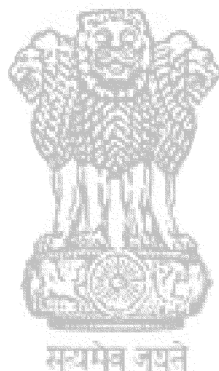


# APPRAISAL OF STEEL DEMAND

**Report of the  
National Council of Applied Economic Research  
New Delhi**

Prepared for  
The Committee on Steel Demand Appraisal



**COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH  
NEW DELHI**

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सत्यमेव जयते

## PREFACE

The Second Five Year Plan provided for a production target of 4½ million tons of finished steel to be achieved by 1960-61 through the expansion of the existing steel companies, viz. TISCO and IISCO, and through the establishment of three new steel mills at Bhilai, Durgapur and Rourkela.

But as these projects began to take shape, and as increased supplies were in sight, it was natural that a need was felt for a careful appraisal of demand which could ensure that the supply could be fully and effectively utilised. For this purpose a study of the demand from the various sectors of the economy was considered to be useful, both short term and fairly long term. What would be the quantity of demand for steel of different categories in the Third and Fourth Plan periods, and what are likely to be the end-uses of steel, the larger production of which was being planned?

These questions were highly important, for on a reasonably correct answer to them depended the pattern and size of the future steel production plans. Demands that are wide of the mark could result in a misallocation of resources, so wasteful and injurious to a low-income economy in its critical years of growth.

Some of those who expressed their doubt regarding the capacity of the country to absorb the production targetted for at the end of the Second Plan were largely influenced by the possible unfavourable cost-price relationship. The price of Indian steel, involving the operation of an Equalisation Fund, ruled higher than the international levels; and this, in their opinion, would be a serious limiting factor to demand for Indian steel. This view had some amount of support from certain theoretical economists also, who argued that because of low incomes, the markets in underdeveloped countries for commodities like steel, aluminium, etc. might not be large enough to support large sized modern plants.

It is not proposed to examine here the soundness or otherwise of these views. Suffice it to say that these doubts were genuine. They were first expressed in the Metals Committee of the Council of Scientific & Industrial Research at a meeting held on 6th February 1958, and later brought up prominently both before the Board of Scientific & Industrial Research and the Governing Body. It was thereupon decided by an official resolution dated 22nd March 1958 that the subject required an objective and complete investigation by an independent economic research organisation.

This is how this study came to be undertaken by the National Council of Applied Economic Research. It involved the prediction of demand for steel not only in quantities, but also in detailed categories in two phases—one the short-run period of 1960-61 or the end year of the Second Plan, and the other the comparatively long range periods, 1965-66 and 1970-71, the end years of the Third and the Fourth Plans.

Prediction in economic as well as in other affairs is obviously fraught with risks; and not less so, even in the short term, when the prophecy is too



near the event. It is often safer to predict trends than immediate or very short term changes.

Bearing this in mind, the Council had to do some thinking on the methodology to be adopted, so that the errors of prediction may be reduced to a minimum. Prediction-economists usually resort to the macro-economic approach, employing estimates of National Income, Population, etc. to the short term forecasts, and the micro-approach, involving detailed study of demand and supply to the long-range projections. In this study, however, the roles of these approaches have been reversed. The micro-approach involving the study of end-uses of steel in quantities and categories by a number of industries and users was studied in detail and the requirements of the country for 1960-61 estimated in the light of their short run programmes. Once this was done, a fairly reliable picture of the inter-industry relationships and the resulting pattern of consumption by quantities and categories over the entire economy came to emerge. To this pattern was applied the National Income, Population, and other macro economic variables to project the patterns for the end years of the ensuing plans, 1965-66 and 1970-71. Neither the Time Series method, nor the Specific Analogy method has been employed except by way of illustration. The applicability of those methods to the study on hand had serious limitations which became obvious even at a very early stage of the investigations.

The Council has had some experience in the realm of demand forecasting, and had developed a certain measure of expertise among its economists and statisticians in this field, but a demand study of steel presented peculiar difficulties. Its almost pervasive use in modern life required an investigation into nearly every branch of industry under an end-use approach. This is a time consuming process, and as it turned out, even with the best of efforts, there are areas, though not of much significance quantitatively, where the estimates cannot be said to be firm.

Secondly, it was fortunate that CSIR decided to set up a Committee under the Chairmanship of the Director-General of the NCAER himself to guide the study. The Committee consisted of representatives of steel industry, and of the Ministry of Steel, and others experienced in the industry. Without the Committee's help it would not have been possible for the Council's staff to have successfully completed a study which needs the combined skills of the economist and technical expert.

Thirdly, the study involves a number of assumptions, major and minor, broad and detailed. For example, whether and to what extent substitutes, natural and synthetic, would be found in the next ten years for steel. But frankly, technological changes are a variable which call for some amount of crystal-gazing and could not be reckoned with in any serious manner here.

Despite all these limitations, no efforts have been spared to reduce the range and depth of possible errors to present a fairly intelligible concrete picture of the trends. The demand for steel in 1960-61 has been estimated at 3.6 million tons, and the production trends, as they are, seem to justify this figure. It has to be remembered that, in the short run, the supply determines demand. The forecast for 1965-66 is 7.2 million tons of finished steel and for 1970-71, 12.9 million tons of finished steel; and the conclusion is that at no time during the Third and Fourth Plans is there any likelihood

of demand lagging behind supply. The demand estimated in terms of different categories compared with the capacity production of existing plants will serve as a guide to the rolling programme of future expansions of the steel industry in the country.

An incidental value of this study, however, lies in its by-products. The study of the end-uses of steel has thrown up a mass of information about the structure, growth, and investment of a number of industries embracing almost the entire economy, providing the guidelines for the planning and programming of their development through the Third and the Fourth Plans. This inter-industry data incidentally thrown up, is of inestimable value in improving the technique of projections. The study clearly points to the desirability of setting up a machinery which could collect all the data relating to steel on a continuing basis. Such a machinery can be of help in the field of economics in many ways. Predictions here attempted can be refined from time to time in the light of new developments. Predictions as basis for planning can be facilitated for several other industries dependent on steel use. It could be a clearing house of information to the steel industry both in the private and public sectors. It is one of the findings of this study that an organisation of this character should be established as early as possible.

In the completion of this project, I have received much help from a number of individuals and organisations. The sponsor, the Council of Scientific & Industrial Research, and in particular its Director-General, Prof. Thacker, have given the Survey Team great encouragement throughout. To the Advisory Committee who placed their vast technical experience at our disposal, the study owes a great debt. The engineering associations and the business firms also gave their wholehearted cooperation. Among the Council's staff who participated in the study special mention should be made of Dr. B. Natarajan, Director and Dr. A.K. Mukherji, Mr. S. Balakrishna and Mr. S.R. Iyengar. To all of the above, I wish to express my thanks.

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P. S. LOKANATHAN  
*Director-General*

## CHAPTER ONE

### INTRODUCTION

The Board of Scientific & Industrial Research, and the Governing Body of the Council of Scientific & Industrial Research at their meetings held on 21st and 22nd March, 1958 decided to conduct a study of the capacity of the country to absorb  $4\frac{1}{2}$  million tons of steel output planned for 1960-61. In pursuance of this, the Council of Scientific & Industrial Research constituted a Committee for Steel Demand Appraisal consisting of the following members to fix up the programme and other details of work :

- |  |                         |
|--|-------------------------|
| 1. Dr. P.S. Lokanathan,<br>Director-General,<br>National Council of Applied<br>Economic Research, New Delhi.   | <i>Chairman</i>         |
| 2. *Shri G. Ramanathan,<br>Deputy Secretary,<br>Department of Iron & Steel,<br>Government of India.            | <i>Member</i>           |
| 3. Dr. B.D. Kalekar,<br>Senior Industrial Adviser,<br>Ministry of Commerce & Industry,<br>Government of India. | <i>Member</i>           |
| 4. Shri A.S. Bam,<br>Iron & Steel Controller,<br>Government of India.  | <i>Member</i>           |
| 5. Shri K.N.P. Rao,<br>Tata Iron & Steel Co. Limited,<br>Jamshedpur.   | <i>Member</i>           |
| 6. Shri R.N. Kapur,<br>Indian Iron & Steel Co. Limited,<br>Calcutta.   | <i>Member</i>           |
| 7. Dr. B.R. Nijhawan,<br>Director,<br>National Metallurgical Laboratory,<br>Jamshedpur.                        | <i>Member</i>           |
| 8. Dr. B. Natarajan,<br>Director,<br>National Council of Applied<br>Economic Research, New Delhi.              | <i>Member-Secretary</i> |

The study, however, was entrusted to the National Council of Applied Economic Research in February 1959, as a sponsored project of the Council of Scientific & Industrial Research.

The first meeting of the Committee was held in New Delhi on the 30th March 1959, when the programme of work was discussed and set out in

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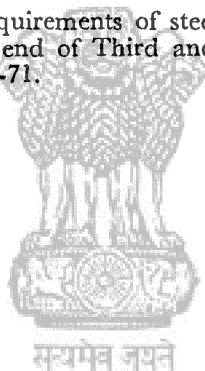
\* Earlier Shri K.S. Raghupathi, Deputy Secretary, Ministry of Steel was a member of the Committee.

detail. The second meeting of the Committee was held on the 15th July 1959, in the office of the Iron & Steel Controller in Calcutta to discuss an interim report prepared by the National Council of Applied Economic Research. The Committee after discussing the interim report indicated the lines on which further work might be done. The third meeting of the Committee was held on the 30th November 1959, when the National Council's draft report was considered in detail. While generally approving the draft, the Committee made certain suggestions for incorporation in the final report. The final report was signed by the Committee at a meeting held on the 7th March 1960 in New Delhi.

### OBJECTIVES

The basic objectives of the study are :

- (i) to estimate by a realistic approach the requirements of steel in 1960-61 in relation to total availability in the country including imports ;
- (ii) to estimate requirements by categories of steel in 1960-61 including the normally imported categories ; and
- (iii) to estimate the requirements of steel, in the aggregate and by categories at the end of Third and Fourth Plans, that is, in 1965-66 and 1970-71.



## CHAPTER TWO

# METHODOLOGY AND ASSUMPTIONS

## METHODS

In an approach to the problem of estimating steel demand a number of methods can be employed: (1) Historical Analogy method, (2) Industrial Output method, (3) National Estimates method, (4) Market approach, (5) End-uses method and (6) Trend method. The degree of precision of the results attained will depend upon the method employed, and the particular method adopted depends upon the circumstances of the country, the data available and the objectives to be attained. The extent to which the various methods are suitable for this project are discussed in Appendix one.

The End-uses method has been found to give the most reliable estimate of demand for a basic commodity like steel. It has, however, been supplemented by the National Estimates method, and to a limited extent by the Trend method. The forecasting of future demand by regression analysis has its obvious limitations, when the base of steel production and consumption has been as narrow as it was in the past in India, and when large investment is planned in establishing a solid base for the industrialisation of the country and in increasing the output of the steel consuming industries. The Trend method is at least likely to be useful for a period when the supply is comparatively inelastic in the short period, and so for certain commodities this method has been used in estimating the requirements for 1960-61.

The methodology of estimation will no doubt vary in its details with each individual sector of the economy depending upon the availability of data and the special factors affecting the demand for steel in that particular sector. But the general principles adopted may be briefly described here.

The major line of approach adopted for 1960-61 has been to find out by a dis-aggregative method the actual categorywise consumption of steel by consumers in different sectors of the economy during the last three years and the progress these sectors have made in relation to the targets set by the Second Plan as revised in May 1958. From this an assessment has been made of what could yet reasonably be fulfilled during the remaining years of the Second Plan. The steel requirements of the remaining programme have then been arrived at with the aid of "technical coefficients" in different industries, or by working out the steel content of various investment plans.

For projections of demand for steel beyond 1960-61, the different factors affecting the future demand were duly weighed, keeping in view the structural and technological changes that are likely to be brought about by planned development, as well as those which could be currently visualised from general considerations. The general factors, such as anticipated changes in income, population growth, pace and pattern of growth of different sectors in the economy as contemplated in the planned programme or as far as can be visualised under the present state of knowledge were all taken into account. Factors indicating structural

changes, such as emphasis on the development of heavy industries, the general policy in regard to import of machinery and equipment, and their replacement by indigenous production, etc., are some of the important determinants in this procedure of estimation. The analysis was carried out here, too, sector by sector, and the impact of the macro-variables on each of these sectors was duly assessed to arrive at the aggregate demand.

In this procedure, it is essential to know who consumes steel and in what form, what is the relative importance of each consumer, what has been the rate of progress of a particular economic sector towards the target for the Second Plan, and what are the factors determining its future growth.

While an estimate of the total apparent consumption may be obtained by adding up the total production and net imports (on the assumption of no changes in stock), there is no direct knowledge as to how much of the total production or the net imports is consumed by various end-users in a year. However, as the distribution of steel, both home produced and imported, is controlled by the Government of India, the quantity of steel actually allocated to various quota holders over a period of years is expected to give an idea of the consumption of steel by different users.

But the quota holders are not necessarily the actual users of steel. On account of the shortage of steel, there is usually a considerable lag between allocation of steel to quota holders and their actual consumption against deliveries from producers or from imports. Moreover, for certain categories of steel, allotment figures do not reflect the correct position as to its consumption. Figures of allotment for categories like wires, tin plates, tool and alloy steel, etc. have hardly any relation to the demand in the country or its consumption. In these cases, allotment is practically based on indigenous production and all indents are placed on producers. The imports are given directly to the consumers in addition to the allocations from indigenous sources. This is necessary, because the indigenous production of certain categories of steel like wire is limited to a small range of gauges only. Imports are mostly for gauges beyond this range. For the purpose of assessment of demand for such categories, the allotment figure alone is of no use; production and imports should be added, and the total suitably adjusted, keeping in view the fact that the demand is being met only partially at present. By putting all such information together, some idea about the consumption of steel in different sectors of the economy has been obtained.

A questionnaire was issued to various consumers of steel both in the public and the private sectors. The list of consumers who were addressed in this connection is given in Appendix four. The questionnaire was followed up by personal contacts, and the response to these approaches was, on the whole, satisfactory.

### ASSUMPTIONS

In a planned economy, the demand for an important basic commodity like steel is ultimately determined by the nature of the country's development plans and the pattern and the size of investment in different sectors of the economy, public and private. It is, therefore, essential to an understanding of the basic assumptions of this study to give an outline of the plans and the magnitudes and the distribution of investment outlays as between different sectors of the economy.

The Second Plan<sup>1</sup> gives the basic information with regard to planned investment in the public sector and to some extent in the private sector also ; and the reappraisal<sup>2</sup> in May 1958 indicates the actual progress of investment plans up to 1957-58 and the anticipated outlays for 1958-59. All information with regard to the Second Plan investment here utilised has been based on the data given in these two publications by the Planning Commission.

The Third Plan is in the process of formulation, but for the purpose of this study, an outline of the Third Plan has been framed largely on the basis of the preliminary thinking of the Planning Commission indicated in a paper of that body dated November 1958, with this difference that while that paper gives the outlays at 1957-58 prices, this study assumes the 1952-53 prices for them. This means that in real terms the investments proposed for the Third Plan in this study are somewhat higher, and will, therefore, generate an income slightly higher than the estimates projected in this paper of the Planning Commission ; for, as prices in 1957-58 have increased by about 8.4 per cent over 1952-53 prices, the total investment outlay here assumed namely Rs. 10,000 crores is not the same as the investment outlay of Rs. 10,000 crores now proposed for the Third Plan. Our figure is about 8.4% higher in real terms, or Rs. 10,840 crores in 1957-58 prices. To this extent, the demand for steel herein estimated may also have to be adjusted downwards. But whether this adjustment will be to the full equivalent of 8.4% or more or less will very much depend on the pattern of investment that will be adopted for the Third Plan. As it is, the distribution of outlays between the different sectors has closely followed the lines of the recent thinking of the Planning Commission. If, however, this pattern changes, there are likely to be variations in our category estimates ; but by and large the total steel demand may not substantially alter.

For the Fourth Plan, population is assumed to increase at about 2 per cent ; but per capita income only at about 3 per cent per annum as during the Second and Third Plan periods. This gives an investment outlay of Rs. 14,800 crores at 1952-53 prices for the Fourth Plan. This has been distributed between different sectors on the assumption of a general increase in capital-output ratio, and more particularly in large scale and medium industries.

The assumptions in respect of the growth of different economic sectors and individual industries which are involved in the estimates of the future demand for a basic commodity like steel are too numerous to be discussed at length. A brief mention may, however, be made about some of them here.

The projection of demand for steel by the Railways during the Third and Fourth Plan periods is based mainly on the anticipated volume of traffic that the railways are expected to carry during these periods. An estimate of the total traffic, in goods and passengers, likely to be generated by the end of the Third and Fourth Plan periods has been prepared. It has been assumed also that railways will carry about 80 per cent and 75 per cent of the total additional traffic likely to be generated by the increased tempo of agriculture and industrial production during the Third and

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1. Second Five Year Plan, Planning Commission, Govt. of India, 1956.

2. Appraisal and Prospects of the Second Five Year Plan, Govt. of India, May 1958.

**TABLE 1—DISTRIBUTION OF INVESTMENT IN THE THIRD AND FOURTH PLANS**

(Rs. crores in 1952-53 prices)

SECTOR	THIRD PLAN			FOURTH PLAN		
	Public	Private	Total	Public	Private	Total
1. Mining and oil	200	100	300	344	100	444
2. Power	650	50	700	925	75	1,000
3. Basic industries	800	200	1,000	1,750	250	2,000
4. Organised large-scale industries ..	500	500	1,000	1,265	915	2,180
5. Small-scale industries	200	100	300	294	150	444
6. Transport and communications	1,250	50	1,300	1,693	50	1,743
7. Roads	400	..	400	625	..	625
8. Agriculture	600	200	800	776	200	976
9. Irrigation	500	200	700	600	200	800
10. Housing	600	1,200	1,800	700	1,450	2,150
11. Schools, hospitals, etc.	500	100	600	800	150	950
12. Other construction	100	300	400	150	338	488
13. Addition to stock, misc.	400	300	700	438	562	1,000
<b>TOTAL</b>	<b>6,700</b>	<b>3,300</b>	<b>10,000</b>	<b>10,360</b>	<b>4,440</b>	<b>14,800</b>

Fourth Plan periods respectively. Thus during the Third and Fourth Plans respectively, railway programmes for rolling stock as well as track and others have to be geared to carry an estimated additional traffic of about 58 and 159 million tons and over the 1960-61 figure of 163 million tons. Passenger traffic is expected to increase by about 5 per cent per annum during the Third Plan over the Second Plan figure, and 8 per cent per annum during the Fourth Plan over the Third Plan figure. A number of structural changes have also been allowed for, such as increased tempo of electrification, change over to electric locomotives, etc.

The total development expenditure on roads and road development projects has been taken in this study as Rs. 400 crores and Rs. 640 crores respectively for the Third and Fourth Plans in place of Rs. 590 and Rs. 1,065 crores assumed in the Road Development Plan by the Chief Engineers. In this, the non-availability of high tensile steel for roads and road bridges during the Second Plan period was duly taken into account.

It has been assumed that the total tonnage of shipping likely to be developed during the Third and Fourth Plans is 288,000 GRT and 466,000 GRT respectively. The outlay on ports is assumed to be Rs. 56 crores during the Third Plan, apart from the port's own contributions. In the Fourth Plan it has been assumed to increase to Rs. 92 crores.



The basic assumptions relating to industrial development are indicated in the allocations given in Table 1. One noteworthy feature of these allocations is the growing importance of the public sector in the economy in conformity with the declared objective of the Government to achieve a socialist pattern of society by evolution and all the basic industries are to be developed in the public sector. Scarcity of different categories of steel was generally felt more in the private sector. It has, therefore, been assumed that steel will be available in progressively larger quantities for this sector and that the quantity of steel consumed by the private industry for a given amount of investment will tend to increase\* at a rate higher than that for the public sector industry.

Another factor which is likely to increase the consumption of steel by industry for a given outlay will be the gradual replacement of imported machinery and equipment by indigenous production during the Third and Fourth Plan periods. In this category falls the following projects for the Third Plan :

Heavy Machinery Building Plant, Foundry/forge projects.  
Mining Machinery project  
Tool and Alloy Steel Plant  
Heavy Electrical Plant (Full Scheme)  
Heavy Machine Tool Works  
Fertiliser Plants  
Heavy Structural Fabrication  
Marine Diesel Engines Project  
Second Heavy Electrical Plant  
Second Stage of Bhopal Heavy Electrical Plant

Amongst the projects which have been assumed to come up during the Fourth Plan period, mention may be made of the following :

Heavy Plate and Vessel Works  
Fertiliser Plants (part)  
Oil Refinery Equipment Manufacture

For the Automobile industry it has been assumed that the indigenous content of the automobiles coming out of the plants in India is not going to be more than 80 per cent by weight of steel by the end of the Third Plan. As some special steels may not be produced in the country even by the end of the Fourth Plan, a small percentage will continue to be imported. The indigenous component by weight has been assumed to go up to 80% by 1965-66 and to 90% by 1970-71.

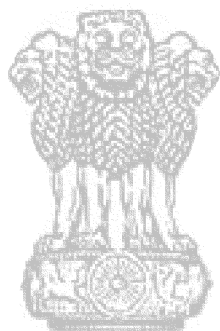
The target for the Iron and Steel industry has been taken to be 11 million tons of ingots by 1965-66 including the output of the Fourth Plant in the public sector and 17.1 million tons by 1970-71 when plants in the public and private sectors expand their capacity to the maximum. This programme excludes secondary producers and re-rollers whose share in the total production of steel is assumed progressively to decline, although they might increase their absolute production to some extent. The indigenous production of chemical machinery, sugar mill machinery and textile machinery has been taken to increase progressively during the Third and Fourth Plan periods. The demand for steel for coal machinery

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\* Steel required for construction, manufacture and maintenance of industries have also been included under the head 'Industry' and are not separately shown in the summary Tables, 93, 94 and 95.

and equipment will be reflected in the coal mining plant at Ranchi. The production capacity of tin plates has been assumed to equal to that of the Tin Plate Company plus M/S Khem Chand Raj Kumar. While the overall demand for tin plates by 1960-61 has been found to be much larger than the available capacity, it has been assumed that it will not be possible to produce more than 120,000 tons per annum by 1960-61.

It has been assumed throughout that the level of prices of steel will not alter to such an extent as to cause a wide margin of difference in the demand for consumer and producer goods.



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## CHAPTER THREE

# END-USES OF STEEL

This chapter gives the requirements of steel by end-uses. For some sectors, however, the National Estimates method has also been employed by adding up the quantity of steel required in each individual project assumed to be completed in a Plan period.

The chapter is divided into two parts. The first gives the details of estimates for each individual sector or industry, while the second sums up this and other available information presenting the estimates in eight broad heads as follows:

1. Transport and communications
2. Large scale and medium industries
3. Small scale industries
4. Housing and construction
5. Power projects
6. Irrigation projects
7. Agriculture
8. Others

## Part One : Steel Demand of Individual Industries

### TRANSPORT AND COMMUNICATIONS

#### 1. Railways

**The Railway Plan.** With a capital investment of about Rs. 974 crores, the Indian Railways constitute the largest national undertaking. Besides the needs of replacement and modernisation of the existing assets, the Railway plan is designed to meet the increased demand for rail transport arising from additional production in the various sectors of the economy. Outlay on Railways in the Second Plan is estimated at Rs. 900 crores, out of a total allotment of Rs. 1,345 crores for Transport and Communications. In addition, there is an outlay of Rs. 225 crores out of Railway Depreciation Fund, thus making a total of Rs. 1,125 crores, which is 20 per cent of the size of the Second Plan. The foreign exchange component of this outlay is of the order of Rs. 385\* crores.

Although the total outlay for Transport and Communications was reduced by the National Development Council in May 1958 from Rs. 1,385 crores to Rs. 1,345 crores, the Railway projects were considered a part of the 'core' of the plan, and the allocation for Railways remained untouched.

The programmes, originally drawn up for an outlay of Rs. 1,125 crores, were later estimated<sup>1</sup> to cost Rs. 100 crores more, owing to rise in prices. It was not, however, possible to raise the existing provision, and so

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\* Revised from the original Rs. 425 crores.

1. Appraisal and Prospects of the Second Five-Year Plan, Government of India, May 1958, p. 78.

TABLE 2—CATEGORYWISE SHARE OF RAILWAYS IN THE TOTAL CONSUMPTION OF STEEL FROM INDIGENOUS SUPPLY

CATEGORIES	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
(Tons)										
(1) Blooms, billets and slabs :										
Railways	46,969	46,883	35,301	46,951	30,393	39,166	32,811	30,807	29,779	21,119
All-India	49,501	48,843	67,468	65,494	41,492	42,103	56,645	42,705	37,603	39,804
Percentage	94.88	95.99	52.32	71.69	73.25	93.02	57.92	72.14	79.19	53.06
(2) Heavy rails and fishplates :										
Railways	49,407	45,560	52,933	37,496	29,423				80,569	71,613
All-India	64,513	51,232	57,292	47,362	64,450	86,505	119,652	133,545	105,386	74,142
Percentage	76.58	88.93	92.39	79.17	45.65				76.31	96.59
(3) Bars $\frac{1}{2}$ " and up :										
Railways	34,630	46,381	32,413	33,235	24,358	21,759	35,705	38,868	43,652	64,672
All-India	191,971	196,591	223,053	209,110	176,126	156,908	221,883	232,655	228,149	247,073
Percentage	18.04	23.59	14.53	15.89	13.83	13.87	16.09	16.71	19.13	26.18
(4) Spring steel :										
Railways	5,474	7,139	7,682	7,307	7,859	8,673	10,898	13,922	11,324	19,014
All-India	5,821	7,629	8,176	9,399	8,852	10,139	12,305	16,321	12,153	19,810
Percentage	94.04	93.58	93.96	78.24	88.78	86.54	88.57	85.30	93.18	95.98
TOTAL :										
Railways	225,877	240,334	177,499	192,441	161,359	115,070	167,154	164,564	244,790	303,507
All-India	849,174	887,115	1,059,512	1,027,124	1,141,383	1,024,538	1,291,112	1,279,032	1,157,948	1,134,387
Percentage	26.6	27.1	16.8	18.7	14.13	11.13	12.94	12.87	21.1	26.80

Note : Deliveries of steel are taken as consumption.

Source : Iron &amp; Steel Controller, Calcutta.

TABLE 2--TOTAL CONSUMPTION OF STEEL BY RAILWAYS FROM INDIGENOUS SUPPLY AND IMPORTS

(Tons)

	FIRST PLAN PERIOD					SECOND PLAN PERIOD				
	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59(a)	1959-60(a)	1960-61(a)
<b>I. Railways:</b>										
Indigenous supply		121,186	115,906	177,336	267,296	254,213	291,713	386,000	487,000	642,000
Imports						207,800	410,331	597,000	180,000	79,000
Total						462,013	702,044	983,000	667,000	721,000
<b>II. All sectors:</b>										
Indigenous supply	1,157,056	1,044,548	1,298,805	1,117,006		850,839	1,059,071			
Net imports	171,122	184,849	271,221	892,827		1,666,444	1,431,622	823,793 (b)		
Total	1,328,178	1,229,397	1,570,026	1,999,833		2,517,283	2,490,693			
Percentage of I to II						18.35	28.19			

(a) Figures are planned figures as estimated by the Railway Board in June 1958

(b) April-December only.

Note: Second Plan period data for Railways are from the Railway Board. All other data are from the Iron & Steel Controller.

some of the projects may have to be postponed. Foreign exchange difficulties have also contributed to this. The projects likely to be thus postponed are:

- (i) Electrification schemes connected with Tambaram-Villupuram section and Sealdah Division on the Calcutta area.
- (ii) Metre gauge coach factory

**Share of Railway Consumption.** Consumption of indigenous steel by railways during the last ten years ranged from 225,877 tons in 1948 to 303,507 tons in 1957. The share of railways in all India consumption of indigenous output has increased from about 19% in 1950-51 to 27% in 1957-58. If imports are also included total consumption of steel by railways in 1957-58 was, of the order of 700,000 tons. This again works out to 28% of imports plus indigenous production.

**Pattern of Railway Consumption.** Table 2 gives the category-wise deliveries of steel from Indian production to railways from 1948 onwards. It will be seen that for certain categories like blooms, billets and slabs, heavy rails, fish-plates, and spring steel, the share of railway consumption is very high. The share of blooms, billets and slabs which was more than 90% in 1948 has, however, declined to about 53% of the all-India total in 1957. The share of heavy rails and fishplates is 97% of the all-India total in 1957. This is also the case with spring steel. Consumption of bars by the railway is, however, about a quarter of the all-India total.

**Railway Physical Programme.** The implications of the revision of the Railway Plan on the demand for steel could be understood best with reference to the steel content of the original Railway plan. The target of the original Railway plan together with the steel required are given below:

RAILWAY PROGRAMME	UNIT	1956-61 SECOND PLAN TARGETS	STEEL NORMS IN TONS PER MILE OF TRACK	STEEL CON- SUMPTION ('000 TONS)
<b>A. Construction in Railways:</b>				
(i) Renewals	miles	8,000	250—300	2,000—2,400
(ii) New lines	,,	842	250—300	680—810
(iii) Conversion to BG	,,	265		
(iv) Doubling	,,	1,607		
(v) Other line capacity (incl. addl. loops, points, etc.)	,,			
(vi) Electrification	,,	826	16	13
(vii) Maintenance of track	,,	38,000	5	190
1. Sub-total				2,883—3,413
2. Bridges for new tracks and doubling	Miles of new track	2,700	20	54
3. Other bridges	Rs. million of cost	270		54
contd.				

Contd.

4. Station buildings etc. for new track	Rs. million of cost	165	..	33
5. Maintenance of civil works	..	..	..	33
6. Workshop requirements for repairs and maintenance	..	..	..	33
7. Sub-total (2 to 6)				207
8. Reserves (10% of total)				342—402
9. TOTAL (1 plus 7 plus 8)				3,432—4,022

## B. Others

10. Steam locomotives B.G.	Numbers	1,600	158	tons/No.	258
11. Wagons (4 wheelers) B.G.	..	81,454	12	..	977
12. Passenger coaches B.G.	..	6,541	30	..	196
13. Locomotives M.G.	..	582	103	..	60
14. Locomotives N.G.	..	81	79	..	6
15. Wagons M.G.	..	21,772	7.8	..	170
16. Wagons N.G.	..	4,021	6	..	24
17. Coaches M.G.	..	4,190	19.5	..	82
18. Coaches N.G.	..	633	15	..	10
TOTAL B					1,778
GRAND TOTAL					5,210—5,800

## Notes :

(i) to (v) The requirements of steel per mile of track are based on broad gauge lines. Steel per mile of track 250-300 tons (*rails 140 tons, sleepers—100% steel—195 tons, other track materials 17 tons*) depending on proportion of steel sleepers (low 50%, high 75%). Excludes steel for additional loops, etc., assumed to come from uprooted rails.

(vi) For electrification, 16 tons of steel per mile.

(vii) For maintenance of the track, 5 tons of steel per mile based on operational experience.

(2) Average steel requirement on bridges for new tracks estimated at about 20 tons per mile of track, double, converted or new.

(3) 200 tons of steel per million rupees of cost on bridges.

(4) Cost of station building, etc. taken as 25% of cost on new track. Steel requirement per million rupees of cost is taken at 200 tons.

(5), (6), (8) Notional estimates.

Steel norms for metre gauge and narrow gauge are taken as 65% and 50% of the norms for broad gauge, respectively.

B.G.: Broad Gauge; M.G.: Metre Gauge; N.G.: Narrow Gauge.

Source: Planning Commission.

The provision of Rs. 380 crores for rolling stock programmes during the Second Plan includes Rs. 183 crores for development and Rs. 197 crores

for rehabilitation. The following table gives the details of the physical programmes of the rolling stock.

	LOCOMOTIVES				WAGONS				COACHES			
	B.G.	M.G.	N.G.	Total	B.G.	M.G.	N.G.	Total	B.G.	M.G.	N.G.	Total
Development	533	373	..		66,575	16,820	..		2,149	2,768	..	
Rehabilitation	1,062	209	81		14,879	4,952	4,021		4,392	1,422	633	
TOTAL	1,595	582	81	2,258	81,454	21,772	4,021	107,247	6,541	4,190	633	11,364

Source: Second Five Year Plan, p. 467

The physical achievements of this programme in 1956-57 and 1957-58 are indicated in the following figures of rolling stock placed on line:

#### ROLLING STOCK PLACED ON LINE DURING 1955-57 & 1957-58

(In numbers)

ROLLING STOCK	BROAD GAUGE			METRE GAUGE			NARROW GAUGE		
	56-57	57-58	Total	56-57	57-58	Total	56-57	57-58	Total
Locomotives	322	225	547	254	378	632	3	..	3
Coaches	565	915	1,480	704	424	1,128	32	69	101
Wagons	17,968	19,804	37,862	13,936	9,674	23,610	120	66	186

Source: "Indian Railways", Railway Board.

Taking the physical achievement during the first two years, a programme for the remaining period has been worked out on the assumption that the rolling stock programmes remain unchanged.

#### ROLLING STOCK PROGRAMMES

(In numbers)

	LOCOMOTIVES			WAGONS			COACHES		
	56-61	56-57 & 57-58 (actuals)	58-59 to 60-61	56-61	56-57 & 57-58 (actuals)	58-59 to 60-61	56-61	56-57 & 57-58 (actuals)	58-59 to 60-61
Broad gauge	1,595	547	1,048	81,454	37,862	43,592	6,541	1,480	5,061
Metre gauge	582	632	..	21,772	23,610	..	4,190	1,128	3,062
Narrow gauge	81	3	78	4,021	186	3,835	633	101	532
TOTAL	2,258		1,126	107,247		47,247	11,364		8,655



TABLE 4—CATEGORYWISE CONSUMPTION OF STEEL BY RAILWAYS DURING THE SECOND PLAN

(In tons)

CATEGORIES	SECOND PLAN PERIOD REQUIRE- MENTS	ESTIMATED SUPPLY FROM INDIGENOUS PRODUCTION	ACTUAL CONSUMP- TION DURING 56-57 & 57-58	PLANNED TOTAL FOR THE NEXT THREE YEARS	TOTAL OF (4) & (5)	SHORTFALL (—) OR EXCESS (+) (6) — (2) (7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Billets and blooms	508,200	461,000	46,507	190,000	236,507	— 271,693
2. Structural	444,000	336,000	174,537	303,000	477,537	+ 33,537
3. Bars and rounds	734,000	559,000	134,362	399,000	533,362	— 7,200,638
4. Sheets	{ 595,800	394,000	37,066	94,500	131,566	— 138,808
5. Plates			126,926	198,500	235,426	..
6. Spring steel		80,000	22,906	63,000	85,906	— 31,594
7. Other categories	89,000	71,000	..	36,000	36,000	— 53,000
8. Rails	1,449,000	571,000	384,161	769,000	1,153,161	— 295,839
9. Fishplates	50,000	5,000	26,228	24,000	50,388	+ 388
10. Steel sleepers (transverse)	242,000	68,000	84,105	267,000	351,105	+ 109,105
11. Steel sleepers (turnout)	123,000	23,000	18,972	61,000	79,972	— 43,028
TOTAL	4,352,500	2,568,000	1,005,930	2,405,000	3,460,930	— 891,570

Note : The requirements of wheel-sets, axles and tyres are of the order of 20,000 tons per year and have been included under blooms and billets.

TABLE 5—REQUIREMENTS OF STEEL BY RAILWAYS IN 1960-61

(In tons)

CATEGORY	REPAIRS & MAINTENANCE	WORKS	TRACK MATERIALS	WAGON BUILDING	CHITTARANJAN LOCO WORKS	UNDER FRAME BUILDERS	GRAND TOTAL
1. Billets and blooms	41,000	..	..	4,450	6,775	1,500	55,550
2. Heavy structurals	15,300	..	..	17,500	1,500	4,300	41,500
3. Light structurals	11,600	5,000	..	11,000	300	2,000	31,000
4. Bars and rounds	75,000	13,000	..	12,400	7,600	4,500	116,400
5. Sheets	11,450	750	..	10,000	650	..	23,500
6. Plates	16,000	5,500	..	28,000	14,700	5,800	75,500
7. Spring steel	9,000	..	..	6,500	900	..	16,500
8. Rails	..	..	200,000	..	..	..	200,000
9. Fishplates	..	..	6,000	..	..	..	6,000
10. Steel sleepers (transverse)	..	..	72,000	..	..	..	72,000
11. Steel sleepers (turnout)	..	..	16,000	..	..	..	16,000
12. Other categories	7,800	100	..	150	..	2,500	11,850
TOTAL	179,350	24,450	294,000	90,000	32,425	20,600	665,800

From the last table on page 14, it follows that broad gauge as well as metre gauge programmes are progressing satisfactorily except in the case of broad gauge coaches where the progress in the first two years is only 23 per cent of the total plan. Progress in the narrow gauge rolling stocks, however, where most of the programmes are for rehabilitation and not for development is rather slow.

**Steel Consumption Trends.** Table 4 gives (i) the Railways' total requirements of steel (categorywise); (ii) the actual consumption of steel during the first two years of the Second Plan; and (iii) the planned total for the next three years. It can be seen that the total shortfall in the anticipated consumption of steel by Railways at the end of the Second Plan is estimated at about 8 lakh tons. Categorywise, this means a reduction of about 3 lakh tons in rails, of about 2.7 lakh tons in billets and blooms and of about 2 lakh tons in bars and rounds.

The impact of this shortfall fell mainly on Repairs and Maintenance for existing track and other works, like station buildings, bridges, etc. As against an indent by the Iron and Steel Controller for about 3.11 lakh tons for Repairs and Maintenance and for Works Programmes in the first two years of the Second Plan, the actual supplies were only 2.35 lakh tons, leaving a backlog of nearly 75,000 tons. As against this, supplies of steel to projects like Chittaranjan, Perambur Coach Factory, etc. were on the whole adequate, and the programmes of expansion for wagons, locomotives and coaches were according to schedule.

The last column of Table 4 gives the shortfall for different categories of steel resulting from the lag in the Repairs and Maintenance programme. The shortfall has been in all the categories except in heavy and light structurals.

**Requirements of Steel by Railways in 1960-61.** Table 5 shows the estimated requirements of steel, categorywise, for the different physical programmes. Much of the investment activity in Railways has taken place during the middle years of the Plan, i.e. 1957-58, 1958-59 and 1959-60, and consequently the demand for steel in 1960-61 is a little lower than the average steel requirements that can be worked out from the data in Table 4. In estimating the demand in 1960-61, actuals for the first three years and the estimates of the Railway Board for 1959-60 have been taken into consideration, and the remainder of the physical programme determined.

**Demand for Steel for Railways in the Third and Fourth Plans.** The projection of demand for steel by Railways during Third and Fourth Plans is mainly based on the anticipated volume of traffic that the Railways will have to carry during these periods. Estimates of traffic likely to be generated by the end of Third and Fourth Plans have been prepared on the basis of plan targets of production and are given in the table on next page. Estimates prepared by the Road Development Plan are also given in the table for purposes of comparison.

On the basis of the above NCAER traffic estimates, physical plans for the railways have been worked out in detail for rolling stock programme,

**TRAFFIC ESTIMATES FOR THE THIRD AND FOURTH PLANS**

(Million tons)

	1965-66		1970-71	
	RDP	NCAER	RDP	NCAER
Industry	266	240	430	404
Agriculture	105	129	119	169
TOTAL	371	369	549	573
Long distance traffic	300	276*	440	429*
Railway share	228	221†	305	322†

RDP : Road Development Plan

\*75% of total production

†80% of Long Distance Traffic in 1966, and 75% in 1971.

maintenance of track and renewals, electrification, new lines, double tracks, etc. The main features of this programme are:

(i) It is assumed that the Railways will carry about 80% and 75% of the additional traffic tonnage to be generated by the increased tempo of agricultural and industrial production during the Third and Fourth Plan periods. This means that the railway programmes—rolling stock as well as track and others—must be geared to carry an additional traffic of about 58 and 159 million tons over the 1960-61 figure of 163 million tons during the Third and Fourth Plans respectively.

(ii) Passenger traffic in the Third Plan is expected to increase by about 5% per annum over the Second Plan, and in the Fourth Plan by 8% per annum over the Third Plan.

(iii) A number of structural changes are also envisaged at an increased tempo and account has been taken of their impact on demand for steel, though necessarily, in a tentative way. These are electrification of the track, demand for electric locomotives, welded rails, etc.

(iv) As far as possible the break-up has been given for development and rehabilitation or replacement needs. Similarly account has been taken of the estimated arrears of track renewals by the end of Second Plan that must spill over into the Third Plan, and the track renewals for the Fourth Plan are taken to be 18% of the total railway track at the end of 1960-61.

The Railway programmes for rolling stock and track for the Third and Fourth Plans have been phased on the assumption that the peak of development in each programme will be reached in the middle of the five year Plan period. At the later stages of the plans, the tempo of activity will slow down both from the point of view of budgetary provision, and the needs of traffic. This phasing corresponds with the practice actually adopted by the Railway authorities in the past. The targets thus obtained for 1965-66 and 1970-71 are shown in Table 6.

**TABLE 6—TARGETS FOR RAILWAYS AT THE END OF THIRD AND FOURTH PLANS**

RAILWAY PROGRAMME	1965-66	1970-71
<b>I. Rolling stock (numbers)</b>		
(1) Locomotives B.G. M.G.	400 150	600 220
(2) Wagons B.G. (4-Wheelers) M.G.	18,000 5,000	25,000 9,400
(3) Coaches B.G. M.G.	1,500 1,000	1,900 1,100
<b>II. Track programme (in miles)</b>		
(1) Renewal	1,800	1,300
(2) New lines	300	800
(3) Doubling	450	550
(4) Conversion	70	300
(5) Electrification	300	900
(6) Maintenance	9,000	9,500

**TABLE 7—BREAK-UP OF INVESTMENT ON RAILWAYS DURING THE THIRD PLAN**

	(Crores of Rs.)	
	SECOND PLAN (Actuals)	THIRD PLAN (NCAER estimates)
1. Rolling stock	400	466
2. Track renewal and new lines	320	465
3. Others	405	425
TOTAL	1,125	1,356
Plan investment	900	1,028
Railway Depreciation Fund*	225	328

\*The Depreciation Fund is taken to accumulate at an increased rate of about Rs. 65 crores per annum.

Based on the current cost of locomotives, wagons and carriages, as given in the latest issue of 'Works, Machinery and Rolling Stock Programme of Railways, Part II, for 1959-60', the break-up of investment outlay for the above programme during the Third Plan may be conceived as in Table 7.

The Railway Plan envisaged here is well within the investment outlay for the transport sector.

The requirements of steel for the fulfilment of this physical programme have been worked out and are shown in Table 8. For the following

TABLE 8—REQUIREMENTS OF STEEL BY THE RAILWAYS FOR THE THIRD AND FOURTH PLANS

PHYSICAL PROGRAMME	UNIT	PRODUCTION 1961-66	TARGET 1966-71	STEEL NORM IN TONS PER UNIT	STEEL REQUIREMENTS	
					1961-66	1966-71
(Thousand tons)						
<i>Rolling Stock:</i>						
Locomotives	B.G.	2,400	3,200	168	403	538
	"					
	M.G.	800	1,100	94	75	104
Wagons	B.G.	95,000	130,000	12	1,140	1,560
	"					
	M.G.	28,000	47,400	7.8	218	370
Coaches	B.G.	8,000	10,000	30	240	300
	"					
	M.G.	5,700	5,900	19.5	111	115
SUB-TOTAL (1)					2,187	2,987
<i>Track Programme:</i>						
Renewal	Miles	9,400	7,600	250—300	2,350—2,820	1,900—2,280
	"					
New lines	"	1,700	4,000	270—320	459—544	1,080—1,280
	"					
Doubling	"	2,700	3,000	..	729—864	810—960
	"					
Conversion from M.G. to B.G. and and N.G. to M.G.	"	500	1,500	..	135—160	405—480
	"					
Electrification	"	2,000	5,000	16	129	322
	"					
Maintenance	"	43,000	46,500	5	215	233
SUB-TOTAL (2)					4,017—4,732	4,550—5,595
Others (15% of the grand total)					1,096—1,221	1,330—1,514
GRAND TOTAL					7,300—8,140	8,867—10,096

TABLE 9—CATEGORYWISE REQUIREMENTS OF STEEL BY RAILWAYS IN 1965-66

(Tons)

CATEGORY OF STEEL	REPAIRS, MAINTENANCE & WORKS	TRACK MATERIALS	ROLLING STOCK PROGRAMME			ELECTRIFICATION OF TRACK	GRAND TOTAL
			Wagon building	Locomotives	Coaches		
1. Heavy structurals	18,400	..	50,000	3,800	7,000	..	79,200
2. Light structurals	20,200	..	31,400	700	4,000	18,200	74,500
3. Bars and rods	106,000	..	35,500	19,000	7,000	1,000	168,500*
4. Sheets	14,800	..	28,300	1,600	24,200	..	68,900
5. Plates	26,000	..	79,300	37,000	14,000	..	156,300
6. Spring steel	10,800	..	18,000	2,200	1,000	..	32,000
7. Wheels, tyres and axles	..	..	52,000	8,000	12,000	..	72,000
8. Rails	..	456,000	..	..	..	..	456,000
9. Fishplates	..	14,000	..	..	..	..	14,000
10. Steel sleepers (transverse)	..	164,500	..	..	..	..	164,500
11. Steel sleepers (turnout)	..	36,900	..	..	..	..	36,900
TOTAL	196,200	671,400	294,500	72,300	69,200	19,200	1,322,800

\*Includes 3,000 tons for wire and wire products.

TABLE 10—CATEGORYWISE REQUIREMENTS OF STEEL BY RAILWAYS IN 1970-71

(Tons)

CATEGORY OF STEEL	REPAIRS, MAINTENANCE & WORKS	TRACK MATERIALS	ROLLING STOCK PROGRAMMES			ELECTRIFICATION OF TRACK	Total
			Wagon building	Locomotives	Coaches		
1. Heavy structurals	22,800	..	72,800	5,600	8,000	..	109,200
2. Light structurals	25,000	..	46,000	1,000	6,000	54,600	132,600
3. Bars and rods	131,200	..	52,000	28,600	9,000	3,000	223,800*
4. Sheets	18,200	..	41,400	2,400	29,000	..	91,000
5. Plates	32,200	..	116,000	55,000	17,500	..	220,700
6. Spring steel	13,300	..	26,800	3,400	1,300	..	44,800
7. Wheels, tyres and axles	..	..	78,000	11,000	13,200	..	102,200
8. Rails	..	524,000	..	..	..	..	524,000
9. Fishplates	15,400	..	..	..	..	..	15,400
10. Steel sleepers (transverse)	..	188,800	..	..	..	..	188,800
11. Steel sleepers (turnout)	..	42,300	..	..	..	..	42,300
TOTAL	242,700	770,500	433,000	107,000	84,000	57,600	1,694,800

\*Includes 4,000 tons of wire and wire products.



items, however, a combined estimate has been arrived at 15% of the total.

- (i) Station buildings for new tracks
- (ii) Maintenance of civil works
- (iii) Workshop requirements for repairs and maintenance
- (iv) Railway housing
- (v) Reserves

The categorywise estimates for 1965-66 and 1970-71 have been shown in Tables 9 and 10. The total requirements of steel thus work out to 1,322,800 tons in 1965-66 and 1,694,000 tons in 1970-71.

## 2. Roads and Road Bridges

Total investment outlay planned for the Second Plan on road works and road bridges was Rs. 246 crores. The plan envisaged the construction of 60 major bridges at a cost of Rs. 20 crores; minor bridges at Rs. 5 crores; and in addition works in respect of 35 major bridges which were incomplete during the First Plan.

On an average, road works and road bridges require about 2% of the total steel for the country. The estimates for 1960-61 have been arrived at by taking into account the inter-action of a variety of factors, the trend in consumption, its relationship with planned requirements of steel, the relationship of steel consumption to total investment on roads and road bridges during the first three years of the Second Plan, and the reduced allocation for roads after the appraisal in 1958. This works out to a total of 92,000 tons for the last two years of the Second Plan. The demand for steel for construction of roads and road bridges in 1960-61 can, therefore, be put at 46,000 tons, as shown in Table 11.

The categories of steel required for roads and road bridges are mostly structurals, bars (tested) and rods; but the bottleneck has been high tensile steel which was responsible for a severe set-back in bridge construction; this special quality of steel is not manufactured in India in sufficient quantity and the bulk of the requirement has to be met from imports. The total imports in the whole five year period amounted to 6,000 tons. The progress of bridge construction had, therefore, to be slowed down during the first two years of the Second Plan. The programme had to be

**TABLE 11—REQUIREMENTS AND CONSUMPTION OF STEEL FOR ROADS AND ROAD BRIDGES**

(Tons)

	PLANNED REQUIREMENTS	CONSUMPTION
1956-57	66,577	45,008
1957-58	106,098	40,000
1958-59	112,954	45,000
1959-60	115,088	46,000 (E)
1960-61	120,000 (E)	46,000 (E)

E : Estimated

**TABLE 12—CATEGORYWISE STEEL REQUIREMENTS FOR ROADS AND ROAD BRIDGES**

CATEGORIES	(Tons)		
	1960-61	1965-66	1970-71
Heavy structurals	4,950	7,000	11,000
Light structurals	1,250	2,000	3,000
Rails and fishplates	100	Neg.	Neg.
Sheets	750	1,000	2,000
Plates	600	1,000	2,000
Bars and rods	38,100	54,000	87,000
Wire and wire products	200	Neg.	Neg.
<b>TOTAL</b>	<b>45,950</b>	<b>65,000</b>	<b>105,000</b>
Neg.: Negligible.			

carried out with much lower allocations of steel than planned. It meant altering the designs of bridges, increased costs and ultimately use of even more steel for a particular bridge work.

The Chief Engineer's Report on Road Development for India, 1961-81, envisages a total outlay of Rs. 5,200 crores on road bridges and road works in the country. The requirements of steel for this plan have been estimated on the assumption of an expenditure of Rs. 590 crores during the Third Plan and Rs. 1,060 crores during the Fourth Plan on road bridges and road works. These figures, which work out to 7% of the total investment outlay contemplated for each of the Third and Fourth Plan periods, appear rather high. It has been assumed that the investment expenditure on roads would be Rs. 400 crores during the Third Plan and Rs. 625 crores during the Fourth Plan. On that basis the total requirements of steel for 1965-66 and 1970-71 have been estimated and shown in Table 12.

### **3. Other Transport and Communications (Excluding Railways and Roads)**

Under this head are discussed the requirements of steel for shipping and ports, posts and telegraphs, civil aviation, broadcasting, and other transport and communications.

Table 13 shows the break-up of investment outlay on Transport and Communications among the more important heads. The outlays on ports and shipping have been stepped up by Rs. 10 crores during the Third Plan. During the Fourth Plan, outlay is assumed to be double that for the Second Plan. Outlays on civil aviation, and posts and telegraphs have also been increased as shown in Table 13.

**TABLE 13—INVESTMENT OUTLAY ON TRANSPORT AND COMMUNICATIONS  
IN THE SECOND, THIRD AND FOURTH PLANS**

(Rs. crores in 1952-53 prices)

	OUTLAY IN THE SECOND PLAN	PROPOSED OUTLAYS IN THE	
		Third Plan	Fourth Plan
1. Railways	900.0	1,028	1,300
2. Roads and road transport	262.5	400	640
3. Ports and harbours	45.5	56	92
4. Shipping	47.5	58	95
5. Civil aviation	43.0	53	95
6. Other transport	10.5	14	19
7. Posts and telegraphs	63.0	76	106
8. Other communications and broadcasting	13.0	15	21
TOTAL	1,385.0	1,700	2,368

Note: Figures for Second Plan are from "Plan Resources and Outlay—A Survey" Planning Commission, 1959. Figures for Third and Fourth Plans are NCAER estimates.

\*Including inland water transport, the steel requirements of which have been included under the head 'Large and Medium Industries—Private Sector', Part II, Chapter Three.

**(A) Shipping, Ports and Harbours Requirements in 1960-61.**

The requirements of steel in 1960-61, for shipping, ports, and harbours in India, including lighthouses and lightships, as estimated by the respective authorities, are shown below:

PORTS AND HARBOURS	STEEL REQUIREMENTS IN 1960-61 (Tons)
1. Mangalore	32
2. Pondicherry	155
3. Tuticorin	80
4. Mysore ports	200
5. Cochin	819
6. Madras	1,650
7. Visakhapatnam	2,000
8. Kandla	2,924
9. Bombay	3,270
10. Calcutta	12,300
11. Hindustan Shipyard	12,400
12. Lighthouses and lightships	1,600
TOTAL	37,440

**Requirements in 1965-66 and 1970-71.** In 1947 the Shipping Policy Committee had recommended a target of 2 million tons GRT to be achieved in five to seven years. The progress of shipping has, however, been halting, and the total shipping tonnage for 1951, 1957 and 1958 came only 390,707, 582,000 and 630,000 GRT only. It is presumed that the target of 2 million GRT would be achieved at least by the end of the Fourth Plan. Assuming a linear growth towards this target, we get 730,000, 1,200,000 and 2,000,000 GRT as the cumulative totals of shipping tonnage to be acquired by 1960-61, 1965-66 and 1970-71 respectively. By phasing this, the targets for the years 1965-66 and 1970-71 work out to 105,000 and 180,000 GRT respectively.

A decision has been taken to establish a ship-building yard at Cochin during the Third Plan period at an investment of Rs. 20 crores. The project seeks to build ships of the size of 16,000 to 18,000 GRT with a minimum target of 60,000 and a maximum of 80,000 GRT in a year in the initial stages, to be doubled afterwards. If the full programme for the Cochin Shipyard as well as for the Visakhapatnam Shipyard are given effect to, the above targets may possibly be achieved. But from past experience of progress in this sphere, it would be more realistic to assume a target of 70,000 GRT for 1965-66 and 114,000 GRT for 1970-71 with a total tonnage of 288,000 GRT and 466,000 GRT for the Third and Fourth Plans respectively. Also, this growth seems possible within the investment outlay assumed for the plan periods.

From a study of steel consumption in relation to production at the Hindustan Shipyard, a technical coefficient of 0.62 ton of steel per GRT is derived. On this basis, estimates of steel requirements for the above targets of shipping tonnages work out to 43,400 tons in 1965-66 and 71,000 tons in 1970-71.

**Ship Building and Repairs (Private Sector).** In addition to ship building in the public sector, there is some activity in building small ships, launches, etc. in the private sector, as also in ship repairing. On the basis of current information on these heads, the estimated requirements for 1960-61, 1965-66 and 1970-71 have been put at 15,000 tons, 24,000 tons and 39,000 tons respectively.

The total requirements of steel during the years 1965-66 and 1970-71, due to activity in ship-building, ports and harbours thus come to 101,400 tons and 160,000 tons respectively. The estimates for

---

	(Tons)		
	1960-61	1965-66	1970-71
1. Shipping and shipyards	12,400	43,400	71,000
2. Ship repairs and building (private sector)	15,000	24,000	39,000
3. Ports and harbours	23,440	30,000	40,000
4. Lighthouses and lightships	1,600	4,000	10,000
TOTAL	52,440	101,400	160,000

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**TABLE 14—REQUIREMENTS OF STEEL FOR PORTS, SHIPPING AND COMMUNICATIONS**

	(Tons)		
	1960-61	1965-66	1970-71
1. Shipbuilding (public sector)	12,400	44,000	71,000
2. Shipbuilding and ship repairs (private sector)	11,400 3,600	18,000 6,400	29,000 10,000
3. Ports and harbours	23,440	30,000	40,000
4. Lighthouses and lightships	1,600	4,000	10,000
5. Posts and telegraphs	19,000	23,000	30,000
6. Civil aviation	400	800	1,200
7. Telephone industry	600	1,200	1,800
TOTAL	72,500	127,000	193,000

ports and harbours for 1965-66 and 1970-71 include those for minor ports also such as Malpe, Cuddalore, Karwar and those on the Saurashtra coast\*.

**(B) Posts & Telegraphs.** Investment outlay in Posts and Telegraphs during the Second Plan was planned for Rs. 63 crores, and has been assumed to go up to Rs. 76 crores and Rs. 106 crores during the Third and Fourth Plans. The requirements of steel for 1960-61 have been estimated by the Posts and Telegraphs Department at 12,000 tons. This, however, does not include the requirements of telegraph wire, estimated at 7,000 tons during 1960-61 on the basis of 'apparent consumption'. The steel requirements for Posts and Telegraphs have been estimated at 23,000 tons for 1965-66 and 30,000 tons for 1970-71.

**(C) Civil Aviation and Telephone Industries.** The requirements for Civil Aviation have been similarly estimated at 400 tons, 800 tons and 1,200 tons in 1960-61, 1965-66 and 1970-71 respectively.

The requirements of the telephone industry in 1960-61, 1965-66 and 1970-71 are estimated on the same basis at 600 tons, 1,200 tons and 1,800 tons respectively (see Table 14).

The categories of steel required have been estimated mostly on the basis of information supplied by the respective authorities, supplemented by NCAER estimates. (e.g. for ship repairs, 80% plates were assumed). The requirements by categories are shown in Tables 15, 16 and 17.

\* It is learnt that there is a programme of conversion of one or two ports into deep sea harbours, and large-scale improvements to intermediate ports in the Third Plan. If this would result in larger allocations than assumed, the estimates will have to be revised suitably.

TABLE 15—PORTS, SHIPPING AND COMMUNICATIONS : CATEGORYWISE REQUIREMENTS OF STEEL IN 1960-61

(Tons)

CATEGORIES	SHIPBUILD- ING (PUBLIC)	SHIPBUILDING & SHIP REPAIRS (PRIVATE)	PORTS & HARBOURS	LIGHT- HOUSES & LIGHTSHIPS	POSTS & TELEGRAPHS	CIVIL AVIATION	TELEPHONE INDUSTRIES	TOTAL
Heavy structurals	1,800	2,100	3,193	..	..	..	..	7,093
Light structurals	400	450	1,345	..	4,000	80	..	6,275
Heavy rails	..	..	5,280	..	..	..	..	5,280
Sheets	..	..	1,429	..	5,500	200	360	7,489
Slates	9,900	12,000	1,309	..	..	60	..	23,769
Bars	300	450	3,002	800	..	..	120	4,752
Rods	..	..	7,138	800	2,500	..	..	10,438
Wire	..	..	154	..	7,000	40	90	7,284
Bolts, nuts, etc.	..	..	5	..	..	20	30	55
Others	..	..	5	..	..	..	..	5
<b>Total</b>	<b>12,400</b>	<b>15,000</b>	<b>23,440</b>	<b>1,600</b>	<b>19,000</b>	<b>400</b>	<b>600</b>	<b>72,440</b>

TABLE 16—PORTS, SHIPPING AND COMMUNICATIONS: CATEGORYWISE REQUIREMENTS OF STEEL IN 1965-66

(Tons)

CATEGORIES	SHIPBUILD- ING (PUBLIC)	SHIPBUILDING & SHIP REPAIRS (PRIVATE)	PORTS & HARBOURS	LIGHT- HOUSES & LIGHT SHIPS	POSTS & TELEGRAPHS	CIVIL AVIATION	TELEPHONE INDUSTRY	TOTAL
Heavy structurals	6,160	3,360	4,080	..	..	..	..	13,600
Light structurals	1,320	720	1,710	..	5,000	160	..	8,910
Heavy rails	..	..	6,750	..	..	..	..	6,750
Sheets	..	..	1,830	..	6,875	400	720	9,825
Plates	35,200	19,200	2,310	..	..	120	..	56,830
Bars	1,320	720	3,930	2,000	..	..	240	8,210
Rods	..	..	9,150	2,000	3,125	..	..	14,275
Wire	..	..	210	..	8,000	80	180	8,470
Bolts, nuts, etc.	..	..	30	..	..	40	60	130
Total	44,000	24,000	30,000	4,000	23,000	800	1,200	127,000

TABLE 17—PORTS, SHIPPING AND COMMUNICATIONS: CATEGORYWISE REQUIREMENTS OF STEEL IN 1970-71

(Tons)

CATEGORIES	SHIPBUILD- ING (PUBLIC)	SHIPBUILDING & SHIP REPAIRS (PRIVATE)	PORTS & HARBOURS	LIGHTHOUSES & LIGHTSHIPS	POSTS & TELEGRAPHS	CIVIL AVIATION	TELEPHONE INDUSTRY	TOTAL
Heavy structurals	9,940	5,460	5,440	..	..	..	..	20,840
Light structurals	2,130	1,170	2,280	..	6,666	240	..	12,486
Heavy rails	..	..	9,000	..	..	..	..	9,000
Sheets	..	..	2,440	..	9,166	600	1,080	13,286
Plates	56,800	31,200	3,080	..	..	180	..	91,260
Bars	2,130	1,170	5,240	5,000	..	..	360	13,900
Rods	..	..	12,200	5,000	4,168	..	..	21,368
Wire	..	..	280	..	10,000	120	270	10,670
Bolts, nuts, etc.	..	..	40	..	..	60	90	190
TOTAL	71,000	39,000	40,000	10,000	30,000	1,200	1,800	193,000



**LARGE SCALE INDUSTRY****(A) INDUSTRIAL MACHINERY****4. Iron and Steel Industry**

For the iron and steel industry the estimates of steel requirements in 1960-61 have been calculated separately for the private and public sector plants on the basis of their expansion and development programmes remaining to be completed in the Second Plan. By this method the steel requirements for 1960-61 work out to 75,000 tons. The estimates for 1965-66 and 1970-71 are based on the actual requirements of steel for a million ton plant in the public sector. Small plants are assumed to require about sixty per cent of a major plant. After allowing for an import of 48,400 tons of steel by way of machinery, the requirements, as estimated, come to 107,000 tons for 1965-66. For 1970-71, however, the assumption is that the machinery imports will be small, and the requirements of steel have been estimated at 176,000 tons. The categories of steel have also been estimated on the basis of the actuals used in the public sector plants during the last three years. The details are shown in Tables 18 and 19.

**5. Chemical Machinery**

The present capacity and targets of production of heavy chemicals, together with the estimated requirements of steel, are shown in Table 20. It has been assumed that Rs. 30 million worth of chemical equipment and machinery are required to produce 400 tons of soda ash per day, or 150 tons of caustic soda per day, or 1,000 tons of sulphuric acid per day, or 100 tons of fertilisers per day. Then by taking (i) the number of working days to be 320 in a year, (ii) Rs. 4,000 as the fabrication cost per ton of equipment and machinery and (iii) 75% as the rolled steel part of the total weight, the steel requirements of different chemical industries have been calculated.

It will be noticed that the steel requirements of the chemical industry for 1960-61 work out to 42,389 tons while for a much bigger expansion during the Third and Fourth Plans, the requirements for 1965-66 and 1970-71 are 40,500 tons and 45,000 tons. This arises from differences in the periods over which the development has been phased. While the targets set for 1960-61 have to be achieved in two years, the targets for 1965-66 and 1970-71 are to be attained in five years. The estimated requirements for 1965-66 and 1970-71 therefore, work out to be lower than that for 1960-61.

All this steel will not be required to be met from indigenous production. The bulk of the machinery will have to be imported in the Second Plan. The present capacity for manufacture of chemical machinery is Rs. 92.5 lakhs worth. Although new schemes have been sanctioned to increase the capacity to about Rs. 4 crores per year, it is not known whether they are likely to materialise by 1960-61. It seems, therefore, realistic to assume that most of the estimated requirements for 1960-61 will have to be imported, leaving only a small share to be met from the existing indigenous capacity. The requirements of steel for 1960-61 have been estimated at 2,000 tons.

Assuming that 30% and 50% of the requirements, as estimated above, are to be met from indigenous production by the end of Third and Fourth plans respectively, the estimates of steel requirements have been put at 12,200 tons for 1965-66 and 22,500 tons for 1970-71.



**TABLE 20—TARGETS OF PRODUCTION & ESTIMATED STEEL REQUIREMENTS FOR CHEMICAL MACHINERY**

NAME OF INDUSTRY	PRESENT CAPACITY 1958-59	(Tons)					
		1960-61		1965-66		1970-71	
		Production target	Steel requirements	Production target	Steel requirements	Production target	Steel requirements
Soda ash	111,000	300,000	4,160	600,000	2,620	1,000,000	3,520
Caustic soda	69,000	150,000	4,750	300,000	2,500	500,000	4,690
Sulphuric acid	290,000	500,000	1,600	800,000	1,000	1,200,000	1,000
Fertilisers							
(a) Nitrogenous	86,400	377,000	25,550	800,000	14,900	1,200,000	14,060
(b) Phosphatic	51,760	80,000	2,480	500,000	14,800	1,000,000	17,590
Other chemicals*			3,860		3,680		4,080
TOTAL			42,400		40,500		45,000
Less imports as machinery			40,400		28,300		22,500
Net indigenous requirements			2,000		12,200		22,500

\*Taken as 10% of the requirement for heavy chemicals.

**TABLE 21—CATEGORYWISE STEEL REQUIREMENTS FOR CHEMICAL MACHINERY**

YEAR	TOTAL RE- QUIREMENTS FROM INDIGE- NOUS PRO- DUCTION	(Tons)					WIRES
		SHEETS	LIGHT STRUCTU- RALS	HEAVY STRUCTU- RALS	BARS & RODS	PLATES	
1960-61	2,000	700	400	100	440	300	60
1965-66	12,200	4,250	2,450	600	2,650	1,850	400
1970-71	22,500	8,100	4,500	1,000	4,900	3,400	600

The categories of steel have been estimated and shown in Table 21.

## 6. Cotton Textile Industry

The requirements of steel for the cotton textile industry can be dealt with under two broad heads:

- A. for baling of raw cotton, and
- B. (i) for the manufacture of cotton textile machinery, and  
(ii) for maintenance, repairs, packing, development of mills.

A. The production of raw cotton in 1957-58 was of the order of 4.75 million bales. The targets of production for the years 1960-61, and 1965-66 are 5.5 million bales, and 7.8 million bales respectively. Assuming the same rate of growth during the Fourth Plan the target for 1970-71 may be put at 11.5 million bales. Taking 3 lb. as the weight of four hoops of 12 ft. each, which are required for each bale, the quantity of steel required will work out to 6,600 tons in 1960-61, 9,000 tons in 1965-66 and 13,000 tons in 1970-71. Adding  $2\frac{1}{2}$  per cent as the wastage for baling cotton, the total requirements of hoops would work out to 6,150 tons in 1960-61, 9,225 tons in 1965-66 and 13,325 tons in 1970-71.

B. (i) Cotton mill machinery can be put under three main categories: machinery required for (i) spinning mills, (ii) weaving mills and (iii) processing. This last item consists of a large range of machines for bleaching, dyeing, printing, mercerising, sanforising, etc.

The requirements of steel for the cotton textile industry will depend upon the demand for cloth in future, the present capacities of the spinning and weaving mills and the expansion of the textile industry envisaged in the Plans.

There are, at present, 470 mills in India comprising 175 spinning mills and 295 composite mills. The total number of spindles installed at present is about 13 million, and that of looms about 200,000.

The future requirements of textile machinery in India will be for (a) the expansion of existing capacities of spinning and weaving mills and (b) replacement of worn out machinery and (c) modernisation of the existing machinery by replacement by up-to-date machinery.

All of these will depend on—

- (a) the demand for cloth for internal consumption.
- (b) the quantity that can be exported
- (c) the policy of the Government regarding the future of the cotton textile industry.

The quantity of cloth required in 1960-61 can be worked out on the basis of 17.5 yd. per head, a figure which has been recommended by the Textile Enquiry Committee (1958) as a realistic estimate, after taking into consideration all related economic factors. At 17.75 yd. per head, the quantity of cloth required in 1960-61 comes to 7,000 million yd. for an estimated population of 400 millions. But the recent estimate of population by the Planning Commission for 1960-61 is 430.8 millions. This would in all probability reduce the per capita availability of cloth for domestic consumption from 17.5 yd. to 16.2 yd., rather than result in an increase of the aggregate demand. To this should be added an export figure of 800 million yards which may be taken as a reasonable estimate. Thus the total production is estimated at 7,800 million yards in 1960-61.

In order to encourage the handloom industry there is a proposal by the Government to stabilise the production of mill made cloth at 5,100 million yards for internal consumption and another 30 million yards for additional exports by installing new machinery (looms) under export promotion scheme. The distribution of the aggregate production would then be some-what as given in Table 22.

On the basis of this expected production of cloth of 7,800 million yards, the requirements of various items of textile machinery for replacement, expansion and modernisation have been worked out and shown in Table 23.

TABLE 22—PRODUCTION\* OF COTTON CLOTH IN 1960-61

SECTOR	MILLION YARDS
Mill sector	5,130 (720)
Handloom sector	2,220 (80)
Power loom sector	450 (—)
TOTAL	7,800

\* Anticipated exports are shown in brackets

TABLE 23—REQUIREMENTS OF COTTON TEXTILE MACHINERY IN 1960-61

ITEMS OF MACHINERY	NUMBERS
1. Blowroom equipment	50
2. Carding engines	1,800
3. Comber sets	15
4. Draw frames	120
5. Speed frames	360
6. Spinning ring frames	1,440
7. Winding machines	
(a) High speed	35
(b) Fully automatic	15
8. Warping machines	
(a) High speed	25
(b) Fully automatic	15
9. Sizing machines	30
10. Plain looms	3,720
11. Automatic looms	3,000

Source: "Capital" June 1959.

On the basis of actual observations, steel norms were worked out for different items of textile machinery. Employing these norms, category-wise steel requirements for additional machinery have been calculated, and shown in Table 25.

B. (ii) In addition to the steel for the manufacture of textile machinery, the textile mills require considerable quantities for construction, expansion, renovations, reorganisation, etc. of factory buildings and godowns; as well as for repairs, maintenance and packing purposes. On the basis of information supplied by the Textile Commissioner, the requirements of steel for all these purposes have been estimated at 10,500 tons for 1960-61. This has been assumed to increase by about 25 per cent over

each plan period, so that the steel requirements of the textile industry for these purposes come to about 13,000 tons in 1965-66 and 16,000 tons in 1970-71.

It has been assumed that per capita cloth consumption, already at a low level due mainly to an unexpected increase in the rate of population growth, is likely to go up to about 19 yards in 1965-66 and 21 yards in 1970-71. Since population is estimated to go up to about 479.76 million by 1965-66 and 527.8 million by 1970-71, production of cloth by 1965-66 and 1970-71 (including cloth for exports which are assumed to go up to 1,000 million yards in 1965-66 and stabilised at that level afterwards) is expected to be of the order of 10,000 and 12,250 million yards respectively.

In fixing the targets of production for different sectors producing cloth, the following points are taken into account: according to the estimates of the Kanungo Committee and the Karve Committee the number of active handlooms varies from 12 lakhs to 20 lakhs and the maximum producing capacity of the handloom sector between 2,160 to 3,600 million yards. A figure of 2,700 yards has, however, been taken as a reasonable production target for handlooms in 1965-66. A phased programme of replacing 50,000 handlooms by powerlooms has been suggested during the Fourth Plan. Notwithstanding that this programme reduces the number of handlooms, the production from handlooms can be sustained at 2,700 million yards even in 1970-71, provided the efficiency of the handloom sector is increased by a more intensive utilisation.

Production of cloth by powerloom sector in 1965-66 is put at 800 million yards (an increase of 350 million yards over the 1960-61 figure). Out of the additional 350 million yards of cloth to be produced, 150 million yards can come out of the powerlooms to be transferred to the powerloom sector by the mill sector (at a rate of 2,500 per year). For the remaining 200 million yards, the powerloom sector has to be expanded. The requirements of steel for this have been worked out.

For the Fourth Plan, besides the 150 million yards that can be produced in the power looms to be transferred from the mill sector, additional cloth of about 600 million yards is expected to be produced in the 50,000 powerlooms to be added to this sector by replacement of handlooms under

**TABLE 24—PRODUCTION OF COTTON CLOTH\***

	(Million yd.)	
	1965-66	1970-71
Mill sector	6,500 (900)	8,000 (900)
Handloom sector	2,700 (100)	2,700 (100)
Powerloom sector	800 (—)	1,550 (—)
<b>TOTAL</b>	<b>10,000</b>	<b>12,250</b>

\* Anticipated exports are shown in brackets.

TABLE 25.—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE TEXTILE INDUSTRY IN 1960-61, 1965-66 AND 1970-71

CATEGORIES	1960-61				1965-66				1970-71			
	For baling raw cotton	For develop-ment, mainte-nance, repairs, packing, etc.	For machinery	Total	For baling raw cotton	For develop-ment, mainte-nance, repairs, packing, etc.	For machinery	Total	For baling raw cotton	For develop-ment, mainte-nance, repairs, packing, etc.	For machinery	Total
Heavy structurals	..	300	..	300	..	375	..	375	..	496	..	496
Light structurals	..	766	..	766	..	907	150	1,057	..	1,134	150	1,284
Light rails	..	58	..	58	..	72	..	72	..	90	..	90
Sheets	..	1,707	2,200	3,907	..	2,134	3,900	6,034	..	2,667	9,100	11,767
Plates	..	766	..	766	..	895	950	1,845	..	1,119	1,100	2,219
Bars and rods	..	4,532	3,500	8,032	..	5,655	7,150	12,805	..	7,081	9,400	16,481
Wires	..	107	50	157	..	134	100	234	..	167	150	317
Hoops and strips	6,150	2,264	..	8,414	9,225	2,828	..	12,053	13,325	3,546	..	16,871
Bolts, nuts, etc.	..	..	150	150	..	..	300	300	..	..	450	450
TOTAL	6,150	10,500	5,900	22,550	9,225	13,000	12,550	34,800	13,325	16,300	20,350	50,000

(Tons)

the phased programme mentioned above (at 40 yards a day, and 300 working days a year).

The rest of the demand, it has been assumed, would be met from the mill sector. In the mill sector, powerlooms are expected to be replaced by automatic looms at the rate of 2,500 per annum. The increase in the production of the mill sector is expected to be obtained out of the addition of the required automatic looms (after taking into account the decrease in mill production resulting from the transfer to the powerloom sector mentioned earlier).

The details of estimated production in the different sectors are given in Table 24.

The categorywise steel requirements for additional machinery have been obtained on the basis of the norms as explained previously, and to that have been added the requirements of steel for maintenance, repairs, packing and construction. The requirements of steel in 1965-66 will be about 34,800 tons, and in 1970-71 about 50,000 tons. The details are given in Table 25.

## 7. Rayon Industry

The rayon industry comprises two distinct sections, the manufacture of rayon yarn and the weaving of the yarn into fabrics. Rayon yarn is also used in miscellaneous industries like the knitting, hosiery, gas mantle, rubber tyre, etc. Production of rayon yarn (both acetate and viscose) during the recent years has been as follows:

YEAR	PRODUCTION OF RAYON YARN (Tons)
1954	5,332
1955	6,771
1956	8,690
1957	11,009
1958	14,943

The installed capacity at the end of 1958 for the production of rayon yarn was only 18,000 tons, though the capacity licensed till the end of 1958 was 35,940 tons.

Under the Second Plan the target of production of rayon fabrics is fixed at 350 million yards in 1960-61. In 1958 there were 3,883 rayon weaving units having 44,500 looms. In addition to these, there were about 96,000 handlooms producing rayon and cotton and rayon mixed fabrics in the country. The production capacity of the rayon weaving industry has been estimated at about 600 million yards for 1958, although the utilisation is only about 50 per cent or less owing to shortages of raw material. The target of 350 million yards set up for the Second Plan would require about 80 million lb. of rayon yarn.



On the basis of the targets tentatively fixed for rayon and staple fibre for 1960-61 and for the succeeding plan periods, the probable demand for rayon fabrics has been estimated at 600 million yards in 1965-66 and 1,050 million yards in 1970-71.

In view of the estimated capacity of 600 million yards existing as on date, installation of additional looms may not be necessary to achieve the target of 350 million yards set up for 1960-61. On the other hand, the present capacity for the production of rayon yarn is inadequate to meet the demand in 1960-61. It is, however, hoped that out of the capacity of 80.48 million lb. licensed till the end of 1958, at least 70 million lb. will materialise by 1960-61.

The steel required for this increase of about 30 million lb. in two years has been estimated at about 800 tons; or the requirements of steel in 1960-61 will be of the order of 400 tons.

For the years 1965-66 and 1970-71, it is necessary to install additional capacities both for the production of yarn and for weaving. It has been estimated that about 1,850 tons of steel (on the basis of the estimate for cotton textile industry) will be required for the machinery needed to manufacture 100 million yards of fabrics. The steel requirements for 1965-66 and 1970-71 estimated on this basis are 1,200 tons and 1,700 tons respectively.

For the construction activities involved in the installation of additional capacity of 100 million yards of fabrics, it is estimated that about

**TABLE 26—STEEL REQUIREMENTS FOR THE RAYON INDUSTRY**

YEAR	TARGET OF PRODUCTION (MILL. YD.)	(Tons)			TOTAL
		ADDITIONAL MACHINERY FOR RAYON YARN AND CLOTH	CONSTRUCTION NEEDS	MAINTENANCE, REPAIRS & PACKING	
1960-61	350	400	600	100	1,100
1965-66	600	1,200	1,800	300	3,300
1970-71	1,050	1,700	3,000	500	5,200

**TABLE 27—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE RAYON INDUSTRY**

YEAR	TOTAL REQUIREMENTS OF STEEL	HEAVY STRUCTURALS	LIGHT STRUCTURALS	(Tons)		BARS & RODS	WIRES	HOOPS & STRIPS
				SHEETS	PLATES			
1960-61	1,100	20	40	280	60	550	20	130
1965-66	3,300	50	120	850	200	1,660	50	370
1970-71	5,200	80	200	1,360	320	2,660	80	500

3,500 tons of steel will be required. The requirements of steel, estimated on this basis, for 1960-61, 1965-66 and 1970-71 are 600 tons, 1,800 tons and 3,000 tons respectively.

Table 26 summarises the requirements of steel for the rayon industry including its maintenance, repairs, packing etc.

The categorywise requirements of steel have been worked out as shown in Table 27.

### 8. Sugar Machinery

It is proposed to increase the production of sugar to 2.25 million tons under the Second Plan. For this purpose, the rated capacity is proposed to be increased to 2.5 million tons. This is to be achieved in two ways:

(a) by expansion of the units already existing and (b) by establishing new factories. The foreign exchange crisis in the recent past forced the decision to manufacture sugar machinery in the country, and two Consortiums were formed in collaboration with foreign interests for the manufacture of sugar plants. Only the minimum essential components that cannot be manufactured in the country would be imported.

Sugar machinery consists of (i) cane crushers, (ii) centrifugals, (iii) machinery for clarification, evaporation, condensation, etc. There has been an increase in the demand for sugar machinery as can be seen from Table 28.

The demand reached a record figure of Rs. 9.3 crores in 1956-57, representing an increase of over 1,300 per cent over 1952-53.

The value of indigenous production of sugar machinery was only Rs. 3 lakhs in 1952-53, went up to Rs. 32 lakhs in 1956, Rs. 162 lakhs in 1957 and Rs. 200 lakhs in 1958. In 1959 it is estimated at Rs. 320 lakhs.

Sugar production in 1960-61 is targetted at 2.25 million tons with a production capacity of 2.5 million tons. The capacity in 1956 was 1.74 million tons. The investment required for establishing additional capacity of about 0.76 million tons to achieve the target of 2.5 million tons is roughly Rs. 50 crores. The cost of replacement and modernising existing factories is estimated at another Rs. 50 crores.

**TABLE 28—MANUFACTURE OF SUGAR MACHINERY IN INDIA**

YEAR	(Lakhs of Rs.)		TOTAL	INDEX 1952-53 =100
	VALUE IMPORTED	VALUE PRODUCED IN INDIA		
1952-53	68.16	3.92	72.08	100.00
1953-54	69.14	2.98	73.12	107.7
1954-55	91.98	12.69	104.58	153.43
1955-56	399.44	19.04	418.48	613.96
1956-57	897.83	32.06	929.89	1,364.27

Source: M.P. Gandhi's 'Sugar Annual'—1957-58

Sugar production in India in 1958-59 was 1.98 million tons. On the basis of this figure and taking account of the effect of changes in per capita income, tastes, habits, etc., the estimates of sugar production have been put at 2.25, 3.00 and 4.00 million tons respectively for 1960-61, 1965-66 and 1970-71.

The requirements of steel are calculated on the following assumptions. One complete plant of 1,000 tons crushing capacity per day costs Rs. 84 lakhs; the fabrication would cost Rs. 3,000 per ton including raw materials. At this rate the weight of complete plant is about 2,800 tons. Of this the proportion of steel is between 1,500 and 1,600 tons. Fourteen plants are scheduled to be produced by 1960-61. Even if they are to be produced a little later, the steel required should be obtained by 1960-61 or earlier.

Therefore, the steel required for 14 plants is 21,000 to 22,400 tons in two years. The annual requirement works out to 10,500 to 11,200 tons (i.e. approximately 10,000 tons would be required in 1960-61). This is the steel required to increase production from 1.98 million tons in 1958-59 to 2.25 million tons in 1960-61, i.e. for 0.27 million tons or roughly for a quarter million tons. On this basis, the steel required in 1961-66 and 1966-71 would be 63,000 tons and 84,000 tons respectively.

Phasing these over the plan periods, the steel requirements in 1965-66 and 1970-71 may be taken to be 15,000 tons and 20,000 tons respectively. Allowing for normal repairs and maintenance of plant and machinery at 6.5% (NCAER estimate from a special study), the total requirements of steel work out to 11,200 tons in 1960-61, 16,000 tons in 1965-66 and 21,300 tons in 1970-71.

YEAR	TARGETS OF PRODUCTION OF SUGAR (million tons)	STEEL REQUIREMENTS (tons)
1960-61	2.25	11,200
1965-66	3.00	16,000
1970-71	4.00	21,300

**TABLE 29—CATEGORYWISE STEEL REQUIREMENTS FOR SUGAR MACHINERY**

	(Tons)		
CATEGORIES	1960-61	1965-66	1970-71
Light structurals	1,700	2,400	3,200
Plate	2,300	3,200	4,300
Sheet	4,500	6,400	8,500
Bars and rods	2,800	4,000	5,300
TOTAL	11,300	16,000	21,300

The categorywise distribution is given in Table 29.

### 9. Tea Machinery

Production of Indian tea is steadily increasing. It rose from 568.8 mill. lb. in 1948 to 704.4 mill. lb. in 1958 already exceeding the target of 700 million lb. for 1960-61. However, the industry is facing a severe competition from other tea growing countries, Ceylon, Pakistan, Japan, China, Formosa, Kenya, Nyasaland and Indonesia. In striving to maintain her place as the largest exporter of quality tea, India is not only taking steps to improve quality, but also to lower production costs, which in turn involves changes in the existing range of tea-processing machinery.

India has been manufacturing tea machinery and spares for the last 40 years. Two manufacturing units in India produced tea processing machinery in 1956 and 1957 of the value of Rs. 79 and Rs. 58 lakhs. At present the annual turnover of tea-processing machinery is of the value of Rs. 65 lakhs. It has been estimated that the average cost of fabrication for tea machinery involving castings and rolled steel is Rs. 3,500 per ton, and that 1,500 tons of rolled steel are required for the annual turnover.

In view of the competition from other countries, and the increased use of alternative beverages in the importing countries, no attempt has been made to visualise the rate of expansion of the industry and relate it to the steel required. Instead, the requirements at the end of Third and Fourth Plans are obtained by assuming an annual increase of 7% in the consumption of steel, mainly on account of modernisation of plants and increase in maintenance. The categories of steel required are sheets, bars and rods, plates and light structurals. The categorywise estimates of steel requirements in 1960-61, 1965-66 and 1970-71 for tea-processing machinery are given in Table 30.

**TABLE 30—CATEGORYWISE REQUIREMENTS OF STEEL FOR TEA MACHINERY**  
(Tons)

	1960-61	1965-66	1970-71
Sheets	750	1,013	1,368
Bars and rods	525	709	957
Plates	75	101	136
Light structurals	150	202	273
<b>TOTAL</b>	<b>1,500</b>	<b>2,025</b>	<b>2,734</b>

### 10. Jute Industry

**Jute Baling.** There is a considerable demand for steel hoops for baling. Production of jute goods in 1958-59 was more than a million tons or more than 5 million bales. Assuming that 4 hoops of about 12 ft. each are required for a bale, the total length of hoops required is estimated at 50 ft. per bale, or 3 lb. of steel. On this basis the total requirement of steel comes to about 8,000 tons annually for baling. This may be taken as the requirement for 1960-61 also, as jute production which has already reached the target of 5 million bales may be maintained at that level till the end of the Second Plan period. For 1965-66 taking 6.5 million bales of jute as the target, the requirements of baling hoops will be 8,700 tons. Assuming the same rate of increase over the Fourth Plan period

TABLE 31—REQUIREMENTS OF STEEL FOR JUTE INDUSTRY

(Tons)

CATEGORIES	1960-61				1965-66				1970-71			
	For baling raw jute products	For development, maintenance, repairs, etc.	For jute machinery	Total	For baling raw jute products	For development, maintenance, repairs, etc.	For jute machinery	Total	For baling raw jute products	For development, maintenance, repairs, etc.	For jute machinery	Total
Light structurals	..	300	1,230	1,530	..	360	2,138	2,498	..	450	3,417	3,867
Sheets	..	300	1,230	1,530	..	360	2,138	2,498	..	450	3,417	3,867
Plates	..	50	205	255	..	60	356	416	..	75	570	645
Bars and rods	..	250	1,025	1,275	..	300	1,781	2,081	..	375	2,847	3,222
Wires	..	100	410	510	..	120	712	832	..	150	1,139	1,289
Hoops	16,000	..	..	16,000	17,400	..	..	17,400	19,000	..	..	19,000
TOTAL	16,000	1,000	4,100	21,100	17,400	1,200	7,125	25,700	19,000	1,500	11,390	31,900

Note: Totals rounded off.

also, a target of 7 million bales would call for a supply of 9,500 tons of steel in 1970-71 on this account.

In addition to this, the jute industry requires hoops for the baling of raw jute. Assuming that equal quantities of hoops are required for baling raw jute as for baling jute products, the total requirements of hoops for baling purposes come to 16,000 tons in 1960-61, 17,400 tons in 1965-66 and 19,000 tons in 1970-71.

**Jute Machinery.** It is assumed that the capacity for the manufacture of jute machinery, which was licensed till 1958, will materialise by 1960-61. The requirements of steel for the manufacture of capacity already installed up to 1958, have been estimated at 1,020 tons on the basis of the steel norms for carding engines, drawing frames, etc. as found from actual observations. By 1960-61 the total requirements of steel may rise up to 4,100 tons. The requirements in 1965-66 for jute machinery can be taken as 25% more than that in 1960-61, i.e. 5,125 tons. Similarly, for 1970-71 it is assumed that it would be 25% more than that in 1965-66, i.e. about 6,390 tons. In addition, 5,000 tons will be required for the manufacture of looms, which would increase by 1970-71.

**Repairs and Maintenance.** The demand for steel by the jute industry for maintenance, repairs and modernisation is estimated at 1,000 tons for 1960-61 on the basis of about 10 tons per mill annually. This is likely to increase by 4 per cent in the Third Plan and 5 per cent in the Fourth Plan periods in view of the greater need for maintenance and repairs. The steel requirements on this account for 1965-66 and 1970-71 may, therefore, be put at 1,200 tons and 1,500 tons respectively.

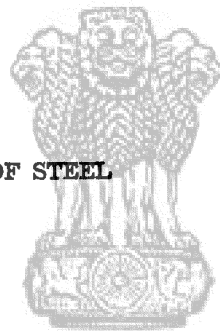
The targets of production together with the total requirements of steel for jute industry are shown in the table below :

YEAR	TARGETS OF JUTE PRODUCTION (million bales)	TOTAL REQUIREMENTS (tons)
1960-61	5.0	21,000
1965-66	6.5	25,700
1970-71	7.0	31,900

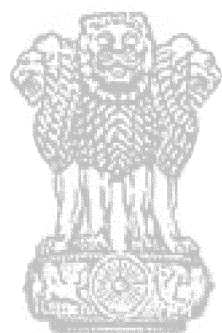
The categorywise steel requirements of the jute industry are given in Table 31.

## 11. Cement Machinery

The production of cement in India in 1958 was of the order of 6 million tons which is nearly four times the production in 1946. This rapid increase in production has been brought about in response to the large demand from development projects and industrial expansion. In spite of this, however, the per capita consumption of cement in India is as low as 35 lb. while in Sweden it is 740 lb., in Belgium 316 lb. and in Japan 90 lb. The target of production of cement at the end of Second Plan was originally fixed as 13 million tons, but was subsequently revised to 8.2 million tons. Production in 1959 may be estimated at 7.2 million tons, and installed capacity of industry about 7.4 million tons. The accordance of sanction to various new firms for setting up cement factories and the expansion



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Assuming that production of transformers in India will be 4.50 million kVA in 1965 and 8.00 million kVA in 1970, the requirements of steel have been calculated and shown in Table 35.

### 13. Switchgear

(i) **High Tension Switchgear:** The targets for power generating capacities at the end of the Second, Third and Fourth Plan periods are 6.9, 12.8 and 22 million kW. The increases in the Third and Fourth plan periods over corresponding previous plan period are 5.9 and 9.2 million kW respectively.

It has been estimated that the total weight of ferrous materials required for high tension switchgear to match 30 MW of power installed capacity is about 170 tons. About 20% of this is pig iron and the rest is rolled steel. On this basis, the rolled steel required for the production of high tension switchgear in the Third Plan corresponding to 5.9 million kW of power generating capacity is 22,658 tons.

It is assumed that heavy switchgear will not be produced in India by 1960-61, and no steel is, therefore, required for this purpose in the Second Plan. In the Third Plan the production of switchgear by the Heavy Electricals may commence by the middle of the plan period and, therefore, only 50% of the total steel requirements for switchgear is taken into account. For the Fourth Plan the indigenous share is taken to be 75%.

So, for the manufacture of switchgear in the Third Plan, the steel requirements will be 11,329 tons, and for the Fourth Plan 36,037 tons. Phasing these uniformly over the Plan period, the steel required for this production would be 3,800 tons in 1965 and 7,200 tons in 1970. The categorywise distribution is given in Table 36.

(ii) **Low Tension Switchgear:** The capacities licensed till the end of 1958 for the manufacture of L.T. switchgear, motor control gears and iron-clad switch and switch fuse units are 2,198 units, 220,616 units and 177,650 units respectively. It is assumed that these licensed capacities would materialise by 1960-61. The norms calculated for the steel requirements are 10 lb. per L.T. switchgear, 4 lb. per motor control gear and 1 lb. per iron-clad switch and switch fuse unit. The steel required in 1960-61 for L.T. switchgear on the basis of these norms is about 500 tons. It is assumed that production in 1965-66 would be double that in 1960-61 and in 1970-71 double that in 1965-66. Thus the steel requirements will be 1,000

**TABLE 36—CATEGORYWISE REQUIREMENTS OF STEEL FOR  
H.T. SWITCHGEAR**

CATEGORIES	(Tons)	
	1965-66	1970-71
Light structurals	725	1,368
Plates	455	864
Sheets	1,670	3,168
Bars and rods	950	1,800
<b>TOTAL</b>	<b>3,800</b>	<b>7,200</b>

**TABLE 37—CATEGORYWISE REQUIREMENTS OF STEEL FOR L.T. SWITCHGEAR**

CATEGORIES	(Tons)		
	1960-61	1965-66	1970-71
Light structurals	95	190	380
Plates	60	120	240
Sheets	220	440	880
Bars and rods	125	250	500
<b>TOTAL</b>	<b>500</b>	<b>1,000</b>	<b>2,000</b>

**TABLE 38—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE SWITCHGEAR INDUSTRY**

CATEGORIES	1960-61			1965-66			1970-71		
	For L.T. switch-gears	For H.T. switch-gears	Total	For L.T. switch-gears	For H.T. switch-gears	Total	For L.T. switch-gears	For H.T. switch-gears	Total
Light structurals	95	..	95	190	725	915	380	1,368	1,748
Plates	60	..	60	120	455	575	240	864	1,104
Sheets	220	..	220	440	1,670	2,110	880	3,168	4,048
Bars and rods	125	..	125	250	950	1,200	500	1,800	2,300
<b>TOTAL</b>	<b>500</b>	<b>..</b>	<b>500</b>	<b>1,000</b>	<b>3,800</b>	<b>4,800</b>	<b>2,000</b>	<b>7,200</b>	<b>9,200</b>

tons in 1965-66 and 2,000 tons in 1970-71. Table 37 gives the steel requirements of L.T. switchgear according to categories.

Table 38 sums up the categorywise requirements of steel for both H.T. and L.T. switchgears.

#### 14. Conduit Pipes

The production of conduit pipes in India was 6.25 million ft. in 1955-56, went up to 10.93 million ft. by 1956-57 and fell to 8.15 million ft. in 1958-59, mainly due to shortage of steel sheets. The capacity of this industry is considered adequate to meet the present demand, which trade estimates put at 18 million ft. But, in view of the shortage of steel sheets, the target for 1960-61 may be put at 15 million ft. From a study of the data furnished by the National Conduit Pipes Ltd., relating to the Second Plan period the steel requirements for the production in 1960-61 have been estimated at 3,900 tons. Of this about 15 per cent, i.e. 580 tons, will be consumed for conduits required in private buildings and the balance of 3,320 for conduits required in public buildings. This 85 per cent for public buildings is split up into 60 per cent for schools, hospitals, office buildings, and

TABLE 39—REQUIREMENTS OF STEEL FOR CONDUIT PIPES

YEAR	PRIVATE HOUSES	(Tons)		TOTAL
		PUBLIC BUILDINGS, SCHOOLS, HOSPITALS, ETC.	FACTORY ELECTRIFICATION AND INDUSTRIAL ACTIVITIES	
1960-61	580	2,340	980	3,900
1965-66	800	4,200	3,000	8,000
1970-71	1,000	5,400	6,600	13,000

25 per cent for factory electrification and industrial activities, i.e. 2,340 and 980 tons respectively.

The proposed investment in buildings by the private sector in the Second Plan is Rs. 1,120 crores, and the anticipated investments in the Third and Fourth Plans are Rs. 1,350 crores and Rs. 1,720 crores. The steel requirements on this account have, therefore, been stepped up from the estimate for 1960-61, and put at 800 tons for 1965-66 and 1,000 tons for 1970-71.

The investment in buildings, schools, hospitals, etc. in the public sector in the Third Plan has been anticipated to increase to Rs. 1,212 crores over the anticipated Second Plan figure of Rs. 880 crores, and increase in the Fourth Plan to Rs. 1,640 crores. The steel requirements on this head have accordingly been stepped up from the estimate of 1960-61, and put at 4,200 tons for 1965-66 and 5,400 tons for 1970-71.

For estimating the requirements of factories and power stations, the estimate for 1960-61 has been related to the proposed investments on large scale industries and power. As the investments on these heads as a whole are assumed to double over each of the Third and Fourth Plans, the steel requirements on this account have been put at 3,000 tons for 1965-66 and 6,600 tons for 1970-71. Table 39 shows the requirements of conduit pipes in different sectors.

### 15. Aluminium Conductors Steel Reinforced (ACSR)

The installed capacity in 1955-56 was 13,370 tons. The anticipated capacity in 1960-61 is 21,570 tons. No steel of indigenous production will be required in 1960-61 for ACSR cables. All the steel (high tensile galvanised steel wire) will have to be imported since such steel is not yet being manufactured in India. On the assumption that the demand for ACSR cables would increase during the Third and Fourth Plans at the same rate as during the Second Plan, the demand would work out to about 33,730 tons of cables by 1966, and 54,300 tons by 1970-71. As the steel norm for this cable is taken to be 0.35 times the weight of the conductor, the steel wire required for 1965-66 is about 11,800 tons, and for 1970-71 is 19,000 tons (Table 40). It is assumed that plants for the production of special steel wire will be set up in the Third Plan and all steel requirements of ACSR would be completely met from indigenous sources.

**TABLE 40—REQUIREMENTS OF STEEL FOR ACSR CABLES**

(Tons)

YEAR	ESTIMATED DEMAND FOR CABLES	ESTIMATED REQUIREMENT OF HIGH TENSILE GALVANISED STEEL WIRE
1960-61	21,570	7,550*
1965-66	33,730	11,800
1970-71	54,300	19,000

\* All imported.

**16. Electric Fans**

The production of electric fans in India since 1950-51 is given below :

YEAR	PRODUCTION (Thousand units)
1950-51	194
1951-52	215
1952-53	169
1953-54	208
1954-55	256
1955-56	296
1956-57	385
1957-58	550
1958-59	636

Against a target of 320 to 350 thousand fans per annum by 1955-56, the actual production was only 296,000. Since imports and exports of electric fans have not been appreciable, the indigenous production may be taken as representing the demand. Imports of ceiling fans and parts are banned. Imports of table fans have been reduced. Only industrial exhaust fans and blowers are allowed to be imported liberally.

During the Second Plan period, the installed annual capacity is expected to go up from about 400,000 fans in 1955-56 to 600,000 in 1960-61 and production to go up from 296,000 to 600,000.

**Demand in 1960-61.** Factors that influence the demand for electric fans are the rise in the standard of living consequent on the rise in real income of the population and the general availability of electric power. A linear trend is fitted to the production data and after allowing for the expected change in population by 1960-61, the demand for fans in 1960-61 is estimated at 692,000 units out of which about 40,000 units may be exported\*.

On the basis of the steel norms calculated from the data given in the "Industrial Development Programme in 1956-61", the steel requirement for 1960-61 for the above demand of 692,000 units works out to 12,420 tons.

\* Exports of fans which were comparably low in 1957 are on the increase in recent months. About 29,000 units were exported during the first nine months of 1959 as compared with an export of about 21,000 units in the twelve months of 1958.

**TABLE 41—CATEGORYWISE REQUIREMENTS OF STEEL FOR ELECTRIC FANS**

CATEGORY	(Tons)		
	1960-61	1965-66	1970-71
Sheets	900	1,300	1,800
Plates	450	630	760
Bars and rods	750	1,000	1,200
Strips	900	1,300	1,800
Special steel	9,265	13,150	17,150
Ball bearings	155	220	290
TOTAL	12,420	17,600	23,000

**Demand for Steel in 1965-66 and 1970-71.** The basic factors that influence the demand for fans in future years are the increase in income, population growth, urbanisation and the availability of electric power in urban areas. The trend variable is expected to allow for the increase in the use of fans on account of the last two factors. Hence after estimating the demand for fans by the linear trend, as described above, and allowing for the income and the population effects, the demand for electric fans works out to 980,000 in 1965-66 and 1,280,000 units in 1970-71. It is anticipated that out of these 100,000 units will be exported in 1965-66, and 150,000 units in 1970-71, as exports are seen to be increasing in recent months.

The categorywise requirements of steel are estimated to be as given in Table 41.

### **17. Refrigerators, Air-conditioners, Water-coolers, etc.**

The categories of steel required for the manufacture of the above item of equipment are black-sheets, galvanised sheets, and to a small extent, light structurals. The demand for these durable consumer goods depends largely on the standard of living of the higher income groups and increase in urbanisation. A certain percentage may, however, be allowed for on account of changes in taste. The demand for these goods estimated on the above basis is given in Table 42. The requirements of sheets and angles for 100 units of each of these items of equipment have been taken as follows :

	SHEETS (B.P. AND G.P.)
	(Tons)
Air-conditioners	4.50
Water-coolers	7.25†
Refrigerators	8.35
Bottle-coolers	14.00
Beverage coolers	5.70
Ice cream cabinets	8.30
Food freezers	8.30

† Plus 3 tons of angles.

B.P. : Black plain

G.P. : Galvanised plain

TABLE 42-CATEGORYWISE REQUIREMENTS OF STEEL FOR REFRIGERATORS, WATER COOLERS AND AIR-CONDITIONERS EQUIPMENT

(Tons)

EQUIPMENT	1960-61				1965-66				1970-71			
	Demand Nos.	Sheets	Bars & angles	Total	Demand Nos.	Sheets	Bars & angles	Total	Demand Nos.	Sheets	Bars & angles	Total
Air-conditioners	19,800	890	..	890	23,910	1,076	..	1,076	28,620	1,288	..	1,288
Water-coolers	2,000	145	60	205	2,415	173	72	245	2,890	209	87	296
Refrigerators	7,600	635	..	635	9,177	766	..	766	10,985	918	..	918
Bottle-coolers	375	53	..	53	450	63	..	63	540	75	..	75
Beverage coolers	250	14	..	14	300	17	..	17	360	18	..	18
Ice cream cabinets	375	31	..	31	450	34	..	34	540	45	..	45
Food freezers	375	31	..	31	450	34	..	34	540	45	..	45
TOTAL	1,799	60		1,859	2,163	72		2,235	2,598	87		2,685

Based on these norms, the total requirements of the above categories of steel for these items of equipment in the years 1960-61, 1965-66 and 1970-71 work out as shown in Table 42.

### 18. Electric Motors

Production of electric motors up to 200 H.P. during the last several years is given below :

#### PRODUCTION OF ELECTRIC MOTORS IN INDIA

YEAR	PRODUCTION (‘000 H.P.)
1950-51	99
1951-52	153
1952-53	160
1953-54	161
1954-55	201
1955-56	279
1956-57	387
1957-58	507
1958-59	646*

\* Estimated on the basis of actuals for the period April-September, 1958.

Source : Monthly statistics of production of selected industries in India.

Demand for electric motors arises from the increased supply of electric power for industries. As power is one of the most important requirements of industrial production, the volume and pattern of demand for motors depend upon the pace at which various industries develop, including those pertaining to the manufacture of capital equipment and machine tools requiring motors to be incorporated.

For projection of demand for electric motors into the future, a relationship was obtained between the power generating capacity and the total connected load of electric motors and this ratio was applied to the estimated power generating capacity in 1960-61, 1965-66 and 1970-71 as given in the section on electric transformers and the total steel required, together with categories are given in Table 43.

**TABLE 43—TARGETS AND STEEL REQUIREMENTS FOR ELECTRIC MOTORS**

YEAR	ESTIMATED DEMAND FOR MOTORS (‘000 H.P.)	ELECTRICAL STEEL SHEETS	M.S. SHEETS (Tons)	BAR & RODS	TOTAL
1960-61	712	8,900	140	1,210	10,250
1965-66	1,452	18,150	290	2,460	20,900
1970-71	3,357	41,960	670	5,710	48,340

## (C) MECHANICAL AND GENERAL ENGINEERING INDUSTRIES

## 19. Automobiles

Production of automobiles during the years 1951 to 1959 is shown in Table 44.

The targets of production for automobiles in the Second Plan for 1960-61 has been fixed as follows :

Cars	12,000
Trucks and omnibuses	40,000
Jeeps and station wagons	5,000
	<hr/> 57,000

The production of cars exceeded the plan target in 1956, but fell in later years, particularly in 1958. The production of trucks, jeeps, etc. is far behind the target and the total outturn of automobiles is only of the order of 27,000 in 1958, against the targetted production of 57,000 in 1960-61.

The fall in production was essentially due to reduced foreign exchange allocations to the industry, and the trend is towards widening the gap between the targets and production. Efforts were, however, made in 1959 to increase the production by liberalising the import of components and special steels, as a result of which, production picked up and 36,468 vehicles were produced that year (11,993 cars, 10,099 commercial vehicles and 5,376 jeeps).

**Demand for Automobiles in 1960-61.** The year 1959 may perhaps be taken to be one during which the falling trend in production was arrested, and the upward trend commenced. This may be seen from the figures of production for 1959 shown in Table 45.

TABLE 44—PRODUCTION OF AUTOMOBILES

(Numbers)

YEAR	CARS	TRUCKS	JEEPS*	PASSENGER BUSES	TOTAL
1951	12,385	9,884	N.A.	N.A.	22,272
1952	6,952	8,339	N.A.	N.A.	15,288
1953	4,936	8,990	N.A.	N.A.	13,926
1954	5,435	9,027	N.A.	N.A.	14,462
1955	10,927	12,787	4,104	3,036	23,084
1956	12,984	10,920	4,824	3,408	32,136
1957	11,604	11,892	4,680	3,756	31,932
1958	7,812	11,128	3,852	4,104	26,796
1959	11,993	19,099	5,376	Included in trucks	36,468

N.A. : Not available.

\*Includes Land Rovers, Station Wagons, Utilities and Mobile Health Vans.

Source : Monthly Statistics of Production of Selected Industries in India.



TABLE 45—PRODUCTION OF AUTOMOBILES IN 1959

(Numbers)

	FIRST HALF OF 1959	THIRD QUARTER OF 1959	FOURTH QUARTER OF 1959	TOTAL
Cars	4,616	3,464	3,913	11,993
Trucks and buses	8,419	5,262	5,418	19,099
Jeeps	2,628	1,314	1,434	5,376
TOTAL	15,663	10,040	10,765	36,468

In fact production was geared to the highest pitch during the last month of the year, when 1,621 cars, 2,125 commercial vehicles and 632 jeeps were produced. It is, however, more realistic to assume a production total for 1960-61 based on the last quarter's figures. This would work out to 18,000 cars, 24,000 commercial vehicles and 6,000 jeeps for 1960-61.

**Demand for Automobiles in the Third and Fourth Plans.** The future demand for automobiles depends on a number of factors such as increase in income and industrial activity, increase in trade and commerce, increase in number of upper income groups who can afford to own private cars, prices of automobiles, etc. The demand for motor cars, passenger buses and other types of passenger vehicles are estimated separately, as the factors influencing their demand are somewhat different from those influencing the demand for commercial vehicles. The demand for passenger vehicles is taken to depend on changes in the levels of income, particularly in the upper income brackets, total planned investment and the ensuing activity in commerce and trade. Assuming a normal life of 10 years for an automobile, the number of passenger vehicles that would be required by way of additions and replacement are estimated as follows:

(Thousands)

YEAR	MOTOR CARS	PASSENGER BUSES	Misc.
1961-66	125	35	15
1966-71	175	50	20

Phasing the requirements suitably over the plan periods, the estimated demand in 1965-66 and 1970-71 is as follows:

(Thousands)

YEAR	MOTORS CARS	PASSENGER BUSES	Misc.
1965-66	45	15	5
1970-71	60	20	10

**TABLE 46—TARGETS AND REQUIREMENTS OF STEEL FOR AUTOMOBILES**

TYPE OF VEHICLE	1960-61		1965-66		1970-71	
	Target of production (Number)	Steel requirements (Tons)	Target of production (Number)	Steel requirements (Tons)	Target of production (Number)	Steel requirements (Tons)
Motor cars	18,000	3,400	45,000	27,000	60,000	41,000
Lorries	18,000	10,000	45,000	81,000	60,000	121,500
Buses	6,000	4,500	15,000	36,000	20,000	54,000
Jeeps	6,000	1,100	15,000	9,000	20,000	13,500
TOTAL	48,000	19,100	120,000	153,000	160,000	230,000

**TABLE 47—CATEGORYWISE REQUIREMENTS OF STEEL FOR AUTOMOBILES**  
(Tons)

YEARS	STRUCTURALS	SHEETS & STRIPS	PLATES	BAR & RODS	WIRES	ALLOY STEEL FORGING	SKELP	TOTAL
1960-61	770	14,270	1,530	770	1,530	..	230	19,100
1965-66	1,910	114,800	12,770	3,830	9,560	9,560	570	153,000
1970-71	2,550	166,100	17,130	5,110	12,780	25,560	770	230,000

The demand for commercial vehicles depends mainly on increased transport needs arising from a growth in agricultural and industrial production. Traffic to be carried by trucks may be classified as (i) long distance traffic (with average load of 300 miles), (ii) feeder traffic and (iii) local traffic—mainly to carry agricultural products (70% of agricultural production). The underlying assumptions for these estimates of traffic potential are the same as in the "Road Development Plan"<sup>1</sup> (See also the Section 1 on Railways). Working on this basis the demand for trucks for long distance, local and feeder traffic has been estimated at 330,300 and 536,300 for the Third and Fourth plan periods. By a suitable phasing of the production programme, the demand for trucks in 1965-66 and 1970-71 has been put at 45,000 and 60,000 tons respectively; and the demand for jeeps at 15,000 and 20,000 in 1965-66 and 1970-71, respectively.

The demand for steel for the production of the estimated number of automobiles depends on the steel content of indigenous production. According to a recent speech by the Union Minister of Industry, the indigenous contents achieved for cars, jeeps, and trucks come respectively to 60%, 66% and 60% by value. These figures are obtained by comparing the average of c.i.f. prices of imported components of different models with the ex-factory cost of the vehicle in India. Though the above percentages are fairly large, the steel content of indigenous production is perhaps not considerable. With the recent emphasis on reducing the import content of automobiles, the indigenous content by value is to go up to 75 to 85 per cent

1. Chief Engineers Report on "Road Development Plan"; Ministry of Transport, 1958.

by 1960-61. It is, however, doubtful whether the industry will be able to achieve this target. Six years ago it was said that cars would be completely manufactured (not merely assembled) in India by 1956. Three years after that date production was haltingly progressing, although there are signs of improvement recently. It will, therefore, be more realistic to assume that the indigenous content can rise only up to 70% by value. However, the indigenous content of automobiles by weight of steel has been put at 25%, which is the weighted average of the indigenous contents of the three major producers, the weights being their expected production. Most of the requirements of special steel have been assumed to be imported during the Third Plan. As some special steel may not be produced even by the end of the Fourth Plan, a small percentage is assumed to be imported. The overall indigenous component by weight of steel is taken to go up to 80% by 1965-66 and 90% by 1970-71.

By taking the steel requirements of cars, lorries, jeeps and buses as 0.75<sup>1</sup> ton, 2.25 tons, 0.75 ton and 3.00 tons respectively, the demand for steel on account of automobiles has been estimated and given in Table 46.

The categories have been worked out on the assumption that progressively more of cold rolled sheets and some special wires will be available in future years, so that the indigenous content comes to 25%, 80% and 90% for 1960-61, 1965-66 and 1970-71, respectively. These are shown in Table 47.

## 20. Bicycles

There were 13 manufacturing units in the large scale sector in 1955-56 with a capacity of 7.6 lakhs of bicycles. It was anticipated that the number of units in the large scale sector will increase by 1960-61 to 18 with a single shift capacity of 8.95 lakhs complete cycles, and with double shift the capacity could be raised to 15 lakh units. Actual production of the bicycles in the large scale sector is given in Table 48.

Despite the target for export of 150,000 bicycles by the end of the Second Plan, there are hardly any exports, as the internal demand was very

**TABLE 48—NUMBER OF BICYCLES PRODUCED IN INDIA**

YEAR	PRODUCTION (Thousands)
1950-51	101
1951-52	120
1952-53	211
1953-54	289
1954-55	401
1955-56	550
1956-57	695
1957-58	821
1958-59	911

<sup>1</sup> This is based on the weighted average of the three models of cars currently produced in India, the weights being their expected production in 1960-61. An allowance of 20% scrap has been made after deducting from the unladen weights of latest models, the weights of tyres, tubes and other components which do not require steel. The weight is biased more towards that of Hindustan cars, which are comparatively heavier and of which 9,000 are expected to be produced in 1960-61 out of a total of 18,000. If the emphasis in future years is shifted to small cars, then this norm may have to be reduced and will affect the quantities shown in the table.

**TABLE 49—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE MANUFACTURE OF BICYCLES**

CATEGORIES	(Tons)	YEARS		
		1960-61	1965-66	1970-71
Skelps		9,200	14,500	19,000
M.S. strips		8,000	12,700	16,700
Sheets		1,600	2,500	3,300
Bars and rods		2,700	4,400	5,700
Wires		700	1,100	1,400
Spring and alloy steel		700	1,100	1,400
TOTAL		22,900	36,300	47,500

strong, leaving little margin for exports. Stocks of bicycles with the manufacturers are meagre, and recent data on stocks show that variations in stocks are small. Consumption could, therefore, be taken as the sum total of indigenous production plus imports. But as imports stopped during the later years of the Second Plan period, total indigenous production gives an indication of the trend in consumption in recent years.

The different types of steel required for the manufacture of bicycles are mild steel sheets (20-25 guages), steel panel sheets, cold rolled steel strips, cold rolled bright hexagonal bars, steel tubes, etc. Out of these the most important are the cold rolled strips and steel tubes. Skelp is required for the manufacture of the bicycle frames.

The Small Scale Industry has estimated that 47 lb. of steel would be required for the manufacture of a complete bicycle. This is the estimate adopted by the Planning Commission also. But it appears somewhat on the high side. In fact, in view of the wide differences in the estimates\* of steel requirement, particularly for steel tubes, the National Council made a careful observational study of the requirements of a bicycle by noting down the actual weights of various components of different makes of bicycles. As a result of this study it is felt that a norm of 41 lb. of steel per bicycle, after allowing for process scrap, can be safely adopted.

**Estimate of Consumption of Steel: 1960-61.** Production in 1958-59 in the large scale sector was in the region of 9 lakhs of complete bicycles. On the basis of the trend projection, production likely to be achieved in 1960-61 has been estimated at 11.13 lakhs. In this estimation, however, the income effect has been ignored, as supply is more decisive in the short period—between now and 1960-61.

The target of production for the Second Plan was put at 12.5 lakh units, out of which the organised sector was to produce 10 lakh units. For our calculation, we have used a figure of 41 lb. of steel per bicycle consisting of 14 lb. of strips, 16 lb. of skelps, 5 lb. of bars and rods, etc. On this basis the demand for steel by the organised sector of the bicycle industry in

\*Estimates by different authorities varied from about 22 lb. to 63 lb. of steel per bicycle. The last figure is quoted in the Steel Review of British Iron & Steel Federation, and is also given by an important Indian manufacturer. The data in the Industrial Development Programme of the Second Plan work out to a total of 36 lb. per bicycle.

1960-61 would come to 18,300 tons. The estimated production of bicycles in the small scale sector in 1960-61 is about 250,000. The steel required for this is about 4,600 tons. Thus, the total steel required for both the organised and small scale sectors in 1960-61 is about 22,900 tons.

**1965-66 and 1970-71.** For projection of the demand for bicycles in 1965-66 and 1970-71, however, factors like changes in population and changes in income have been taken into account apart from the trend. On this basis, the estimated demand for bicycles in 1965-66 and 1970-71 comes to 19.86 lakhs and 25.97 lakhs respectively. Of these, the share of the small sector is estimated at 4 lakhs in 1965-66 and 5.2 lakhs in 1970-71, requiring 36,360 tons and 47,500 tons of steel respectively.

On the basis of the norms worked out by the Council, the different categories of steel required for the manufacture of complete bicycles, in 1960-61, 1965-66 and 1970-71 are shown in Table 49.

## 21. Machine Tools

The production of machine tools by the large and small scale sector has gone up (in value) from Rs. 1.56 crores in 1955 to Rs. 5.76 crores in 1958, while the imports increased from Rs. 5.31 crores in 1955 to Rs. 24 crores in 1958. Table 50 gives the production and imports of machine tools from 1955 to 1958.

The total capacity licensed till the end of 1958 for the manufacture of machine tools under the Industrial Development and Regulation Act is worth Rs. 7 crores. It is assumed that this capacity will materialise by 1960-61. To this must be added the production from the small scale sector which is estimated at about Rs. 2.5 crores for the same year. Thus, the total production of machine tools in 1960-61 may be expected to reach Rs. 9.5 crores in value.

To estimate the future requirements of machine tools the changes in the requirements of machine tools in the U.S.A. in relation to the steel production is studied, and this is applied suitably to Indian conditions, bearing in mind that the industries in India are in the evolutionary stage and are not stabilised as in the case of the United States.

In the process of rapid industrialisation and the efforts taken to build up new capacity for the production of industrial machinery, there appears to be more intensive use of machine tools in India at the present moment

**TABLE 50—PRODUCTION AND IMPORTS OF MACHINE TOOLS**

YEAR	(Rupees crores)			VALUE OF TOTAL CONSUMPTION OF STEEL
	PRODUCTION	IMPORTS	TOTAL	
1955	1.56	5.31	6.87	119.94
1956	2.50	8.38	10.88	175.02
1957	4.59	15.81	20.40	173.28
1958	5.76	24.00	29.76	139.62

(The ratios of the value of machine tools to the value of steel consumption were 1/8 in 1957 and 1/5 in 1958).

as compared with industrially advanced countries. It is, however, expected that the relation that exists now in such countries as the U.S.A. between the consumption of finished steel and that of machine tools will also be applicable to India by 1970-71, by which time the machine building industry will have stabilised itself.

The value of machine tools produced in the U.S.A. and that of steel for the years 1947, 1954 and 1956 are given in Table 51.

This shows that the ratio of the value of machine tools produced to that of steel is approximately 1/10. Assuming that the machine building industry would be stable by 1970-71, machine tools required then can be estimated to be of the value of Rs. 78 crores to correspond with the total requirements of finished steel of 12.86 million tons in 1970-71.

Although imports of machine tools have been steadily increasing until now, it is expected that with the increase in the indigenous production, it would gradually fall in the coming plan periods. On this assumption, of the estimated requirements of Rs. 78 crores by 1970-71, the imports would only be of the order of Rs. 13 crores. The production for 1965-66 may reach Rs. 30 crores.

In order to find out the steel norm for machine tools, weights of the steel content of various types of machine tools like lathes, drilling machines, milling machines, etc. were worked out, and it has been estimated that for machine tools valued at Rs. 1 crores, approximately 1,000 tons of rolled steel would be required including process scrap. On the basis of this norm the steel requirements work out to 9,500 tons in 1960-61. The requirements according to categories are given in Table 52.

**TABLE 51— PRODUCTION OF MACHINE TOOLS AND FINISHED STEEL  
IN INDIA**

YEAR	(Million \$)	
	VALUE OF MACHINE TOOLS	VALUE OF FINISHED STEEL PRODUCED
1947	490	5,130
1954	839	7,475
1956	883	7,566

**TABLE 52—CATEGORYWISE REQUIREMENTS OF STEEL FOR MACHINE TOOLS**

CATEGORIES	(Tons)		
	1960-61	1965-66	1970-71
Bars and rods	8,550	27,000	58,500
Plates	800	2,550	5,500
Wires	150	450	1,000
TOTAL	9,500	30,000	65,000

## 22. Steel Furniture

The present capacity of the steel furniture industry is about 31,020 tons.

Production in 1958 was restricted to a level of 20,400 tons mainly due to shortage of strips and sheets. The raw material position particularly for skelps and sheets is likely to improve by 1960-61; and it would be realistic to put the anticipated production for 1960-61 at the present capacity of the industry.

Relating this demand to per capita income and the estimated population in the years 1960-61, 1965-66 and 1970-71, and allowing for process scrap at 20%, the requirements of steel in these years are estimated at 37,200 tons, 50,000 tons and 45,000 tons respectively. The categories of steel required are sheets, bars and rods and skelps. The categorywise distribution of the future demand for steel is shown in Table 53. It has been assumed that the proportion of furniture using steel tubes will progressively increase from 6% in 1960-61 to 10% in 1965-66 and 15% in 1970-71.

**TABLE 53—CATEGORYWISE REQUIREMENTS OF STEEL FOR STEEL FURNITURE**

CATEGORIES	(Tons)		
	1960-61	1965-66	1970-71
Skelps	2,220	7,500	9,750
Bars and rods	1,480	2,500	3,250
Sheets	33,500	40,000	52,000
TOTAL	37,200	50,000	65,000

## 23. Hardware and Expanded Metals

The present installed capacity for hardware is 6,396 tons. Buildings and hardware fittings consist of hinges, hasps, staples, etc. The demand for expanded metals for which the installed capacity is 7,260 tons is also considered with that of hardware, as both are related to housing and construction works. The actual production in 1958 was only 3,250 tons of hardware and 1,735 tons of expanded metal. This was due to shortage of raw material for hardware and black sheets for expanded metal. It is expected that the supply position would improve and the estimates of the demand for 1960-61 can be put at the maximum capacity of the industry. In both cases, allowing 20% for process scrap, the requirement of steel in 1960-61 would be 16,387 tons (7,675 tons for hardware and 8,712 for expanded metal). The investments on construction in 1960-61, 1965-66 and 1970-71 are of the order of Rs. 366, Rs. 512 and Rs. 672 crores respectively, and relating the requirement of steel to these investments, the demand for steel on account of hardware and expanded metal in 1965-66 and 1970-71 would be 22,942 tons and 30,088 tons. The main categories of steel required are B.P. sheets for expanded metal, and sheets, and bars and rods for hardware. The proportion of sheets used will be 70% and bars and

**TABLE 54—CATEGORYWISE REQUIREMENTS OF STEEL FOR HARDWARE AND EXPANDED METALS**

CATEGORIES	(Tons)		
	1960-61	1965-66	1970-71
Sheets	11,471	16,059	21,062
Bars & rods	4,916	6,883	9,026
TOTAL	16,387	22,942	30,088

rods 30%. The categorywise distribution of steel demand would be as given in Table 54.

#### **24. Containers and Drums**

The manufacture of containers requires mainly one particular category of steel, viz. either tinplates or sheets. The country's production of tinplates is consumed almost entirely by the container industry. Black sheets and galvanised sheets are generally used for the larger sized drums and containers, utilized for the storage of paints & varnishes, petroleum products, etc. Containers made out of tinplates are used for the packaging of food products like fruits, vegetables, milk, confectionery, etc., and non-food products, like paints and varnishes (only for small quantity packings), pharmaceuticals, toilet, petroleum products, etc. The anticipated demand for tinplates and black sheets in the container industry in 1960-61, 1965-66 and 1970-71 have been worked out, based on the current production capacity and the estimated demand for the various consumer products in the coming years. This in turn depends mainly on the increase in per capita income and the growing tendency of the public to rely more on the canned and tinned products. Table 55 gives the estimated demand for black-sheets in the container industry for the years under consideration.

The estimates derived for tinplates have been put at 250,000 tons for 1965-66 and 400,000 tons for 1970-71 as shown in Table 56.

**TABLE 55—REQUIREMENTS OF BLACK AND GALVANISED SHEETS FOR CONTAINERS AND DRUMS**

CONSUMER GROUP	(Tons)		
	1960-61	1965-66	1970-71
Paints and varnishes	4,000	7,200	11,080
Petroleum products	25,000	40,000	47,500
Other non-food products	6,000	11,100	14,830
Miscellaneous uses	5,000	12,500	17,200
TOTAL	40,000	70,800	90,610



**TABLE 56—REQUIREMENTS OF TINPLATES FOR DRUMS AND CONTAINERS**

		(Tons)		
No.	CONSUMER GROUP	1960-61	1965-66	1970-71
1.	Milk and allied products	3,800	10,000	20,000
2.	Fruit, vegetable and fish industries	2,600	10,000	18,000
3.	Confectionary and biscuits	5,700	9,000	12,000
4.	Vanaspati and other edible oils	35,700	54,000	80,000
5.	Cashew	4,900	7,000	10,000
6.	Other food products	4,400	10,000	20,000
	<b>FOOD PRODUCTS TOTAL</b>	<b>57,100</b>	<b>100,000</b>	<b>160,000</b>
7.	Paints and varnishes	4,500	8,000	15,000
8.	Pharmaceutical and toilet industries	4,200	10,000	20,000
9.	Petroleum products	50,600	85,000	130,000
10.	Other non-food products	7,100	14,000	25,000
	<b>NON-FOOD PRODUCTS TOTAL</b>	<b>66,400</b>	<b>117,000</b>	<b>190,000</b>
11.	Tea chests	1,500	3,000	5,000
12.	Misc. uses	15,000	30,000	45,000
	<b>GRAND TOTAL</b>	<b>140,000</b>	<b>250,000</b>	<b>400,000</b>

## 25. Sewing Machines

Figures of production of sewing machines by the organized sector are given in Table 57.

The anticipated production in 1960-61, according to the "Second Five Year Plan" is 300,000 sewing machines, out of which 80,000 units are to be manufactured by the small scale sector. Domestic consumption was estimated to go up to 270,000 units, allowing for an export of 30,000 units.

**Demand in 1960-61.** A linear trend is fitted to the data of production, and on the basis of the trend, production of sewing machines by the organized sector in 1960-61 is estimated at 240,000. Assuming that the small scale sector achieves the target of 80,000 units set for it, the estimated production of sewing machines in 1960-61 has been put at 320,000 units.

Exports of sewing machines in 1958 were about 9,800 and in the first nine months of 1959, they were about 9,000, besides exports of machine parts. It is expected that exports in 1960-61 will be of the order of 15,000 units which will be met out of the expected production of 320,000 units in 1960-61.

The estimated demand for different categories of steel in 1960-61, on account of sewing machines is given in Table 58.

**Demand in 1965-66 and 1970-71.** The demand for sewing machines in 1965-66 and 1970-71, taking into account the linear trend and changes

**TABLE 57—PRODUCTION OF SEWING MACHINES IN INDIA**

(Thousands)

YEAR	PRODUCTION
1950-51	33
1951-52	48
1952-53	52
1953-54	68
1954-55	81
1955-56	108
1956-57	141
1957-58	176
1958-59	228

**TABLE 58—CATEGORYWISE REQUIREMENTS OF STEEL FOR SEWING MACHINES IN 1960-61**

(Tons)

YEAR	SHEETS	BARS & RODS	STRIPS	WIRE	TOTAL
1960-61	1,265	640	465	160	2,530

**TABLE 59—CATEGORYWISE REQUIREMENTS OF STEEL FOR SEWING MACHINES IN 1965-66 AND 1970-71**

(Tons)

YEAR	SHEET	BARS & RODS	STRIPS	WIRE	TOTAL
1965-66	2,370	1,190	900	290	4,750
1970-71	2,975	1,490	1,115	370	5,950

in per capita income, are estimated at 600,000 units and 750,000 units, respectively. The organised sector is expected to produce about 450,000 units in 1965-66 and 600,000 units in 1970-71. The rest, it is expected, will be produced by the small scale sector. Estimated exports of about 40,000 units in 1965-66 and 75,000 units in 1970-71, are expected to be met out of the production of 600,000 units and 750,000 units.

The estimated demand for different categories of steel in 1965-66 and 1970-71 is given in Table 59.

## **26. Water Pipes and Tanks in Housing**

It has been estimated that for construction of buildings worth Rs. 10,00,000 the steel required for water pipes and water tanks and other fittings is nearly 22 tons.

The envisaged investment on construction of houses, schools buildings, hospitals, etc, is about Rs. 366 crores in 1960-61 and the estimated

**TABLE 60—CATEGORYWISE STEEL REQUIREMENTS FOR PIPES AND WATER TANKS**

	(Tons)		
	1960-61	1965-66	1970-71
Skelps	50,000	75,000	90,000
Sheets	33,000	50,000	60,000
<b>TOTAL</b>	<b>83,000</b>	<b>125,000</b>	<b>150,000</b>

investments in 1965-66 and 1970-71 are Rs. 512 crores and Rs. 672 crores, respectively. Using the norms of steel quoted above, the steel required at the end of the Second, Third and Fourth Plan periods are 83,000 tons, 125,000 tons and 150,000 tons respectively, the categories being skelp for pipes and sheets for water tanks. The categorywise distribution of these demands is shown in Table 60.

#### (D) MINING AND METALLIC INDUSTRY

Under this head are discussed the requirements of the following :

- (i) Coal machinery and equipment.
- (ii) Machinery for mining metallic and non-metallic minerals.
- (iii) Aluminium industry.
- (iv) Petroleum refining industry.

#### 27. Coal Machinery and Equipment

The production of coal has been steadily increasing from 32 million tons in 1950 to 45 million tons in 1958. Under the Second Plan the target of production by 1960-61 was put at 60 million tons, i.e. an increase of 22 million tons over the 1955 production of 38 million tons. This envisages an increase of 10 million tons (30 per cent) in the private sector, and 12 million (27 per cent) in the public sector.

Despite recent assurances by the Government of India, the achievement of the original target for 1960-61 appears to be a difficult task because of the poor rate of progress at present. A revised target of 55 million tons of coal, therefore, has been proposed for 1960-61. This means an additional production capacity of 10 million tons by 1960-61. The value of

**TABLE 61—CATEGORYWISE REQUIREMENTS OF STEEL FOR COAL MACHINERY AND EQUIPMENT**

	(Tons)		
CATEGORIES	1960-61	1965-66	1970-71
Skelp	787	9,000	10,500
Sheets	787	9,000	10,500
Plates	525	6,000	7,000
Light structurals	1,050	12,000	14,000
Heavy structurals	264	3,000	3,500
Wires	787	9,000	10,500
Bars and rods	1,050	12,000	14,000
<b>TOTAL</b>	<b>5,250</b>	<b>60,000</b>	<b>70,000</b>

TABLE 62—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE COAL INDUSTRY

(Tons)

CATEGORIES	1960-61			1965-66			1970-71		
	For machinery	Construc- tion, main- tenance, etc.	Total	For machinery	Construc- tion, main- tenance, etc.	Total	For machinery	Construc- tion, main- tenance, etc.	Total
Blooms and billets	..	5	5	..	14	14	..	24	24
Heavy structurals	264	3,000	3,264	3,000	8,038	11,038	3,500	13,980	17,480
Light structurals	1,050	5,000	6,050	12,000	13,393	25,393	14,000	23,292	37,292
Rails and fishplates	..	5,800	5,800	..	15,531	15,531	..	27,012	27,012
Sheets	525	4,800	5,325	6,000	12,859	18,859	7,000	22,368	29,368
Plates	787	3,000	3,787	9,000	8,039	17,039	10,500	13,980	24,480
Bars and rods	1,050	4,000	5,050	12,000	10,718	22,718	14,000	18,636	32,636
Wires	787	150	937	9,000	408	9,408	10,500	708	11,208
Skelp	787	..	787	9,000	..	9,000	10,500	..	10,500
TOTAL	5,250	25,755	31,005	60,000	69,000	129,000	70,000	120,000	190,000

equipment and machinery required to increase production capacity by 1 million tons has been estimated at Rs. 2.4 crores. Their weight and the steel component can be put at 6,850 tons and 4,110 tons respectively by taking Rs. 3,500 per ton and 60% as rolled steel. Assuming 25% of the total machinery and equipment to be available from indigenous production by the end of the Second Plan, the demand for steel on this account in 1960-61 may be put at 5,250 tons.

The targets of production for 1965-66 and 1970-71 have been taken as 115 million tons and 200 million tons respectively, i.e. coal capacity be raised by 60 million tons and 85 million tons during the Third and Fourth Plan periods. Coal Machinery Plant in the public sector is expected to start production during the Third Plan; the supply of indigenous machinery and equipment is likely to go up, and is taken to constitute 80% of the total during the Third Plan. It is assumed that by the end of the Fourth Plan the demand for coal machinery and equipment can be fully met from indigenous supply. On these assumptions and by suitable phasing of the total during the next two plan periods, the demand for steel for these purposes has been estimated at 60,000 tons in 1965-66 and 70,000 tons in 1970-71. The details of different categories of steel are shown in Table 61.

In addition to the demand on account of coal machinery, steel is required for construction, maintenance, repairs and replacement. The requirements for these purposes have been estimated to be 600 tons per million tons of coal production on the basis of actual consumption during the first three years of the Second Plan. At this rate 69,000 tons and 120,000 tons of steel will be required in 1965-66 and 1970-71 respectively for construction, maintenance and repairs. The categorywise distribution of these requirements is given in Table 62.

## 28. Machinery for Mining Minerals

**Metallic Minerals.** The output of the chief metallic minerals, iron ore, manganese, and bauxite, and the targets of production are shown in Table 63.

It is estimated that about 500 tons of steel will be required for manufacture of equipment for the mining of one million tons of ore. Then, on the basis of the above targets, the estimates of steel requirements come to 700, 1,100 and 1,500 tons for 1960-61, 1965-66 and 1970-71 respectively.

**Non-metallic Minerals.** For machinery for mining non-metallic minerals, about fifty per cent of the requirements of steel for metallic minerals have been taken, which will come to 350, 550 and 750 tons, respectively during 1960-61, 1965-66 and 1970-71.

**TABLE 63—TARGETS OF PRODUCTION OF IRON ORE, MANGANESE AND BAUXITE**

	(Million tons)			
	1958 ACTUALS	1960-61	1965-66	1970-71
Iron ore	5.7	8.0	18	32
Manganese	1.4	1.8	2.3	3.0
Bauxite	0.12	0.15	0.24	0.48
<b>TOTAL</b>	<b>7.22</b>	<b>9.95</b>	<b>20.54</b>	<b>35.48</b>

**TABLE 64—CATEGORYWISE REQUIREMENTS OF STEEL FOR MINING EQUIPMENT FOR METALLIC MINERALS**

(Tons)

CATEGORIES	1960-61	1965-66	1970-71
Heavy structurals	35	55	75
Light structurals	140	220	300
Sheets	105	165	225
Plates	70	110	150
Bars and rods	140	220	300
Wires	105	165	225
Skelp	105	185	225
<b>TOTAL</b>	<b>700</b>	<b>1,100</b>	<b>1,500</b>

**TABLE 65—CATEGORYWISE REQUIREMENTS OF STEEL FOR MINING EQUIPMENT FOR NON-METALLIC MINERALS**

(Tons)

CATEGORIES	1960-61	1965-66	1970-71
Heavy structurals	18	30	38
Light structurals	68	110	150
Sheets	53	80	113
Plates	35	60	75
Bars and rods	70	110	150
Wires	53	80	112
Skelp	53	80	112
<b>TOTAL</b>	<b>350</b>	<b>550</b>	<b>750</b>

The categories of steel requirements are shown in Tables 64 and 65.

## 29. Aluminium Industry

The target for aluminium production set at 25,000 tons for 1960-61 may not be achieved. But as the capacity is already installed, no steel is required on this account, although production may not be more than 20,000 tons in 1960-61.

The target for production of aluminium is set at 100,000 tons in 1965-66, which is supposed to double by 1970-71. It is, however, anticipated that by 1965-66 capacity only for 85,000 tons will materialise and 170,000 tons only by 1970-71. The steel requirements for the anticipated production are estimated by taking Rs. 6,000 as the investment in plant and machinery required to produce one ton of aluminium, Rs. 5,000 as the fabrication cost per ton of machinery and 55 per cent as the rolled steel component. Thirty per cent of the machinery and equipment are assumed to be produced in India

**TABLE 66—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE ALUMINIUM INDUSTRY**

CATEGORIES	(Tons)					
	1965-66			1970-71		
	Machinery	Buildings	Total	Machinery	Buildings	Total
Heavy structurals	300	1,050	1,350	600	1,350	1,950
Light structurals	600	2,100	2,700	1,200	2,700	3,900
Plates	600	..	600	1,200	..	1,200
Sheets	600	1,750	2,350	1,200	2,250	3,450
Bars and rods	600	2,100	2,700	1,200	2,700	3,900
Wires	150	..	150	300	..	300
Strips	150	..	150	300	..	300
TOTAL	3,000	7,000	10,000	6,000	9,000	15,000

during the Third Plan and fifty per cent during the Fourth Plan. The steel requirements for aluminium machinery work out to 3,000 tons for 1965-66 and 6,000 tons for 1970-71, after making some allowances for normal repairs and maintenance.

The steel requirements for factory buildings have been calculated on the assumption that about 10,000 tons of steel are required to set up a plant of 20,000 tons capacity. The estimates work out to 7,000 tons for 1965-66 and 9,000 tons for 1970-71, after making allowances for normal repairs and maintenance at about 100 tons and 200 tons respectively. The total requirements thus come to 10,000 tons for 1965-66 and 15,000 tons for 1970-71.

The estimated categorywise requirements of steel are given in Table 66.

### 30. Petroleum Refining Industry

India's present production of crude petroleum from the Digboi field amounts to 0.4 million tons. An additional production of 2.5 million tons is expected from the Assam Oil Company's new fields in Naharkatiya and Moran. Over the last ten years Indian demand for petroleum products has increased considerably, nearly threefold, to 6 million tons which represents an average growth of 10.5% per annum. It has been estimated that the future demand for petroleum will advance at an annual rate of not less than 7%. Taking into consideration all the above points the refining capacity for petroleum in 1965-66 and 1970-71 has been put at 10.5 million tons and 15 million tons, respectively. The capacity of the existing four refineries in India is of the order of 4.3 million tons and with the establishment of the two refineries in Assam and Bihar, the capacity will go up to about 7 million tons. This leaves a gap of 3.5 million tons for which the refining capacity is to be established in the country.

An investment of about Rs. 15 crores is needed for the plant and machinery required to refine one million tons of oil. It is assumed that the cost of fabrication per ton of plant and equipment will be about Rs. 3,600, and

**TABLE 67—CATEGORYWISE REQUIREMENTS OF STEEL FOR PETROLEUM INDUSTRY**

(Tons)

YEAR	PETRO- LEUM DEMAND TARGET (million tons)	CATEGORIES						Total
		Heavy struc- turals	Light struc- turals	Sheets	Bars & rods	Plates	Wires	
1965-66	10.5	1,300	2,200	1,800	1,300	1,800	400	8,800
1970-71	15.0	3,400	5,600	4,500	3,400	4,500	1,100	22,500

that 30% and 60% of the total machinery required will be manufactured in India by 1965-66 and 1970-71, respectively. The requirement of steel in 1960-61 for refining machinery has not been taken into consideration in view of the existing meagre capacity for producing this type of equipment. The categorywise steel requirements for the equipment needed in 1965-66 and 1970-71 worked out on the basis of the above assumptions, are given in Table 67.

### Part Two: End-Uses of Steel by Sectors

It should be realised that the end-uses of steel are so numerous that it is practically impossible to take everyone of them into account and exhaust the list of the consumers of steel, except perhaps under broad heads such as, industry, agriculture, power, etc. Moreover, for an important basic commodity like steel, the uses are likely to increase in an ever growing number and variety, as industrialisation continues to advance. Utilising the estimates obtained in Part one and other relevant information available, an attempt is made in this part to estimate sectorwise the aggregate demand for steel in the country at the end of the Second, Third and Fourth Plans.

#### TRANSPORT AND COMMUNICATIONS

The Transport sector includes railways, roads, bridges, ports and shipping, posts and telegraphs, civil aviation and others. The demand or steel on account of railways and roads has been discussed earlier. The requirements of inland water transport, mainly boats and crafts, are included later under the private industrial sector.

The total demand for inland water transport, however, is small, and may not exceed 500 tons per annum. The consolidated estimates for Transport and Communications sector may be summarised as in Table 68.

**TABLE 68—REQUIREMENTS OF FINISHED STEEL FOR THE TRANSPORT AND COMMUNICATIONS SECTOR**

(Tons)

SECTOR	1960-61	1965-66	1970-71
Railways	653,530	1,322,800	1,694,800
Roads and road bridges	45,950	65,000	105,000
Other transport and communications	72,440	127,000	193,000
<b>TOTAL</b>	<b>771,920</b>	<b>1,514,800</b>	<b>1,992,800</b>



## LARGE SCALE AND MEDIUM INDUSTRIES

**Private Sector.** Important industries requiring steel have been discussed earlier in Part one. Table 69 summarises the estimates for these industries. Besides these, there are a number of industries which require steel in various quantities. The Central list of industries itself consists of more than 100 heads. The State list of industries getting steel from the States quota is in addition to this.

For estimation of steel requirements, we have to distinguish between the private sector and the public sector. The requirements of the private industry are for the purpose of development, manufacturing and maintenance. The total investment for industries in the private sector during the Second Plan was planned to be about Rs. 975 crores. However, it is observed that investment outlay in the private sector during the first three years of the Second Plan period has exceeded the figure originally expected, and has been placed at Rs. 780 crores. Relating this amount to the total of 2.2 million tons of steel consumed by private industry for development, manufacture and maintenance purposes, both in the Central list and the State list of industries, an estimate of the requirements of steel for the private industries for a million rupees of investment is obtained. It is assumed that most of the categories of steel required by private industries, particularly, plates, bars and rods, would be available in greater quantities when the steel plants in the public sector go into production within the next two years. The investment in 1960-61 is assumed at Rs. 240 crores, which is nearly as high as the average investment by the private sector during the first three years of the Second Plan period. The steel norm is expected to go up by 50 per cent by the end of the Second Plan period. Working on this basis, the 1960-61 estimates of total requirements of steel for the private industry have been placed at 1,021,000 tons.

Investment in large-scale private industries in the Third Plan has been assumed at Rs. 1,100 crores including stocks. The tendency of greater availability of the relevant categories of steel, particularly flat products for the private sector, is likely to increase by about 15 per cent per annum during the Third Plan period over the 1960-61 figure. On this basis, the total requirements of steel for the private industry in 1965-66 is likely to be about 1.83 million tons.

During the Fourth Plan period, the investment in large-scale industries in the private sector has been taken to be Rs. 1,817 crores. The steel norm has been assumed to increase during the Fourth Plan by about a third over the 1965-66 figure for reasons mentioned in the previous paragraph. The total requirements of the private industry thus work out to 3,410,000 tons of finished steel in 1970-71.

**Public Sector.** Industries in the public sector are mainly the steel plants, the Heavy Electrical Plant, National Coal Development Corporation, industries under the Heavy Engineering Corporation, etc. The total investment in Government development schemes for industry, excluding power, transport, housing, etc., is Rs. 790 crores during the Second Plan period, out of which Rs. 420 crores have been spent until 1958-59. Taking Rs. 200 crores as the investment in 1960-61 in the public sector industries, corresponding steel requirements have been estimated at 550,000 tons. The basis for this calculation has been the steel consumption by the Government development schemes during the first three years of the Second Plan period. Out of about 920,000 tons of steel consumed in these three years,

**TABLE 69—ESTIMATED REQUIREMENTS OF FINISHED STEEL FOR  
SELECTED MANUFACTURING INDUSTRIES**

NAME OF INDUSTRY	(Tons)		
	1960-61	1965-66	1970-71
1. Iron and steel industry	75,000	107,000	176,600
2. Chemical industry	2,000	12,200	22,500
3. Textile machinery	22,550	34,800	50,000
4. Rayon industry	1,100	3,300	5,200
5. Sugar machinery	11,300	16,000	21,300
6. Tea machinery	1,500	2,000	2,800
7. Jute machinery	21,100	25,700	31,900
8. Cement machinery	3,000	9,000	14,200
9. Electric transformers	7,650	25,700	45,700
10. Switchgears	500	4,800	9,200
11. Conduit pipes	3,900	8,000	13,000
12. A. C. S. R.	7,550	11,800	19,000
13. Electric fans	12,400	17,600	23,000
14. Refrigerators, air-coolers, etc.	1,900	2,300	2,700
15. Electric motors	10,250	20,900	48,400
16. Automobiles	19,100	153,000	230,000
17. Bicycles	22,900	36,300	47,500
18. Machine tools	9,500	30,000	65,000
19. Steel furniture	37,200	50,000	65,000
20. Hardware and expanded metals	16,400	23,000	30,100
21. Containers and drums	180,100	321,000	491,000
22. Sewing machines	2,500	4,800	6,000
23. Water pipes and tubes for industries	80,000	175,000	370,000
24. Water and tanks for housing	83,000	125,000	150,000
25. Coal machinery	31,000	129,000	190,000
26. Metallic industries	700	1,100	1,500
27. Non-metallic industries	400	600	800
28. Aluminium industry	..	10,000	15,000
29. Petroleum refining industry	..	8,800	22,500
<b>TOTAL</b>	<b>664,500</b>	<b>1,368,700</b>	<b>2,169,900</b>

40 per cent went to Government schemes coming under the State heads. It was also observed that during this period the consumption of steel by the industries in the public sector increased at the rate of 25 per cent per annum. Assuming that the rate would go down during the last two years of the Plans, since much of the constructional activity in the public sector has already taken place during the middle years, the steel required for an investment of one million rupees has been worked out, and the requirement for 1960-61 has been estimated.

For the Third Plan, the investment in industries in the public sector is taken to be Rs. 1,900 crores. In estimating the steel norm for an investment of one million rupees in the public sector industries during this phase, consideration must be given to the heavy engineering industries that are to come up during the Third Plan, apart from the heavy machinery and foundry-forge projects. There are proposals for the mining machinery projects, heavy machine tool works, heavy structural works, plate and vessel works, marine diesel engine projects and alloy and tool steel plants in the public sector. In view of the heavy requirements of steel for construction and as raw material for many of these industries, it will not be unrealistic to assume an increase of about 60 per cent in the steel norm. Calculating on this basis, the estimated requirements of steel for public sector industries work out to 1,769,000 tons.

For the Fourth Plan, total investment in large scale and medium industries in the public sector has been taken to be Rs. 3,560 crores. The steel norm for a million rupees of investment has been adopted as 20 per cent more than that for the Third Plan phase, and the requirements have worked out to 4,560,000 tons of finished steel.

These estimates for large scale and medium industries, may now be summarised. Both public and private investments in this sector are estimated at about Rs. 440 crores, 650 crores and 1,200 crores in 1960-61, 1965-66 and 1970-71, respectively. The steel requirements on the basis of increasing steel norms reflecting the needs of construction as well as manufacture in the proposed heavy industries, are estimated at 1,571,000 tons, 3,599,000 tons and 7,970,000 tons in 1960-61, 1965-66 and 1970-71, respectively.

A reference will be made here to Tables 69 and 70. Table 69 summarises the results for 29 industries, for which separate sections have been written up in detail in Part One. Table 70 gives the estimated requirements of steel for another 31 industries, for which it was not possible to give such detailed attention.

The total of steel requirement for the 60 industries covered thus comes to 0.80, 1.66 and 2.72 million tons in the three years under discussion. Those, however, fall considerably short of the totals of 1.57, 3.59 and 7.97 million tons for large and medium industries as a whole obtained on the basis of the macro approach. This is because most of the 60 industries covered in Tables 69 and 70, except for Iron & Steel and a few others, come under the private sector; and although their requirements of steel for maintenance and packing and further development are likely to grow enormously, particularly when the foundations for a steady industrial growth are being laid during the Third and Fourth Plans, it is hardly possible to take account of all of them in any study of individual industries, however, detailed. Nevertheless it is to be noted that these 60 industries cover about 80% of the total steel requirements of the private sector of the large scale industry.

TABLE 70—ESTIMATED DEMAND FOR STEEL BY SOME SELECTED INDUSTRIES IN INDIA

NAME OF INDUSTRY	(Tons)		
	1960-61	1965-66	1970-71
1. Tractors	4,200	13,600	26,000
2. Pumps and compressors	3,000	4,400	6,100
3. Diesel engines	3,300	5,500	8,700
4. Oil mill machinery	1,500	3,300	7,200
5. Rice, dal and flour mill machinery	1,000	2,200	4,800
6. Other machinery	6,000	13,000	28,700
7. Cables and wires	1,000	2,200	4,800
8. Metres	800	1,800	3,900
9. Radios	1,000	2,200	4,800
10. Light railway materials and colliery tubs	7,000	15,200	33,600
11. Panel pins	1,200	2,600	5,700
12. Hospital furniture	750	1,700	3,600
13. Steel belt lacing	500	1,100	2,400
14. Duplicators and typewriters	700	1,500	3,300
15. Umbrella ribs and fittings	750	1,600	3,600
16. Steel rails	400	900	2,000
17. Rubber	500	1,100	2,400
18. Weighing machines	600	1,300	2,900
19. Shaftings	2,000	4,400	9,600
20. Grinding wheel	100	200	500
21. Tubewell fittings	300	700	1,500
22. Fire extinguishers	200	500	1,000
23. Leaf springs	20,000	45,000	100,000
24. Water fittings	1,500	3,300	7,200
25. Jobbing	6,000	12,000	18,000
26. Carriage and carriage fittings	400	900	2,000
27. Stranded wire	2,500	5,400	11,900
28. Buckets	7,500	15,000	23,200
29. Enamelware	8,800	13,500	20,000
30. R.C.C. humepipes	7,500	16,200	25,000
31. Bolts, nuts and rivets	45,000	90,000	180,000
TOTAL	136,000	291,250	554,400

**SMALL SCALE INDUSTRIES**

In the Second Plan a provision of Rs. 200 crores was made for village and small industries programmes in the public sector, besides an outlay of Rs. 100 crores in the private sector. Out of this, Rs. 46 crores is for small scale industries, and Rs. 15 crores for industrial estates, i.e. a total of Rs. 61 crores for small scale industries. Out of an odd 125 small industry schemes, more than 36 schemes utilise steel for the manufacture of their products.

In recent years the share of steel consumption by small scale industries has been about 3 per cent of the total. The quantities of steel given in Table 71 have been allocated in bulk to the small scale and cottage industries :

The total allocation of steel made so far is less than 50% of the demand placed by the State Directors of Industries. Apart from these allocations of steel, the National Small Industries Corporation and the State Trading Corporation assist in import and distribution of cycle and sewing machine parts, knitting needles, etc.

Small scale industries are composed of many diverse items of manufacture, and no single item or group of items can be taken to represent that sector adequately. Allocation of steel to each item of industry is not available, nor the production figures. Neither the actual consumption of steel consuming sectors of small scale industries, nor even a list of such industries is readily available. The different categories of steel for the items of manufacture are also not available.

From the available information it is, however, noticed that there is a steady increase in the demand and allotment of steel to small scale industries for the last two years and the Development Commissioner expects that the requirements of the small scale industries during the next two years will be of the order of 4 lakh tons per annum and will continue to increase steadily in future. In the absence of details of the consumption for various items of the small scale industries, the estimates of steel consumption will

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**TABLE 71—DEMAND FOR AND ALLOTMENT OF STEEL FOR SMALL SCALE INDUSTRIES**

(Tons)	
YEAR	ALLOCATIONS
1952-53	8,991
1953-54	9,004
1954-55	18,500
1955-56	28,964
1956-57	100,000
1957-58	52,750
1958-59	107,950
1959-60	110,600*

\* Allocation for the first two quarters.

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**TABLE 72—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE SMALL SCALE INDUSTRIES SECTOR**

CATEGORY	(Tons)		
	1960-61	1965-66	1970-71
Light structurals	22,500	33,750	60,000
Black sheets	111,000	166,500	296,000
Galvanised sheets	60,000	90,000	160,000
Plates	42,000	63,000	112,000
Bars and rods	36,000	54,000	96,000
Wires	28,000	42,750	76,000
<b>TOTAL</b>	<b>300,000</b>	<b>450,000</b>	<b>800,000</b>

have to be based on the trend in the consumption of this sector as a whole and the proposed investments in Third and Fourth Plan periods.

The estimated requirements for 1960-61 have been arrived at on the basis of information supplied by the Development Commissioner for Small Scale Industries, and the trend in the consumption of steel in the small scale industry sector which is increasing, particularly in view of the establishment of industrial estates throughout the country and intensification of efforts to boost up production in the small-scale sector. The estimates of the total requirements of steel for 1960-61, 1965-66 and 1970-71 have been obtained by a method similar to that for large-scale industries. The estimated investments in the Third and Fourth Plan periods are Rs. 300 crores and Rs. 400 crores respectively for small scale and village industries. The anticipated outlay under this head during the Second Plan is only Rs. 260 crores. Phasing the increase in outlay of Rs. 40 crores and Rs. 100 crores during the Third and Fourth Plan periods respectively for small-scale and village industries, and taking the steel consumption during the first three years of the Second Plan period as the basis for estimating the steel norm, the requirements for small-scale and village industries in 1960-61, 1965-66 and 1970-71 have been put at 300,000, 450,000 and 800,000 tons respectively. The categories have been worked out on the basis of information from the States during the last 3 quarters, and confirmed by the Development Commissioner. These are given in Table 72.

### HOUSING AND CONSTRUCTION

The planned outlay on social services and miscellaneous heads under the Second Plan is of the order of Rs. 1,045 crores. The anticipated outlay, however, may come only to Rs. 880 crores. Out of this, investment for housing and construction purposes is estimated at Rs. 492 crores. The private sector was to invest about Rs. 1,000 crores during the Second Plan period, including Rs. 200 crores for schools, but the actuals may be of the order of Rs. 1,020 crores. Relating the actual steel consumption by the public and private sectors to the amount invested during the first three years of the Second Plan period, the steel requirements for 1960-61 for housing and construction come to 350,000 tons. This does not include the steel required for industrial construction and housing, as also for

**TABLE 73—INVESTMENT OUTLAY ON HOUSING AND CONSTRUCTION  
IN THE PUBLIC SECTOR**

(Rs. crores at 1952-53 prices)

	THIRD PLAN	FOURTH PLAN
Schools and hospitals	577	700
Housing (office, residence, etc.)	500	700
Relief and rehabilitation	25	40
Miscellaneous	110	200
<b>TOTAL</b>	<b>1,212</b>	<b>1,640</b>

construction in power and irrigation ; all these have been included under the appropriate sector.

For the Third and Fourth Plans, the outlay on housing and construction by the public sector has been taken to be Rs. 1,212 crores and Rs. 1,640 crores, respectively and the outlays by the private sector are taken as Rs. 1,350 crores and Rs. 1,720 crores, respectively. The details for the public sector are shown in Table 73.

Similar distribution of the allocation for private housing has also been made. The requirements of steel have been worked out on the basis of the steel norm for housing as observed during the Second Plan, suitably modified to take account of the greater needs of modern housing in the future, particularly during the Fourth Plan period, when the required categories of steel are likely to be available in sufficient quantities. The estimated requirements of steel for housing and construction, as defined here, thus come to 632,000 tons and 821,000 tons by the end of the Third and Fourth Plan periods, respectively.

### POWER PROJECTS

The requirements of steel for power projects for 1960-61 have been worked out by the Central Water and Power Commission in great detail for every project and the total steel requirement estimated by the CWPC may be taken for our purpose. The categories of steel have been worked out by the NCAER on the basis of available information in respect of the pattern of demand for different categories of steel for the fourth quarter of 1958-59.

The proposed investment during the Third and Fourth Plans for power are Rs. 700 crores and 1,000 crores, respectively. Power projects are all in the public sector. There is, however, a small number of power stations installed by the industrial establishments which require steel for construction and maintenance to the extent of about 6 to 7 per cent of the total consumption of steel under the head 'Power'.

Two methods have been followed for the purpose of estimation of the requirements for 1965-66 and 1970-71. In the first method, the total investment actually incurred on account of power projects during the first three years of the Second Plan period are related to the actual consumption of steel during this period. It has been assumed that 40 per cent of the

**TABLE 74—REQUIREMENTS OF STEEL FOR POWER PROJECTS IN THE PUBLIC AND PRIVATE SECTORS**

(Tons)

	PUBLIC SECTOR	PRIVATE SECTOR
1965-66	255,000	11,000
1970-71	357,000	22,000

total investment on multi-purpose projects has been utilised for power projects and 60 per cent for irrigation projects. The data for steel consumption by the power projects have been based on three years' information regarding the total steel consumption in all power projects, and one year's detailed steel consumption in every individual power project. The estimates have been made separately for the private and public sectors. In the second method, estimates were made on the basis of anticipated increases in generating capacity for the Third and Fourth Plan periods, as estimated by the Energy Section of the NCAER. The available data regarding steel consumption of every individual power project for one year were then utilised to arrive at the total requirements of steel for power projects as a whole. The requirements of steel for all power projects, thus estimated, including those in the private sector, are shown in Table 74.

### IRRIGATION PROJECTS

The total outlay on irrigation projects from 1956-57 to 1958-59 was Rs. 111 crores. This together with the 60 per cent of the investment on multipurpose projects, comes to an outlay of Rs. 199 crores during the first three years of the Second Plan. The outlay required for completing the remainder of the irrigation projects for the Second Plan is estimated at Rs. 70 crores. On the basis of steel consumption during the first three years of the Second Plan on irrigation projects, the requirements for 1960-61 have been obtained as 157,633 tons. The proposed investment on irrigation projects including multipurpose projects during the Third and Fourth Plan periods are Rs. 700 crores and Rs. 800 crores, respectively. For the Third Plan the investment is supposed to rise gradually to a peak of Rs. 170 crores in the final year whereas for the Fourth Plan an equal phasing has been assumed. With this phasing and taking the steel norms, as indicated by a study of the actual steel consumption on irrigation projects during the first three years of the Second Plan, the estimated requirements for 1965-66 and 1970-71 work out to 221,000 and 208,000 tons respectively.

### AGRICULTURE

The steel quota allotted for agricultural purposes is meant mainly for the fencing of agricultural lands and fabrication of agricultural implements and equipment. In addition to this the industrial sector consumes a considerable amount of steel for the manufacture of agricultural machinery and implements. The requirements for the latter have been included under the head "Large-scale and Medium Industries". In this section the balance of the demand for steel in the agricultural sector is considered.

The demand for steel for these purposes during the Second Plan period, as put forward by the Ministry of Agriculture, ranges from about 300,000 tons in 1956-57 to about 410,000 tons in 1960-61. Owing to the shortage of steel in the beginning of the Second Plan period, allotment of steel to the



agricultural sector during the first three years was of the order of 100,000 tons only. However, it went up recently, and the total for the first two quarters of 1959-60 comes to about 160,000 tons. At this rate the allotment for 1959-60 to agriculture may be of the order of 300,000 tons. This possibly is an indication of a comparatively easy supply position, and perhaps also of the allocation of priority to agriculture, the steel requirements of which had been most inadequately met during the first three years of the Second Plan.

An attempt will be made here to obtain an estimate of the steel requirements for agriculture by macro-economic methods in the first instance. Investment in agriculture during 1959-60 as well as 1960-61 has been estimated at Rs. 125 crores in the Second Plan Appraisal. This gives a steel norm of about 240 tons per million rupees of investment. The steel norm is supposed to increase at a faster rate than in the beginning of the Second Plan as the supply position eases comparatively. On this hypothesis, a steel norm of 260 tons per million rupees has been adopted for 1960-61. It is also assumed that with a rise in demand, the steel norm will increase further by about 7 per cent per annum over the Third and Fourth Plan periods. Steel norms thus come to 280 tons, 350 tons and 440 tons per million rupees of investment during 1960-61, 1965-66 and 1970-71, respectively.

Investment in agriculture has been assumed for the purpose of this study to be Rs. 800 crores in the Third Plan and Rs. 976 crores during the Fourth. By phasing the investment uniformly during the five year plan periods, an investment of Rs. 160 crores in 1965-66 and Rs. 200 crores in 1970-71 is obtained. And it has already been pointed out that investment in 1960-61 will be of the order of Rs. 125 crores. On the basis of these investment figures and the steel norms, the requirements for steel for agricultural purposes by macro-economic estimates come to 320,000 tons in 1960-61, 435,000 tons in 1965-66 and 610,000 tons in 1970-71. This, however, needs to be checked by the application of the end-uses method to the agricultural sector.

The total requirements may be estimated separately under the following heads :

- (a) Additional requirements of machinery and implements ;
- (b) Requirements for replacement of machinery and implements ;
- (c) Fencing of (i) Cultivators' holdings, and (ii) Pastures and grazing lands ;
- (d) Plant protection equipment ; and
- (e) Building and construction in the agriculture sector.

(a) **Additional Requirements for Implements and Machinery.**  
The demand for steel for additional agricultural machinery and implements arises mainly on account of the following items :

- 1. Ploughs — wooden and iron ;
- 2. Carts — of all types ;
- 3. Sugarcane crushers — Power-driven and bullock driven ;
- 4. Gur boiling pans; and
- 5. Ghanis — used in extraction of oil, etc.

TABLE 75—EXPECTED NUMBER OF AGRICULTURAL IMPLEMENTS AND MACHINERY IN INDIA

(Numbers)

IMPLEMENTS	ACTUALS			ESTIMATES		
	1945	1951	1956	1960-61	1965-66	1970-71
<b>Ploughs</b>						
(i) Wooden	27,306,361	31,809,279	36,615,101	42,000,000	47,000,000	51,000,000
(ii) Iron	480,998	930,380	1,366,915	1,900,000	2,700,000	4,000,000
<b>Carts</b>	8,482,870	9,853,780	10,991,186	12,000,000	13,000,000	14,000,000
<b>Sugarcane crushers</b>						
(i) Power-driven	8,950	21,260	23,291	30,000	39,000	50,000
(ii) Bullock-driven	480,571	504,925	544,988	580,000	610,000	630,000
<b>Gur boiling pans</b>						
<b>Ghanis</b>						
(i) More than 5 seers		241,877	96,335			
(ii) Less than 5 seers		203,695	212,177			
				930,000	975,000	1,020,000

\* NCAER estimate

In Table 75 are given the actual number of agricultural implements and machinery in use in India according to the Indian Livestock Census, 1956, and their expected number at the end of the Second, Third and Fourth Plans, on the assumption of a rate of increase similar to that observed in the past. For purposes of projection of the demand for these implements and machinery, account has been taken of the trend in their numbers as well as the growing need to supply agriculture with the much wanted machinery and implements of superior type—namely, steel ploughs, power-driven sugarcane crushers, harvester combines, etc. It has, therefore, been assumed that the rate of increase in the use of carts and bullock-driven sugarcane crushers will gradually decline although they will continue to be used in future. The use of steel ploughs and power-driven crushers, on the other hand, is assumed to increase progressively. The steel requirement for all these have been obtained by multiplying the number required in the particular year with the steel norm, as estimated by the NCAER from the average for the different varieties of implements that exist in India. It is not possible to do justice to each item of machinery, with all its variants, but in arriving at the steel norm, account has been taken of the availability of various types of machinery in as realistic a manner as possible. The figures are given in Table 76.

(b) **Requirements of Steel for Replacement of Implements and Machinery.** For the purpose of estimating the replacement needs, an

**TABLE 76—REQUIREMENTS OF STEEL FOR ADDITIONAL MACHINERY AND IMPLEMENTS**

NAME OF IMPLEMENT OR MACHINERY	STEEL NORM IN LB. PER UNIT	1960-61		1965-66		1970-71	
		Number required	Steel require- ments (tons)	Number required	Steel require- ments (tons)	Number required	Steel require- ments (tons)
Ploughs							
(i) Wooden	4.5	1,073,000	2,200	1,000,000	2,100	800,000	2,000
(ii) Iron	25	100,000	1,200	160,000	1,800	260,000	3,000
Carts	80	200,000	7,200	200,000	7,200	200,000	8,000
Sugarcane crushers							
(i) Power-driven	800	1,700	600	1,800	700	2,200	1,000
(ii) Bullock-driven	400	9,000	1,600	6,000	1,100	4,000	1,000
Gur boiling pans	400	7,500	1,200	12,000	2,100	12,000	2,000
Other implements and machinery			6,000		10,000		13,000
TOTAL			20,000		25,000		30,000

Note: Requirements for agricultural implements and machinery like oil engines, power-driven pumps, and tractors, etc. are included under the head industries. Steel norms are NCAER estimates.

assumption has been made regarding the average life of the implements or machinery, particularly its steel part, which has to be replaced. These assumptions have been made mostly on the basis of actual observations of the average life of different implements and machinery in different parts of the country. Then by applying the steel norms mentioned above, the replacement needs are estimated for 1960-61, 1965-66 and 1970-71. These are given in Table 77.

In the case of carts, due to lack of data on the number of existing carts according to different types, the total number of carts required to be replaced has been multiplied by a steel norm which has been taken to be about 80 pounds per cart (48 pounds for the two wheels and the remainder of 32 pounds for axles, etc.). Again, with reference to gur boiling pan, the norm has been taken to be the same as that for bullock-driven sugarcane crusher.

(c) **Requirements of Steel for Fencing of (i) Cultivators' Holdings, and (ii) Pastures and Grazing Lands.** (i) According to the latest National Sample Survey data, the number of cultivators' holdings in India is 5 million, with an average area of 6.25 acres. If 2% of the total number of holdings, i.e. one lakh holdings, are fenced during the five-year period 1961-66, the requirement of barbed wire (BWG 12) in 1965-66 has been estimated at 7,000 tons, on the basis of a calculated steel norm of 1/3 ton for fencing a circular area of 6.25 acres.

During the Fourth Plan period, however, it has been assumed that about 5 per cent of the present number of holdings, i.e. about 250,000 holdings, would be fenced, requiring about 17,000 tons of barbed wire in 1970-71.

(ii) Requirements of steel (barbed wire) for fencing pastures and grazing lands are, however, difficult to estimate. For, there is little significance in

**TABLE 77—REQUIREMENTS OF STEEL FOR REPLACEMENT NEEDS**

IMPLEMENTS OR MACHINERY	1960-61		1965-66		1970-71	
	Number	Steel in tons	Number	Steel in tons	Number	Steel in tons
<b>I. Ploughs</b>						
(i) Wooden	8,400,000	17,000	9,400,000	19,000	10,200,000	21,000
(ii) Steel	380,000	4,250	540,000	6,000	800,000	9,000
<b>II. Carts</b>	4,800,000	172,000	5,200,000	188,000	5,600,000	200,000
<b>III. Sugarcane crushers</b>						
(i) Power-driven	3,750	1,250	4,900	1,750	6,250	2,250
(ii) Bullock-driven	58,000	10,400	61,000	11,000	63,000	11,500
<b>IV. Gur boiling pans</b>	93,000	16,600	97,500	17,250	102,000	19,250
		221,500		243,000		263,000

TABLE 78—REQUIREMENTS OF STEEL FOR FENCING

	AVERAGE SIZE OF PLOT IN ACRES	1960-61		1965-66		1970-71	
		No. of plots to be fenced	Steel in tons	No. of plots to be fenced	Steel in tons	No. of plots to be fenced	Steel in tons
(1) Cultivators' holdings	6.25 ( $\frac{1}{4}$ of a ton)	10,000	3,500	20,000	7,000	50,000	17,000
(2) Pastures and grazing lands	15.00 ( $\frac{1}{2}$ of a ton)	10,000	5,000	20,000	10,000	40,000	20,000
TOTAL			8,500		17,000		37,000

the concept of a normal or standard size (area) for a pasture, because the difference between the area of a pasture land in a village and the one in a forest area may be very large and may come to anywhere in hundreds of acres. But for the purposes of our calculation, we have assumed that the average size of a pasture is about 15 acres.

The area of pasture and grazing lands in India, according to the Agricultural Statistics of India, Vol. I, is 27,566,000 acres in 1954-55. Although the possibility of further diversion to pasture is uncertain, for purposes of estimation of steel requirements for fencing, the area under pastures has been taken around 30 million acres. Assuming that about 1 per cent and 2 per cent of the number of pastures (2,000,000) are to be fenced in 1965-66 and 1970-71, i.e. about 20,000 and 40,000 respectively, and on the basis of an average of  $\frac{1}{2}$  ton of steel wires per plot of 15 acres, the requirements of barbed wire for fencing pastures and grazing lands, in 1965-66 and 1970-71 are estimated at 10,000 tons and 20,000 tons, respectively, as shown in Table 78.

**(d) Requirements of Steel for Plant Protection Equipment.** There is a large variety of implements and equipment that are produced at present under the name of plant protection equipment, and it is not possible to cover item by item. Sprayers and dusters, manually operated and power-operated, plant protection vans, and aeroplanes are the more important ones.

The demand for steel on account of their production is arbitrarily put at 10,000 tons for 1960-61, 30,000 tons for 1965-66 and 80,000 tons for 1970-71.

**(e) Building and Construction in Agriculture Sector.** During the Third and Fourth Plans the development of warehousing facilities has been envisaged both at urban and rural areas at a much faster rate than in the Second Plan. Thus the requirements of steel for purposes of building

and other construction has been estimated at 30,000, 80,000 and 150,000 tons, respectively during 1960-61, 1965-66 and 1970-71, on the basis of information relating to the Third Plan period from the Planning Commission.

The estimated requirements of steel for different purposes in agricultural sector by the end-uses method thus come to a total of 320,000, 435,000 and 610,000 tons for 1960-61, 1965-66 and 1970-71, respectively, and the details are shown in Table 79. The figures obtained by the end-uses method are fairly close to the estimates derived earlier by the macro approach. It should be noted that these estimates do not include the requirements of steel for diesel engines, pumps, tractors, sugar machinery and other agricultural machinery, all of which come under large and medium scale industries already accounted for.

For estimating the requirements of different categories of steel, the information obtained from the State Governments at the time of steel allocation in 1958-59 has also been utilized. These are consolidated in Table 80.

**TABLE 79—REQUIREMENTS OF STEEL BY THE AGRICULTURAL SECTOR**

SECTORS	(Tons)		
	1960-61	1965-66	1970-71
<b>1. Replacement demand</b>			
(i) Carts	172,000	188,000	200,000
(ii) Sugarcane crushers and gur boiling pans	28,250	30,000	33,000
(iii) Ploughs, etc.	21,250	25,000	30,000
<b>2. Barbed wire for fencing</b>			
(i) Cultivators' holdings	3,500	7,000	17,000
(ii) Pastures, etc.	5,000	10,000	20,000
<b>3. Additional demand for machinery and implements</b>	20,000	25,000	30,000
<b>4. Plant protection equipment</b>	10,000	30,000	80,000
<b>5. Building and construction</b>	30,000	80,000	150,000
<b>6. Others</b>	30,000	40,000	50,000
<b>TOTAL</b>	<b>320,000</b>	<b>435,000</b>	<b>610,000</b>

N.B. As mentioned earlier, these estimates do not include the requirements of steel for diesel engines, pumps, tractors, sugar machinery, etc.

**TABLE 80—CATEGORYWISE REQUIREMENTS OF STEEL FOR THE AGRICULTURAL SECTOR**

	(Tons)		
CATEGORIES	1960-61	1965-66	1970-71
Heavy structurals	4,350	13,000	15,000
Light structurals	14,250	37,000	45,000
Bars and rods	157,300	181,900	250,800
Plates	12,000	20,000	25,000
Sheets	121,000	161,000	231,000
Sleepers and sleeper bars	1,000	2,000	3,000
Wire and wire products	10,000	20,000	40,000
Tool, alloy and special steel	100	100	200
TOTAL	320,000	435,000	610,000

**TABLE 81—ESTIMATED REQUIREMENTS OF STEEL BY CONSUMING SECTORS IN 1960-61, 1965-66 AND 1970-71**

	(Thousand tons)		
CONSUMING SECTORS	1960-61	1965-66	1970-71
1. Transport and communications	772 (21.4)	1,515 (21.1)	1,993 (15.5)
2. Large and medium-scale industries	1,571 (43.4)	3,599 (50.2)	7,970 (62.0)
3. Small scale industries	300 (8.3)	450 (6.3)	800 (6.2)
4. Housing and construction	350 (9.6)	632 (8.8)	821 (6.4)
5. Power projects	107 (3.0)	266 (3.7)	379 (3.0)
6. Irrigation Projects	158 (4.4)	221 (3.1)	208 (1.6)
7. Agriculture	320 (8.9)	435 (6.1)	610 (4.7)
8. Others	35 (1.0)	50 (0.7)	75 (0.6)
GRAND TOTAL	3,613 (100.0)	7,168 (100.0)	12,856 (100.0)

(Figures within brackets are percentages)

**TABLE 81A—ESTIMATED REQUIREMENTS OF STEEL BY CONSUMING SECTORS IN 1960-61, 1965-66 AND 1970-71**

(Thousand metric tons)

CONSUMING SECTORS	1960-61	1965-66	1970-71
1. Transport and communications	784	1,539	2,025
2. Large and medium scale industries	1,596	3,657	3,098
3. Small scale industries	305	457	813
4. Housing and construction	356	642	834
5. Power projects	109	270	385
6. Irrigation projects	160	225	211
7. Agriculture	325	442	620
8. Others	36	51	76
GRAND TOTAL	3,671	7,283	13,062

**TABLE 82—ESTIMATED REQUIREMENTS OF CATEGORIES OF FINISHED STEEL IN 1960-61, 1965-66 AND 1970-71**

(Thousand tons)

CATEGORIES	1960-61	1965-66	1970-71
1. Heavy structurals	270 (7.5)	500 (7.0)	874 (6.8)
2. Light structurals	330 (9.1)	640 (8.9)	1,202 (9.4)
3. Rails and fishplates	311 (8.6)	700 (9.9)	931 (7.2)
4. Sleepers and sleeper bars	98 (2.7)	215 (3.0)	249 (1.9)
5. Tinplates	140 (3.9)	250 (3.5)	400 (3.1)
6. Sheets	583 (16.1)	1,051 (14.7)	2,336 (18.2)
7. Plates	300 (8.3)	666 (9.3)	1,274 (9.9)
8. Bars and rods	1,097 (30.4)	2,176 (30.3)	3,918 (30.5)
9. Wire and wire products	126 (3.5)	212 (2.9)	346 (2.7)
10. Special steel (including tool and alloy steel)	107 (3.0)	276 (3.8)	514 (4.0)
11. Skelp	168 (4.6)	330 (4.6)	590 (4.6)
12. Wheels, tyres and axles	43 (1.2)	72 (1.0)	102 (0.8)
13. Hoops and strips	40 (1.1)	80 (1.1)	120 (0.9)
TOTAL	3 613 (100.0)	7,168 (100.0)	12,856 (100.0)

(Figures within brackets are percentages)



**TABLE 82A—ESTIMATED REQUIREMENTS OF CATEGORIES OF FINISHED STEEL IN 1960-61, 1965-66 AND 1970-71**

(Thousand metric tons)

CATEGORIES	1960-61	1965-66	1970-71
1. Heavy structurals	274	508	888
2. Light structurals	335	650	1,221
3. Rails and fishplates	316	711	946
4. Sleepers and sleeper bars	100	218	253
5. Tinplates	142	254	406
6. Sheets	592	1,069	2,373
7. Plates	305	677	1,294
8. Bars and rods	1,114	2,211	3,981
9. Wire and wire products	128	215	352
10. Special steel (including tool and alloy steel)	109	281	522
11. Skelp	171	335	600
12. Wheels, tyres and axles	44	73	104
13. Hoops and strips	41	81	122
GRAND TOTAL	3,671	7,283	13,062

**Total Steel Requirements.** The estimated requirements for different consuming sectors are brought together in Table 81\*, and their category-wise distribution in Table 82\*. Table 81 shows that the most important steel consuming sector is Industry, both large and small, but Railways are the biggest single consumer, accounting for about one fifth of the total demand. From Table 82 it will be seen that among the categories the most important are bars and rods, the demand for which accounts for nearly 30% of the total requirements. The demand for structurals as a whole becomes somewhat less in later plan periods, while that for flat and round products goes up comparatively in future years.

The total requirements of finished steel for 1960-61, 1965-66 and 1970-71 come to 3,613,000 tons, 7,168,000 tons and 12,856,000 tons, respectively. Corresponding crude steel requirements for these years are 4,817,000 tons, 9,557,000 tons and 17,141,000 tons.

**Total Pig Iron Requirements.** Basic Pig iron required to correspond to these quantities of steel in the three years under discussion are 5,884,000 tons, 11,295,000 tons and 20,258,000 tons. If to these the requirements of foundry-grade pig iron, as discussed in some detail in Appendix Two, are added, the total requirements of pig iron come to 7,144,000 tons in 1960-61, 13,625,000 tons in 1965-66 and 24,258,000 tons in 1970-71.

\*The corresponding figures are shown in metric tons in Table 81A and Table 82A respectively.

## CHAPTER FOUR

# REQUIREMENTS OF SOME CATEGORIES OF STEEL

This chapter discusses in detail the requirements by end uses of certain categories of steel which raise special problems,—these being,

1. Wire and wire products
2. Tool and alloy steel
3. Skelp and
4. Structural.

### 1. Wire and Wire Products

The allotment of wire and wire products by the Iron and Steel Controller has been of the order of 6,000 to 10,000 tons per quarter for the past few years. In 1958-59 the total allotment came to 35,846 tons. However, the allotment, which is based on indigenous production has no relation to the demand or consumption of these products in the country, because in addition to this allotment, licenses for imports of wire are also given directly to consumers. The indigenous production is limited to certain range of gauges and mainly to mild steel wires. Imports are for gauges beyond the range of indigenous production and for special quality wires. For estimation of demand, therefore, production and imports have to be added, and suitable adjustments made for the fact that the demand for wire and wire products is being met only partially at the moment. Table 83 shows the production and imports of wires from 1955 to 1958.

The totals in the table give the apparent consumption of wire and wire products in the country.

For a more realistic assessment of the demand, it will be necessary to examine the demand arising in each sector of the economy according to end-uses. Tables 84 and 85 summarise the information collected from the categorywise estimates for different industries and sectors discussed in the previous Chapter.

The total requirements of wire and wire products come to 152,000 tons in 1960-61, 264,000 tons in 1965-66 and 436,000 tons in 1970-71. Some allowances have to be made in these totals for inclusion of special steel wires which should really come under the head "Tool and Alloy Steel". The corresponding estimates of the requirements of special steel wires are 26,000 tons, 52,000 tons and 90,000 tons for 1960-61, 1965-66 and 1970-71.

The percentage of the total requirements of wire and wire products (excluding special wires) to the finished steel comes to 3.5, 2.9 and 2.7 respectively for 1960-61, 1965-66 and 1970-71.

### 2. Tool, Alloy and Special Steels

Tool, alloy and special steels, that is all steels other than ordinary carbon steels, are another important item requiring discussion. All categories

included in the draft classification of tool, alloy and special steels by the Indian Standards Institution are covered under this head. In addition, silicon sheets needed for the production of transformers, electric motors, electric fans, and other electric apparatus have also been included here for convenience, although strictly speaking, they may not come under the classification of special steels.

**TABLE 83—WIRE PRODUCTION AND IMPORTS**

	(Tons)			
	1955	1956	1957	1958
Production	34,669	35,867	36,873	32,244
Imports	48,308	83,366	59,618	47,136
<b>TOTAL</b>	<b>82,977</b>	<b>119,233</b>	<b>96,491</b>	<b>81,380</b>

**TABLE 84—SECTORWISE REQUIREMENTS OF WIRE AND WIRE PRODUCTS**

	(Tons)		
SECTORS	1960-61	1965-66	1970-71
1. Transport and communications			
Railways	2,000	3,000	4,000
Telegraph	7,000	8,000	10,000
2. Large scale industries*	91,000	164,000	274,000
3. Small scale industries	28,500	43,000	76,000
4. Housing and construction	8,500	16,000	20,000
5. Power projects	2,250	6,000	8,000
6. Irrigation projects	2,200	3,000	3,000
7. Agriculture	10,000	20,000	40,000
8. Others	550	1,000	1,000
<b>TOTAL</b>	<b>152,000</b>	<b>264,000</b>	<b>436,000</b>

of which

(a) Special steel wires are :

Large scale industries	20,000	42,000	71,000
Small scale industries	6,000	10,000	19,000

(b) Ordinary wires

	126,000	212,000	346,000
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\*Further details are given in Table 85.

**TABLE 85—REQUIREMENTS OF WIRE AND WIRE PRODUCTS FOR THE LARGE SCALE INDUSTRIAL SECTOR**

(Tons)

END-USES	1960-61	1965-66	1970-71
1. Automobiles	1,650	7,450	12,850
2. Bicycles	700	1,100	1,400
3. Iron and steel industry	170	255	410
4. Chemical industry	60	360	670
5. Textile industry	160	250	330
6. Jute industry	500	800	1,300
7. ACSR	10,000	15,180	24,430
8. Machine tools	150	450	1,000
9. Coal industry	790	9,400	11,200
10. Mineral industry	260	470	580
11. Sewing machines	110	175	230
12. Wire ropes and stranded wires	13,000	24,000	32,000
13. Electrode wires	13,000	22,000	41,000
14. Ball bearings	300	1,700	5,600
15. Umbrella ribs	1,350	2,900	6,400
16. Screw	6,000	12,000	27,000
17. Bolts and rivets	11,000	19,000	36,000
18. Wire nails	27,500	40,000	60,000
19. Barbed wire (Other than agriculture)*	1,000	2,000	4,000
20. Wire products	2,000	3,000	4,500
21. Others	1,300	1,510	2,100
TOTAL	91,000	164,000	274,000

\* Barbed wire for fencing agricultural lands is shown under the agriculture sector.

The production and imports of various categories of tool, alloy and special steels, during 1957 and 1958 are shown in Table 86. Under the imports of special steels, both worked and unworked, are included. The same table also indicates the consumption of finished steel for the corresponding periods. It will be seen that the consumption of alloy steel in 1958 has increased to 3.7 per cent from 2.2 per cent in 1957, although the total consumption of finished steel in 1958 was less than in 1957.

**TABLE 86—PRODUCTION, IMPORTS AND CONSUMPTION OF TOOL, ALLOY AND SPECIAL STEEL**

	(Tons)	
	1957	1958
<b>(A) Imports</b>		
Alloy, tool and spring steel (unfinished)	21,264	17,812
Alloy, tool and spring steel (semifinished and finished)	6,442	21,380
Forgings	7,000	7,000
Total imports of special steel	34,706	46,192
<b>(B) Indigenous production</b>		
Spring and tool steel	22,193	28,367
Electrical steel sheets	7,262	10,931
Total indigenous production of special steel	29,455	39,298
Total consumption of special steel	64,161	85,490
Indigenous production of finished steel	1.347 mill.	1.299 mill.
Import of finished steel	1.541 mill.	1.028 mill.
Total consumption of finished steel	2.888 mill.	2.327 mill.
Percentage of special steel	2.2	3.7

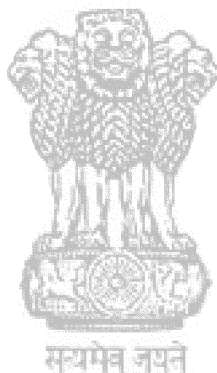
By employing the norms generally accepted for consumption of alloy steel by machine building and other industries, we obtain a total consumption of 64,468 tons corresponding to the output in 1958 of 24 major industries (listed in the table below) in which the percentage of alloy steel used is comparatively high. This total when related to the consumption of finished steel in 1958 shows a percentage of 2.8. However, the true position seems to be reflected by the overall percentage of 3.7 as obtained for 1958, which takes into account the remaining industries, for which norms for consumption of alloy steel are not available.

From the point of view of quantitative production, alloy steel, however vital, does not constitute a major aspect of a developing steel industry. For example, in the United States, alloy steel production was uniformly between 5 and 6 per cent of the total steel production prior to World War II, and 8 per cent since the end of the war. This is partly due to the increasing use of stainless steel in the various engineering industries of that country.

As India is at an early stage of industrialisation, it seems reasonable to use the percentage of 3.7 (obtained by analysing the present consumption) for estimating the demand for special steels in 1960-61 and to increase it to

**CONSUMPTION OF SPECIAL STEEL BY VARIOUS END-USES**

No.	INDUSTRIES	(Tons)	CONSUMPTION OF SPECIAL STEEL
1.	Ball bearings		237
2.	Clock springs		2
3.	Leaf springs		17,000
4.	Razor blades		200
5.	Umbrella ribs		830
6.	Special welding electrodes		124
7.	Stainless steel utensils		2,250
8.	Wire ropes		1,000
9.	Zip fastners		207
10.	Machine tools		376
11.	Small and hand tools		3,311
12.	Automobiles		9,554
13.	Gudgeon pins		19
14.	Valves		13
15.	Car dynamos		2
16.	Diesel engines (stationary)		95
17.	ACSR		5,035
18.	Electric fans		8,480
19.	Electric motors		7,788
20.	Transformers		4,487
21.	Bicycles		2,450
22.	Sewing machines		500
23.	Needles		208
24.	H.T. bolts and nuts		300
	<b>TOTAL</b>		<b>64,468</b>



4 by 1970-71. Relating these percentages to the estimates of total finished steel as obtained by end-uses analysis, the requirements of special steels are estimated as below :

	1960-61	1965-66	1970-71
(a) Estimated consumption of finished steel	3.613 mil. tons	7.168 mil. tons	12.856 mil. tons
(b) Estimated consumption of tool, alloy and special steels based on (a)	133,700 tons	275,900 tons	514,400 tons

Analysing the categories of alloy steel needed by the 24 industries enumerated in the table above and also by the other industries which have not been included, the consumption pattern of various items for 1958 becomes as follows :

CATEGORY	IMPORTS	INDIGENOUS PRODUCTION	TOTAL
(a) Forgings	7,000	..	7,000
(b) Wires	13,000	..	13,000
(c) Bars and rods	4,800	3,000	8,100
(d) Constructional steel	2,000	..	2,000
(e) Sheets, stainless and others	3,000	..	3,000
(f) Electrical steel sheets	6,700	11,000	17,700
(g) Spring steel	5,000	25,000	30,000
(h) Others	4,700	..	4,700
TOTAL	46,200	39,300	85,500

This pattern is not expected to alter appreciably in the next plan periods, unless the production of stainless steel can be contemplated on a large scale or unless freer imports of these items are allowed.

Although, the requirements of special steel for 1960-61 have been estimated as above at 133,700 tons, the indigenous capacity for the fabrication of components using special steel may not be developed to this extent, and some components of special steel would still have to be imported. The items in which indigenous capacity may not be developed to the full extent by 1960-61 are forgings, constructional steel and, to a small extent, bars and rods. Allowing for a 20 per cent reduction on this account, the requirements of special steel may be estimated at 107,000 tons, instead of 133,700 tons.

This allowance need not, however, be made for the 1965-66 and 1970-71 requirements, because with the contemplated setting up of a number of electric furnaces and also with the materialisation of a large number of schemes for intermediate products, sufficient capacity may be assumed to develop in the country so as to absorb the full requirements as assessed above.

The requirements of special steel by different sectors are shown in Table 87. Approximately 68 per cent of the consumption of tool, alloy and special steels is by the Industries sector, both large and small. This is followed by the Transport sector, mainly the railways. The requirements of special steel other than spring steel for Transport and Communications sector, have been Included under the Industries sector. The consumption by other sectors is comparatively small.

As some of the categories of special steel like free-cutting steel and low alloy structural steel may be manufactured by the main steel producers, it may be useful to reclassify the total requirements according to the different

**TABLE 87—SECTORWISE REQUIREMENTS OF TOOL, ALLOY AND SPECIAL STEEL IN 1960-61, 1965-66 AND 1970-71**

SECTORS	(Tons)		
	1960-61	1965-66	1970-71
Industries (large and medium)	82,700	223,900	432,100
Small scale industries	5,600	14,400	26,900
Transport and communications	16,500	32,000	45,000
Power projects	600	1,400	2,700
Irrigation projects	1,200	3,200	5,800
Other uses	400	1,000	1,900
<b>TOTAL</b>	<b>107,000</b>	<b>275,900</b>	<b>514,400</b>

**TABLE 88—REQUIREMENTS OF VARIOUS CATEGORIES OF ALLOY, TOOL AND SPECIAL STEEL**

No.	CATEGORIES	(Tons)		
		1960-61	1965-66	1970-71
1.	Free cutting and low alloy steels	27,000	73,100	136,300
2.	Stainless steels	12,000	41,500	77,200
3.	Electrical steel sheets	29,000	59,000	110,000
4.	Alloy steels including spring steel and alloy constructional steel	33,000	87,700	163,600
5.	Die steels high speed steels and magnet steels,	6,000	14,600	27,300
	<b>TOTAL</b>	<b>107,000</b>	<b>275,900</b>	<b>514,400</b>

categories of special steel (as distinct from the classification of rolled or semi-finished items included in Table 87). On the basis of certain basic information from the Development Wing of the Ministry of Commerce and Industry, this reclassification has been done, as shown in Table 88.

### 3. Skelp

The demand for skelp in the manufacture of tubes and pipes below six inches diameter is discussed below. Seamless tubes which do not require skelp are excluded from this account. At the moment the manufacture of tubes and pipes is somewhat restricted on account of an inadequate supply of skelp. In 1958 the total production of steel pipes and tubes, the major portion of which was for sizes below six inches diameter, was about 82,000 tons. Total imports of steel tubes and pipes in 1958, as given in the Monthly Statistics of Foreign Trade, was of the order of 27,065 tons of which large-size tubes account for 11,773 tons. The apparent consumption in 1958 was thus of the order of 95,000 tons after making some allowance for the indigenous production of large size tubes. This is about 4 per cent of the total consumption of finished steel in 1958,



Production of skelp has been stepped up at the Tata Iron & Steel Works and the present rate of production is of the order of one lakh tons per annum. The capacity for skelp production at the Tata's was put at 144,000 tons in the Industrial Programme for the Second Plan. It is learnt that the Tatas plan to produce 168,000 tons of skelp during the year 1960-61. With increasing availability of skelp from Tatas, the production of tubes and pipes is likely to increase considerably. Preliminary estimates put the production of steel tubes and the pipes at about one lakh tons for the year 1959. Imports for the first eight months indicate that the total may come to about 17,000 to 18,000 tons in 1959. Thus the total consumption of steel pipes and tubes is likely to be of the order of about 118,000 tons for the year 1959. If the consumption of steel tubes and pipes is likely to increase at about the same rate, then the total anticipated requirements for 1960-61 may be put at about 150,000 tons (of which hot finished welded tubes may come to about 133,000 tons and electric resistance welded tubes about 17,000 tons). Allowing 10 per cent scrap for hot welded tubes and 15 per cent scrap for the ERW tubes (according to the estimates made by one of the leading producers) the total skelp requirements for 1960-61 can be put at 168,000 tons.

**TABLE 89—PRODUCTION OF FINISHED STEEL AND STEEL PIPES IN SOME INDUSTRIALLY ADVANCED COUNTRIES**

		(Thousand tons)			
		1955	1956	1957	1958
<b>U.K.</b>					
(1)	Steel tubes	1,260	1,438	1,240	1,105
(2)	Finished steel	15,669	16,446	17,139	15,302
	Percentage of (1) to (2)	8.0	8.75	7.25	7.25
<b>West Germany</b>					
(1)	Steel tubes	1,354	1,400	1,537	1,348
(2)	Finished steel	16,265	17,813	18,897	17,420
	Percentage of (1) to (2)	8.25	7.85	8.1	7.75
<b>U.S.S.R.</b>					
(1)	Steel tubes	3,549	3,851	4,196	4,600
(2)	Finished steel	33,908	36,033	37,634	N.A.
	Percentage of (1) to (2)	10.40	10.60	11.20	..
<b>U.S.A.</b>					
(1)	Steel tubes	9,106	9,522	9,866	N.A.
(2)	Finished steel	72,926	71,947	69,432	51,582
	Percentage of (1) to (2)	12.50	13.15	14.20	..
<b>Japan</b>					
(1)	Steel tubes	432	509	574	528
(2)	Finished steel	7,716	9,069	10,200	9,094
	Percentage of (1) to (2)	5.6	5.65	5.75	5.85
N.A.: Not available.					

The percentage (consumption) of skelp to the total finished steel comes to about 4.6 for 1960-61. This proportion is generally higher in more industrialised countries.

Table 89 shows the production of finished steel and steel pipes in some industrially advanced countries. It will be seen that for Japan the percentage of consumption of steel tubes to total finished steel is over 5, and for U.K., West Germany, U.S.S.R., and U.S.A., the percentage ranges from 7 to 14. Indian consumption, as anticipated in 1960-61, may come up near the Japanese standard.

It will, therefore, be on the side of caution to assume that at least this percentage will be maintained in future years. By taking the percentage of 4.6 for 1960-61 to continue for the next two Plan periods, the total estimates for steel pipes for 1965-66 and 1970-71 can be put at 330,000 tons and 590,000 tons, respectively.

Table 90 gives the break-up of the total requirements for skelp so far as it is possible to estimate by end-use. In this table, the requirements of tubes for the end-uses against items 1 to 10 have been related to the physical targets already known or assumed to materialise for 1960-61 and the succeeding plan periods. Item 11 has been related to the investment figures proposed for residential housing in the public and private sectors,

**TABLE 90—REQUIREMENTS OF SKELP ACCORDING TO END-USES**

END-USE	(Tons)		
	1960-61	1965-66	1970-71
1. Bicycles	8,000	12,400	16,200
2. Conduit pipes	4,000	9,300	13,800
3. Steel furniture	2,300	4,300	7,300
4. Automobiles	100	500	800
5. Boiler tubes for locomotives	11,400	13,200	13,300
6. Stationary boilers	500	2,200	5,000
7. Transformer tubes	1,700	5,600	10,000
8. Electric fans	1,000	2,500	2,600
9. Coal mining machinery	1,000	9,000	10,000
10. Other mining machinery	1,000	2,000	3,000
11. Water pipes for housing and construction (replacement and new construction)	50,000	75,000	90,000
12. Water pipes <sup>1</sup> (others)	80,000	175,000	370,000
13. Others <sup>2</sup>	7,000	19,000	48,000
TOTAL	168,000	330,000	590,000

1. For factories, power houses, railway construction, irrigation works and tubewells.

2. Including scaffolding and other constructional uses.

for the respective plan periods. The estimates against item 12 correspond to the volume of construction work envisaged in the various plan period for factories, power houses, railway stations, irrigation and water supply, etc. The figures against item 13 have been included so as to cater to such possible end-uses as scaffolding, tubular construction of buildings and other miscellaneous items.

#### 4. Structural Fabrication, and the Demand for Structural

Fabricated structurals are required by almost all the consuming sectors for various types of constructional work as indicated below :

1. Transport and communications. Rail and road bridges, station platforms, traction, steel framework for buses and trucks.
2. Power projects. Power station building steelwork, substation buildings, transmission towers, distribution stations and distribution pole brackets, etc.
3. Agriculture. Grain stores, factories for manufacture and repairs of agricultural machinery and implements.
4. Irrigation. Steel work for dam construction including sluice gates and control arrangements.
5. Large, medium and small scale industries. Factory structures for industrial units in the engineering, chemical and other fields.
6. Mining and metallurgy. Steel structures for coal mining, coal conveying, coal washing and coal carbonisation ; steel structures for mining other metallic and non-metallic minerals ; steel structures for steel, aluminium ; copper, ferromanganese and other metallurgical industries.
7. Housing and construction. Steel framework for the construction of large office blocks, hospitals, colleges, schools and also for the larger residential buildings.
8. Other sectors.

Table 91 indicates approximately the magnitude of requirement of structurals by the above sectors.

The demands put forward by the various consuming sectors amounted to 585,000 tons during 1958-59. Although the allotments made during 1958-59 were very nearly equal to the demands put forward by the consuming sectors, the actual deliveries were much less amounting only to 342,000 tons approximately. This has affected the production of fabricated structurals by the established firms and only 60 to 70 per cent of the installed capacities are being utilised.

The production of 70 units in the organised sector and imports of fabricated structurals during 1957 and 1958 are shown below :

YEARS	(Tons) INDIGENOUS PRODUCTION	IMPORTS	TOTAL
1956	90,500	N.A.	..
1957	84,435	43,440	127,875
1958	100,000	44,904	144,904

N.A. : Not available.

The above production figures do not include the output from the railway workshops, P.W.D. workshops, wagon builders and other government owned workshops, such as those of D.V.C., Bhakra Nangal and Madras

**TABLE 91—ALLOTMENT OF STRUCTURALS DURING 1958-59**

(Thousand tons)

	HEAVY STRUCTURALS	LIGHT STRUCTURALS	TOTAL	PERCENTAGE
1. Transport and communications	46.2	33.1	79.3	13.7
2. Power projects	33.5	49.3	82.8	14.4
3. Agriculture	2.5	7.5	10.0	1.7
4. Irrigation	17.3	14.6	31.9	5.5
5. Large, medium and small scale industries, including mining and metallurgy	129.7	156.5	286.2	49.6
6. Housing and construction	8.4	9.1	17.5	3.0
7. Others	21.0	48.6	69.6	12.1
<b>TOTAL</b>	<b>258.6</b>	<b>318.7</b>	<b>577.3</b>	<b>100.0</b>

**TABLE 92—SECTORWISE REQUIREMENTS OF STRUCTURALS IN 1960-61, 1965-66 AND 1970-71**

(Thousand tons)

SECTORS	1960-61			1965-66			1970-71		
	H.S.	L.S.	Total	H.S.	L.S.	Total	H.S.	L.S.	Total
1. Transport and communications	54	38	92	100	85	185	141	148	289
of which									
Railways	42	31	73	79	75	154	109	133	242
2. Large scale and medium industries	184	213	397	301	312	613	610	722	1,332
3. Small scale industries	..	14	14	..	34	34	..	60	60
4. Housing and construction	5	17	22	13	51	64	17	66	83
5. Power	12	17	29	45	84	129	64	120	184
6. Irrigation	11	11	22	28	24	52	26	22	48
7. Agriculture	4	14	18	13	37	50	15	45	60
8. Others	..	6	6	..	13	13	1	19	20
<b>TOTAL</b>	<b>270</b>	<b>330</b>	<b>600</b>	<b>500</b>	<b>640</b>	<b>1,140</b>	<b>874</b>	<b>1,202</b>	<b>2,076</b>

H.S. : Heavy structurals,

L.S. : Light structurals,

Government Electricity Department. The overall capacity of these workshops is assessed at about 200,000 tons. Thus it would be more correct to state that the total consumption of fabricated structurals during 1957 and 1958 could be 328,000 tons and 345,000 tons respectively. These figures also correspond to the total deliveries of structural steel to the various consuming sectors. In terms of rolled steel, the total consumption of fabricated structurals work to 10.4 and 15 per cent, respectively.

Even in highly industrialised countries like the U.K. and West Germany, the normal percentage of fabricated structurals to the rolled steel are 14 and 16. For a country like India, where basic metal industries are in a rapid state of development, and the initial momentum has been given to industrialisation, the establishment of factories, power houses, road and rail bridges would all result in a large demand for fabricated structurals.

It is, therefore, considered reasonable to assess the future requirements of fabricated structurals in 1960-61 and the succeeding plan periods at about 15 per cent of the rolled steel estimates made for these years. The figures are as follows :

(Million tons)			
	1960-61	1965-66	1970-71
(a) Estimates of rolled steel	3.612	7.168	12.856
(b) Estimates for fabricated structurals based at 15 per cent of (a)	0.542	1.075	1.928
(c) Estimates of structural steel assuming 10 per cent process scrap	0.600	1.200	2.100

These overall estimates may be compared with those obtained by analysing the requirements of structurals for each sector and industry by end-uses, as described in the previous chapter. They are shown in Table 92.

## 5. Other Categories

The requirements of other categories have been estimated for each sector separately by the end-uses method, as described in the previous chapter. The details are shown in Tables 93, 94 and 95.

It will be seen from these tables, that the category which is mostly required is bars and rods, for which the demand is about 30% of the total. Flat products like sheets, plates and tinplates go up from about 28% to 30% of the total by 1970-71. Other findings and conclusions are put together in Chapter Six.

TABLE 93—ESTIMATED REQUIREMENTS OF CATEGORIES OF FINISHED STEEL BY CONSUMING SECTORS IN 1960-61

SECTORS	(Tons)												TOTAL
	HEAVY STRUCTURAL RAILS	LIGHT RAILS	SLEEPERS AND SLEEPER BARS	TIN-PLATES	SHEETS	PLATES	BAR AND RODS	WIRE AND WIRE PRO-DUCTS	TOOL, ALLOY AND SPECIAL STEEL	SKELP	WHEELS, TYRES AND AXLES	HOOPS AND STRIPS	
Transport and communications	53,540	38,530	211,380	88,000	..	31,740	99,870	180,080	9,000	16,500	43,280	..	771,920
of which : Railways	41,500	31,000	206,000	88,000	..	23,500	75,500	126,250	2,000	16,500	43,280	..	653,530
Large scale and medium industries	183,810	212,770	65,820	9,200	139,750	190,160	120,880	286,990	71,000	82,600	168,000	40,000	1,570,980
Small scale industries	..	13,950	..	..	..	171,000	42,000	44,550	22,500	6,000	..	..	300,000
Housing and construction	4,550	17,400	700	..	..	49,350	2,100	267,400	8,500	..	..	..	350,000
Power projects	12,200	17,000	31,800	..	..	1,800	3,000	38,550	2,250	600	..	..	107,200
Irrigation projects	11,350	10,600	1,100	..	..	9,150	18,300	103,700	2,200	1,200	..	..	157,600
Agriculture	4,350	14,250	..	1,000	..	121,000	12,000	157,300	10,000	100	..	..*	320,000
Others	200	5,500	200	..	250	8,800	1,850	17,650	550	..	..	..	35,000
Total	270,000	330,000	311,000	98,000	140,000	583,000	300,000	1,096,220	126,000	107,000	168,000	40,000	3,612,700

\* Demand for 100 tons of hoops and strips is included under bars and rods.

TABLE 94.—ESTIMATED REQUIREMENTS OF CATEGORIES OF FINISHED STEEL BY CONSUMING SECTORS IN 1965-66

SECTORS	(Tons)											TOTAL	
	HEAVY STRUCTURE-RAILS	LIGHT STRUCTURE-RAILS	RAILS AND FISH-PLATES	SLEEPERS AND SLEEPER BARS	TIN-PLATES	SHEETS	PLATES	BAR AND RODS	WIRE AND WIRE PRO-DUCTS	TOOL, ALLOY AND SPECIAL STEEL	WHEELS, TYRES AND AXLES		HOOPS AND STRIPS
Transport and communications	100,000	85,500	477,000	201,000	..	80,000	214,000	242,500	11,000	32,000	72,000	..	1,515,000
of which : Railways	79,200	74,500	470,000	201,000	..	68,900	156,300	165,500	3,000	32,000	72,000	..	1,322,800
Large scale and medium industries	301,000	312,000	148,000	12,000	250,000	439,000	331,000	1,049,500	122,000	224,500	330,000	80,000	3,599,000
Small scale industries	..	33,500	..	..	..	252,000	63,000	53,700	33,000	14,800	..	..	450,000
Housing and construction	13,000	51,000	1,000	..	..	88,000	4,000	459,000	16,000	..	..	..	632,000
Power projects	45,000	84,000	72,000	..	..	5,000	9,000	43,600	6,000	1,400	..	..	266,000
Irrigation projects	28,000	24,000	2,000	..	..	13,000	22,000	125,800	3,000	3,200	..	..	221,000
Agriculture	13,000	37,000	..	2,000	..	161,000	20,000	181,900	20,000	100	..	..*	435,000
Others	..	13,000	..	..	..	13,000	3,000	20,000	1,000	..	..	..	50,000
TOTAL	503,000	640,000	700,000	215,000	250,000	1,051,000	666,000	2,176,000	212,000	276,000	330,000	80,000	7,168,000

\* Demand for 100 tons of hoops and strips is included under bars and rods.

## APPRAISAL OF STEEL DEMAND

TABLE 95—ESTIMATED REQUIREMENTS OF CATEGORIES OF FINISHED STEEL BY CONSUMING SECTORS IN 1970-71

SECTORS	(Tons)												TOTAL
	HEAVY STRUC- TURAL	LIGHT STRUC- TURAL	RAILS AND FISH- PLATES	SLEEPERS AND SLEEPER BARS	TIN- PLATES	SHEETS	PLATES	BAR AND RODS	WIRE AND WIRE PRO- DUCTS	TOOL, ALLOY AND SPECIAL STEEL	SKELP TYRES AND AXLES	HOOPS AND STRIPS	
Transport and communica- tions	141,000	148,100	548,400	231,100	..	104,300	313,900	344,300	14,700	45,000	102,200	..	1,993,000
of which : railways	109,200	132,600	539,400	231,100	..	91,000	220,700	219,800	4,000	44,800	102,200	..	1,694,800
Large scale and medium industries	610,000	722,000	275,000	15,000	400,000	1,400,000	780,000	2,422,400	202,300	433,300	590,000	120,000	7,970,000
Small scale industries	..	60,000	..	..	..	448,000	112,000	96,000	57,000	27,000	..	..	800,000
Housing and construction	17,000	66,000	2,000	..	..	115,000	5,000	596,000	20,000	..	..	..	821,000
Power projects	64,000	120,000	103,000	..	..	7,000	13,000	61,300	8,000	2,700	..	..	379,000
Irrigation proj- ects	26,000	22,000	2,000	..	..	12,000	21,000	116,200	3,000	5,800	..	..	208,000
Agriculture	15,000	45,000	..	3,000	..	231,000	25,000	250,800	40,000	200	..	*	610,000
Others	1,000	19,000	..	..	..	19,000	4,000	31,000	1,000	..	..	..	75,000
TOTAL	874,000	1,202,100	930,400	249,100	400,000	2,336,300	1,273,900	3,918,000	346,000	514,000	590,000	102,200	12,856,000



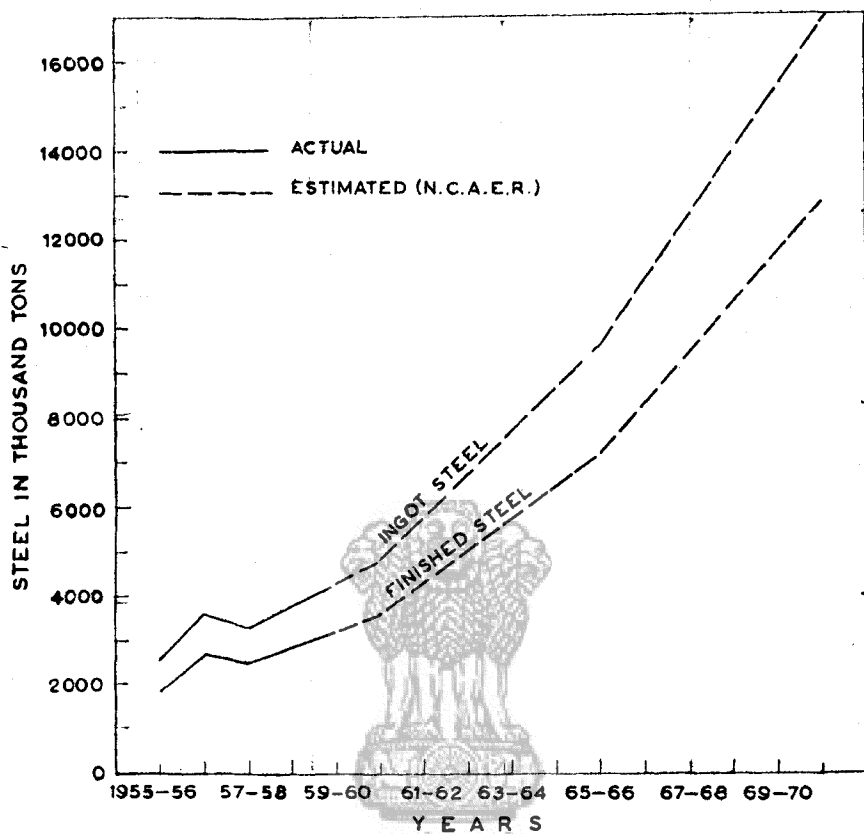


FIG. 1—CONSUMPTION OF STEEL IN INDIA

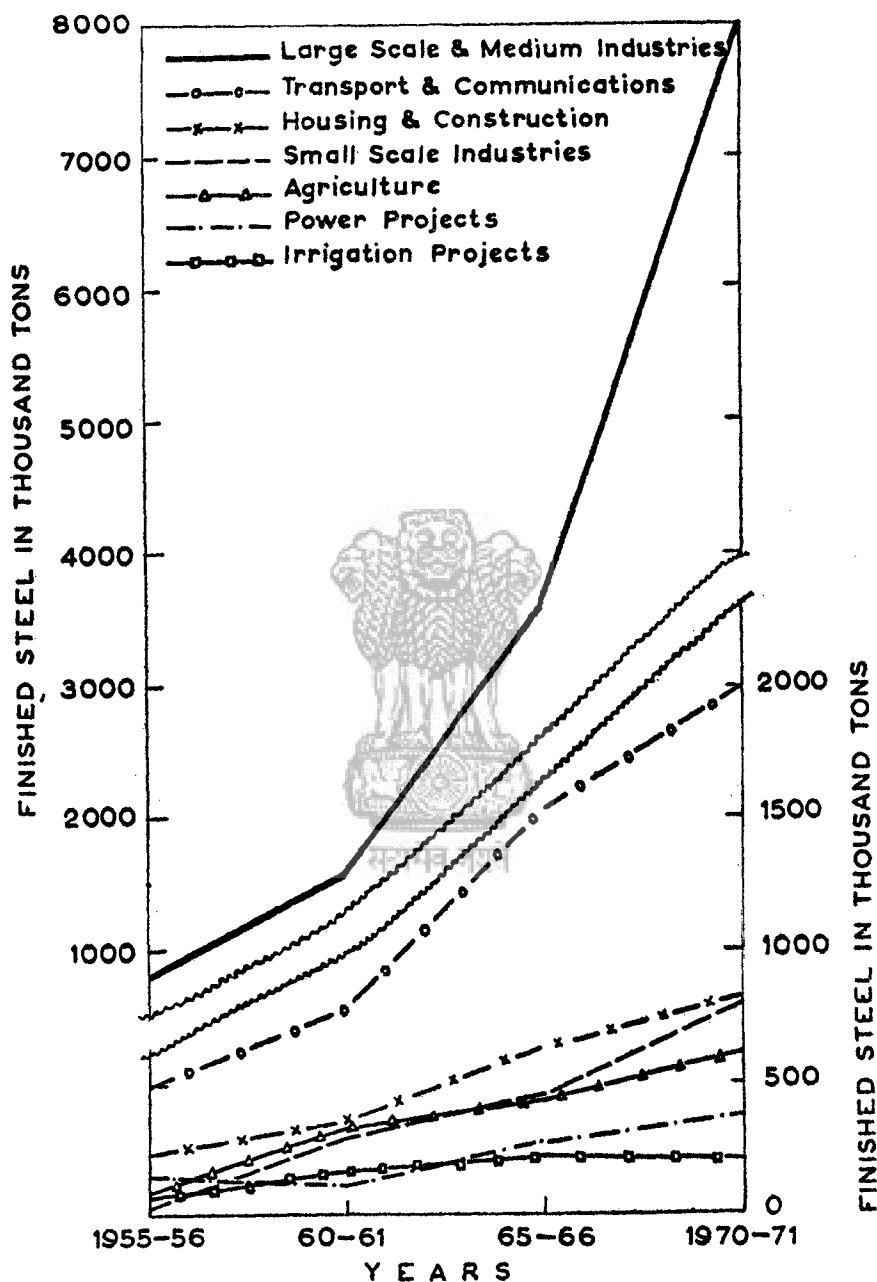


FIG. 2—ESTIMATED CONSUMPTION OF FINISHED STEEL IN INDIA BY SECTORS

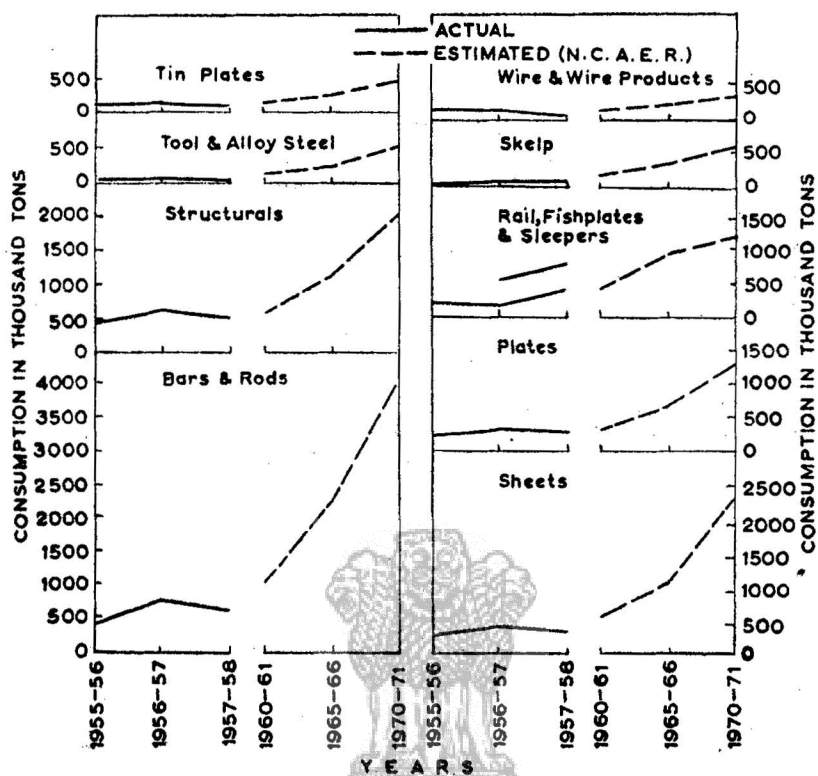


FIG. 3—CONSUMPTION OF STEEL IN INDIA BY CATEGORIES

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## CHAPTER FIVE

# LOOKING AHEAD

Any attempt to project demand over long periods of time must depend upon assumptions as to the trend and growth patterns of the economy and its component segments. Inevitably this involves a certain measure of crystal-gazing ; but if the assumptions are clearly stated, the projections may be modified as events confirm or change the conditions.

The demand for steel in the next ten years will depend on the economic development of the country, which will be shaped largely by the Third and Fourth Plans. It was for this reason that this study began by stating the assumptions made regarding the shape of the plans and of future government policy.

Not only the shape of the plans, but all the structural and technical changes in the economy have been taken into account as far as they can be inferred from current government policy and from technological progress already in sight. Thus, note has been taken of the intention to continually emphasising heavy industry, to develop heavy electricals, to establish more machine tool industries and similar policies. It is possible that the government may not be able to fulfil all these intentions. But we have assumed that if some unforeseen modification on present plans reduces steel requirements, this will probably be compensated by new requirements not yet conceived. Thus the Heavy Machinery Building Plant at Ranchi is concentrating at the moment on machinery for the iron and steel industry ; but it may shift (or extend) its operations to other types of machinery. Alternatively, a new plant may be erected elsewhere for this purpose.

It is impossible at present to know how far the estimates made in this study must eventually be modified because of such policy changes in the future ; but no effort has been spared to ensure that the estimates are based on assumptions that are as realistic as they can be in the existing state of knowledge vouchsafed to us.

Changes in production techniques and the pace at which they are introduced will also influence future patterns of steel demand. It has been assumed that electric locomotives will largely be imported at least during the Third Plan period. If it is decided to use more diesel and electric locomotives than steam locomotives, this is likely to alter the demand for different categories of steel, shifting it from boiler plates, tubes, etc. to high quality rolled steel bars, thin flats, etc. Again, it has been assumed that during the Third and Fourth Plan periods 2,000 miles and 5,000 miles of track respectively will be electrified as against 826 miles during the Second Plan period. An intensification of these changes would entail changes in the pattern of steel demand, so that there would be a more pronounced increase in the demand for heavier rolled sections for the turning points, welded rails, etc. than is now estimated for the Railways. More intensive use of the tubular form of coaches which are still in the experimental stage

would reduce the demand for heavy sections in the building of under-frames. The effect of more intensive use of aluminium bodies in railway carriages would be similar. It has been assumed that current trends in these respects will continue, and there will not be substantial changes in the tempo of these innovations. Any departure from this assumption will alter the demand for steel in volume and varieties.

We may visualise other structural changes. The basic industrial policy of the Government will determine whether and to what extent new capacity will be installed to manufacture certain types of machinery and equipment which are now imported and which we have assumed will be imported, at least in part, during the Third and the Fourth Plan periods. Thus, according to our estimates, about 40,000 to 50,000 tons of steel per annum will be required to manufacture chemical machinery during the next 10 years, but it has been assumed that not more than 30 per cent and 50 per cent of the requirements would be available from indigenous resources during the Third and Fourth plan periods, respectively. In the same way, it has been assumed that refinery equipment will mostly be imported. If these assumptions, based on the present trend of thinking of the Government, are later proved invalid and the Government decides to instal new capacity to supply the full needs of those types of machinery, steel demand will go up. Thus, for example, it may increase considerably for chemical machinery from about 12,000 tons to more than 40,000 tons in 1965-66. In the same way if all the machinery and equipment for oil refinery have to be produced in the country, the requirements for petroleum refinery equipment will go up to about 30,000 tons by the end of the Third Plan period. Developments in the foreign exchange situation may bring about such a change in the industrial policy of the Government. All these are instances of structural changes which may invalidate the estimates presented here. The economist can only hope to minimise the margin of error from such causes by giving due consideration to the possibilities of the future in as realistic a manner as possible.

In fact, changes in the national income and in the pattern and magnitude of the investment outlays may cause considerable changes in the estimates of steel demand. Thus, if the plan outlay is considerably less than has been assumed above, the estimated requirements of steel will have to be brought down. For the purpose of this study an investment outlay of about Rs. 10,000 crores has been contemplated in 1952-53 prices. If the outlay of the Third Plan period is ultimately planned for Rs. 10,000 crores at current prices, which are about 8 per cent higher than those in 1952-53, then the estimated requirements of steel may have to be brought down by a certain amount. The full extent of this adjustment may not be more than half a million tons. But, as pointed out earlier, the extent of this adjustment ultimately depends on the pattern of investment outlay adopted for the Third Plan, and may very well be less than the full equivalent of 8.4%. Again if the share of investment outlay in the public and the private sectors actually adopted is different from that assumed in this study (a ratio of 2:1 has been taken here), there may be changes in the estimates, the magnitude and the direction of which are uncertain, and which depend finally on the pattern of investment in the two sectors. If the pattern of investment changes, then there are likely to be changes in the category estimates also.

Changes in the rate of growth of population are also likely to affect the estimates particularly for the consumer goods industries, the targets for

which are usually made to depend on the growth of population. It is well known that Indian population has recently grown at a faster rate than previously anticipated. The population figures used in this study are those which the Government has adopted for purposes of future planning. The growth rates corresponding to these figures are 2.1 per cent and 1.9 per cent for the Third and Fourth Plan periods, respectively. If the actual growth rates differ from these figures, then the estimate of steel consumption must be modified. But as steel is in demand comparatively more for producers' goods and development work, the effect of such changes will be less than that caused by movements in the factors effecting the demand for producers' goods.

There is one important limitation of the estimates of requirements by categories which have been presented here. While the overall requirements for different categories have been estimated, it was beyond the scope of this study to enquire into the sizes, sections and exact quality of each category that would be required by industry. It is conceivable that while there can be an overall balance between the supply and demand of a particular category, deficit in particular sections, sizes or qualities may actually be the cause of bottlenecks in some industry. These will have to be met from imports. At the same time there may be a surplus of particular sizes and sections in other industries, to dispose of which exports must be promoted and production of goods which need them must be encouraged. However, there is no knowledge as to the sections, sizes or qualities in which such deficit or surpluses may occur.

Another limitation of the study has been a comparative lack of data in many sectors of the economy with regard to the technical and other factors operative in various industries. Thus, no information is directly available on the consumption of steel by various sectors of the economy. Again, the distribution of imported steel to different sectors of the economy is not known precisely, except in a very general way that most of the imported steel is consumed by the railways. In the absence of such data, there is no option but to assume that the steel, allocated by the Government, has been consumed by different quota holders, and this probably is not incorrect although there may be a time lag between deliveries and allocation periods.

To estimate the consumption of many sectors, data on allocations had to be combined with that on production and imports, bearing in mind that because supplies were inadequate only a part of the requirements of the industries would be met. Lack of relevant data leads the research worker in this field, as in many other aspects of the Indian economy, to feel an urgent need for better organisation in the compilation of all data on consumption of steel by end-users. Looking ahead we may perhaps hope that in future all information on steel will be coordinated at a central place, and published periodically as is currently done by the U.K. Iron & Steel Board, and the British Iron & Steel Federation, or the American Iron and Steel Institute.

We should also realise that the technical coefficients or steel norms, on which the estimates of totals and categories have been based, had to be worked out on the basis of available published information and in consultation with the responsible officials in the Government departments and in private industries. This has been supplemented by intensive field study as was conducted for textile machinery at the Delhi Cloth Mills, the bicycle industry at Delhi and for a few other industries.

There is an implicit assumption that the selling price of steel will be at the same level as the current control price. While it will be interesting to examine the consequences of reducing the price of steel on the demand for various products, it will be unrealistic to assume that the Government will completely remove price control. The presumption is that on balance the Government will find the advantages of keeping the control sufficiently great. Moreover, it is not certain that in the event of removal of the control or abolition of the Equalisation Fund, actual prices will decline because the pressure of other forces like railway freight, cost of fuel, wages, etc. may actually tend the prices to increase. It is, therefore, realistic to assume that the price would be more or less stable or that the level of steel prices will not change to such an extent as to widen the gap in the demand for consumer and producer goods.

The precision of the estimates presented here depends mainly on the factors discussed above. In using the estimates of steel requirements, either in the aggregate or for the different categories, it will be useful to bear all this in mind. Short term fluctuations in demand which cannot be predicted or changes in structure and technique, and Government policy on lines different from those anticipated here, may upset all calculations. But so far as can be judged at present, the future requirements of steel should be by and large of the pattern and order of magnitude shown in this study.

If the estimates of requirements of steel with all their limitations can be taken as shown here, then it is useful to study the balance between supply and demand in 1960-61. The estimates of production by the existing plants as shown in Table 96 have been prepared on the basis of information now available on their rate of progress. In view of the present difficulties in regard to the supply of suitable raw materials, the production of Tatas during 1960-61 may not come up to the full amount anticipated after their Two Million Ton programme is over. The Indian Iron & Steel Company, however, is expected to produce 0.75 million tons including billets as originally planned. In Bhilai two blast furnaces have already been commissioned. The blooming mill was commissioned in November last and by the end of December 1959 the billet mill and four other plants went into operation. The total plan for Bhilai was to produce about 622,000 tons of finished steel, in addition to 150,000 tons of billets for re-rollers. In view of the fact that the Bhilai schedule is also somewhat behind the plan, it will perhaps not be unrealistic to presume that out of the total planned annual production, it will be possible for Bhilai to produce only about 450,000 tons of rolled products. Of these only 100,000 tons are assumed to be rolled into finished categories at Bhilai, as the rail and structural mill there may not be commissioned till late in the year. The remainder is presumed to increase temporarily the supply of billets to rerollers from Bhilai to a figure of 350,000 tons in 1960-61.

According to the scheduled programme of Rourkela, the plate mill is likely to be commissioned only in 1960. But in view of the lag in the programme in Rourkela, although the plate mill will be commissioned, only about 75 per cent of its anticipated production may be available by 1960-61.

For Durgapur it is estimated that only about 100,000 tons of billets may be available for re-rollers in 1960-61. The total quantity of billets which would be made available to the secondary producers and re-rollers during

TABLE 96—ESTIMATED PRODUCTION OF FINISHED STEEL IN 1960-61

(Thousand tons)

CATEGORIES	TISCO	IISCO	MYSORE	ROURKELA	BHILAI	DURGAPUR	SECONDARY PRODUCERS & RE-ROLLERS	TOTAL
1. Heavy structurals	90	150	..	..	60	..	..	300
2. Light structurals	125	80	10	..	..	..	80	295
3. Rails, fishplates and sleepers	76	100	..	..	40	..	..	216
4. Tinplates	..	..	..	..	..	..	70	70
5. Sheets	150	120	..	..	..	..	..	270
6. Plates	100	..	..	150	..	..	..	250
7. Bars and rods	192	160	24	..	..	..	560	936
8. Wire and wire products	..	..	..	..	..	..	50	50
9. Tool, alloy and special steel	..	..	..	..	..	..	30	30
10. Wheels, tyres and axles	24	..	..	..	..	..	..	24
11. Skelp	168	..	..	..	..	..	..	168
12. Hoops and strips	..	..	6	..	..	..	20	26
TOTAL	925	610	40	150	100	..	810	2,635
Semis for re-rollers	305	140	..	..	350	100	..	895
GRAND TOTAL	1,230	750	40	150	450	100	..	..



1960-61 comes to about 895,000 tons\*, as shown in Table 96. This together with some billets supplied by steel foundries may enable them to produce about 810,000 tons of finished steel, the details of which are shown in the table.

The low shaft furnaces at Coimbatore (Madras) and Barbil (Orissa) are producing only pig iron at the moment. The production of the last two are, therefore, not taken into consideration. The total production in 1960-61 comes to 2.635 million tons as shown in Table 96.

In Table 97 below the total estimated production is shown against the estimated requirements of different categories of steel in 1960-61. It will be seen from this table that the overall deficit in the supply by the end of the Second Plan is of the order of about a million tons. The deficit is higher in sheets and bars and rods, coming to 313,000 and 161,000 tons, respectively. The deficit in tool and alloy steel will be less than what has been shown in this table, because the electrical steel sheets which have been included under the head 'sheets' in the production of Tatas, have been considered under the tool and alloy steel requirements. Therefore, the deficit in tool and alloy steel may come to about 62,000 tons rather than 77,000

**TABLE 97—DEMAND AND SUPPLY POSITION IN 1960-61**

No.	CATEGORIES	(Thousand tons)		
		NCAER ESTIMATE OF DEMAND	NCAER ESTIMATE OF PRODUCTION	SURPLUS (+) OR DEFICIT (-)
1.	Heavy structurals	270	300	(+) 30
2.	Light structurals	330	295	(-) 35
3.	Rails and fishplates	311	216	(-) 193
4.	Sleeper bars, etc.	98		
5.	Tinplates	140	70	(-) 70
6.	Sheets	583	270	(-) 313
7.	Plates	300	250	(-) 50
8.	Bars and rods	1,097	936	(-) 161
9.	Wire and wire products	126	50	(-) 76
10.	Alloy and tool steel	107	30	(-) 77
11.	Wheels, tyres and axles	43	24	(-) 19
12.	Skelp	168	168	..
13.	Hoops and strips	40	26	(-) 14
	TOTAL	3,613	2,635	(-) 978

\* The greater supply of billets by primary producers for the electric furnace-cum-re-rollers is likely to increase the availability of steel castings, which is discussed separately in Appendix Three.

tons, as shown in the table. (The deficit in sheets will correspondingly go up to 328,000 tons from 313,000 tons as shown).

One interesting point revealed by this table is the apparent excess capacity of heavy structurals. This excess, however, may be expected to diminish in the course of the first two years of the Third Plan period when the demand for heavy structurals will rise on account of new schemes for further industrialisation. As a corollary to this it would appear that future planning of production in steel mills should concentrate more on light structurals, merchant bars and round products.

It may be worthwhile to look into this more closely by examining the balance between the requirements and anticipated supply in 1965-66. It has been assumed that capacity for 11 million tons of ingot steel will be installed in the country by 1965-66. Omitting one million tons for small plants, about which no firm decision is known at the moment, it is doubtful whether the output for the remainder of the capacity, i.e. 10 million tons will be available before 1965-66. If there is a slight lag in the production of the new plants which will have to be put up during the Third Plan, the requirements and the supply in 1965-66 may just balance, because estimated requirements come to 7.2 million tons, whereas 10 million tons ingot capacity is expected to produce finished steel of about 7.5 million tons.

But it is essential that the production programme of the steel plants to be set up during the Third Plan period should be planned in such a way as to concentrate more on the production of certain categories in which, taking account only the output of the existing plants, we are likely to be in short supply by 1965-66. Table 98 shows the expected production of different categories of steel by the existing plants in public and private sectors, when they come into full production.

The capacities of Tatas and IISCO are taken directly from pamphlets showing their production programme; the figures for Mysore, from Programme of Industrial Development; and the figures for the public sector plants from the Fourth Annual Report of the Hindustan Steel. Re-rollers are assumed to produce 750,000 tons from the available supply of blooms and billets from the primary producers. Production at full capacity may be possible within the first year or two of the Third Plan. Table 98 gives the details.

The categories which these plants are expected to produce are more or less fixed as a decision is known to have been taken on the mills which have to be installed in these plants.

Table 99 shows the estimated requirements in 1965-66 against the anticipated production of the existing plants at full capacity, and the deficit in different categories. It will be noticed that there may perhaps be less need for further capacity to come up in heavy and light structurals. The slight excess in heavy structurals is only apparent, because the Bhilai capacity of 284,000 tons of heavy structurals includes that for some light structurals also. The need will probably be more for the expansion of capacity for the production of flats and rounds, wire and tinplates and to a certain extent of rails and fishplates also.

It has been assumed in the section on Iron and Steel industry in Chapter Three, Part One, that the three existing plants in the public sector will

TABLE 98—ESTIMATED PRODUCTION OF EXISTING STEEL PLANTS AT FULL CAPACITY

(Thousand tons)

CATEGORIES	TISCO	IISCO	MYSORE	DURGAPUR	BHILAI	RAOURKELA	RE-ROLLERS	ESTIMATED PROD. AT FULL CAPACITY OF EXISTING PLANTS
1. Heavy structurals	140	150	10	..	284	..	..	584
2. Light structurals	240	120	10	200	..	..	30	600
3. Rails and fishplates	135	100	..	..	110	..	..	345
4. Sleeper bars, etc.	6	..	..	60	90	..	..	156
5. Tinplates	..	..	..	..	..	50	100	150
6. Sheets	150	120	..	..	..	470	..	740
7. Plates	100	..	..	..	..	200	..	300
8. Bars and rods	221	160	48	240	136	..	500	1,305
9. Wire	..	..	5	..	..	..	50	55
10. Tool and alloy steel	..	..	19	..	..	..	50	69
11. Wheels, tyres and axles	30	..	..	40	..	..	..	70
12. Skelp	168	..	..	..	..	..	..	168
13. Hoops and strips	..	..	8	..	..	..	20	28
Total	1,190	650	100	540	620	720	750	4,570
Blooms and billets for forging	10	..	..	100	..	..	..	..
Semis for re-rollers	300	150	..	150	150	..	..	..

Source: TISCO and IISCO capacities obtained directly from pamphlets showing the programme; Mysore figures from Programmes for the Industrial Development; Public Sector figures from Fourth Annual Report of Hindustan Steel. Re-rollers are assumed to produce 750,000 tons from available supply of billets from the primary producers.

**TABLE 99—DEMAND FOR CATEGORIES IN 1965-66 AND THE EXPECTED SUPPLY FROM EXISTING PLANTS**

(Thousand tons)

CATEGORIES	ESTIMATED PRODUCTION AT FULL CAPACITY OF EXISTING PLANTS	ESTIMATED DEMAND NCAER 1965-66	(+) OR (—)
1. Heavy structurals	584	500	(+) 84
2. Light structurals	600	640	(—) 40
3. Rails and fishplates	345	700	(—) 355
4. Sleeper bars, etc.	156	215	(—) 59
5. Tinplates	150	250	(—) 100
6. Sheets	740	1,051	(—) 311
7. Plates	300	666	(—) 366
8. Bars and rods	1,305	2,176	(—) 871
9. Wire	55	212	(—) 157
10. Tools and alloy steel	69	276	(—) 207
11. Wheels, tyres and axles	70	80	(—) 10
12. Skelp	168	330	(—) 162
13. Hoops and strips	28	72	(—) 44
TOTAL	4,570	7,168	(—)2,598

increase their installed capacity from 1 million tons to 1.8 million tons of ingot steel, and a fourth plant at Bokaro with a capacity of 1.5 million ingot tons will also be installed. Besides these, small plants are also assumed to be installed with a total capacity of 1 million ingot tons (see Table 18). The supply position in 1965-66 will depend mainly on the decisions that are ultimately taken in respect of these increases in capacity of the steel industry, the time schedules that are fixed for them, and their actual performances in keeping up the time schedules. If all these programmes are adopted, and carried out in time so as to increase the supply of finished steel by 1965-66, corresponding to the anticipated ingot capacity of 11 million tons, then there is likely to be some surplus. On the basis of the progress observed during the Second Plan, it will, however, be more realistic to assume that not all the expansions in capacity will actually materialise by 1965-66, and the supply will lag somewhat behind the estimated requirements. However, the deficit in different categories, as shown in Table 99, could be taken as some guide in determining the rolling programme for the expansion of the steel industry during the Third Plan period.

The total requirements for 1970-71 have been estimated at 12.85 million tons of finished steel, which require about 17.1 million tons of ingot

capacity. The supply position in 1970-71 depends not only on the assumed expansion of the steel plants during the Fourth Plan, as shown in Table 18, but also on the expansions actually made during the Third Plan period. If the expansion programmes during the Third Plan and Fourth Plan periods are carried out strictly according to schedule so as to produce finished steel according to full capacity, then there is likely to be a balance between the supply and demand in 1970-71. Here again, it would be more realistic to assume that steel in the finished form may not be available according to the full capacity anticipated in 1970-71; so that the supply will again be somewhat behind the estimated requirements for 1970-71. The estimated requirements of categories in 1970-71 as shown in Table 82 could be taken as some guide in determining the rolling programme for the expansion of the steel industry during the Fourth Plan.

It is, however, possible that even if the full programmes are carried out, there will be surplus or deficit within certain categories, because the requirements are not only for the categories but also for different sizes, sections and specific qualities of the different categories. From the point of view of consumers of steel, an answer to this question is very important. But this requires a more detailed investigation into sizes, sections, etc. of each category of steel required by engineering industries, and is outside the scope of this study. In the event of any surplus it is, however, advisable that instead of exporting these steel categories as such, engineering industries which can absorb them should be developed in the country, and the exports of finished engineering goods should be encouraged.

In fact a slight excess capacity in a basic commodity like steel is perhaps desirable from certain points of view. The growth of many ancillary industries in foreign countries actually preceded the main industry, but in India the process has been reversed in many instances. An easy supply position in steel is likely to encourage the development of many subsidiary and ancillary industries, whose restricted growth has been the cause of difficulties in some of the main industries, such as, automobile manufactures. In this connection, the need for constant vigilance on the progress of the main and ancillary industries, and also for periodical assessment of the supply and requirements of steel by different industries cannot be over-emphasised.

## CHAPTER SIX

# FINDINGS AND CONCLUSIONS

1. For 1960-61 the total requirements of finished steel by the large scale and medium industries, which are the most important of the steel consuming sectors of the economy, have been estimated at 1,571,000 tons of finished steel. Industries in the private sector are expected to consume about 65 per cent of the total and the public sector industries about 35 per cent. Of the private industry requirements, about 18 to 24 per cent is needed for development purposes and 82 to 76 per cent for manufacturing, maintenance and repairs.

2. The requirements of the large scale and medium industries in 1965-66 and 1970-71 are estimated at 3,599,000 tons and 7,970,000 tons of finished steel respectively. Of this, the share of the industries in the public sector will be 49 per cent and 57 per cent in 1965-66 and 1970-71 respectively, as compared with 35 per cent in 1960-61. The steel requirements of the industries in the public sector, as compared with those in the private sector will increase as greater emphasis is laid on developing basic industries in the public sector. However, by the end of the Fourth Plan, the requirements of finished steel by industries in the private sector will increase by 330 per cent over the 1960-61 requirements, or by 33 per cent per annum (or by 18% per annum at compounds rate), over the entire period 1960 to 1970.

3. The requirements of finished steel for small scale industries have been estimated at 300,000 tons by 1960-61. These are likely to go up to 450,000 tons by 1965-66 and to 800,000 tons by 1970-71. The percentage share of the small scale industries in the total requirements of steel is, however, likely to go down from about 8 per cent in 1960-61 to 6 per cent in 1970-71.

4. Railways are the most important single consumer of steel in the country. The total requirements of railways in 1960-61 have been estimated at 653,530 tons. The requirements of finished steel by the railways by 1965-66 and 1970-71 are likely to go to 1,322,800 tons and 1,694,800 tons, respectively.

5. The total requirements of finished steel for transport and communications as a whole for 1960-61 have been estimated at 771,920 tons. The demand is likely to increase to 1,515,000 tons in 1965-66 and 1,993,000 tons in 1970-71. The share of the transport and communications sector will thus go down from 21.4 per cent in 1960-61 to 21.1 in 1965-66 and 15.5 per cent in 1970-71.

6. The requirements of construction and housing have been estimated at 350,000 tons in 1960-61, rising to 632,000 tons in 1965-66 and 821,000 tons by 1970-71. These include construction on account of private housing, and housing in the public sector on account of schools, hospitals, etc. However, they exclude the requirements of steel on account of industrial housing

and construction, power, irrigation, and other sectors, which have been considered under the appropriate heads.

7. The requirements of finished steel for the power projects likely to be completed by 1960-61 have been estimated at 107,200 tons. The demand is likely to rise to 266,000 tons in 1965-66 and 379,000 tons in 1970-71.

8. The requirements of irrigation projects have been estimated at 157,600 tons in 1960-61. This is likely to rise to 221 000 tons by 1965-66 and 208,000 tons in 1970-71.

9. The requirements of agriculture in 1960-61 have been estimated at 320,000 tons, rising to 435,000 tons by 1965-66 and 610,000 tons by 1970-71.

10. The estimate of the total requirements of finished steel by all the sectors is 3.613 million tons for 1960-61. The production of finished steel in 1960-61 in India may perhaps be no more than 2.635 million tons. The requirements of finished steel in 1960-61 will, therefore, have to be met partly from imports, which should be of the order of 1.0 million tons. This volume of imports can be reduced only by stepping up the production schedule of the steel plants in the public sector. If the total requirements for steel, as estimated for 1960-61, are met either from imports or from increased indigenous production, and the consumption comes up to the anticipated level, then the per capita consumption of steel in India will be 19 lb. on the basis of an estimated population of 430.8 millions in 1960-61. This compares with the present per capita consumption of steel of 12.7 lb., and with the Chinese consumption of 12.5 lb. in 1955.

11. The requirements of finished steel for all the sectors taken together have been estimated at about 7.2 million tons in 1965-66. On the basis of an estimated population of India at 479.6 millions per capita consumption of steel will rise to 34 lb. in 1965-66. If the estimated demand in 1965-66 can be met from indigenous production and supplemented, if necessary, for particular categories, sections and sizes by imports, then the level of steel consumption in India, by the end of the Third Plan, will be above that of Philippines in 1952-54 with a per capita consumption of 23 lb., or that of Egypt with a per capita consumption of 21 lb. But it will be still below the level of Russian consumption of steel in 1925, which was 36 lb. per capita.

Production of finished steel at the existing plants may come up to their full capacity perhaps by 1962-63, bringing the total output of steel to 4.6 million tons, as shown in Chapter Five. The requirements by that time will have gone up to about 5 million tons, so that the shortage in steel will continue till the fourth steel plant in the public sector goes into production. By the time the fourth steel plant is able to turn out finished steel, i.e. by the end of the Third Plan, the requirements will have again gone up to 7.2 million tons, as estimated. Thus at no time, during the Third Plan, is there likely to be an excess of supply over the requirements of steel in the country.

12. The requirements of finished steel in 1970-71 have been estimated at 12.9 million tons. On the basis of an estimated population of 527.8 millions in 1970-71, per capita consumption of steel is thus expected to rise to 56 lb. If India is able to absorb the quantity of steel anticipated

above, the per capita steel consumption in India by the end of the Fourth Plan will be above that of Greece in 1952-54 with a consumption of 50 lb. per capita, and that of Turkey in 1952-54 with a consumption of 45 lb. per capita. It will, however, still be below the level of Japanese consumption of steel in 1925, which was 63 lb. per capita, or that of Russia in 1928 when consumption was 64 lb. per capita. It will also be below the level of consumption of Ireland and Portugal in 1952-54 with a per capita consumption of 80 lb. and 64 lb. respectively, or that of Argentina in 1952-54 with a consumption of 133 lb. per capita. Capacity of finished steel production has been assumed to go up during the Fourth Plan to 12.8 million tons by 1970-71 by further extension of existing plants in the public and private sectors. If this programme of extension is completed by 1970-71, then there is likely to be a balance between supply and demand by the end of Fourth Plan. But judging from the observed lag in keeping to the schedule, it is perhaps more realistic to assume that even by 1970-71, production will not come to full capacity as anticipated so that there may still be a shortage, though small. Thus during the Fourth Plan also there is hardly any likelihood of the supply of finished steel exceeding requirements.

13. The categorywise requirements of steel in 1960-61, 1965-66 and 1970-71 have also been estimated and shown in Tables 93, 94 and 95. The most important category is bars and rods (also called rounds and flats) the demand for which has been estimated at 1.1 million tons in 1960-61, rising to 2.2 million tons in 1965-66 and 3.9 million tons in 1970-71.

14. Flat products such as plates, sheets and tin plates at present constitute a low percentage of the total and will continue to do so in 1960-61. But they are likely to grow in importance in future years and their total requirements are estimated to increase from 1,023,000 tons in 1960-61 to 1,967,000 tons in 1965-66 and to 4,010,000 tons in 1970-71. This is the experience of other countries, such as the United States or the United Kingdom where, with progress in industrialisation, the demand for structurals was found to go down and that for other flat and round products to go up. According to the categorywise estimates it is found that the requirements of flat and round products<sup>1</sup> rise from about 59 per cent of the total in 1960-61 to about 62 per cent of the total by 1970-71. The expected increase in the consumption of bars and rods is particularly steep for the industrial sector, whose share in the total requirements of bars and rods is likely to increase from 26 per cent in 1960-61 to 50 per cent in 1965-66 and 63 per cent in 1970-71.

15. The requirements for structurals have been estimated at 0.6 million tons, 1.2 million tons and 2.1 million tons for 1960-61, 1965-66 and 1970-71 respectively on a macro-economic basis. These are comparable with the estimates obtained by the end-uses method separately for heavy structurals and light structurals. The estimated requirements for heavy structurals by this method come to 270,000 tons, 500,000 tons and 874,000 tons for 1960-61, 1965-66 and 1970-71, respectively, and those for light structurals come to 330,000 tons, 640,000 tons and 1,202,000 tons. Some experts believe that the use of heavy structurals is likely to go down in the near future, following the trend of technical changes that have taken place in Western countries in constructional engineering, whereby heavy

1. Total of plates, sheets, tinplates, bars and rods.



structurals are replaced by reinforced concrete, tubular forms of structurals and welded construction using flat products.

The estimates of requirements of structurals being largely based on the current allocations by the Iron and Steel Controller and State Governments must be taken to reflect a certain degree of substitution of structurals by reinforced concrete construction, which has already taken place and which is particularly visible in urban areas. However, it remains to be seen whether further substitution of this kind would take place in India. First, it will be too much to assume that India, in the wake of industrialisation, can adopt modern changes in constructional engineering which occurred in the West at the height of its industrial development. Even in the Western countries the percentage share of structurals in the total consumption of finished steel has not been of a lower order than has been assumed in this study (See Chapter Four, 4). The end-uses analysis separately for heavy structurals and light structurals confirm the overall estimates. Moreover, capacity for the production of steel pipes and tubes is still limited, and as revealed in Table 99, production of bars and rods in 1965-66 at full capacity in the existing steel plants will also be short by about 0.87 million tons as compared with the requirements. The production of welding electrodes at the moment is comparatively modest, and is just sufficient to cater to the normal requirements of the structural fabricating industry. It is doubtful whether, even after the contemplated expansion in the capacity for production of welding electrodes, there would be sufficient quantity available for diversion to produce built-up structural sections as substitutes for rolled structural members. Thus, considered from various points of view—the volume and pace of development work required in the process of industrialisation or shortage in the capacity of relevant categories and industries—it would, perhaps, be unrealistic to assume that further technological changes of this types in construction will be adopted under Indian conditions. The end-uses estimates may, therefore, be taken as the requirements for structurals.

16. The tin plate requirements are of the order of 140,000 tons in 1960-61, but as the programme of tin plate production at Rourkela is not likely to be completed by the end of the Second Plan, and as the Tin Plate Company of India and M/s. Khemchand Rajkumar can together produce only up to 120,000 tons by the end of the Second Plan, there will be a deficit of about 20,000 tons in 1960-61 in the supply of tin plates. For 1965-66, however, the estimate of tin plate requirements is 250,000 tons, which is expected to rise to 400,000 tons in 1970-71.

17. The requirements for wire and wire products have been estimated at 126,000 tons in 1960-61, forming about 3.5 per cent of the total demand. The demand for this category is likely to increase to about 212,000 tons in 1965-66 and 346,000 tons in 1970-71. The percentage of wire and wire products to the total steel requirements goes down to 3.0 per cent in 1965-66 and 2.7 per cent in 1970-71.

18. The requirements of all kinds of special steel, including alloy and tool steel, have been estimated at 107,000 tons in 1960-61, 276,000 tons in 1965-66 and 514,000 tons in 1970-71.

19. During the Third and Fourth Plan periods there is likely to be a considerable development of the tube industry and as a consequence the demand for skelp is likely to increase. Thus the requirements of skelp for

pipes and tubes have been estimated at 168,000 tons in 1960-61, 330,000 tons in 1965-66 and 490,000 tons in 1970-71.

20. The requirements of basic pig iron for steel making come to 5.88, 11.30 and 20.26 million tons for 1960-61, 1965-66 and 1970-71, respectively.

The requirements for pig iron for castings (as detailed in Appendix Two) have been estimated at 1.26, 2.33 and 4.00 million tons for 1960-61, 1965-66 and 1970-71, respectively.

21. With the anticipated increase in the supply of billets for re-rolling purposes from the primary producers, the steel foundries may concentrate their efforts more on the production of steel castings for industrial machinery and for transport equipment. The requirements of steel castings have been estimated at 126,000 tons, 250,000 tons and 450,000 tons in 1960-61, 1965-66 and 1970-71, respectively.

22. The Third Plan programmes for the steel industry should concentrate more on the development of further capacities for flat products such as sheets, plates, bars and rods, wire, skelp and special steel.

23. If, the programmes of building up the fourth steel plant in the public sector during the Third Plan, and those of expansion of the existing plants are behind schedule, and their full capacity production, as assumed (see Table 18), is not available before the end of the Third and the Fourth Plans, then the total supply is likely to fall short of the estimated requirements in 1965-66 and 1970-71.

If, however, the contemplated expansion of capacity of the steel industry is ahead of schedule, there is likely to be some excess in the supply of certain categories, which depend partly upon the rolling mills that are set up in the future. In such an event encouragement of engineering industries using these categories and promotion of export of these products should be preferred to exports of the finished categories, as such.

24. There is need to organise the collection of full data on consumption of steel emanating from different sources, such as the office of the Iron and Steel Controller, Development Wing, the State Governments, and other consumers, Government and private organisations and to coordinate them at a central place. The data should be published periodically in more or less the same form as by the Iron & Steel Board of the United Kingdom and the British Iron & Steel Federation.

25. The usefulness of the estimates of the steel demand presented above can be enhanced by making periodical assessments of the progress of different sectors of the economy and the repercussions on the future demand for steel. This requires that similar studies should be conducted from time to time.

## RECOMMENDATIONS

1. It is recommended that an organisation be set up to collect all information in respect of production and consumption of steel both by the public and the private sectors, and to publish them periodically as done at present by the U.K. Iron & Steel Board and the American Iron & Steel Institute.

2. There should be periodical studies of the demand for and the supply of steel, categorywise, by a realistic reappraisal of the progress of different industries and sectors.

3. If any surplus of any category of steel can be anticipated, manufacture of engineering goods consuming these should be undertaken with a view to exports, rather than exporting the finished categories.

4. If the requirements of steel in 1965-66, as estimated in this study, are to be met from indigenous sources of supply, the capacity of the steel industry has to be increased from 6 million ingot tons to about 9.6 million ingot tons. This additional capacity is expected to produce about 2.6 million tons of finished steel, which is the difference between the requirements of 1965-66 and the supply from existing plants at full capacity production.

5. In planning the production programme for expansion of the steel industry, special attention should be paid in increasing the capacities of flats and rounds, wire, skelp and special steel.

The rest of the Committee would like to record its thanks and appreciation of the work of the National Council of Applied Economic Research in the preparation of this Report in such a thorough and competent manner under the direction of our Chairman and Director-General of the Council. The Committee would also like to express its appreciation to the Member-Secretary, Dr. B. Natarajan, who was the Director of the Council in charge of the project and to Dr. A.K. Mukherji and to Mr. S. Balakrishna and to Mr. S.R. Iyengar on the staff of the Council for their able assistance.

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P.S. LOKANATHAN	<i>Chairman</i>
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R.N. KAPUR	<i>Member</i>
B.R. NIJHAWAN	<i>Member</i>
B. NATARAJAN	<i>Member-Secretary</i>

New Delhi

7th March 1960.

## APPENDIX ONE

# A NOTE ON THE METHODS OF ESTIMATING STEEL DEMAND

There are several methods of estimating the requirements of steel in the country: (1) Historical Analogy method, (2) Industrial Output method, (3) National Estimates method, (4) Market approach, (5) End-uses method, and (6) Trend method. The method to be adopted for a country depends mainly on the availability of data and the objectives set for the study.

As described earlier, the End-uses method has been mainly used for this study in combination with the National Estimates method and the Trend method, and sometimes with Historical Analogy method also. This procedure is supposed to give the most reliable estimates of the requirements of a basic commodity like steel. This appendix gives an account of attempts which have been made to use some of the other methods also for the estimation of the total demand for steel.

In the Historical Analogy method, a particular country whose stage of economic development has been more or less similar to that of India is selected, and the rate of growth of steel consumption in that country studied for an analogous period of development. Here a basic assumption is that the economy is free from external disturbances like war, depression, etc. The observed rate is then imputed to the economy under study and the demand is estimated by taking a simple proportion. As is clear, this method can give only a very rough idea of the requirements of steel, for, it is not easy to find a country which is strictly comparable to another in any particular stage of development.

Figure 1 shows the growth in steel consumption for several countries, for which the data are shown in Table 1 of the Appendix. Consumption of steel in the U.K. rose from 1.8 million tons in 1885 to about 2.46 million tons in 1900. In the U.S. the production of steel was 2.6 million tons in 1885 which rose to 9.4 million tons by 1900 and to 28 million tons before the beginning of the First World War. It may be asked whether it is legitimate to compare the development of the U.K. and the U.S.A. and apply the experience of the steel industry there to Indian conditions. In India purposive economic development is a recent phenomenon, and has no parallel in the economic history of those countries. Nor are the recent experiences of East European and other countries applicable to India due to basic differences in the productive systems of these countries and India. Consumption of steel in Czechoslovakia rose from 1.8 million tons in 1947 to 3.3 million tons by 1951, and in Poland from 1.5 million tons in 1947 to 2.6 million tons in 1951. Comparison with China is also not appropriate, for the same reason. Consumption of steel in China rose from 1.2 million tons in 1951 to 3.5 million tons in 1955 and to 5.5 million tons by 1957. In 1958 it has been reported to be of the order of 11 million tons.

TABLE I—TREND OF APPARENT STEEL CONSUMPTION IN SELECTED COUNTRIES

(Figures in thousand metric tons of crude steel)

Year	INDIA	JAPAN	WEST GERMANY	U.K.	U.S.S.R.	U.S.A.	CHINA	POLAND	CZECHOSLOVAKIA
1885	..	..	..	1,770	..	2,562	..	..	..
1890	..	..	..	2,870	..	4,277	..	..	..
1895	..	..	..	2,580	..	6,115	..	..	..
1900	..	..	..	4,580	..	9,400	..	..	..
1905	..	..	..	5,210	..	..	..	..	..
1910	..	..	..	5,250	..	..	..	..	..
1915	..	..	..	3,470	..	..	..	..	..
1920	760	2,027	..	6,610	..	..	..	..	520
1925	1,657	1,848	10,620	7,230	3,234	43,300	..	..	1,020
1930	1,908	2,689	8,837	7,230	6,649	38,400	..	..	1,190
1935	1,348	4,489	14,230	8,550	12,843	33,400	..	..	..
1939	1,375	6,133	20,341	11,670	18,836	44,700	..	..	..
1945	1,460	1,957	..	..	11,200	66,900	..	..	..
1946	1,527	556	..	..	12,400	54,700	..	..	..
1947	1,323	951	3,500	11,730	13,800	68,600	..	1,510	1,830
1948	1,344	1,675	6,000	13,690	18,600	75,200	..	1,740	2,070
1949	1,570	2,831	9,600	14,590	23,300	66,082	..	..	..
1950	1,649	4,114	10,147	14,045	27,300	85,784	..	..	..
1951	1,274	5,266	11,011	19,933	31,300	94,346	1,225	2,642	3,287
1952	1,776	5,031	11,933	14,661	34,500	87,211	1,242	..	..
1953	1,784	6,751	14,601	16,302	37,900	99,640	2,224	3,494	4,097
1954	2,244	6,391	16,522	16,430	40,600	77,683	2,765	3,949	4,270
1955	2,800	7,184	21,397	18,850	43,534	102,456	3,479	4,309	3,761
1956	3,591	9,810	21,097	19,022	47,043	100,910	5,325	4,645	4,214
1957	3,619	12,935	20,136	17,034	52,749	97,178	5,544	4,932	4,814

Source : (i) U.N. Statistical Year Book, 1957.

(ii) European Steel Market 1954, 55, 56, 57 and '58.

(iii) "The European Steel Industry and the Wide Strip Mill" 1953, U.N.

(iv) Figure for Japan for 1920 is taken from Statistical Year Book, 1957 of the Japan Iron and Steel Federation.

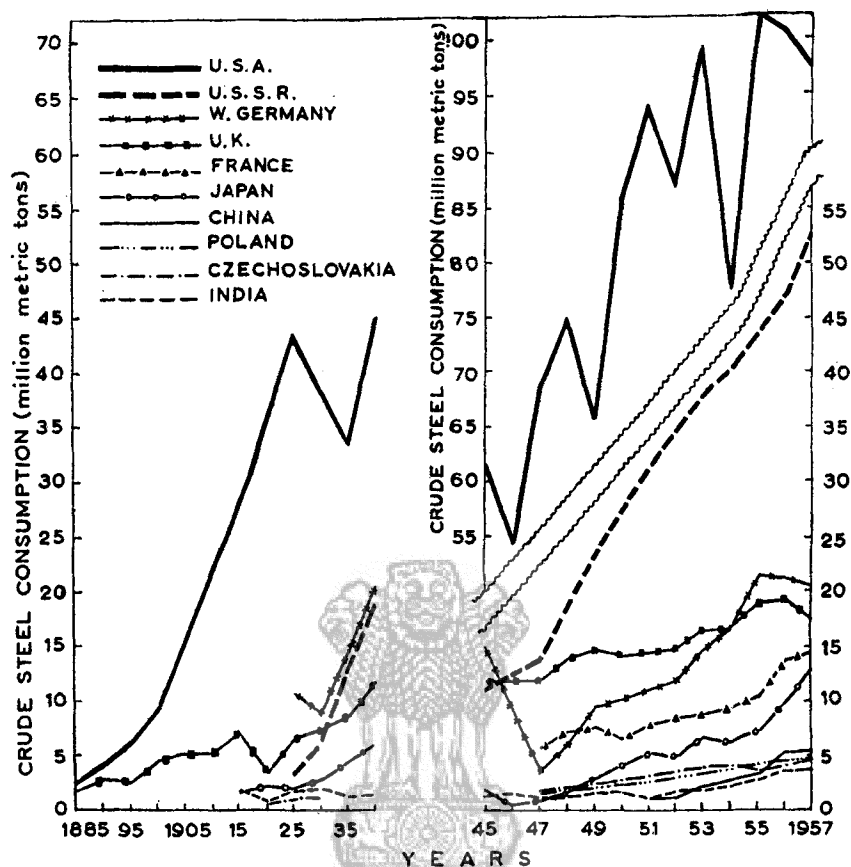


FIG. 1—CRUDE STEEL CONSUMPTION IN SELECTED COUNTRIES

Japanese experience can perhaps be used, but only to a limited extent inasmuch as the political urges behind economic development in the world today are very different from the time when Japan was in an analogous stage of development. The pattern of Japanese economic development cannot be compared with the democratic planning now adopted in India. Consumption of steel in Japan rose from 1.8 million tons in 1925 to 3.2 million tons by 1930 and to about 6 million tons on the eve of the Second World War. After the post-war setback, the Japanese steel industry has revived. The consumption of steel increased from about 5.3 million tons in 1951 to 12.6 million tons in 1957. This is an increase of about 140 per cent over the 6 year period—1951 to 1957. On the basis of this growth rate in steel consumption in Japan, India, with 3.6 million tons of crude steel consumption in 1956, may be expected to consume 7.8 million tons by 1961 and 17 million tons by 1966.

On the other hand, in the U.K., the pioneer in steel production methods, in the period (1885-1913) which witnessed the early stages of growth of the steel industry, crude steel consumption rose from 1.8 million tons in 1885 to 7.2 million tons in 1913. This is an increase of about 300 per cent

during the 28 year period, or about 10 per cent per annum during the entire period. If we impute this growth rate to India we find that the crude steel consumption in India would be 5.5 million tons in 1961 and 8.5 million tons in 1966. It can be easily seen that this method is not likely to give an unambiguous and reliable estimate of the total requirements in the country.

The Industrial Output method has several variants. One of them consists in establishing a relationship between the growth in steel consumption and the growth in industrial output in a selected country between two points of time, and then using this to forecast the future demand for steel in the country on the basis of the expected increase in industrial production. In another variant of this method, a number of countries representing a cross section of various stages of economic development are selected, and the relationship between steel consumption and industrial output as observed by fitting a regression line to the data relating to all these countries is applied to the country concerned. It should be pointed out that any variant of this method should really be considered as further refinement of the Historical Analogy method, and are really projections of historical experiences of other countries and are open to limitations similar to the Historical Analogy method.

Attempts have been made to estimate the steel demand by this method also. For this purpose it is assumed that the rate of growth of steel consumption in India during the next two or three plan periods can be compared with that in the U.S.A. in the nineteenth century upto the beginning of the First World War. It is found that the per capita steel production in the U.S.A. rose from 0.055 ingot tons in 1889 to 0.322 ingot tons in 1913, when the per capita income nearly doubled, increasing from \$ 155.05 to \$ 292.01 in 1913 (Historical Statistics of the U.S.A. 1789 to 1945, U.S. Bureau of the Census). In other words, per capita steel production increased by 485% during a period when per capita income rose by 88%. Per capita income in India is also planned to be doubled by about the end of the Fifth Plan. Imputing the same rate of growth of per capita steel consumption to India in relation to the proposed increase in per capita income, and assuming the population to grow at the current observed rate which is about 2%, the estimates of steel consumption, as shown in Table 2, come to 3.7 million tons, 7.5 million tons, and 13.3 million tons for 1960-61, 1965-66 and 1970-71, respectively.

It is, however, to be noted that this method is not likely to yield a unique estimate of the requirements of steel consumption in the country. If, instead of taking the rate of growth of the steel industry in the United States, that in the United Kingdom is taken, the rate of growth is not as high. Income per head at constant prices was £31.05 in 1885 and increased to £57.37 in 1938 when steel consumption increased from about 110.5 lb. per head to 321.1 lb. per head. This rate of growth, however, will give estimates of steel consumption which would be considerably lower than those obtained by using the United States' rate of growth. It is to be noticed that comparison with the U.S. rate of growth gives estimates which are nearer those obtained by more refined methods used in this study, although there may be some argument against this procedure in view of the dissimilarity in the economic backgrounds of the two countries.

**TABLE 2—GROWTH OF PER CAPITA NATIONAL INCOME AND PER CAPITA STEEL CONSUMPTION**

	POPULATION (MIL.) AT THE END OF YEAR	PER CAPITA NATIONAL INCOME* (Rs.)	PER CAPITA FINISHED STEEL CONSUMPTION (lb.)	TOTAL CONSUMPTION OF FINISHING STEEL (Mill. tons)
1955-56	391.4	284.5	12	2.135
1960-61	430.8	312.9	19	3.719
1965-66	479.6	359.7	35	7.510
1970-71	527.8	410.8	56	13.310

\* At 1952-53 prices

In the above method, growth of the steel industry in India has been compared with that in one country only. A more refined method would be to take a cross section, representative of the various stages of economic development. A relationship between per capita steel consumption and per capita industrial output or income may be found out from such a cross-section which may be applied to Indian conditions. For this purpose 26 countries were chosen to represent various stages of economic growth. Some of these were in Western Europe, some in Latin America and others were in Asia. Table 3 shows the per capita national income, manufacturing output and steel consumption for these 26 countries. A regression equation was fitted to the per capita consumption of steel and industrial output for these 26 countries for the years 1952-54 expressed in terms of constant U.S. dollars as shown below. (See Table 2 and Chart 2).

$$Y = 7.2115 + 0.6651 X$$

where Y = per capita steel consumption (in kilogrammes for 1952-54)

and X = per capita industrial output [in U.S. dollars at (average) 1952-54 prices]

On the basis of this equation the estimates of crude steel consumption for India come to 8.9 million tons for 1965-66 and 11.5 million tons for 1970-71.

The logarithmic form of the regression equation was also fitted to the data for 26 countries. The equation obtained was  $Y = 0.8235X^{0.9646}$ . The estimates of total requirements for India on the basis of the logarithmic form of the equation were, however, considerably lower, and came to only 6.2 million tons of crude steel for 1970-71.

The market approach consists in dividing the country in well-defined zones or markets, where steel is actually consumed, and then estimating the requirements of each zone separately. Lack of relevant data is the greatest handicap in applying this method to Indian conditions.

Another method for estimating the steel requirements is to fit a trend line to the data of steel consumption in India itself for a number of years.



**TABLE 3—PER CAPITA NATIONAL INCOME, MANUFACTURING OUTPUT AND STEEL CONSUMED IN SELECTED COUNTRIES**

COUNTRY	PER CAPITA STEEL CONSUMPTION (kg.)	PER CAPITA NATIONAL INCOME (U.S. Dollars)	PER CAPITA MANUFACTURING OUTPUT
1. Pakistan	3	70	5
2. India	6	60	7
3. Thailand	8	80	16
4. Egypt	10	120	16
5. Philippines	11	150	9
6. Belgium-Congo	12	70	19
7. Turkey	21	210	15
8. Greece	23	220	53
9. Portugal	29	200	74
10. Ireland	37	410	102
11. Argentina	61	460	140
12. Lebanon	68	260	42
13. Japan	75	190	61
14. Italy	94	310	137
15. Finland	126	670	284
16. South Africa	127	300	119
17. Austria	142	370	228
18. Israel	146	470	127
19. New Zealand	147	1,000	152
20. Denmark	155	750	323
21. Norway	192	740	326
22. Netherlands	202	500	230
23. West Germany	302	510	287
24. Canada	313	1,310	585
25. U.K.	323	780	396
26. U.S.A.	551	1,870	739

Note: (1) Per capita manufacturing output is expressed in constant U.S. dollars, average of 1952-54.

Source: U.N. Statistical Papers Series E.No. 4, "Per Capita National Product of Fifty-five countries: 1952-54".

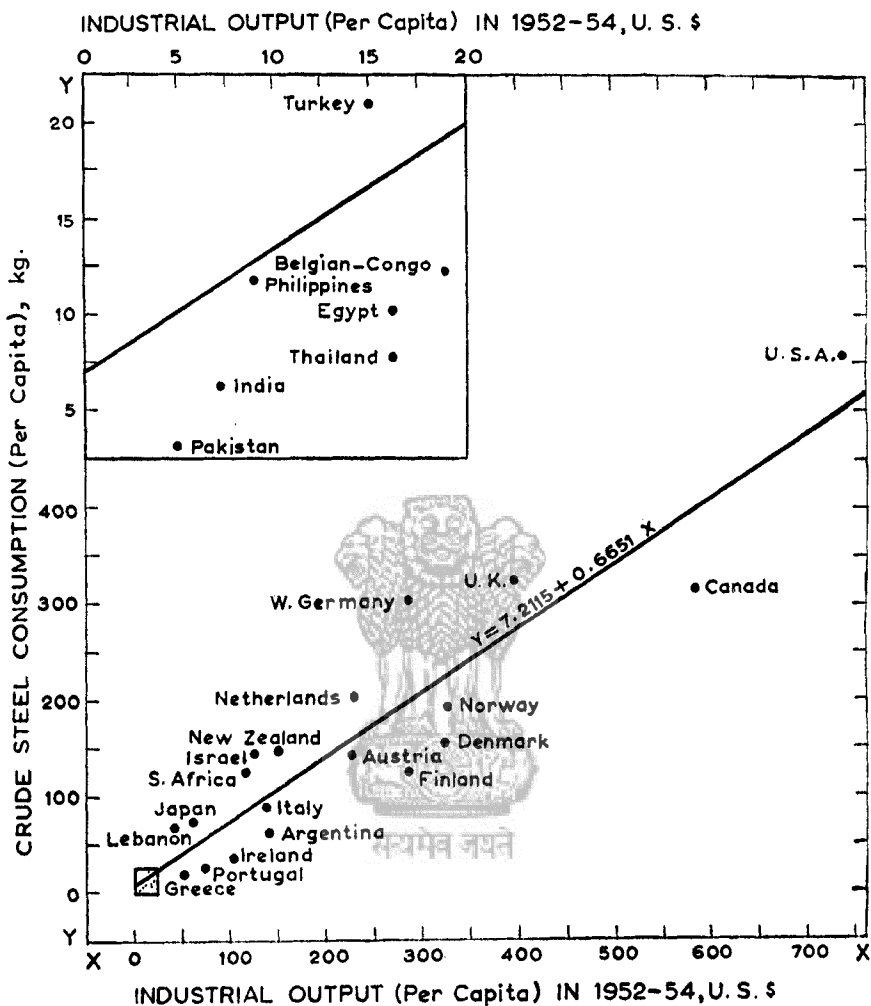


FIG. 2—CRUDE STEEL CONSUMPTION (PER CAPITA) AND INDUSTRIAL OUTPUT (PER CAPITA) 1952-54

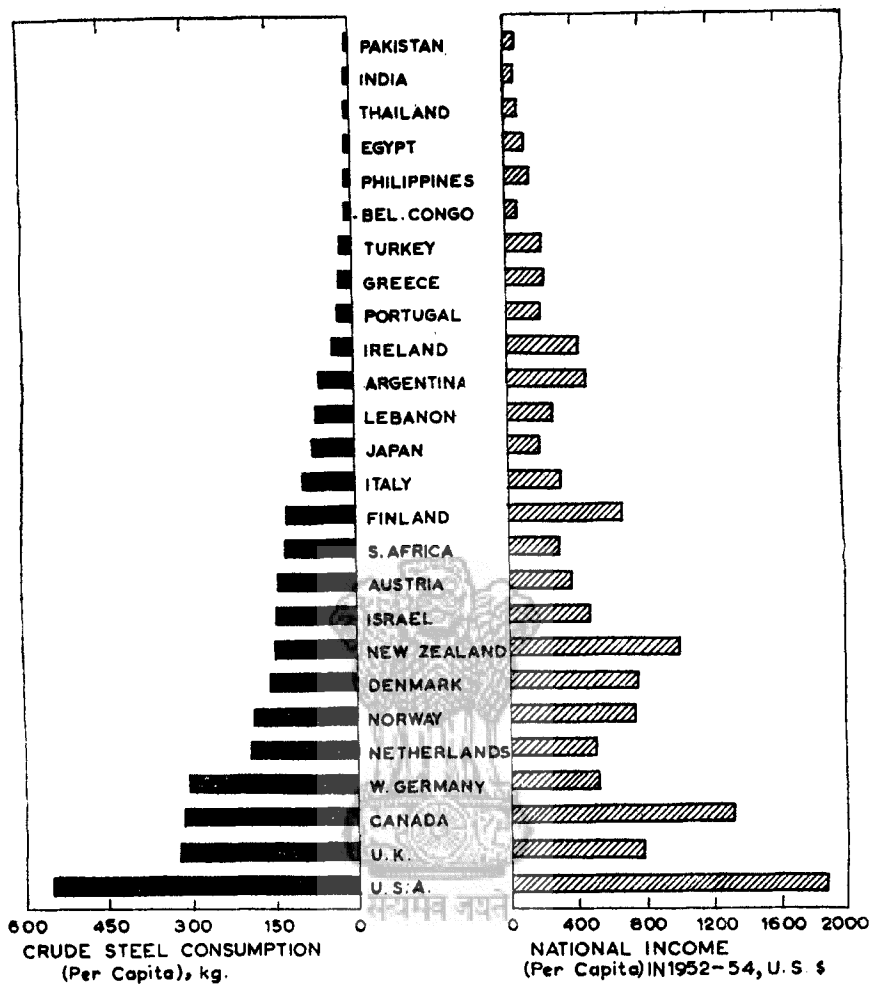


FIG. 3.—PER CAPITA STEEL CONSUMPTION AND NATIONAL INCOME IN SELECTED COUNTRIES IN 1952-54

The limitation of this method, of course, is that there will be forces acting towards changes in the rate of growth and, therefore, this method is also not likely to give a reliable estimate. However, if the period for fitting a trend line relates to one in which the recent changes on account of planning have come into play in greater or lesser degree, then this method might give an estimate not wide of the mark. Thus, fitting a growth curve to the per capita consumption of steel in the last eight years of planning in India, the estimate of total consumption in 1960-61 has been found to be 3.5 million tons. The trend method may also be applied to the relationship between the per capita steel consumption in India to the net value of industrial output in India for the past years. The estimated demand by the last method worked out to 2.9 million tons for 1960-61.

Another method of estimation may be described as 'National Estimates Approach' which is the most direct way of estimating the requirements of steel. The procedure is to add the quantities of steel required as indicated in each individual plan. It will be seen that this method is likely to give information which can be utilised for forecasting according to the 'End-uses Approach'.

In the End-uses method, total consumption of different steel products is classified according to uses to which they are put. From the time series of consumption data in the past, an estimate of future demand is obtained for each type of product by regression analysis.

The order of approximation of the estimates by the various methods is supposed to increase with the order in which they have been described above. Thus the Historical Analogy method is expected to give only a very rough and approximate idea of the future steel consumption in the country. The margin of error for such an estimate is obviously likely to be very high. The End-uses method which, in general, involves also the use of what has been described as the National Estimates Approach, is considered to give the most reliable estimate of the future requirements of a basic commodity like steel.

Strictly speaking, it is not possible to estimate the demand for steel by the application of any one method, and in general, different methods may have to be used for the individual sector or industry depending upon the availability of data, and the demand factors to be considered for that particular industry or sector. As explained earlier, the End-uses method used occasionally in combination with other methods for particular sector or industry forms the main basis of the estimates presented in this report.

## APPENDIX TWO

### PRODUCTION OF PIG IRON FOR CASTINGS

(a) **Requirement of Iron Castings for General Purposes.** The import and production figures for foundry grade pig iron and of iron castings for the years 1957 and 1958 are tabulated below :

YEAR	(Tons)						
	PIG IRON				IRON CASTINGS		
	Ingot moulds	Produc- tion	Imports	Total	Produc- tion	Imports	Total
1957	17,500	294,511	119,266	431,277	113,560	5,014	118,574
1958	27,500	431,593	89,674	548,767	76,000	301	76,301

The totals given for pig iron and castings do not reflect truly the consumption of these items, because a large part of India's requirement of iron castings is met by imports in the form of complete process plants, industrial and other machinery. On the basis of values of imports for machinery during 1957 and 1958, it is estimated that the approximate weights of grey iron castings forming part of the imported machinery would be of the following order :

YEAR	VALUE OF IMPORTED MACHINERY (Crore Rs.)	APPROXIMATE WEIGHTS OF GREY IRON CASTINGS INCLUDED IN THE IMPORTED MACHINERY
		(Tons)
1957	232.92	466,000
1958	186.92	374,000

Thus, it would be more correct to state that our present consumption of grey iron castings and, therefore, our requirement of pig iron should correspond to the total of imported machinery components and the indigenous production of iron castings, as indicated below :

YEAR	(Tons)		
	IMPORTS OF GENERAL CASTINGS	INDIGENOUS PRODUCTION	TOTAL CONSUMPTION
1957	471,014	113,560	584,574
1958	374,301	76,000	450,301

The present consumption of castings represents 20.3 per cent and 19.4 per cent of the total consumption of finished steel in 1957 and 1958,

respectively. These percentage relationships between rolled steel and requirement of grey iron castings compare favourably with the corresponding relationships existing in the more industrially advanced countries as indicated below :

COUNTRY	ROLLED STEEL IN MILLION TONS	PRODUCTION OF CASTINGS IN MILLION TONS	PERCENTAGE
U.S.A. (1957)	79.99	15.10	19.00
U.K. (1958)	15.30	3.44	22.40

Therefore, the requirements of general iron castings for 1960-61, 1965-66 and 1970-71 have been estimated at 20 per cent of the estimates made in this report for finished steel. The figures are :

	(Million tons)		
	1960-61	1965-66	1970-71
(a) Estimated requirement of finished steel	3.612	7.168	12.856
(b) Estimated requirement of general castings at 20 per cent of (a) above	0.722	1.437	2.571

(b) **Requirement of Cast Iron Pressure and Other Pipes.** The consumption of cast iron pipes from indigenous production and imports has been as follows :

	(In tons)					
	1953	1954	1955	1956	1958	1959
(a) Indigenous production						
(i) C.I. pressure pipes	63,621	89,438	95,490	106,701	138,250	163,850
(ii) C.I. rain, drain and conduit pipes	7,872	9,000	11,616	12,000	16,600	19,800
(b) Imports	3,031	3,258	5,351	8,168	6,056	2,965
TOTAL	74,524	101,696	112,457	126,869	160,906	186,615

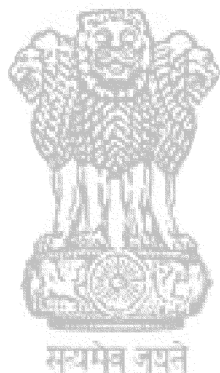
(E) : Estimated.

The above trend of consumption follows a straight line and it is reasonable to use the same for projecting the future requirements for C.I. pipes. On this basis, the figures for 1960-61, 1965-66 and 1970-71 are as follows :

ESTIMATED REQUIREMENT OF C. I. PIPES			
	(In tons)		
	1960-61	1965-66	1970-71
(a) For internal consumption	225,000	310,000	430,000
(b) For export	100,000	200,000	350,000
TOTAL	325,000	510,000	780,000

On the basis of the separate estimates for general iron castings and cast iron pipes made as above the estimated requirements of pig iron in 1960-61, 1965-66 and in 1970-71 are 1.26, 2.33 and 4.00 million tons respectively.

In arriving at the estimated requirement of pig iron for 1960-61, 1965-66 and 1970-71, an allowance of 20% has been added over the weight of the estimated demand for general castings and cast iron pipes for the corresponding periods. At present, the foundries in India on an average require pig iron and scrap approximately equivalent to 25 to 35 per cent over the weight of the finished castings. We have taken a reduced allowance of 20 per cent as it is expected that the rest of the requirement will be made up by foundry scrap available within the country. The production of grey iron castings is fairly well developed in India. With the establishment of the heavy foundry under the public sector and the various expansions contemplated by the foundries under the private sector, it is anticipated that the bulk of our requirement of finished castings for machine building purposes can be fabricated within the country. This is our second assumption in arriving at the estimated requirement of pig iron.



### APPENDIX THREE

## A NOTE ON STEEL CASTINGS

The products from the steel foundries are used largely by the Railways in the manufacture of locomotives, coaches and wagons ; by the industrial machinery manufacturers for parts of machinery in steel, cement, sugar, paper and other industries.

The steel foundries in India have also been playing an important part in the production of steel by casting their surplus metal into billets for castings suitable for re-rolling purposes. However, with the expansions already under implementation, the supply of billets for re-rolling purposes can be expected to increase from the major steel producing units. Therefore, in the future, the steel foundries in India should concentrate their efforts more on the production of steel castings for industrial machinery and for transport equipment.

The production of steel castings alone from the existing foundries is as follows :

YEAR	TONS
1952-53	11,341
1953-54	12,069
1954-55	15,255
1955-56	18,033
1956-57	22,806
1957-58	24,312
1958 (April to Dec.)	17,075

However, the total liquid metal capacity of the existing steel foundries is of the order of 200,000 tons. Thus, the production of steel castings for machinery parts has been only about 10 to 12 per cent of the total available capacity for steel melting.

The consumption of steel castings made up of indigenous production and imports has been as follows for the years 1957 and 1958 :

	(In tons)	
	1957	1958
Steel castings, indigenous production	23,343	28,072
Steel castings, imports as part of industrial machinery (estimated)	56,505	55,152
TOTAL	79,848	83,224



TABLE 1—RELATIONSHIP BETWEEN ROLLED STEEL AND PRODUCTION OF STEEL CASTINGS  
IN SELECTED COUNTRIES

No.	COUNTRY	1954			1955			1956			1957			1958		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1.	U.S.S.R.	30,972	2,200	7.10	33,908	2,333	6.85	36,033	2,447	6.80	37,634	2,376	6.3	N.A.	N.A.	N.A.
2.	Czechoslovakia	3,118	154	4.95	3,381	156	4.63	3,705	165	4.45	3,961	180	4.55	4,254	204	4.80
3.	Poland	2,920	121	4.15	3,350	134	4.00	3,803	145	3.80	3,956	153	3.9	4,282	158	3.70
4.	U.S.A.	N.A.	N.A.	N.A.	84,700	1,340	1.58	83,250	1,700	2.04	79,990	1,800	2.25	N.A.	N.A.	N.A.
5.	U.K.	14,757	302	2.05	15,669	317	2.02	16,446	337	2.05	17,139	339	1.99	15,270	291	1.90
6.	France	7,859	164	2.10	9,906	172	1.74	10,512	170	1.61	11,060	218	1.96	11,521	230	2.00
7.	West Germany	14,080	260	1.85	17,554	315	1.80	19,250	349	1.82	20,242	333	1.64	18,638	295	1.58
8.	Italy	3,443	69	2.00	4,341	79	1.82	4,815	81	1.68	5,875	86	1.46	5,515	87	1.57

A : Production of finished steel products in thousand metric tons.

B : Production of finished steel castings in thousand metric tons.

C : Percentage of finished steel castings to finished steel products.

In terms of our rolled steel consumption for the same years, the percentages of steel castings work out to 2.77 and 3.58. It will be seen that the indigenous production of steel castings forms about one per cent of our total steel consumption and the greater part of our requirement of steel castings is met by imports.

The relation between production of rolled steel and production of steel castings in some of the industrialised countries is given in Table 1. In those countries where the production of industrial machinery is greater such as in U.S.S.R., Czechoslovakia and Poland, the percentage of steel castings is comparatively higher. The percentages for these countries are about 6.8, 4.7 and 4.0, respectively.

On the basis of 3.5 per cent which is considered reasonable for India in the light of our programmes for heavy industries and machine building activities, our requirements of steel castings for 1960-61, 1965-66 and 1970-71 would be:

	1960-61	1965-66	1970-71
(a) Estimated consumption of rolled steel (million tons)	3.613	7.168	12.856
(b) Estimated requirement of steel castings at 3.5 per cent of (a) (in tons)	126,000	250,000	450,000

Since we have already a capacity of about 200,000 tons for liquid metal in the steel foundries, it should be possible to meet our entire requirement of steel castings in 1960-61, provided the steel foundries switch over completely to this item. Expansion of steel foundries may be necessary to cater to the increased needs in 1965-66 and 1970-71.

As far as availability of raw materials, namely steel scrap, is concerned, it is anticipated that there would be no difficulty. Process scrap from the steel consuming industries is usually estimated at 20 per cent of the rolled steel production, whereas the requirement of scrap for steel castings is figured at only 3.5 per cent.

## APPENDIX FOUR

# LIST OF GOVERNMENT DEPARTMENTS, PRIVATE INDUSTRIES, ASSOCIATIONS AND INDIVIDUALS WHO WERE ADDRESSED FOR INFORMATION ON STEEL

### PUBLIC ORGANISATIONS

1. Iron & Steel Controller, Calcutta.
2. Senior Industrial Adviser, Development Wing, Ministry of Commerce & Industry.
3. Joint Director (Steel), Railway Board.
4. Ministry of Steel, New Delhi.
5. Hindustan Steel Limited, New Delhi.
6. Development Commissioner, Small Scale Industries, New Delhi.
7. Joint Secretary & Consulting Engineer, Ministry of Transport, New Delhi.
8. Coal Controller with the Govt. of India, Calcutta.
9. Textile Commissioner, Ministry of Commerce & Industry, Bombay.
10. Agricultural Engineer, Indian Agricultural Research Institute, New Delhi.
11. Chairman, Central Water & Power Commission, New Delhi.
12. Economic & Statistical Adviser, Directorate of Economics & Statistics, Ministry of Agriculture, New Delhi.
13. Joint Secretary & Controller, Vegetable Oil Products, Directorate of Sugar & Vanaspathi, New Delhi.
14. Director of Planning & Deputy Chief Engineer, Posts & Telegraphs Directorate, New Delhi.
15. Ministry of Defence.
16. Ministry of Food.
17. Ministry of Scientific Research and Cultural Affairs.
18. Managing Director, National Coal & Development Corporation, Ranchi.
19. Managing Director, Heavy Engineering Corporation, Ranchi.
20. Directorate General of Supplies & Disposals, New Delhi.
21. Chief Engineer, Central Public Works Department, New Delhi.
22. State Authorities\* (42 in number)

### PRIVATE ORGANISATIONS

23. Tata Iron & Steel Co. Ltd., Jamshedpur.

\* The State steel quotas for agricultural and non-agricultural purposes are not necessarily held by the Director of Industry or any one single authority. It has, therefore, been necessary to address the appropriate authority in the various State Governments who are the sponsoring authorities for the steel quota; their number is 42.

- |   |   |
|---|---|
| 24. Indian Iron & Steel Co. Ltd.,<br>Calcutta.  | 45. Hindustan Motors Ltd.,<br>Hooghly, West Bengal.               |
| 25. American Refrigerator Co.,<br>Calcutta.   | 46. Mahindra & Mahindra Ltd.,<br>Bombay.                          |
| 26. Iron, Steel & Hardware<br>Merchants' Chamber of India,<br>Bombay.                         | 47. Premier Automobiles Ltd.,<br>Bombay.                          |
| 27. Air-Conditioning Corporation<br>(P) Ltd., Calcutta.                                       | 48. Tata Locomotive &<br>Engineering Works,<br>Tatanagar.         |
| 28. The Textile Machinery<br>Corporation Ltd., Calcutta.                                      | 49. Standard Motors Products of<br>India Ltd., Madras.            |
| 29. Walchandnagar Industries<br>Ltd., Bombay.   | 50. Hind Cycles Ltd.,<br>Bombay.                                  |
| 30. The Indian Sugar & General<br>Engineering Corporation Ltd.,<br>Yamuna Nagar (Ambala Dt.). | 51. Sen-Raleigh Industries of<br>India Ltd., Calcutta.            |
| 31. Binny Engineering Co. Ltd.,<br>Madras.  | 52. T.I. Cycles of India Ltd.,<br>Ambattur (near Madras).         |
| 32. K.C.P. Limited,<br>Madras.  | 53. Atlas Cycle Industries Ltd.,<br>Sonepat.                      |
| 33. New India Development<br>Corporation, Bombay.   | 54. Indian Tube Co. Ltd.,<br>C/o. Stewards & Lloyds,<br>Calcutta. |
| 34. Andrew Yule & Co. Ltd.,<br>Calcutta.  | 55. British Indian Electric<br>Construction Co. Ltd., Calcutta.   |
| 35. V. Ramakrishna & Sons,<br>Madras.   | 56. Britannia Engineering Co. Ltd.,<br>Calcutta.                  |
| 36. A.C.C.-Vickers-Babcock Ltd.,<br>Bombay.   | 57. Hindustan Motors,<br>Calcutta.                                |
| 37. Metal Box Co. of India Ltd.,<br>Calcutta.   | 58. General Electric Co. of<br>India Ltd., Calcutta.              |
| 38. Central India Machinery<br>Manufacturing Co. Ltd.,<br>Gwalior.                            | 59. Associated Electric Industries<br>(India) Ltd.,<br>Calcutta.  |
| 39. Cooper Engineering Ltd.,<br>Satara.   | 60. Jay Engineering Works,<br>Calcutta.                           |
| 40. Indian Machinery Co. Ltd.,<br>Howrah.   | 61. English Electric Co.,<br>Howrah.                              |
| 41. Mysore Machinery<br>Manufacturing Ltd.,<br>Bangalore.                                     | 62. Automobiles Manufacturers'<br>Association, Calcutta.          |
| 42. Machinery Manufacturers<br>Corporation Ltd.,<br>Calcutta.                                 | 63. Engineering Association of<br>India, Calcutta.                |
| 43. National Machinery<br>Manufacturers Ltd.,<br>Bombay.                                      | 64. India Engineering Association,<br>Calcutta.                   |
| 44. Ashok-Leyland Ltd.,<br>Madras.  | 65. Guest, Keen, Williams, Ltd.,<br>Calcutta.                     |
|   | 66. Indian Aluminium Co. Ltd.,<br>Calcutta.                       |