Chapter 7. PRESENT SITUATION AND FUTURE INFRASTRUCTURE PLAN

7.1 Port and Port Facilities

Sohar port is planned to be one of the most important infrastructure for the industrialization of northern Oman. According to the master plan, the construction work will be completed in the year 2002. An electric power station, a petroleum chemical plant, and an aluminum refinery are also planned to be constructed behind the port.

In the original plan of Sohar port, the approach channel and the turning basin were planned to have same depth of -15 m. However, in the present plan, the depth has been changed to -16.5 m for the approach channel and -16 m for the turning basin due to the condition changed to that the Steel Complex will be constructed at the back of the port as shown in Figure 7-1-1.
At the back of the phase 1 port area, an exclusive quay wall for the Steel Complex, one raw material berth for 100,000 DWT and one product berth for 20,000 DWT, and one product berth for 10,000 DWT are planned to be constructed along 700-m long waterfront line. The location of berth would ensure a very efficient handling of cargoes to/from the Steel Complex.

7.2 Road

Trunk road (Route 1) runs about 4 km southwest of Sohar port, connecting Muscat and GCC. However, access from Route 1 to the Sohar Port construction site is a potential problem. Though a two-lane paved road is available from Route 1 up to existing Majis jetty (which is about 2 km south of the proposed Steel Complex Site), there is no access between the Majis jetty and the Steel Complex. Nevertheless, it is naturally expected that such access road will be also constructed as part of the port development plan. At the Complex side, a connection road from an access road to the Steel Complex would be considered.

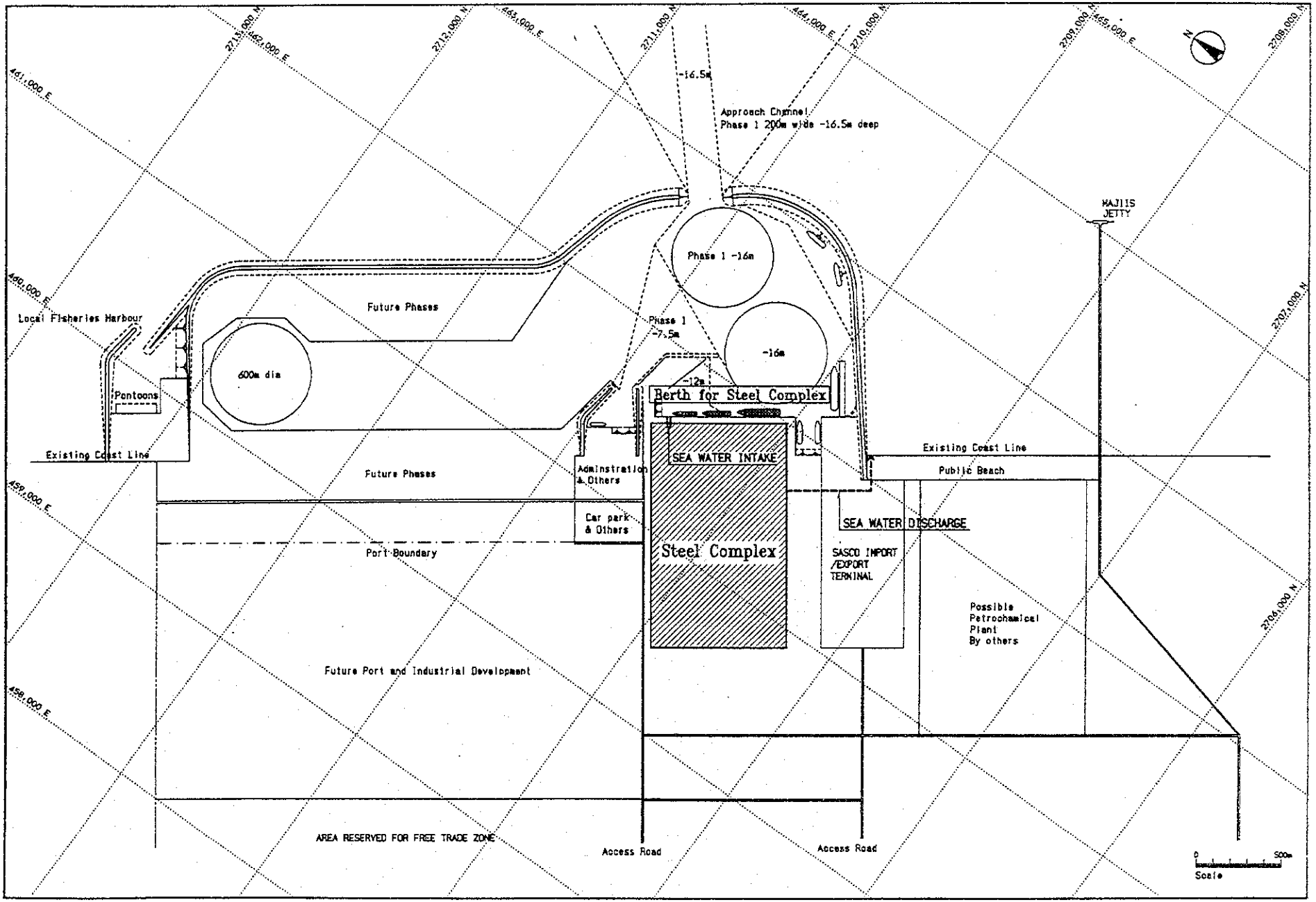


Figure 7-1-1 Proposed Site Location

7.3 Electrical Power Supply

(1) Power capacity in Sohar region

1) After an site investigation it has concluded that the power capacity in Sohar region is not sufficient for the Steel Complex. MOEW does not have plan to provide the required power to the Steel Complex.
2) A power generation plant for the Steel Complex with a capacity greater than 200 MW needs to be constructed by the Steel Complex or by the private sector.
3) In Sohar, other big projects for petrochemicals, an oil refineries and an aluminum smelters are planned so there is a possibility that one of the big projects would have surplus electricity.
4) In addition to the above, this power generation plant would be connected to the power supply grid between Muscat and Sohar (including Wadi Jizzi power station) by a 132 kV line within a couple of years by the Government. If it is interconnected, the Steel Complex would be able to overcome the difficulties for normal operations of the Steel Complex, and to have a higher short circuit level (fault level). Total power generation capacity supplied by the network will be more than 2240 MW by the year 2004.
5) With the above measures, a short circuit capacity of a min. 3,000 MVA - max. 6,000 MVA could be obtained, and flicker compensation equipment to minimize voltage fluctuation could be reduced.

(2) Connections at 132 kV between Muscat and Sohar (including Wadi Jizzi power station) at present are as follows;

1) Wadi Jizzi P/S to Sohar S/S : in operation
2) Sohar S/S to Khaburah S/S (about 60 km): tender will be issued by July in 1998
3) Khaburah S/S to Masanaah S/S (about 60 km) : under design
4) Masanaah S/S to Muscat System : in operation

(3) Wadi Jizzi power station

1) Total generation capacity : 278 MW, 334 MW by end of year 1999
2) Demand : Max. 300 MW (in Summer) min. 90 MW (in Winter)
3) Fuel : Natural gas (and oil for emergency)
4) Type and GT frame size : Gas turbine frame No-5 x 3 sets and No-6 x 8 sets
5) Fault level at 132 kV : Max.1283 MVA , min. 397 MVA at present. 2500 MVA in 2015
6) Generation cost : 7.6 baiza / kWh

(4) Sohar sub-station

1) Total transformer capacity : 2 x 125 MVA
2) Average demand : 100 MVA
3) Max. demand : 124 MW (in Summer)
4) Voltage variation : 132 kV to 126 kV
5) Frequency variation : 50 Hz to 49.8 Hz
6) Frequency stoppage (power failure) : twice a year (in past 3 years)

(5) Applicable tariff structure

1) Domestic and government consumers

Slab (kWh)	Rate Baiza / kWh
00000-03000	10
03001-05000	15
05001-07000	20
07001-10000	25
above 10000	30

2) Commercial consumers
Flat rate of 20 baiza / kWh

3) Industrial consumers
(a) Within specified industrial areas
Summer months (May, June, July and August) 24 baiza / kWh
Winter months (Sept. to April) 12 baiza / kWh
(b) In other areas
Summer months 24 baiza / kWh
Winter months 16 baiza / kWh
In Dhofar region : Summer months (April to July)
Winter months (August to March)

4) Agricultural and fisheries
Up to 7000 kWh 10 baiza / kWh
above 7000 kWh 20 baiza / kWh

5) Hotel / tourism
00000-03000 10 baiza / kWh

03001-05000	15 baiza / kWh
above 5000	20 baiza / kWh

(6) Master Plan Study for the Electric Power Sector

Maximum demand for electricity and plans for future generation are shown in Table 7-3-1 as under.

Table 7-3-1 After modification by actual data -1997

Unit : MW

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Peak demand	1373	1447	1521	1688	1790	1890	1987	2061	2134	2206	2277
Net supply capacity	1406	1551	1645	1833	1928	2022	2157	2241	2241	2335	2411
Reserve margin	1406	1551	1645	1833	1928	2022	2157	2241	2241	2335	2411
Firm generation	1311	1456	1550	1738	1833	1927	2062	2146	2146	2240	2316
Balance of firm generation to peak demand	-62	9	29	50	43	37	75	85	12	34	39
Rusail P/S	500.4	594.5	688.6	782.7	782.7	782.7	782.7	782.7	783	783	782.7
Future expansion		94.1	94.1	94.1							
		(GT-7)	(GT-8)	(GT-9)							
Ghubra P/S	537	537	537	537	537	537	484.5	473.6	474	474	473.6
Future expansion							-52.5	-105			
								94.1			
Manah P/S	86.4	86.4	86.4	86.4	86.4	86.4	180.5	180.5	181	181	180.5
Future expansion							94.1				
							(GT-4)				
Barka P/S	0	0	0	0	94.1	188.2	282.3	376.4	376	376	470.5
Future expansion					94.1	94.1	94.1	94.1			94.1
					(GT-1)	(GT-2)	(GT-3)	(GT-4)			(GT-5)
Wadi Jizzi P/S	281.8	281.8	333.2	333.2	427.3	427.3	427.3	427.3	427	521	503.6
Future expansion			51.4		94.1					94.1	-17.8
			(GT-12/13)		(GT-14)					(GT15)	(GT-1)
Expansion total		94.1	145.5	94.1	188.2	94.1	94.1	83.2		94.1	76.3

Source : MOEW

7.4 Water

(1) History of development

In Oman, the habitants have shared in the benefit of many wells for water supply from ancient times as well as Faraj Systems (canal, a kind of intake system from ground water zone) which are in service even now to supply water to rural areas.

Water consumption in Muscat area is increasing year by year, and so an advanced

desalination project was established to construct the first desalination unit at Ghubrah due to increasing demand for water resource, which was completed in 1976. The total capacity is now 35 MIGPD.

In 1989, the Government of Oman started to take an active interest in controlling his water resources and began to restrict both new well drilling and free intake of water from existing wells.

And recent Government policy on water can be seen in the fifth Five-Year Development Plan (1996-2000). The plan aims to provide potable water for all residential areas by the year 2005.

(2) Water resources

In the Sohar area, well water is supplied to the residential area and also Sohar Industrial Estate.

Total amount of well water is 8,000 m^3/d (8 wells x1,000 m^3/d) at present and a desalination plant will be constructed in future along with area industrialization.

7.5 Natural gas

(1) Natural gas reserves

Gas fields are located in Yibal, Barik, Saih Nihayda, Saih Rawl and Fahud which are located in the middle of Sultanate of Oman

Total natural gas reserves in Sultanate of Oman is as follows :

Expected	25.4 TCF (non-associated gas)
Proven	17.7 TCF (non-associated gas)

The net balance of Associated gas for the next 25 years is approximately zero.

Source : Sohar and Salalah gas supply study, (Long term gas supply plan for Sultanate of Oman) : Revision 2, February 1998

[Definition]: Expected: (50% chance and the remaining 50% chance will be less)
Proven: (85% chance and the remaining 15% chance will be less)
Natural gas exists underground and has to be taken out to the above ground economically.
50% chance means that 50% of reserves has a possibility for being taken out economically.

Natural gas exploration program is in progress in order to increase the confirmed reserves to more than 35 TCF.

(2) Natural gas production, uses and demand forecast

Historical production and utilization of non-associated gas and demand forecast are indicated in Table 7-5-1 and Table 7-5-2 respectively.

Compared with past production amount, demand forecast of natural gas will increase significantly. Demand forecast includes big projects such as LNG project, urea project, aluminum smelter project, poly-olefin project, etc.

LNG project represents one of the bases for the economic diversification strategy from oil to gas, and the export of LNG will start in 2000.

As per forecast, natural gas production(expected) could not meet the demand of the year of 2011, and so shortage of gas production could be covered by the new reserves developed by natural gas exploration program.

Table 7-5-1 Historical Production and Utilization of Non-associated Gas

(Unit: Million scf/d)

	Production	Utilization	
	Non-associated gas	Domestic & industry	Oil field injection
1992	179	170	9
1993	201	192	9
1994	219	198	21
1995	222	205	17
1996	243	226	17

Source: PDO -as supplied to MOG 30/11/97 Ref:AEG/126/97

Table 7-5-2 Demand Forecast of Natural Gas

(Unit: Million scf/d)

Year	2000	2005	2010	2015	2020
Power	411	603	795	904	1014
LNG	712	959	959	959	959
Industry/Others	82	493	575	575	466
Total	1205	2027	2301	2411	2438

Source: PDO

(3) Situation of natural gas pipeline

The existing government gas control system provides gas to the Sohar area through a combined 20" and 36" pipe line from Yibal to Murayrat and a 16" pipeline from Murayrat to Sohar. It is fully utilized.

The supply pressure from Saih Nihayda is 7.0 Mpa.

A new pipeline from Fahud to Sohar is proposed to meet long-term domestic and industrial demands for the region.

The distance from Fahud to Sohar is approximately 300 km.

Front end design for the planned pipeline is based on a 32" diameter and design work has already been completed.

The construction of new pipeline is scheduled to be completed by the summer in 2001.

7.6 Telecommunication

(1) Telephone and facsimile requirements

Approximate requirements for normal telephone, facsimile and cellular telephone for the Steel Complex will be as follows;

-Telephone	: 25 lines
-Facsimile	: 10 lines
-Cellular telephone	: 20 lines

(2) Telephone (including cellular) and facsimile services by GTO will be sufficient for the Steel Complex.

Chapter 8. CONCEPTUAL STUDY FOR INFRASTRUCTURE AND UTILITIES

8-1 Port and Port Facilities

8-1-1 Port

The government will be responsible for the construction of the new Sohar port, of which a construction project plan has been established on the condition that the Steel Complex will be constructed in the nearby area. However, it is not necessary to construct the port solely as a part of the Steel Complex construction project .

8-1-2 Berth and berth facilities

It is assumed that the port facilities such as quay walls will be constructed by the government and that loading facilities such as unloaders and gantry cranes would be erected as a part of the Steel Complex construction project.

(1) Cargo volume and ship type

1) Raw materials

There will be two types of materials, namely: main material (e.g. Iron oxide, Cokes) and auxiliary materials (e.g. mineral ores, silicon). Auxiliary raw materials would be handled by the same cranes used for handling products and are unloaded at the product berths while main raw materials would require different unloading cranes.

Table 8-1-1 shows cargo volume, ship type, ship size, the number of ships, and berth for each item.

Table 8-1-1 Cargo Volume of the Raw Material

Item	Cargo Volume(t/y)	Ship Type	Ship Size(D.W.T.)	Cargo Volume per Ship(ton)	Total No. of Ships per Year	Berth Used
Iron oxide	1,920,000	Ore carrier	100,000	80,000	24	Raw material
Scrap	98,900	Cargo ship	20,000	10,000	10	Product
Coke lump	42,000	Cargo ship	20,000	3,000	14	Raw material
Fettling materials	18,400	Cargo ship	10,000	2,000	10	Product
Fe-Mn	12,000	Cargo ship	10,000	2,000	6	Product
Fe-Si	5,300	Cargo ship	10,000	1,000	6	Product
Others	2,600	Cargo ship	10,000	1,000	3	Product

2) Products

The products consist of steel bars only. As a result of marketing study, export destination, cargo volume, and ship type are summarized in Table 8-1-2.

Table 8-1-2 Cargo Volume of the Products

Export Destination	Cargo Volume (t/y)	Ship Type	Ship Size (D.W.T.)	Cargo Volume per Ship (ton)	No. of Ship Entry/Arrival to Port(/y)
Domestic	39,000	Cargo ship	20,000	2,000	20
Kuwait	34,000	Cargo ship	20,000	2,000	17
Bahrain	10,000	Cargo ship	20,000	2,000	5
Saudi Arabia	30,000	Cargo ship	20,000	2,000	15
Yemen	130,000	Cargo ship	20,000	2,000	65
Jordan	5,000	Cargo ship	20,000	2,000	3
Syria	10,000	Cargo ship	20,000	2,000	5
Kenya	1,000	Cargo ship	20,000	1,000	1
Tanzania	1,000	Cargo ship	20,000	1,000	1
Pakistan	3,000	Cargo ship	20,000	1,000	3
ASEAN	70,000	Cargo ship	20,000	3,000	24

(2) Berth arrangement

Judging from expected volume of cargoes, ship type, and the number of ship arrivals, it would be desirable to provide one raw material berth and two product berths.
Figure 8-1-1 shows the arrangement plan of the three berths.

BERTH ARRANGEMENT PLAN

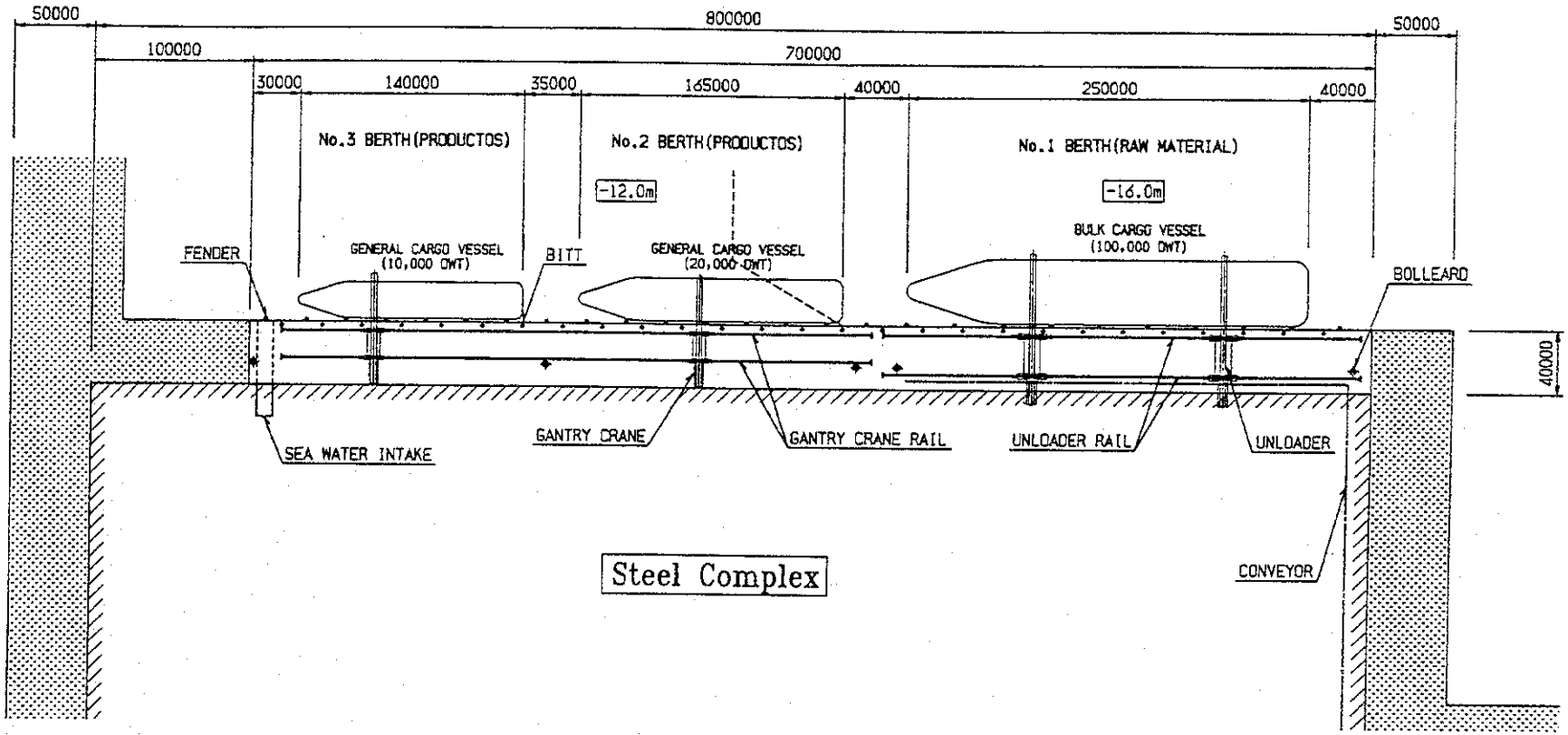


Fig 8-1-1 Berth Arrangement Plan

(3) Berth facilities

Tow Unloaders would be provided purposely at the raw material berth to handle the unloading of Iron oxide and Coke lump. At the product berths, tow gantry cranes would be provided for the purpose of loading products and of unloading auxiliary materials.

The specifications of the cranes are as follows:

Unloader	
Type:	Rope trolley type grab bucket unloader
Capacity:	1,000 t/h.
Rail gauge:	25 m
Gantry crane	
Type:	Bridge type crane
Capacity (Max. lifting load):	20 t
Rail gauge:	20 m

(4) Calculation of berth occupancy rate

The calculated results as indicated in Table 8-1-3 below are within the target occupancy rate (60%) for all berths.

(5) Preliminary Design of Quay Wall and Crane Foundation

Figures 8-1-2 and 8-1-3 show the typical sections of the raw material and product berth construction respectively.

Table 8-1-3 Berth Occupancy Rate

	Items	Cargo volume(ton)	Productivity (ton/hr/crane)	No. of crane	Necessary operation time (hours)	Necessary operation time (days)	Occupying days per ship	No. of ships per year	Total occupying days per year		Occupancy rate
No.1 Berth	Iron oxide	80,000	600	2	66.7	3.2	3.4	24	82		
	Coke lump	3,000	200	1	15.0	0.7	0.9	14	13		
									Berth Total	94	27%
No.2 Berth	Scrap	10,000	60	1	166.7	7.9	8.2	10	82		
	Fettling materials	2,000	30	1	66.7	3.2	3.4	10	34		
	Ferromanganese	2,000	30	1	66.7	3.2	3.4	6	20		
	Ferro-silicon	1,000	30	1	33.3	1.6	1.8	6	11		
	Graphic - electrode	1,000	30	1	33.3	1.6	1.8	3	5		
									Berth Total	153	44%
No.3 Berth	Steel bars	2,000	100	1	20.0	1.0	1.2	130	156		
	Steel bars	3,000	100	1	30.0	1.4	1.6	24	38		
	Steel bars	1,000	100	1	10.0	0.5	0.7	5	4		
									Berth Total	198	57%

Table 8-1-3 Berth Occupancy Rate

	Items	Cargo volume(ton)	Productivity (ton/hr/crane)	No. of crane	Necessary operation time (hours)	Necessary operation time (days)	Occupying days per ship	No. of ships per year	Total occupying days per year		Occupancy rate
No.1 Berth	Iron oxide	80,000	600	2	66.7	3.2	3.4	24	82		
	Coke lump	3,000	200	1	15.0	0.7	0.9	14	13		
									Berth Total	94	27%
No.2 Berth	Scrap	10,000	60	1	166.7	7.9	8.2	10	82		
	Fettling materials	2,000	30	1	66.7	3.2	3.4	10	34		
	Ferromanganese	2,000	30	1	66.7	3.2	3.4	6	20		
	Ferro-silicon	1,000	30	1	33.3	1.6	1.8	6	11		
	Graphic - electrode	1,000	30	1	33.3	1.6	1.8	3	5		
									Berth Total	153	44%
No.3 Berth	Steel bars	2,000	100	1	20.0	1.0	1.2	130	156		
	Steel bars	3,000	100	1	30.0	1.4	1.6	24	38		
	Steel bars	1,000	100	1	10.0	0.5	0.7	5	4		
									Berth Total	198	57%

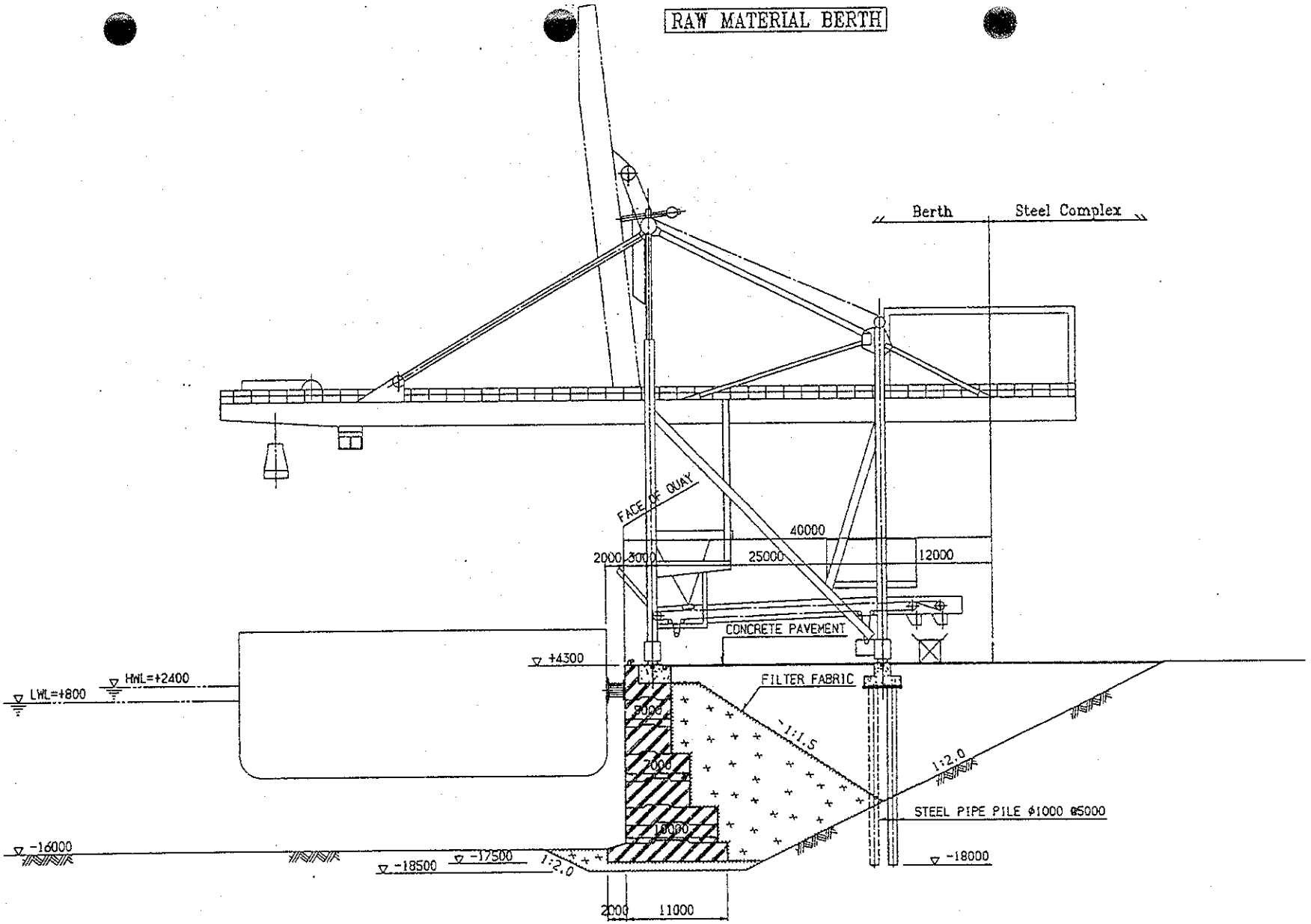


Figure 8-1-2 Typical Section of Raw Materials Berth

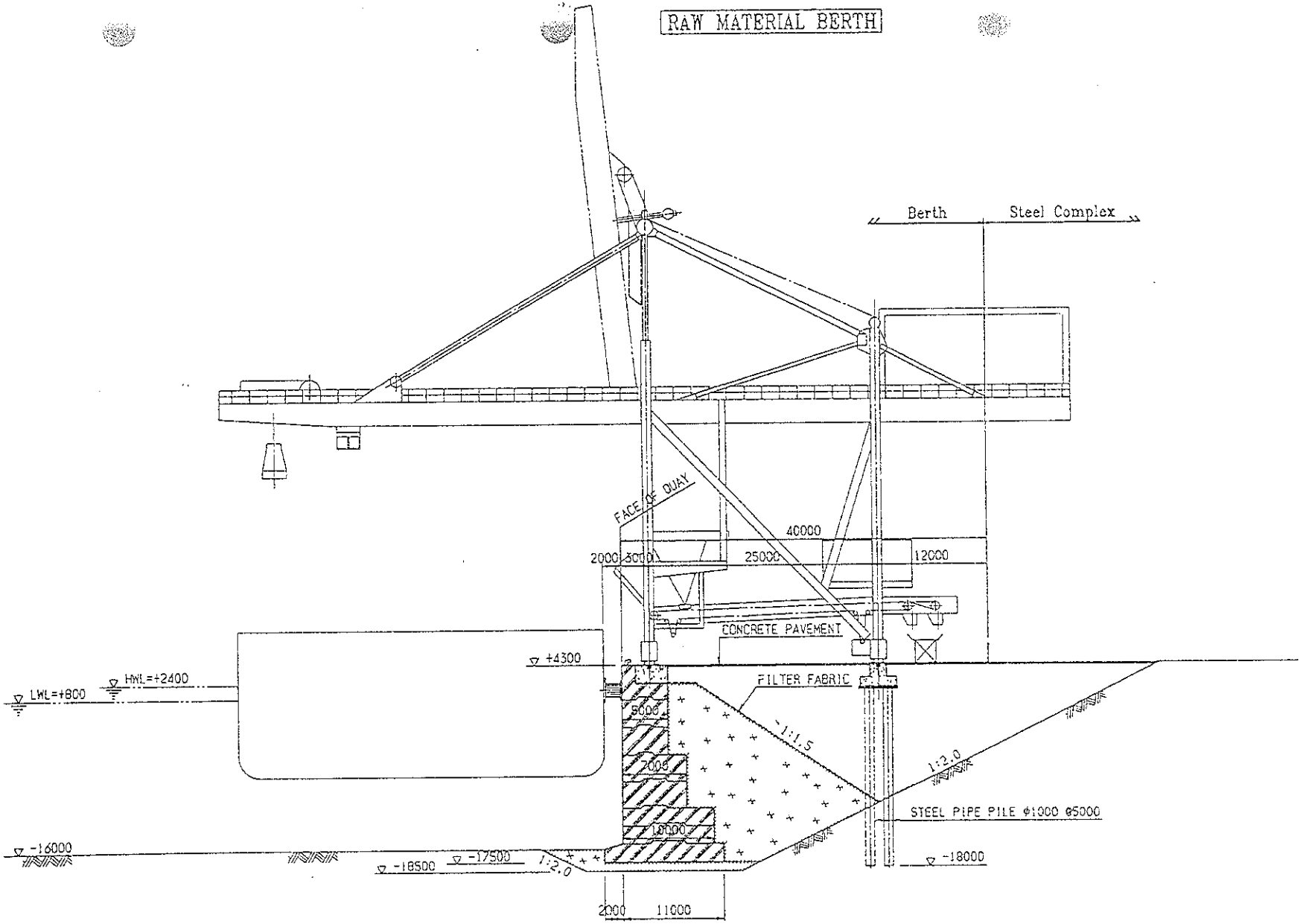


Figure 8-1-2 Typical Section of Raw Materials Berth

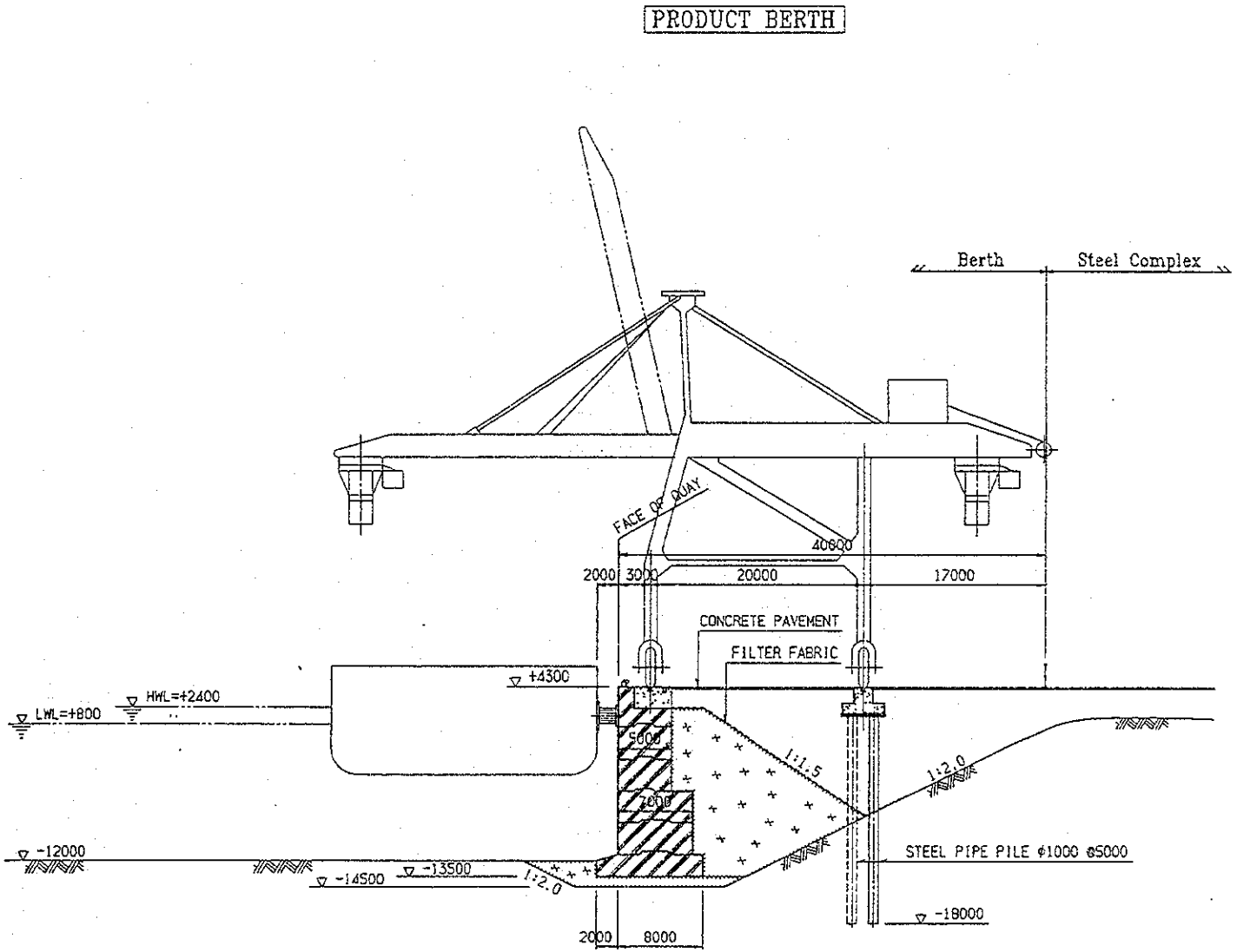


Figure 8-1-3 Typical Section of Product Berth

8.2 Road

The government is proceeding with a plan to construct access road from the existing trunk road (Route 1) to the port area. In addition, it is expected that main roads in the port area will also be constructed by the government. Therefore, construction of access roads from the Steel Complex site to these main roads will be the only concern of the Steel Complex construction project. Although the details of the construction plan of the main roads within the port area is not yet available or still unknown at present, it is assumed that total linear length of the roads, which should be constructed as a part of the Steel Complex construction project, is relatively short.

8.3 Electrical Power Supply

8.3.1 Power requirement

Approximate power requirement for the Steel Complex will be as follows;

-Maximum demand : 200 MW
-Average load : 164 MW
-Supply voltage : 132 kV
-Number of line : 2-lines
-Short circuit capacity of incoming power : at least 1500 MVA at 132 kV

8.3.2 Conceptual design of power plant

The conceptual design of a power plant with a capacity of 200MW for the Steel Complex covers basic matters, including the power generation system, equipment configuration and equipment specifications.

(1) Design conditions and fuel

1) Design conditions

The conceptual design of the mechanical and electrical facilities of the power plant will be based on the following design conditions, standards and criteria.

(a) Design conditions

Atmospheric temperature : 50℃maximum, 5℃minimum, 30℃ average, 50℃ design

Sea water temperature :	35℃maximum, 30℃ design
Relative humidity :	100% maximum, 40% annual average, 100% design
Rainfall :	100mm annual average, 80mm maximum in 24 hour period
Maximum wind velocity :	40 m/s
Number of thunderstorm days (IKL) :	20 days/year
Elevation :	Maximum of 1,000m

(b) Voltage classifications and wiring method

Voltage :	132kV, 33kV, 11kV, 6.6kV, 415V, 240V
Frequency :	50 Hz
Wiring :	3-phase 3-wire system, but 3-phase 4-wire system for 415V and 240V
Earthing :	Direct earthing system on the primary side of the power transmission transformer and resistance earthing system on the secondary side

(c) Applicable standards and criteria

International Electrotechnical Commission (IEC)
Japanese Electrotechnical Committee (JEC) Standards
Japan Electrical Manufacturers' Association (JEM) Standards
Japan Electrical Association Code (JEAC)
Japanese Cable Makers' Association Standards (JCS)
Japan's Electrical Standards (issued by MITI)

2) Fuel and fuel supply

(a) Fuel

Fuel for the gas turbines in the combined cycle plant shall be as follows.

* Main fuel : Natural gas (lower heating value 35,800 kJ/kg)
* Emergency fuel : Distillate oil (lower heating value 42,915 kJ/kg)

Table 8-3-1 show the composition and basic data for distillate oil.

(b) Fuel supply

The Ministry of Oil and Gas shall install a natural gas pressure reducing station and connecting pipelines at the project site. All facilities up to the pressure reducing valve (and filter) will come under the jurisdiction of the Ministry of Oil

and Gas. The power plant will need gas pipes leading from the pressure reducing valve. The natural gas supply must meet the plant's required pressure and volume conditions, namely :

* Service pressure : 20 kg/cm²
* Service quantity : 42,000 kg/h (per GT unit)

Main fuel (natural gas) data shows in Table 8-5-2 of chapter 8.5.

A distillate oil tank will also be installed to supply emergency fuel to the plant.

Table 8-3-1 Emergency Fuel (Distillate Oil) Data

Description	Figures
Density	0.8377
Kinetic Viscosity at 40℃ (cS)	3.9
Cloud Point (℃)	-6
Pour Point (℃)	-15
Sulphur (% weight)	0.44
Ash (% weight)	0.005
Flash Point (℃)	114
Water Content	Nil
Sediment	Nil
HHV (kJ/kg)	45,700 (10,918 kcal/kg)
LHV (kJ/kg)	42,915 (10,252 kcal/kg)

Source : JICA 1994

(2) Selection of independent system power plant

1) Criteria and system selection

The system must support significant load follow up and frequent start up and shut down functions. It must also maintain high thermal efficiency during partial load, to reduce the consumption of natural gas fuel, while generating electricity in response to load fluctuations. A combined cycle power generation system which maintains high thermal efficiency is important because the electricity load becomes the base load for the plant. We therefore recommend the combined cycle for the power plant.

2) Combined cycle power plant outline and characteristics

Figure 8-3-1 shows the basic configuration of combined cycle power plant.

The characteristics of combined cycle power generation system are as follows.

(a) High thermal efficiency
(b) Short start up and shut down time
(c) Maximum output changes with atmospheric temperature
(d) Small quantity of hot water discharge

(3) The Combined Cycle Power Plant System and Basic Plant Structure

Combined cycle power generating systems are classified depending on the combination of gas and steam turbines. The exhaust heat recovery cycle and exhaust supplementary firing cycle mainly utilize gas turbines, while steam turbines are employed in the exhaust recombustion cycle, super charged boiler cycle and feed water heating cycle.

These cycles have particular characteristics. The system will be selected with consideration to plant output, types of fuel, and operating and site environmental conditions. As exhaust gas temperature increases with rising gas turbine temperatures, an exhaust heat recovery cycle is the most efficient system.

Figure 8-3-1 shows the operation of the exhaust heat recovery cycle, in which gas turbine exhaust gas is led to the heat recovery steam generator (heat exchanger HRSG), where HRSG generates steam to operate the steam turbine. This is the simplest of all combined cycle systems and is used at many plants around the world. The system' s features include;

(a) A high proportion of gas turbine output than steam turbine output.
(b) Increasing thermal efficiency as the gas turbine inlet temperature rises.
(c) Short start-up time.
(d) Small level of hot water discharge per plant.
(e) Small level of CO_2 discharge per plant.

The combined cycle system enables installation of gas turbines in the first phase, with HRSG and steam turbines added in the second phase as electricity demand increases.

As exhaust heat recovery systems promise increased power output and improved thermal efficiency, this plant structure will be used for the Steel Complex.

(4) Drawing list

Figure 8-3-1 Basic Configuration of Combined Cycle Power Plant
Figure 8-3-2 Single Line Diagram for Combined Cycle Power Plant
Figure 8-3-3 General Arrangement of Combined Power Plant
Figure 8-3-4 Proposed Location of Power Plant for the Steel Complex

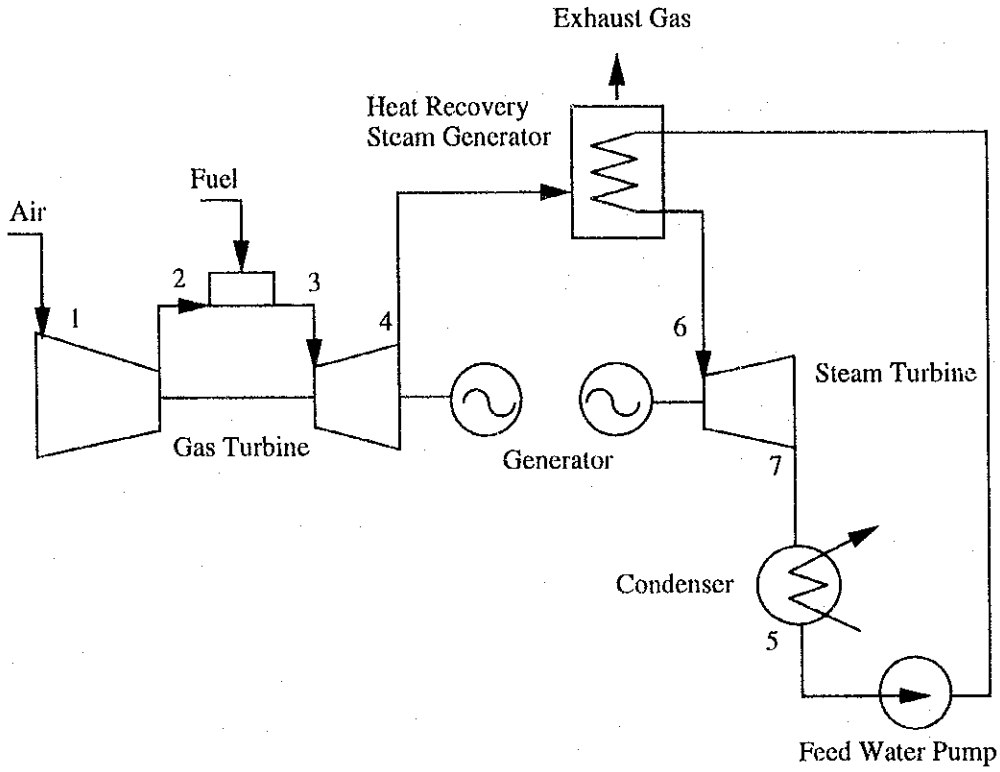


Figure 8-3-1 Basic Configuration of Combined Cycle Power Plant

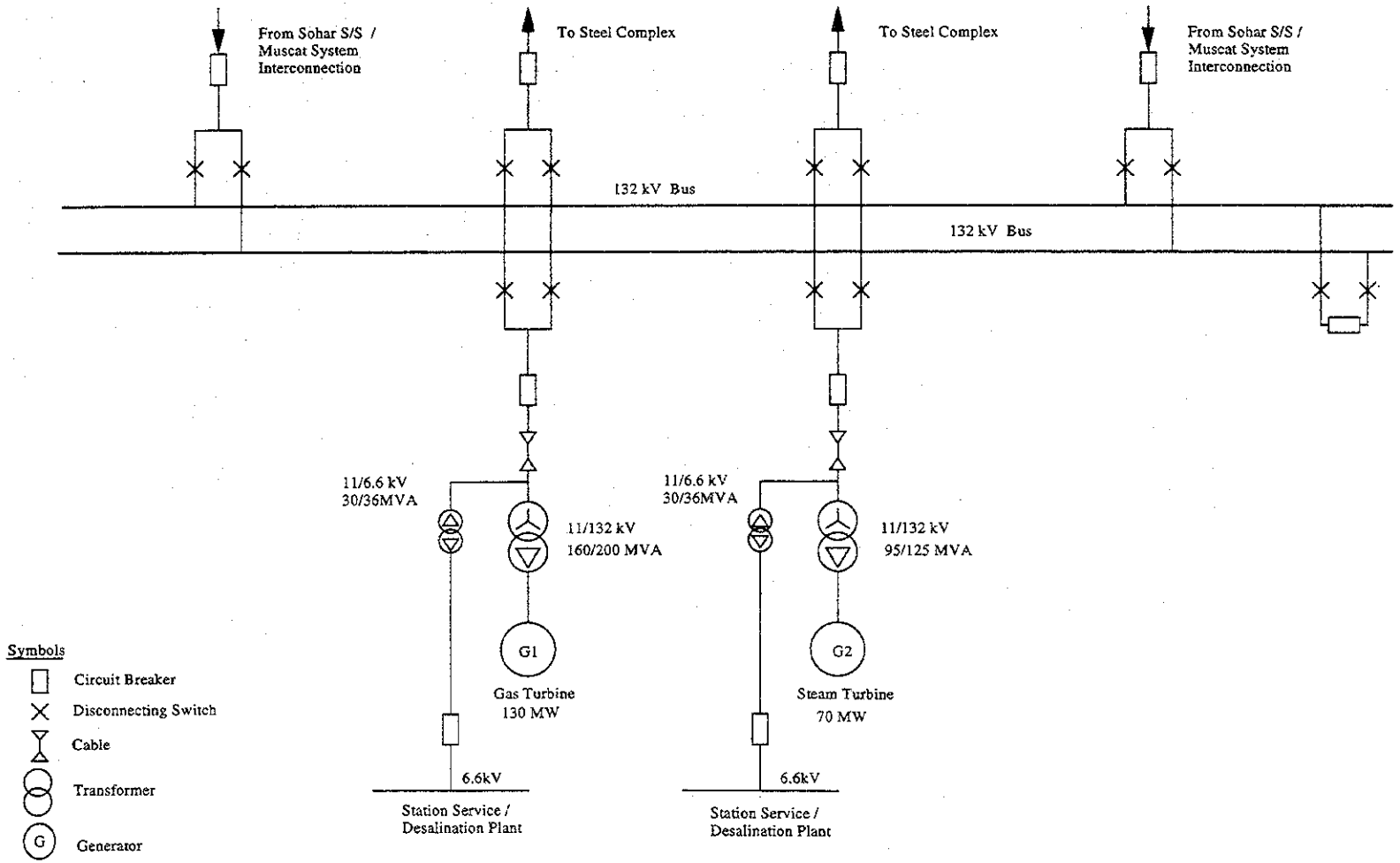
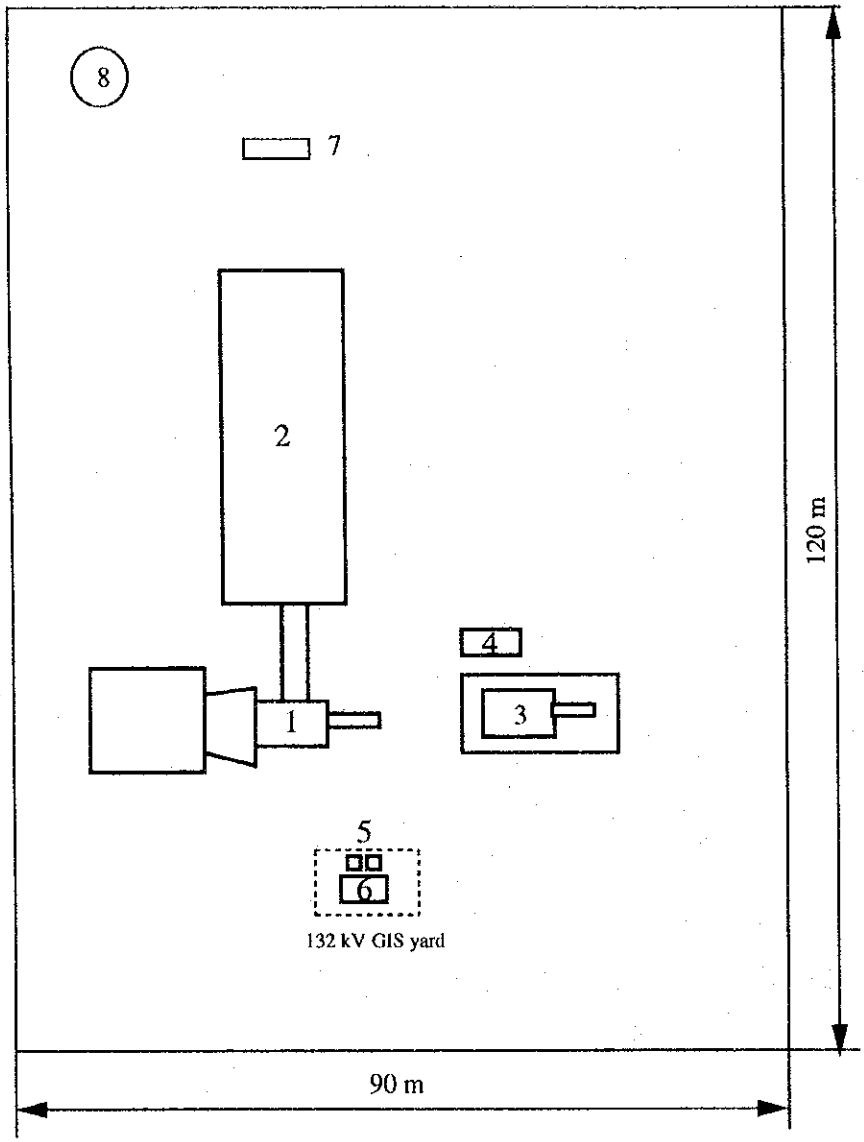


Figure 8-3-2 Single Line Diagram for Combined Cycle Power Plant



1 : Gas Turbine Generator Package
2 : HRSG
3 : Steam Turbine Generator
4 : Electric and Control House
5 : Main Transformer
6 : 132 kV GIS
7 : Water Treatment System
8 : Fuel tank

Figure 8-3-3 General Arrangement of Combined Cycle Power Plant

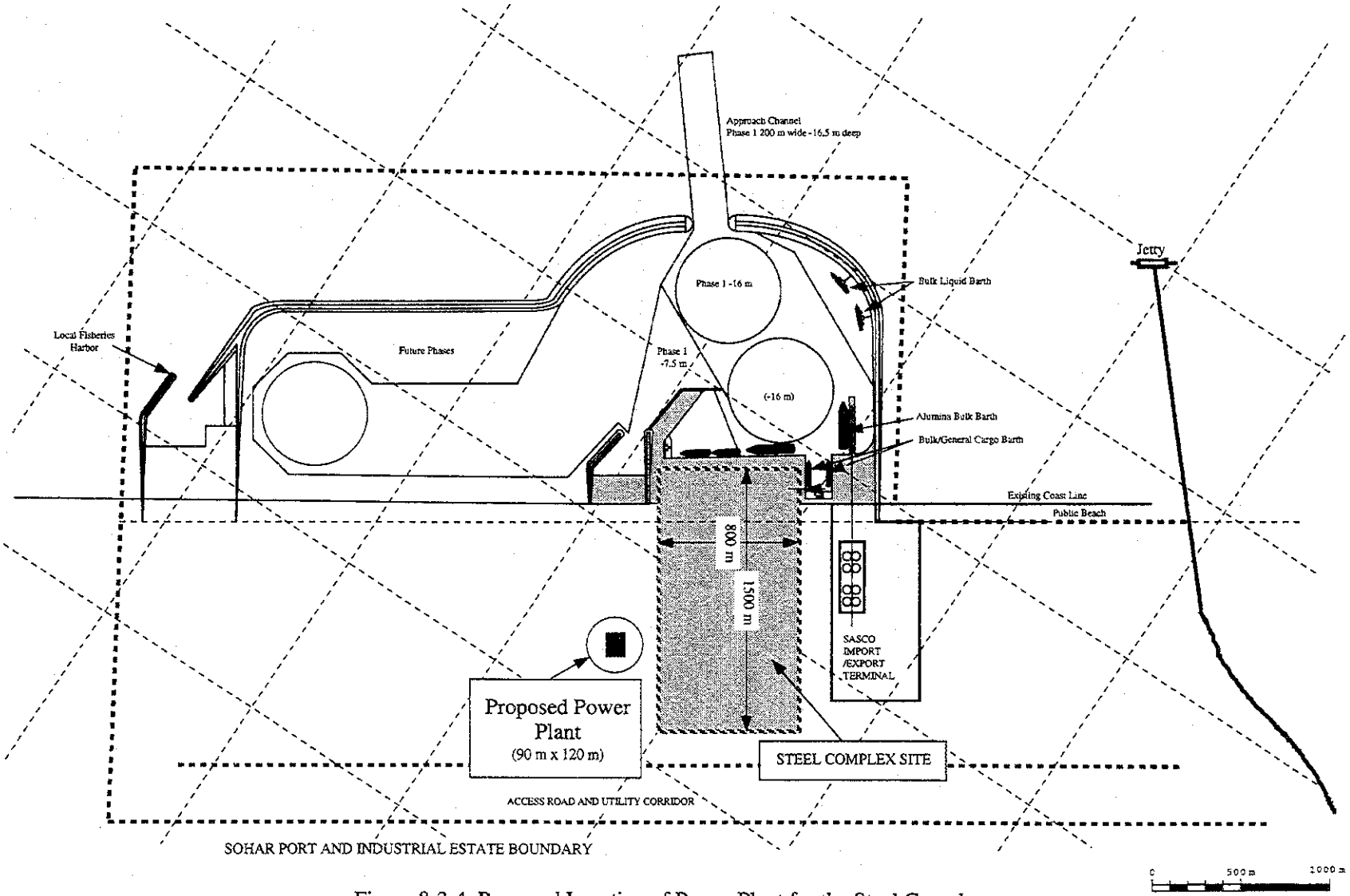


Figure 8-3-4 Proposed Location of Power Plant for the Steel Complex

8.4 Raw Water Supply

(1) Potable water

- the Steel Complex requirements will be 200 m^3/day (200 liters/person x 1,000 persons).
- Situation of potable water in the plant site (Sohar)

Potable water is supplied from the 8wells (1,000m^3/day in each well) and supply capacity is 250 m^3/h . The distance from the existing distribution network to the proposed site is approximately 5 km for the 4" and 7 km for the 12" pipeline.

(2) Industrial water

- Fresh water requirements will be 200m^3/h, 4,800 m^3/day, and 1,200,000 m^3/year.
  Unit consumption: 1.0m^3/t-steel product x 1,200,000 t/y
- Situation of fresh water at plant site (Sohar)
  Fresh water for industry use is not available in Sohar.
  Installation of desalination plant for the Steel Complex will be considered in Sohar.
- The required facility
  . One desalination plant
  . A connection pipeline of potable water

In the case of installation of a desalination plant, potable water can be supplied from desalination plant. Therefore, a connection pipeline will not be required.

(3) Conceptual design of desalination plant

Specifications for the desalination plant to be installed in Sohar are as follows:

1) Design criteria
   - Raw sea water
     .Condition : 30 deg.C
     .Maximum allowable temperature : 35 deg.C
     .Others : As per Table 8-4-1.

Table 8-4-1 Sea Water Analysis in Sohar

Item	Unit	Value
Turbidity	NTU	<1.0
Conductivity of sea water	μ S/cm	54,100
Total dissolved solid (TDS)	mg/l	40,500
pH		8.1
Chloride ion	mg/l	20,500
Calcium ion	mg/l	400
Magnesium ion	mg/l	1,430

Source : Water sample was collected from seashore of Sohar proposed port and was analyzed in Japan on July 15,1998.

- Product water quality

Product water quality shall conform to the standard quality of drinking water in the Sultanate of Oman (OS 8/1978).

Further more, the quality mentioned below shall be observed.

.TDS : < 110 mg/litter

.Total hardness : < 20 ppm as CaCO3

.Chloride iron : < 50 mg/l as CaCO3

- Production capacity : 5,000 m^3/d

The product water will be transferred by the pumps to the Steel Complex and the power station.

The product water will also be stored in the potable water storage basin. After chemicals are dosed for pH adjustment, sterilization and lime, product water will be transferred as potable water to the Steel Complex and power station.

2) Type of desalination plant

R-O (Reverse Osmosis) and MSF(Multi Stage Flush) type desalination plants are mainly operating in the world. R-O type desalination plant is selected in this Study considering technical and economic aspects.

3) Plant specifications

The main specifications of the desalination plant (5,000m^3/d) are indicated in Table 8-4-2.

Table 8-4-2 Main Specification of Desalination Plant

No.	Equipment	Q'ty	Specification
IW-001	Pressure filter Including: backwashing system	5	Filter media: sand Capa: 240 m^3/h,
IW-002	Back Wash Pump	2	Type: Centrifugal Capa: 300 m^3/h
IW-003	Filtrate Water Basin	1	Type: Rectangular/RC Capa: 360 m^3
IW-004	RO Supply Pump	4	Type: Centrifugal Capa: 240 m^3/h
IW-005	Cartridge Filter	5	Type: FRP
IW-006	1st Stage RO Unit	3	Type: Spiral Wound RO Membrane
IW-007	High Pressure Pump with Pressure Recovery Turbine	3	Type: Turbine Capa: 70 m^3/h, 600 m head
IW-008	1st Stage Treated Water Tank	1	Type: Rectangular/RC Capa: 360 m^3
IW-009	2nd Stage RO Unit	3	Type: Spiral Wound RO Membrane
IW-010	RO Supply Pump	4	Type: Centrifugal Capa: 85 m^3/h, 30 m head
IW-011	2nd Stage Treated Water Tank	1	Type: Rectangular /RC Capa: 360 m^3
IW-012	Chemical Dosing System Including: 1-pH Control Unit 1-Chemical Cleaning Unit 1-Chlorination Unit	1	
IW-013	Potable Water Tank	1	Type: Rectangular/RC Capa: 500 m^3
IW-014	Potable Water Supply Pump	2	Type: Centrifugal Capa: 30 m^3/h, 35 m head

8.5 Natural gas supply

(1) The Steel Complex natural gas requirements

The DR-based Integrated Steel Complex and a power station for the Steel Complex in this study will require natural gas as indicated in Table 8-5-1.

Table 8-5-1 Required Quantity and Quality of Natural Gas for Steel Complex

	Steel Complex	Power Station for Steel Complex
Supply capacity	Max. 66,000 Nm^3/h Av. 54,000 Nm^3/h 396,000,000 $Nm^3/year$ 14,700,000 MMBTU/year	Max. 50,000 Nm^3/h Av. 45,000 Nm^3/h 265,000,000 $Nm^3/year$ 9,800,000 MMBTU/year
Service	Feed to DR plant (Direct Reduction plant) for reducing gas Fuel gas for furnaces	Fuel gas for gas turbine and/or steam boiler
Supply pressure and quality	4.0±0.1 kg/cm^2G C5+ (Heavy hydrocarbon) :<0.1(mol%) Sulfur (as H2S): < 5-10 ppm	27-30 kg/cm^2G

(2) Natural gas supply

- New pipeline project

A new pipeline from Fahud to Sohar has been proposed to meet long-term domestic and industrial demands for the region.

Front end design for the planned pipeline is based on a 32" diameter, and approximately 300 km in distance and design work has already been completed.

The construction of new pipeline is scheduled to be completed by the summer in 2001.

Natural gas can also be supplied from above pipeline to the Steel Complex.

- Natural gas supply quality in Saih Nihayda

The contents of heavy hydrocarbon are higher than those of the requirement of Steel Complex.

A heavy hydrocarbon removal system is newly required for reducing the contents of heavy hydrocarbon in natural gas required for the Steel Complex.

(3) Conceptual design of natural gas supply system

Natural gas will be used not only for the Steel Complex but also for many projects in Sohar region.

Conceptual design of natural gas supply system will be made by the Government so as to

meet sufficiently all the requirement of the projects concerned.

Therefore, conceptual design of natural gas for the Steel Complex is not required.

8.6 Infrastructure Implementation Schedule

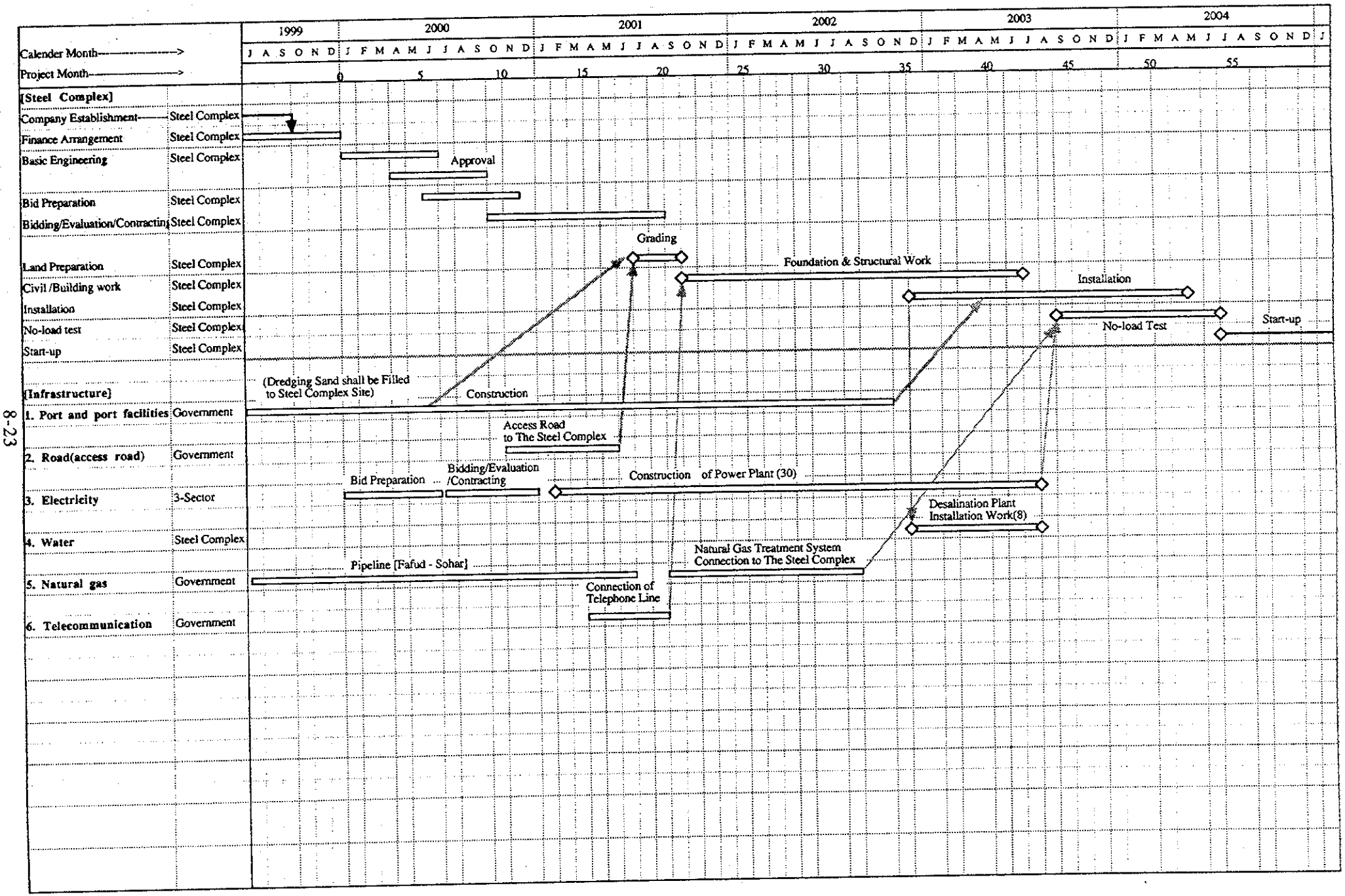
Infrastructure implementation schedule including port and port facilities, road, electricity, water, and natural gas is summarized in Figure 8-6-1.

Critical path will be a power plant because electric power is required before to start the no-load test of Steel Complex (at the project month =44 months).

The power plant (200 MW) will require 30 months for construction.

The power plant project should start at the same time as the Steel Complex project (at the project month =0 month).

Figure 8-6-1 Infrastructure Implementation Schedule



Chapter 9. SITE CONDITIONS FOR THE STEEL COMPLEX

9.1 Location and Natural Condition

9.1.1 Location

Sohar, which face the Gulf of Oman, is located 250 km northwest of Muscat. Sohar is strategically located along important sea routes that connect Indian Ocean to GCC countries. After the completion of the new port construction in Sohar, it is expected that Sohar will be further developed as one of the most important bases or hubs for marine transportation in northern Oman. The development and construction plan is already underway, in a site located about 20 km away from the center of Sohar. The proposed construction site of the Steel Complex is located within the port area of the development plan, having an area of 1,200,000 m^2(800 m×1500 m).
(Refer to Figure 7-1-1)

9.1.2 Natural condition

(1) Meteorological condition

Meteorological conditions are not always important factors as compared with other site conditions in general, except the impact of stormy wind on port operations. However, the northern coast of Oman does not experience cyclone in the past 40 years. On the other hand, it is important to notice the occasional occurrence of special weather condition such as the occurrence of maximum rainfall of 110mm/day.

(2) Topographical Condition

The proposed site of the Steel Complex is situated on the existing coastal line. Behind the coastal line, there is a 300-m width flat land (with an elevation of 2-3 meters above the sea level) that is parallel to the coastal line. However, the elevation of the land at the farther on-shore side is almost the same as that of the sea level (0-1 m). Since the elevation of half of the land of the proposed Steel Complex is very low, it is necessary to fill such portion up to suitable ground elevation using the dredged soil obtained from port construction.

(3) Soil Condition

Based on the boring test results of the proposed berth area, the soil profile shows that the subsoil is consist of 8-m to 10-m thickness layer of medium dense sand and a layer of more than 10-m thickness of sandstone. Since the medium dense sand layer would be dredged in securing the proper water depth of the new port, the proposed berth of the Steel Complex will be constructed on the sandstone layer which can provide adequate bearing capacity.

At the proposed Steel Complex site, the surface is made up of 10-m to 12-m thickness layer of medium dense sand with 10-30 N-value. Below this layer, there are alternately stable and stiff siltstone and sandstone. Judging from the N-value of surface layers, it can be expected that there will be enough bearing capacity of equipment foundations of the Steel Complex. Moreover, it is necessary to examine the type of the foundation carefully as the filling work of 3-m to 4-m thickness are executed using dredged soil.

(4) Sea condition

Sea condition is another important factor that should be considered in the design and construction of berth. It can be judged that the project site has favorable sea conditions, i.e., little occurrence of high waves, very small tide difference, almost no tidal currents and little amount of drift sand.

9.1.3 Site preparation

The data on the present geographic conditions of the Steel Complex construction site shows that the ground levels of the area vary from D.L 0 to +3 meters. Since the ground level set/required by the Sohar port construction work is +4.3 meters, the filling work of as thick as 3 meters should be done. Dredged soil obtained from the port construction work will be used as fill materials. In such case, only ground leveling work will be carried out by the Steel Complex project.

9.2 Social Conditions

According to the General Census of population in 1993, the population of boys aged between 10 and 15 was about 139,000, and by simple assumption, 5% of them, approximate 7,000 boys may be in Sohar city. From these figures, it will not be very difficult to recruit work forces for the Steel Complex since it will need 1,200 workers at most, and it is also possible to recruit from

outside.

As for housing matters for employees, it will be possible to build corporate houses and dormitories near to the Steel Complex, and also it will be possible to obtain enough numbers of good level houses for rent. This is the answer from Sohar Development Office.

As for hospitals, there are two hospitals in Sohar city. They have 481 beds and 115 doctors with 350 nurses in 1998. Besides the above, there are health centers covering Sohar city which have more than 50 doctors and 190 nurses. These medical situations will be sufficient to conform the needs by the Steel Complex employee.

As for schools, since the government takes care of all school projects properly, we do not see any outstanding problem to concern for schools.

Chapter 10. RAW MATERIALS FOR THE STEEL COMPLEX

The raw materials required in a direct reduction (DR) process of iron oxide and an electric arc furnace (EAF) route of a steel making plant include iron ore (oxide pellets and lump ore), scrap and other auxiliary materials such as limestone, cokes, ferro-alloys, aluminum and fluorite. Generally, a feasibility study is based on the principle that these raw materials are of local origin or production. However, in this study, the raw materials were classified into those to be locally procured in Oman and those to be imported, with consideration given to the present status of the resource researches and the developments being conducted in Oman.

As the result of this study, the raw materials were divided into three categories as follows, depending on supply sources:-

(1) Domestic supply

Limestone

(2) Domestic and importation, together

Steel scrap

(3) Importation

1) Iron ore (oxide pellets and lump ore)
2) Graphite electrodes
3) Refractories
4) Cokes (lump or breeze)
5) Ferro-manganese
6) Ferro-silicon
7) Aluminum (shot and bar)
8) Fluorspar

Although locally produced scrap is available in the domestic market, the quantities do not suffice for the Steel Complex so it was concluded that steel scrap would also be imported.
Limestone is produced in Oman.

Typical standard quantities of the raw materials required for the Steel Complex of 1.2 million tons per year production basis are shown in Table 10-1-1.

Table 10-1-1 Main Raw Materials for the Steel Complex

(Unit: tons/y)

Raw Material		Quantity	Remarks
Iron ore	Oxide pellets	1,920,000 -1,344,000	Maximum ratio of lump ore will be
	Lump ore	0 - 576,000	30%
Steel scrap		98,900	Purchased steel scrap
Limestone		100,800	
Cokes (lump or breeze)		42,000	
Ferro-alloy	Ferromanganese	12,200	
	Ferro-silicon	5,300	
Aluminum		120	
Fluospar		120	

Chapter 11. IMPLEMENTATION PLAN

11.1 Project Schedule

The overall implementation schedule for the Steel Complex project is shown in Figure 11-1-1.

The start-up date of the Steel Complex is scheduled to be July 1, 2004. The total construction period from basic engineering to start-up of the project is estimated at 54 months and the period of construction for major plants from CIF contract to start-up is set at 36 months. Other ancillary facilities shall be implemented with proper timing for start-up of the Steel Complex.

At the preparation stage, the basic engineering, which includes such work as review of the feasibility study, environmental impact assessment (E.I.A), overall implementation schedule, organization of management and the operating plan are conducted.
When construction of the new steelworks has been decided and approved by the owner and relevant authorities, project organization shall be established and contractual strategies shall be made.

The project is executed by contracts concluded between the project owner and contractors. Inadequate content of the bidding and contract documents, inadequate bidder qualifications or bid management will cause serious damage to the following contract performance and administration.

11.2 Establishment of the Company

11.2.1 Role and function of the Company

Once the viability of the Steel Complex Project is confirmed, it is required to establish a business entity (the Company) carrying out the investment and operation of the Steel Complex.

The role and function of the Company are as follows at each stage.

(1) Promotion stage

At this stage, usually a few, limited founders will organize the Company at a nominal capital as a promotion Company.

To prepare the bankable feasibility study report by appointing a reliable and competent financial advisor, to invite equity participant (shareholders), and to arrange required loans;

bankable FS report includes the following;

- confirmation and/or draft contracts of required utilities (natural gas, water, electricity and the infrastructure) with price formula or schedule at a definite time schedule
- confirmation of readiness to obtain approvals from governmental authorities concerned in Oman
- confirmation and/or draft contracts of providing managerial and operational assistance by a reliable and competent steel company or companies in order to assure and maintain the satisfactory production level
- confirmation and/or draft contracts of marketing or marketing cooperation with reliable and competent trading company or companies
- confirmation and/or draft contracts of related plant supply and construction
- confirmation of intention of equity participants to cover the planned equity capital.

Based on the bankable FS report, required loan financing will be able to arranged.

(2) Transformation from promotion company to substantial operating company

Once the above-mentioned confirmations and finance arrangement are ready, the Company, which is the substantial entity to execute the Steel Complex project, is transformed from the promotion company or newly established on the basis of the shareholders agreement and articles of association.
Upon establishment, the Company will enter into contracts with concerned parties in accordance with the confirmations and draft contracts mentioned above.

(3) Construction stage

The major functions of the Company at this stage are:

- contract awards of plant supply and constructions
- administration of the plant construction
- recruiting of employees for overseas and in-plant training as planned
- control of funds and expenditures

11.2.2 Shareholding structure of the Company

In consideration of the objectives of the Company (industrialization and human resource development in Oman) and the privatization policy of Oman, it is advisable and indispensable that the following shareholders will involved in the Company.

(1) Omani leading private entities
(2) Foreign companies who can undertake the technology transfer for the engineering, operation, management and marketing of the most efficient steel complex.
(3) Omani governmental authorities or investment institutions

11.3 Organization and Personnel

(1) Organization

An organization plan of this project is charted in Figure 11-3-1.

This organization is made under the following consideration:
- Main raw material receiving from bulk carriers and product loading onto cargo ships are included in the company organization as one section in Production Department.
- Top Management Affairs section is positioned in the place directly controlled by Managing Director whose main jobs will be Board of Directors affairs and Secretarial matters.
- Environmental Control section is positioned in the place directly controlled by General Manager.
- The quality section is also positioned in the place directly controlled by General Manager.
- The computer section is positioned in Production and Technical Control Department.

Under GM, there are 7 departments and 29 sections in the company organization, and 2 Deputy General Managers will be allocated as staff to assist GM.

(2) Manpower requirement

Required manpower in the stage where production work is stabilized, is shown in Table 11-3-1.

The required manpower is 1,239 persons in total. Workers like office boys are not counted in the table.

(3) Recruitment and training

1) Recruitment

As there is no integrated steel works in Oman so far, it is necessary to recruit a certain number of experienced engineers and skilled workers from abroad.

Section managers (or candidates) for each plant and Maintenance & Utilities dept. should be recruited at the stage of plant designing, around 2 years prior to the start-up of production. Other personnel should be recruited at least 6 months prior to the start-up of production.

As for newly graduate applicants, qualification is needed according to the field they apply to.

2) Training

The purpose of training is to let new employees acquire enough skill to execute their jobsin the plant as soon as possible.

Section managers (or candidates) for each plant and Maintenance & Utility dept., who are recruited 2 years prior to the start-up, can get some knowledge from on the job training.

For other members who would join 6 months prior to the start-up, training will begin lectures, and sometimes they will go to the site and observe installation work.

Some qualified trainees including Section managers (or candidates) would go abroad and observe similar integrated steel works as overseas training.

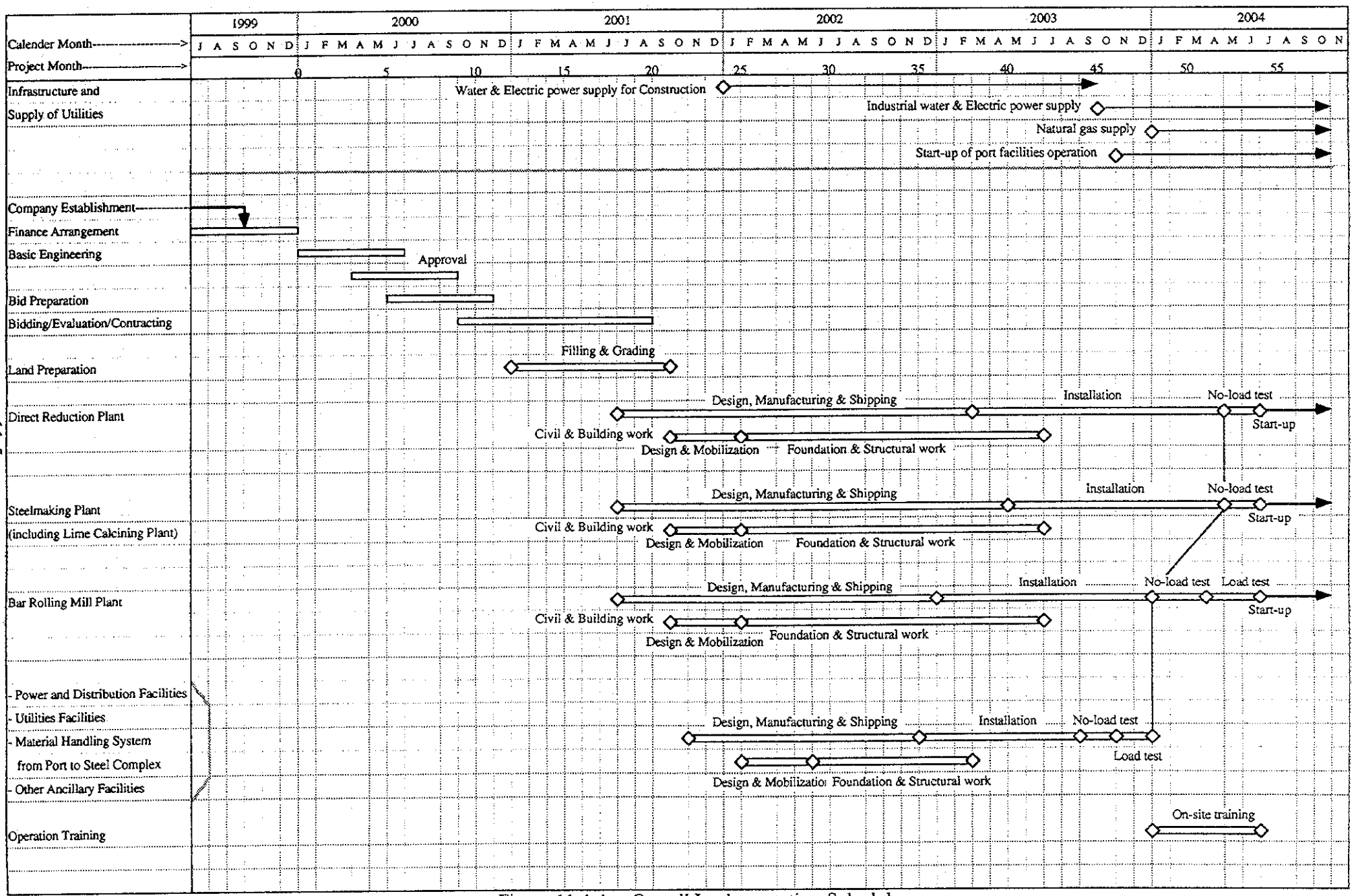
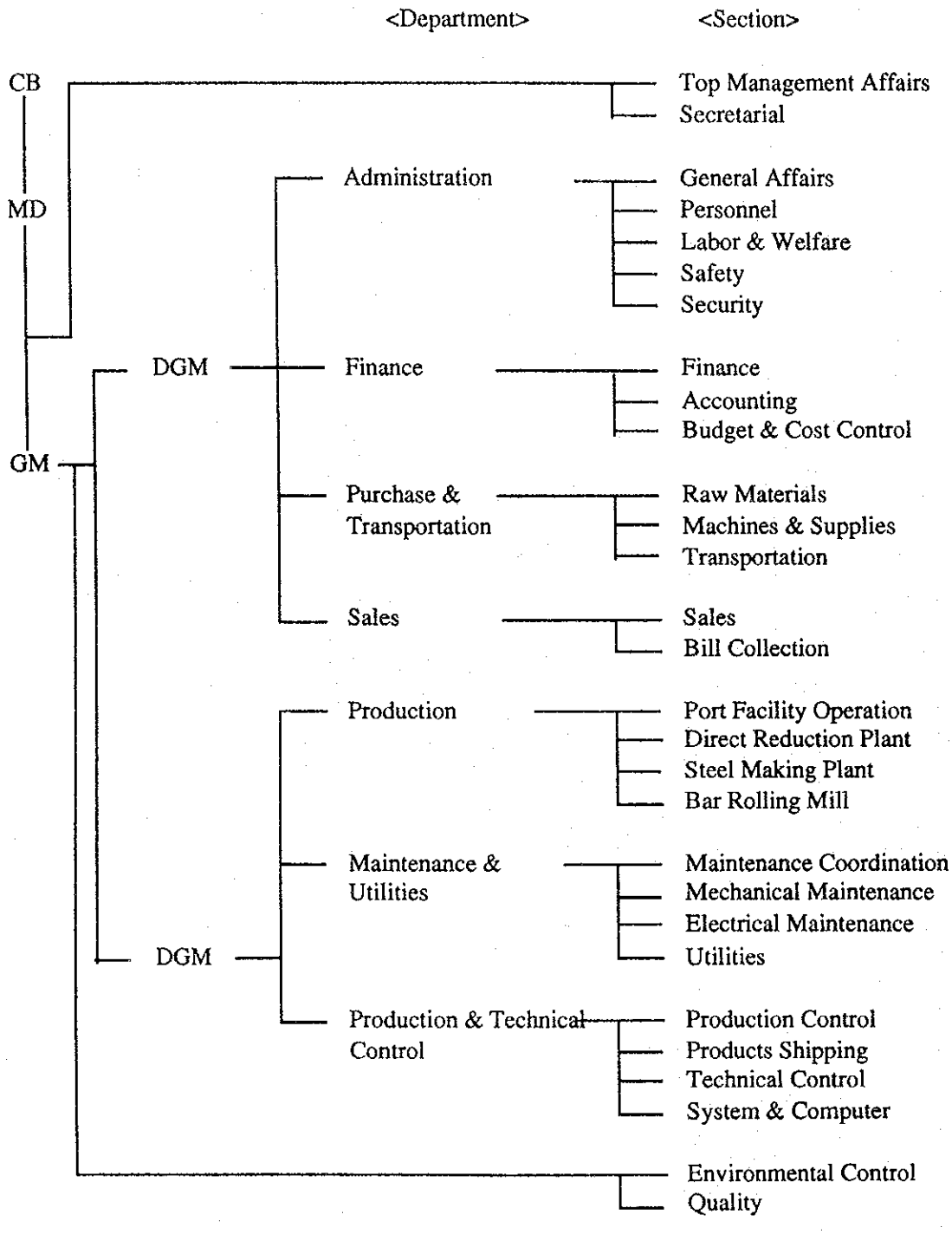


Figure 11-1-1 Overall Implementation Schedule



Note: CB/ Chairman of Board MD/ Managing Director
GM/ General Manager, DGM/ Deputy General Manager

Figure 11-3-1 Organization Chart

Table 11-3-1 Manpower Requirement

DEPT	Section	Sub Section	CB	MD	GM	DGM	DM	SM	ASM	E&SP	F	AF	W	Total
	TMA		1	1	1	2		1	1	1				8
	Secret.							1	1	2				4
AD							1	5	5	10	2	8	12	43
FD							1	3	3	6				13
PTD	RM						1	1	1	2	1	1	2	9
	MS							1	1	1	1	1	4	9
	Transp.							1	1	3	3	14	44	66
	Sub-total	(PTD)					1	3	3	6	5	16	50	84
SD	Sales						1	1	2	4				8
	Bill col.							1	1	4				6
	Sub-total	(SD)					1	2	3	8				14
PRD	**Port faci.**	Material Handling					1	1	1	1	1	3	12	20
	DRP	DRP						1	1	3	5	16	28	54
										1	4	8	20	33
		LCP							1	1	4	5	16	27
	SMP	EAF						1	1	2	8	21	80	113
		CCM							1	2	8	26	117	154
	BRM							1	1	3	5	21	247	278
	Sub-total	(PRD)					1	4	6	13	35	100	520	679
MUD	MC						1	1	1	3		1	2	9
	MM	Port						1	1		1	4	4	11
		DRP							1	1	1	4	9	16
		SMP							1	2	1	6	16	26
		BRM							1	2	1	5	15	24
		M. Repair							1	3	2	3	19	28
	EM	Port						1	1		1	4	4	11
		DRP							1	1	1	4	9	16
		SMP							1	2	1	4	16	24
		BRM							1	1	1	4	15	22
		Power distr.							1	1	1	4	12	19
		E. Repair							1	2	2	3	15	23
		Instrument.							1	2	1	3	7	14
	Util.							1	1	2	3	10	41	58
	Sub-total	(MUD)					1	4	14	22	17	59	184	301
PTCD	PC						1	1	2	2				6
	PS							1	2	4	1	5	14	27
	TC							1	1	3				5
	Sys.&Computer							1	1	3				5
	Sub-total	(PTCD)					1	4	6	12	1	5	14	43
	Environmental C.							1	1	1	1	1	1	6
	Quality							1	1	2	2	6	32	44
Grand total			1	1	1	2	7	29	44	83	63	195	813	**1,239**

Chapter 12. ENVIRONMENTAL ASSESSMENT

The process planned to be adopted by the Steel Complex of this Study consists of a direct reduction plant (DRP), electric arc furnaces (EAF) and a bar rolling mill plant (BRM).
The integrated steel production process is new to Oman, therefore, it is necessary to assess the environmental pollutants which will be generated from the Steel Complex and to properly estimate the impact on the environment.
To judge the environmental conditions after the installation of the Steel Complex, as an environmental assessment, the Study Team surveyed the present environmental situation at the proposed site, and then calculated the distribution of pollutants using a simulation based on surveyed data and predicted pollutant volume emitted from the new Steel Complex.

The results of the calculations were verified to be within the allowances accorded by Oman's environmental laws and regulations for items defined by Oman. The results were verified to be within the allowances accorded by WHO's guide line of environmental standard for items which have not been determined yet in Oman.

12.1 Present Environmental Situation

(1) Environmental laws

The basic environmental protection law called " Law on the conservation of environment and prevention of pollution for Royal Decree 10/82" , was issued on February 9, 1982 in Oman.
Thereafter, some regulations were issued as amendments to Royal Decree 10/82.
This law covers air pollution, water pollution, noise and, waste material treatment.

Owners of new sources of work must submit an Environmental Impact Statement (EIS) to the Ministry and obtain an Environmental Impact Assessment (EIA) 2 months before starting a project. The term, Environmental Impact Statement (EIS), refers to a document which summarize the Environmental Impact Statement (EIS) Study.

(2) Current situation

At present, there are no remarkable environmental problems at the proposed site for the Steel Complex due to limited industrial activity and geographical conditions.
Environmental laws and regulations have not been systematically implemented at present. However, some amendments have been undertaken by relative authorities.

Under these conditions, excepting a few people and companies, interest in environmental pollution seems to be generally very low.

12.2 Environmental Control for the Steel Complex Project

Tables 12-2-1 shows the estimated emission of air pollutants which will be generated from the Steel Complex, Table 12-2-2 shows the estimated noise level, and Table 12-2-3 shows the estimated discharge waste water.

Table 12-2-1 Estimated Air Emission Data

Element	NOx			SOx		Dust
Plant	DRP	SMP	BRM	DRP	SMP	
Facility	Reformer	EAF	Reheating furnace	Reformer	EAF	
Emission value (mg/Nm^3)	69.0	7.4	205.4	2.4	2.3	5.0
Exhaust gas volume (Nm^3/hr)	680,000	2,100,000	73,000	680,000	2,100,000	
Exhaust gas temperature (deg.C)	300	90	250	300	90	

Table 12-2-2 Estimated Noise Levels

Pollutant	Process	Facility	Value (dB)
Noise	DRP	Blower Area	95 - 105
	SMP	EAF	105
	BRM	Mill	105
	Utility	Air Compressor	95

Table 12-2-3 Estimated Discharged Waste Water

Parameter	Unit	Value
Quantity	m^3/hr	max.25,000
Temperature	degrees C	less than 7.0 above ambient receiving sea water temperature

12.3 Assessment

Considering the characteristics of the Steel Complex, the items to be simulated are as follow;

- Air pollution: NOx, SOx, Dust, Noise
- Water pollution(sea discharge): Hot waste water

The results mentioned above are summarized in Table 12-3-1.

Table 12-3-1 Evaluation

Parameter		Contribution*	Limit
Air Quality ($\mu g/Nm^3$)	NO_2	0.11	150**
	SO_2	0.017	40-60***
	T.S.P.	5.77	60-90***
Noise (dB)		max. 58.5	70****

Note: * Maximum value (in the case of air quality, at ground level)
WHO's standard: ** Annual mean
*** Daily mean
**** Omani regulation (Ministerial Decision 80/94)

An environmental impact assessment was conducted on the principle pollutants NOx, SOx and dust as well as noise which can be expected to be emitted from the Steel Complex with reference to the following standards.

- Environmental standards

  Comparing of the pollution levels, calculated by simulation using data from the site and the predicted emissions levels from the Steel Complex, with national standards and WHO's guideline for emission control.

As a result of the assessment, the emissions value from the Steel Complex and environmental pollution near the site will be within the limits of the above mentioned standards.
Therefore, it can be said that pollution will be kept within the limits of national standards provided the Steel Complex is constructed equipped with the environmental control systems described in this report.

Chapter 13. ESTIMATION OF CAPITAL INVESTMENT

The total plant construction cost (without power plant) is estimated at US$ 665 million, of which a breakdown is shown in the following table.
The total plant construction cost (with power plant) is estimated at US$ 805 million.

Table 13-1-1 Breakdown of the Capital Investment

	(US$ '000)
DR Plant	150,000
Rolling Mill Plant	90,000
Steel Making Plant	105,000
Others	123,000
Equipment cost total	468,000
Installation	50,000
Civil & building works	110,000
Land preparation	5,000
Owner's engineering	12,600
Contingency	19,400
Total	665,000

(1) The estimation is made at the current price level as of October 1998.
(2) The scope of the capital investment is according to the battery limit and technical specifications of the Steel Complex defined.
  (i) The electric power is supplied by the Power Company to the substation of the Steel Complex.
  (ii) It is assumed that the port and berths required by the Steel Complex are to be constructed by the government authorities.
  (iii) All contracts for this project will be made through limited tender and under the single responsibility of a reliable company or consortium to secure the shortest possible construction time schedule as planned.
(3) Import duty is assumed to be exempted according to the Law.
(4) Equipment cost : CIF Sohar including supervisory services
(5) Others of equipment cost includes unloading/loading facilities, material handling facilities, electric sub-station, utilities facilities, lime calcining plant, maintenance shop, in-works transportation facilities.

Chapter 14. ESTIMATION OF PRODUCTION COST

14.1 Cost Calculation Method

Process-wise cost accounting is adopted.
Production process: Direct Reduction Plant - Steel Making Plant - Bar Rolling Mill Plant
Semi-finished and finished products: DRI - Billet - Bar

14.2 Calculation of Production Costs

14.2.1 Estimation basis

(1) Production cost is estimated in US dollars with the constant price level of the year 1998.

(2) The present conversion rate of RO. to US dollar is adopted.
1 US dollar = RO. 0.3846 (RO. = US$ 2.60)

14.2.2 Raw materials and supplies cost

Costs of raw materials and supplies are estimated by the following procedures as shown in the Table 14-2-1 and are used for the financial projections.

(1) The unit prices of raw materials and supplies are estimated in consideration of international market and local market.

Table 14-2-1 Unit Prices of Raw Materials and Supplies

	Unit Price (US$/Ton)
Imported	
Iron oxide pellets	46.16
Fe Mn	500.0
Fe Si	650.0
Fluorspar	175.0
Graphite electrode	3,400
Domestic	
Steel scraps	120.0
Lime stones	13.0

Notes: 1) Prices of imported goods consist of CIF and other charges. It is assumed in the financial analysis that the import duty on materials and supplies are exempted.

(2) Unit consumption of raw materials and supplies are summarized from Chapter 6 APPLICABLE TECHNOLOGY FOR THE STEEL COMPLEX in the following table.

Table 14-2-2 Production Yield and Unit Consumption

Item	(Unit)	Unit Consumption
1) DRP		
Iron oxide pellets	(t/t-DRI)	1.450
Electric power	(kWh/t-DRI)	100.0
Natural gas	(MMBTU/t-DRI)	9.92
2) SMP		
Steel yield	(%)	85.5
Billet yield	(%)	97.0
DRI/Scrap ratio	(%)	89.8:10.2
Electric power	(kWh/t-BT)	695.0
Natural gas	(MMBTU/t-BT)	0.12
4) Bar		
Product yield	(%)	97.0
Electric power	(kWh/t-Bar)	90.0
Natural gas	(MMBTU/t-Bar)	1.10

14.2.3 Utilities cost

The present unit price of electricity for industrial use in Oman is RO. 0.016 (US$ 0.0416)/kWh and the unit price of natural gas presently indicated is not less than US$ 0.8/MMBTU.

The results of financial analysis by applying these unit prices (electricity: US$ 0.0416/kWh, natural gas: US$ 0.8/MMBTU) is 11.02 % of IRR as show in detail in Chapter 15.3.3 (Original Case), which shows non-feasibility of the Steel Complex Project commercially.

On the other hand, electricity and natural gas prices in the neighboring countries of the Gulf Region are as shown in the table below.

One of the essential factors in the competitiveness and commercial viability of the Steel Complex Project is cost of energy (electricity and natural gas) in addition to the market and production efficiency (modern, efficient plant equipment and production technology). Therefore, it is necessary to ensure that the level of energy costs for the Steel Complex Project is comparable to those for the existing and possibly future steel companies in the neighboring countries. Otherwise, it would be difficult for this Project to attract the interest of investors or

financiers.

It is advisable for the purpose of industrialization in Oman to supply energy at a competitive cost level to a large scale of industrial project like this Steel Complex Project.
The Steel Complex is a large electricity consumer and its consumption is rather stable irrespective of summer or winter, and daytime or night time, which will contribute to higher operation rate of power plant.

Therefore, referring to the level of energy costs in the neighboring countries, the financial analysis in this Report adopts the following assumptions for costs of natural gas and electricity as the Recommended Case.

Natural gas: US$ 0.6/MMBTU
Electricity: US$ 0.025/kWh

Table 14-2-3 Energy Cost in the GCC Countries and Other Oil-producing Countries

Country	Electricity (US$/kWh)	Natural gas (US$/MMBTU)
Venezuela	0.018	0.60
Iran	0.010	0.20
Saudi Arabia	0.013	0.50
UAE	0.020	0.50
Qatar	0.020	0.50
Bahrain	0.03	0.75
Kuwait	0.005	0.50
Egypt	0.024	0.76

Also at the Recommended Case, it is assumed that electricity will be supplied to the Steel Complex by a private power company to be newly established by the following reasons.

i) The power plant operation and power supply business needs special, indigenous technology and know-how, which are quite different from steel companies.

ii) In order to secure investors and finance a private-based independent power project, it is the most important key factor that an overseas, experienced power company or companies take leadership in promoting and establishing the power project.

iii) If the Steel Complex Project includes a power project, the total investment cost becomes much larger, and furthermore it is necessary to organize investors and financiers which might have interest both or either in the two kinds of projects of quite different industries. Then, it would be very complicated and difficult to ensure smooth and successful finance arrangements.

iv) Although this Steel Complex is a large scale electricity consumer which will be one of the base loads and therefore attractive for an IPP (independent power producer) project, it is very difficult for an independent power plant exclusive for the Steel Complex to cope with the fluctuation of electricity consumption in the electric arc furnace. In order to cope with such fluctuation, it is indispensable and essential to secure a larger short-circuit break capacity: inter-connection with a large electricity network as a back-up power.

v) For the above purpose it is highly recommended that the Steel Complex be supplied with electricity by the IPP Project being promoted for the industrialization and regional development of the Sohar area.

vi) It is expected that the above IPP Project, which covers the power requirements for not only the Steel Complex but also other projects, can enjoy a higher efficiency in investment and power generation cost according to the scale of merit.

vii) It is considered possible that the IPP Project can supply electricity at a price of US$ 0.025/kWh provided that natural gas is supplied at US$ 0.6/MMBTU and a combined cycle gas turbine system is applied.

(1) The following unit price of electricity, natural gas and water is applied in the Recommended Case of this Report.

Purchase Prices of Utilities

Electricity

US$ 0.025/kWh

Natural gas

US$ 0.6/MMBTU

Industrial water

(It is assumed that the Steel Complex has its own desalination plant.)

(2) Consumption of utilities are assumed in the following.

Electricity

1,050.9 kWh/ton of steel bar

Natural gas

12.31 MMBTU/ton of steel bar

Water

Industrial water

0.85 Nm^3/ton of steel bar

14.2.4 Labor cost

The annual labour cost for the Steel Complex is estimated as follows:

Table 14-2-4 Annual Labour Cost for the Steel Complex

Item	Number	Unit labour cost (US$/person-year)	Labour cost (US$ '000/year)
CM & MD	2	100,000	200
General Manager	1	75,000	75
Deputy General Manager	2	60,000	120
Department Manager	7	50,000	350
Section Manager	29	30,000	870
Assistant Section Manager	44	24,000	1,056
Engineer & Specialist	83	22,000	1,826
Foreman	63	15,500	977
Assistant Foreman	195	12,400	2,418
Worker & Clerk	813	10,000	8,130
Total	1,239	12,497	16,022

14.2.5 Repair costs and special repair costs

US$ 10 per ton of products (steel bars) is assumed to be the annual repair and maintenance cost in consideration of experiences of similar steel plants.

14.2.6 Depreciation

In the financial analysis, the fixed assets in aggregate are depreciated over 17 years equally.

14.2.7 Sales and general expenses

Sales and general expenses such as land rent, jetty usage fee, management, technical assistance fee, insurance premium and other miscellaneous expenses are estimated.

(1) Land rent

The land rental fee is estimated at US$ 319,000 per year.
(1,828,000 m2 x RO. 0.1/m2-year)

(2) Jetty usage fee

The usage fee of the jetty area is estimated at US$ 2,420,000 per year according to the following calculation.

1) Construction cost (to be done by the Government): US$ 27.8 million
2) The annual fee is set so as to get IRR of 6% for the period of 20 years.

(3) Insurance premium for the plant equipment

The annual insurance cost for the plant equipment is assumed at 0.1 % of the total plant construction cost.

US$ 665 million x 0.1 % = US$ 665,000 per year

(4) In-plant transportation and subcontract works

The annual in-plant transportation and sub-contract works are estimated at US$ 1 per ton of products (steel bars).

US$ 1/t x 1,164,000 t/y = US$ 1,164,000 per year

(5) Sales expenses and commissions

In order to secure constant and stable customers and markets it is necessary to appoint foreign and local sales agents.
The sales related expenses and sales commission is assumed to be 1.5% of sales in the financial analysis.

(6) Technical, management assistance cost and expenses

In order to secure a smooth start-up, to reach the earliest full production level and to keep a stable and high production level, it is essential to introduce technical and managerial assistance through stationing experienced personnel of advanced, overseas steel companies at the Steel Complex.

(7) Miscellaneous expenses

The miscellaneous expenses are estimated to be 5% of the labour cost.

US$ 16,000,000/y x 5% = US$ 800,000 per year

(8) Sales and general expenses mentioned in this section are included in the Other Expenses of the Fixed Cost at Profit & Loss Statements of the financial analysis.

14.3 Production Plan

14.3.1 Production plan

The production plan is planned as follows:

Table 14-3-1 Production Plan

(Unit: tons)

Products	1st year	2nd year	3rd year and after
DRI	910,000	1,186,900	1,300,000
Billets	840,000	1,095,000	1,200,000
Steel Bars	814,800	1,062,700	1,164,000
(Operation rate)	(70.0%)	(91.3%)	(100%)

Chapter 15. FINANCIAL ANALYSIS

15.1 Precondition for Financial Analysis

15.1.1 Financial project period (Project life)

Financial projection covers the period of 20 years from the start-up of the Steel Complex.

15.1.2 Fund requirements and fund raising

(1) Fund requirements

Funds required for the Steel Complex are as follows:

1) Capital investment

The total plant construction cost (without power plant) is estimated at US$ 665 million, of which a breakdown is shown in the following table.

Table 15-1-1 Capital Investment

(Unit: US$ 1,000)

Item	Total
Equipment cost	468,000
Installation cost	50,000
Civil & building cost	105,000
Land preparation	5,000
Owner's engineering	12,600
Contingency	19,400
Total	665,000

2) Pre-production cost

The pre-production cost is estimated as follows:

(Unit: US$ 1,000)

Labor cost	18,000
Temporary office rental and office expenses	2,400
Fee and expenses for financial advisors	2,000
Process license fee	7,000
Miscellaneous expenses	2,600
Total	32,000

3) Interest during construction period

The interests on long-term debts during construction period are amortized equally during 15 years after start-up in the account of deferred assets.

4) Initial working capital fund

Fund requirements for raw materials and supplies at the start-up of operation is estimated as follows:

- Raw materials (pellets): inventory of 1.5 months' consumption of the first operation year
- Manufacturing supplies: inventory of 3 months' consumption of the first operation year

5) Total investment cost

As a result of estimation based on the mentioned assumptions, the total investment is as follows:.

Table 15-1-2 Total Investment Cost

(Unit: US$ 1,000)

Item	Total
Capital investment	665,000
Pre-production cost	32,000
IDC	61,151
Initial working capital	25,520
Total	783,671

(2) Fund raising

The total investment is assumed to be covered by equity capital and long-term loans with the terms and conditions shown in the following.

(a) Debt-equity ratio is assumed to be 70:30.

(b) Terms and Conditions of Long-term Loans

Interest rate	9.0 % p.a.
Loan period	10 years
Grace period	2 years
Repayment	8 years

Repayment methods: annual equal repayment

(3) Fund raising and fund demand schedule

The fund demand and raising schedule for the Steel Complex Project is planned as shown in the following table.

Table 15-1-3 Schedule of Fund Raising and Demand

(Unit: US$ 1,000)

Year	-3	-2	-1	Total
Fund Demand				
Capital investment	166,250	266,000	232,750	665,000
Pre-production cost	4,000	5,000	23,000	32,000
IDC	5,232	18,232	37,666	61,151
Initial working capital			25,520	25,520
Total	175,503	289,232	318,936	783,671
Fund Raising				
Long-term loans	116,734	171,539	260,167	548,594
Equity capital	58,769	117,539	58,769	235,078
Total	175,503	289,232	318,936	783,671

15.1.3 Sales schedule

(1) Sales plan

On the basis of the production plan, the sales plan is planned by country or area in the following table.

Table 15-1-4 Sales Plan (Country-wise Sales Quantity)

(unit: 1,000 tons/year)

Country/Area	Year 2005 Sales Tonnage	Year 2010 Sales Tonnage
Domestic (Oman)	400	570
UAE	470	395
Kuwait	34	40
Bahrain	10	5
Saudi Arabia	30	10
Yemen	130	105
Jordan	5	4
Syria	10	6
Kenya	1	1
Tanzania	1	1
Pakistan	3	2
Asia	70	25
Total	1,164	1,164

The sales plan by area in the domestic market is estimated as follows:

Table 15-1-5 Domestic Sales Plan (Area-wise Sales Quantity)

Area	Sales Tonnage ('000 tons/year)	(%)
Muscat	74	(18%)
Al Batinah (Sohar)	67	(17%)
Mustadam	10	(3%)
A'Dahirah	54	(13%)
Ad Dakhlyah (Nizwa)	85	(21%)
Ashharqiyah (Sur)	55	(14%)
Al-Wusta	16	(4%)
Dhofar (Salalah)	39	(10%)
Total	400	(100%)

(2) Sales price

In the Original Case and Recommended Case, the C&F price of imported steel bars is very conservatively assumed at US$ 300 per ton in consideration of the recently very depressed worldwide market situation.

Sales prices of steel bars are estimated on the basis of actual prices in the targeted market area and the trend of the international market.
The net FOB price of steel bars for the Steel Complex is calculated to be the sales price to the customers minus transportation costs and related charges from the Steel Complex.

Sales prices assumption

Domestic	(US$/ton)	
CIF price of imported steel bars	300	
Import duty (5%)	15	
Location advantage	10	
Transportation cost to Dhofar area	(-) 3	(US$ 30/ton x 10%)
Ex-factory domestic price	322	

The location advantage represents the costs that importers would have to cover for (1) opening a letter of credit, (2) maintaining large storage yards and inventories, (3) buying reasonably large quantities to minimize unit import-related costs, and (4) handling charges before deliveries.

Export	(US$/ton)	
CIF price of imported steel bars	300	
Import duty		
(4% is accounted for GCC countries)	14	
Location advantage	10	
(applied for only UAE)		
(-) Transportation cost	- (T)	
Ex-factory export prices		
for UAE	314	
for Saudi, Kuwait, Bahrain	292	
for Yemen, Jordan, Syria,		
Kenya, Tanzania, Pakistan	270	
for Asia	260	
Weighted average export price	298	301
	(in 2005)	(in 2010)

In the market in Oman and GCC countries, the preferential buying policy of domestic products and common tariff are taken into consideration. The present import duties in GCC countries are as follows:

Oman: 5% (general except special luxury items)
UAE: 4% (general except special luxury items)
Saudi Arabia : 12% (general except special luxury items),
20% for steel bars and wire rods
Qatar: 5% (general except special luxury items), 20% for steel bars
Bahrain: 4% (general except special luxury items)

The sales plan of the Steel Complex is summarized as follows:

Table 15-1-6 Sales Plan

Year	1st year			2nd year			3 - 7 year		
	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)
Domestic	400	322	128.8	400	322	128.8	400	322	128.8
Export	356.6	298	106.3	662.7	298	197.5	764	298	227.7
Total	756.6	310.7	235.1	1,062.7	307.0	326.3	1,164	306.2	356.5

Year	8th year and after		
	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)
Domestic	570	322	183.5
Export	594	301	178.8
Total	1,164	311.3	362.3

15.1.4 Corporate income tax

It is assumed that the Steel Complex is exempted from corporate income tax for 5 years after the start-up under the provision of Law. The tax exemption may be extended for another 5 years. In this study 10-year tax holiday is adopted.

After the completion of tax-exemption period, corporate income tax is estimated at 7.5 % of taxable income in compliance with the Corporate Income Tax Law.
(The above tax rate is applicable to companies : foreign capital is equal to or less than 90%, Omani capital is equal or more than 51%, public share holding company and public share is 40%.)

15.2 Analysis and Evaluation of Financial Statement

15.2.1 Assumption of analysis and evaluation of financial statement

The financial analysis is made on the basis of the following assumptions:

(1) Minimum cash requirement

Minimum cash requirement is retained in the account. The said amount is assumed to be 3 % of the annual sales amount during a period of the financial projection years.

(2) Accounts receivable

The amount of the accounts receivable is assumed to be 4 % of the annual sales amount (0.5 month of sales amount) during a period of the financial projection years.

(3) Inventories

1) Raw materials and manufacturing supplies
12.5 % of the amount of raw materials to be consumed in next year (1.5 months' consumption) is assumed as the year end inventories of raw materials.

25 % of the amount of manufacturing supplies to be consumed in next year (3 months' consumption) is assumed as the year end inventories of raw materials.

2) Finished products and semi-finished products
4 % of the annual sales amount (0.5 month of sales amount) during a period of financial projection is assumed as the year end inventories of finished products and semi-finished products.

(4) Account Payable

Account payable is taken into consideration in the account payable which is indicated as the net amount where the account payable is offset.

(5) Corporate income tax payable

Corporate income tax incurred in a year is assumed to be paid in the following year.

15.2.2 Financial analysis of Original Case

The results of the financial analysis for the Original Case are summarized as follows:

(1) Profit and loss

As shown in the following table, the Steel Complex will suffer from cumulative loss until the 4th operational year.

Table 15-2-1 Profit and Loss (Original Case)

(Unit: US$ million)

Year	1	2	3	4	5	10
Sales Amount	253	326	356	356	356	362
Net Profit	(-) 32	(-) 7	8	14	20	62
Profit/sales (%)			(2%)	(4%)	(6%)	(17%)
Cumulative profit	(-) 32	(-) 39	(-) 31	(-) 17	3	232

(2) Internal rate of return (IRR)

IRR of the Original Case is as follows:

	(after tax base)	(before tax base)
IRR (on Investment):	11.0%	11.2%
IRR (on Equity):	11.3%	11.6%

In comparison with the assumed interest of 9% p.a. for finance and also projected profit & loss as well as projected cash flow it is difficult to judge that this Steel Complex Project in the Original Case is feasible commercially.

Especially, the debt service coverage ratio is less than 1.0 until the 7th operational year. Judging from the above profit and loss projection and IRR, it will be very difficult to invite and organize financing as a commercial project.

15.2.3 Financial analysis for the Recommended Case

The results of the financial analysis for the Recommended Case are summarized as follows:

(1) Cost of products

The cost per ton of products is as follows:

Table 15-2-2 Cost of Products per Ton

(Unit: US$ per ton of steel bars)

	5th year	10th year
Iron oxide	74.7	74.7
Energy (gas & electricity)	33.7	33.7
Other materials	50.5	50.5
Variable cost	158.9	158.9
Fixed cost	79.8	76.5
Total production cost	238.7	235.4
NOE	29.2	2.7
Total cost	267.9	238.1

(2) Profit and loss

As shown in the following table, the Steel Complex will enjoy a substantial net profit from the second operational year, while suffering from deficit in the first year due to lower operation rate on the way of the learning curve.

Table 15-2-3 Profit & Loss Projection (Recommended Case)

(Unit: US$ million)

Year	1	2	3	4	5	10
Sales Amount	253	326	356	356	356	362
Net Profit	(-) 14	15	30	38	44	85
Profit/Sales (%)		(5%)	(8%)	(10%)	(12%)	(23%)
Cumulative Profit	(-) 14	1	31	69	113	460

(3) Key financial ratios

The key financial ratios in balance sheet such as debt equity ratio and current ratio are as follows:

Year	1	2	3	4	5	10
debt-equity	71:29	70:30	64:36	57:43	49:51	0:100
debt service coverage ratio	1.62	2.23	1.07	1.14	1.21	1.30

(4) Internal rate of return (IRR)

IRR of the Recommended Case is as follows:

	(after tax base)	(before tax base)
IRR (on Investment):	13.7%	13.9%
IRR (on Equity):	16.1%	16.4%

In comparison with the assumed interest of 9% p.a. for finance and also projected profit & loss as well as projected cash flow, it is judged that this Steel Complex Project is feasible and deserve to take further steps for its materialization.

The debt service coverage ratio is kept always at more than 1.0.

(5) Sensitivity analysis

Sensitivity analysis is made against the Recommended Case in the following conditions:

Capital Investment	IRR (on Investment)
Base	13.7%
10% up	12.5%
10% down	15.1%
Pellet Price	
Base	13.7%
10% up	12.7%
10% down	14.7%
Sales Price of Bar	
Base	13.7%
5% up	15.6%
5% down	11.7%
Natural Gas	
Base (US$ 0.6/MMBTU)	13.7%
US$ 0.65	13.6%
US$ 0.70	13.5%
US$ 0.75	13.3%
US$ 0.80	13.2%

Electricity

Base (US$ 0.025/kWh)	13.7%
US$ 0.02	14.3%
US$ 0.03	13.0%
US$ 0.03	12.7%

Interest rate of long-term loans

	IRR (on investment)	IRR (on equity)
Base (9% p.a.)	13.7%	16.1%
8.0 % p.a.	13.7%	17.0%
8.5 % p.a.	13.7%	16.6%

15.3 Supplement Studies

The financial analyses for the following three cases are presented.

1) Alternative Case with own power plant

2) Optimum scenario of Original Case

Sales price of steel bars	:	provable market price under the recovered and improved steel market
Other assumptions and conditions	:	same as of the Original Case

3) Optimum scenario of Recommended Case

Sales price of steel bars	:	provable market price under the recovered and improved steel market
Other assumptions and conditions	:	same as of the Recommended Case

15.3.1 Alternative case with own power plant

In this case, it is assumed that the Steel Complex have its own power plant and generate electricity as per the following assumption.

The other conditions and assumptions are same as of the Recommended Case.

(1) Assumption of own power plant

1) Plant construction cost

In consideration of actual construction cost of US$ 600/kW capacity in the past, projected cost of gas-fired CCGT (combined-cycle gas turbine) by OECD/IEA, and small scale of this power plant, the construction cost of the power plant (200 MW CCGT) is at US$ 140 million. (US$ 700/kW capacity)

2) Cost of natural gas

The unit consumption of natural gas is assumed 10,100 BTU/kWh. (heat efficiency: approx. 34%)

3) Operating and maintenance cost

It is assumed that the annual operating and maintenance cost is 5% of the plant construction cost.

(2) Results of financial analysis

The results of the financial analysis are as follows:

1) Total investment cost and fund requirement

The estimated total investment cost and fund raising is as follows:

Table 15-3-1 Total investment cost & finance plan (Alternative Case)

(Unit: US$ million)

Fund Demand	
Capital Investment	805
Pre-production cost	32
IDC	74
Initial working capital	25
Total	936
Fund raising	
Long-term loans	655
Equity capital	281
Total	936

2) Profit and loss projection

The projected profit and loss for this case is as shown hereunder.

Table 15-3-2 Profit and loss (Alternative Case)

(Unit: US$ million)

Year	1	2	3	4	5	10
Sales Amount	253	326	356	356	356	362
Net Profit	(-) 23	11	29	38	45	91
(%)		(3%)	(8%)	(11%)	(13%)	(25%)

3) IRR

IRR of this case is as follows:

	(after tax base)	(before tax base)
IRR (on Investment):	12.8%	13.0%
IRR (on Equity):	14.7%	15.0%

In this case, the Steel Complex may attain a certain level of profit and IRR.
However, the total investment cost is US$ 936 million, much larger than US$ 783 million of the Recommended Case.

15.3.2 Optimum scenario of Original Case

The Optimum scenario of the Original Case adopts a provable market price under the recovered and improved steel market, while a rather conservative market price is applied for the Original Case in Chapter 15.3.3 " Financial Analysis for the Original Case" .
The other assumptions and conditions except sales price of steel bars are same as of the Original Case.

(1) Sales price and sales plan

In this scenario, C&F price of imported steel bars is assumed at US$ 305 per ton against US$ 300 per ton for the Original Case.

In addition, location advantage is assumed at US$ 15 per ton against US$ 10 for the Original Case.

The sales plan of the Steel Complex is summarized as follows:

Table 15-3-3 Sales Plan (Optimum Scenario)

Year	1st year			2nd year			3 - 7 year		
	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)
Domestic	400	332	132.8	400	332	132.8	400	332	132.8
Export	356.6	306	109.1	662.7	306	202.8	764	306	233.8
Total	756.6	319.7	241.9	1,062.7	315.8	335.6	1,164	314.9	366.6

Year	8th year and after		
	Tonnage ('000 tons)	@ (US$/T)	Amount (mill. US$)
Domestic	570	332	189.3
Export	594	309.5	183.8
Total	1,164	321	373.1

(2) Financial analysis

The results of the financial analysis are as follows:

1) Profit and loss projection

The projected profit and loss for this case is as shown hereunder.

Table 15-3-4 Profit and loss (Optimum Scenario of Original Case)

(Unit: US$ million)

Year	1	2	3	4	5	10
Sales Amount	260	336	367	367	367	373
Net Profit	(-) 24	3	18	25	31	73
Profit/sales (%)		(1%)	(5%)	(7%)	(8%)	(20%)
Cumulative profit	(-) 24	(-) 21	(-)4	21	52	335

2) IRR

IRR of this case is as follows:

(after tax base)

IRR (on Investment) : 12.2%

IRR (on Equity) : 13.4%

In this case, the Steel Complex may enjoy higher profitability and IRR comparing with the Original Case. However, it might be difficult to rely on this Optimum scenario, which is not expected to realize at an earlier time, for the purpose to invite and convince possible investors and financiers.

Therefore, this case is presented for reference in this Study Report.

15.3.3 Optimum Scenario of Recommended Case

The Optimum scenario of the Recommended Case adopts a provable market price under the recovered and improved steel market, while is the same as of the Optimum Scenario of Original Case.

The other assumptions and conditions except sales price of steel bars are same as of the Recommended Case

(1) Sales price and sales plan

The sales plan of the Steel Complex is the same as of the Optimum scenario of Original Case.

(2) Financial analysis

The results of the financial analysis are as follows:

1) Profit and loss projection

The projected profit and loss for this case is as shown hereunder.

Table 15-3-5 Profit and loss (Optimum Scenario of Recommended Case)

(Unit: US$ million)

Year	1	2	3	4	5	10
Sales Amount	260	336	367	367	367	373
Net Profit	(-) 7	24	41	48	54	96
(%)		(7%)	(11%)	(13%)	(15%)	(26%)
Cumulative profit	(-) 7	17	58	106	160	558

(2) IRR

IRR of this case is as follows:

		(after tax base)
IRR (on Investment)	:	14.8%
IRR (on Equity)	:	18.2%

In this case, the Steel Complex may enjoy higher profitability and IRR comparing with the Recommended Case. However, it might be difficult to rely on this Optimum scenario, which is not expected to realize at an earlier time, for the purpose to invite and convince possible investors and financiers.
Therefore, this case is presented for reference in this Study Report.

Chapter 16. NATIONAL ECONOMIC ANALYSIS

The expected effects of the Steel Complex are as follows:

(1) Development of the related and supporting industries

By constructing the Steel Complex and operating the Steel Complex, various business activities, related & supporting industries will be encouraged and developed.

These industries includes transportation industry, stores and warehouse, port relate services, maintenance and repair, and energy industries including IPP.

In future, this Steel Complex Project leads to more development of other steel industries like wire rods, higher grade of steel bars and flat steel products, which can be one of the basis of industrialization and economic development of Oman.

(2) Creation of employment opportunities

This Project will create 1,239 jobs only for the operation of the Steel Complex.
During construction of the Steel Complex, a large number of jobs will be created.
For the indirect benefits, the number of employment opportunities could be several times of the said direct employment, when the effects on related industries are taken into account.

(3) Acceleration of human resource development

The Steel Complex requires various kind of technologies, skills and abilities for operation and management, which will be developed through the actual operation and transferred from the technical and managerial cooperation of experienced steel companies in the initial operational years.
For the smooth and successful technology transfer, it is considered to be essential to arrange and develop the education and basic training systems in Oman.

(4) Increase of the GNP

Through the operation of the Steel Complex, the GNP of Oman will be increased.

The expected added value of the Steel Complex is US$ 2,592 million for 20 years (average: US$ 130 million per year).

In addition, the added value to Oman will be further increased by the effects on related industries.

For reference, in Japan the metal industries creates 1.4 - 1.5 times of its GNP additionally.

(5) Foreign currency earning and saving

The Project will earn foreign currencies directly and also save foreign currencies by substituting import of steel bars.

On the other hand, foreign currencies will be paid for the purchase of plant equipment and raw materials and supplies for the operation of the Steel Complex.

The estimated foreign currency earning and saving is US$ 3,259 million for 20 years (average US$ 163 million per year).

Table 16-1-1 Foreign Currency Saving and Earning

(Original Case)

(Unit: US$ million)

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Foreign currency earning																				
Export of bars	106.3	197.5	227.7	227.7	227.7	227.7	227.7	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8	178.8
Foreign currency payment																				
Raw materials & supplies	82.2	115.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5
Maintenance	7.3	9.5	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Other fixed cost	14.3	15.4	15.9	14.6	14.6	13.2	13.2	12.0	10.7	10.7	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Repayment of loan			68.6	68.6	68.6	68.6	68.6	68.6	68.6	68.6										
Repayment of interest	49.4	49.4	46.3	40.1	33.9	27.8	21.6	15.4	9.3	3.1										
Total of FC payment	153.2	189.9	267.8	260.3	254.1	246.6	240.4	233.0	225.6	219.4	145.0	145.0	145.0	145.0	145.0	145.0	145.0	145.0	145.0	145.0
Net foreign currency earning	-46.9	7.6	-40.1	-32.6	-26.4	-18.9	-12.7	-54.2	-46.8	-40.6	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8
Foreign currency saving																				
Domestic sale of bars	128.8	128.8	128.8	128.8	128.8	128.8	128.8	128.8	183.5	183.5	183.5	183.5	183.5	183.5	183.5	183.5	83.5	183.5	183.5	183.5
Total FC earning & saving	81.9	136.4	88.7	96.2	102.4	109.9	116.1	74.6	136.7	142.9	217.3	217.3	217.3	217.3	217.3	217.3	217.3	217.3	217.3	217.3

20 years total: 3,259.4

Chapter 17. CONCLUSION AND RECOMMENDATION

The conclusion and recommendation of the feasibility study on Direct Reduction Plant Based Steel Complex Project in the Sultanate of Oman are as follows.

Total investment cost for the Steel Complex (without power generation plant) will reach US$ 783 million as estimated including construction cost, pre-operation cost, initial working capital and interest during construction.
The ROI of 13.7 % at the Recommended Case will be acceptable for investors and financiers . As a result, it can be said that the Steel Complex Project at the Recommended Case is feasible and effective in terms of capital investment.

However, financial conditions for the Steel Complex are easily influenced by its surroundings such as change of interest and foreign currency exchange rate, especially in a case where the plant is constructed in a developing country. Therefore, in order to ensure stable management, to expedite the establishment of the private entity to promote and implement this Steel Complex Project and to expedite required equity participation by local and foreign companies, it is recommended that the Government assists the Project by exempting import duties and sales tax on the plant equipment. The Government is also required to waive such taxes as income tax and sales tax during a certain period after start-up of the plant. In addition to the above, the government is requested to assist to organize a private sector by whom power generation plant will be constructed to supply electricity to aluminum smelter project, petrochemical project and the Steel Complex Project at Sohar area.

Considering the effects on the national economy of Oman, construction and operation of the Steel Complex requires considerable amounts of construction materials, raw materials such as limestone and scrap, utilities and also generates employment opportunities not only at the Steel Complex itself but also among supporting industries.

The Steel Complex Project is planned to export more than 65% of its production and to deliver to the domestic market in Oman approximately 34% of products which are import substitutes. The Steel Complex will contribute foreign currency earning & saving of US$ 3,259 million over twenty years.

Therefore, materialization of the Steel Complex Project will have beneficial effects on promoting expanded employment opportunities and development of supporting industries in Oman as well as improvement of international balance of foreign currency with utilization of national resources such as natural gas and limestone.

Consequently, it can be concluded that construction of the Steel Complex in Oman is recommended, and it will contribute to the development of the Omani economy as a whole.

APPENDIXES

Appendix A4-1-1 Ranges and limits of Steel Products and Regions

1. Steel Products

Semi-finished			Billet. Bloom. Slab
Finished	Long products	Bar & wire rod	Bar. Wire rod. Wire
		Section	Wide-flange beam. Angle. Channel. Steel sheet pile
		Other	Rail. Rail accessories
	Flat products	Sheet	Hot rolled. Cold rolled. Coated
		Plate	
	Pipes	Seamless	
		Welded	ERW. Forge welding. Electric arc

2. Regions

Region		Country
Middle East	GCC5 or 6	Saudi Arabia, UAE, Kuwait, Qatar, Bahrain, (Oman)
	Other Middle East	Except for Egypt, Turkey
Asia	South Asia	Pakistan, India, Sri Lanka, Bangladesh
	ASEAN5	Thailand, Malaysia, Indonesia, Singapore, Philippines
	Other Asia	China, Japan, R. Korea, Taiwan, Viet Nam
Africa	East Africa	Kenya, Tanzania, South Africa
	Other Africa	Except for East Africa. Egypt, included
Western Europe	EU(15)	EU10, Austria, Finland, Greece, Portugal, Sweden
	Other Western Europe	Except for EU(15). Turkey, Slovenia, Yugoslavia, included
Eastern Europe	The Former USSR	
	Other Eastern Europe	Except for Slovenia, Yugoslavia
North America	Central America, included	USA, Mexico, etc.
South America	Central America, excepted	Except for Mexico
Oceania		Australia, New Zealand

Source : IISI