OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

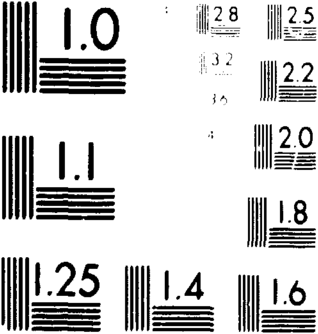
FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



1.0
2.8
2.5
3.2
2.2
3.6
2.0
1.1
1.8
1.25
1.4
1.6

RESTRICTED

11491

5 March 1981

English

Turkey.

CHECKING UP OF THE FEASIBILITY REPORT MADE BY SIDEMIR PROJECT GROUP REGARDING THE ESTABLISHMENT OF AN INTEGRATED IRON AND STEEL WORKS AT SIVAS-DOĞANCA FOR A CAPACITY OF 2.400.000 TONS PER YEAR.

DP/TUR/76/038/11-16/31.8.C

TURKEY

Technical report made by STEN BERGMAN concerning detailed project study of four different kinds of non flat rolling mills.

Prepared for the Government of Turkey by the United Nations Industrial Development Organization, executing agency for the United Nations Development Programme.

00..98

This report has not been cleared with the United Nations Industrial Development Organization which does not, therefore, necessarily share the views presented.

I. TABLE OF CONTENTS 2

II. SUMMARY 3

III. INTRODUCTION. 4

A. Project background 4

B. Rolling mill installations. 5

1. Continuous 4-strand wire rod mill 5

2. Light section mill 6

3. Medium section mill 7

4. Heavy section and rail mill 7

5. Reheating furnaces 8

IV. FINDINGS 9

1. Continuous 4-strand wire rod mill 9

2. Light section mill 10

3. Medium section mill 10

4. Heavy section and rail mill 11

V. RECOMMENDATIONS 12

VI. APPENDICES 13

II. SUMMARY

This report concerns detailed project study in non-flat rolling, Project no DP/TUR/76/038/11-16/31.8.C Turkey. The purpose of the project is to make the Turkish Iron and Steel Industry self-reliant with regard to the preparation and implementation of expansion plans.

In cooperation with the Project Group of Sivas Iron and Steel Works the Feasibility Study of Sivas Project has been studied in the part of the four non-flat rolling mills concerned during the time 13 February to 7 March 1981, travelling time to and from Ankara, Turkey not included.

Two of the mills are of continuous type*, all with layouts representative for modern high productive rolling mills.

Recommendations have been given to contact presumeable machine deliverers in order to get preliminary quotations and layout drawings based upon the figures shown in the feasibility study.

A strengthening of railway communications from the coast to Sivas seems to be very important.

*and the other two of semicontinuous type

III. INTRODUCTION

A. Project background

In the Third Five Years Development Plan, decided by the Turkish Government in July 1976, is considered the establishment of a fourth integrated iron and steel works in Turkey. This would bring up the steel production to an ultimate capacity of 10 million tpy included certain extensions at already existing steel works as considered by the State Planning Organisation, DPT. This fourth establishment should according to the Governments decision be an inland complex in the Sivas province and also be helpful in solving the present unemployment problems by promoting the growth of satellite industries in the region.

With respect to regional demand projections and to the production and expansion programs of the already existing works the capacity of the Sidemir plant has been determined as 2 million tpy long products. Later this figure has been increased to to 2.4 million tpy by considering the demand of heavy sections and rails which could not be met by the other works according to the report of the Sidemir Project Group.

The estimated plant site is close to the main iron ore deposits of Turkey and the plant will process fine ores and pellets. The plant is also expected to receive lump ores from far situated deposits.

Negative factors to be considered are among other things inadequacy of existing railway facilities, unsuitable climate conditions, poor communication and housing facilities and the lack of skilled labour in Sivas region etc.

Of economical reasons the total steel works poject has to be realized in two stages, stage I and II.

B. Rolling mill installations

According to the feasibility study the following four different, high productive non-flat rolling mills will be installed:

- One fully continuous 4-strand Wire Rod Mill with a capacity of 900 000 tpy. - Stage I
- One fully continuous Light Section Mill with a capacity of 500 000 tpy. - Stage II
- One semicontinuous Medium Section Mill with a capacity of 600 000 tpy. - Stage II
- One semicontinuous Heavy Section and Rail Mill with a capacity of 400 000 tpy. - Stage I

The analysis of the steel produced will be

C : 0.04-0.8%
Mn: 0.25-1.15
P : 0.04 (max)
S : 0.05 (max)
Si: 0.15-0.40

1. Continuous 4-strand Wire Rod Mill

Initial Material :	Continuously cast billets 115x115mm^2 in cross-section, 15m in length and 1530kg in weight.
Rolling system :	Roughing train-7 two-high horizontal stands Intermediate train-8 two-high horizontal stands Finishing train-4 one-strand finishing blocks with 10 no-twist two-high stands each in 45^o-arrangement Each block driven by two motors.
Final products :	Wire rods 5.5-12.5 mm in diameter marketed as coils of 1500 kg in weight.

Typical production program :	5.5-7 mm dia. 20% -180.000 tpy 8-lo mm dia. 50% -450.000 tpy 10.5-12.5 mm dia. 30% -270.000 tpy. 150.000 tpy of bars of 9.5-12.5 mm dia. will be deformed reinforcing bars. Rods thicker than 12.5 mm dia. might be also produced by removing the semi-finished material before entering the finishing blocks.

2. Light section mill

Initial material :	Continuously cast billets 115X115 mm^2 in cross-section, 15 m in length and 1530 kg in weight.
Rolling system :	Roughing train -8 two-high horizantal stands 1 two-high vertical stand Intermediate train -4 two-high horizontal stands -1 two-high vertical stand Finishing train -2 two-high horizontal stands -2 two-high vertical stands
Final products :	Bars with a diameter of 12-70 mm Strips 5-20 mm thick,40-80 mm width Angles 20x20 to 80x80 mm Channels 30-140 mm high (Flexible to roll other sections)
Typical production program :	Bars and rods 12.5-70 mm, 40% -200.000 tpy Strips 5-20 mm thick, 40-80 mm wide, 5%--25.000 tpy Angles 20x20 to 80x80 mm, 25% -125.000 tpy Channels 30-140 mm high, 30% -150.000 tpy

3. Medium section mill

Initial material : Continuously cast blooms 200x200 mm^2 in cross section, 5m in length and 1540 kg in weight

Rolling system : Roughing train -1 two-high reversing stand with manipulators
Intermediate train -2 two-high horizontal stands with grip type tilters
Continuous finishing train
-1 universal two-high stand
-7 universal two-high stands for optional use as horizontal two-high stands or as universal stands
-4 tilting stands (can be put in either as horizontal stands or as vertical stands)

Final products : IPN beams 80-200 mm
IPE beams 80-2oo mm
IPB beams 100-160 mm
IPBI beams 100-160 mm
IPBV beams 100-140 mm
Channels 50-200 mm
Equal sided angles 50x40 - 150x20 mm
Unequal sided angles 60x40x5 - 120x80x8 mm

Typical production programs :
I-beams -40% -240.000 tpy
Channels -15% 90.000 tpy
I-sections -20% -120.000 tpy
Angles -25% -150.000 tpy

4. Heavy section and rail mill

Initial material : Continuously cast blooms 265x340 mm^2 in cross-section, 4 m in length and 2775 kg in weight

Rolling system : Break-down stand -1 two-high reversing stand with manipulators

Roughing group -1 two-high horizontal stand
1 two-high universal stand
Intermediate group ,1 two-high universal stand
1 two-high horizontal stand
Finishing train -1 two-high universal stand

Final products : Rails up to60 kg/m - 40% -180.000 tpy
Full range of heavy structurals (channels, piles and beams of IPN, IPE, IPB, IPBI, IPBV) - 60% - 250.000 tpy

5. Reheating furnaces

For reheating of initial material walking beam type 3-zone reheating furnaces are proposed for all four rolling mills. Actual operation time is assumed to be 18 hrs/day (i.e. 75% operation efficiency). For heating the furnaces mixed gas with a calorific value of 3096 Kcal/Nm^3 is assumed.

Table I.

Reheating furnace data	Wire rod mill	Light section mill	Medium section mill	Heavy section and rail
Number of furnaces	2	1	2	1
Capacity in tph	110	120	80	110
Length in m	22	24	21	37
Width in m	16	16	11.5	9.5
Furnace area in m^2	352	384	242	352
Specific load in kg/m^2-hr	313	313	332	313
Specific heat cons. in kcal/t	387.000	470.000	490.000	520.000
Product yield (assumed)	0.95	0.93	0.86	0.85

IV. FINDINGS

1. <u>Continuous 4-strand wire rod mill</u>

1.It is necessary to study the arrangement of the two reheating furnaces further, with respect to charging and discharging of billets in first hand and also with respect to maintanance and supervision. It is necessary to have seperate charging and discharging devices for each furnace. It may be possible to arrange the two furnaces with the discharging ends against each other with some distance between the ends. The discharging of the furnaces then necessitates the installation of a special discharging car with two parallel separate driven roller tables between the furnaces and the roughing train and of about the same length as the billets. These roller tables might probably be provided with radiant protective hoods in order to avoid unnecessary losses of heat. If this solution of some reason not should be possible the installation of one furnace only is the alternative, but then the advantage of two furnaces will be losed. The problems with respect to the number of furnaces and the furnace discharging must be carefully discussed both with the furnace constructor and the rolling mill firms.

2. If rods thicker than 12.5 mm will be produced at a later stage this must be foreseen already at the planning stage. It might be possible to reserve some space at the centerline of the four finishing trains in order to install a roller table for the bars later on. Space for cooling beds, shears etc. must also be foreseen.

3. Another problem is how to take care of the coils after the forced cooling sections. It will probably be necessary to install a sufficient long hook conveyor with unloading devices.

4. Weighing equipment must be foreseen.

5. The number of stands, roll diameters and barrel lengths, rolling speed and motor data have to be controlled and recommened by the rolling mill firms.

6. The billets from the storage yard have to be inspected with respect to surface defects, which have to be eliminated by hand scarfing.

7. The proposed Wire Rod Mill seems to be very alike a wire rod mill delivered by Schloemann-Siemag to Cockerill-Ougree SA, Seraing, Belgium a few years ago, which is of very late design.

2. <u>Light section mill</u>

1. The total number of stands is 18 which seems to be well enough even with respect to the quite big number of sections which have to be rolled in the mill. Anyhow the number of stands, roll diameters and barrel lengths, rolling speed and motor data have to be controlled and recommended by the rolling mill firms.

2. In the layout sketch is only indicated a rake type cooling bed at the delivery end. This must be completed with cooling bed shears, roller tables, straightening machines, weighing equipment etc. The machine firms should be asked for their suggestions, what they recommend as a minimum and what they recommend as the best total solution when running the mill at full production.

3. Same remarks as in point 1.6.

3. <u>Medium section mill</u>

1. The mill layout shows totally 15 stands and seems to be identical with a medium section mill, delivered by Schloemann-Siemag for Huta Katovice PR, Poland a few years ago. It is a very modern mill of late design which makes a very wide and adjustable rolling programme possible.

2. The mill layout indicates only a rake-type cooling bed, 2 straighteners and a chain type cross-conveyor at the delivery end. It must also be completed with further roller tables roughing and finishing saw groups, further cross-conveyors, storage beds, weighing equipment etc. The machine firms should be asked for these suggestions, what they recommend as a minimum during the start up period and what they recommend as the best total solution when running the mill at full production.

3. A high pressure water descaling equipment for the hot

blooms incorporated in the roller table before the breakdown stand should be considered.

4. The number of stands, roll diameters and barrel lengths, rolling speed and motor data have to be ccontrolled, and recommended by the rolling mill firms.

5. The blooms from the storage yard have to be inspected with respect to surface defects, which have to be eliminated by hand scarfing.

4. Heavy section and rail mill

1. The schematic mill layout shows 6 stands. The first of them, the breakdown stand is a two-high reversing mill with manipulators. The arrangement of the stands seems to allow sufficient number of passes in order to reach the desired rolling programme.

The layout has to be carefully examined by the different machine firms with respect to number of stands, distances between the stands, roll diameters and barrel lengths, rolling speed and motor data.

2. A high-pressure water descaling equipment for the hot bloom incorporated in the roller tables before the breakdown stand should be considered.

3. The schematic mill layout does not show any equipment after the finishing stand. The different machine fimms should also suggest and offer structurel and rail cooling beds, straightener, gage press, cold saws, drilling equipment, stacking devices etc.

4. The blooms from the storage yards have to be inspected with respect to surface defects which have to be eliminated by hand scarfing.

V. RECOMMENDATIONS

1. Even if the demand of different kinds of steel products,, which is growing year after year, necessitates the constrution of the forth integrated steel works within some years, the cheapest way to raise the steel production in Turkey rapidly must be to increase the production of steel at the already existing steel works. It also seems to be very important to take care of the iron ore deposits in Sivas region, which in its turn necessitates a strengthening of the railway communications to that region. With good existing railway communication, it might be easier to decide when and where the forth iron and steel works will be constructed.

2. To be able to get an idea of the sizes of the different buildings for the rolling mills, it is necessary to have at least preliminary layout drawings for the rolling mills etc. from the machine firms. According to my opinion, you now have necessary data to give them in order to get quotations or at least preliminary ones.

3. Automatic control of the various operations in the different reheating furnaces and rolling mills with help of electronic computers and suitable transmitters should be considered.

4. It seems to be very important to get verified from the railway authorities in Turkey and in other presumable rail buying countries that they will approve rails rolled from continuously cast blooms 265x340 mm^2 which means a conciderable less total reduction than rolling blooms made from ingots.

5. For all engineering work of this kind it is very important to have a good but simple identification system (index numbering system) for the proposed plant. That numbering system should be the basis for identifying the different drawings in the drawing register and for all technical correspondance and other technical documents referring to the plant in your technical archives. And it is very important to have this system already when the engineering work is going to start.

VI. APPENDICES

A. Rolling mill specialist for engineering work

When starting the engineering work for such a big project as this the common way is to turn to a big consulting firm with specialists of all kinds and also a big staff of draftsmen. The total staff may be thousand people and more. Such a consulting firm has the capacity to make the hole plant layout and if desired also all detail work. I should guess that for this steel works only for the buildings and all outside works (railways and roads inside the plant, external tubing etc.) the amount of drawings should amount to about 10 000 to 20 000. The final layout drawings and the drawings for helping devices etc. will not be made by the machine delivering and furnace delivering firms. They must be made by somebody else, which also requires suitable personnel.

As you intend to perform this job here in Turkey it is very important to get the right and real specialised and clever men to the key posts.

The coordinator of the whole work must have a number of specialists to his disposal and one of them must be responsible for the four rolling mills. He should be high graduated, be able to speak and write english and german fluently and have at least 15 years practical experience from rolling, especially from non flat rolling. Some years experience from earlier job as draftsman would also be a merit. This rolling specialist ought to have an assistant who can be a little younger but also with good knowledges technically and linguistically.

B. Overhead cranes - Some advices

1. Working cranes in steel works should be of the Heavy-Duty type with welded box type girders. The German "DIN-Normen für Hüttenkrane" should be referred to when asking for or ordering an overhead crane (these norms may also be printed in english)

Normal shop cranes, for instance cranes for maintenance in the rolling mills can be of Normal-Duty type.

2. The crane bridges shall have non flanged supporting wheels and two pairs of steering wheels at one of the rails. The steering wheels must be adjustable.

3. When the supporting wheels are showing high wear they can be made of hardened cast special alloy steel.

4. Try to get supporting wheel, steering wheels, brakes, wires etc. of not too many sizes which means cheaper spare parts.

5. The speeds for travelling and hoisting shall be tyristor controlled on all handling cranes for beams etc. and on all magnet cranes, may be also at some cranes in the rolling mills.

6. Four elctric main lines (one for earthing). With only three lines it is possible to burn the roller bearings by short circuit.

7. All electric circuits should be well marked with screw-fastened engraved plates. Complete set of transparent drawings mechanical and electrical should be delivered with the cranes.

8. The German type of crane rail, for instance K-120, is recommended as cranerails and also for the trolley on the crane itself. See "Stahl im Hochbau".

The wide width of the rail head of the K-rail decreases the so called Herz' pressure and the wear will not be so strong.

9. The cranes shall be finish painted against corrosion by the crane deliverer.

10. Cranes equipped with horizontal turnable hoisting machinery are recommended for handling the billets and the blooms at the storage yards.

11. The lifting magnets should be attached to lifting beams hanging in two lifting blocks attached to a common hoisting machinery.

12. The crane bridge should be equipped with a full-sight, closed drivers cabin, mounted under one of the main girders, eventually at the center line of the bay in order to give the driver the best possible sight.