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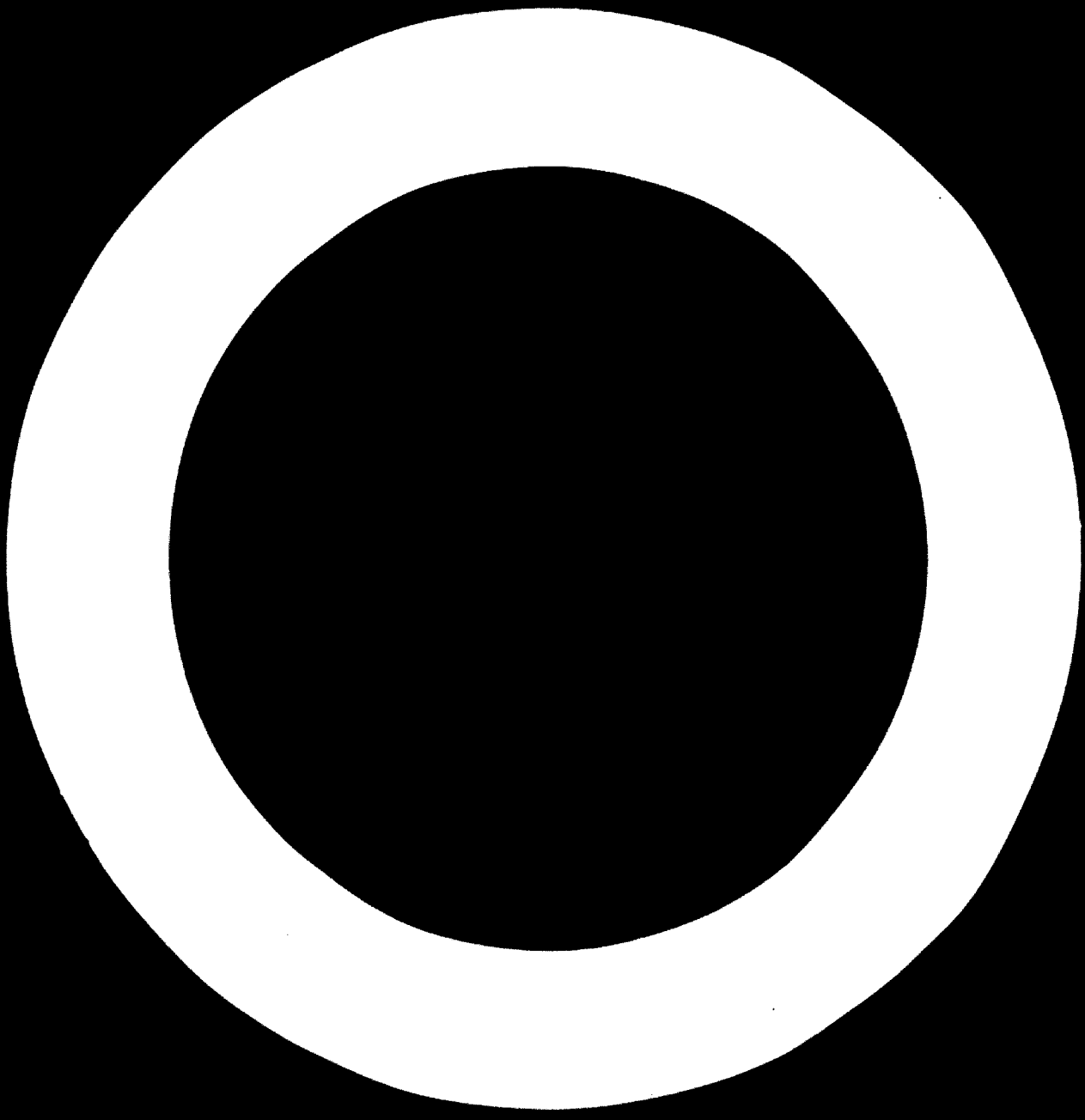

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

S.F. PROJECT - IRA-16

COUNTRY: IRAN

FS 389

C/F

S/F IRON + STEEL; COPPER; NON-FERROUS

MASTER DEMAND STUDY FOR

MECHANICAL AND CAPITAL GOODS PRODUCTS

1972 - 1987

pp. 142

PART I

10. BASIC METAL INDUSTRIES

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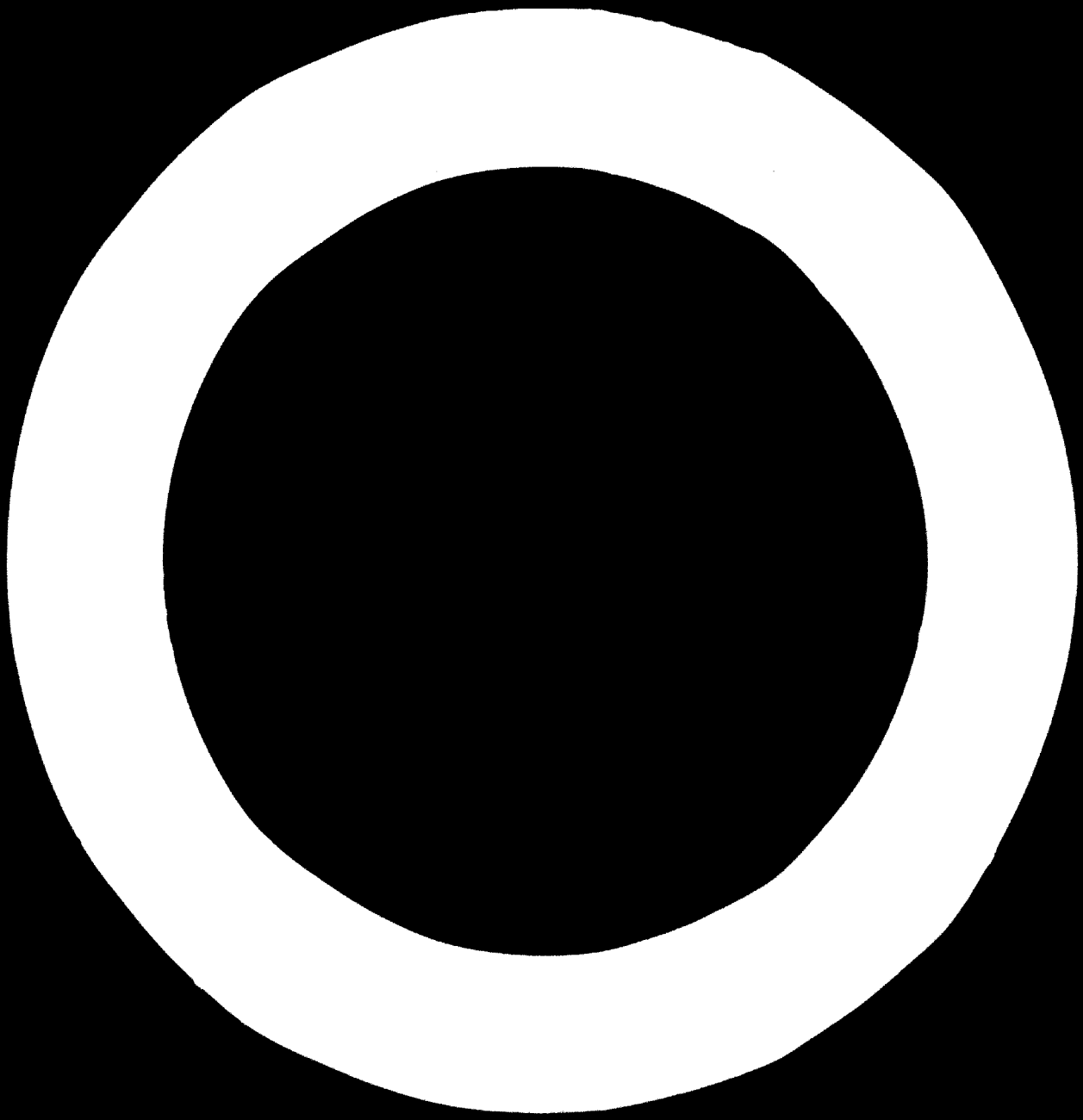
Date: October, 1973



Group No. 34 - Basic metal industries

Code No. 341 Iron and steel basic metal industries

Code No. 342 Copper basic metal industry

Code No. 343 Non-ferrous basic metal industry

Code No. 344 Precious metals basic industry

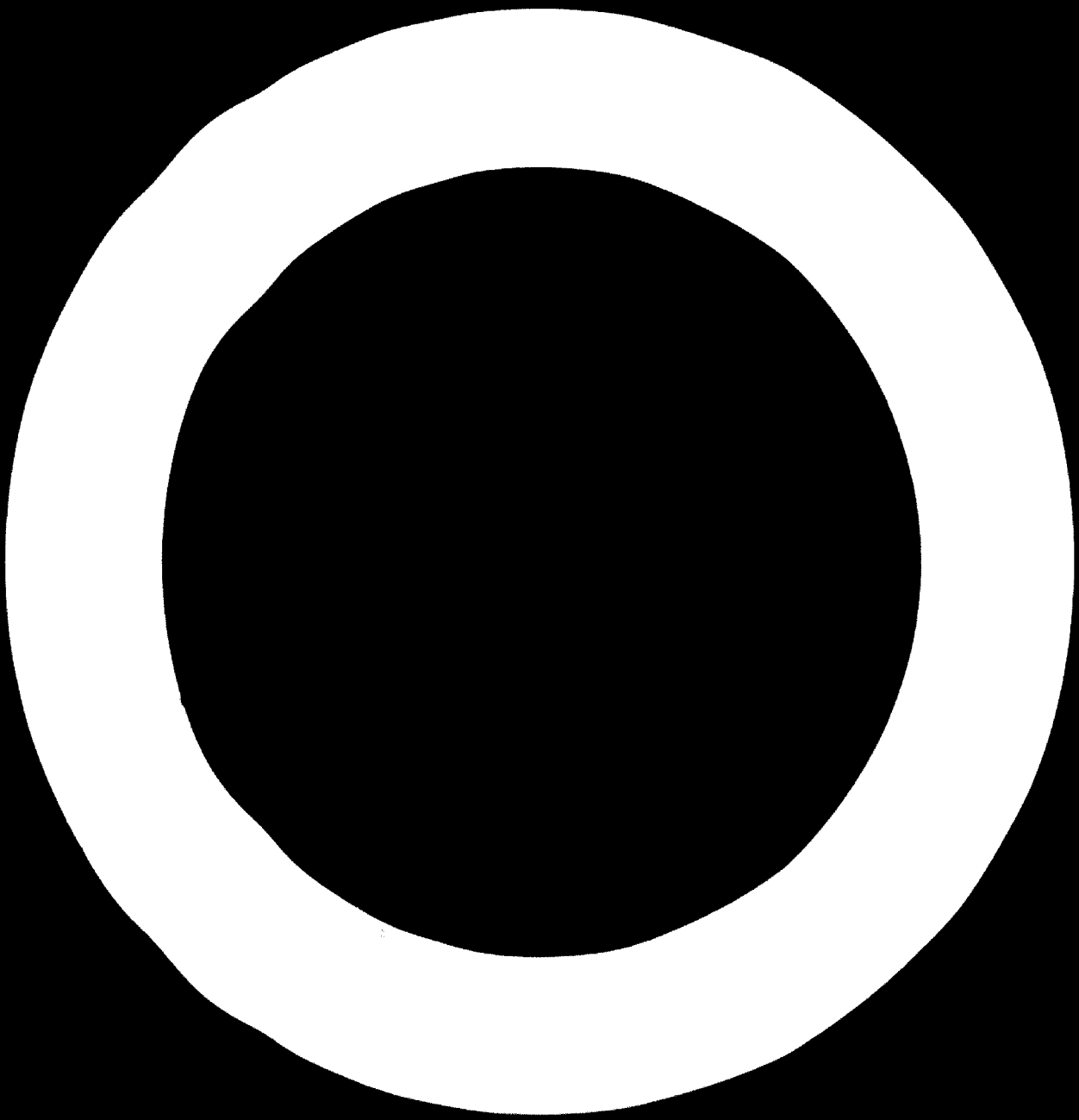


Table 1

According to the Iranian Industrial statistics 1968 published by the Bureau of statistics of the Ministry of Economy, the sumary statistics on Industrial establishments of Basic Metal Industries in Iran in 1347 (1968/9) were as follow :

	Central Province	Fars, Esfahan and Yazd Province	Iran
number of establishment	328	141	[illegible]
total persons engaged	1360	[illegible]	[illegible]
- from theme: owners, employers, and family members	589	191	[illegible]
salary and wage earners			
operatives	3350	[illegible]	[illegible]
- others	421	-	[illegible]
New investment (before depreciation)			
1000 $.	169826	-	1822118
Value of gross output 1000 $.	4090148	23188	5649320
Gross value added 1000 $.	592323	7415	1523001

Table 2

Time series of the Value of Output, Value Added, Total Employees, Wages and Salaries by Basic Metal Industries

	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 [illegible]	[illegible]
Total employees	1128	3154	2721	2996	2955	4811	1918
Total wages and salaries 1000 $.	32933	66633	94519	69692	102485	214538	[illegible]
Value of output 10^6 $.	369	1098	1032	890	995	1865	[illegible]
Value added 10^6 $.	108	282	328	240	350	[illegible]	[illegible]

source: the Iranian Industrial Statistics 1968 published by the Bureau of Statistics of the Ministry of Economy

Table 3

Production and value of Basic Metal Products According to the Iranian Industrial Statistics published by the Bureau of Statistics of the Ministry of Economy

		1331 (1952/3)	1332 (1953/4)	1333 (1954/5)	1334 (1955/6)	1335 (1956/7)	1336 (1957/8)	1337 (1958/9)
Cast-iron articles	tons	550	645	741	3210	1564	2219	2421
Aluminium steels	tons	1100	1364	1450	908	3212	2871	2521
Cast-iron articles	tons	3756	3683	3916	2206	12623	13000	14337
Copper rolled and in steels	tons	2066	1895	1336	1499	1273	1921	2078
Others	1000 R.	25689	750319	704929	368163	364669	1079016	2319968
T O T A L	1000 R.	369187	1098287	1031847	890404	995109	1865369	3112398

Table 4

Basic Metal Industries and Metal Products Industries Comparison of the Fourth and Fifth Five Year Plan

	The Fourth Five-year Plan	The Fifth Five-year Plan
Total new employment	64700	101300
Total new investment - Million Rials	75800	169500
Value added - Million Rials	11800	11300
Annual growth rate of employment - %	13.4%	11.5%
Annual growth rate of investment - %	89.0	17.8
Annual growth rate of production - %	25.1	35.0
Annual growth rate of value added - %	25.0	35.0
Capital-labour ratio 1000 R/person	1171.5	1673.1
Value added-labour ratio-1000R/person	183.4	606.1
Capital to value added ratio	6.42	6.36

Source: the Fifth Five-year Plan

[illegible]

Tariff No.		1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	[illegible]	1347 (1968/9)	1348 (1969/70)	1349	[illegible]	[illegible]
	Structurals											
701-2	**Beams**	[illegible]	105891	162940	179876	[illegible]	[illegible]	250236	191497	[illegible]	[illegible]	[illegible]
701-8	**Channels**	[illegible]	[illegible]	8629	12246	[illegible]	19057	[illegible]	26467	21738	[illegible]	[illegible]
701-3	**Angles**	[illegible]	[illegible]	23573	30829	[illegible]	[illegible]	12990	[illegible]	[illegible]	[illegible]	[illegible]
701-6	**Tees**	1113	3624	3441	8979	4329	[illegible]	4809	10420	[illegible]	[illegible]	[illegible]
701-7	**Sections**	451	550	1170	2659	[illegible]	[illegible]	1737	[illegible]	[illegible]	[illegible]	[illegible]
	Sub-Total	139715	153618	199753	254659	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bars and Rods											
701-1	**Rods**	19175	30599	33669	37917	[illegible]	[illegible]	[illegible]	20208	[illegible]	17667	[illegible]
701-4	**Rounds**	5875	10524	10767	24005	[illegible]	[illegible]	7947	[illegible]	[illegible]	6820	[illegible]
701-5	Other shapes	1190	[illegible]	2239	5980	[illegible]	[illegible]	6780	[illegible]	[illegible]	[illegible]	[illegible]
	Sub-Total	27240	46333	46675	67902	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27048	[illegible]
	Wires											
702A	**Below 0.5 mm dia.**	243	404	252	183	274	480	1072	[illegible]	166	581	708
702B	**Above 0.5 mm dia.**	16826	15462	18225	27478	[illegible]	[illegible]	51260	[illegible]	[illegible]	[illegible]	[illegible]
	Sub-Total	17069	15866	18477	27661	[illegible]	48484	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Rails and railway materials											
713	**Rails**	527	396	578	314	1074	8671	61847	61675	81459	1660	2676
714 to 717	**Sleepers and other railway materials**	2046	4159	260	1538	6187	9241	7261	20834	16737	3937	6966
	Sub-Total	2573	4573	838	1852	7261	17912	69098	82509	98196	5593	9642
709 to 712	**Steel pipes, tubes and pipe fillings**	72677	60217	125983	174172	[illegible]	283155	116064	225107	61298	121632	[illegible]
703, 704A	**Steels and plates uncoated**	50481	44360	66912	111135	[illegible]	304707	520680	339923	383619	[illegible]	[illegible]
704B1	**Galvanised sheets**	17512	16799	25634	23556	27234	33532	38465	46045	25857	29311	51719
704B2	**Sheets Tin plates**	10339	9996	14670	21449	27401	22730	31392	36130	14296	37708	43075
704C	**Sheets** Ni and Cr plated	5683	100	32	49	148	100	105	157	164	205	401
704D, 705	**Other sheets**	3503	1256	1745	1839	2274	2818	1672	1922	1769	3215	6371
706	**Hoops**	1778	2207	2770	6707	6761	[illegible]	5586	[illegible]	[illegible]	7252	17429
	Sub-Total	87296	74118	111763	154825	[illegible]	[illegible]	397860	432315	[illegible]	590236	598482
707	**Alloy sheet**	295	625	1277	3514	3972	35249	38491	21919	6072	19434	18062
	Semi Products											
699	**Ingots**	385	63	170	136	[illegible]	[illegible]	4662	7705	11573	83	5322
700	Blooms and billets	90	90	133	139	316	1966	3971	35542	203806	305827	565
	Total semi products	477	153	303	275	[illegible]	[illegible]	8633	43247	218179	305410	5887
	Total Steel Products (with semis)	347338	355485	505069	384840	719742	[illegible]	[illegible]	1169690	1250206	1504599	1144403

Table 3

Imports of Copper and Copper Base Alloys

Tariff No.		1964(1343)		1965(1344)		1966(1345)		1967(1346)		1968(1347)		1969(1348)		1970(1349)		1971(1350)		1972(1351)	
		Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)	Qty Ton	Value (mil.Rl)
[illegible]	Ingots, Blocks, Copper	307	24	[illegible]	[illegible]	427	13	[illegible]	[illegible]	3190	[illegible]	[illegible]	7	[illegible]	[illegible]				
[illegible]	Shavings, Copper, Fillings Copper, Scrap, Copper	[illegible]	27	[illegible]	4	[illegible]	2	[illegible]	2	[illegible]	1	[illegible]	2	101	7				
[illegible]	Wire, Copper, of not more than 0.5 mm diameter	[illegible]	2	[illegible]	1.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	95	15	[illegible]	14				
[illegible]	Rods, Wire, Copper of more than 0.5 mm diameter	365	43	[illegible]	53	1334	134	3119	[illegible]	3165	304	4401	301	[illegible]	341				
[illegible]	Plates, Sheets, Sheets, Copper Excluding Foil	2025	124	[illegible]	115	[illegible]	130	[illegible]	430	[illegible]	415	3251	[illegible]	[illegible]	410				
[illegible]	Foil, Copper of a Thickness not Exceeding [illegible] mm	114	10	41	5	137	20	229	[illegible]	[illegible]	[illegible]	275	[illegible]	[illegible]	72				
[illegible]	Tubing, Piping Copper	331	43	[illegible]	[illegible]	[illegible]	39	334	76	[illegible]	[illegible]	610	[illegible]	630	116				
761	Solder, Copper, Alloyed with any base metals in sticks, rods, Pellets, Powder,	3	0.8	[illegible]	2	4	1.3	3	1	3	4	[illegible]	6	[illegible]	3				
762	Casting, Stamping, Forging Copper Shapes, Copper, Cut other than at right angle	107	[illegible]	173	[illegible]	90	3	79	7	[illegible]	16	[illegible]	21	[illegible]	30				
[illegible]	Tanks, Vats, Vessels, Large, other of Copper without Fittings Mechanical	[illegible]	[illegible]	[illegible]	[illegible]	0.1	[illegible]	0.2	[illegible]	0.1	[illegible]	-	-	-	-				
764	Wire Cable, Copper Plated wire melting Copper	[illegible]	[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3307	[illegible]	[illegible]	[illegible]				
[illegible]	Lattice - work, Netting of Copper Wire, Sheeting Punched Copper	7	2	7	[illegible]	[illegible]	2	5	2	[illegible]	3	[illegible]	5	[illegible]	[illegible]				
[illegible]	Pins, [illegible] Copper, Nails, [illegible]																		
[illegible]	With or without Plating, Base Metal, Staples Copper.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	1	1	[illegible]				
[illegible]	[illegible]	[illegible]	3	[illegible]	3	[illegible]	1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	3	[illegible]	2	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	7	[illegible]	[illegible]				
[illegible]	[illegible], Copper	[illegible]	[illegible]	[illegible]	1.5	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible], Copper	[illegible]	[illegible]	[illegible]	7	[illegible]	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible], Copper [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	-	-	-	-	-	-				
[illegible]	[illegible], Keys, [illegible], Padlock, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	3	[illegible]	2	[illegible]	[illegible]	1	[illegible]	[illegible]				
[illegible]	[illegible], Copper, Furniture, door, window and etc.	[illegible]	4	[illegible]	3	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible], Stove Heater, [illegible] and etc.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	2	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible], Copper	37	[illegible]	[illegible]	[illegible]	2	1.1	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible] - [illegible], Copper [illegible] without Finish or Polished and etc.	79	[illegible]	[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]					

Source: Foreign Trade Statistics of Iran

CODE NO. 341 IRON AND STEEL BASIC METAL INDUSTRIES

Manufacture of iron and steel including all processes from smelting in blast furnaces to the semi-finished stage, that is, the production of billets, blooms, slabs or bars, re-rolling into basic forms such as sheets, plates, strips, tubes, rails, rods, tinplate, rough castings, forgings.

Code No. 3411 Making pig iron
Code No. 3412 Production of rough castings of grey cast iron
Code No. 3413 Production of castings made of cast steel
Code No. 3414 Production of pig iron and all kinds of steel
Code No. 3415 Production of forgings
Code No. 3419 Miscellaneous ferrous metal basic industry

CODE NO. 3411, 3414 PRODUCTION OF PIG IRON AND ALL KINDS OF STEEL

There is no complex metallurgical plant in Iran producing pig iron and steel from iron ore. The first plant of this kind , Ariamehr Iron and Steel Plant in Esfahan is under construction and the first stage was in operation in year 1351(1972). All data given here are according to "Project Report Iron and Steel Plant at Esfahan".

IRON AND STEEL PLANT AT ESFAHAN

The capacity of the first stage of construction is 500,000 to 550,000 tons/year of finished rolled steel products but it is presupposed that this plant will be extended to 1,745,000 tons/year in the 5th Five Year Plan and to 3,670,000 tons.year in the sixth

five Year Plan.

The iron ore base of the Plant is the Chogart deposit and Bafq Sakang iron ore region located 340 km from the Plant site (see code No. 121), the fuel base is the Kerman coal deposit located 700 km from the Plant site, the Elburz region and Northern Khorasan. Question of coking coal is till now studied by specialists from the USSR. Explored reserves of coking coal of the Kerman deposit make up about 115 millions tons. In the above given report one alternative is dealing with possibility of import of coke from USSR. The economical results are the same (the expensive best quality coke will reduce the consumption of other raw materials, the investment will be lower etc.) In this study alternative with local coke was taken into consideration. Limestone is supplied to the Steel Plant from the Pirbakran deposit located 30 km off the Steel Plant, dolomite is supplied from the Lachuleh deposit, located at a distance of 75 km from the Plant. Quarzite is delivered to the Steel Plant from the Natkestaneh or Lavalum deposits. Refractory clay will be delivered to the Steel Plant from the Semiron or Jepolan deposits located at a distance of 240 km and 195 from the Plant respectively.

Main raw materials needed for the full production in the first, second and third stage of construction from the outside resources:

		1st Stage	2nd Stage	3rd Stage
Full Capacity	Tons	500,000	1,745,000	3,670,000
Iron ore	tons	850,000	2,800,000	6,650 ,000
Steel scrap from outside resources	tons	5,900	189,000	48,000
Coal	tons	640,000*	1,430,000*	3,250,000*
Limestone	tons	250,000	437,000	778,000
Dolomite	tons	21,000	49,000	97,000
Quarzite	tons	26,000	110,000	138,000
Refractory clay	tons	32,000	62,000	76,000
Refractories	tons	3,600	19,600	87,100
Manganese ore	tons	27,000	92,000	200,000
Natural gas	10^9 kcal/year	1,620	4,622	8,830

* Including production of coke for outside customers-125000 t/y in the first stage, 78,000 t/y in the second stage and 155,000 t/y in the third stage.

Description of Machinery - Equipment and Process

Iron and steel plant in Ajaccio has the following plants and departments:

Coking Department and By-products Plant having capacity of 444,000 tons/year in the first stage of construction of which 346,000 tons/year of metallurgical coke, 49,000 tons/year of foundry coke and 19,000 tons/year of coke fines. One coke oven battery is provided, consisting of 2 blocks of 39 coke ovens having 27.3 cu.m. each. The project provides for recovery of the coke oven by-products: ammonia, benzene and phenol processed into various chemical products in a total amount of about 37,000 tons/year (see code No. 3212).

The second stage of construction envisages erection of coke oven battery No. 2 similar to the battery No. 1 which is under construction now. By-product plants, plants for gas cleaning from hydrogen sulfide and for crude benzole rectification will be expanded insignificantly.

In the third stage of construction coke oven batteries No. 3 and 4, the coal handling plant No. 2, by-product plant No. 2, plant No. 2 for coke oven gas cleaning from hydrogen sulfide will be erected. Each battery will consist of 65 ovens each with a volume of 32.5 m^3. By-product plant will consist of recovery of benzol of coke oven batteries No. 3 and 4 and construction of the tar distillation plant of the batteries No. 1-4. To reduce the content of naphtalene in coke oven gas provision is made for the naphtalene cleaning plant.

Sintering Department- Agglomeration of iron ore fines as well as iron containing wastes (flue dust, rolling mill scale) together with the limestone, manganese ore and quartzite is to be carried out at

the sintering plant. The sintering plant in the first stage of construction is furnished with one sintering machine with sintering area of 75 sq.m., the possible annual capacity of the sintering plant is 700,000 tons of sinter.

In the second stage of construction the sintering machine No. 2 will be constructed, and in the third stage of construction the sintering machines No. 3 and 4 will be constructed, each having sintering area of 75 sq.m.

Blast Furnace Plant - In the first stage of construction one blast furnace with useful volume of 1033 cu.m. was built, having output of 500,000 tons/year. The charge is delivered to the blast furnace plant by a conveyor system and from the bins to the skips by means of a scale car. One pig casting machine is provided to cast pig iron.

The second stage of construction envisages additional erection of one blast furnace with a useful volume of 3000 cu.m. and at the third stage of two more similar furnaces.

All the pig iron is planned to be utilized in convertor shops.

Convertor Shops - In the first stage of construction convertor shop is furnished with 2 convertors each of 80 tons capacity and a mixer of 1300 tons capacity. The annual capacity of the convertor shop in the first stage is 550,000 tons in cast billets. Three continuous steel casting plants are provided in the convertor shop.

In the second stage of construction one convertor of 100 tons capacity and three continuous casting plants for merchant sections will be erected.

In the third stage of construction provision is made for construction of the new converter shop No. 2 comprising three converters of 130 - 150 tons capacity each and four continuous casting plants.

Rolling Mill - The Production Programme for Finished Rolled Products in Tons:

	1st Stage	2nd Stage	3rd Stage
Round, square, hexagonal sections from dia. 10 to 150 mm	70,000	345,000	345,000
Plate 20 to 300 mm wide and 4 to 20 mm thick	20,000	20,000	20,000
Angle iron sizes 2 to 20	35,000	160,000	160,000
I-beams, sizes 10 to 30	234,000	1,070,000	1,070,000
Channels, sizes 5 to 30	11,000	90,000	90,000
Rails for narrow gauge	5,000	5,000	5,000
Hoops 20 to 50 mm wide, 2.0 to 3.5 mm thick	5,000	5,000	5,000
Wire rods dia. 5.5 to 10 mm	50,000	50,000	50,000
Billets 80 x 80 mm	70,000	-	-
Total Merchant Sections	500,000	1,745,000	1,745,000
Hot rolled sheets and strips	-	-	1,200,000
Cold rolled sheets and strips	-	-	500,000
Galvanized sheets and strips	-	-	145,000
Black plates without coating	-	-	10,000
Tin Plates with electrolytic coating	-	-	70,000
Total Flats			1,925,000
Grand Total Finished	500,000	1,745,000	3,670,000

[illegible] cold rolled sheets and strips with galvanized sheets and strips will be most probably produced in the separate plant (see below), the production programme of the third stage of construction will be adjusted as follows:

Merchant sections	1,745,000	tons
Hot rolled sheets and strips	1,990,000	tons
Total	3,735,000	tons

Hot rolled sheets and strips will be partly supplied to rolling mill for production of cold rolled sheets and strips and galvanized sheets and strips (approx 625000 tons), the remaining quantity of hot rolled sheets (1300000 tons) will be sold directly to mechanical engineering plants.

There are two alternatives for the second stage of construction the above mentioned one as the first alternative and the second alternative-establishment of the flat products production with retention of the merchant sections rolling at a level of 500000 tons/year.

With the construction of the plant according to the second alternative, in 1354(1975/6) there will be a shortage in merchant sections of about 900000 tons/year and all flat products should be practically imported, since due to high capital expenditures (about 13 billion rials) completion of construction of the flats rolling complex and reaching the rated capacities practically would be possible not earlier than in 1356(1977/8).

Taking into account the foregoing and in particular the possibility of faster achievement of rated capacities with due consideration for utilization of available reserves envisaged by the project for the first stage of construction, the Technical and Economic Report recommends the first alternative of the second stage.

The rolling mills include two section mills in the first stage of construction:

The 650 mm heavy-section mill consisting of 2 continuous reheating furnaces each 90 tons/hour for reheating billets, 4 two-high working stands, the first three of which are reversing, a hot saw, cooling beds, straight lining machines, cold sheers, and crop and scale handling devices.

The 350/250 mm bar and rod mill consisting of one 60 tons/hour continuous reheating furnace for reheating billets, 19 two-high working stands arranged in 4 rolling lines. The first 13 stands, arranged in 3 lines form the bar part of the mill, while last six stands are combined into a continuous rod group. The equipment of the mill includes a cooling bed, cold sheers, coilers, conveyors and balers for balling-up and handling hoops and rods.

In the second stage of construction provision is made for construction of the 300 mm and 500 mm merchant mils and increase in the production of the 650 mm heavy-section mill which is already erected.

In the third stage of construction either 1700 mm semi-continuous hot rolling strip mill or 2000 mm semi-continuous hot strip mill will be erected.

[illegible] consists of [illegible] granulating unit and a slag yard. The granulated slag output will be:

		1st stage	2nd stage	3rd stage
Granulated slag output	tons/year	[illegible],000	730,000	1,640,000

Production of Refractories - The project provides for the production of these refractories - tons/year

	1st Stage	2nd Stage	3rd Stage
Tar bonded refractories	9,000	20,000	40,000
Fire clay refractories	20,000	47,000	67,000
Refractory powders, mortars and masses	8,000	17,000	18,000
Total	37,000	84,000	125,000

Other refractories, met from outside:

		1st Stage	2nd Stage	3rd Stage
Other refractories	tons/year	3,600	10,400	17,000

Till now, the refractory plant was not yet built and most probably this plant will be built as separate plant - see Code No. 3914 Refractory Products.

Dolomite and clays are to be burned in two rotary kilns dia. 1.6m and 34m long. Three shaft furnaces dia. 3.2 m are installed for calcination of limestone in the first stage of construction. Expansion of the lime production plant is considered in two alternatives: in the shaft furnaces or in the rotary kilns. The annual overall lime output will be:

		1st stage	2nd stage	3rd stage
Lime output	tons/year	61,000	200,000	430,000

Scrap Yard - is planned for preparing and storing return and outside scrap:

		1st stage	2nd stage	3rd stage
Return scrap	tons/year	72,100	107,000	[illegible]
Scrap from outside resources	tons/year	5,900	180,000	18,000
Total scrap	tons/year	78,000	111,000	[illegible]

Repair Shops

Repair of machinery, equipment buildings and structures is carried out in repair shops with the use of spare parts manufactured there or supplied from outside.

Requirements of spares and Replaceable Equipment Made of Metal.

		1st stage	2nd Stage	3rd stage
Spares made in repair shops	tons/year	12,000	18,400	40,100
Spares purchased from outside - rolls	tons/year	2,400	1,500	[illegible]
- others	tons/year	1,000	3,600	[illegible]
Total requirements of spares made of metal	tons/year	15,400	23,500	[illegible]

In the first stage of construction the repair shops consists of foundry with capacity of 6500 tons/year, forge shop with a capacity of 2000 tons of forgings, steel structure shop-3000 tons of steel structures, the machine shop-4700 tons/year of machine parts, heat treatment shop, surfacing shop, wood working shop, the metallurgical equipment repair shop, the electrical repair shop and repair shops for the coke oven and by-product plant [illegible]

sintering plant, the rolling mill, event. for the refractories plant etc.

Oxygen Plant supplies the Plant with oxygen for the converter shop and for flame cutting. In the first stage of construction it consists of 2 air separating units each with a capacity of 4200 cu.m. per hour of oxygen at 15 kg/sq.cm. pressure. The oxygen excess of about 3000 cu.m. per hour is delivered to the blast furnace. At the second stage of construction it is planned to expand the existing oxygen plant with additional installation of 4 units similar to these designed for the 1st stage of construction. In the third stage of construction provision is made for construction of the oxygen plant No. 2 comprising three air dissociation units with a capacity of 12,600 cu.m. of 95% oxygen per hour, 10,200 cu.m. of 99.5% oxygen per hour 9300 cu.m. of 98% nitrogen per hour.

Electric Power In the first stage of construction two turbogenerators with a capacity of 12,000 kW each are installed at the turboblower and power station. The remaining load of the Plant amounting to 38,500 KW is supplied by the district power station at the town of Dombe. The main stepdown substation has two 63/6.3 KV transformers 40 MVA each. The boiler house is furnished with 4 boilers, each with a capacity of 75 tons/hour steam at 40 atm.

In the second stage of construction the power station will be equiped with one 60 MW turbo-generator; total capacity of power station and turboblower will amount to 84 KW. In the third stage of construction one more 60 MW turbo-generator will be installed; total capacity of power station and turboblower will amount to 144 KW. In the second variant all excess gases not utilized

by the production shops of the Plant (2682.10^9 kcal/year at the second stage of construction and up to 9700.10^9 kcal/year at the third stage of construction) will be utilised in thermal power plant and turbo-blower station, the total installed capacity in the second stage of construction will be 152 MW and in the third stage of construction will be 322 MW.

Technological Steam for various technological needs is supplied at 8-10 ate abs. bearing maximum output 68 tons/hour at the first stage of construction, 173 tons/hour at the second stage of construction and 330 tons/hour in the third stage of construction.

Compressor Station In the first stage of construction three compressors are installed, each with a capacity of 200 cu.m. per minute and separate blower station provided with two 200 cu.m. per minute compressors. In the second stage of construction three additional compressors will be installed, each with a capacity of 200 cu.m. per minute and provision is made for construction of new blower plant. In the third stage of construction there will be constructed the compressor plant No. 2 comprising four compressors of 400 cu.m. min. each.

Water Supply The source of industrial water supply for the plant is the river Zayandehrud on which the Shah Abbas Kabir water reservoir is built. Owing to insufficient water yield of the source a recirculation water supply system is provided in the Plant.

	1st Stage	2nd Stage	3rd Stage
The industrial water consumption cu.m./hr	30,000	102,000	154,000
Fresh water requirements-normal cu.m./sec.	1	2.3	3.3
-max. cu.m./sec.	1.4	3.2	5.4

Transport

		1st stage	2nd stage	3rd stage
The outside turnover by railway	1000 tons	2300	7000	17,200
by lorries	1000 tons	200	700	1,500
Total outside turnover	1000 tons	2500	8600	18,700
The inside turnover by railway	1000 tons	1100	3640	8,000
by lorries	1000 tons	3400	1500	3,100
by mechanical transp.	1000 tons	500	11600	26,500
Total inside turnover		5000	15740	55,600

There are two plants producing finished rolled products from imported billets:

[illegible], Ahwaz

This plant is producing angles 20 x 20 x 3mm up to 90 x 90 x 7mm, T's from 30 mm up to 50 mm, narrow strips 10 x 4 mm to 8x 12 mm and round bars for reinforced concrete dia. 8 mm up to 32 mm as well as for mechanical engineering dia. 8 mm up to 32 mm. All these shapes are till now rolled from imported billets dimensions 80 x 80 mm.

There are installed two mills: Mill No. 1 for production of angles, tees, bars and strips - capacity 65,000 tons/year and Mill No. 2 for production of angles, bars and strips, capacity 85,000 tons/year. Total capacity of the plant is 150,000 tons/year; the production in year 1347(1968/9) was 31,250 tons of rods and bars, 1725 tons of tees and 10,855 tons of angles, i.e. total production was 43,100 tons; the production in year 1348 (1969/70) was 69,118 tons of rods and bars, 450 tons of tees and 20,619 of angles i.e. total production was 90,167 tons; total production in 1349(1970/1) was 101431 tons. Mill No. 3 continuous wire rod mill with wire finish-

... mill having capacity of 100,000 tons/year was installed in 1349(1970) and Mill No. 4 I-beams and medium size sections having capacity of 150,000 tons/year was put to operation in 1351(1972). In the same time two electric arc melting furnaces , having 90 tons capacity each were installed with continuous casting equipment, having capacity of 200,000 tons/year of casted billets. Total installed capacity at the end of the fourth five year plan will be 200,000 tons/year of billets produced from scrap and approx 400,000 tons/year of bars, rods and sections, produced from the above given billets, as well as from imported billets.

In the 5th five year plan two other electric arc melting furnaces having capacity 90 tons each and Mill No. 5 will be installed for production of medium size sections, having capacity of 150,000 tons/year. The next phase under consideration is direct reduction from ore to sponge iron and steel,

<u>Description of Existing Machinery , Equipment and Process</u>

Billets are mechanically fed into push heating furnaces by feeder of billets. In furnaces, heated by oil, billets are heated to prescribed temperature and then mechanically transported by hot billet feeder to mill No. 1 or No. 2 Both mills consist of one reversing two-stand mill and one seven-pass mill, one cooling bed and one stacking table. After cooling cold shears are cutting products to prescribed length, products are baled and handled by overhead cranes.

<u>Ahwaz Rolling and Pipe Mill in Ahwaz</u>

New plant is being established in Ahwaz to produce 140,000 tons/year of skelp from imported billets and 40,000 tons/year of black

and galvanized pipes dia. ½" - 6" from skelp produced in the [illegible]. The mill will supply to market max. 100,000 tons of skelp and 40,000 tons of pipes per year. Skelp (strip) produced in this mill have max. width 520 mm and thickness 1.5 mm up to 4.5 mm. Ahwaz Rolling and Pipe Mill was put into operation in 1350 (1971).

Forecast of expansion of existing plants and construction of new Rolling Mills.

As already mentioned, Iron and Steel Plant in Esfahan will be enlarged to 1,745,000 tons/year of steel finished sections in the fifth five year plan and 3,670,000 tons/year of steel finished products in the sixth five year plan.

Forecast of Installed Capacities of Steel Basic Metal Industries in Iran in 1000 tons/year

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Iron and Steel Mill Esfahan-				
- section	500	1745	1745	1745
- flats	-	-	1990	1990
IPCO Ahwaz -section	400	950	800	1000
-seamless pipes	-	80	80	80
Ahwaz Rolling and Pipe Mill	140	140	300	300
Cold rolled sheets	-	-	740	740
New plant-billets, sections	-	-	2500	3000
Alloy steels	-	-	100	300
Sponge iron (highly reduced pellets)	-	-	1530	1530

Table 1

Import of Rails

Tariff No.		1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
713	Rails Tons	1073	8671	61847	61675	81459	1660

Source: Foreign Trade Statistics of Iran

In the future demand will be higher due to construction of new lines and reconstruction of old ones.

Forecast of Demand and Production of Rails According to the Author of this Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand of Rails	tons	40000	44000	50000	56000
Production of rails-narrow gage	tons	5000	5000	5000	5000
-normal gage	tons	-	-	50000	60000
Total production	tons	5000	5000	55000	65000
Imports- ; exports +	tons	-35000	-39000	+5000	+9000

Production of rails for normal gage should be included either into the second stage of production programme of Iron and Steel Mill in Esfahan or into the production program of the new plant for the production of structruals.

STRUCTURALS

Imports of structurals see Table 4

Forecast of Demand, Production and Shortage or Surplus of Structurals According to the Author of this Study (See Materials Flow Sheets and forecast of steel consumption)

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand tons	678000	1310000	2460000	3600000
Production: Iron and Steel Plant at Esfahan "	80000	1120000	1320000	1320000
IRMCO Ahwaz "	170000	320000	480000	650000
New Plant "	-	-	720000	1500000
Total production "	250000	1440000	2520000	3470000
Surplus + or shortage - "	-428000	+130000	+60000	-130000

Description of machinery, equipment and process see Iron and Steel Plant at Esfahan, and IRMCO Ahwaz.

BARS, RODS,

Imports of bars and rods see Table 5

Forecast of Demand, Production and Shortage of Bars and Rods According to the Author of This Study

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand tons	91000	265000	560000	860000
Production: Iron and Steel Plant at Esfahan "	20000	310000	395000	395000
IRMCO Ahwaz "	40000	150000	225000	325000
New Plant "	-	-	300000	300000
Total production "	60000	460000	920000	1020000
Surplus + or shortage - "	- 31000	+195000*	+360000*	+120000*

Description of machinery and equipment and process see Iron and Steel Plant at Esfahan and IRMCO Ahwaz

* Surplus could be partly used for the production of drawn wire

[illegible] STEEL TUBES AND PIPES

Straight as well as spiral welded pipes are used for production of different kinds of mechanical engineering products, the biggest quantity is used in Iran for gas and oil lines.

Import of Welded and Seamless Steel Tubes and Pipes (in tons)

Tariff No.		1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
[illegible] 710A.B. [illegible] 711A.B. C.	Welded & Seamless Steel Tubes & pipes	100,878	279.393	389,838	217,718	56,094	116569

Source: Foreign Trade Statistics of Iran

To get import of welded steel tubes and pipes only, the import of seamless steel tubes and pipes must be deducted (see seamless tubes & pipes).

There are four plants under production in Iran at present:

Ahvaz Pipe Mill-Ahvaz

The plant is producing welded steel pipes on two automatic lines by high-frequency ERW forming and SAW automatic welding. The parameters of both lines are:

- The first line: Welded pipes
  - diameter 6" upto 18"
  - thickness 0,083" upto 0,315"
  - length upto 40 feet.
  - capacity 120,000 tons/year in two shifts
- The second line: Welded pipes
  - diameter 18" upto 48"
  - thickness 0,188" upto 0,625"
  - length upto 40 feet
  - capacity 240,000 tons/year in two shifts

Description of Machinery, Equipment and Process

Raw materials, i.e. hot rolled coils for small diameters of pipes and hot rolled sheets, 10 feet long for big diameters of pipes are transported to the factory by trucks, and unloaded in the material store by overhead cranes. The width of coils or sheets is either adjusted according the produced diameter (width = II D) or is bigger and the material is on both sides cut (approx. 3/4").

The raw material is transported to both lines by overhead cranes. The first operation is cutting of material on both sides (if necessary), ERW high frequency forming, ERW automatic welding, cutting of pipe to prescribed length by cold saw and surface treatment.

There is a well equipped testing room in theplant. All pipes are subjected to a hydrostatic pressure test. Other non-destructive tests: X-ray test and ultrasonic test. Destructive tests: tensile test, bend test, sharply tensile test, flatenning test etc.

Production of Welded Pipes in Ahwaz Pipe Mill-Ahwaz According to the Bureau of Statistics of the Ministry of Economy

	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
Production - tons	20,000	87,000	45,000	100,000

The production is, and will be limited by demand,

Forecast of Production of Welded Pipes in Ahwaz Pipe Mill Ahwaz According to the Author of this study

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production - tons	120,000	240,000	360,000	360,000

Small quantities will be exported to the countries in the Persian Gulf.

Skelp rolling and pipe mill-Ahwaz

A new unit is being established in Ahwaz to produce 100,000 tons/year of skelp and 40,000 tons/year of black and galvanized pipes.

There are installed two high-frequency welding plants for production of pipes-one up to diameter 2" and one upto diameter 6". The production started at the end of 1350(1972). The raw material for this production, i.e. the skelp (strip) upto the width 508 mm and thickness upto 4,85 mm is produced in the plant.

Other producers of welded steel tubes

Some firms, producing closed thin walled propies, like Sepanta Co. Tehran etc. are also producing welded steel tubes and pipes made mostly of cold rolled sheets. It is estimated that the production in these plants in 1351(1972/3) was approximately 25000 tons

Percent of Demand, Production, Imports and Exports of Welded Steel Tubes and Pipes According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	190,000	370,000	555,000	700,000
Production-Ahwaz Pipe Mill Ahwaz	tons	120,000	240,000	360,000	360,000
-Ahwaz Skelling and Pipe Mill Ahwaz	tons	20,000	40,000	80,000	80,000
Other Plants	tons	25,000	60,000	80,000	280,000
Total Production	tons	165,000	340,000	520,000	680,000
Imports	tons	25,000	50,000	55,000	720,000
Exports	tons	-	20,000	20,000	20,000

[illegible] Steel Tubes and Pipes

At the present time all requirements of seamless pipes are being imported. To assess the trend of past consumption and determine the future demand no basic figures are available since the import statistics are of little help as they do not record seamless tubes under a separate tariff. However, the export statistics of the industrial countries are of considerable help, since they show the seamless steel tubes under a separate heading.

Seamless Tubes Exports of [illegible] Countries to Iran (in tons).

	1964	1965	1966	1967
Seamless Tubes and Pipes in tons	19,400	32,900	41,000	45,400

Seamless steel tubes and pipes are mostly used in production of oil and natural gas (at present approximately 60%), water walls, refineries, automobile industry etc. Wherever possible seamless tubes and pipes are being replaced by welded pipes and the demand for seamless pipes may fall.

According to the tentative agreement between Ministry of Economy and IRMCO Ahwaz, the latter will prepare a study and afterwards a project for production of seamless tubes.

IRMCO Ahwaz is collaborating with Demag A.G.(F.R. Germany) Demag A.G. elaborated in 1351(1972). Study concerning a Tube Push Bench Plant for Manufacturing Seamless Galvanized Threaded Tubes in Nominal dia from ¾" up to 5", capacity approx 80,000 tons/year in two shift operation.

The plant should be built in two stages. The production programme

and capacity of the first stage of construction - seamless threaded galvanized tubes in sizes 5" up to 7", wall thickness, 2,75 mm up to 4,5 mm, 80,000 tons/year/two shift operation.

2. Description of Machinery, Equipment and Process

The continuously cast billets are cut into the required length on the cut-off shears and these sections are heated to the temperature of 1200-1250°C in the rotary hearth furnace. Next operations are pressure water descaling and piercing by means of a piercing punch on the piercing press to a hollow cylinder with a solid end. At the push bench a mandrel rod is introduced into this cylinder and pushes it through the die cages on the roller die bed, whereby the cylinder is elongated to 10-20 times its original length to form a push bench tube. The tube with mandrel rod still in it is carried to a reeler where the tube is extended by about 2-5 mm so that the mandrel rod is now loose in the push bench tube. The mandrel rod is pulled out of the tube by an extractor and conveyed via a roller table to a mandrel tool storage.

The push bench tube is cropped at both ends by two hot saws and arrives at a reheating furnace where it is heated to approx. 900-950°C. The heated push bench tube is then descaled in a pressure water descaping facility and subsequently reduced to a tube of the reduced outside dia. and wall thickness in a stretch reducing mill. The tubes are cooled on a cooling bed and from there conveyed by a delivery roller table to a cold saw which cuts them into double lengths(up to 12m) and rimoves the thickned ends produced during stretch reducing.

The tubes are straightened on a straightener, if required. The tubes to be galvanized are subdivided into single lengths by another cold saw. Prior to galvanizing the tubes are chamfered on end milling machines and hydraulically tested on tube testers. The tested

[illegible] the [illegible] in accordance [illegible] Consequently, they are straigh[illegible] [illegible] combination machine [illegible] tube [illegible] different [illegible] have different [illegible].

[illegible] the mandrel [illegible] furnace and, [illegible] pressure water descaler, [illegible] mandrel [illegible] are reconditioned on special [illegible].

In the second stage of construction will be installed 1 elongator [illegible], [illegible] will be extended for [illegible] mandrel rods [illegible] and [illegible] type cooling bed will be extended to a length of approx. [illegible] m.

Forecast of demand, Installed capacity, production and shortage of seamless tubes according to the author of this study

		1351 (1972/73)	1356 (1977/78)	1361 (1982/83)	1366 (1987/88)
Demand	tons	45,000	80,000	105,000	120,000
Installed capacity	tons	-	80,000	80,000	80,000
Production	tons	-	30,000	60,000	80,000
Shortage	tons	45,000	50,000	45,000	40,000

The small growth rate of demand of seamless tubes in the next fifteen years is due the replacement of seamless tubes by welded tubes.

Thin Walled Steel Profiles

There are two types of thin walled steel profiles produced in Iran:

1. Open profiles made directly from [illegible]
2. Closed profiles: thin steel strips are converted to thin walled welded tubes and thin profiles by rolling machines.

Thin walled profiles are used mainly for steel furniture, framework like doors, windows, in automobile industry etc.

Production of Thin Walled Profiles

	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)
Sepanta Co. Tehran	22,000	25,000	28,000	32,000	35,000	40,000
Omnlaye Felez Co. Tehran	2,500	4,000	12,000	20,000	24,000	32,000
Givar Co. Tehran	3,200	7,100	9,600	12,300	14,300	17,700
Pars Profile Co. Tehran	-	-	2,250	5,400	6,700	5,000
Nime Sabok Profile Tehran	-	-	2,500	6,800	14,700	25,000
Total	27,700	36,100	54,350	76,500	99,600	119,700

Source: The Research Centre for Industrial and Trade Development of the Ministry of Economy

At present there are five producers of thin walled profiles in operation (see above) and four new plants are under construction

Capacity of Existing and New Plants

Sepanta Co. Tehran	60000	tons	year
Omnlaye Felez Tehran	35000	"	"
Givar Co. Tehran	25000	"	"
Pars Profile Co. Tehran	15000	"	"
Nime Sabok Profile Tehran	30000	"	"
Sepagit Co. Isfahan	15000	"	"

Shiraz Profile Shiraz	10000	tons/year
Toos Profile Mashad	10000	" "
Sanaye Felezi Khuzestan Ahwaz	12000	" "
Total Capacity	212000	tons/year

Forecast of Demand Production and Capacity of Thin Walled Sheet Profiles According to the Author of this Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	130,000	240,000	350,000	450,000
Production	tons	130,000	240,000	350,000	450,000
Existing capacity	tons	212,000	212,000	212,000	212,000
New Capacity	tons	-	60,000	200,000	300,000

Forecast of production prepared by the Ministry of Economy, for the fifth five-year plan i.e. 330,000 tons/year in 1356(1977/8) seems to be high, as some thin walled profiles will be replaced in the future by aluminium profiles etc.

Description of Machinery, Equipment and Process

Mostly new machinery and equipment but of old design. Some firms are producing themselves machinery and equipment in theirs own repair shops (for example Sepanta Co. Tehran etc.). They are following the design of 30-40 years old machines with low productivity.

HOT ROLLED COILS AND SHEETS

Hot rolled coils and sheets facilities do not exist in Iran as the demand is not big enough for such a production. With increasing demand of sheets for production of final products like welded pipes, components and parts in mechanical and electrical engineering as well as for production of cold rolled sheets and coils it would be feasible to produce hot rolled coils and sheets not only for domestic use, but also for export.

Import of Sheets and Products Made of Sheets (which will be in the future produced in Iran.)

Tariff No.		1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
703-706	Import of Sheets tons	182,634	383,200	398,314	424,177	458,708	594,984
709-711	Import of Welded pipes approx.tons	65,000	450,000	360,000	180,000	20,000	50,000

Under presupposition that 90% of welded pipes as well as 90% of cold rolled sheets will be produced in the country, it would be feasible to produce hot rolled coils and sheets already in the sixth five year plan.

It is presupposed that sheet hot rolling mill having the capacity 1000000 tons will be built in the sixth five year plan (See Ariamehr Iron and Steel Plant in Esfahan)

[illegible] production, exports and imports of hot rolled [illegible] sheets according to the author of this study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
[illegible]	tons	540,000	700,000	2,120,000*	3,080,000*
Production	tons	-	-	1,980,000	1,980,000
Imports	tons	540,000	700,000	150,000	1,020,000
Exports	tons	-	-	-	-

* Including hot rolled coils and sheets for production of cold rolled sheets and strips (which will become local in Iran-see Material Flow sheet 1361(1982/3)

From the above given forecast of demand and production is seen that the proposed capacity of the Iron and Steel Plant in Esfahan will be unsufficient in the seventh five year plan (under the presupposition that cold rolled sheets and coated sheets will be produced in the country). New capacity should be built in the seventh five-year plan; the production should start in the eight five-year plan.

COLD ROLLED COILS AND SHEETS

There are two main groups of cold rolled coils and sheets: black cold rolled coils and sheets without coating, used mostly for production of transport equipment, space heaters, cookers, steel furniture, refrigerators etc.

The cold cold rolled coils and sheets, i.e. sheets tin or zinc plated, nickel or/and aluminium plated sheets etc, used mostly for production of tin cans, steel containers, tinsmith's hardware etc.

Cooked cold rolled coils and sheets are made of black cold rolled sheets and coils, therefore the forecasted demand and production of black cold rolled coils and sheets includes also coils and sheets for the production of cooked sheets and coils.

Till now all cold rolled coils and sheets are imported. With increasing demand of cold rolled coils and sheets it would be feasible to produce them in Iran.

Forecast of Demand, Production and Shortage of Black Cold Rolled Coils and Sheets According to the Author of this Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand of black cold rolled coils and sheets					
- final products	tons	294,000	550,000	850,000	1,200,000
- for production of coated coils and sheets	tons	-	-	240,000	240,000
Total demand	tons	294,000	550,000	1,090,000	1,440,000
Production	tons	-	-	740,000	740,000
Shortage	tons	294,000	550,000	350,000	700,000

Description of Machinery, equipment and Process

Black cold rolled coils and sheets will be produced either on the 1700 mm five-stand cold rolling with or 1400 mm continuous five-stand cold rolling mill and 4000 mm reversible cold rolling mill.

It is advisable to build a plant with the capacity 740000 tons in the fifth five-year plan and to put it into operation at the begining of the sixth five-year plan and to extend it in the seventh five-year plan (but the production will start at the begining of the eight five year plan).

Forecast of Demand, Production and Shortage of Coated Cold Rolled Coils and Sheets According to theAuther of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	108,000	220,000	430,000	640,000
Production	tons	-		215,000	215,000
Shortage	tons	108,000	220,000	215,000	425,000

It is advisable to build a unit with capacity 215000 tons/year in the frame of cold rolling mill in the fifth five-year plan and to put it into operation at the beginning of the sixth five-year plan and to extend it in the seventh five-year plan (but the production will start at the beginning of the eight five-year plan).

From the total capacity, 145000 tons will be galvanized sheets and coils and 70000 tons plates with electrolytic coating.

STEEL SLEEPERS

Steel sleepers are made of hot rolled steel special flat profiles by pressing.

The Import of Steel Sleepers

Tariff No.			1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
714	Steel sleepers	pcs	49,700	30,208	82,690	116,430	241,394	-
		tons	2,136	5,964	3,979	7,226	13,849	-

It is presupposed that steel sleepers will be more used in future and that these sleepers will be made in Iran of special profiles (hot rolled profiled strips) by pressing on hydraulic press together with highway steel guards.

Forecast of Demand and Production of Steel Sleepers According to the Author of this Study

		1351 (1977/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	pcs	165,000	190,000	230,000	255,000
	tons	9,900	11,400	13,800	15,300
Production	tons	-	-	14,260	15,300

Steel Wire Drawing

There are four factories having steel wire drawing shop in Iran at present: Ama Electrode Co. Tehran having capacity 10,000 tons in one shift/year. This firm is producing galvanized as well as not galvanized steel wires for own consumption and 5000 tons/year for other consumers.

Oreg Industrial Organisation, Tehran having capacity 6000 tons/year in one shift. This firm is producing steel wires for own consumption as well as 1500 tons year in one shift for other consumers.

Tick-Tack Nail factory Qazvin having capacity 5000 tons/year in one shift. Part of the production of steel wires is consumed for production of nails. Mikh Sazie Iran Tehran (Nail factory) having capacity 7000-8000 tons/year in one shift. Total production of steel wires is consumed for production of nails. It is estimated that consumption of cold drawn steel wires (local production plus import) was in year 1351(1972/3) 69000 tons/year, from this 27000 tons/year galvanized wires, 12000 tons soft drawn wires and 30000 tons hard drawn wires. Soft drawn wires are used for cotton bundles and concrete armatures.

IRMCO Ahvaz got licence for production of 40000 tons/year cold drawn

galvanized as well as not galvanized steel wires. Also Orex Industrial Organisation will expand their manufacturing programme for fine cold drawn wires (BWG 33) for mosquito nets.

Forecasted Demand, Capacity, Production, Imports and Exports of [illegible] according to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	69,000	140,000	250,000	360,000
Existing capacity (incl. IRSCO Ahwaz)	tons	92,000	92,000	92,000	92,000
New capacity	tons	-	-	200,000	300,000
Production	tons	24,000	90,000	230,000	370,000
Imports	tons	47,000	50,000	30,000	20,000
Exports	tons	-	-	10,000	30,000

Description of Existing Machinery, Equipment and Process

Mostly modern machinery and equipment. Wires are cold drawn through diamond or hard metals wire drawing dies on modern drawing machines and then heat treated in special furnaces. Some factories are equipped with continuous galvanising equipment. Diamond or hard metals wire-drawing dies are ground on special die-grinding machines.

ALLOY STEELS

Alloy steels are special steels used for production of highly stressed, corrosion, wear or heat resistant components and parts such as tools, springs, shafts, gears etc.

Imports of Alloy Steels According to the Foreign Trade Statistics

Tariff No.			1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
707A	Blocks, ingots	tons	-	33	67	761	19	24
707B	Blooms, billets, flat bars	tons	-	52	611	206	128	129
707C	Bars	tons	460	631	783	1,061	1,117	6,281
707D	Wire	tons	958	6,982	6,747	1,719	410	2,177
707E	Sheets	tons	2,251	27,013	28,560	17,589	3,575	9,833
707F	Hoops	tons	301	541	1,729	583	524	970
	Total	tons	3,970	35,252	38,497	21,919	6,073	19,434

According to the above given statistics the consumption of alloy steels is abnormally low in Iran at present. The ratio of alloy steels to other steels was 1:1177 in 1341(1962/3) and 1:35 in 1347(1968/9). In countries with advanced mechanical engineering industries this ratio is 1:12 up to 1:9. Most probably in import statistics some kinds of alloy steels (for example carbon constructional steels) are given under other numbers.

According to the "Feasibility Report on Ferro Alloy Plants and Alloy Steel Plant" by M.N. Dastur and Co. Private Ltd. Calcutta the consumption of alloy steels in 1347(1968/9) incl. indirect imports in the form of finished metal products, machinery and parts was about 31000 tons; the possible demand of alloy steels in 1356(1977/8) is estimated at about 76000 tons per year. Even these estimates seems to be low.

Forecast of Demand of Alloy Sheets According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand *	tons	22,000	84,000	180,000	360,000

* Without indirect imports

It is proposed to install a plant with a capacity of about 150,000 tons of finished alloy steels per year (i.e. 150,000 tons of ingot steel) in the fifth five year plan i.e. the production will start in the sixth five year plan and to extend this plant in the sixth five year plan to about 450,000 tons of ingots per year to give 300,000 tons of finished products in the seventh five year plan.

Forecast of Production of Alloy steels According to the Auther of this study

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of Alloy steels in tons	-	-	100,000	300,000

Production mix of the first stage:

Constructional steels:	Carbon constructional steel	30,000	tons/year
	low alloy medium tensile steel	24,000	" "
	Medium alloy,high tensile "	6,000	" "
	Case hardening steel	15,000	" "
Spring steels -	Carbon spring steel	5,000	" "
	Silico manganese spring steel	12,000	" "
	Chrome vanadium spring steel	3,000	" "
Alloy tool steels -	High speed steel	500	" "
	Hot work die steel	300	" "
	Cold work die steel	1,000	" "
	Low alloy tool steel	1,000	" "
	Die block	500	" "
	Carbon tool steel	2,000	" "
	TOTAL	100,000	tons/year

Round steel dia. 12 to 125 mm, square steel 12 x 12 to 125 x 125mm flat steel: thickness 4 up to 26mm, width 10 to 75 mm.

Description of Machinery, Equipment and Process

The steelmelt shop consist of three aisles-a covered scrap aisle, a furnace aisle and a teeming aisle. Scrap bins are arranged in the covered scrap aisle. The unloading from wagons and loading into the furnace charging buckets is carried out by the scrap crane. Two sets of 30 ton scrap transfer cars and tray for trucks with 40 ton weight bridges are provided on each truck. A jaw crusher is provided for reducing ferro-alloys.

Four 35 ton swing pool top-charged electric arc furnaces are located in the furnace aisle with multi-coil 6 power transformers 12 MVA, 3 phase, 50 cycles with possible overloading melting by 10%. One 40/10 ton overhead crane will serve this aisle for charging scrap into the furnace. Two portable weighing scales are provided on the furnace charging platform. Molten furnace slag is carried in a slag pot on slag car to the teeming aisle and to the slag and debris dump. Teeming aisle is served by two 60/10 ton overhead cranes for handling steel ladles and slag pot and one 15-ton crane for shipping operations. The casting is performed on trucks from bottom from casting gallery. The size of ingots will be 440 x 440 mm, the weight 1,5 tons. Four trucks with four ingots are required for one melting.

The other facilites provided in the teeming aisle are ladle preheating station, stopper rod drying oven, ladle stands and ladle relining pit. After casting the whole set is shifted by a winch to the stripping and mould preparation building.

Mould preparation building is served by one 5-ton overhead crane. The moulds are cooled down and are prepared on the cars by coating to protect the mould surface from erosive action and splash of liquid steel.

The limestone calcining plant consists of one 45-ton of burnt lime per day vertical shaft kiln including necessary crushing, screening, charging and storage facilities. Natural gas will be used as fuel.

For the production of high speed and tool steels, one steelmelt shop and forge shop is proposed to be installed. The building consists of three aisles a furnace aisle, a middle aisle and forging aisle. Furnace aisle is equipped with one 6-ton electric arc furnace with 3000 kVA transformer and is served by two 10/5 ton overhead cranes. Ancillary facilities consist of ladle pre-heating units, stopper rod dryer, ladle and roof relining and slow cooling boxes for ingots. Forge shop is equipped with one 1000 ton hydraulic press, one 2-ton pneumatic hammer, four batch type furnaces and one bogie hearth type preheating and annealing furnace.

Ancillary facilities consist of rail-bound manipulator, chain turning gear, mobile charger, slow cooling boxes and equipment for inspection and testing.

Before the ingots are bloomed they are heated in four pit type furnaces, heated by natural gas. Output of furnaces is 24 ingots i.e. 36 tons/hour of operation time.

The blooming mill is producing the square billets in the range from 80 x 80 mm to 150 x 150 mm, heavy sections dia. 60 to 125 mm, and square steel 60 x 60 up to 125 x 125mm . The blooming mill is required to handle about 140000 tons/year of ingots producing about 118300 tons of billets and heavy sections. The blooming mill is a two-high/rolling mill dia. 600 x 1000 mm, drive 1500 kW D.C. On either side of the mill, electrically driven manipulators are provided. The main mill pulpit will accomodate all operating controlls for the mill, ingot buggy and ingot weighing scale. The

* reversing mill dia. 800 x 2000 mm, drive 2 x 1500 kW D.C. and two three-high

hot shear is of 500 ton capacity and a [illegible] with a blade dia. 1000 mm is provided for cutting finished lengths. The billets and heavy sections from the blooming mill are received on the cooling bed in the conditioning department or slowly cooled in unheated pit.

Ancillary facilities for treatment of rolled products consist of 4 straightening machines, 2 machines for all surface grinding of billets, 2 machines for local grinding of defects and 2 defectoscopes.

The light section and medium section mill [illegible] steel dia. 12 up to 60mm, square steel 12 up to 60 mm [illegible] thickness 4 to 26 mm, width 10 to 75mm. The light section and medium section mill is the three, three-high rolling mill dia. 560 x 1000 mm, drive 600 kW, four alternating two-high rolling mill dia. 300 or 360 x 600 mm, drive 2 x 600 kW D.C. three alternating two-high rolling mill dia. 280 or 300 x [illegible] mm, one alternating two-high rolling mill dia. 280 x 600 mm drive 2 x 660 kW D.C.

Before the billets are rolled they are heated in one walking beam two-zone furnace with double walking beam and reversing run securing a minimum surface decarbonation.

Ancillary facilities for treatment of rolled products consist of cold saws for division of bars, two straightening machines, 2 grinding machines for local grinding of defects and 2 defectoscopes.

Approx 20% of total output (20000 tons/year) will be subjected to heat-treatment. About 13000 tons/year of bars will be normalized, full annealed or subcritical annealed, about 7000 tons/year will

[illegible] treated [illegible] quenching). For normalising, [illegible] and full ann[illegible] treatments, two car bottom furnaces [illegible] bottom furnace [illegible] quenching [illegible] one oil quenching tank [illegible] provided. The heat-treated bars will [illegible] straightened on two multi-roll rotary straighteners and on one roller type shape straightener for flats .

Forecast of [illegible], capacity, production and shortage of Alloy Steels According to the author of this study

		1[illegible] ([illegible])	1356 (197[illegible])	13[illegible]1 ([illegible])	1366 (1987/[illegible])
Demand	tons	[illegible]	84,000	1[illegible]0,000	360,000
Capacity	tons	-	-	100,000	300,000
Production	tons	-	-	90,000	[illegible]0,000
Shortage	tons	22,000	84,000	[illegible]0,000	100,000

Direct-Reduction Process-Sponge Iron

The direct reduction processes are studied in Iran already for five years. In the reduction process the iron ore is reduced in the solid stage to sponge iron by addition of the reducing agents like natural gas, non-coaking coal or oil. The final product of direct-reduction process is sponge iron. Basically sponge iron can be employed in all metallurgical furnaces for the production of pig iron, foundry iron, and steel.

The main advantages of the direct-reduction is lower capital investment for steel plants based on sponge iron production and electric-arc furnace and the use of cheaper reducing agents than coke. The latter is of basic advantage for Iran as the resources of coaking coal are limited,on the other hand

88% of gas is burnt without any utilization.
At the early planning for this industry the HYL process was studied for adoption in Iran. According to final "Bench and Mav scale Tests on the Reducibility Characteristics of Iranian and Indian Ore" prepared (1970) by Swindell-Dressler Co. Pittsburgh from four tested Iranian iron ores only Sharm Abad iron ore is suitable for HYL process, but only after the beneficiation of the ore. According to this report, the HYL process could be based either on this iron ore or it is possible to import iron ore from Pale (Goa) India. (of which samples were also tested). More recent discovery of the Gol Gohar mine near Bandar Abbas indicate suitability of ore for direct reduction.

At the beginning of the year 1352(july 1973) Iron Steel Industries Corporation issued two letters of intend - one to Badische Stahlwerk A.G. Baden Baden and the other to A. Thyssen A.G. in Dusseldorf.*

Badische Stahlwerk A.G. Baden Baden will set up most probably in Bandar Abbas direct-reduction plant with capacity of 1,2 millions tons of highly reduced pellets. This plant will be based on Mittland-Korf process. Bandar Abbas will be chosen for this plant because it is near the Gol Gohar iron ore deposits, the possibility of getting natural gas to the site at low cost, the availability of water and export facilities.

A. Thyssen A.G. Dusseldorf will set up most probably in Ahwaz direct-reduction plant with capacity of 330,000 tons of highly reduced pellets, based on Puroper process. The choice of Ahwaz as the site for this plant has been prompted by the fact that

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* In January 1974 a third agreement in principle was signed by the Iron steel Industries Corporation and Swindell-Dressler Co., for building a third plan with a yearly capacity of one million tons.

there is rolling mill in this city which would use highly reduced pellets as raw materials.

Forecast of Production of Highly Reduced Pellets According to the Author of This Study

	1981 (1977/81)	1986 (1977/81)	1981 (1982/5)	1986 (1987/8)
Production tons	-	-	1,330	1,330

Highly reduced pellets will be partly used instead of scrap (see scrap for production of steel), partly for exports. It is proposed that the capacity of the above mentioned plants will be extended in the seventh five-year plan, but the production will be increased in the eight five-year plan.

SCRAP FOR PRODUCTION OF STEEL

Scrap is one of the principal sources of the iron for production of steel. It is estimated that iron and steel scrap represents in different countries 40-50% of metal iron for production of steel.

There are two groups of scrap: Primary scrap and secondary scrap:

1. Primary Scrap

1.1 Revert scrap This scrap originates in steel mills - for example rejected ingots, blooms, ingots and billets crops, ends cut from bars, pipes etc. This scrap in complex steel mills is fully utilized in the factory, i.e. it is re-melted and re-rolled. In re-rolling mills (like Ahvaz Rolling and Pipe Mill, IRMCO Ahvaz upto 1350) this scrap can't be utilized in the factory and is sold as a "product" to other consumers of scrap. In good re-rolling mills scrap represents 8-8%

to the total quantity of billets purchased outside; in [illegible] Ahwaz this ratio is abnormally high-approx. 1:3 (1).

1.2 Industrial scrap: Consumers of steel i.e. mechanical engineering establishments, engineering plants and repair shops are generating scrap in which their products. The scrap consist of rejected products, machine cuttings, sheet metals, short ends etc. This scrap represents 8-35% of steel, castings or forgings used for production of final products or components and parts. The ratio depends on the technological process, the shape of component and part, semi-product etc. Industrial scrap is suitable for re-melting in any electrical furnace, as an additive to other steel making processes, to cupola oven etc. The collection of this scrap is easy from big factories and shops. Only small quantity generated in small workshops is lost.

2. Secondary scrap:

This scrap originates in households, agricultural farms and all kinds of industries. Secondary scrap are broken components and parts, worn out machinery and equipment, steel profiles, pipes etc. arising from the demolition of buildings etc. It is uneasy to collect this scrap, as it is scattered throughout the country. The scrap is collected only in big factories and shops; scrap from households and agricultural farms is mostly lost. Broken grey iron castings are mostly re-melted in cupola oven. All kinds of secondary scrap could be used in electric furnaces and in other steel making processes.

The up-to-date collection of industrial scrap as well as secondary scrap is a complicated activity, which should be well organized.

It includes not only the transportation of the scrap to one place, but also the dismantling of old machines and the sorting of the scrap by [illegible] workers according to the materials (ordinary steel, alloy steel, cast iron castings, steel castings, non-ferrous metals etc.). Big pieces are cut to suitable sizes for transportation, the small cuttings of sheets are fagotted on the balin press and the treated scrap is transported to the foundry or steel work.

The existing shops and dealers with scrap in Iran are only partly performing the above given activities. In the future there should be improvement in this field.

Forecast of Production, Demand, Surplus or Shortage of Scrap According to the Author of This Study

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production-Primary scrap -revert scrap 1)	81,000	264,000	857,000	1,100,000
-industrial scrap 2)	204,000	411,000	703,000	1,050,000
Secondary scrap -approximately 3)	145,000	175,000	220,000	360,000
Total production	430,000	850,000	1,780,000	2,510,000
Demand - steel mills 1)	76,000	874,000	1,785,000	2,120,000
Foundries	84,000	196,000	315,000	540,000
Total demand	160,000	1,070,000	2,100,000	2,660,000
Surplus + or shortage -	+270,000	- 220,000	- 320,000	- 150,000

1) See Material Flow Sheets. Revert scrap of foundries is not included

2) Calculated on the base that approximately 12% of total demand of steel will be scrap, consisting of rejected products, machine chips, shear scraps, short ends etc.

3) The estimation is based on 40-50% of demand of steel 25 years ago plus 50-60% of imported products made of steel and grey iron and steel castings. The above given surplus or shortage are only theoretical figures as the collection of industrial and secondary scrap is and will remain low and therefore surplus will be lower and shortage higher. In the future, shortage of scrap will be covered by highly reduced pellets (see Direct Reduction).

[illegible] AT 1000 TONS

1981(1972/3)

	Iron and Steel plant Isfahan	IRMCO Ahwaz	Ahwaz Rolling Pipe mill	TOTAL
Iron Ore				
Production +	+ 770	-	-	
Consumption -	- 770	-	-	
	-	-	-	-
Coal				
Production +	+ 570	-	-	
Consumption -	- 570	-	-	
	-	-	-	-
Lime stone				
Production +	+ 320	-	-	
Consumption -	- 320	-	-	
	-	-	-	-
Quarzite				
Production +	+ 13	-	-	
Consumption -	- 13	-	-	
Manganese Ore				
Production +	-	-	-	
Consumption -	- 24	-	-	
	- 24	-	-	- 24
Steel and Iron Scrap				
Production +	+ 61	+ 20		
Consumption -	- 76			
	- 15	+ 20	-	+ 5
Pig Iron				
Production +	+ 500	-	-	
Consumption -	- 210	-	-	
	+ 290	-	-	+ 290
Billets 150x150 mm)				
Production +	+ 210	-	-	
upto 250x250mm and)				
Consumption -	- 115	-	- 80	
	+ 95	-	- 80	+ 15

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	Iron and Steel plant Iafahan	IRMCO Ahvaz	Ahvaz Rolling Pipe mill	TOTAL
Billets 80x80 mm				
Production +	-	-	-	
Consumption -	-	- 275	-	
	-	- 275	-	- 275
Round, Square, Hexag. Sections				
Production +	+ 20	+ 20	-	
Consumption -	-	-	-	
	+ 20	+ 20	-	+ 40
Angle Irons				
Production +	-	+ 80	-	
Consumption -	-	-		
	-	+ 80	-	+ 80
I-beams				
Production +	+ 80	+ 90	-	
Consumption -	-	-	-	
	+ 80	+ 90	-	+ 170
Flats				
20mm upto 200mm)				
Production +	-	-	-	
4 up to 20mm)				
Consumption -	-	-	-	
	-	-	-	-
Channels				
Production +	-	-	-	
Consumption -	-	-	-	
	-	-	-	-
Rails narrow gauge				
Production +	+ 5	-	-	
Consumption -	-	-	-	
	+ 5	-	-	+ 5
Hoops 20-50mmX2,5-3,5mm				
Production +	-	+ 20	-	
Consumption -	-	-	-	
	-	+ 20	-	+ 20
Wire, Rod				
Production +	-	+ 40	-	
Consumption -	-	-	-	
	-	+ 40	-	+ 40

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	Iron and Steel plant Isfahan	TRICO Ahwaz	Ahwaz Rolling Pipe mill	TOTAL
Skelp 1,5-4,85x3[illegible]				
Production +	-	-	+ 70	
Consumption -	-	-	- 22	
	-	-	+ 48	+ 18
Pipes - welded				
Production +	-	-	+ 20	
Consumption -	-	-	-	
	-	-	+ 20	+ 20
Pipes-seamless				
Production +	-	-	-	
Consumption -	-	-	-	
	-	-	-	-

According to this flow sheet the import of billets was 260000 tons; according to the Foreign Trade Statistics of Iran the import of billets was 266078 tons. The difference is only 2,3% (change of stock)

MATERIAL FLOW SHEET IN 1000 TONS
1356(1977/8)

	Iron and Steel plant Isfahan	Ahwaz	Ahwaz Rolling & Pipe mill	+ Remarks -
Iron Ore				
Production +	+ 2,800	-	-	
Consumption -	- 2,800	-	-	
	-	-	-	-
Coal				
Production +	+ 1,170	-	-	
Consumption -	- 1,170	-	-	
	-	-	-	-
Limestone				
Production +	+ 437	-	-	
Consumption -	- 437	-	-	
	-	-	-	-
Quarzite				
Production +	+ 110	-	-	
Consumption -	- 110	-	-	
	-	-	-	-
Manganese Ore				
Production +	+ -	-	-	
Consumption -	- 92	- 6	-	
	- 92	- 6	-	- 98
Steel and Iron Scrap				
Production +	+ 220	+ 44	-	
Consumption -	- 434	- 440	-	
	- 214	- 396	-	- 610
Pig Iron				
Production +	+ 1,950	-	-	
Consumption -	- 1,640	-	-	
	+ 310	-	-	+ 310
Billets 150x150mm upto 250x250mm and 100x300-500mm				
Production +	+ 1,600	-	-	
Consumption -	- 1,600	-	- 154	
	-	-	- 154	- 154
Billets 80x80mm				
Production +	-	+ 400	-	
Consumption -	-	- 350	-	
	-	- 150	-	- 150

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	Iron and Steel plant Isfahan	IRMCO Ahwaz	Ahwaz Rolling & Pipe mill	Remarks
Billets 200 - 270mm & 330 - 430 mm				
Production	-	-	-	
Consumption	-	- 38	-	
	-	- 38	-	- 38
Round, Square, Hexag. Sections				
Production	270	50	-	
Consumption	-	-	-	
	270	50	-	320
Angle Irons				
Production	130	180	-	
Consumption	-	-	-	
	130	180	-	310
I-Beams				
Production	920	140	-	
Consumption	-	-		
	920	140	-	1060
Flats 20mm upto 200mm & upto 20mm				
Production	20	-	-	
Consumption	-	-	-	
	20	-	-	20
Channels				
Production	70	-	-	
Consumption	-	-	-	
	70	-	-	70
Rails Narrow Gauge				
Production	5	-	-	
Consumption	-	-	-	
	5	-	-	5
Hoops 20-80mm & 3-3.5mm				
Production	5	30	-	
Consumption	-	-	-	
	5	30	-	35

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	Iron and Steel plant Isfahan	MIDCO Ahvaz	Ahvaz Rolling & Pipe Mill	Hormozgan
Wire, Rod				
Production +	40	100	-	
Consumption -	-	-	-	
	40	100	-	140
Shelp 1,5 - 4,8x508mm				
Production +	-	-	100	
Consumption -	-	-	43	
	-	-	57	57
Pipes - Welded				
Production +	-	-	40	
Consumption -	-	-	-	
	-	-	40	40
Pipes-Seamless				
Production +	-	30	-	
Consumption -	-	-	-	
	-	30	-	30

MATERIAL FLOW SHEET IN 1000 Tons

1361 (1982/3)

	Iron and Steel Plant Isfahan	1000 Ahwaz	Ahwaz Rolling and Pipe Mill	Cold Rolled Sheets	Direct Reduction Plant (Bandar Abbas)	Direct Reduction Plant (Ahwaz)	New Plant	Total + Losses
Iron ore								
Production +	+ 6650	-	-	-	-	-	-	
Consumption -	- 6650	-	-	-	- 1900	- 650	- 3140	Could be partly replaced by highly reduced pellets
	-	-	-	-	- 1900	- 650	- 3140	- 5690
Coal								
Production +	+ 3250	-	-	-	-	-	-	
Consumption -	- 3250	-	-	-	-	-	- 1520	
	-	-	-	-	-	-	- 1520	- 1520
Limestone								
Production +	+ 778	-	-	-	-	-	-	
Consumption -	- 778	-	-	-	-	70 - 23	- 365	
	-	-	-	-	-	70 - 23	- 365	- 458
Quarzite								
Production +	+ 138	-	-	-	-	-	-	
Consumption -	- 138	-	-	-	-	-	- 65	Could be partly replaced by ferro-silicon
	-	-	-	-	-	-	- 65	- 65
Manganese Ore								
Production +	-	-	-	-	-	-		
Consumption -	- 200	- 12	-	-	-	-	- 96	Could be partly replaced by Ferro-manganese
	- 200	- 12	-	-	-	-	- 96	- 307
Steel and Iron Scrap								
Production +	+ 307	+ 80	-	-	-	-	+ 240	Could be partly replaced by highly reduced pellets
Consumption -	- 605	-300	-	-	-	-	- 360	
	- 48	-300	-	-	-	-	- 60	- 308

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	Iron and Steel Plant Isfahan	IRMCO Ahwaz	Ahwaz Rolling and Pipe Mill	Cold Rolled Sheets	Direct Reduction Plant (Nandar Abbas)	Direct Reduction Plant (Ahwaz)	New Plant	Total + Remarks
Directly reduced billets								
Production +	-	-	-	-	+ 1200	+ 330	-	
Consumption -	-	-	-	-	+ 1200	+ 330	-	+ 1530
	-	-	-					
Pig Iron								
Production +	+ 1140	-	-	-	-	-	+ 1800	
Consumption -	- 1140	-	-	-	-	-	- 1650	
	-	-	-	-	-	-	+ 150	+ 150
Billets 150x150 up to 170x [illegible] 100x200-300								
Production +	+ 4040	+ 330	-	-	-	-	+ 1600	
Consumption -	- 4040	- 175	- 330	-	-	-	- 1250	
	-	- 25	- 330	-	-	-	+ 350	- 5
Billets 90x90 mm								
Production +	-	+ 190	-	-	-	-	-	
Consumption -	-	- 330	-	-	-	-	-	-
	-	-	-					
Billets 200-270mm and 330-430 mm								
Production +	-	-	-	-	-	-	-	
Consumption -	-	- 105	-	-	-	-	-	- 105
	-	- 105	-	-	-	-	-	
Round, square, hexagonal sections								
Production +	+ 345	+ 75	-	-	-	-	+ 150	
Consumption -	-	-	-	-	-	-	-	
	+ 345	+ 75	-	-	-	-	+ 150	+ 570
Nodular irons								
Production +	+ 880	+ 270	-	-	-	-	+ 220	
Consumption -	-	-	-	-	-	-	-	
	+ 880	+ 270	-	-	-	-	+ 220	+ 660

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	Iron and Steel Plant Isfahan	Ferro Ahwaz	Ahwaz Rolling and Pipe Mill	Cold Rolled Sheets	Direct Reduction Plant (Bandar Abbas)	Direct Reduction Plant (Ahwaz)	New Plant	Total	Remarks
Bars									
Production	1070	210	-	-	-	-	250		
Consumption	-	-	-	-	-	-	-		
	1070	210	-	-	-	-	250	1530	
Rods 20 up to 200mm									
Up to 20 mm									
Production	20	-	-	-	-	-	100		
Consumption	-	-	-	-	-	-	-		
	20	-	-	-	-	-	100	120	
Channels									
Production	90	-	-	-	-	-	250		
Consumption	-	-	-	-	-	-	-		
	90	-	-	-	-	-	250	340	
Angles									
Production	5	-	-	-	-	-	50		
Consumption	-	-	-	-	-	-	-		
	5	-	-	-	-	-	50	55	
Rods 20-50 mm									
2-3,5 mm									
Production	5	45	-	-	-	-	-		
Consumption	-	-	-	-	-	-	-		
	5	45	-	-	-	-	-	50	
Plates									
Production	30	150	-	-	-	-	150		
Consumption	-	-	-	-	-	-	-		
	30	180	-	-	-	-	150	350	
Skelp 1,5-4,85x520mm									
Production	-	-	300	-	-	-	-		
Consumption	-	-	87	-	-	-	-		
	-	-	213	-	-	-	-	213	

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	Isfahan Steel Plant	IRMCO Ahvaz	Ahvaz Rolling and Pipe Mill	Cold Rolled Sheets	Direct Reduction Plant (Bandar Abbas)	Direct Reduction Plant (Ahvaz)	New Plant	Total	Remarks
Hot Rolled Sheets and Strips									
Production +	+ 1980	-	-	-	-	-	-		
Consumption -	-	-	-	- 780	-	-	-		
	+ 1980	-	-	- 780	-	-	-	+ 1200	
Cold Rolled Sheets and Strips									
Production +	-	-	-	- 240	-	-	-		
Consumption -	-	-	-	- 240	-	-	-		
	-	-	-	+ 500	-	-	-	+ 500	
Galvanized Sheets and Strips									
Production +	-	-	-	+ 145	-	-	-		
Consumption -	-	-	-	-	-	-	-		
	-	-	-	+ 145	-	-	-	+ 145	
Black Plates Without Coating									
Production +	-	-	-	+ 10	-	-	-		
Consumption -	-	-	-	-	-	-	-		
	-	-	-	+ 10	-	-	-	+ 10	
Tin Plates with Electrolytic Coating									
Production +	-	-	-	+ 70	-	-	-		
Consumption -	-	-	-	-	-	-	-		
	-	-	-	+ 70	-	-	-	+ 70	
Pipes-Welded									
Production +	-	-	+ 80	-	-	-	-		
Consumption -	-	-	-	-	-	-	-		
	-	-	+ 80	-	-	-	-	+ 80	
Pipes-Seamless									
Production +	-	+ 80	-	-	-	-	-		
Consumption -	-	-	-	-	-	-	-		
	-	+ 80	-	-	-	-	-	+ 80	

Railway

	Nos.	Tons	Nos.	Tons		ture								
Rails	-	**39120**	-	**39120**	**39120**	-	-	-	-	-	-	-	-	
Steel Sleepers	165000	10230	-	-	-	-	-	-	-	-	-	-	-	
Concrete sleepers	285000	72675	285000	72575	-	-	-	-	-	-	-	-	-	
Sleeper - screws	-	**3987**	-	**100**	-	-	-	-	-	-	-	-	-	
Screws	-	1860	-	100	-	-	-	-	-	-	-	-	-	
[illegible] plates	-	13173	-	-	-	-	-	-	-	-	-	-	-	
Rail anchoring device	-	[illegible]	-	-	-	-	-	-	-	-	-	-	-	
[illegible]gs	-	[illegible]	-	-	-	-	-	-	-	-	-	-	-	
Switches, frogs, cross points	-	[illegible]	-	-	-	-	-	-	-	-	-	-	-	
Wheel sets, wheel centres, axles	-	1200	-	-	-	-	-	-	-	-	-	-	-	
[illegible]gons	310	3690	-	-	-	-	-	-	-	-	-	-	-	
Locomotives	**20**	**1600**	-	-	-	-	-	-	-	-	-	-	-	
Coaches	**25**	**500**	-	-	-	-	-	-	-	-	-	-	-	
Signalling and safety	-	7990	-	[illegible]	-	400	[illegible]	[illegible]	-	[illegible]	-	[illegible]	-	
T O T A L		**165117**		112495	39120	400	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	-	

Construction of Buildings

	Demand		Production		Structure	Sheets Strips		Sheet coated	Tires	Bars Rods Blooms	Pipes Tubes	Remarks
	Pcs.	Tons	Pcs.	Tons		Hot Rolled	Cold Rolled					
New Private Construction												
Dwelling Houses												
Kiln bricks and steel	-	296200	-	296200	236960	59240	-	-	-	-	-	-
Reinforced concrete	-	16600	-	16609	-	-	-	-	1209	12440	-	-
Stone and wood or steel	-	1343	-	1347	1343	-	-	-	-	-	-	-
Prefabricated elements	-	2928	-	2928	-	-	-	-	778	2150	-	-
Others	-	26540	-	26540	21230	5310	-	-	-	-	-	-
Constr. Industry and Trade												
Kiln bricks and steel	-	82896	-	82896	62170	20726	-	-	-	-	-	-
Reinforced concrete	-	2622	-	2622	-	-	-	-	552	1970	-	-
Prefabricated elements	-	558	-	558	-	-	-	-	144	410	-	-
Others	-	744	-	744	560	184	-	-	-	-	-	-
New Public Construction												
Housing and Café Building												
Kiln bricks and steel	-	120874	-	120874	96699	24175	-	-	-	-	-	-
Reinforced concrete	-	8370	-	8370	-	-	-	-	2070	6300	-	-
Prefabricated elements	-	4512	-	4512	-	-	-	-	1112	3400	-	-
Others	-	3780	-	3780	2840	940	-	-	-	-	-	-
Industry												
Kiln bricks and steel	-	189178	-	189178	141131	47044	-	-	-	-	-	-
Reinforced concrete	-	3763	-	3763	-	-	-	-	943	2800		-
Prefabricated elements	-	1152	-	1152	-	-	-	-	252	900	-	-
Others	-	1128	-	1128	850	278	-	-	-	-	-	-

	Demand		Production		Structure	Sheets strips		[illegible]	[illegible]	[illegible]	[illegible]	
	Pcs.	Tons	Pcs.	Tons		Hot Rolled	Cold Rolled	Coated				
Repairs	-	7846	-	7846	5877	1573	-	-			-	
Subtotal	-	770000	-	770000	500640	190470	-	-	10020	30070	-	-
Steel doors and window shutter doors	-	90000	-	90000	84000	3360	10060	12540	-	2230	-	[illegible] thin rolled profiles
Gas, cold & hot water installation*	-	30700	-	30700	760	1450	-	-	-	-	28500	without "technical [illegible] fittings
Tinsmiths hardware (Ovens, roofing etc.)	-	24100	-	22700	-	-	-	22700	-	1400	-	
Railings, steel ornaments on facade etc.	-	38600	-	38600	27000*	1600	3400	2500	1500	1700	2700	[illegible] thin rolled profiles
Total					602000	165000	13400	37540	11720	36000	30200	
<u>Other Construction Activities</u>												
<u>Agricultural Construction</u>												
(incl. irrigation)	-	70000	-	70000	40000	6000	-	-	1400	5?00	16000	
<u>Cement Consuming Industry</u>												
Concrete poles, pipes etc.	-	4000	-	4000	-	-	-	-	1600	3200	-	
<u>Construction of Communications</u>												
Roads, bridges, Harbours Airfields etc.	-	64000	-	64000	41000	8800	3200	2800	1400	3200	3600	
<u>Transmission and Distribution</u>												
Electric Transmission towers incl. micro-wave towers		16300	-	2000	2200	60	-	-	-	160	-	-

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	Demand		Production		Structure	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	Pcs.	Tons	Pcs.	Tons		Hot Rolled	Cold Rolled					
Water mains, Gas and Oil Distribution	-	145000	-	145000	-	-	-	-	-	-	145000	
Total					91200	14850	3200	3400	4400	12360	165000	

1351(197[illegible])

Dams and Irrigation

	Demand		Production		Structure	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	Pcs.	Tons	Pcs.	Tons		Hot Rolled	Cold Rolled					
Steel for reinfor. concrete	-	10500	-	10500	-	-	-	-	-	10500	-	-
Sluices	-	620	-	620	340	340	-	-	-	10	-	-
Lifting devices	-	590	-	300	110	100	-	-	-	50	-	-
Piping for dams (without power houses)	-	2060	-	2060	-	-	-	-	-	-	2060	-
Gates	-	440	-	-	-	-	-	-	-	-	-	-
Irrigation-Sluices	-	910	-	910	500	500	-	-	-	20	-	-
Total	-	15120	-	14390	950	940	-	-	-	10300	2060	-

Transport Equipment

	Demand		Production		Struc-	Sheets Strips		Sheet	Tubes	Bars Rods	Forgings	Remarks
	Pcs.	Tons	Pcs.	Tons	turals	Hot Rolled	Cold Rolled	Coated		Blooms		
Cars	46000	-	43300	-	1738	-	17320	-	216	1773	1	-
Vannettes, Station wagons	16000	-	13400	-	429	-	1288	-	66	536	268	-
Buses, Minibuses	2900	-	2800	-	168	1680	4200	220	-	700	280	-
Trucks	4200	-	3200	-	320	1600	3200	160	-	480	128	-
Tractors	6250	-	6000	-	-	-	-	-	-	-	-	SKD
Motorcycles, scooters,	68000	-	34000	-	-	34	272	-	68	-	204	-
Bicycles	130000	-	15000	-	-	15	30	-	30	90	120	-
Autom. diesel engines	12000	-	4900	-	39	122	-	-	15	40	35	-
Autom. petrol enimges	-	-	-	-	-	-	-	-	-	-	-	-
Stationary diesel engines	12300	-	1200	-	14	33	-	-	5	18	14	-
Trailers	3200	-	2800	-	1680	840	-	-	10	112	140	-
Tillers incl. accessory	2900	-	2320	-	12	46	-	-	-	23	-	SKD
Automobile ancillaries	-	-	-	-	-	-	-	-	-	-	-	-
					4480	4370	29310	380	410	3800	1405	

Metal Products

	Demand		Production		Struc-turals	Sheets Strips		Steel Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Wire nails	-	11300	-	11200	-	-	-	-	11980	-	-	-
Arc welding electrodes	-	14000	-	12000	-	-	-	-	9750	-	-	-
Blank bolts, nuts, rivets, washers	-	21400	-	12000	-	1370	-	-	2800	9510	-	-
Bright bolts, nuts and washers	-	1350	-	180	-	-	-	-	20	430	-	-
Expanded metal(sheets)	-	550	-	400	-	-	440	-	-	-	-	-
Barbed wire	-	2900	-	1800	-	-	-	-	1960	-	-	-
Other products made of wire	-	12800	-	12000	-	-	-	-	13500	-	-	-
Radiators for central heating (made of steel sheets)	-	5000	-	4800	-	-	5110	-	-	570	-	without valves
Steel containers	-	12000	-	12000	1530	-	6150	6610	310	760	-	-
Tin cans for food industry	-	13320	-	13320	-	-	-	17580	-	-	-	-
Tin cans for other industries	-	9840	-	9840	-	-	-	12990	-	-	-	-
Gas cylinders	290000	-	280000	3080	-	-	4060	-	-	230	-	without pressure regulators
Fire extinguishers	55000	-	32000	352	-	-	420	-	-	50	110	without valves
Gas cookers	250000	-	250000	-	1250*	-	10800	-	-	500	-	*mostly thin walled profiles
Kerosene space heaters	300000	-	300000	-	1300*	-	12000	-	-	600	-	*mostly thin walled profiles

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	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	Tons	pcs.	Tons		Hot Rolled	Cold Rolled					
Kerosene and gas water heaters	52000	-	48000	-	240	-	480	1920	-	-	240	
Tanks incl. covers	-	18200	-	16200	2200	9600	5800	600	-	-	180	without valves
Steel furniture	-	18000	-	18500	8800*	470	3860	1540	180	330	6120 *	mostly thin walled profile
Tinsmiths hoardware	-	9600	-	7200	-	-	-	8160	-	-	-	
Total					15320	11440	48310	49400	40500	12000	6950	

Agricultural and industrial machinery and equipment (SEC(1972/3)

	Demand		Production		Struc-turals	Sheets, strip, ...		Steel coated	Wires	Bars, rods, ...	Tubes	Metal
	pcs.	tons	pcs.	tons		hot rolled	cold rolled					
Agricultural implements	-	19600	-	10200	2300	1050	700	600	110	182	320	
Tea processing machines	275	80	264	68	5	10	-	2		8	3	
Shelves				1000	3200	750	1400	450		900	4800	-
Building and road const. machines					160	110	120	-	12	50	13	-
Weighing machinery					3	9	-	-	-	4	-	-
Cranes and other material			-	350	120	20	-	-	2	30	2	-
Passenger and ind. lifts	240	-	20	-	10	4	3	10	2	1	1	-
Wood working machines	875	-	600	-	20	42	-	-	-	81	-	-
Power driven pumps	10840	-	8000	-	-	-	-	-	-	120	280	-
Deep well pumps	1700	-	1400	6	-	-	-	-	-	210	140	-
Textile machinery	4070	-	1150	-	80	300	-	-	50	110	50	-
Machinery for food industry	-	4770	-	1170	150	390	12	4	-	50	60	-
Cement machinery	-	15800	-	540	80	200	10	4	-	30	45	-
Equipment for			-	5000	370	2000	700	-	-	650	190	-
Heavy plates and vessels work.			1000	1000	32	880	10	-	-	10	150	-
Machine tools	4130	-	1240	-	20	60	5	-	4	330	14	-
Hand tools				3090	-	800	-	-	-	100	-	-
and scrapers			150		15	75	30	-	-	6	-	-
Technological piping			-	12400	-	-	-	-	-	-	12600	-
Road rollers			30		5	140	-	-	-	10	2	-
Total					6560	6750	2990	1070	190	5390	18450	-

[illegible]													
[illegible]													
[illegible]rgmann pipes 1000 m	[illegible]	-	1200	-	-	-	-	3[illegible]	-	-	-	-	
[illegible] sets	140000	-	140000	-	-	-		-	-		-		
Refrigerators and disp. cases	193000	-	192000	-	-	-	[illegible]	-	2[illegible]	[illegible]	[illegible]		
[illegible]dio sets incl. radiogram			200000	-	-	-	[illegible]	-	[illegible]	1	-		
Drinking water coolers	3800		3800	-	-	-	-	[illegible]	-	[illegible]	14		
[illegible]ectric meters	240000		230000	-	-	-	[illegible]	-	6[illegible]	-	-		
[illegible]sert coolers	[illegible]5000	-	[illegible]5000	-	11[illegible]	-	-	[illegible]	30	-	34[illegible]		
Electric washing machines	30000		30000	-	-	-	[illegible]	-	-	[illegible]	[illegible]		
Electric fans	210000		190000	-	-	-	[illegible]	-	[illegible]	[illegible]	[illegible]	without dynam sheets	
[illegible]ectric transformers 1000 kVA			1000	-	380	490	-*	-	-	36	325	*transfo mer she are not given h	
Electric meters			5000	-		-	10*	-	-	20	-	*without dynam sheets	
Switch and control gears				1500	100	50	355	80	-	80	70	-	
Air-conditioners	12000		3500		36	-	70	210	-	28	20	-	
Total					650	540	9500	6510	410	660	980		

		Rails	Struc-turals	Sheets strips			Wires	Bars Rods Blooms	Pipes Tubes	Remarks
				Hot Rolled	Cold Rolled	Coated				
.	Railway	39120	400	50	10	-	3020	220	80	
.1	Construction of Buildings	-	682000*	165880	13180	37320	11720	36600	30200	* partly t[illegible] walled [illegible] files
.2	Other construction Activities	-	91200	14860	3200	2800	4400	12360	165400	
.3	Dams and Irrigation	-	950	940	-	-	-	10580	2060	
.1	Transport Equipment	-	4400*	4370	29310	380	410	3800	1405	* partly t[illegible] walled [illegible] files
.2	Repairs of Transport Equipment	-	420*	2860	2930	30	50	380	145	
.1	Metal Products	-	15320*	11440	48310	49400	40500	12980	6950	* [illegible]
.2	Repairs and items not covered	880	3880	2860	9560	9500	8100	5250*	2400	
.1	Agricultural and Industrial machinery	-	6580	6750	2790	1070	180	6390	18950	
.2	Repairs and items not covered	-	2100	1350	930	260	100	2180	6100	
.1	Electrical Equipment	-	650	540	9500	6510	410	660	980	
2	Repairs and items not covered	-	300	100	2030	450	110	200	330	
	Total	40000	808000	212000	920000	108000	69000	91000 55000	235000	

Total consumption of steel (without steel castings) 1655000 tons.

In structurals are included thin walled profiles which will be made of imported cold rolled sheets and strips - see.Thin Walled Profiles.

Structurals= total demand	[illegible]	tons
Thin walled profile - demand	130000	"
- production	130000	"

Consumption of cold rolled sheets and strips for the production of thin walled profiles 145000 tons

Structurals other than thin walled 678000 tons

In pipes and tubes are given imported seamless pipes and tubes as well as welded pipes, made of hot or cold rolled sheets and strips.

Tubes and pipes - total demand	235000 tons
Seamless tubes and pipes - demand	45000 "
Welded pipes and tubes - total demand	190000 "
From these imported welded pipes and tubes	[illegible] "
Consumption of hot rolled sheets	[illegible] "
Consumption of cold rolled sheets	[illegible] "

Final Recapitulation of Demand

Rails	[illegible] tons
Structurals	[illegible] "
Hot rolled sheets, strips	[illegible] "
Cold rolled sheets, strips	[illegible] "
Coated sheets and strips	[illegible] "
Wires	[illegible] "
Bars, rods, blooms	[illegible] "
Seamless pipes	[illegible] "
Welded pipes (imported)	[illegible] "
Total demand	[illegible] tons

Production and total apparent consumption compared with forecasted demand

		Imports		Production	Total Apparent Consumption	Forecasted Demand
		Ordinary steel	Alloy steel			
Rails	tons	9642	-	5000	14642	40000
Structurals	tons	377643	-	250000	627643	678000
Bars, rods	tons	26297	8496	60000	94793	91000
Plates	tons	45015	1260	24000	70283	69000
Flat products	tons	598182	7326	110000	715808	702000
Pipes, tubes and fittings	tons	63367	-	165000	228367	235000

The difference between total apparent consumption and forecasted consumption of rails is due to the big stock of rails from the year 1349(1950/1) - the import of rails was 81159 tons. In other groups the differences are max. + 8%, min. - 2.5%

[illegible] OF STEEL CONSUMPTION

1356(1977/8)

Railway

	Demand		Production		Rails	Structurals	Sheet strips		Sheet coated	Tires	[illegible]		
	pcs.	tons	pcs.	tons			Hot rolled	Cold rolled					
Rails	-	43200	-	43200	43200	-	-	-	-	-	-	-	-
Steel Sleepers	190000	11780	-	-	-	-	-	-	-	-	-	-	-
Concrete Sleepers	345000	87975	345000	87975	-	-	-	-	-	3500	-	-	-
Sleeper-screws	-	3837	-	3837	-	-	-	-	-	-	4620	-	-
Screws	-	2100	-	2100	-	-	-	-	-	-	[illegible]	-	-
Bed plates	-	14875	-	-	-	-	-	-	-	-	-	-	-
Rail anchoring device	-	3625	-	-	-	-	-	-	-	-	-	-	-
Rings	-	875	-	-	-	-	1770	-	-	-	-	-	-
Switches, frogs, cross points	-	1900	-	-	-	-	-	-	-	-	-	-	-
Wheel sets, wheel centres axles	-	1800	-	-	-	-	-	-	-	-	-	-	-
Wagons	480	13440	100	2800	-	300	1300	10	-	-	[illegible]	[illegible]	
Cranes	32	640	-	-	-	-	-	-	-	-	-	-	-
Locomotives	28	2240	-	-	-	-	-	-	-	-	-	-	-
Signalling and safety devices	-	9360	-	2000	-	1200	150	20	-	100	-	60	-
Trolley poles reinf. concrete	1000	1700	1000	1700	-	-	-	-	-	100	-	-	-
Electric poles (steel structure)	420	325	420	325	-	320	50	-	-	-	55	-	-
Supporting tubes	-	100	-	-	-	-	-	-	-	-	-	400	-
Total		199112		144197	43200	2220	3270	30	-	3870	7170	280	

1[illegible] (1977/8)

Construction of buildings

	Demand		Production		Structurals	Sheets Strips Hot Rolled	Sheets Strips Cold Rolled	Sheet Coated	Wires	Bars Rods Blooms	Tubes	Remarks
	pcs.	Tons	pcs.	Tons								
New Private Construction												
Dwelling Houses												
Kiln bricks and steel	-	523864	-	523854	419083	104771	-	-	-	-	-	-
Reinforced concrete	-	46427	-	46427		-	-	-	9327	37100	-	-
Stone and wood or steel	-	1271	-	1271	1271	-	-	-	-	-	-	-
Prefabricated elements	-	15472	-	15472	-	-	-	-	3072	12400	-	-
Others	-	22979	-	22979	18400	4579	-	-	-	-	-	-
Const. Industry and Trade												
Kiln bricks and steel	-	150390	-	150390	120000	30390	-	-	-	-	-	-
Reinforced concrete	-	7400	-	7400	-	-	-	-	1500	5900	-	-
Prefabricated elements	-	3200	-	3200	-	-	-	-	700	2500	-	-
Others	-	1404	-	1404	1053	351	-	-	-	-	-	-
New Public Construction												
Housing and City Building												
Kiln bricks and steel	-	206220	-	206220	164976	41244	-	-	-	-	-	-
Reinforced concrete	-	21508	-	21508	-	-	-	-	4408	17100	-	-
Prefabricated elements	-	10272	-	10272	-	-	-	-	2572	7700	-	-
Others	-	5027	-	5027	3800	1227	-	-	-	-	-	-
Industry												
Kiln bricks and steel	-	365228	-	365228	273921	91307	-	-	-	-	-	-
Reinforced concrete	-	14834	-	14834	-	-	-	-	2934	12000	-	-
Prefabricated elements	-	6080	-	6080	-	-	-	-	1280	4800	-	-
Other	-	2256	-	2256	1692	564	-	-	-	-	-	-

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	Demand		Production		Struc-turals	Sheets Strips		Sheet	Wires	Bars Rods Blooms	[illegible]	Remarks
	pcs.	Tons	pcs.	Tons		Hot Rolled	Cold Rolled	Coated				
Repairs	-		-	17078	9804	2567	-	-	2207	2500	-	-
Subtotal	-	1430000	-	1430000	1014000	288000	-	-	28000	102000	-	-
Steel doors and windows, shutter doors	-	165000	-	165000	140000*	5680	13200	20300	-	3250	-	*mostly thin walled profiles
Gas, cold and hot water installations*	-	52000	-	52000	1300	2500	-	-	-	-	48200	*without technological installations fittings
Tinsmith's hardware (eaves, roofing etc)	-	40000	-	40000	-	-	-	40000	-	2400	-	
Railings, steel ornaments on facade etc.	-	64000	-	64000	40000*	2080	3650	4140	2500	3820	4500	mostly thin walled profiles
Total	-	1781000	-	1781000	1201300	288830	23850	65000	30000	110970	52700	
Other Construction Activities												
Agricultural Construction (incl. irrigation)	-	195000	-	195000	120000	15000	-	-	3500	14000	42000	
Cement consuming industry Concrete poles, pipes etc.	-	13000	-	13000	-	-	-	-	4500	9000	-	
Construction of Communication (roads, bridges, harbours airfields etc.)	-	180000	-	180000	123000	20400	9400	8000	4200	9400	10800	
Electric transmission towers incl. micro-wave towers	-	18000	-	18000	19000	540	-	-	-	1440	-	

	Demand		Production		Struc turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	
	pcs.	Tons	pcs.	tons		Hot Rolled	Cold Rolled					
Rubber mains, gas and oil distribution	-	250000	-	250000	-	-	-	-	-	-	250000	
TOTAL					262600	41940	9600	8400	12200	36540	302800	

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Dams and Irrigation

	Demand		Production		Structurals	Sheets, strips		Sheet Coated	Wires	Bars, rods, blooms	Tubes, tubes	Remarks
	pcs.	tons	pcs	tons		Hot rolled	Cold rolled					
Steel for reinfor. concrete	-	13500	-	13500	-	-	-	-	-	13500	-	-
Sluices	-	840	-	840	440	440	-	-	-	20	-	-
Lifting devices	-	810	-	600	220	200	-	-	-	180	-	150
Piping for dams (without power houses	-	2620	-	2620	-	-	-	-	-	-	2620	-
Gates	-	600	-	-	-	-	-	-	-	-	-	-
Irrigation-Sluices	-	1370	-	1370	770	760	-	-	-	40	-	-
-Piping (without pumps)	-	4500	-	4500	-	-	-	-	-	-	4500	-
Total	-	24250	-	23430	1430	1420	-	-	-	13880	7120	150

Transport Equipment

	demand		production									
	pcs.	tons	pcs.	tons	tons							
Cars	96000	-	90000	-	-			-				-
Vannettes	23800	-	21400	-	-			-				-
Buses and Minibuses	4100	-	4100	-				-				-
Trucks	9800	-	7800	-				-				-
Motorcycles, scooters,	140000	-	85000	-	-			-				-
Bicycles	100000	-		-	-			-				-
Tractors	8700	-	8000	-				-				-
Trailers incl. accessory	3200	-	2700	-	19		-	-	-			-
Stationary diesel engines	11520	-	6100	-			-	-				-
Autom. diesel engines	17000	-	9800	-			-	-				-
Autom. petrol engines	259800	-	65000	-	-			-				-
Automobile accessories		-	5000	-	-				-			-
Trailers	5600	-	5300	-			-	-	-			-
Total					5300	22900		890	1340	12100	4420	

Metal Products

	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Tires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Wire nails	-	14300	-	14300	-	-	-	-	15200	-	-	-
Arc welding electrodes	-	24500	-	23000	-	-	-	-	19000	-	-	-
Barbed wire	-	5200	-	4900	-	-	-	-	5140	-	-	-
Other products made of wire	-	23000	-	23000	-	-	-	-	25000	-	-	-
Black bolts, nuts, rivets, washers	-	36000	-	23000	-	2630	-	-	5370	18200	-	-
Bright bolts, nuts, rivets washers	-	2650	-	1200	-	-	-	-	140	2860	-	-
Expanded metal (sheets)	-	1000	-	900	-	-	980	-	-	-	-	-
Radiators for central heating (made of steel sheets)	-	9000	-	9000	-	-	10000	-	-	1080	-	without valves
Bath tubes made of steel sheets	24000	-	24000	-	-	-	860	-	-	-	-	
Toilets, basins for showers, dishes etc. made of steel sheets	30000	-	30000	-	-	-	560	-	-	-	-	
Steel containers	-	17000	-	17000	2230	-	6000	9800	480	1200	-	
Tin cans for food industry	-	29700	-	29700	-	-	-	38500	-	-	-	
Tin cans for other industries	-	17000	-	17000	-	-	-	23700	-	-	-	
Gas cylinders	440000	-	440000	4850	-	-	6370	-	-	300	-	without pressure regulators

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	Demand		Production		Struc-turals	Sheets strips Hot rolled	Sheets strips Cold rolled	Sheet Coated	Tires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.									
Fire extinguishers	95000	-	48000	328	-	-	630	-	-	70	160	Without Valves
Gas cookers	340000	-	320000	-	1600*	-	12800	-	-	640	-*	mostly thin walled profiles
Kerosene space heaters	400000	-	400000	-	1730*	-	16000	-	-	800	-*	mostly thin walled profiles
Kerosene and gas water heaters	65000	-	65000	-	330	-	650	2600	-	-	320	without valves
Tanks incl. towers	-	36000	-	35000	4750	20700	12700	1300	-	-	400	without valves
Steel furniture	42500	-	42000	-	20000*	1000	8700	3600	410	730	14600*	mostly
Tinsmith's hardware	-	18400	-	18000	-	-	-	19800	-	-	-	thin walled profiles
Total					30640	24330	77380	100100	70710	25820	15480	

Agricultural and industrial machinery and equipment

	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Tires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Agricultural machinery and equipment	-	20400	-	21000	4000	2500	1700	1350	240	4200	680	
Tea processing machines	300	115	295	105	10	20	-	5	-	20	10	
Machin. and equipment for food industry (incl. spare parts)	-	5700	-	3300	600	1250	80	140	40	380	470	
Spare parts for mining	-	2000	-	900	140	120	20	15	30	130	80	
Textile machinery and equipment	4000	-	2400	-	70	180	40	60	30	550	30	
Machinery and equipment for cement factories (incl. spare parts)	-	10700	-	5400	1500	2800	290	40	40	620	280	
Machinery and equipment for brick factories (incl. spare parts)	-	12000	-	6000	1200	650	50	30	20	1150	50	
Forged grinding balls	-	4000	-	3000	-	-	-	-	-	3330	-	
Equipment for chem. Industry (incl. spare parts)			-	20000	2000	12000	4000	20	-	4320	1120	
Machines for rubber and plastic industry			200	-	60	200	20	20	-	130	20	
Spare parts for basic metal industries	-	30000	-	20000	3200	5400	600	150	300	4200	1300	
Machine tools	7400	-	5710	-	180	320	30	-	20	1630	80	
Food working machines	1000	-	1000	-	30	70	-	-	-	90	-	
Road rollers	370	-	300	-	50	2100	-	-	-	100	10	
Dumpers and scrapers			300	-	30	150	60	-	-	10	-	
Building and road const. machines			-	1500	320	200	240	-	20	80	10	

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	Demand		Production		Struc-	Sheets Strips		Sheet	Wires	Bars	Pipes	
	pcs.	tons	pcs.	tons	turals	Hot Rolled	Cold Rolled	Coated		Rods Blooms	Tubes	
Industrial boilers			-	7500	430	1200	-	-	-	70	1170	
Technological pipings			-	25000	140	100	-	-	-	60	25100	
Valves and fittings	-	12400	-	6200	-	120	-	-	-	300	-	
Air compressors			1000	-	-	60	-	-	-	40	40	
Power driven pumps	13170	-	12500	-	-	-	-	-	-	240	780	
deep well pumps	2170	-	2000	-	-	-	-	-	-	320	640	
Passenger and industrial lifts	450	-	100	-	200	80	50	40	40	20	10	
Cranes and other material handling		6500	-	4500	1650	930	320	-	-	320	450	
Weighing machinets	-	600	-	420	70	200	50	-	-	210	-	
Shelves etc.	-	17400	-	17000	5300	1300	2000	750	-	1400	8200	
Tools, special tools etc.				8000	-	1200	400	-	-	8000	200	
Total					22760	34030	10750	2620	830	32280	40360	

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Electrical Equipment

	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Bergmann pipes 1000 m	4400	-	4400	-	-	-	-	410	-	-	-	-
TV sets	210000	-	210000	-	-	-	-	80	-	10	-	-
Refrigerators and	250000	-	250000	-	-	-	10000	-	300	376	600	-
Radio sets	300000	-	300000	-	-	-	75	-	45	6	-	-
Drinking water coolers	6100	-	6100	..	-	-	-	195	-	5	24	Compresser
Electric meters	280000	-	275000	-	-	-	500	-	73	-	-	-
Desert coolers	135000	-	135000	-	170	-	-	8100	72	-	54	
Electric washing machines	63000	-	50000	-	-	-	1250	-	-	82	82	-
Electric fans	300000	-	250000	-	-	-	600*	-	100	375	100	without dynamo sheets
Electric conductors (ACSR)			-	2000	-	-	-	-	1830	-	-	-
Vacuum cleaners	35000	-	25000	-	-	-	150*	-	20	100	75	without dynamo sheets
Electric transformers			1000	-	610	700	*	-	-	110	500	*without transfor-mer sheets
Electric meters			100000	-	-	-	200*	-	-	600	-	*without dynamo sheets
Switch and control gears					330	170	1205	205	-	265	200	-
Air-conditioners	20000		200000	-	300	-	400	1240	-	100	135	-
Total					1430	900	14000	10000	2430	2000	1700	

RECAPITULATION

	Rails	Struc-turals	Sheets Strip			Wires	Bars Rods Blooms	Pipes Tubes	Remarks
			Hot Rolled	Cold Rolled	Coated				
1. Railway	43200	2220	3270	30	-	[illegible]	7470	280	
2.1 Construction of Buildings	-	1301300*	296830	23850	65040	30500	110970	52700	*partly thin walled profiles
2.2 Other construction Activities	-	262800	41940	9600	8400	12200	34540	302880	
2.3 Dams and Irrigation	-	1480	1420	-	-	-	13860	7120	
3.1 Transport Equipment	-	5300*	22900	61200	890	1340	12100	4420	*partly thin walled profiles
3.3 Repairs of Transport Equipment	-	530	13700	7540	90	150	4300	2360	
4.1 Metal Products	-	30640*	24330	77380	100100	70710	25820	15480	*mostly thin walled profiles
4.2 Repairs and items not covered	-	12560	6180	24860	28100	17150	8620	6120	
5.1 Agricultural and Industrial Machinery	-	23760	34030	10750	2620	830	32280	40560	
5.2 Repairs and items not covered	800	8850	8980	2690	800	210	12450	15750	
6.1 Electrical Equipment	-	1430	980	14580	10290	2430	2090	1790	
6.2 Repairs and items not covered	-	360	480	3620	470	610	700	620	
Total	44000	1550000	455000	236000	2[illegible]0	140000	265000	450000	

Total consumption of steel (without steel castings) 3360000 tons

In structurals are included thin walled profiles which will be made of cold rolled sheets and strips-see Thin Walled Profiles.

Structurals - total demand	1500000	tons
Thin walled profiles - demand	240000	"
- production	240000	"
consumption of cold rolled sheets and strips for the production of thin walled profiles	270000	"
Structurals other than thin walled	1310000	"

In pipes and tubes are given seamless pipes and tubes as well as welded pipes, made of hot or cold rolled sheets and strips.

Tubes and pipes - total demand	450000	tons
Seamless tubes and pipes - demand	80000	"
Seamless tubes and pipes - production in Iran	30000	"
Welded pipes and tubes-total demand	370000	"
From these welded pipes and tubes made in Iran	340000	"
imported	30000	"
Consumption of hot rolled sheets for production of pipes and tubes	350000	"
Consumption of cold rolled sheets for production of pipes and tubes	40000	"

<u>Final Recapitulation of Demand</u>

Rails	40000	tons
Structurals	1500000	"
Hot rolled sheets, strips	700000	"
Cold rolled sheets, strips	800000	"
Coated sheets and strips	200000	"
Wires	160000	"

Bars, rods, blooms	465,000	tons
Seamless tubes and pipes	80,000	"
Welded pipes (imported)	30,000	"
Total demand	3,430,000	tons

Recapitulation of Forecasted Demand, Production, Imports and Exports

		Forecasted Demand	Production	Imports	Exports	±
Rails	tons	44,000	5,000	39,000	-	- 39,000
Structurals	tons	1,310,000	1,440,000	20,000	150,000	+ 130,000
Bars, rods, blooms wires	tons	265,000	460,000	40,000	235,000	+ 195,000*
Flat products	tons	1,560,000	1,152,000	1,408,000	-	-1,408,000
Seamless tubes and pipes	tons	80,000	30,000	50,000	-	- 50,000
Welded pipes	tons	370,000	340,000	50,000	20,000	- 30,000

* Part of this quantity will be used for production of drawn wire.

FORECAST OF ORDINARY STEEL CONSUMPTION

1361(1982/3)

Railway

	Demand		Production		Rails	Structurals	Sheet strips		Sheet	Wires	Bars	Tubes	
	pcs.	tons	pcs.	tons			Hot Rolled	Cold Rolled	Coated		Rods Blooms		
Rails	-	49,320	-	49,320	49,320	-	-	-	-	-	-	-	-
Steel sleepers	230,000	14,260	230,000	14,260	-	15,690	-	-	-	-	-	-	*Special profiles
Concrete sleepers	450,000	114,750	450,000	114,750	-	-	-	-	-	4,680	-	-	-
Sleeper -screws	-	4,287	-	4,287	-	-	-	-	-	-	5,160	-	-
[illegible]	-	2,340	-	2,340	-	-	-	-	-	-	2,820	-	-
[illegible]lates	-	16,573	-	16,573	-	18,230*	-	-	-	-	-	-	*Special profiles
[illegible] anchoring device	-	2,925	-	2,925	-	3,210*	-	-	-	-	-	-	*Special profiles
Bolts	-	975	-	975	-	-	1,930	-	-	-	-	-	-
Switches, frogs, crossings, points	-	2,000	-	-	-	-	-	-	-	-	-	-	-
Wheel sets, wheel centres axless wheel tyres	-	2,700	-	-	-	-	-	-	-	-	-	-	-
Wagons	680	19,040	480	12,480	-	2,260	5,860	30	-	-	1,020	100	-
Coaches	43	860	-	-	-	-	-	-	-	-	-	-	-
Locomotives	38	3,040	-	-	-	-	-	-	-	-	-	-	-
Troley poles reinf. concrete	2,400	2,640	2,400	-	-	-	-	-	-	140	-	-	-
Electric poles (steel structure)	630	788	630	788	-	- 800	40	-	-	-	40	-	-
Supporting tubes	-	270	-	270	-	-	-	-	-	-	-	280	-
Signalling and safety devices	-	11,300	-	4,500	-	3,100	400	30	-	600	-	120	-
Total		217,070		226,230	49,320	43,290	8,250	60	-	5,420	9,040	500	-

Construction of Buildings

	Demand		Production		Structurals	Sheet strips		Sheet Coated	Wires	Bars Rods Blooms	Tubes Pipes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
New Private Construction												
Dwelling Houses												
Kiln bricks and steel	-	1,052,845	-	1,052,845	842,280	210,565	-	-	-	-	-	-
Reinforced concrete	-	104,922	-	104,922	-	-	-	-	20,922	84,000	-	-
Stone and wood or steel	-	1,307	-	1,307	1,307	-	-	-	-	-	-	-
Prefabricated elements	-	43,163	-	43,163	-	-	-	-	8,663	34,500	-	-
Others	-	29,280	-	29,280	23,430	5,850	-	-	-	-	-	-
Constr. Industry and Trade												
Kiln bricks and steel	-	265,650	-	265,650	199,240	66,410	-	-	-	-	-	-
Reinforced concrete	-	22,528	-	22,528	-	-	-	-	4,528	18,000	-	-
Prefabricated elements	-	9,438	-	9,438	-	-	-	-	1,938	7,500	-	-
Others	-	2,717	-	2,717	2,038	679	-	-	-	-	-	-
New Public Construction												
Housing and City Building												
Kiln bricks and steel	-	358,200	-	358,200	286,560	71,640	-	-	-	-	-	-
Reinforced concrete	-	61,400	-	61,400	-	-	-	-	12,400	49,000	-	-
Reinforced elements	-	25,347	-	25,347	-	-	-	-	5,047	20,300	-	-
Others	-	9,948	-	9,948	7,958	1,990	-	-	-	-	-	-
Industry												
Kiln bricks and steel	-	675,010	-	675,010	506,257	168,753	-	-	-	-	-	-
Reinforced concrete	-	37,660	-	37,660	-	-	-	-	7,660	30,000	-	-
Prefabricated elements	-	17,180	-	17,180	-	-	-	-	3,380	13,800	-	-
Other	-	4,680	-	4,680	3,510	1,170	-	-	-	-	-	-

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	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Repairs	-	28,725	-	28,725	17,420	4,943	-	-	462	5,[illegible]	-	-
Subtotal	-	2,750,000	-	2,750,000	1,890,000	53,200	-	-	65,000	263,[illegible]	-	
Steel doors and windows, shutter doors	-	250,000	-	250,000	212,000*	8,600	27,500	30,500	-	3,700	-	*mostly thin walled [illegible] profiles
Gas, cold and hot water installations*	-	90,000	-	90,000	2,400	4,600	-	-	-	-	83,000	* without technological installation
Tinsmith's hardware (eaves, roofing etc.)	-	62,000	-	62,000	-	-	-	62,000	-	3,700	-	
Railings, steel ornaments on facade etc.	-	98,000	-	98,000	65,600*	4,800	8,500	7,500	3,000	4,600	7,000*	*mostly thin walled profile
Total	-	3,250,000	-	3,220,000	2,170,000	550,000	36,000	100,000	70,000	277,000	90,000	
Other Construction Activities												
Agricultural construction (incl. irrigation)	-	370,000	-	370,000	230,000	28,000	-	-	7,000	25,000	80,000	
Cement consuming industry concrete poles, pipes etc.	-	25,000	-	25,000	-	-	-	-	8,000	17,000	-	
Construction of communication (roads, bridges, harbours, airfields etc.)	-	280,000	-	280,000	180,000	38,000	14,000	12,000	6,000	14,000	16,000	
Electric transmission towers incl. micro-wave towers	-	21,000	-	21,000	23,000	1,000	-	-	-	2,000	-	
Water mains, gas and oil distribution	-	400,000	-	400,000	-	-*	-	-	-	-	320,000	
Total	-	1,096,000	-	1,096,000	433,000	67,000	14,000	12,000	21,000	58,000	416,000	

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Dams and Irrigation

	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Steel for reinfor. concrete	-	16,200	-	16,200	-	-	-	-	-	16,200	-	-
Sluices	-	1,050	-	1,050	580	580	-	-	-	20	-	-
Lifting devices	-	1,010	-	1,010	400	350	-	-	-	160	-	-
Piping for dams(without power house)	-	3,270	-	3,270	-	-	-	-	-	-	3,270	-
Gates	-	810	-	-	-	-	-	-	-	-	-	-
Irrigation - sluices	-	2,060	-	2,060	1,130	1,120	-	-	-	60	-	-
- piping (without pumps)	-	5,300	-	5,300	-	-	-	-	-	-	5,300	-
Total	-	29,700	-	28,890	2,110	2,050	-	-	-	16,440	8,570	-

Transport Equipment

	Demand		Production		Struc-	Sheets Strips		Sheet	Tires	Bars Rods Blooms	Tubes Tubes	Spare
	pcs.	tons	pcs.	tons	turals	Hot Rolled	Cold Rolled	Coated				
Cars	-	-	150,000	-	-	7,500	600,000	-	750	9,000	600	-
Vannettes	-	-	32,000	-	-	1,280	10,240	-	128	1,440	600	-
Buses and minibuses	-	-	4,800	-	384	3,120	7,200	480	-	1,530	624	-
Trucks	-	-	13,000	-	1,560	6,500	13,000	650	-	1,950	520	-
Motorcycle, scooters	190,000	-	170,000	-	-	1,700	4,250	-	510	850	1,020	-
Bicycles	290,000	-	290,000	-	-	290	580	-	580	2,320	2,320	-
Tractors	11,100	-	10,500	-	630	3,150	1,260	-	50	840	420	-
Tillers	3,350	-	3,100	-	36	62	50	-	-	110	16	-
Stationary diesel engines	17,400	-	9,600	-	200	288	-	-	40	150	120	-
Automative diesel eng.			25,300	-	170	2,720	-	-	52	170	80	-
Automative petrol eng.			90,000	-	-	-	240	-	-	3,600	-	-
Automobile ancillaries					-	8,100	760	970	-	310	190	-
Trailers			7,500	-	7,500	3,000	-	-	-	150	-	-
Total					10,480	37,710	97,580	2,100	2,110	22,480	7,010	

Metal Products

	Demand		Production		Struc turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Wire nails	-	16,500	-	16,500	-	-	-	-	17,600	-	-	-
Arc welding electrodes	-	37,000	-	36,500	-	-	-	-	30,000	-	-	-
Barbed wire	-	8,800	-	8,500	-	-	-	-	9,100	-	-	
Other products made of wire	-	39,000	-	39,000	-	-	-	-	11,000	-	-	
Black bolts, nuts, rivets, washers	-	57,000	-	48,000	-	5,500	-	-	11,200	37,800	-	
Bright bolts, nuts, rivets, washers	-	4,700	-	3,400	-	-	-	-	400	8,100	-	
Expanded metal(sheets)	-	1,800	-	1,700	-	-	1,850	-	-	-	-	
Radiators for central heating (made of steel sheets)	-	17,500	-	17,500	-	-	18,800	-	-	1,970	-	without valves
Bath tubs made of steel sheets	62,000	-	60,000	-	-	-	2,140	-	-	-	-	
Toilets, basins for showers dishes etc.made of steel sheets	68,000	-	64,000	-	-	-	990	-	-	-	-	
Steel containers	-	24,000	-	24,000	3,040	-	9,500	13,600	620	1,300	-	
Tin cans for food industry	-	46,800	-	46,800	-	-	-	82,200	-	-	-	
Tin cans for other industries	-	24,750	-	24,750	-	-	-	32,700	-	-	-	
Gas cylinders	530,000	-	530,000	5,830	-	-	7,700	-	-	430	-	without pressure regulators
Fire extingwishers	150,000	-	70,000	770	-	-	920	-	-	100	230	without valves
Gas cookers	120,000	-	120,000	-	2,100*	-	15,800	-	-	860	-	*mostly thin walled profiles

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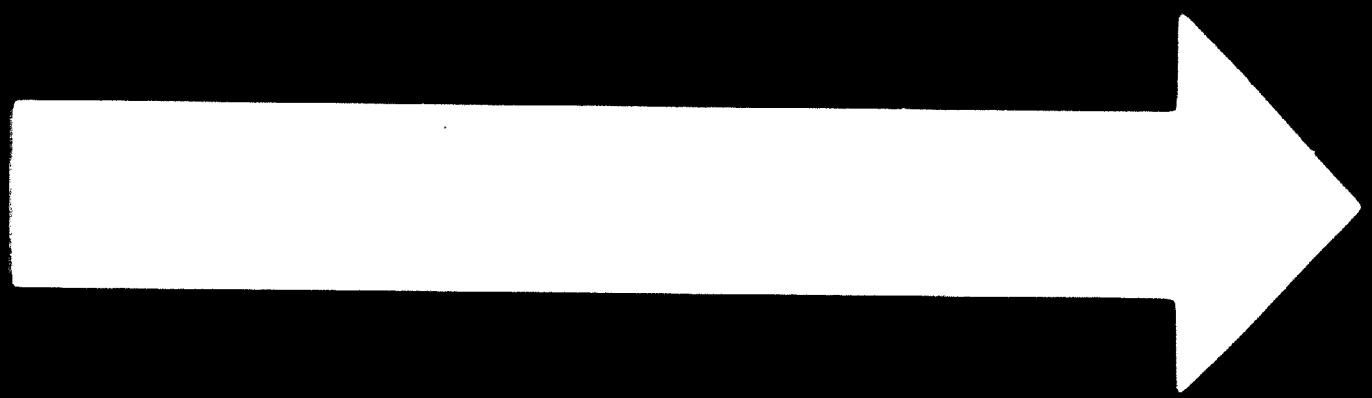

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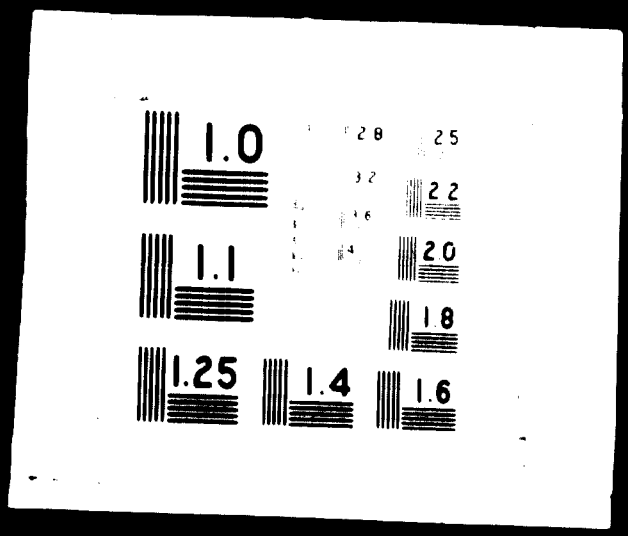

	Demand		Production		Struc-turals	Sheets Strips		Sheet Coated	Wires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Kerosene space heaters	470,000	-	470,000	-	2,030*	-	18,800	-	-	940	-	*mostly thin walled profiles
Kerosene and gas water heaters	80,000	-	80,000	-	400	-	800	3,200	-	-	390	
Tanks incl. towers	-	60,000	-	60,000	8,130	35,500	21,800	2,300	-	-	680	
Steel furniture incl. etc.	-	78,000	-	75,000	35,700*	1,800	15,300	6,400	730	1,300	26,000	
Tinsmith's hardware	-	32,200	-	32,000	-	-	-	35,200	-	-	-	
Water meters	100,000	-	100,000	-	-	-	-	-	-	80	-	
Total					51,400	42,800	114,400	155,600	110,650	53,080	27,300	

Agricultural and Industrial Machinery and Equipment

	Demand		Production		Structurals	Sheets Strips		Sheet Coated	Tires	Bars Rods Blooms	Pipes Tubes	Remarks
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Agricultural machinery and equipment	-	41,200	-	33,500	7,400	3,800	2,600	2,050	370	6,400	1,050	
Tea processing machines	260	125	225	115	10	30	-	10	-	30	10	
Machinery and equipment for food industry (incl. spare parts)	-	6,600	-	4,820	1,400	2,300	120	220	60	540	620	
Spare parts for mining	-	5,100	-	2,700	420	360	60	40	90	390	240	
Textile machinery and equipment	5,750	-	4,600	-	1,400	2,300	120	220	60	540	620	
Machinery and equipment for cement factories (incl. spare parts)	-	18,100	-	16,200	4,100	8,200	280	310	100	890	880	
Machinery and equipment for brick factories (incl. spare parts)	-	24,000	-	24,000	4,800	2,600	200	120	80	4,600	200	
Forged grinding balls	-	7,100	-	7,000	-	-	-	-	-	7,770	-	
Equipment for chem.industry (incl. spare parts)				37,300	3,750	19,200	7,200	30	-	6,500	1,700	
Machines for rubber and plastic industry			370	-	90	360	30	30	-	180	30	
Spare parts for basic metal industries	-	68,000	-	44,000	7,200	10,800	1,200	300	700	8,400	2,600	
Industrial boilers			-	8,000	860	3,600	-	-	-	240	4,200	
Technological pipings			-	38,000	220	200	-	-	-	120	38,500	
Valves and fittings	-	18,500	-	9,300	-	180	-	-	-	940	-	
Air compressors			3,000	-	-	120	60	-	-	120	80	
Power driven pumps	14,800	-	14,000	-	-	-	-	-	-	280	440	
Deep well pumps	2,700	-	2,600	-	-	-	-	-	-	430	840	

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	Demand		Production		Struc-	Sheets strips		Sheet	Tires	Bars	Tubes	Remarks
	pcs.	tons	pcs.	tons	turals	Hot Rolled	Cold Rolled	Coated		Rods Blooms	Pipes	
Machine tools	11,240	-	9,480	-	360	640	60	-	40	3,300	110	
Wood working machines	2,320	-	2,060	-	60	140	-	-	-	180	-	
Road rollers	540	-	450	-	80	3,200	-	-	-	240	20	
Dumpers and scrapers			450	-	50	230	90	-	-	30	-	
Building and road constr. machines			-	4,500	480	600	740	-	60	240	20	
Passenger and industrial lifts	880	-	800	-	400	180	100	80	80	30	20	
Cranes and other material handling	-	11,000	-	8,800	3,000	1,880	640	-	-	640	900	
Weighing machines	-	950	-	840	140	400	100	-	-	420	-	
Shelves etc.		26,000	-	25,000	8,900	1,900	3,000	1,080	-	2,100	12,300	
Tools, special tools, etc.			-	16,000	-	2,400	800	-	-	16,000	400	
Total					48,120	65,630	17,400	4,460	1,640	61,590	65,810	

Electrical Equipment

	Demand		Production		Struc-turals	Sheets & Strips		Sheet Coated	Wires	Bars rods Blooms	Pipes Tubes	
	pcs.	tons	pcs.	tons		Hot Rolled	Cold Rolled					
Bergmann pipes 1000m	4,600	-	4,600	-	-	-	-	430	-	-	-	-
TV Sets.	300,000	-	300,000	-	-	-	115	-	-	15	-	-
Refriger. and display cases	305,000	-	305,000	-	-	-	12,390	-	354	945	710	-
Radio sets	400,000	-	400,000	-	-	-	100	-	60	8	-	-
Drinking water coolers	9,200	-	9,200	-	-	-	148	-	-	12	33	-
Electric meters	340,000	-	340,000	-	-	-	677	-	90	-	-	-
Desert coolers	180,000	-	180,000	-	1,500	-	4,460	2,380	96	-	-	-
Electric washing machines	120,000	-	115,000	-	-	-	1,700	-	-	170	180	-
Electric fans	370,000	-	350,000	-	-	-	840	-	140	530	140	-
Electrical conductors (ACSR)			-	3,200	-	-	-	-	2,240	-	-	-
Electric transformers 1000 KVA			2,560	1,010	-	1,520	-	-	-	640	1,200	without transformer sheets
Electric meters			250,000		-	60	600*	-	-	1,250	-	without dynamo sheets
Switch and control gears			-	4,800	700	410	2,900	-	-	750	580	-
Air-conditioners	30,000	-	30,000	-	1,100	-	3,600	670	-	540	65	-
Total					3,300	1,990	27,530	4,080	2,980	4,860	2,900	

RECAPITULATION

	Rails	Structurals	Sheets Strips			Wires	Bars Rods Blooms	Pipes Tubes	Remarks
			Hot Rolled	Cold Rolled	Coated				
1. Railway	49,320	43,290	8,250	60	-	5,420	9,040	500	
2.1 Construction of Buildings	-	2,170,000	550,000	360,000	10,000	70,000	277,000	90,000	
2.2 Other Construction Activities	-	433,000	67,000	14,000	12,000	21,000	58,000	416,000	
2.3 Dams and Irrigation	-	2,110	2,050	-	-	-	16,440	8,570	
3.1 Transport Equipment	-	10,480	37,710	97,380	2,100	2,110	22,420	7,010	
3.2 Repairs of Transport Equipment	-	2,100	22,480	19,520	320	420	7,850	3,680	
4.1 Metal Products	-	51,400	42,800	114,400	155,600	110,650	53,080	27,300	
4.2 Repairs and items not covered	-	24,890	13,230	38,150	47,580	34,380	21,200	12,400	
5.1 Agricultural and Industrial Machinery	-	45,120	65,630	17,400	4,460	1,640	61,550	65,810	
5.2 Repairs and items not covered	680	22,560	17,660	6,220	1,820	490	26,300	24,500	
6.1 Electrical equipment	-	3,300	1,990	27,530	4,080	2,980	4,860	2,990	
6.2 Repairs and items not covered	-	1,650	1,200	9,140	2,040	910	2,060	1,240	
Total	50,000	2,810,000	830,000	380,000	240,000	250,000	560,000	660,000	

Total consumption of steel (without steel castings) 5780000 tons

In structurals are included thin walled profiled which will be made of cold rolled sheets and strips-see Thin Walled Profiles

Structurals - total demand	2,810,000 tons
Thin walled profiles - demand	330,000 "
- production	350,000 "
Consumption of coled rolled sheets and stripe for the production of thin walled profiles	390,000 "
Structurals other than thin walled	2,460,000 "

In pipes and tubes are given seamless pipes and tubes as well as welded pipes made of hot or cold rolled sheets and strips.

Tubes and pipes - total demand	860,000 tons
Seamless tubes and pipes - demand	105,000 "
Seamless tubes and pipes -production in Iran	80,000 "
-imports	25,000 "
Welded pipes and tubes - total demand	555,000 "
from these made in Iran	520,000 "
- imported	35 ,000 "
Consumption of hot rolled sheets for production of pipes and tubes	500,000 "
Consumption of cold rolled sheets for production of pipes and tubes	80,000 "

Final Recapitulation of Demand

Rails	50,000 "
Structurals	2,460,000 "
Hot rolled sheets, strips	1,330,000 "
Cold rolled sheets, strips	850,000 "
Coated sheets and strips	240,000 "
Wires	250,000 "
Bars, rods, blooms	560,000 "
Seamless tubes and pipes	105,000 "

Welded pipes (exported)	35,000 tons
Total demand	5,440,000 "

Recapitulation of forecasted Demand Production, Imports and Exports

		Forecasted Demand	Production	Imports	Exports	+ -
Rails	tons	50,000	55,000	-	5,000	+ 5,000
Structurals	tons	2,460,000	2,520,000	-	60,000	+ 60,000
Bars, rods, blooms	tons	360,000	720,000	-	360,000	+ 360,000*
Wires	tons	250,000	230,000	30,000	10,000	- 20,000
Flat products	tons	2,410,000	2,395,000	13,500	100,000	- 35,000
Seamless tubes and pipes	tons	105,000	80,000	25,000	-	- 25,000
Welded pipes	tons	555,000	520,000	55,000	20,000	- 35,000

* From this quantity 245000 tons will be used for production of 230000 tons of drawn wire

CODE NO. 3113 : PRODUCTION OF CASTINGS OF GREY CAST IRON

The consumption and production of grey iron castings and steel castings in Iran is absolutely as well as relatively low. In countries with advanced mechanical engineering industry the ratio of the consumption of grey iron castings plus steel castings to steel is 1:3 up to 1:5; this ratio in Iran is 1:18 up to 1:20; the reasons why the ratio in Iran is low are:

1. The majority of steel is consumed in construction of dwelling houses or industrial buildings where the consumption of grey iron castings is abnormally low.

2. There is no sewerage system in any Iranian town, therefore the consumption of pipes made of grey iron castings is limited only to vertical sewerage drains in the houses. These sewerage drains are now partly replaced by pipes made of Iranit or Farsit.

3. The production of classical mechanical engineering industry (production of machine tools and other machines, engines, etc) - the main consumer of grey iron castins in other countries is in Iran neglectable. Main components and parts (frames, etc.) made of grey iron castings and steel castings are mostly imported as ready made components.

4. The quality of castings produced in Iran is mostly low, therefore some producers of machines and engines are replacing castins by steel. These components are either made of plain bars or of welded hot rolled steel sheets. These components are either made of plain bars or of welded hot rolled steel sheets. This practice is advan-

tegeoum mainly in production of castings in small lots, where the production of patterns is too expensive.

It is presupposed that the growth rate of consumption as well as production of grey iron castings and steel castings will be in future higher than this one for steel, as

1. The classical mechanical engineering will be substantially enlarged

2. The sewerage system will be built in some towns.

At present there is a large number of small foundries in addition to a few large and medium cale units.

1. Machine va Lulch sazi Iran, Tehran

The biggest existing foundry in Iran, producing pipes, inside dia. 50up to 700mm length upto 5,5m, made of grey iron castings and nodular iron castings by centrifugal casting method (approx. 80 tons/day), fittings for the above mentioned pipes (approx. 10 tons/day) steam boilers for central heating (approx. 5 tons/day) and other grey iron and nodular iron castings (approx. 5 tons/day). Capacity of the plant, i.e. grey iron casting plus nodular iron castings is approx. 30,000 tons/year/one shift, production is approx. 100 tons/day, from this approx. 70 tons/day of nodular iron castings.

Mostly modern machinery and equipment Melting facilities: two cupola ovens, inside dia. 900 mm as well as three electric induction low-frequency furnaces, capacity 5,5 tons each. There are 12 sets of machinery and equipment for centrifugal casting of pipes, good sand preparation unit,

twin-type jolt-squeeze moulding machine, overhead cranes, machine tools for machining of fittings. It is at present the best equipped foundry in Iran.

4.Iran Metal Co. Tehran

Production of pipes upto inside dia. 8" and length upto 3m, made of grey iron castings by centrifugal casting method (approx. 18 tons/day), fittings for the above mentioned pipes (approx. 15 tons/day), and other grey iron castings (3 tons/day). The existing capacity is approx. 18,000 tons/year, the production is approx. 11,000 tons/year. Melting facilities: two electric induction furnaces 700 KVA each and two furnaces 1500 KVA each and one cupola oven (out of operation, as factory is using mostly scrap for their production). Four sets of centrifugal casting machines for pipes, 6 pairs of jolt-squeezer moulding machines, central sand conditioning plant, annealing plant for pipes.
The plant asked for licence for production of enamelled bath tubs and other enamelled sanitary grey iron castings-see Bath Tubs.

5.Zigma Co. Tehran - Sherkate Sanaye Richtegari-Tehran

Factory producing cast iron radiators and steam boilers for central heating. Grey iron foundry is producing components and parts of radiators (2,8 tons/day) of steam boilers (1,4 tons/day) and various castings (approx. 9 tons/day). Capacity is approx. 6000 tons/year, production is approx. 4000 tons/year. Melting facilities: 2 electric induction furnaces a 1 ton.

6.Kuh-e-Chodda Co. Tehran

Foundry producing castings for spare parts, balls for cement plants. Capacity approx. 2000 tons/year, production approx. 1000 tons/year. Melting facilites: one rotary cylinder melting furnace oil fired with preheating of air. Moulding: one

[illegible] automatic machine, 2 moulding machines.

5. [illegible] Co. Tehran

[illegible] iron castings for gas ranges, electrical [illegible] and spare parts. Capacity approx. 2000 tons/year, production approx. 500 tons/year. Melting facility: 1 coal-fired crucible furnaces of 100 kg.

6.Parloola Co. Tehran

Foundry producing grey iron castingsfor spare parts. Capacity approx. 1500 tons year, production approx. 1000 tons/year. Melting facility: electric induction furnace.

7.Repair-shop of State Railways in Tehran

Grey iron foundry, non-ferrous metal foundry and well equipped steel foundry producing spare parts for state railways. Production programme of grey iron foundry: brake shoes (approx. 2400 tons/year) and spare parts (approx. 50 tons/year). Melting facilites in grey iron foundry: two cupola ovens inside dia. 650 mm. Capacity approx. 4000 tons/year production approx. 2400-2500 tons/year.

8.Saeed Sheydaee Factory-Tehran

Foundry producing pipes, parts and fittings for sewage system slunit and mannole ovens, closures etc. made of grey iron castings. Capacity is approx, 1200 tons/year, production approx. 800 tons/year. Melting facility: pit oven with pots, heated by fuel oil.

9.Irio (Iran Foolad) Co. Tehran

Foundry producing grey iron castings for radiators and

boilers for central heating systems, spare parts and various job castings. Capacity approx. 2000 tons/year, production approx. 1200 tons/year. Melting facilities: two cupola ovens, inside dia 600mm; in future there will be installed two induction, low-frequency electric furnaces a' 3,5 tons each.

10.Khosrow Karim Khanze-and Co. Tehran

Foundry producting various job castings, grey iron castings for spare parts etc. Capacity approx. 1000 tons/year, production approx. 800 tons/year, Melting facility: one electric induction furnace.

Small Foundries

There are approx. 150 upto 200 small foundries in Iran at present, producting grey iron castings on small scale. They are employing 2 upto max. 10 workers, in total they employ about 550 workers. Melting facilities: mostly pit ovens with pots, fuel oil heated, exceptionally also cupola ovens: they are mostly without any mechanisation means. The products of these foundries are mostly of low quality. Total productinn of these foundries is approx. 6000 tons/year. Research Centre for Industrial and Trade Development of the Ministry of Economy(Mr. Sohanaki) has prepared review of 69 of these foundries, mostly located in Tehran.

Modern small foundries are built in Industrial Estates. For example Industrial Estates in Ahvaz has one grey iron foundry with capacity approx. 1000 tons/year/two shifts. Melting facility: one oil fired rotary one ton furnace. Max. weight of castings 750 kg. Small, well equipped grey iron foundry shops are built as a part of big plants for production of mechanical and electrical engineering products. They are supplying castings to own factory and the surplus is sold to other customers. Two examples:

[illegible]

The foundry was built four years ago. It is producing components and parts for own factory, as well as for other customers, mainly for Iran Transfo Co. Tehran (gears for transformators and switch boards etc.) Max. weight of casting about 80 kg.

Melting facility: oil fired melting oven, capacity 180 kg. Moulding: one pair of moulding machines with roller conveyor, and preparation: one electric runner mixer. Capacity of foundry shop approx. 140 tons/year, production approx. 120 tons/year.

Arj Co. Tehran

The foundry shop is producing grey iron castings for gas ranges, water heaters, space heaters, refrigerators etc. Max weight of casting about 400 kg.

Melting facility: one oil-fired furnace with a tilting crucible, capacity [illegible] kg. Moulding as well as sand dressing is manual. Production of grey iron foundry shop is approx. 360 tons/year/one shift.

Some small foundries (some times well equipped) are part of repairshops of big factories (for example Chitsazi Tehran, Suggar Plant in Haft Tappeh and some other sugar factories, Fathi Mafg. Co. Tehran etc.).

More details about existing as well as new foundries see "Capacity Study for Foundries and Forges in Iran" prepared by Kovoprojekta - Praha (Polytechna Praha).

New foundries under construction

1. Metallurgical Engineering Plant in Fabriz

grey iron castings for production of machine tools, presses, pumps, electric motors and compressors, capacity 8000 tons/year in the first stage with the possibility for expansion to 15,000 and 30,000 tons/year in the second stage of construction. Cca. 900 tons of castings/year will be sold to other consumers in the first stage of construction.

Modern foundry for castings upto the weight 3000 kg in one piece. Melting facilities: two cupola ovens inside dia. 900mm with forehearth and one electric medium-frequency induction furnace with two crucibles, output 1ton per hour. Central sand conditioning plant with mechanical or pneumatical transportation of sand. Moulding: small moulds produced in big series are produced on four pairs of moulding machines combined with roller conveyors; big moulds in pit with the help of sand-slinger. Used sand is washed and reclamated in sand washing and reclamation Plant. Heat treatment: car-type annealing furnace 2.5 x 4m.
The production started in 1351(1972) and reached at the beginning of the year 1352(1973) 30% of the projected capacity. The quality of castings is very good.

2. Machine Building Plant-Arak

Foundry for production of grey iron castings for conveyors, industrial and package boilers, cranes etc. Capacity of this section of foundry is 2500 tons/year. Melting facility: 1 electric induction medium-frequency furnace with 2 crucibles, capacity 2,5 tons each. Moulding: 2 pairs of moulding machines with roller conveyors. Central sand dressing plant

c nstalla of vacuum sorting equipment for new sand and conditioning plant for return sands.

Heat treatm of castings: car-type furnace 2x3,5m. M weight of castings - 5 tons. Grey iron castings for external customers will re resent 2000 tons/year.

3. Morasti Co. Tehran

The foundry was built 25 years ago, but the old foundry will be closed and replaced by completely new one. This firm got a licence for production of valves and fittings for water upto rated dia. 300mm and rated pressure 10 atmospheres, made of grey iron castings and non-ferrous metals. The grey iron foundry with capacity 6000 tons/year is under construction and will be in operation in 1352(1973); new non-ferrous metals foundry will be in operation in 1354(1975).
The grey iron factory will be equipped with 1 low frequency induction electric furnace with 2 crucibles a'3 tons most probably not sufficient for 6000 tons/year of grey iron castings.

4. Iron and Steel Plant in Esfahan

Repair shop will have own grey iron foundry with capacity of 2000 tons/year in the first stage of construction, 4000 tons/year in the second stage of construction and 7000 tons/year in the third stage of construction. The maximum weight of a grey iron casting is 10 tons. Melting department: one cupola 5 tons/hour in the first stage of construction and the same in the second stage of construction. The preparation of moulding and core mixtures is centralised. The main

quantity of castings is moulded in turn-over jolting machines. Single castings are moulded manually with the aid of pneumatic tampers. Dressing of castings will be performed by pneumatic hammers. Heat treatment of castings will be performed in a car-type compartment furnace. Maximum lifting capacity of the crane is 30 tons.
Description of steel foundry - see Steel Foundries.

5. Iran National Manufacturing Co. Tehran

The foundry will produce components and parts for approx. 65000 pcs. of automobile engines, 1500 cu. cm and 1800 cu.cm. i.e. cylinder block, cylinder head, bearing cap cluster, exhaust branch, fly wheel, cam timing wheel, alternator pulley, impellor, brake, disc, brake drum, crank timing wheel, fan pulley hub. Total weight of these castings will be approx. 6900 tons/year. Other castings will be imported from Chrysler United Kingdom Ltd.

The average capacity of melting facilites i.e. oil fired rotary melting furnace will be 6,5 tons/hour, the maximum capacity is 8 tons/hour. The melting department will have more than 30% of spare capacity.

The foundry will be put to operation in 1354(1975/6). It is recommended to enlarge this foundry in the sixth five-year plan to produce more sets (approx. 100,000 pcs/year) and to produce also castings which will be in the first stage imported from U.S. Also castings for gear-boxes and other parts for chassis could be cast in this foundry.

[illegible] casting in tons (main groups only)

Tariff		1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	[illegible]
[illegible]	Cast iron piping - tons	11,462	6,018	6,994	3,217	10,228	[illegible]
[illegible]	Cast iron joints - tons	1,012	1,680	658	170	407	[illegible]
[illegible]	Iron castings, unmachined - tons	1	8	99	101	74	[illegible]
752B	Iron castings semi-machined - tons	217	142	31	42	184	[illegible]
752C	Iron castings fully-machined - tons	1,029	1,108	1,354	1,122	1,073	[illegible]
	TOTAL	14,721	8,956	9,036	4,652	11,966	[illegible]

Source: Foreign Trade Statistics of Iran

Forecast of Consumption, Installed Capacity, Production and Imports of Grey Iron

(According to the Interim report "Capacity Study for Foundries & Forges in Iran" by Novoprojekta Praha).

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption of Grey iron castings	80,000	169,000	232,000	380,000
Installed Capacity	84,000	84,000	84,000	84,000
Extension of capacity of existing foundries	-	29,500	77,000	90,000
New foundries to be constructed	-	38,800	66,300	210,000
Production of grey iron castings	76,000	152,400	227,600	377,000
Gap	4,000	16,600	4,400	3,000

Malleable cast iron is cast iron with low carbon content to get less brittle and more tough material. There are two principle methods to produce malleable cast iron:

1. White heart malleable. The castings are made in the white condition, i.e. free of flake graphite, then they are packed in hematite iron ore and heat treated for 60 or more hours. The carbon is removed by oxidation.

2. Black heart malleable, the white castings are annealed at a temperature; the iron carbides are decomposed into temper carbon.

There is only one foundry producing malleable castings in Iran, Sherkate Malleable Tehran constructed in 1348 (1969), capacity 3000 tons/year. All requirements of malleable castings till 1348(1969) were covered by imports. Sherkate Malleable Tehran is equipped with two cupola ovens with electric forehearth for 6 tons. Production in 1350 (1972) is 7-8 tons/day. Moulding: 6 pairs of moulding machines; sand dressing; 2 edge runner mixers; malleableizing: 1 electric double-chamber furnace, output 10 tons/ day and 1 electric doublechamber furnace, output 3,5 tons/ day. The main production programme are fittings made of malleable castings from 1/4" upto 3". With additional machinery and equipment the capacity could be extended upto 7000 tons/year of pipe fittings upto rated dia. 6".

Sherkate Malleable Tehran is producing black heart malleable, i.e. the iron white castings with lower carbon and silicon content than in grey iron are annealed at a red temperature so that the iron carbides are decomposed into temper carbon.

Forecast of Consumption, Installed Capacity, Production and Shortage of Malleable Castings (According to the Interim Report "Capacity Study for Foundries and Forges in Iran" by Kovoprojekta Praha.

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption	3,400	14,500	22,000	32,000
Installed capacity	3,000	3,000	3,000	3,000
Extension of capacity of existing foundries	-	3,500	9,600	9,600
New foundries to be constructed	-	2,000	9,300	20,000
Production	2,400	8,500	21,800	31,800
Shortage - Import	1,000	6,000	200	200

Ductile Iron Castings

Ductile iron or nodular iron, spheroidal graphic (or S.G.) iron was invented approx. 20 years ago.

The addition of magnesium is changing flake graphite into the form of balls or spheroids. Ductile iron castings are tough, ductile etc. There are only two firms in Iran at present, producing ductile iron castings (S.G. iron castings);

1. Ghateate Fouladi Tehran

This foundry is producing S.G. iron castings mostly for automobile industry. Capacity approx. 2000 tons/year, production approx. 1200 tons/year in 1349(1970/71). Melting facilities: one small cupola oven (out of production), one pit furnace with pots, oil fired; one electric induction furnace will be installed in the future. This firm is producing S.G. iron castings under licence from the International

Nickel Co. Iran Inc.,.

2. Machine va Tuleh Sazi Iran, Tehran

The foundry is producing pressure pipes rated dia. 50 upto 700mm and length 0.5 upto 5,5m made of ductile iron castings by centrifugal method. The production of ductile castings is 70 upto 75 tons/day. Description of melting facilites see the same firm under grey iron castings and respective pipe fittings.

CODE NO. 3413 STEEL FOUNDRIES

Steel castings are mostly made of steel scrap molten in electric furnace. There are either steel castings of normal quality, or alloy steel castings. Steel castings as well as alloy steel castings have better properties as grey iron castings, mainly they are more tough and less brittle.

Production of steel castings in Iran at present is low, as there is only one steel foundry under operation:

Repairshop of State Railways in Tehran

The foundry is well equipped. Melting facility: one electric are furnace, capacity 1,5 ton. Moulding of small pieces is done in one pair of moulding machines with roller conveyor, big pieces are moulded by hand. Heat treatment upto 1150° C is performed in one electric car - hearth furnace 1,2 x 1,5m.

The capacity of the steel foundry in one shift operation is approx. 800 upto 900 tons year, the production at present is only 120 tons/year.

Steel foundries under construction

1. **Shateate Fouladi Tehran**

This firm, producing primarily ductile iron castings, ordered new induction furnace, capacity 1,3 ton/hour for production steel castings of normal quality as well as for production of alloy steel castings (Mn upto 11%, Cr-Ni steel castings etc.) The capacity of this foundry will be approx. 2000 tons/year/one shift.

2. **Machine Building Plant Arak**

The foundry will produce steel castings for own factory as well as for other customers - for example manganese steel castings- grindin, balls dia 40 up to 100 mm - 2700 tons/year, heat resistant steel castings 900 tons/year; total capacity of steel foundry is 6000 tons/year.

Melting facilities: three arc furnaces, each 1,5 tons capacity. Moulding shop: two pairs of moulding machines. Central sand conditioning plant with mechanical underground transport. Used sand is washed and reclaimed in sand washing and reclamation plant.

The foundry will be put to operation in 1351 (1972/3).

3. **Iron and Steel Plant in Esfahan**

Steel foundry is designed for production of spare parts for own plant. The foundry will be built in three stages (in compliance with the construction of steel plant). In the first stage of construction the capacity will be 3100 tons/year, in the second stage 4300 tons/year and in the third stage 12200 tons/year. The production of rolls is not included in the above given quantity (see Metallurgical and other Rolls).

Melting facilities: 1 electric arc furnace, capacity 6 tons in the first stage of construction, 2 electric arc furnaces, capacity 6 tons each in the second stage of construction and 3 electric arc furnaces, capacity 6 tons each, one 12 ton-electric arc furnace and one electric induction medium-frequency furnace with 2,5 ton crucibles in the third stage of construction.
The maximum weight of one piece of steel casting to be produced in the foundry will be 23 tons(max. lifting capacity of one crane is 50 tons).

4. Metallurgical Engineering Plant in Tabriz

The grey iron foundry is able to produce also small quantity of steel castings. In the project it was calculated that the production of steel castings will be in the range of approx. 100 tons/year. Melting facilities: 1 electric induction medium-frequency furnace with two crucibles, output 1 ton per hour (predominantly used for grey iron castings).

It is estimated that annual consumption of steel castings in 1350 (1971/2) was 7370 tons, mostly covered by imports.

Forecast of consumption, installed capacity, production and Gap of Steel Castings* (According to the Interim Report "Capacity study for foundries and forges in Iran" by Kovoprojekta Praha.

	1351 (1972/3)	1355 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption	9,000	30,500	53,100	85,000
Installed Capacity	7,000	7,000	7,000	7,000
Extension of capacity of existing foundries	-	9,200	22,200	28,000
New foundries to be constructed	-	9,000	23,000	50,000
Production	2,200	25,000	52,100	83,000
Gap	6,800	5,500	1,000	2,000

* including grinding balls and cylpebs.

CAST GRINDING BALLS AND CYLPEBS

Cast grinding cylpebs and balls, dia. 40 upto 100mm made of alloy steel castings with high content of manganese or molybdenum with vanadium (the best quality) are used for grinding clinker with gypsum to get finished product-cement.

The calculation of consumption of cast grinding balls and cylpebs see "Special Machinery and Equipment for Cement Factories".

Forecast of Consumption, Capacity, Production and Shortage of Cast Balls and Cylpebs According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption	tons	2,160	4,460	7,100	11,070
Existing Capacity	tons	2,700	3,700	2,700	2,700
New Capacities	tons	-	2,500	5,000	10,000
Production	tons	300	4,000	7,100	11,070
Shortage	tons	1,860	460	-	-

All cast grinding balls and cylpebs are till now imported to Iran.

The first production will start in the new steel foundry in Machine Building Plant in Arak. The capacity is 2,700 tons/year. Already in the fifth five-year plan the capacity should be doubled and so in the sixth and seventh five-year plan.

CAST METALLURGICAL ROLLS AND OTHER ROLLS

Metallurgical rolls are used for rolling of all kinds of steel sections or steel sheets and flats. They are made either

of grey iron castings, nodular iron castings, steel castings, or they are forged. Their shape and size depends on the rolling mill, the rolled product etc. For example there are grey iron chilled rolls, rolls with indifferent chilled zone, profile rolls etc.

All cast metallurgical rolls for Iron and Steel Plant in Esfahan as well as for IRSID Ahwaz and Ahwaz Rolling and Pipe Mill and all other rolls (for example for sugar cane plant, milling rolls, rolls for rubber machinery and equipment etc.) are till now imported. Neither Iron and Steel Plant in Esfahan, nor any other plant has a provisions for the production of these rolls.

The consumption of cast metallurgical rolls in Iron and Steel Plant in Ahwaz is forecasted by Kovoprojekta Praha in "Interim Report on Capacity Study for Foundries and Forges in Iran" 2,100 tons/year in the first stage of construction, 1,500 tons/year in the second stage of construction and 8,300 tons/year in the third stage of construction.

Forecast of Consumption of Cast Metallurgical and Other Rolls-tons

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Metallurgical Rolls -				
-Iron & Steel Plant Esfahan	480	5,770	7,700	8,300
-other rolling mills	450	2,370	4,100	6,000
Other rolls	120	860	1,200	2,000
Total	1,050	7,000	13,000	16,300

It is recommended to build a plant for production of cast metallurgical as well as other rolls, i.e. grey iron, nodular and steel foundry and machining shop with heavy lathes and special

roll grinding machines (the grinding machine should have the copying equipment as some rolls are slightly concave or convex). The maximum weight of rough (not machined) metallurgical roll will be approx. 5 tons.

The best location of the production of metallurgical as well as other rolls will be Iron & Steel Plant in Esfahan, not only that it will be the biggest consumer of metallurgical rolls, but also therefore that the existing foundry could be easily extended for this production. (See "Capacity Study for Foundries and Forges in Iran" by Kavoprojekta Praha.

CODE NO. 341: INDUSTRY OF SEMI-FINISHED PRODUCTS OF STEEL BY FORGING

Forging of steel (or of other ductile metals) is a process at which the metal is heated to the temperature at which grains begin to coarsen and then metal blanks are shaped by hammering or pressing. There are developped different processes of forging using different machines - for example for hammer forging are used board drop gravity hammer, the air lift gravity hammer, the steam drop hammer etc, for forge pressing are used hydraulic or mechanical (eccentric, crank, friction-screw) forging presses. Special processes are roll forging on roll forging machines, conterblow forging or cold forging.

All kinds of above mentioned forging processes are either closed die work (the metal is shaped between a pair of forging dies), semi closed-die work or open frame or smith (without dies).

There are only small forging shops in Iran at present as part of big maintenance shops (for example Abadan Refinery etc.)

equipped mostly with small pneumatic or leaf spring hammers.

The biggest existing [illegible]

1. Iran Abzar Co. Tehran

The firm is producing black tools and implements like shovels, spades, rakes, hoes, pickaxes, hammers, crowbars, steel wheels and storage handling trucks. The plant consist of 6 shops:

1 Press shop for production steel sheet implements like spades, shovels and other. In the press shop are installed two production lines: Production line for shovels-consisting of one eccentric press 160 ton, furnace upto 800°C, eccentric presses 25 tons and 63 tons and one salt bath.
Production line for spades: eccentric presses, 1 oil heated furnace 1 friction press 63 tons, 1 bath and 1 painting equipment (deepening process)

2. Forge shop for production of pickaxes, hammers etc. The machinery and equipment of this shop consists of 3 pneumatic hammers, one power hammer with head weighing 700 kg, one crank press 500 tons, two eccentric presses and one oil-fired furnace.

3. Shop for production of steel wheel barrows and storage handling trucks.

4. Shop for production of wooden implement handles equipped with modern semi-automatic and automatic wood-working machines.

a. Shop for production of tyres for wheel barrows and storage facilities etc.

b. Tool room for production of dies.

The press and forge shop have production capacity approx. 2100 tons/one shift. There is the possibility for extension of existing capacity to produce also other black tools and implements like hammers, screw drivers etc. see Implements and Black Tools.

2. Repairshop of Iranian State Railway-Tehran

The forge shop is equipped with pneumatic hammers upto the weight of head 700 kg, screw-type friction presses upto 100 tons and with horizontal forging machine for bar stock upto 55mm dia. The forge shop has capacity approx. 1200 tons/year/single-shift operation: the max. weight of a hammer-forged product is 100kg max. weight of a die-forged product is 2kg. Production programme: different spare parts like compression collars for leaf springs, pins, bolts, levers, shafts etc.

New Forging Shops under Construction

1. Machine Building Plant Arak

The forging shop which will be put to operation in 1351(1972/3) will supply the forgings not only for own plant, but also for other plants, mainly in Arak area (for wagons, agricultural machinery and equipment etc.).
Production programme: Closed-die work as well as open frame forgings, hot pressings and hot bendings required for production pro ramme of own plant (conveyors, gearboxes, boilers etc.

Installed machinery and equipment: pneumatic forging hammers with a head weighing 250kg, 400kg and 1000 kg, 1 steam-pneumatic die-forging hammer with head weighing 1000kg, . screw-type friction press with pressing force of 250 tons, 1 horizontal forging machine with capacity of 250 tons, 1 hot bending machine with capacity of 100 tons, 1 hydraulic sheet-metal press 630 tons with a manipuletor with loading capacity of 2,5 tons and one crank press 1000 tons, 2 chamber heating furnaces 3,8m x 3,8m slot heating furnaces 2,3 x1m, 1,1x0,6m, and 1,4x0,7m and one forge hearth 0,58x0,69m

Heat treating shop is equipped with 1 electric hardening furnace 0,4x2x0,1m, 1 electric tempering furnace with the same dimensions 1 conveyor type electric hardening furnace 0,4x3m, 1 oil fired chamber furnace 1,4x2,5m, 1 electric salt bath dia 400mm, 1 electric chamber furnace 0,4x0,8x0,36m and 2 pit-type electric furnaces dia 0,95x 1,25m and 0,5x0,65m with quenching and soaking tanks etc.

Capacity of the forge shop: 1500 tons/year/two-shift operation, max. weight of a hammer-forged product-250kg max. weight of die-forged product 10kg, max. weight of a hot pressing from sheet metal 500kg.

2. Metallurgical Engineering Plant in Tebriz

The forging shop will be put to operation in 1351(1972/3). It is designed to produce forgings and hot pressings for own factory as well as for other plants in Tebriz area.

The capacity of forge shop is 1050 tons/year/single shift operation; max. weight of open forging is 150kg, max. weight of closed die-forged product is 20kg.

Machinery and equipment: 4 pneumatic hammers with head weighing from 10kg upto 1000 kg, two hydraulic drop-forging hammers with heads weighing 500 and 2000kg. The chamber type heating furnaces are heated with oil.

3. Iron and steel Plant at Isfahan

The forging shop in this plant is designed to produce forgings for spare parts for own plant. The production will start in 1351(1972/3).
Present forging capacity is 2000/tons/year/two-shifts operation with possible extension to 5200 tons/year/two-shift operation; max. weight of open frame forged parts is 1900 kg.

Machinery and equipment: four power hammers with heads weighing from 1kg to 5000 kg. Each hammer has one heating furnace.

Forecast of Consumption capacity, Production and Shortage/Forgings* of

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption:					
Free-forged forgings(open frame f.)	tons	1,720	3,820	7,640	13,500
Die forgings	tons	8,200	38,870	58,180	87,000
Hot-pressed pressings from sheets	tons	2,100	4,840	6,820	9,500
Total consumption		12,020	47,530	72,640	110,000
Existing capacity	tons	10,830	10,830	10,830	10,830
Extension of cap. of existing forge shops	tons	-	7,150	16,750	22,150
New forge shops to be constructed	tons	-	23,000	39,000	80,000
Production	tons	3,300	40,000	65,000	105,000
Shortage Import	tons	8,820	7,530	7,640	5,000

* According to the Interim report, Capacity study for Foundries and Forges in Iran, prepared by Kocoprojekta Praha.

[illegible] Balls

Forged grinding balls, dia 40 upto 100mm made of alloy steel with high content of manganese or molybdenum with vanadium (the best quality) are used for grinding clinker with gypsum to get finished product cement.

The calculation of consumption of forged grinding balls see "Special Machinery and Equipment for Cement Factories".

Forecast of Consumption, Capacity, Production and Shortage of Forged Balls According to the Author of this Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	136[illegible] ([illegible])
Consumption	tons	2,160	4,460	7,100	11,[illegible]
Capacity	tons	-	5,000	8,000	12,000
Production	tons	-	3,000	7,000	11,[illegible]
Shortage	tons	2,160	1,460	100	-

All forged grinding balls are till now imported to Iran.

There is no project to produce forged balls in Iran. It is advisable to build in the fifth five-year plan a new forge shop for production of forged balls and to extend it in the sixth and seventh five-year plan.

CODE NO. 342 COPPER BASIC METAL INDUSTRY

Code No. 3421 Manufacture of Copper by All Methods Except Electrolysis
Code No. 3422 Manufacture of Copper by Electrolysis
Code No. 3423 Manufacture of Alloys of Copper Including Bronze and and Brass
Code No. 3424 Rolling and Drawing of Copper and Alloys

CODE NO. 3422 MANUFACTURE OF COPPER BY ELECTROLYSIS

Sarcheshmeh Copper Company will start in the fifth five-year Plan the construction of one smelter which will convert part of the production of copper concentrates into blister copper and the same quantity will be converted to refined copper. It is presupposed that in 1356(1977/8) the plant will be ready for operation, having the capacity of 60,000 tons/year of refined copper.

Smelting

The purpose of smelting is to separate copper from the iron, sulphur and gangue . There are three major steps in smelting: roasting, reverbatory furnacing and converting.*

Roasting is the heating of the copper concentrate in oxidising atmosphere to oxidise the sulphur and iron and remove volatile impurities. The roasted concentrate is charged by special charging machine into reverbatory furnace filled with pulverised coal where it is smelted to produce a matte of copper sulphide containing 45-50% copper. The combustion products on the outlet of the furnace of temperature 1250°C will be led in two parallel

* Description of process partly according to "A Pre-feasibility Study for the Manufacture of Semi-finished and Finished Copper Alloy Products in Iran" by METRA International.

running boilers where they will be cooled to temperature 350°C and after dust removal are led into the chimney or for the desulphurisation. Steam obtained in the boiler is used for the electric power generation and then for industrial purposes. The following reactions take place:

1. All the concentrate gangue is fluxed to a silicate slag
2. The oxidised iron is fluxed from the sulphate with silicon
3. Sulphur is oxidized to sulphur dioxide
4. The copper content is converted to stable Cu_2S and associated with FeS in the matte.

The matte in liquid condition is tapped into ladles to be transferred to the convertor. The Convertor is a horizontal furnace with 60-90 tons tap. The first stage of converting is rapid oxidation of the iron sulphide to iron oxide and sulphur dioxide. Enough silica is supplied to form an iron silicate slag. When the slagging is complete and the slag has been tapped, blowing is continued to oxidise the sulphide to leave metallic copper. The product of the converter is known as "blister copper". The gases with SO_2 content may be utilised for production of H_2SO_4.

Refining

Blister copper must be refined before use. Refining process consists of:

1. Fire refining in reverbatory type furnaces fired by pulverised coal to produce purer and more homogenous anodes, casted on the anode casting machine.

2. Electrolytic refining of the anodes to recover precious metals and remove impurities. The electrolyte used usually consists of about 3% copper and 13% free acid, cathodes are specially prepared rolled copper. A current of density of about 20amp per sq. foot of anode and a voltage 100-200mV is passed through the circuit. After about 14 days, cathodes weighing about 110kg are ready.

   Description of machinery and equipment cranes, reinforced concrete lead tanks, equipment for preparation of electrolytic, equipment forcirculation, heating and filtration of electrolyte, equipment for production of basic cathode, equipment of decoppering of electrolyte, equipments for electrolysis equipment for washing and dispatch of cathode, piping and fittings for distribution of electrolyte, water, steam, sulphuric acid in the scope of the electrolysis building, rectifiers and distribution system of alternating and direct current.

3. A second melting operation in reverbatory furnace fired by pulverised coal to adjust the physical properties of electrolytic copper to cast in shapes for use in industry.

Forecast of Production of Refined Copper According to the Author of this Study

		1351 (1974/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of refined copper	tons	-	-	60,000	60,000

CODE NO. 3483 MANUFACTURE OF COPPER AND ALLOYS OF COPPER INCL. BRONZE AND BRASS

According to "A Pre-feasibility Study for the Manufacture of Semi-finished and Finished Copper and Copper Alloy Products in Iran "by Metra International, the consumption of copper and copper alloys in 1356(1977/8) will be 48,000 tons/year mostly copper wire 28,000 t/y, copper alloys sheet 8,000 tons/year and copper alloys rods 5,000 t/y.

COPPER - ALLOY CASTINGS

Copper-alloy castings are required for different industries, mainly for electrical, engineering, automobile, chemical and food industries. There are now approx. 80upto 100 small foundries, producing castings not only made of copper and copper alloys, but also of other non-ferrous metals. Most of these foundries have primitive melting facilities as well as machinery and equipment. Some of them are without any mechanization.

Import of Copper - Alloy Castings, Stampings, Forgings

Tariff No.			1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1350 (1971/2)
762	Imports	tons	55	79	125	201	296	229

Source: Foreign Trade Statistics of Iran

Description of Existing as well as New Foundries

1. Repairshop of Iranian State Railways Tehran ferrous metal foundry with Al-alloy castings. There are installed three crucible furnaces and one oil-fired crucible furnace with a tilting crucible of 1000 kg capacity. Moulding, core-making and fettling is done manually. Estimated production

of copper-alloy castings is 50 tons per annum.

2. Arj Corporation Tehran

The foundry is producing copper-alloy castings for the final production of gas ranges, water heaters, space heaters etc.
Melting facilities: four oil-fired furnaces with withdrawab crucibles for different kinds of non-ferrous metal castings (incl. aluminium alloy castings).
Estimated present production is approx. 40 tons/year.

3. Industrial Estates, Ahwaz

The copper-alloy castings and other non-ferrous metal castings for small scale industry in Ahwaz are made in non-ferrous metal foundry, equipped with a tilting 150kg crucible furnace. Moulding, sand dressing and fettling is manual. Estimated present production is approx. 10 tons/year.

4. Dorosti Co. Tehran

The firm plans to build a new foundry for copper-alloy castings of small valves and fittings with the capacity of approx. 1000-1500 tons per annum. These castings will be partly produced on the pressure die-castings machines, partly on sand moulding machines.
The new foundry for copper-alloy castings will be put to operation in 1354(1975/6).

5. Fathi Co. Touran (Medium Weight Profiles Mfg. Co.)

The foundry is designed for production of components and parts made of copper-alloy castings for own factory. Melting facilities: one oil-fired crucible furnace for copper alloys capacity 300 kg. Moulding, sand dressing, and fettling are manual. Estimated capacity is approx. 200 tons/year, the production started in 1350(1972/3).

6. Metallurgical and Engineering Plant, Tabriz

The designed annual capacity is 95 tons of copper-alloy castings in one shift operation. Copper-alloy castings will be produced for own final production programme as well as for other customers. The foundry started production in 1351 (1973/4). Melting facilities: oil fired tilting crucible furnaces. Copper-alloy castings are made either as pressure die-castings on pressure die-casting machines, or as normal sand moulded castings.

7. Iron and Steel Plant in Esfahan

The copper alloy castings foundry will produce castings for needs of own plant. It is designed to have capacity 100 t/y in the first stage of construction, 300/tons/year in the second stage of construction and 600 tons/year in the third stage of construction. Melting shop will be equipped most probably with oil-fired tilting crucible furnaces, moulding will be manual. The foundry will be put into operation in 1352(1973/4).

Other copper-alloy castings foundries, equipped with pressure die-casting machines: Baradarane Tahasili Tehran, Payma Workshop Tehran, Darwish Workshop Tehran and Azmayesh Company, Tehran. These foundries are producing components and parts for own final production programme (Azmayesh Co. for domestic appliances) or for other customers.

[illegible] Production and Shortage of Copper-Alloy Castings

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
[illegible]	tons	2,250	4,180	6,760	10,000
[illegible] capacity	tons	2,600	2,600	2,600	2,600
[illegible]	tons	-	850	3,200	3,800
New [illegible]	tons	-	-	-	4,000
Production	tons	2,000	3,440	5,800	9,600
Shortage(import)	tons	250	740	960	400

Source: Interim report "Capacity study for Foundries and Forges in Iran" by Kavoprojekta Praha.

[illegible] 342: ROLLING AND DRAWING OF COPPER ALLOYS

According to "A Preleasibility study for the Manufacture of Semi-fini hed and Finished Copper and Copper Alloy Products in Iran" elaborated by Metra International, the requirement for copper and copper alloy semis in 1356 (1977/8) will be:

Copper			Copper Alloys		
wire	27116 tons/year		wire	144	t/y
sheet strip	1670	"	sheet strip	7977	"
rods bars	338	"	rods bars	1950	"
tube	121	"	tube	600	"
total	31105	"	total	13681	"

[illegible] period in 1356(1977/8) could be met by two plants.

1. [illegible] wire and Plant

From two major continuous casting and rolling processes in operation, the Southwire continuous casting process was chosen as most economical. This process transforms copper cathode directly into tough pitch copper wire rod. The basic principle of the process is that molten copper is poured continuously on to a large, grooved casting wheel, where it solidifies as the wheel rotates and emerges

[illegible] a square bar. This bar is then shaved, rolled to wire rod, pickled and coiled in a continuous process. The best size will be [illegible]-9, having nominal output, per hour 9 tons, i.e. [illegible] tons per year, allowing a subsequent 30% growth in output.

__Description of [illegible] equipment__

Copper cathodes will be melted in twelve ton cathode melting furnace and molten material will be held in holding furnace to maintain a uniform temperature before the metal will be poured into pot on the casting machine. Casting machine is designed to cast a copper bar of 2,5 square inch cross section. Extractor conveyor translates the motion of the hot, but solid cast bar to horizontal plane. A shear system cuts the cast bar into convenient lengths and then the bar passes through a bar conditioner which removes any ring mould flash by adjustable multiple cutting tools. The mill will consist of two breakdown stands which prepare the cast bar for entry into the eight stand finishing mill. The finished rod is coiled on the coiler pinch rolls. An in-line pickling system is required to quench cool and clean the copper rod.

2. __An Extrusion Plant__

Using an extrusion press, 2500 tons press power, and finishing lines to produce tubes, rods, bars and sections and strip. Casting of billets: gas fired priming furnace and three 500KVA induction melting furnaces. Eight inch dia. billets are cast in the block moulds to give a billet weight of up to 270 kg. Nominal output of 2500 tons extrusion press is 10,4 tons/hour, max. size of output from press is within circle of 130-250mm, max, bor of tube dia 105-165mm. The extruded product from the press is either coiled or run out on to the run-out table. A large proportion of the press output is cleaned and pickled

in wash and pickle tanks. Products which are to be drawn to size are pointed on either a 60ton twin hammer forge or a rotary swager. A range of three drawbenches rated at 60,30, and 15 tons together with the tube reducing machine will handle all drawing operations except for long lengths of small products like fine tube which must be finished on bull blocks. There will be considerable spare capacity in this part of the plant. A variety of straightening machines using both roller and stretcher methods will be needed. Two heat treatments will be used; electrically heated furnace for bright annealing with a protective gas atmosphere for copper and high copper alloys, and open annealing and pickling for brass and other copper alloys.

All strip rolling in this mill is carried out as a cold rolling operation. All products are rolled on the breakdown mill and annealed, after which lighter finish rolling or intermediate and finish rolling is used depending on the product dimension and alloy. For certain narrow products a wire flattening mill should be considered. Such a mill will typically produce a small range of products down to about 18mm x 5mm from rod of 13mm dia. Various saws, slitters, edge trimmers, milling lines etc. are needed for finishing processes.

Forecast of Demand and Production of Copper and Copper Alloys - Wires Rods, Bars, Tubes, Sheets, Strips according to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	27,800	14,800	65,200	91,000
Production - Wire Rod Plant	"	-	32,760	42,400	42,400
Production - Extrusion Plant	"	-	20,800	41,000	41,000
Shortfall - Export	"	-27,800	+3,760	+18,200	-7,600

[illegible]

[illegible]

Although there are only small cobalt-nickel occurrences till now discovered in Iran and again activity is not expected on large scale, it is presumed that the basic-industry of these two non-ferrous metals would not be established in the next 10 years.

MANGANESE

Till now there is no plant for production of manganese. As in future there will be big demand of ferromanganese in the steel mill in Esfahan and in other plants in Iran (local demand for 1361(1982/3) is estimated as 38000 tons/year), it is anticipated that one big unit will be built at the end of the fifth five-year plan.

According to the "Feasibility Report on Ferro Alloy Plants and Alloy Steel Plant" by V.V. Pastur and Co. Private Ltd. Calcutta it is advisable to build one large unit for production of 38000 tons of ferromanganese for annum.

Description of Machinery and Equipment

It is anticipated that the total quantity of 38000 tons/year will be produced in one 20 MVA electric furnace. Raw materials will be transported by wagons to the plants unloading yard. From here the raw materials will be transported by belt conveyors and tripper conveyors to stockpiles. Bay loaders will transport raw materials to manganese ore crusher and from there by belt conveyors to screens over day bins. Belt conveyor will collect crushed ore and despatch to charge to the furnace. Scrap iron will be weighted on scales and hoisted to charging bins and chutes. A charging machine will charge raw materials to the furnace. The electric rotary furnace

will consist of furnace shell with refractories, rotation machinery, hydraulic electrode hoists with hydraulic system, three single phase transformers, control panel, desk and instruments and gas cleaning equipment.

For tapping bay, there will be installed overhead travelling cranes, wagons for tapping ladles, tapping pans and equipment for crushing, screening and packing ferro-manganese (crusher, feeder, screens, scales, rollways etc.)

The disadvantage of the above given proposal is that the iranian manganese ores are most probably not suitable for this process and therefore ores of better quality must be imported from abroad.

According to author of this study it is advisable to use for the iranian conditions.

1 electric furnace 16500KVA with 140-160 V, 65KA electric regime for the ferromanganese production. Manganese ore will be most probably imported.

1 electric furnace 16500 KVA with 150-170V, 65KA electric regime for the ferrosilicomanganese production, Iranian manganese ore will be used.

Ferrosilicomanganese is produced by MnO reduction from ferro-manganese slag by carbon from coke. Slag is granulated by water whereby a suitable building material is made. Carbonaceous ferro-manganese can be produced in this kiln too. The costs for the production variation are not high. Thus a high flexibility of the production may be obtained according to the requirements for the individual ferro-alloys. The above mentioned proposal takes into consideration the use of Iranian manganese or which could by used for the ferrosiliconmanganese production under certain conditions after the performance of the tests. Iranian manganese ore was processed at Kovohuty Istebna in Czechoslovakia with good results. This mode of processing could partially reduce the quantity of imported

manganese ore.

It is advisable to combine the production of ferro manganese and ferrosiliconmanganese with the production of ferro-silicon in one plant (see production of ferro-silicon).

CHROMIC

There is no plant in Iran for production of ferro-chrome. Large occurrences of chromite ore in Iran offer the opportunity for the establishment of plant for production of ferro-chrome.

According to the"reasibility Report on Ferro Alloy Plants and Alloy Steel Plant" by S.N. Dastur and Co, Private Ltd Calcutte it is advisable to build one large unit for production of 4500 tons of high carbon ferro-chrome and 10000 tons of low carbon ferro-chrome per annum.

Description of Machinery and Equipment

Raw materials will be transported to the plant in dump trucks and stacked by mobile pay loaders. From the storage building these materials will be transported by belt conveyors to day bins and from there by a charging system consisting of vibratory feeders, automatic weighers, belt conveyors and elevator to respective kilns. The chrome ore fines are dried in an oil-fired rotary kiln. For calcining limestone, an oil-fired rotary kiln will be provided. The smelting will be performed in an open rotating submerged arc furnace served by a 12000 KVA on-load tap changing transformer. The 8000KVA slag furnace will be of the travelling-tilting type.

The silico-chrome will be tapped into ladle and then casted in pans in the form of slabs. Slabs will be crushed with two jaw crushers and a cone crusher. The crushed silico-chrome will be transported by belt conveyor to an overhead bin. The slag from slag furnace is tapped into a ladle and then crushed silico-chrome is added to this ladle: the resulting low carbon ferro-chrome is

[illegible] solidification the product is hammered, [illegible] transported to the storage bin.

According to the author of this study it is advisable to use [illegible] flex process Perrin method, which is a little different from the other considered technology.

Three kilns, provided with magnesite lining, of an input [illegible] kVA each, will operate in the plant. Production programme and capacity of the plant will be 7800 tons/year of high carbon ferro-chrome, [illegible] tons/year of silicochrome and 10000 tons/year of low carbon ferro-chrome.

The first kiln is designed for the production of carbonaceous ferro-chrome as semi-product for further processing as well as final product. The production process in continuous. The second kiln with 125-155V, 36kA electric regime, is used for silico-chrome production. The production process is continuous, liquid metal is granulated with water. The third kiln with 160-200V, 24-28kA electric regime is designed for the production of ferro-chrome of 6[illegible] Cr content.

By the designed technology 9000 tons/year of silico-chrome are obtained. From the said quantity 6600 tons/year are used for the production of low carbon ferro-chrome and remaining 2400 tons/year can be utilized for other processing. In the case it is possible to sale ferro-chrome with the carbon content of about 0.1% the reduction of ore by silico-chrome direct in the kiln would be more advantageous. The power demand will be reduced up to 3000 KWh per 1 ton and the production capacity of the kiln will rise by 40-50% at this production.

There is no big difference when comparing the specifications

of the main machines and equipments needed for the manual technology with the designed equipment in this proposal. One rotary tubular kiln for the drying of SiCr and the equipment for the water granulation of SiCr and FeCrC have been designed in addition.

Forecast of production of ferro-chrome and silico-chrome According to the author of this study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
High carbon ferro-chrome	tons	-	-	7,800	7,800
low carbon ferro-chrome	"	-	-	10,000	10,000
Silico-chrome	"	-	-	2,400	2,400

CODE NO, 3472 BASIC [illegible] OF ALUMINIUM

ALUMINIUM INGOTS

There is one plant under construction for production of aluminium ingots, Iran Aluminium Company (Iralco), Arak,. The capacity of this plant will be 45000 tons per year. The plant was put into operation in 1351(1972/3). Aluminium ingots will be produced from alumina imported from Australia. From the total production, 25000 tons per annum will be exported.

The factory is built so, as to permit the extension to double the above capacity in the near future. Some services and departments are provided already for the final capacity of 90000 tons. It is anticipated that the expansion of the capacity will be done in the fifth five-year-plan.

Up to now, no suitable bauxite occurrences have been found,

[illegible] not expected that a plant for the production of alumina will be built. Also further extension of the aluminium industry in the sixth and seventh five-year-plans is not envisaged.

Forecast of Production of Aluminium in Ingots According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Capacity	tons	45,000	90,000	90,000	90,000
Production	"	8,000	7[illegible],000	90,000	90,000

ALUMINIUM SHEETS

There is one small factory in Iran at present producing aluminium sheets from aluminium billets and scrap: Sherkate Favaseli Teheran. The production is about 1000 tons of sheets per annum, max dimensions 700 x 200 mm, thickness 0,7-2,5mm. The sheets are cut in the factory to rounds of suitable dimensions for production of aluminium utensils (produced in other small shops).

Existing Machinery and Equipment

Old, primitive machinery and equipment. Aluminium ingots and scrap are melted in two rotating tilting furnaces, fired by fuel oil (two other small furnaces as stand-by). Molten aluminium is poured into moulds 40 x 50 x 4cm. The slabs are heated in two continuous furnaces and then rolled on 3 small hand-operated rolling mills, the largest having a width of 700mm. Sheets are cut to rounds on shears. This type of factory is really suitable only for utilization of aluminium scrap.

Since aluminium ingots would be available, instead of exporting ingots, a rolling mill could be established and coils and sheets exported

after meeting the local demand. It is estimated that local demand in 1356(1977/8) would be about 6000 tons per annum. The suitable capacity for aluminium, hot rolled and cold rolled aluminium coils and sheets would be approx. 15000 tons/year. It is anticipated that this plant would be built in the sixth five-year-plan period when the production of ingots will reach 40000 tons per annum.

Forecast of Production of Aluminium Sheets and Coils According to the Author of this Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production	tons	1,200	1,500	27,000	27,000

ALUMINIUM FOILS

The firm Iran Foil Co. Teheran is producing aluminium foils by re-rolling imported aluminium sheets. The production of the plant is approx. 200 tons per annum. Aluminium foils are supplied to the tobacco industry for packing the cigarettes. Machinery and equipment is semi-mechanized.

Forecast of Production of Aluminium Foils According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production	tons	240	400	800	1,400

It is not anticipated that a new plant will be built in the next 15 years, as a modern plant should have a capacity of at least 6000 tons/year and there will be not enough market for aluminium foils in future.

EXTRUSION OF ALUMINIUM PIPES, TUBES AND SECTIONS

Present requirements of aluminium pipes, tubes and sections are for about 5000 tons/year, being covered mostly by two producers: Pars America Aluminium Co. Teheran, and Alumtex Co. Teheran.

Pars America Aluminium Co. has 1 extrusion press, pressure capacity 3000 tons and 2 extrusion presses, pressure capacity 1250 tons each. The largest pipe produced in the plant is dia 4".

Both plants are utilizing the installed capacity for about 50-55%, i.e. there would be no need of new capacity in the next five years. Unless there should be some export of aluminium pipes, tubes and sections, there will be no need of new capacity until 1355(1976/7). This has been taken into consideration in calculating machinery and equipment, needed in the near future.

Description of existing machinery and equipment

Mostly modern machinery and equipment; aluminium is moltent in electric induction furnaces and automatically fed to extrusion press with die, which is forming the shape of extruded material. On the table with rolls the profile or tube is automatically cut to prescribed length. Some products are anodized.

Forecast of Demand Production and Shortage of Aluminium Tubes, Pipes and Sections According to the Author of This Study

		1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Demand	tons	5,200	10,000	17,000	25,000
Production	tons	5,000	10,000	17,000	25,000
Shortage	tons	200	-	-	-

[illegible]

[illegible]

Tariff No.		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	bars, wires, without finished, tons	61	370	686	151	[illegible]	[illegible]
[illegible]	Bars, wires with finish , tons	5	23	74	193	[illegible]	[illegible]
	T o t a l	69	393	760	347	[illegible]	[illegible]

Source: Foreign trade statistics of Iran

Imports of Wires and Cables (see Electrical Engineering) reached in 1347(1968/9) 7753 tons.

A unit was going into operation in the year 1351(1972) starting with 500 tons/year of wires and rods and ultimately will expand to 1500 tons/year in 3 years. With the expansion of the wire and cable industry there would be large demand for aluminium wire rods and hence scope for increasing the production.

ALUMINIUM ALLOY CASTINGS

Aluminium - alloy castings are required for chemical, engineering , electrical and automobile industries etc. At present small local foundries are producing small aluminium alloy castings. The number of these foundries is not known as most of them are producing also other non-ferrous castings; it is estimated that approx. 40-50 are producing aluminium alloy castings, but since they cannot cover the entire market, the import was:

Import of Aluminium [illegible]

Tariff No.								
280	Import	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Source: [illegible]

Description of existing as well as new capacities

1. Repair shop of Iranian state railways - Tehran

Aluminium alloy castings are produced in non-ferrous metal foundry with Cu-alloy castings. There are installed three crucible furnaces and one oil-fired crucible furnace with a tilting crucible of 1000 kg capacity.
It is estimated, that present production is 45 tons of aluminium alloy castings per annum, mostly spare parts for current maintenance of wagons and Diesel locomotives.

2. Arj Corporation, Tehran

The foundry is producing aluminium alloy castings for gas ranges, water heaters, space heaters etc. Heating facilities: 4 oil-fired furnaces with withdrawable crucibles for different kinds of non-ferrous metal castings. It is estimated that present production represents approx. 30 tons/year.

3. Siemens Iran - Tehran

The foundry is producing aluminium alloy castings for final production programme of own factory (aluminium castings-frames for underwater lights etc.) as well as for other customers (Iran Transfo Co. Tehran). Melting facilities: one oil-fired crucible furnace with two crucibles; moulding either by hand or on a pair of moulding machines (predominantly used for grey iron castings).

... foundry ... in operation ... years, the production is ... approx. 30 tons/year.

4. <u>Metallurgical Engineering Plant in Tabriz</u>

The foundry for production of aluminium alloy castings is designed for 105 tons/year in one shift operation. The foundry will produce components and parts for the final production of machine-tools, forming machines, electric motors, small compressors and diesel engines.
Separately is built pressure die-casting foundry for production of rotors of electric motors, equipped with pressure die-casting machines. Both foundries will be in operation in 1352(1973/4).

5. <u>Machine Building Plant in Arak</u>

Aluminium alloy castings will be produced in specialized foundry, equipped with one tilting crucible furnace 250 kg. The capacity of the foundry is 100 tons of aluminium alloy castings per annum in two shifts.
The foundry will produce aluminium alloy castings upto the weight approx. 150 ..., for the plant's own requirements as well as for outside customers.

Some firms are equipped with pressure die-casting machines for production of aluminium alloy pressure die-castings.
Except Metallurgical Engineering Plant in Tabriz, there are these firms, producing aluminium alloy pressure die castings:
Unrosti Co. Teoran, Baradarane Tahsili Tehran,
Payma Workshop Tehran,
Derwish Workshop Tehran and Aamavesh Co. Tehran.

These firms are producing pressure die-castings not only for their own requirements, but also for other customers. In the

[illegible] aluminium alloy die-casting, will be [illegible], mainly for components [illegible] parts, [illegible] [illegible] electric industry.

New foundries should be built for production of aluminium alloy castings (moulded in sand as well pressure die-castings) for automobile industry, for compressors refrigerators etc.

Forecast of Consumption, Capacity, Production and Gap of Aluminium Alloy Castings (According to the Capacity Study for Foundries and Forges in Iran (by Novoprojekta Praha).

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Consumption	1,450	4,850	6,780	[illegible]
Existing Capacity	1,500	1,500	1,500	[illegible]
Expansion of existing capacities	-	1,250	3,600	[illegible]
New capacity	-	1,000	1,600	[illegible]
Production	950	3,750	6,680	[illegible]
Gap	500	1,100	100	200

ISIC NO: 3133 BASIC INDUSTRY OF ZINC AND LEAD

There is no plant in Iran producing zinc and only one plant producing lead at present: Nakhlak Mine and Aglomerating Plant, belonging to the Mining Department of Plan Organization, situated 60Km north-east of Anarak.

The production of lead (99,5% lead-buillions) in tons

	1340 (1961/2)	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)
Production of lead tons	1,364	[illegible]	[illegible]	375	333	183

Description of Existing Machinery and Equipment

Machinery and equipment is of old style, consisting of 1 grizly, 2 coarse crushers, 1 rod mill, 1 ball mill, 2 screens, 4 jigs, 1 thickener, 1 conditioner, 1 flotation, 1 aglomerating furnace and 1 blast furnace.

According to the "Final Report on Lead and Zinc Smelting in Iran" by Jan H. Meimers and Associates Ltd., it is presupposed that in the fifth five-year plan these plants will be built:

1. Two concentration plants using Waela process for concentration of the Angouran and Shahkuh ores. These plants will be built in Angouran and Shahkuh.

		Angouran	Shahkuh
Ore-amount treated	tons/day	500	500
	tons/year	150000	150000
Primary products: zinc-lead oxide	" "	63500	42000
metal content			
zinc	" "	35740	25200
lead	" "	9980	4980
total	" "	45720	30180
Purification products:			
zinc-oxide	" "	42330	31610
metal content			
zinc	" "	32590	22950
lead	" "	880	410
total	" "	33480	23360
impure lead oxide	" "	17160	9000
metal content			
zinc	" "	2480	1730
lead	" "	8910	4270
total	" "	11360	6000

[illegible]. One electrolytic zinc plant with residue treatment by the Jarosite process, located in Esfahan, treating purified and densified Waelz zinc oxide from Shahkuh (31610tons/year) and Ancouran (1[illegible]570 tons/year) and zinc sulphide concentrate from selective flotation from Kushk (3[illegible]600 tons/year).

Products: slab zinc (99,9 -99,99%) 20600 tons/year, cadmium 160,[illegible] tons/year copper (in cadmium plant residue), 4[illegible],5 t/y lead (in oxide leach residue) 1271 tons/year, sulphuric acid- 22510 tons/year (100% H_2SO_4 basis).

3. One electric lead smelter with lead refinery located in Esfahan. Material available: Ancouran Waelz lead oxide 17160 tons/year, Kavand flotation concentrate 2200 tons/year, Nakhlak lead floation concentrate 10300 tons/year, Kushk selective floatation lead concentrate 6580 tons/year, Yazd siliceous lead oxide ore 3000 tons/year, electrolytic zinc plant lead-silver residue 10550 tons/year, Shahkuh Waelz lead oxide 9000 tons/year total 63790 tons/year.

Products: Refined lead - 28040 tons/year, silver 13600 kg/year, copper in dross 191 tons/year, slag 39100 tons/year (4% Pb, 15% Zn).

4. Cold slag fuming (Waelz process) plant located in Esfahan. Raw material: 39100 tons/year from "Lead Smelter"; anthracite, bituminous coal

Products: Zinc 5160 tons/year, lead 1480 tons/year, total 6640 tons/year.

CODE NO. 3439 - MISCELLANEOUS BASIC INDUSTRY OF ALL OTHER NON-FERROUS METALS

FERRO-SILICON

There is no plant producing ferro-silicon in Iran at present.

As in future there will be big demand of ferro-silicon in the steel Mill in Esfahan and in foundries (local demand for ferro-silicon is estimated as 13000 tons), it is anticipated that one big unit will be built for production of 14000 tons per annum in the sixth-five-year plan 1356-61(1977-1983) and the capacity will be doubled in the seventh five-year plan.

Forecast of Production of ferro-silicon

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of ferro-silicon tons	-	-	14,000	28,000

Description of Machinery and Equipment

Quarzite and steel scrap will be transported to the plant in road trucks. Quarzite will be crushed and screened and then transported by belt conveyors to bins in the stock house. Raw materials will be weighed, conveyed to the furnace bay by belt conveyor and chute charged to 15500 KVA low hood type smelting furnace, for the ferro-silicon production with 150-200V, 70-90kA electric regime and continuous reduction process. The molten ferro-silicon will be tapped in ladles and transported by over-head crane to tapping and finishing bay. The melt will be poured into refractory lined tapping pans. Ready ferro-silicon will be crushed, screened and stored before despatch.

It is advisable to build the production of ferro-silicon with the production of ferromanganese and ferro-siliconmanganese in one plant (see production of ferromanganese).

[illegible]

[illegible]

As it is presupposed that [illegible] will be re-opened, there will be production of gold in melting plant located at the mine. [illegible] will reach approx. 100 kg of gold per annum.

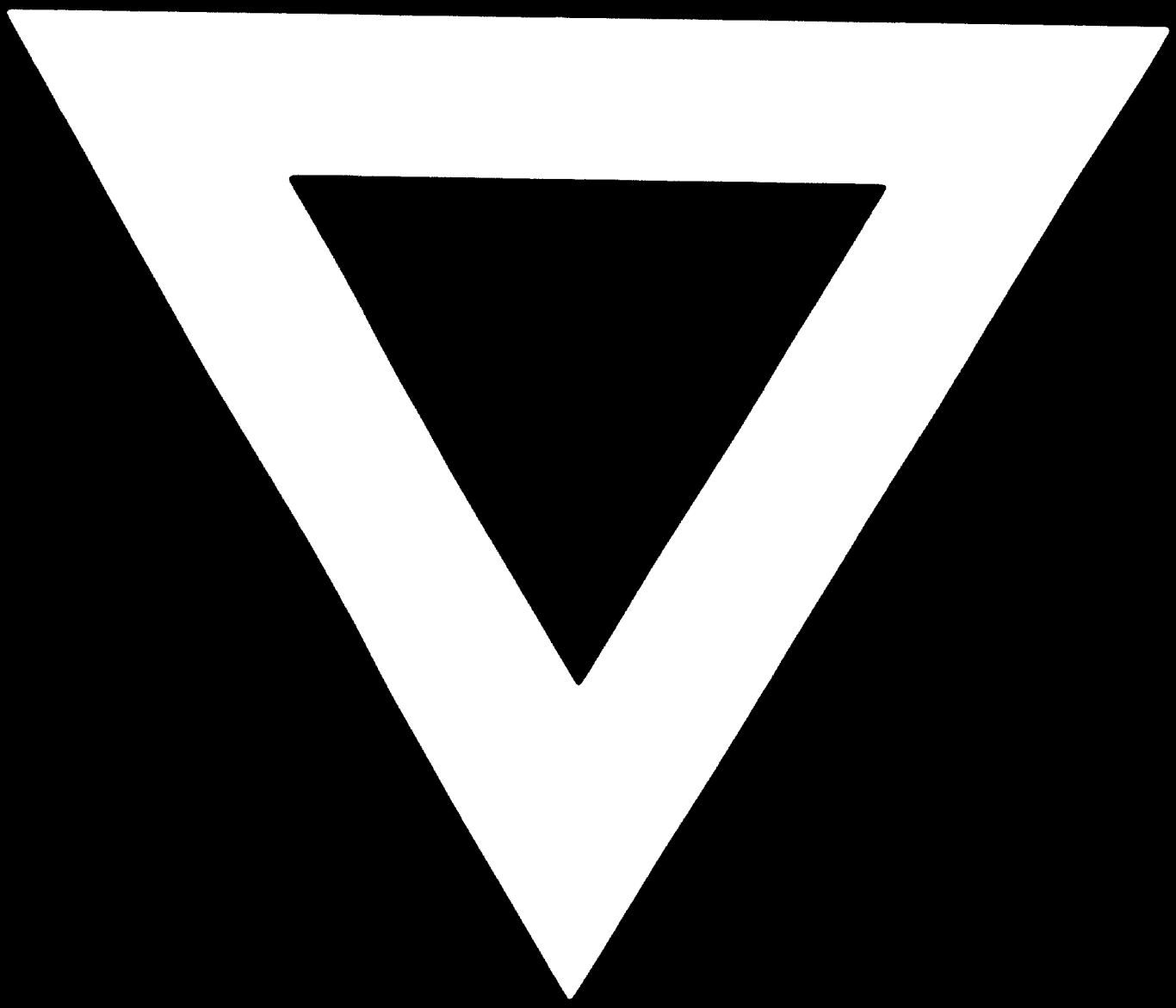
Small quantity of gold could be produced as by-product of Zn - Pb mines.

CODE NO. 3442 SILVER BASIC INDUSTRY

CODE NO. 3443 PLATINUM BASIC INDUSTRY

As there are no silver or platinum mines, there are no basic industries of this kind in Iran at present and it is not anticipated that there will be any developments in these fields.

Small quantity of silver could be produced as by product of Zn-Pb mines.



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