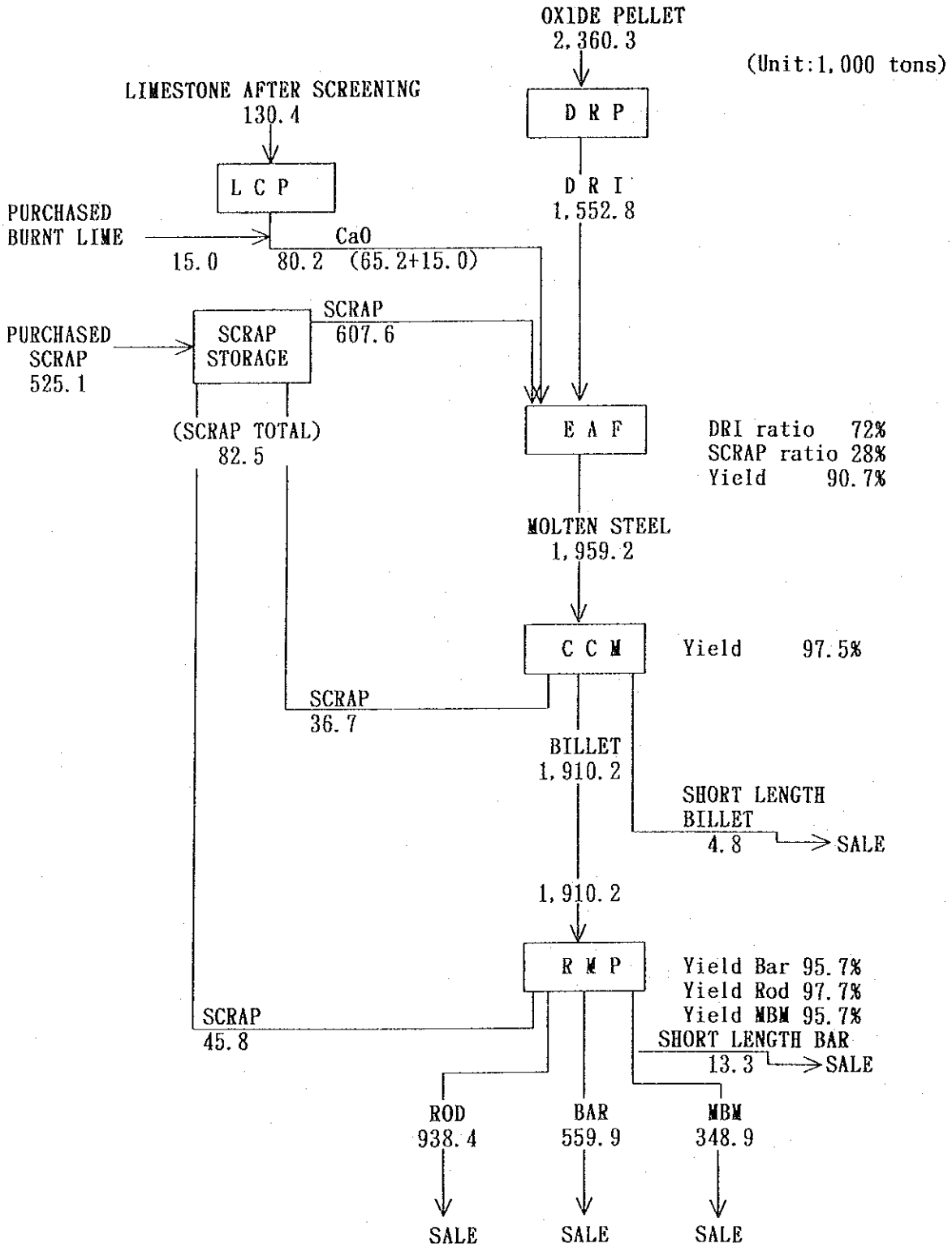


Fig.2-1 Material Balance Sheet for 2 Mil.t/y

3. FACILITIES PLAN

3.1 Facilities to be Expanded

The following facilities will be installed for further expansion :

- One 600-module direct reduction plant
- one 70-ton electric arc furnace
- Three 70-ton ladle furnaces
- One 4-strand billet caster
- One 1-strand rod mill
- One mechant bar mill
- Ancillary facilities

3.2 General Layout

The facilities planned in this F/S are laid out as shown in the attached layout drawing.

N

AMERIA DISTRICT

EMERGENCY & FIRE STATION

ALEX-MATROUH ROAD

WAREH
(STAGE-

GUARD OFFICE

FIRE FIGHTING STATION

CLINIC

OXYGEN PLANT (STAGE-2)

WATER TREATMENT STATION V (STAGE-2)

MAINTENANCE SHOP

CAR REPAIR SHOP

RECONDITIONING STORE

M/S FOR REPAIR

ELECTRICAL M/S FOR REPAIR

VEHICLE SPARE PARTS

RESTAURANT

MAIN OFFICE

RESIDENTIAL AREA

CAR REPAIR SHOP

MERCHANT BAR MILL PLANT (STAGE-2)

STEEL MAKING PLANT (STAGE-2)

FUME EXTRACTION

COVERED SCRAP AISLE

OXYGEN SHOP

DR PLANT

PRODUCTS DISPATCHING YARD

ROD MILL PLANT (STAGE-2)

NEW P.O.Y. SITE OFFICE

FENCE

P.O.Y. SITE OFFICE

TOILET

ROD MILL PLANT

BAR MILL PLANT

RMP SITE OFFICE

STEEL MAKING PLANT

O2&PA STATION

SPORTING AREA

NEW P.O.Y

PRODUCT SHIPPING OFFICE

PRODUCTS DISPATCHING YARD (STAGE-2)

ELECTRIC ROOM

CHEMICAL HOUSE

WATER TREATMENT STATION VI

SUB STATION

CUSTOMER OFFICE

WATER TREATMENT STATION VI (STAGE-2)

WATER TREATMENT STATION

HEAD TANK

WATER TREATMENT STATION II

RICE HULL STORE

TRAINING CENTER

HEAD TNAK STAGE II

TRUCK SCALE

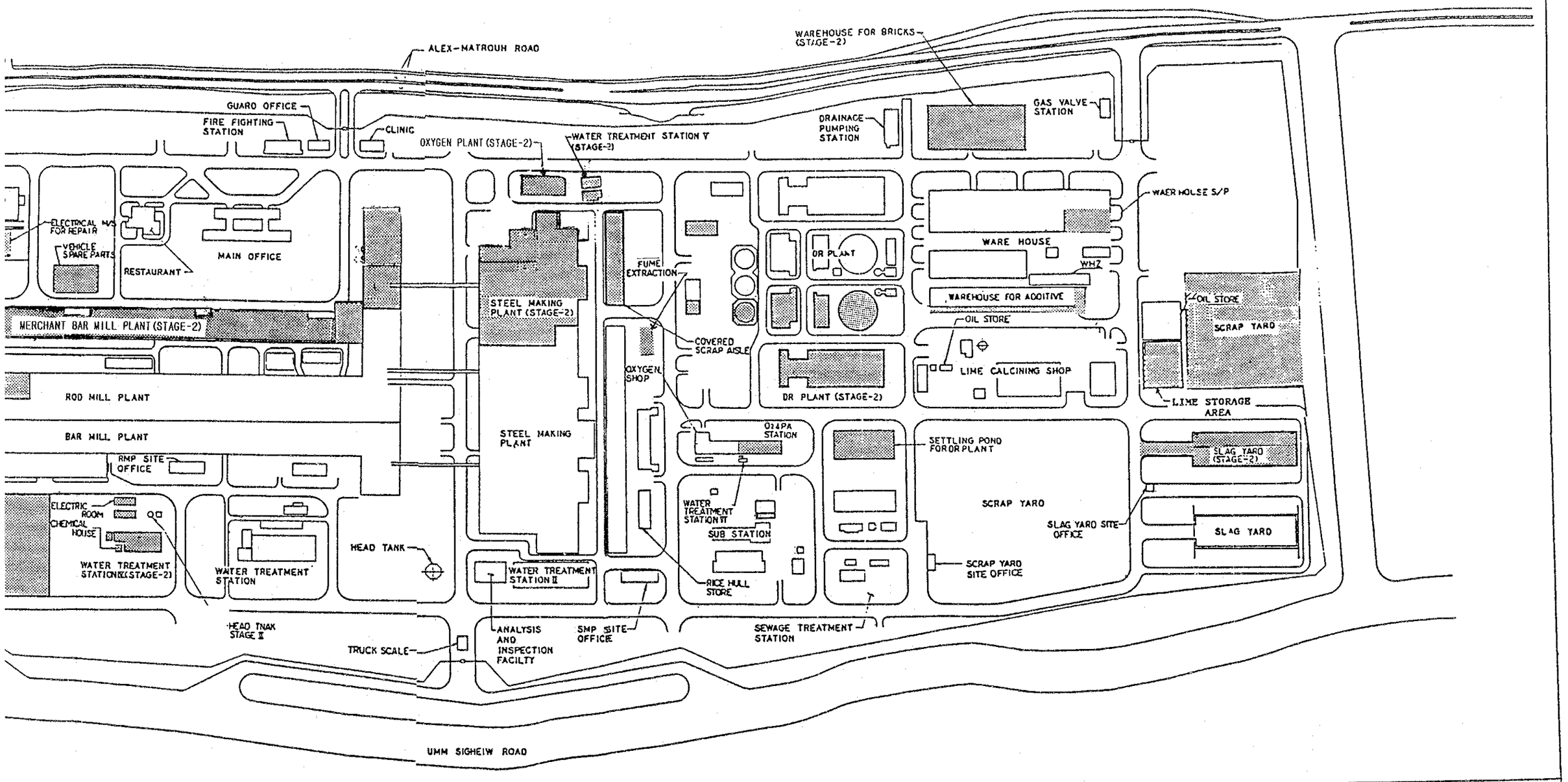
ANALYSIS AND INSPECTION FACILTY

SMP SITE OFFICE

SEWAGE TREATI STATION

UMM SIGHEIW ROAD

NOTE ▒▒: STAGE-



NOTE ▨: STAGE-2

THE EXPANSION PROJECT OF THE EL DIKHEILA IRON & STEEL WORKS	
TITLE	GENERAL LAYOUT
DWG NO.	JICA-G-A5-1
DATE	26 SEP 1993
SCALE	1/2000

3.3 Direct Reduction Plant (DRP)

One module of direct reduction plant, which has the same nominal production capacity as that of the first module, i.e. 716,000 t/h, will be installed.

The new DR plant will be not on HBI basis but on DRI basis, the same as the first module. Considering ANSDK situation, most of the products, i.e. DRI, will be consumed in ANSDK melting shop and only minor portion, if any, will be sold to the outside of ANSDK. In addition, the capital cost and operating cost of HBI basis DR plant is higher than those of DRI basis DR plant.

Basically the new plant will be of the same design as the existing plant except some new development and technology which are beneficial.
Water system will be newly installed adjacent to the existing water system at the south of existing DR plant. At the further south, DR core area (main process facilities) will be newly installed too.
Material handling system will be commonly used as much as possible for the existing module and the new module since the existing module and new module will be of the same MIDREX process.

- Product storage bin : Only an additional bin is required.
- Product screens : Only an additional screen is required.
- Product transfer conveyor : Existing one can be used with minor modification.
- Truck bin : Existing one can be used.
- Truck bin feed conveyor : Existing one can be used.
- Oxide feed conveyors: Existing one can be used from one yard to DR plant.

The existing cold briquetting system is based on 8-hour operation a day. After the expansion, the system can be operated for 16 hours a day to meet the requirement, and so the system will not be expanded.

3.4 Steelmaking Plant (SMP)

1) Outline

a) Basic concept of the expansion project

(1) Production

Production of molten steel at Steelmaking plant (SMP) will be 1,959,200 t/y, up 66% from 1,180,000 t/y at present.

(2) Expansion of facilities

In order to attain the above production target, the following will be expanded or modified.

i) Building to be expanded to the north of present building

ii) With a view of having commonness in operation as well as maintenance, one unit of electric arc furnace(EAF) and one unit of continuous casting machine (CCM), both of the same specification and capacity as the existing ones, to be installed in the building mentioned in i) above

iii) In order to increase handling capacity of direct reduced iron (DRI) as consumption of DRI increases, DRI conveyor lines from storage bins in Direct Reduction Plant (DRI) to hoppers of SMP to be modified

iv) Capacity of fume extracting system for existing 4 EAFs to be increased and dust collecting ducts for existing No.3 and 4 EAFs installed on the north side of existing building to be modified so that charging cranes at EAF yard can travel in both the existing and extended buildings

v) Oxy-lancing & carbon injection technology to be introduced to EAF operation

vi) Three units of ladle furnace (LF) to be installed to ensure control of temperature and composition of molten steel tapped and efficient matching between tapping of EAF and casting of CCM and also to expand kinds of steel produced in future

vii) In line with construction of new EAF and CCM and LFs, indoor scrap yard, dust collectors, cranes, raw material handling facilities, molten steel handling facilities, tundish repair shop, ladle repair shop, control room, electric facilities and other related facilities to be expanded

b) Production

Production of molten steel at SMP after the expansion project will be 1,959,200 t/y, which is produced by 5 EAFs and cast to billets by 4 CCMs. Annual production of billets will be 1,910,200 t.

c) Products

Products will be medium & low carbon steel for rebar and size of billets to be 130mm square x 16m long.

d) Main facilities

Major production facilities of SMP are as follows:

Item		Existing	New	Total
EAF:				
	Number	4	1	5
	Capacity	70 t/ht	Same as left	
	Capacity of transformer	46 MVA	-"-	
LF:	Number	-	3	3
	Capacity of transformer	-	12MVA	
CCM:				
	Number	3	1	4
	Number of strands	4	Same as left	16

e) Basic design

(1) EAF

Main raw materials used in EAF, both existing and new, will consist of DRI 72% and scrap 28%, and Oxy-lancing & Carbon injection to be adopted during melting. SMP will be operated on the basis of effective working days of EAF are 320 days/year on three shifts.

(2) LF

Molten steel tapped by EAF is refined in the ladle to obtain the adequate composition and temperature.

(3) CCM

Both existing and new CCMs will employ in principle 5-heat sequence casting.

(4) Specification, capacity and operation

In principle, new facilities will be of the same specification and capacity and operated with the same method as the existing ones.

(5) Increase of kinds of steel

To prepare for increase of kinds in steel in future, three units of ladle furnace as well as electromagnetic molten steel stirring equipment in the new CCM will be installed.

3.5 Rolling Mill Plant (RMP)

1) Basic oncept of the expansion project

In consideration of the Eqyptian steel market, the third new mill for ANSDK is suitable to install a Merchant Bar Mill (MBM).
This MBM can produce not only rebars, but also angle bars, channel bars, and flat bars.

Therefore in the expansion project, RMP will consist of Bar rolling mill (BAR), Rod rolling mill (ROD) and Merchant bar mill (MBM).

Bar facilities will be kept as it is, and it's roduction will be 559,900 tons/year.

Rod facilities will be increased from one strand to two strands, and it's production will be 938,400 tons/year.

MBM will be installed at the north area of BAR and ROD in parallel, and it's production will be 348,900 tons/year according to the billet supply from steel making plant.

Therefore total production of RMP will be 1,847,200 tons/year.

The outlines of the MBM are described as follows.
(The outlines of the BAR and ROD are described in paragraph 5.2.5 and 6.4.3)

2) Production

a) Billet size
The billet size is to be common with the existing billet size for BAR and ROD.
130mm × 130mm × 16,000 × 2,100 kg

b) Products and size

b) Products and size

(1) Main products

Rebar D10 mm: 4 slit rolling

" D12, D14mm: 3 "

" D16, D18mm: 2 "

" D20-D41 mm: Non

(2) Other roll-able prodcts

Angle bar : 25 × 2

Channel bar (CB): 75 × 40 × 5 mm-100 × 50 × 5 mm

Flat bar (FB): 50 × 6 mm-125 × 12 mm

c) Capacity of rolling productivity (t/h)

Maximum : 110 t/h (product base)

Average : 100 t/h (product base)

d) Capacity of annual production

Approximately 500,000 tons/year

3) Main facilities

a) Reheating furnace

Maximum heating capacity : 110 billet t/h

b) Full continuous rolling mill

(1) No. 1 roughing mill train (No. 1 - No. 4 stands)

(2) No. 2 roughing mill train (No. 5 - No. 8 stands)

(3) Intermediate mill train (No. 9 - No. 12 stands)

(4) Finishing mill train (No. 13 - No. 16 stamds)

c) Finishing facilities

(1) Colling bed

(2) On-line straightener for AB,CB and FB

(3) Stacking line

(4) Bundiling line

d) Civil & Building and crane
   (1) Billet yard and billet handling crane
   (2) Mill yard and mill yard crane
   (3) Products yard and products handling crane
   (4) Roll shop yard and roll shop yard crane
   (5) electric room
   (6) Scale pit and scale pit crane

3.6. Lime Calcining Plant (LCP)

Requirement of burnt lime for steelmaking process will be 80,200 t/y. On the other hand, the nominal production of LCP is 52,800 t/y under the conditions of 330 operation days a year.

As stated in Section 4.3.3, this discrepancy of 27,400 t/y between the requirement of 80,200 t/y and nominal production of 52,800 t/y will be conquered by the utilization of marginal capacity of LCP, 120% overload, and ten additional operation days, and purchase of some 15,000 t/y of burnt lime from the outside of ANSDK.

Due to economical point of view, any new installation or modification of facilities will not be recommended. No new employment for LCP is needed, either.

However, strict maintenance of equipment including daily, periodic, and scheduled maintenance will be required to secure the required production of burnt lime.

3.7. Power Receeiving and Substation Facilities

1) Distribution scheme

a) Power demand for production

Table 3.7-1 indicates estimated power demand for each plant and works after the expnsion.

The expansion plan features:

b) Facilities plan

(1) 8 new 33 kV lines for new DRP, NO.5 EAF, No.1 LF, No.2 LF, No. 3 LF, SMP Auxiliary, Merchant Bar Mill and Rod Mill (One line for each load)

(2) Addition of 2 33 kV feeders for 15 MVA flicker compensator bank (1 for high-impedance transformer, 1 for static condensor)

(3) DRI Plant and Rolling mill (referring to the combination of Bar Mill and Rod Mill) will be equipped with an additional 33kV/6.6kV receiving transformer respectively. This third transformer is considered for back-up purpose in case one of two 33kV/6.6kV working transformers gets out of order.

(4) 8 new 6.6kV lines for new WTS IV, new WTS V, new WTS VII and new No.2 Oxygen Plant (dual lines per station).

c) Emergency power

Expansion results in increase of emergency loads as well as normal production loads. Total of required emergency power for the portion of expansion will

amount to about 1862 kW, which is equivalent to the unit output of the present emergency generators. A third generator having the same capacity as the present generators will be employed to meet the load increase.

The new generator will be designed to be connected to the same 6.6kV emergency bus for the present two generators so that all three generators can work in paralell to achieve higher reliability in power supply operation.

Table 3.7-1 Electricity Balance after Expansion

Plant	Unit cons. kWh/t	Production x 10^3t/y	Operating Hr h/y	Average Power kW	Load Factor	Demand Power kW
DRI	110	1,552.8	7,680	22,200	0.9	24,700
Lime Calcining	60	65.2	7,680	600	0.9	700
SMP (EAF,CC)	622	1,910.2	7,680	159,700	0.7	228,100
BAR	60.9	559.9	6,398	5,300	0.7	7,600
ROD	100.8	938.4	6,700	14,100	0.9	20,200
MBM	60.9	348.9	3,646	5,800	0.7	8,300
Utilities and services			7,680	15,000	0.9	16,700
Total				222,700		306,300

Given the diversity factor of total load to demand factor is 1.1,and works overall demand is 306,300 KW

$$\frac{306,300\ KW}{1.1} = 278,500\ kW$$

3.8. Utilities

1) Basic concept of the expansion

To study a plan of utility facilities for the expansion, a comparision is provided in Table 3.8-1, which shows the design capacity of existing utility facilities, present consumption of utilities, estimated requirements of utilities for the expansion, and total utility requirements.
The study for the expansion of utility facilities has been made in the following points of view:

- Use the surplus capacity of existing utility facilities as much as possible and effectively.
- Minimize the modification work of existing utility facilities.
- Minimize the construction cost for new utility facilities.

The results of the study for the expansion plan of utility facilities in accordance with the above points of view are shown below.

a) Utility facilities that do not require any modification
   - Raw water treatment station
   - Recirculation water treatment station (Water treatment stations-I, II, III)
   - Sewage treatment station
   - Drainage pumping station
   - Water supply facilities for outdoor fire hydrants

b) Utility facilities that require modification
   - Yard piping

c) Utility facilities that require modification or expansion
   - New recirculation water treatment station (Water treatment stations-IV, V, VI, VII)
   - New oxygen shop
   - New nitrogen shop
   - Expansion of air compression station

. Expansion of natural gas station
. New pumping stations No.8 and No.9 for sewage
. New hydrants for fire fighting

The design capacity, utility requirements, and surplus capacity of utility facilities after the expansion are compared in Table 3.8-2.

2) Expansion plan

The expansion plan of utility facilities is summarized below.

a) Water treatment station-IV

Indirect cooling water (ICW) for the new rolling mill plant (RMP) will be supplied and treated in the water treatment station-IV (WTS IV) because the existing water treatment station-I (WTS I) does not have enough capacity for the expansion.
In order to recycle 1,080 m3/h of ICW for new RMP, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

Direct cooling water (DCW) for the new and existing rod mill plants and steelmaking plant (SMP) will be supplied and treated in the existing WTS I and DCW for the existing bar mill plant will be supplied and treated in WTS IV.
In order to recycle 720 m3/h of DCW for the existing bar mill plant, facilities consisting of sedimentation basin, pressure filters, cooling tower, cold well, pumps, etc. will be installed.
For dehydration of scale, the existing dehydration system in the WTS I will be used because it has surplus capacity.
These treatment facilities will be installed on the west of the existing WTS I.

b) Water treatment station-V

Since the existing water treatment station-II (WTS II) has no surplus capacity of indirect cooling water (ICW)

for the steelmaking plant, water treatment station-V (WTS V) will be installed in the northern part of the existing SMP. Therefore, ICW for SMP will be supplied and treated by WTS II and WTS V.
The existing WTS II will cover the facilities of southern part of SMP consisting of Nos.1, 2 and 3 electric arc furnaces (EAF) and Nos.1 and 2 continuous casting machines (CCM) and No. 1 ladle furnace (LF), and WTS V will cover the facilities of northern part of SMP consisting of Nos.
4 and 5 EAF, Nos.3 and 4 CCM, and Nos. 2 and 3 LF.
In order to recycle 5,040 m3/h of ICW in WTS V, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

c) Water treatment station-VI

Water treatment station-VI will be installed on the northern part of the existing SMP to supply and treat the indirect cooling water for the new oxygen and nitrogen shop, additional air compressors and new substation because the existing water treatment station-III has no surplus capacity.
In order to recycle 550 m3/h of ICW in WTS VI, facilities consisting of cooling tower, cold well, pumps, etc. will be installed.

d) Water treatment station-VII

In direct cooling water (ICW) for the new merchant bar mill plant (MBM) will be supplied and treated in the water treatment station-VII (WTS-VII) because the existing water treatment station-I (WTS-I) does not have enough capacity for the expansion.
In order to recycle 840 m3/h of ICW for the new MBM, facilities consisting of cooling tower, cold well, puimps, etc. will be installed.

Direct cooling water (DCW) for the new MBM will be supplied and treated in the water treatment station-VII (WTS-VII) because the existing water treatment station-I (WTS-I) does not have enough capacity for the expansion.

In order to recycle 720 m3/h of DCW for the merchant bar mill plant, facilities consisting of sedimentation basin, pressusre filters, cooling tower, cold well, pumps, etc. will be installed.
For dehydration of scale, the exisisting dehydration system in WTS-I will be used because it has surplus capacity.
These treatment facilities will be installed on the west of new MBM.

e) Oxygen shop

Since a large quantity of oxygen gas has to be injected into EAF for melting a large quantity of scrap, a new oxygen shop will be installed on the northern part of the existing SMP.
The pressure swing adsorption system will be applied to the new oxygen shop instead of the existing cryogenic separation system due to required purity of oxygen gas into EAF and installation cost.
Oxygen gas produced by pressure swing adsorption system will be only supplied into EAF and oxygen gas for other plants will be supplied by the existing cryogenic separation system.

In order to produce 5,200 Nm3/h of oxygen gas, facilities consisting of suction filter, air blower, oxygen gas generation units, oxygen gas compressors, high pressure oxygen holder, etc. will be installed.

f) Nitorogen shop

New nitorgen shop will be installed on the northern part of the existing SMP because the existing nitogen shop has no surplus capacity. The cryogenic separation process will be applied to the new nitorgen shop.

In order to produce 530 Nm3/h of nitogen gas, facilities consisting of air compressor, freon refrigeration unit, desiccation and decarbonation unit, low temperature separation unit, nitorogen gas compressor, nitorogen gas holder, etc. will be installed.

g) Air compression station

Four air compressor units will be added to the existing air compression station to supply the compressed air to the expanded plants because the existing air compression station does not have enough capacity for the expansion. The new air compressor units will have the same capacity as that of the existing unit in consideration of easy operation.
In order to supply 12,800 Nm3/h of compressed air, facilities consisting of air compressor units and air receiver tank will be installed.

h) Natural gas station

The requirement of natural gas for the expansion is more than the design capacity of the existing natural gas station but this requirement is less than the design capacity of EGPC, so the design capacity of the expanded natural gas station will be able to be increased to 75,000 Nm3/h in consideration of margin. The existing flow meter will be exchanged for new one and new flare stack will be additionally installed to treat the natural gas safely. The capacity of new flare stack will be 25,000 Nm3/h.

i) Pumping stations No.8 and No.9

The pumping stations No.8 and No.9 will be installed around the new nitrogen shop and water treatment station-V to transfer the sewage from the plants to the existing sewage treatment station. The pump pit with rough screen and sewage pump will be installed in the pumping station.

j) Hydrants for fire fighting

Hydrants and piping for fire fighting will be installed around the new RMP and MBM and diesel booster pump for the new direct reduction plant will be added.

k) Yard piping

In order to supply utilities to the plants and facilities for the expansion, the following yard piping will have to be modified or installed:

- Potable water
- Make-up water
- Direct cooling water
- Indirect cooling water
- Emergency water
- Sewage
- Drainage
- Oxygen gas
- Nitrogen gas
- Compressed air
- Natural gas
- Fire fighting water

Table 3.8-1 Utility Requirements for Expansion

Station/Shop	Design capacity of existing utility facilities	Present consumption	Estimated requirement for the expansion	Total requirement
1. Raw Water Treatment Station				
· Raw water	930 m3/h	550 m3/h	380 m3/h	930 m3/h
· Make-up water	890 m3/h	500 m3/h	388 m3/h	888 m3/h
· Potable water	50 m3/h	20 m3/h	11 m3/h	31 m3/h
2. Water Treatment Station-I				
· Direct cooling water	3,190 m3/h	2,300 m3/h	2,190 m3/h	4,490 m3/h
· Indirect cooling water	2,000 m3/h	1,500 m3/h	1,916 m3/h	3,416 m3/h
3. Water Treatment Station-II				
· Indirect cooling water	7,150 m3/h	7,150 m3/h	4,531 m3/h	11,681 m3/h
4. Water Treatment Station-III				
· Indirect cooling water	284 m3/h	284 m3/h	550 m3/h	833 m3/h
5. Sewage Treatment Station				
· Sewage	500 m3/d	320 m3/d	37 m3/d	357 m3/d
6. Drainage Pumping Station				
· Drainage	1,950 m3/h	290 m3/h	32 m3/h	322 m3/h
7. Oxygen Shop				
· Oxygen gas (Existing)	400 Nm3/h	200 Nm3/h	92 Nm3/h	292 Nm3/h
· Oxygen gas (PSA)	0 Nm3/h	0 Nm3/h	4,679 Nm3/h	4,679 Nm3/h
· Nitrogen gas	550 Nm3/h	550 Nm3/h	476 Nm3/h	1,026 Nm3/h
8. Air Compression Station				
· Compressed air	12,800 Nm3/h	10,800 Nm3/h	13,110 Nm3/h	23,910 Nm3/h
9. Natural Gas Station				
· Natural gas	50,000 Nm3/h	33,000 Nm3/h	33,681 Nm3/h	66,681 Nm3/h
10. Outdoor Fire Hydrants				
· Fire water	240 m3/h	0 m3/h	0 m3/h	240 m3/h

Table 3.8-2 Utility Requirements after Expansion

Station/Shop	Design capacity of utility facilities for the expansion	Utility requirement for the expansion	Surplus capacity of utility facilities after the expansion
1. Raw Water Treatment Station			
· Raw water	930 m3/h	930 m3/h	0 m3/h
· Make-up water	890 m3/h	888 m3/h	2 m3/h
· Potable water	50 m3/h	31 m3/h	19 m3/h
2. Water Treatment Station-I			
· Direct cooling water	3,190 m3/h	3,050 m3/h	140 m3/h
· Indirect cooling water	2,000 m3/h	1,500 m3/h	500 m3/h
3. Water Treatment Station-II			
· Indirect cooling water	7,150 m3/h	6,642 m3/h	509 m3/h
4. Water Treatment Station-III			
· Indirect cooling water	284 m3/h	284 m3/h	0 m3/h
5. Water Treatment Station-IV			
· Direct cooling water	720 m3/h	720 m3/h	0 m3/h
· Indirect cooling water	1,080 m3/h	1,080 m3/h	0 m3/h
6. Water Treatment Station-V			
· Indirect cooling water	5,040 m3/h	5,040 m3/h	0 m3/h
7. Water Treatment Station-VI			
· Indirect cooling water	550 m3/h	550 m3/h	0 m3/h
8. Water Treatment Station-VII			
· Direct cooling water	720 Nm3/h	720 Nm3/h	0 Nm3/h
· Direct cooling water	840 Nm3/h	840 Nm3/h	0 Nm3/h
9. Oxygen shop			
· Oxygen gas (PSA)	5,200 Nm3/h	4,679 Nm3/h	521
· Nitorogen gas	530 Nm3/h	476 Nm3/h	54 Nm3/h
10. Air Compression Station			
· Compressed air	12,800 Nm3/h	11,110 Nm3/h	1,690 Nm3/h
11. Natural Gas Station			
· Natural gas	75,000 Nm3/h	66,681 Nm3/h	8,319 Nm3/h

3.9 In-works Transportation Facilities

1) Outline

a) Basic concept of the expansion project

In the expansion project, facilities of In-works transportation will be expanded in propotion to the production increase, and the actual working ratio of vehicles managed by ANSDK will be referred to.

b) Volume of materials to be handled

Although the amount of each material is proportional to production, the ratio of handling quantity between after and before expansion is corrected by the unit consumption revised when it is different between after and before expansion.

2) Expansion plan of facilities

Considering the material flow after the expansion and the capacity of existing facilities, expansion of facilities is planned as given below.

a) Transport vehicles and related equipment

The required equipment after the expansion is added in accordance with the increase of the production, also the utilization of existing facilities are considered.

b) Scrap yard

As existing scrap yard will not be sufficient for large quantity of purchased scrap, re-arrangement of

the existing yard (30,000m^2) and a new scrap yard with space of 14,400m^2 which is located on the north side of slag yard will be provided.

c) Indoor warehouse

With the increase of materials, a new warehouse and expansion of the existing warehouses are planned as mentioned below.

(1)Warehouse for brick

A new warehouse with space 6,992m^2 will be built on the north side of the existing warehouse for brick.

(2) Warehouse for spare parts

To cope with the increase of spare parts of equipment and to be convenient for the inventory control, space of 2,500m^2 will be reserved in the brick wareouse with partition.

(3) Warehous for additives

As the space for additives will be short, the warehouse will be expanded 3m in width and 40m on east side.

d) Products yard

In line with increase of production, about 20,000m^2 of products yard (capacity about 17,000 tons of rods) will be constructed on the south side of Bar mill plant.
This 20,000m2 of products yard, however, may not be

euough for storage of products if management metrod is same as that of prosent.
Because, MBM will produce around 350,000 tons of long products per year. Therefore, more practical use of products yard such as shortening of inventory period is essential.

e) Slag yard

As increased quantity of slag will be generated, a slag yard having the same capacity as that of the existing one will be provided.

f) Truck weighing station

The existing equipment is adequate and no increase will be planned.

g) Vehicle repair shop

Considering the increase in the number of vehicles since the start-up of ANSDK and also the fact that repair of existing vehicles will be more frequent as they get old in years, a new vehicle repair shop will be constructed. The scale and contents of the shop will be the same as those of the existing one.

3.10 Analysis and Inspection Facilities (AI)

As a backup for the production facilities such as DR plant, SMP, and RMP (Bar mill, Rod mill & Merchant bar mill), there are the analysis and inspection facilities which perform analysis and inspection as shown in Tables 5.2.11-1 and 5.2.11-2 in Section 5-2-11.

As various production facilities are expanded and the production increases, frequency of analysis and inspection will increase so much that the existing analysis and inspection facilities cannot cope with the situation. It is considered necessary to add one carbon and sulphur determinator, one emission spectrometer, and one complete set of tools for preparation of samples.

The existing one line of sample transportation system for transporting samples from SMP will be insufficient and one more system will be required.

And it is recommended to provide an oil analyzer of portable type for checking the deterioration of lubrication oils.

The existing 100-ton compression tester will be used exclusively for the bending test and so a 70-ton tensile testing machine should be added for the tensile testing.

In line with increased frequency of analyses, it is considered necessary to permit automatic feedback data communication between the host computer at SMP and the FEP at A&I Dept.

Relocation of the existing equipment in the building will provide the space for the above equipment for the expansion.

The number of the personnel in the analysis and inspection facilities will be increased by 18 after the expansion.

3.11 Maintenance Facilities

1) Facilities

In CHAPTER 5, facilities of maintenance shop of El Dikheila Works and its maintenance system are discussed. By utilizing those facilities and system in full, maintenance work required after the expansion can be performed smoothly with some reinforcement which eliminates the bottlenecks. Outline of the equipment to be reinforced is described below.

a) Mechanical

(1) Existing maintenance shop does not have sufficient space to perform scheduled repairs of spare parts and units taken apart from lines. Therfore, new maintenance shop (20m×30m) will be built for assembling and/or disassembling of spare parts and units. The building will be located on the south of the fabrication shop, and two 10-ton overhead travelling cranes and necessary machine tools for repairs will be installed.

(2) Machine tools which work at high operation rate and necessary ones for manufacturing spare parts in the Works will be provided.

(3) Purchase of measuring instruments
For checking of spares and units which are maintained in the new shop, and for inspection of purchased spares, some measuring instruments will be purchased.

b) Electrical

(1) A new maintenance shop for electrical maintenance work such as management of electrical spare parts and repair of air-conditioning and communication facilities, will be built on the south of existing repair shop. The new building (28m×15m) will be equipped a five-ton hoist.

(2) A set of spacial tools for maintenance of air conditioning will be provided.

(3) One forklift for cable drum handling will be provided.

3.12 Civil Engineering and Building Work

Civil engineering and building work includes the construction of foundation for buildings and for machinery and equipment, and of culvert, floor, slabs, roads and drainage, and the construction of buildings, which are required for the expansion of production and ancillary facilities.

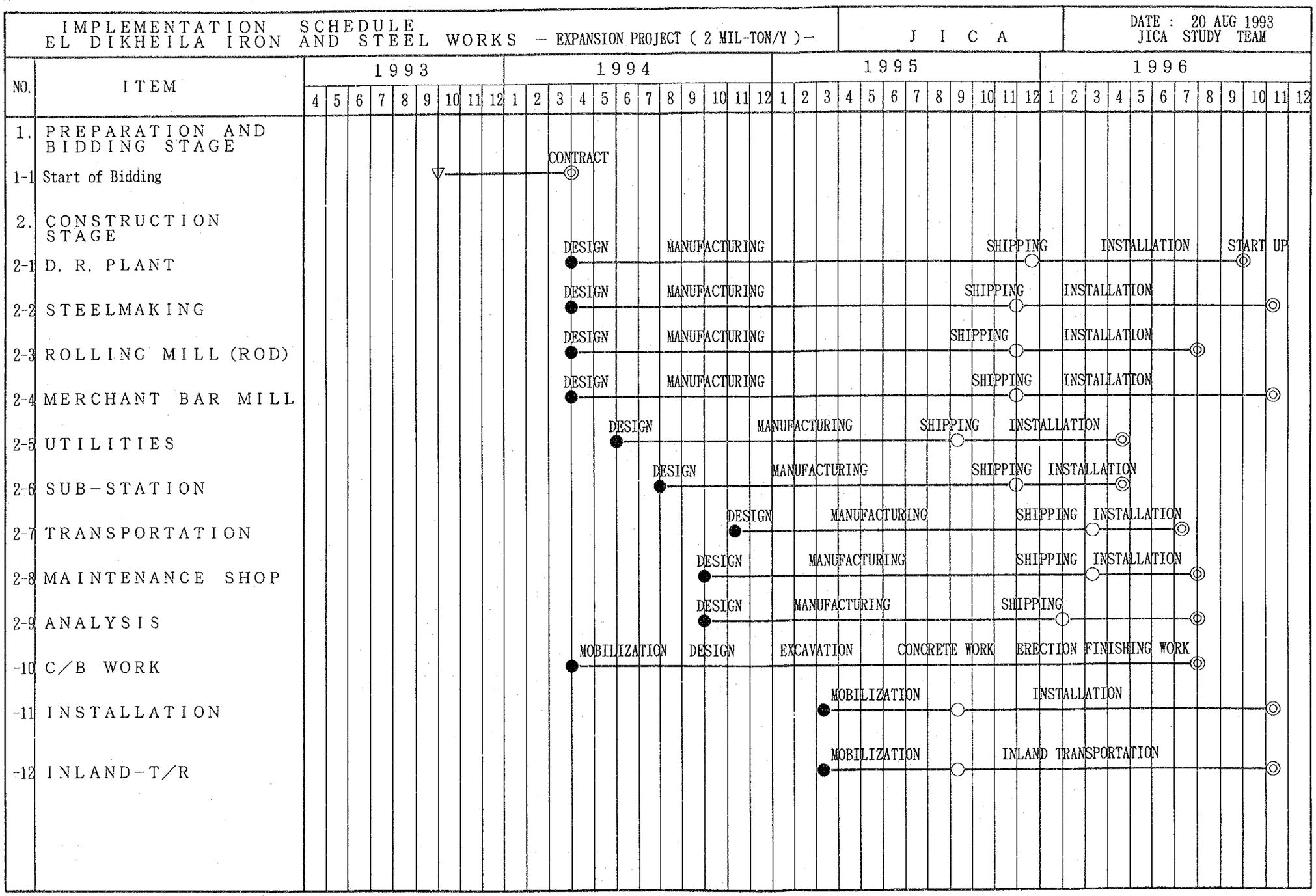
4. IMPLEMENTATION SCHEDULE

As per the attached implementation schedule.

IMPLEMENTATION SCHEDULE
EL DIKHEILA IRON AND STEEL WORKS – EXPANSION PROJECT (2 MIL-TON/Y)–

J I C A

DATE : 20 AUG 1993
JICA STUDY TEAM



5. CONSTRUCTION COST

The costs of facilities planned and site work are updated and listed in Table 5.1-1 and Table 5.1-2.

Table 5.1-1 Summary of Capital Cost Estimation (Without Escalation Case)

Unit : 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	F	T	F	L	T	F	L	T	F	L	T
DRP	128,139	0	128,139	10,812	3,071	13,883	3,258	3,311	6,569	142,209	6,382	148,591
SMP	132,594	4,387	136,981	7,557	2,785	10,342	19,463	9,641	29,104	159,614	16,813	176,427
ROD	29,141	182	29,323	3,085	832	3,917	4,881	1,272	6,153	37,107	2,286	39,393
MBM	66,787	0	66,787	6,646	2,019	8,665	16,482	9,255	25,737	89,915	11,274	101,189
UT	38,600	0	38,600	4,634	1,319	5,953	2,083	2,197	4,280	45,317	3,516	48,833
PW	5,126	0	5,126	852	210	1,062	163	217	380	6,141	427	6,568
TR	7,745	0	7,745	95	123	218	4,278	3,794	8,072	12,118	3,917	16,035
MS	1,732	0	1,732	101	34	135	578	730	1,308	2,411	764	3,175
AI	1,751	0	1,751	33	9	42	0	0	0	1,784	9	1,793
ADM	1,452	0	1,452	0	0	0	0	1,123	1,123	1,452	1,123	2,575
Total	413,067	4,569	417,636	33,815	10,402	44,217	51,186	31,540	82,726	498,068	46,511	544,579
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	12,000	0	12,000
Contingency												
Price C	0	0	0	0	0	0	0	0	0	0	0	0
Physical C	20,653	228	20,882	1,691	520	2,211	2,559	1,577	4,136	24,903	2,326	27,229
Imp. tax	0	20,653	20,653	0	0	0	0	10,237	10,237	0	30,891	30,891
Sales tax	0	43,829	43,829	0	0	0	0	0	0	0	43,829	43,829
Total	20,653	64,711	85,364	1,691	520	2,211	2,559	11,814	14,373	36,903	77,045	113,948
Grand Total	433,720	69,280	503,000	35,506	10,922	46,428	53,745	43,354	97,099	534,971	123,556	658,527

Table 5.1-2 Summary of Capital Cost Estimation (With Escalation Case)

Unit : 1000 USD

	Equipment (CIF)			Installation			Civil & Building			Total		
	F	F	T	F	L	T	F	L	T	F	L	T
DRP	128,139	0	128,139	10,812	3,071	13,883	3,258	3,311	6,569	142,209	6,382	148,591
SMP	132,594	4,387	136,981	7,557	2,785	10,342	19,463	9,641	29,104	159,614	16,813	176,427
ROD	29,141	182	29,323	3,085	832	3,917	4,881	1,272	6,153	37,107	2,286	39,393
MBM	66,787	0	66,787	6,646	2,019	8,665	16,482	9,255	25,737	89,915	11,274	101,189
UT	38,600	0	38,600	4,634	1,319	5,953	2,083	2,197	4,280	45,317	3,516	48,833
PW	5,126	0	5,126	852	210	1,062	163	217	380	6,141	427	6,568
TR	7,745	0	7,745	95	123	218	4,278	3,794	8,072	12,118	3,917	16,035
MS	1,732	0	1,732	101	34	135	578	730	1,308	2,411	764	3,175
AI	1,751	0	1,751	33	9	42	0	0	0	1,784	9	1,793
ADM	1,452	0	1,452	0	0	0	0	1,123	1,123	1,452	1,123	2,575
Total	413,067	4,569	417,636	33,815	10,402	44,217	51,186	31,540	82,726	498,068	46,511	544,579
Eng. Fees	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	12,000	0	12,000
Contingency Price C	51,808	685	52,493	4,437	1,723	6,160	7,023	4,542	11,565	63,268	6,950	70,218
Physical C	20,653	228	20,882	1,691	520	2,211	2,559	1,577	4,136	24,903	2,326	27,229
Imp. tax	0	20,653	20,653	0	0	0	0	10,237	10,237	0	30,891	30,891
Sales tax	0	43,829	43,829	0	0	0	0	0	0	0	43,829	43,829
Total	72,461	65,396	137,857	6,128	2,243	8,371	9,582	16,356	25,938	100,171	83,995	184,166
Grand Total	485,528	69,965	555,493	39,943	12,645	52,588	60,768	47,896	108,664	598,239	130,506	728,745

6. FINANCIAL ANALYSIS

6.1. Schedule of Fund Demand and Raising

Fund demand and raising schedule for the expansion facilities is shown in Table 6.1-1 and Table 6.1-2.

Table 6.1-1 Schedule of Fund Demand and Raising
Case (Without escalation)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand :															
Equipment	658,527		118,485	376,511	121,894		1,190	5,227	5,948	5,948	5,948	5,948	5,948	4,759	721
Pre-production cost	2,238				2,238										
Additional working capital	24,808				11,595	12,352	861								
Interest under construction	70,219		5,439	37,004	27,776										
Demand total	755,792	0	123,924	413,515	163,503	12,352	2,051	5,227	5,948	5,948	5,948	5,948	5,948	4,759	721
Raising :															
Capital	226,726		63,493	62,793	45,590	12,352	2,051	5,227	5,948	5,948	5,948	5,948	5,948	4,759	721
Long-term loan	529,066		60,431	350,722	117,913										
Raising total	755,792	0	123,924	413,515	163,503	12,352	2,051	5,227	5,948	5,948	5,948	5,948	5,948	4,759	721

Table 6.1-2 Schedule of Fund Demand and Raising
Case (With escalation)

Description	Total	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Demand :															
Equipment	728,745		126,154	418,036	138,383		1,275	5,774	6,596	6,596	6,596	6,596	6,596	5,321	822
Pre-production cost	2,718				2,718										
Additional working capital	28,168				13,301	13,926	941								
Interest under construction	77,043		5,630	40,666	30,747										
Demand total	836,674	0	131,784	458,702	185,149	13,926	2,216	5,774	6,596	6,596	6,596	6,596	6,596	5,321	822
Raising :															
Capital	251,023		69,231	69,415	51,338	13,926	2,216	5,774	6,596	6,596	6,596	6,596	6,596	5,321	822
Long-term loan	585,651		62,553	389,287	133,811										
Raising total	836,674	0	131,784	458,702	185,149	13,926	2,216	5,774	6,596	6,596	6,596	6,596	6,596	5,321	822

6.2. Internal Rate of Return on Investment Fund

The result of calculation of IRR is shown in Table 6.2-1.

Table 6.2-1 IRR

Description	ROI	ROE
Without escalation	8.36%	8.67%
With escalation	10.73%	13.09%

7. CONCLUSION

The calculated ROI for the facilities newly planned under the present operational conditions in El Dikheila Iron and Steel Works is as low as 8.36%.

The calculated ROI is affected by high initial investment cost as high as three times in the text of the treaty even the production of products in this plan increases about 1.7 times of present production, i.e. 1.85 million ton per year.

ANSDK plans to be a private company in the near future. Therefore it is quite important for ANSDK to increase the competitiveness as the steel mill together with the increase of supply of steel products in the domestic market in order to decrease imported steel products, thus providing local employment opportunities.

Considering the above, the expansion project should be restudied and replanned as stated in this feasibility study report.

APPENDIX 6

APPENDEX 6

A RESULT OF EXAMINATION OF THE MINUTES OF MEETING

A result of examination of the minutes (reffer to Section 1), which was made by JICA mission and the counterpart in Egypt during the meeting held on from 2 August to 5 August 1993, is described below :

1. **II. Expansion Plan, 1. General : alternative plan for further production**

   A result of examination of the above subject is attached as APPENDIX-2 is about 1.5 million tons per annum, while, that of alternative plan is 1.85 million tons per annum due to change the configuration of facilities and operational conditions in SMP.
   Though the ROI of alternative plan is 8.36 and better than that of APPENDIX-2, the expansion plan incorporated in the text of the treaty should be applied since much atractive ROI comparing with that of the alternative.

2. **II. Expansion plan, 3. RMP and 4. Utility**

   Detail designs and specifications should be considered in engineering stage as described in the minutes of meeting.

3. **II. Expansion Plan, 5. Power station**

   The text will be corrected.

4. **III. Financial analysis, 1. actual dividents ratio was 10% of paid-up capital 1992 instead of 9%**

   9% of dividents ratio was adopted to coordinate all financial analysis and the case of APPENDIX-5.