

GOVERNMENT OF MAHARASHTRA

REPORT OF THE STUDY GROUP FOR
ENGINEERING PERSONNEL

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May, 1966

Report of the Study Group for
Engineering Personnel

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I N T R O D U C T I O N

Difficulties experienced in the implementation of development plans during the first three Plans high-lighted the need for manpower planning as an integral part of the planning process. The shortage of engineering manpower in particular resulted in the slowing down of the tempo of development, affecting practically all sectors of the economy. One of the essential pre-requisites, therefore, for achievement of economic advancement is the timely availability of trained manpower and the creation of facilities for ensuring an adequate inflow of trained workers to the labour force. This calls for examination on a systematic basis of the problems of assessing manpower requirements of the economy and measures for producing the requisite trained manpower. Reorientation of training programmes and expansion of existing training institutions, establishment of new training institutions, special measures for training teachers and instructors and the introduction of new techniques for intensive training with a view to shortening training periods are some of the ingredients in the 'recipe' for manpower planning.

Efforts made so far to assess manpower requirements at the State level have been generally confined to the segmental approach in which information regarding future requirements were obtained from the various Departments by issue of questionnaires. Such an assessment had a limited value as only the State sector requirements could be known by this method. In this study, an attempt has been made to assess the requirements of engineering personnel on a global basis covering both public and private sectors. The approach is one based on norms and on certain assumptions derived from past trends.

For categories of skilled technical manpower, whose mobility is not restricted to the limits of a State and whose requirements and availability are also dependent to a great extent on decision at National level, manpower projections must be made on a national basis in the first instance. Estimates of such manpower requirements and availability at the State level have necessarily to be based on certain assumptions of a projected growth rate of the economy and zero migration into or outside the State. On the degree of validity of such assumptions depends the value of the estimates. With all, *However* the report is presented in the hope that it will be a useful guide for decisions at the State level and that certain deficiencies pointed out in respect of training programmes and utilisation in the engineering sector will lead to a planned human resources development programme consistent with the development needs of the State.

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Sachivalaya,
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May 1966.

REPORT OF THE STUDY GROUP FOR ENGINEERING PERSONNEL

CHAPTER 1 : PRELIMINARY

Constitution of the Study Group : Its Composition and Terms of Reference:

1.1 A Study Group consisting of the under-mentioned official and non-official members was constituted to assess the requirements and availability of Engineering Personnel by the Government of Maharashtra under Finance Department Resolution, No.MPW-2363/XXVIII, dated 24th December 1963.

Members of the Study Group.

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|---|-----------------------|
| 1. The Secretary to Government,
Irrigation and Power Department. | Convenor. |
| 2. The Chief Engineer (Irrigation Projects I)
and Joint Secretary to Government,
Irrigation and Power Department. | Member. |
| 3. The Chief Engineer (Buildings and
Communications) and Joint Secretary
to Government, Buildings and
Communications Department. | Member. |
| 4. The Deputy Director of Industries
(Development), Directorate of Industries. | Member. |
| 5. The Commissioner of Labour and
Director of Employment. | Member. |
| 6. The Director of Technical Education. | Member. |
| 7. The Director, Bureau of Economics
and Statistics. | Member. |
| 8. The Principal, V.J.T.I., Bombay. | Member. |
| 9. The Principal, College of Engineering, Poona. | Member. |
| 10. Shri Bahubali Gulabchand,
Chairman,
The Engineering Association of India. | Member. |
| 11. Shri Prabhu V. Mehta,
Chairman,
All India Manufacturers' Organisation
(Shri Pranlal Patel, Alternate Member). | Member. |
| 12. Shri G. R. Jolly, President,
The Builders' Association of India. | Member. |
| 13. The Deputy Secretary (Planning),
Government of Maharashtra,
Finance Department. | Member-
Secretary. |

Shri D. S. Mulla represented the All India Manufacturers' Organisation in the Study Group meetings in place of Shri Prabhu V. Mehta.

1.2 The terms of reference of the Study Group are:

- "(i) To determine the requirements of trained Engineering personnel both in the public and private sectors, for the remaining period of the Third Five Year Plan and for the Fourth Five Year Plan;
- (ii) To assess the output of such personnel both within the industry and from technical institutions;
- (iii) To establish certain norms and relationships for assessing requirements of such trained personnel in industries;
- (iv) To suggest special measures, if necessary, such as expansion of training facilities and/or apprenticeship, placements, provision of additional seats, re-orientation of the existing training schemes and programmes with a view to accelerating and augmenting the output of engineering personnel, etc."

Scope and Coverage:

1.3 Engineering employment comprises several sectors of industrial activity such as (i) manufacturing, (ii) construction, (iii) transport and communications, and (iv) mining. In order to make as comprehensive an estimate as possible it was considered desirable to cover all these sectors.

1.4 The term "engineering personnel" includes not only engineers but also supervisory personnel and craftsmen. The expression "engineers" comprises graduates, post-graduates and diploma holders in civil engineering, mechanical engineering, electrical engineering, chemical engineering, metallurgical engineering, and mining engineering but excludes architectural engineering. The term craftsmen comprises 24 selected occupations, most of which are basic engineering trades generally considered to be common to a number of industries. The choice of these occupations has been based on (i) "Studies in Occupational patterns of Engineering personnel" prepared by the Manpower Wing of the Finance Department; (ii) occupations for which training facilities exist under the Craftsmen Training Scheme of the State Government and (iii) "designated trades" under the Apprentices Act, 1961. A list of occupations selected for the study is given in appendix "A".

1.5 In connection with the assessment of requirements of engineering personnel at the craftsmen level it may be pertinent to mention that, studies were carried out in the past to assess the requirements of craftsmen, but various Study Groups and Working Groups set up by the Government of India and State Governments stressed the difficulties experienced in the assessment of requirements and supply of craftsmen and have admitted their inability to arrive at even a reasonable estimate. The Report of the Working Group on Technical Education and Vocational Training states that:

"It would, however, be evident that the problem of assessment of demand for craftsmen is very difficult as there are no standard norms laid down regarding training or staffing. Since the data on the subject is scanty, no precise and accurate estimates can be made. It would, however, be useful if some other methods are also used to calculate the requirements of craftsmen so that the results obtained are checked". (vide Page 49 of the report). The Engineering Personnel Committee set up by the Government of India in 1956 has also come to the same conclusion in its report (vide Page 31, Chapter VII of the report).

Approach to the problem

1.6 The Study Group held four meetings in all. The first meeting determined the scope and coverage and discussed the various approaches and methodologies which could be utilized to arrive at a fair estimate of requirements of engineering personnel. The Study Group also decided to attempt an investment-employment survey on a sample basis at the State level. The task of devising a questionnaire for the survey was entrusted to a sub-Group consisting of the representative of All India Manufacturers' Organisation, Director of Technical Education and Director of Bureau of Economics and Statistics. The questionnaire designed by the Sub-Group was examined and finalised in the Second meeting of the Study Group in the light of a pilot survey conducted by the Manpower Wing. It was found from experience during the test survey that response from employers was likely to be inadequate and incomplete in the absence of long term planning by industrial units in general in regard to their developmental and expansion programmes, lack of data regarding requirements of engineering personnel and the reluctance of establishments to disclose information pertaining to capital structure, output, employment patterns etc. It was, therefore, considered advisable to restrict the actual survey to cover major industries only with a view to avoid unnecessary time and labour which would otherwise be entailed in carrying out a full scale survey.

1.7 The Study Group considered it desirable to assess the requirements of engineering personnel for the Fifth Plan also as any expansion of training programmes, even if it could be under-taken immediately would, on account of the gestation period entailed, materially increase the outturn of engineering graduates and diploma holders only at the end of the Fourth Plan.

CHAPTER 2

DETERMINATION OF NORMS AND RELATIONSHIPS FOR ASSESSING THE REQUIREMENTS

2.1 The determination of norms assumes particular significance if the requirements of personnel are to be estimated on a global basis. Past studies in assessment of engineering manpower requirements tended to adopt a segmental approach which generally restricted the estimates to the needs of the public sector only. It was felt that global estimates based on normative studies would extend the scope of assessment to cover both the public and private sectors and that the overall picture would be sufficiently comprehensive to make long-term planning of engineering manpower - more meaningful.

2.2 Since one of the terms of reference of the Study Group is "to establish certain norm and relationships for assessing requirements of engineering personnel in industries", the sample survey of investment employment proposed during the first meeting was conducted. As it was decided to restrict the actual survey to cover major industries, 9 such industries in Maharashtra State covering approximately 70 per cent. of the total factory employment were brought under the scope of the survey. It was felt that representative establishments from each of the major industrial sectors taken up for the survey, covering 60 per cent. of employment in that particular group would be a sufficiently representative cross section of the major sectors of industry in Maharashtra. The industries selected for the survey were:

- 1) Cotton Textile.
- 2) Manufacture of Chemicals and Chemical products.
- 3) Basic Metal industries.
- 4) Manufacture of metal products except machinery and transport equipment.
- 5) Manufacture of machinery except electrical machinery.
- 6) Manufacture of electrical machinery, apparatus, appliances and supplies
- 7) Manufacture of transport equipment.
- 8) Manufacture of professional, scientific, measuring and controlling instruments.
- 9) Electric light and power (generation, transmission and distribution of electric energy).

2.3 According to the Census of Manufacturing Industries, 1962, there were about 1,400 factories in the above industries employing 5.26 lakh workers. Of these, 195 factory establishments engaging about 1.96 lakh workers were selected for the survey. In addition, about 100 construction undertakings representing a cross section of the building trade were also chosen in consultation with the Secretary, Builders' Association of India, Bombay.

2.4 The questionnaire approved by the Study Group at Appendix "B" was circulated among selected factories and undertakings. The concerned Associations such as the All India Manufacturers' Organisation, the Engineering Association of India (Western Region), the Bombay Mill Owners' Association, the Indian Chemical Manufacturers' Association and the Builders' Association of India were requested to assist in obtaining information from their respective constituent units as expeditiously as possible. Reminders were sent directly to the concerned Associations with a view to hastening the replies. In addition, the staff of the Manpower Wing was detailed for personal follow-up and collection of schedules wherever possible. On receipt of questionnaires duly filled in, the information recorded was scrutinized and clarifications obtained from such undertakings as had given incomplete or obviously inconsistent data.

In spite of these efforts, only 45 industrial establishments and two construction undertakings responded to the survey.

2.5 It was intended to establish industrywise norms relating to various aspects of manpower planning such as investment employment, output-employment, sectorwise employment of engineering personnel according to educational level such as graduates and diploma holders, engineer - craftsmen ratio etc. In view of the indifferent response from individual establishments, however it was felt that it would not be realistic to attempt to establish any meaningful industrywise norms. The limited data made available from the survey has, therefore, restricted the scope to determination of such over-all norms as relate to total employment, employment of engineers, investment, output etc.

Norms evolved from ad-hoc survey

2.6 Norms evolved as a result of the local survey which may be helpful in estimating the requirements of engineering manpower are briefly described below:

(i) Ratio of graduate engineers to diploma holders

2.7 The ratio varies from 1 graduate : 1.27 diploma holders in 1956-57 to 1 graduate : 1.59 diploma holders in 1961-62. The ratio of 1 : 1.49 as worked out from the data for 1963-64 may be accented for planning purposes. In all 45 establishments were employing 635 graduate engineers and 1021 diploma holders, yielding the above ratio. (Table No.1). The Education Division of the Planning Commission has also utilized the same ratio. According to the Education Division, "the ratio of diploma holders to graduates to be trained is a function of rationalized utilization of engineering manpower and needs to be further examined. For the time being the existing practice, rationalised to the extent data is available, which would give the ratio of 1 : 1.5 may be used".

(ii) Ratio of graduate engineers to craftsmen and percentage of craftsmen to total employment

2.8 According to the data obtained, the ratio of engineering graduates to engineering craftsmen works out at 1 graduate engineer : 13 to 20 craftsmen. The Directorate of Manpower, Government of India, has estimated the requirements of craftsmen by utilizing a ratio of 1 graduate engineer : 15 craftsmen. The percentage of engineering craftsmen to total employment works out at 10 per cent. for the year 1963-64. (Table No.2).

(iii) Ratio of investment to total employment

2.9 Total employment per crore of investment is estimated at 713 during 1963-64. In that year, 42 establishments invested Rs.134.66 crores and employed a total complement of 96,700 workers. The data reveal a falling trend in employment per crore of investment from 956 in 1956-57 to 856 in 1961-62 and 713 in 1963-64. (Table No.3). The Director General of employment and Training estimated that a net investment of Rs.10,000 crores in the Third Plan would generate an additional employment for 1.01 crore persons giving a ratio of additional employment of 1,010 per crore of investment.

(iv) Ratio of output to employment

2.10 During 1963-64, 31 establishments reported, production of goods and services valued at Rs.81.66 crores and employment of about 62,700 workers.

This gives a ratio of 763 workers per crore of output. Employment per crore worth of output falls from about 1,000 in 1956-57 to 304 in 1961-62 and 763 in 1963-64. A falling trend in employment per crore of output is forecast for 1966-67 as well as for 1971-72. (Table No.4).

(V) Ratio of engineers to total employment

2.11 Employment of workers per engineer during 1956-57 was estimated at 90:1. The figure declined to 70 in 1961-62 and 65 in 1963-64. During 1963-64, 41 establishments reported employment of about 1,500 engineers and about 96,000 workers, giving a ratio of 65 workers per engineer. According to the estimates of the Engineering Personnel Committee (1956), the ratio of total employment to engineers comes to 100:1. In the light of this, the ratio arrived at in the course of the present survey appears to be rather on the lower side. This may, perhaps, be attributed to inadequate response from the non-engineering industry such as Textiles. (Table No.5).

(vi) Trends in capital investment, total employment and employment of engineers

2.12 Although capital is expected to increase during the period 1956-57 to 1970-71 by 5.5 times, total employment is estimated to increase by 2.3 times and the employment of engineers by about 3 times during that period. (Table No.6).

(vii) Ratio of employment of engineers to investments

2.13 Information received from 45 establishments indicates a total investment of Rs.142.45 crores and employment of about 1,700 engineers between them during the year 1963-64. This works out to a norm of 12 engineers per crore of investment. The ratio for the year 1961-62 also works out at 12 engineers per crore of investment. Thus the State level investment-employment ratio in regard to engineers stands substantiated in the light of similar ratios namely, 11 engineers per crore of investment and 12 engineers per crore of investment respectively established by the Perspective Division of the Planning Commission and the working group on Technical Education and Vocational Training.

2.14 It would be pertinent to add a note of caution in regard to arbitrary acceptance or hasty utilization of norms for purposes of manpower planning. The acceptance of norms as sufficiently stable and realistic for practical application must be the result of a series of studies, of research and evaluation carried out continuously over a period of time and refined periodically in the light of technological development, changes in the industrial structure, changes in occupational patterns etc.

Various approaches for estimating requirements of engineers

2.15 Requirements of engineering manpower may be estimated by adopting a number of approaches. Estimates can be related to investment, sectoral growth, the ratio of employment of engineering personnel to total employment in the non-agricultural sector and the overall engineering manpower growth rate. Estimation by a number of methods is desirable in that it would not only enable a comparison and cross-check of the results but would be helpful in evaluating the reliability of the various methodologies at a future date.

(i) Investment-Employment Ratio Method

2.16 The Perspective Planning Division has estimated that "for the Third Plan period with a net investment of Rs.10,000 crores, the projected employment opportunities would be between 93 lakhs to 107 lakhs of persons and out of these, the personnel with engineering qualifications at the degree and diploma level together may be roughly estimated at 1.10 lakhs"¹. The above assumption leads to a norm of 11 engineers per crore of investment.

2.17 The working group on Technical Education and Vocational Training, 1960, has established a ratio of 12 engineers to Rs.1 crore of investment. The Working Group observes, "On this basis a ratio may be established that with an average annual net investment of Rs.2,000 crores per year during the Third Plan, the annual requirements of engineering personnel would be about 24,000"². This ratio substantiates the one established during an ad-hoc survey of investment-employment at the State level undertaken by the Manpower Wing at the direction of the Study Group (vide para.2.13).

2.18 If the investment-employment approach is utilized for assessing requirements of engineering personnel, necessary adjustments will have to be made in the estimate in regard to civil engineering personnel since experience shows that 80 per cent. of the total employment of civil engineers on construction works would cease to exist as soon as construction works are over. Thus 80 per cent. of the civil engineering component of the estimated requirements of engineers during each plan period would be available for utilization in the next Plan period.

(ii) Sectoral Method

2.19 The Education Division of the Planning Commission has utilized "growth rates" for estimating the growth in engineering manpower in the various sectors of the economy.³ In the Mining and Manufacturing sector it is estimated that in terms of net value of production, the annual percentage increase would be 10.3 per cent. that is to say that 10.3 per cent. would be the annual growth rate in this sector of economy. Assuming that requirements of engineering personnel for this sector would increase in the same proportion as its growth rate, the number of engineers would increase at the rate of 10.3 per cent. per annum. A similar assumption has been made by the Committee on Scientific Manpower of Great Britain which states-

"It was reasonable to base projections of the likely need for scientific manpower on the assumption that demand within each industry would on the average, increase in direct proportion to increase in industrial output."⁴

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1. Report of the working group on Technical Education and Vocational Training. Page 44.
 2. Report of the Working Group on Technical Education and Vocational Training. Page 55.
 3. Engineering Manpower Requirements: 1961-81 Certain question regarding Forecasts. Page 3 to 7.
 4. The Long Term Demand for Scientific Manpower, Government of U. K. October 1961 (Page 8).

2.20 The development of Transport and Communications being closely related to the expansion of industries, it is assumed that the number of engineers in Transport and Communications would continue to bear the same proportion to the number employed in Industry and Mining at a given time. Accordingly, the proportion of engineers in Transport and Communications Sector to the number of engineers in Industry and Mining in Maharashtra State, which was 27.6 per cent. in 1961, is assumed to be constant during the Third, Fourth and Fifth Plan periods.

2.21 As regards the Construction Sector, the Perspective Planning Division of the Planning Commission holds that the net investment in this sector would increase by an average rate of 10.7 per cent. per annum during the next fifteen years. Accordingly, this rate is assumed to be the rate of increase in the number of engineers in Construction, though it would perhaps be more correct to adopt a higher rate for Maharashtra, since investment in this Sector has been comparatively higher in the State.

2.22 In the case of "Other Services" such as public sector administrative departments, consultancy services, trade and commerce, and research and educational institutions, it would be reasonable to assume that the engineering employment in this sector, which is ancillary to other sectors, would progressively increase so as to maintain its over-all proportion to the total engineering employment. In 1961- the overall proportion of engineers in the "services" sector in Maharashtra State constituted 48.77 per cent. of the total engineering employment. This percentage is assumed to be constant during the Third, Fourth and Fifth Plan periods. The difference between the total requirements at the beginning and end of each plan would constitute the additional requirement during that period.

(iii) Ratio of Engineers to Employment in Non-Agricultural Sector

2.23 The Working Group on Technical Education and Vocational Training has evolved a ratio between employment of engineering personnel to total employment in the non-agricultural sector based on past trends. According to the Working Group, the ratio has been rising from 0.12 per cent. in 1950-51 to 0.16 in 1955-56 and to 0.24 in 1960-61. The trends of economic development reveal that the percentage is likely to reach 0.41 by 1965-66, 0.55 by 1970-71 and 0.66 by 1975-76. The total requirements of engineers are estimated by applying these percentages to the projected employment in the non-agricultural sector. The additional requirements during the Plan period would be the difference between the requirements at the beginning and at the end of the Plan period.

(iv) Growth Rate Method

2.24 A rough but ready method of estimating the requirements of engineers may be found in projecting the overall growth rate in the stock of engineering manpower. According to the I.A.M.R., the total outturn of engineering graduates and diploma holders in India upto 1951, 1956 and 1961 stood at 55,429, 90,036 and 152,430 respectively. These figures indicate a growth rate of about 11 per cent. per annum in the stock of engineering personnel.

Inter-se ratios among Engineers according to speciality

2.25 Once the over-all requirements of engineers have been assessed, it is necessary to determine their speciality-wise needs based on inter-se ratios

5. Report of the Working Group on Technical Education
and Vocational Training - Page 57.

among the different specialities such as civil, mechanical, electrical, chemical, metallurgical and mining. The inter-se ratios among estimated employment of engineers as obtained in 1963 processed from State Employment Market Information data may be accepted, assuming that these ratios would remain fairly constant over the next 10 years.

Inter-se Ratios

Civil	47.16
Mechanical	16.36
Electrical	32.72
Chemical	3.05
Metallurgical ...	0.40
Mining	0.31

	100.00
	=====

2.26 The State Employment Market Information data has been further processed to obtain the employment pattern of engineers according to sectors of employment. The proportion of employment of engineers in the public and private sectors based on such data for 1963 is given below:-

<u>Speciality</u>	<u>Public Sector</u>	<u>Private Sector</u>
Civil Engineers	91.99	8.01
Mechanical Engineers ...	30.64	69.36
Electrical Engineers ...	62.95	37.05
Chemical Engineers ...	12.96	87.04
Metallurgical Engineers ...	16.67	83.33
Mining Engineers	79.63	20.37

2.27 Similarly the State Employment Market Information data provide inter-se ratios in regard to engineering craftsmen. These ratios are given in Table number 7.

Replacement Needs

2.28 Since the stock of engineering personnel tends to decrease on account of deaths, retirements etc., provision has been made for replacements at the rate of 1.5% per annum, the Education Division of the Planning Commission having assumed the same rate.

2.29 An analysis of the data regarding turnover of workers compiled from the Census of Manufacturing Industries, 1961, for Maharashtra reveals that the replacement ratio on account of death and retirements etc. for the working class population comes to 0.5% per annum. Accordingly, this rate has been utilized for assessing replacements for engineering craftsmen.

Conclusion

2.30 After careful consideration of the various methods of estimating engineering manpower requirements, the Study Group decided that the sectoral growth method was most likely to yield a realistic estimate of engineering manpower needs.

CHAPTER 3

ASSESSMENT OF REQUIREMENTS AND AVAILABILITY OF ENGINEERING PERSONNEL

Total Requirements of Engineers

3.1 The overall requirements of engineers during the Third, Fourth and Fifth Plan periods estimated on the basis of Sectoral growth tabled below have been calculated on the growth rates in the various sectors as assumed in paras. 2.7 to 2.20, 2.19 to 2.22.

TABLE "A"

Requirements of Engineers according to Sectoral approach.

Sector	1961	1966	1971	1976
1. Mining and Manufacturing	5,478	8,929	14,554	23,723
2. Transport and Communications.	1,511	2,464	4,017	6,548
3. Construction	3,761	6,243	10,363	17,181
4. Other Services	5,243	8,642	14,173	23,251
Total	15,993	26,273	43,112	70,703
Additional Requirements		10,235	16,834	27,591
OR		(Third Plan)	(Fourth Plan)	(Fifth Plan)
Say		10,300	16,300	27,600

3.2 In addition to these requirements, it is necessary to provide for replacement needs (on account of deaths, retirements, etc.) calculated at a rate of 1.5 per cent. per annum as indicated in para. 2.28. Accordingly, 1,474 additional engineers would be required during the Third Plan, an additional 2,260 during the Fourth Plan and 3,450 during the Fifth Plan.

3.3 A comparative picture of the requirements of engineers (including replacements needs) for the period 1961-71 estimated according to the different methods is given below:

TABLE "B"

Additional Requirements of engineers (including replacement needs) according to different approaches.

Method	Third Plan	Fourth Plan	Fifth Plan
1. Investment-employment Ratio.			
Investment assumed (Crores of Rs.)	1,200	2,200	3,500
(a) Rs.1 crore : 11 Engineers	11,313	21,213	33,613
(b) Rs.1 crore : 12 Engineers	12,203	23,174	36,922
2. Sectoral Method	11,760	19,100	31,000
3. Engineers to Employment in Non-Agricultural Sector.	11,675	20,400	25,700
4. Growth Rate Method 11% per annum.	12,435	20,778	34,600

Source:- Engineering Manpower Requirements, 1961-31 Certain Questions Regarding Forecasts, p.2

It is observed that the requirements of engineers, as assessed according to different methods, show small variations during the Fourth Plan, whereas they indicate wide fluctuations during the Fifth Plan. Requirements vary between 19,100 and 23,174 for the Fourth Plan and between 27,500 and 33,922 for the Fifth Plan. The Sectoral method forecasts tend to give a conservative estimate of the requirements of engineers, whereas the Investment-Employment approach indicates a more substantial requirements of engineering personnel.

3.4 For engineering manpower assessment to be meaningful, it is necessary to further process the over-all estimates so as to indicate the requirements, by specialities and levels of professional qualifications. Accordingly, the over-all estimates have been first broken up into requirements by professional qualifications on the basis of a ratio of 1 graduate engineer: 1.5 diploma holder and subsequently split up according to specialities on the strength of inter-se ratios of specialities based on State Employment Market Information Unit data.

Availability of Engineers

3.5 At the beginning of the Third Plan, there were nine engineering degree colleges in the State and two colleges were added during the period 1961-66. Of the 11 colleges in the State, 4 are managed by State Government, 2 by the Government of India, 2 by Universities and the remaining 3 are in the private sector. The intake capacity of engineering personnel which stood at 1,243 at the beginning of the Third Plan has been stepped up to 2,030 during the Plan period as a result of expansion of existing institutions and the addition of two new colleges. The programme for expansion of engineering training in the Fourth Plan envisages establishment of one Regional Engineering College and one Government College with an intake capacity of 480 seats between them. In addition, it is proposed to introduce 100 seats for part-time degree courses in the existing colleges. The intake capacity of engineering colleges according to specialities during the period 1958-71 is given in Table No.3.

3.6 The extent of actual outturn of engineering graduates is available upto 1964. Beyond this period, the outturn has been projected upto the end of the Fifth Plan having regard to the wastage ratios in engineering education and the proposed expansion in training facilities during the Fourth Plan. Table No.9 indicates the outturn of engineering graduates according to specialities for the period 1961-76. It is observed from the table that by the end of the Third Plan about 3,800 engineers would be the outturn from the engineering colleges in the State. The outturn during the Fourth and Fifth Plans is estimated at about 5,700 and 8,400 respectively. The outturn figures indicate a shift towards increasing outturn of Electrical and Mechanical Engineers during the Fifth Plan from the preponderance of Civil Engineers during the Third Plan.

3.7 At the beginning of the Third Plan there were 14 polytechnics in the State and 8 additional polytechnics were added during the period 1961-66 bringing their number to 22. Of these, 16 are managed by State Government and the remaining 6 are in the private sector. The intake capacity of polytechnics which stood at 1690 at the beginning of the Third Plan has been increased to 3,360 by the end of the Third Plan. During the Fourth Plan, nine additional polytechnics are proposed to be opened with a total intake capacity of 1,620 seats and 100 seats provided for part-time diploma courses. The intake capacity of polytechnics according to specialities during 1953-71 are given in Table No.10.

3.8 The annual outturn of diploma holders in the State was about 600 at the beginning of the Third Plan which is estimated to increase to 1,330 by

1966

the end of 1965, as a result of expansion of the training facilities during the plan period. On projection of the outturn with due regard to the wastage ratio as obtaining in engineering education at the diploma level and expansion in training programmes, the availability from polytechnics has been estimated at about 3,755 by 1975. Table No.11 gives the outturn of diploma holders according to specialities for the period 1961-75. It is expected that during the Third Plan about 4,350 engineering diploma holders would be available from polytechnics in the State. The outturn is likely to reach nearly 11,300 and 17,500 during the Fourth and Fifth Plans on the basis of training programmes during the Third and Fourth Plans. It would appear that there is yet considerable wastage in engineering education institutions, both at the degree as well as diploma level. Various measures recommended in I.A.M.R. Paper 13/1965 are being taken to reduce the wastage factor with a view to increase availability and reduce the per capita cost of training.

3.9 The additional outturn of engineers as a result of the net increase in intake capacity during 1966-71 would be about 100 only during the Fourth Plan and 500 during the Fifth Plan. Thus the increase in intake capacity during the Fourth Plan would have little impact during that Plan period because of long gestation period for engineers.

Additional Requirements of Engineers

3.10 Correlating the estimated requirements and availability of engineers, it would appear that there would be a shortage of about 3,600 engineers at the end of the Third Plan and about 2,100 and 5,000 at the end of the Fourth and Fifth Plans respectively as indicated below:-

TABLE "C"

Requirements and Availability of Engineers.

	Third Plan			Fourth Plan			Fifth Plan		
	Degree	Dip- loma	To- tal	Degree	Diploma	Total	Degree	Diploma	Total
Requirements	4,926	6,349	11,775	7,939	11,111	19,100	12,967	13,033	31,000
Availability	3,837	4,350	3,187	5,695	11,277	16,972	3,412	17,470	25,382
Shortage	1,089	2,499	3,588	2,294	+166	2,128	4,555	563	5,118

3.11 The requirements and availability of engineers according to speciality and level of education for the Third, Fourth and Fifth Plan periods may be seen at Table No.12. It is evident from the table that shortages are mainly confined to civil and mechanical engineers. Projections indicate that the availability of Electrical engineers would more or less meet the requirements by the end of the Fourth Plan. The requirements of engineers in other branches such as Chemical, metallurgical and mining would appear to be met by the existing training programmes. However, in view of the ^{establishment} est. of the petro-chemical industry in the region and the expected growth of ancillaries, it may be necessary to make a separate study of the requirements of chemical engineers.

Requirements and Availability of Craftsmen

Requirements

3.12 Utilizing the norm of 1 graduate engineer to 15 craftsmen as evolved by the Director ^{of} Manpower (vide para. 2.18) the requirements of engineering

craftsmen work out at about 73,900 during the Third Plan and 1,19,900 and 1,94,500 for the Fourth and Fifth Plans respectively.

3.13 Replacement needs of craftsmen on account of death, retirement etc. at the rate of 0.5 per cent per annum, (vide para. 2.29) works out at about 4,100, 5,000 and 6,700 respectively for the Third, Fourth and Fifth Plans. Thus the total craftsmen requirements would be:-

TABLE No. D

	Third Plan	Fourth Plan	Fifth Plan
Requirement of graduate Engineers	4,926	7,989	12,967
Requirements of Craftsmen (1 : 15)	73,890	1,19,835	1,94,505
Replacement needs (0.5%)	4,084	4,981	6,702
Total requirements of Craftsmen.	77,974	1,24,816	2,01,207

3.14 The requirements of craftsmen according to actual occupations have been based on the inter-se proportion of workers evolved from primary data collected under the E.M.I. Schemes vide Table No.13. The occupationwise requirements of craftsmen is shown in Table No.14.

Availability

3.15 There are at present 31 Industrial Training Institutes in the State of Maharashtra for craftsmen training with an intake capacity of 11,038. The admission of craftsmen to training courses is effected every 9 months and the outturn is available every 18 months. Accordingly, the availability of craftsmen during the Fourth and Fifth Plan periods has been based on the intake capacities of those batches, the outturn from which would become available during the Fourth and Fifth Plan periods. The intake for the batches for the Fourth and Fifth Plans are indicated in Table No.15 and No.16.

3.16 Outturn has been estimated on the basis of the average percentage of 'passes' in the various occupations during the Third Plan period vide Table No.17. Accordingly, the total availability of engineering craftsmen from I.T.Is. (inclusive of expansion of craftsmen training programmes envisaged during the Fourth Plan period) is estimated at 1,01,283 during the Fourth Plan period and 1,73,080 during the Fifth Plan period. To this may be added the outturn under the Apprenticeship training programmes estimated at 2,722 in the Third Plan, about 6,000 during the Fourth Plan and 10,000 in the Fifth Plan period.

^{The} This overall availability of craftsmen would, therefore, be:-

TABLE No. E

	Third Plan	Fourth Plan	Fifth Plan
Outturn from I.T.Is.	17,285	1,01,283	1,73,080
Outturn from Apprenticeship scheme	2,722	5,994	10,000
Total availability of craftsmen	20,007	1,07,277	1,83,080

3.17 The overall requirements and availability of craftsmen by "trades" during the Third, Fourth and Fifth Plan periods is shown in Table No.18. Briefly, the position is as under:-

	Third Plan	Fourth Plan	Fifth Plan
Requirements	77,974	1,24,816	2,01,207
Availability	20,007	1,07,277	1,73,080
Shortage	57,967	17,539	18,127

It is thus estimated that there would be an overall shortage of 57,967 craftsmen during the Third Plan period, 17,539 in the Fourth Plan period and 18,127 in the Fifth Plan period. The shortage of craftsmen is expected to be made good to a substantial extent by training arrangements within industry.

CHAPTER 4

SUGGESTIONS FOR INCREASING AVAILABILITY AND IMPROVING THE QUALITY OF ENGINEERING PERSONNEL.

4.1. The Committee discussed during the last meeting certain important aspects of training programmes which would result in improving the engineering manpower position. Among the items discussed were measures for increasing the outturn of engineering personnel by means other than expansion of training programmes, more effective utilization and deployment of available personnel, improving the quality of technical education and fostering collaboration between industry and technical training institutions. The committee also discussed problems experienced in the public sector in securing suitable candidates to man posts requiring technical and scientific qualifications.

Wastage in Engineering Education

4.2. The rapid expansion in technical training programmes during the last two Plan periods has resulted in lowering of the standard of technical education ~~xxxxxxxxxxxx~~ and ~~an~~ an increasing rate of wastage among pupils at the training stage, both in degree institutions as well as polytechnics. It is essential, therefore, to find ways and means of remedying the situation in the shortest possible time. Since technical manpower is a scarce resource and the capacity of colleges and polytechnics inadequate for turning out the requisite number of qualified engineers to meet the needs of a developing economy, wastage even in limited quantities retards the timely availability of skilled manpower. Quantitative studies of wastages occurring in technical training institutions carried out by competent bodies such as the Planning Commission and the Institute of Applied Manpower Research has revealed that the percentage of wastage in the degree courses range upto 15.6%, while wastage in polytechnics for diploma courses range upto 33.5% in certain specialities. A wastage factor in excess of 10% in degree institutions and 20% in polytechnics must be regarded as a serious matter calling for immediate remedial measures which would increase the outturn of engineers within the existing training resources and at the same time reduce the per capita cost of technical training. Some of the factors considered responsible for the high rate of wastage are:

- (i) Inadequacy of teachers and instructors, both quantitative and qualitative.
- (ii) Inability of students to follow lectures and instructions on account of medium of instruction at the polytechnic level being different from the medium of instruction at the high school stage.
- (iii) faulty system of admissions.
- (iv) outmoded system of examination.
- (v) lack of adequate equipment and appliances.
- (vi) lack of hostel accommodation for students.
- (vii) poor financial condition of students.
- (viii) over-loading of curriculum vis-a-vis the period of time allotted.

In the light of the causative factors enumerated above, the Study Group suggests that the authorities concerned with the formulation and implementation of training programmes should take necessary corrective measures to bring about

a reduction in student wastage in engineering institutions and recommends in particular that:

- (i) steps should be taken to staff engineering educational institutions with qualified teachers in adequate numbers so as to maintain the proper pupil-teacher ratio.
- (ii) special classes in English should be held to enable students to better understand the medium in which training is imparted.
- (iii) The semester system of examination should be introduced.
- (iv) adequate hostel accommodation should be provided.
- (v) the curriculum of technical education institutions be reviewed in consultation between the technical training authorities and representatives of industry.

Utilisation of Engineering Personnel:

4.3. Since the development of human resources takes time, economies in trained manpower that could be achieved by judicious development and optimum utilization of the existing stock would substantially help in easing the strain in a developing economy. In order to achieve maximum utilization of personnel, it is desirable to rationalize the allotment and division of responsibilities at various levels of engineering manpower such as between graduate engineers, diploma holders and the professionally unqualified but practically experienced engineering personnel generally known as "practicals". Such a policy of optimum utilization could result in proportionate growth in output per engineering man-hour at the professional level.

4.4. The Paper on "Manpower Utilization" presented at the Seminar on Employment Information and Manpower Utilization at New Delhi in October 1964 organized by the representatives of industry and Government, laid stress on economising in trained manpower by its more effective utilization. It was argued that such utilization of existing personnel, apart from relieving the strain on an economy with limited resources, would also react favourably on the profession by offering employment commensurate with the level of training. This would make for greater job satisfaction making the profession more attractive to the better type of personnel.

4.5. It was pointed out in the Paper that the extent to which trained engineering technicians are available to relieve professional engineers from routine duties and repetitive tasks, professional engineers would have the opportunity to concentrate their knowledge and abilities to tasks more appropriate to their higher level of competence. The implementation of a policy of optimum utilization calls for intensive study, research and evaluation of the level of responsibilities assumed, duties allotted and the work performed as between diploma holders (engineering technicians) and engineering graduates. Graduate engineers should be exclusively engaged in functions which utilize to the fullest extent possible their professional knowledge and competency. Unfortunately, there has been no such study or evaluation in the country of the responsibilities of engineering technicians vis-a-vis engineering graduates, either in terms of areas of employment, levels of professional responsibility or nature of duties. This should be attempted appropriately by industry in collaboration with professional bodies and educational authorities.

4.6. The opinion of the Study Group is that in many cases graduates are in fact utilized in jobs which could satisfactorily be performed by technicians or diploma holders. The graduate is often employed on such routine duties as

supervision, production, construction and maintenance for the performance of which a well trained diploma holder should prove adequate. The degree holder should be expected to concentrate mainly on research, design, development, planning and organizational work for which he is better suited by virtue of his training at a higher level, while the diploma holder must be used more extensively on supervisory, production and maintenance jobs.

4.7. Other measures for effective manpower utilization policies that the group would recommend for implementation are:

- (i) reduction in turn-over of engineering personnel;
- (ii) availability of opportunities for further professional training;
- (iii) incentives for better terms and conditions of employment, opportunities for advancement etc.

Quality of Engineering Graduates.

4.8. The quality of engineering education undoubtedly affects the progress of developmental programmes. It is essential, therefore, that engineering education imparted in technical training institutions is qualitatively such as would ensure a high level of competence. It can not be denied that the concern voiced in some quarters of a lowering of standards in the turn out of engineers is not entirely without justification. The falling standard of engineering education may be attributed to a number of factors, and in particular to the dearth of teachers and instructors of the right type. A syllabus having a theoretical bias and lack of adequate liaison between industry and training institutions are also contributory factors.

4.9. That there is a dearth of lecturers and teachers of the right calibre, there is no doubt. The main cause for this may be linked to the emoluments and prospects offered by training institutions as compared to those offered in the 'services' and by industry. Fresh engineering graduates who take up the teaching profession, generally do so as an expedient measure with the intention of leaving the profession as and when better opportunities appear. The resultant 'flight' of personnel and the frequent turn over in the teaching profession is bound to have an adverse effect on educational standards and morale of students. It was felt that the training syllabus for engineering education needs to be reviewed and reoriented with a view to meet the basic requirements of industry. The present syllabus appeared over-burdened and the practical work content of the curriculum for both graduates and diploma holders is not fully completed resulting in lack of fundamental knowledge of workshop practice supposed to have been acquired according to the syllabus. Opinions were voiced that it would, perhaps be advisable to have a restricted curriculum rather than one loaded with superfluous coverage; a syllabus having a practical bias and one which would encourage students to study on their own and create a sense of initiative. The present system of engineering education has resulted in a gap between training imparted and the know-how industry needs. The result is that employers have perforce to fill in the gap in professional knowledge by in-plant training programmes and by generally reorienting skills and capabilities towards a more practical application. This inevitably resulted in a certain amount of time-lag before a freshly turned out engineer could be utilized for gainful production. There appears, therefore, an urgent need to bridge the gap between theoretical training and its practical application to industry. This could be best achieved by planned collaboration and cooperation between training institutions and employing establishments. It is desirable that educational institutions and industry come together in order to complete the full process of engineering education. Measures for achieving these objectives, e.g. organizing of summer vacation training programmes in consultation with industry, introduction of sandwich

courses by interpressing institutional training with practical work in industrial establishments, introducing post-graduate diploma courses, and exchange of personnel between educational institutions and industry should be initiated by Government.

4.10. With a view to tone up the calibre of engineering education the Study Group recommends that :

- (i) the terms and conditions of service of teachers and instructors should be favourably reviewed to attract better talent to the profession;
- (ii) care should be taken to select as teachers, persons having a flair for imparting theoretical knowledge combined with practical knowledge of workshop practice;
- (iii) teaching staff should be encouraged to undertake research and advanced work as one of the means of improving teaching standards;
- (iv) reciprocal arrangements should be made for exchange of personnel between industry, design and research organizations and educational institutions on a planned basis, as such a measure would be of mutual benefit to all concerned;
- (v) technical educational authorities may review the syllabus in consultation with representatives of industry from time to time, avoiding, however, too frequent a reorientation of the curriculum,

Recruitment problem in the public sector:

4.11. It is a fact that difficulty is experienced in securing suitable personnel to fill posts in the public sector requiring technical and scientific qualifications. Employment statistics of the State Directorate of the National Employment Service reveal that of the vacancies of engineers remaining unfilled with Employment Exchanges in the State for want of suitable personnel, about 70% to 80% pertain to the public sector.

4.12. By and large, problems and difficulties in the matter of recruitment experienced in the public sector can be attributed to the comparatively unattractive scale of emoluments offered in this sector vis-a-vis more attractive terms and conditions of service obtaining in industry and other private sector establishments. The payment of bonus and fringe benefits offered by the private sector are irresistible incentives which syphon off the better type of candidates for employment.

4.13. Other contributory factors which adversely affect recruitment may be traced to certain conditions peculiar to employment in the public sector :

These are:

- (i) liability of incumbents to be posted in far off and remote areas such as project sites. Such postings impose hardship by way of separation from family, lack of suitable residential accommodation, lack of facilities for education, health, recreation, etc;
- (ii) procedural delays in recruitment, particularly through the Public Service Commission;
- (iii) unfavourable terms and conditions in regard to the probationary period;

- (iv) comparatively limited prospects of advancement;
- (v) a rigid promotional policy based chiefly on length of service, irrespective of factors such as merit and ability.

4.14. Recruitment is only a part of the staffing problem in public sector establishments. The retention of professional personnel is also a persistent problem on account of "flight" of such personnel towards the private sector. In this connection, a quick survey of the various Departments carried out sometime back indicated that of the officers of various categories desirous of leaving Government service, engineers constituted 30.70% of the total number applying for outside employment.

4.15. Apart from such basic factors as salary differential, promotional prospects etc. there are certain aspects of personnel policy which have a direct bearing on the morale and attitude of employees towards the employing organization. These are "jobs satisfaction", awareness of a sense of fairness and justice, human relations, and the "image" of the organization in which they serve. The fostering of a personnel policy based on factors affecting morale would, therefore, go a long way not only in attracting suitable talent but also in retaining trained and experienced personnel. In the final analysis, however, the problem of recruitment and "flight" of personnel is tied up with the larger question of demand and supply, with the need and availability of trained manpower in the context of a developing and expanding economy during which the demand for trained manpower out-paces its availability. The problem, therefore, is one for which there is no immediate solution, but which in time would ease with progressive expansion in training programmes and increasing availability of engineering manpower.

CHAPTER 5

SUMMARY OR CONCLUSIONS AND RECOMMENDATIONS

5.1 After careful consideration of the various methods of estimating engineering manpower requirements, the Study Group is of the view that the "sectoral growth" approach is most likely to yield a fairly realistic estimate of engineering manpower needs. The manpower estimates arrived at by this method are, of course, subject to the validity of the assumptions made in paras 2.19 to 2.22, the important assumption being that the growth rates in the Mining, and Manufacturing and Construction sectors would be 10.3% and 10.7% per annum respectively. On this assumption, the overall requirements of engineers during the Fourth and Fifth Plan periods have been assessed at 19,100 and 31,000 respectively and their availability estimated at 17,000 and 26,000 during the respective Plan periods. The shortages anticipated as a result are mostly confined to the civil and mechanical engineering faculties.

5.2 The requirements of craftsmen are estimated at about 78,000, 1,25,000 and 2,02,000 for the Third, Fourth and Fifth Plans respectively, whereas their availability on the basis of institutional outturn only is assessed at 20,000, 1,07,000 and 1,73,000 for the respective Plan periods. Although the shortage of craftsmen appears to be substantial in the Third Plan (about 58,000), the expansion in training programmes proposed during the Fourth Plan is expected to reduce the shortage to about 18,000 by 1971 and the residual shortage is expected to be made good in a large measure by on-the-job training facilities within industry, for which no statistics are available.

5.3 The Study Group also examined certain important aspects of manpower planning such as wastage in engineering education, optimum utilization of engineering personnel and the quality of technical training. A summary of the recommendations made in this respect is given below:-

I) Reduction in wastage in engineering education:

The authorities concerned with the formulation and implementation of training programmes should take remedial measures to bring about a reduction in student wastage in engineering institutions and to that end recommends that:

- (i) steps should be taken to staff engineering educational institutions with qualified teachers in adequate numbers so as to maintain the proper pupil-teacher ratio;
- (ii) classes in English should be held to enable students to understand better the medium in which training is imparted;
- (iii) The semester system of examination should be introduced;
- (iv) adequate hostel accommodation should be provided;
- (v) the curriculum of engineering education should be reviewed in consultation with the technical training authorities and representatives of industry.

II) Maximum utilisation of engineering personnel:

With a view to achieve maximum utilization of engineering personnel, it is desirable to rationalise the allotment and division of responsibilities at various levels of engineering manpower such as among the graduate

engineers, diploma holders and professionally unqualified but practically experienced engineering personnel generally known as "practicals". The degree holder should be expected to concentrate mainly on research, design, development, planning and organisational work for which he is better suited by virtue of his training at a higher level. The diploma holder must be used more extensively on routine duties such as supervision, production and maintenance jobs.

.III) Improving the quality of engineering graduates:

With a view to toning up the quality of engineering education, it is suggested that:

- (i) the terms and conditions of service of teachers and instructions be favourably reviewed as an incentive to attract better talent to the profession;
- (ii) care should be taken to select as teachers, persons having a flair for imparting theoretical knowledge combined with practical knowledge of workshop practice;
- (iii) teaching staff should be encouraged to undertake research and advanced work as one of the means of improving teaching standards;
- (iv) reciprocal arrangements should be made for exchange of personnel between industry, design and research organisations and educational institutions on a planned basis, as such a measure would be of mutual benefit to all concerned;
- (v) technical educational authorities may review the syllabys in consultation with representatives of industry from time to time. Too frequent a reorientation of the curriculum should, however, be avoided.

5.4 As stated earlier, the Study in Engineering Manpower has been undertaken with a view to facilitate decisions in regard to manpower planning at the State Level. It serves as a pointer to certain deficiencies in training programmes, both qualitative and quantitative, as also to the utilisation of manpower in the Engineering sector. It would be desirable to evaluate, during mid-term appraisals, the validity of assumptions made, particularly those in regard to growth rates in the sectors of economy utilising Engineering Manpower. The findings from such evaluation would serve as a guide, to a more precise assessment of requirements and availability of technical manpower during the Fifth and subsequent plan periods.

A P P E N D I X 'A'

List of Selected Categories of Craftsmen.

CRAFTSMEN.

Code No.	Category.
730	Furnaceman, Metal.
731	Annealers, Tamperers and Related Heat Treaters.
732	Rolling Mill Operators, Metal.
733	Blacksmiths, Hammersmiths and Forgemen.
734	Moulders and Coremakers.
735	Metal Drawers and Extruders.
739	Furnacemen, Rollers, Drawers, Moulders and Related metal Making and Treating Workers(n.e.c.)
740	Precision Instrument Makers, Watch and Clock Makers and Repairmen.
750	Fitter-Machinists, Toolmakers and Machine Tool Setters.
751	Machine Tool Operators.
752	Fitter-Assemblers and Machine Erectors(except Electrical and Precision Instrument Fitter-Assemblers)
753	Mechanics-Repairmen (except Electrical and Precision Instrument Repairmen)
754	Sheet Metal Workers.
755	Plumbers and Pipe Fitters.
756	Welders and Flame Cutters.
757	Metal Plate and Structural Metal Workers.
758	Electro Platers, Dip-Platers and Related workers.
759	Toolmakers, Machinists, Plumbers, Welders, Platers and Related Workers (n.e.c.)(including Metal Engravers other than Printing).
760	Electricians, Electrical Repairmen and Related Electrical Workers.
761	Electrical and Electronics Fitters.
762	Mechanics Repairmen, Radio and Television.
764	Linemen and Cable Jointers.
769	Electricians and Related Electrical and Electronics Workers(n.e.c.)
770	Carpenters, Joiners, Pattern Makers (Wood).
370	Operators, Statuary Engravers and Related Equipment.
371	Boilermen and Firemen.

APPENDIX 'B'

Finance Department.

Instructions for filling in the Questionnaire.

Block I - Identification Particular.

Under item 3 give detailed description of the type of industry to which the undertaking belongs. This should be according to the description given in the classification of industries appended herewith. Where the activities are such that more than one group is manufactured, the group which commands the major share of production will be the industry in which the Undertaking is engaged. Under item 4 indicate the year of establishment of the undertaking, irrespective of changes in managements.

Block II and III - Capital Investment - Existing and anticipated.

Information on the various 'items' under these 'Blocks' should be in respect of establishment located in Maharashtra State only. If separate figures for Maharashtra State are not available, the data given should be computed on the basis of pro-rata business conducted in Maharashtra State.

Indicate here the capital investment or anticipated investment in lakhs of rupees in full integer. Only gross value of the investment should be recorded. Investment recorded, should be as on 31st March of each of the specified years, namely 1956-57/1961-62, 1963-64, 1966-67 and 1971-72. For Undertakings which close their accounts on dates other than 31st March, the years refer to the date on which the accounts were last closed prior to 31st March. For the purpose of this study, capital investment consist of fixed and working capital. Fixed capital comprises lands, buildings including those under construction; improvements to land and other construction; plant; machinery and tools (including un-installed); transport equipment; other fixed assets such as furniture, fixtures etc. and intangible assets. Working capital consists of stock of materials, stores, fuel, semi-finished goods including work-in-progress, and finished products and by-products, cash in hand and at bank and the algebraic sum of sundry creditors as represented by (a) outstanding factor payments, e.g. rent, wages, interest and dividend, (b) purchases of goods and services, (c) short-term loans and advances and sundry debtors comprising amounts due to the factory on account of sale of goods and services and advances towards purchase and tax payments.

Blocks IV and V: Total Employment and Anticipated total employment.

Information given in Blocks IV and V should indicate the actual total emolument (i.e. inclusive of all categories of personnel such as Managerial, Administrative, Supervisory, Technical, Non-technical, Clerical, Skilled, Semi-skilled, un-skilled etc.) in the undertaking as on 31st March of the respective years indicated in Block IV as also the estimates thereof for the years indicated under Block V.

Blocks VI and VII Employment and Anticipated Employment of Engineers, Surveyors and Draftsmen.

In Blocks VI and VII data in regard to only specified categories of personnel-viz. Engineers, Surveyors and Draftsmen, should be included.

For the purpose of this study "Engineers" comprise Civil Engineers, Mechanical Engineers, Electrical Engineers, (including Radio and Telecommunication),

Architects, Metallurgical Engineers, Chemical Engineers and Mining Engineers. Each of these categories of engineers should be further divided into degree and diploma holders.

While completing this item the personnel, required should be identified by the academic/professional qualifications such as Civil Engineers, Mechanical Engineers and not by functional designations such as works Manager, Foreman, Supervisor and Overseer, etc.

The information regarding employment and anticipated requirements recorded should be as on 31st March, of the respective years indicated in the blocks.

Block VIII. Physical Output.

Information regarding 'Physical Output' should be given in terms of annual physical units, produced or manufactured by the factory. The unit of measurement used for indicating the annual output should be clearly stated such as tonnes, meters, etc. Information in regard to physical outputs is sought under three heads; viz. capacity output, actual output and estimated output. Under the term 'capacity output' information should pertain to the 'notional' maximum output on the basis of two shift working. In cases, where the factory is not equipped for two shift working, information should relate to only the shift actually working. However, where the plant is designed for or capable of working more than one shift, the data should relate to two shifts only, irrespective of the actual number of shifts worked by the establishment. Actual output should be indicated for the years 1956-57, 1961-62 and 1963-64 and anticipated output for the 1966-67 and 1971-72.

Block IX - Employment and anticipated requirements of Craftsmen.

The information regarding Craftsmen relate to only 24 selected categories enumerated in column 1 of the Block. The data should refer to the last working day of March of the respective years.

Block X - Training facilities.

Training facilities existing within the Undertaking may be either under the Apprentices Act or outside it on a voluntary basis. The information in respect of these two types of training should be separately recorded under columns 3 to 6 and 7 to 10 respectively.

CONFIDENTIAL

GOVERNMENT OF MAHARASHTRA-FINANCE DEPARTMENT.

Survey of Investment - Employment.

(I) Identification particulars:

1. Name of Undertaking:

2. Address:

3. Industry type:

4. Year of Establishment:

5. Sector

Public

Private

(II) Capital Investment/Gross value. (III) Anticipated Capital investment/
Gross value.
(Rs. in lakhs) (Rs. in lakhs)

Item	1956-57	1961-62	1963-64	Item	1966-67	1971-72
1. Land				1. Land		
2. Buildings.				2. Buildings.		
3. Plant, Machinery & Tools.				3. Plant, Machinery & Tools.		
4. Other fixed assets.				4. Other fixed assets.		
5. Total fixed Capital.				5. Total fixed Capital.		
6. Total working capital.				6. Total working capital.		
7. Total capital.				7. Total capital.		

IX Employment and anticipated requirements of Craftsmen in selected occupations.

Code No.	Category.	No. of persons employed.			Anticipated requirements.	
		1956-57	1961-62	1963-64	1966-67	1971-72
1	2	3	4	5	6	7
730.	Furnacemen.					
731.	Annealers and Temperers.					
732.	Rolling Mill Operators.					
733.	Blacksmiths.					
734.	Moulders.					
735.	Metal Drawers.					
739.	Miscellaneous Metal Workers.					
740.	Precision Instrument Makers.					
750.	Fitter-Machinists					
751.	Machine Tool Operators.					
752.	Fitter-Assemblers.					
753.	Mechanics - Repairmen.					
754.	Sheet Metal Workers.					
755.	Plumbers.					
756.	Welders.					
757.	Structural Metal Workers.					
758.	Electro Plasters.					
759.	Misc. Tool makers and Mechinists.					
760.	Electricians.					
762.	Machanics-Repairmen (Radio)					
764.	Lineman and cable Jointers.					
769.	Misc. Electrical Workers.					
770.	Carpenters and Pattern Maker.					
-	T O T A L					

X Training Facilities.

Code No.	Category	No. of persons trained or proposed to be trained by the undertaking										
		Under Apprentices Act.					Outside Apprentices Act.					
		56-57	61-62	63-64	66-67	71-72	56-57	61-62	63-64	66-67	71-72	
1	2	3	4	5	6	7	8	9	10	11	12	
730.	Furnacemen											
731.	Annealers and Temperers.											
732.	Rolling Mill Operators.											
733.	Blacksmiths.											
734.	Moulders											
735.	Metal Drawers											
739.	Miscellaneous Metal Workers											
749.	Precision Instrument Makers											
750.	Fitter-Machinists											
751.	Machine Tool Operators.											
752.	Fitter-Assemblers											
753.	Mechanics-Repairmen											
754.	Sheet Metal Workers											
755.	Plumbers											
756.	Welders											
757.	Structural Metal Workers											
758.	Electro Plasters											
759.	Miscellaneous Tool Makers and Machinists.											
760.	Electricians.											
761.	Electrical and Electronics Fitter.											
762.	Mechanics Repairmen.(Radio)											
764.	Linemen and Cable Jointers											
769.	Misc. Electrical Workers											
770.	Carpenters & Pattern Makers											

Place
Date

Signature
Designation

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TABLE NO. 1

Ratio of Graduate Engineers to diploma holders

Item	1956-57	1961-62	1963-64
1. Response ...	27	40	45
2. Graduate Engineers employed,,	204	485	685
3. Diploma holders employed ...	260	772	1021
4. Ratio ...	1:1.27	1:1.59	1:1.49

TABLE NO. 2

Ratios of Graduate Engineers to Craftsmen and percentage of craftsmen to total employment.

Year.	Response	Total employ- ment.	No. of gradu- ate en- gineers.	No. of crafts- men.	Ratio	
					Engineer- ing Crafts- men.	Percentage of craftsmen to total employ- ment.
1. 1956-57	19	38,182	186	3,311	1:18	7.7%
2. 1961-62	36	84,552	460	9,375	1:20	10%
3. 1963-64	41	96,556	605	11,328	1:19	10%

TABLE NO. 3

Investment-Employment Ratios

Item	1956-57	1961-62	1963-64
1. Response ...	21	39	42
2. Investment (Rs. in lakhs) ...	4085.41	10092.11	13466.00
3. Employment ...	39042	86339	96707
4. Ratio ... (Rs. 1 crore : Employment).	1:956	1:856	1:718

TABLE NO. 4

Output - Employment Ratios.

Year.	Response.	Value of output (Rs. in lakhs).	Employment.	Ratio Rs.1 crore Employment.
1956-57	14	3228.90	32852	1017
1961-62	30	7004.90	56347	804
1963-64	31	8166.47	62719	768
1966-67	15	4677.07	32825	723
1971-72	12	4304.34	24666	573

TABLE NO. 5

Engineer - Employment Ratios

Item	1956-57	1961-62	1963-64
1. Response ...	19	36	41
2. Total of Employment ...	38,182	84,552	96,556
3. Total of Engineers ...	424	1,208	1,499
4. Ratio ... (Employment : Engineers)	90:1	70:1	65:1

TABLE NO. 6

Trends in capital investment, Total Employment
and Employment of Engineers.

Item	Actual			Anticipated	
	1956-57	1961-62	1963-64	1966-67	1971-72.
Investment					
(i) Land (Rs.in lakhs).	14.77	17.29	17.72	21.87	40.47
(ii) Buildings (Rs.in lakhs).	117.54	235.95	314.47	465.52	500.17
(iii) Plant & Machinery (Rs.in lakhs).	338.12	924.28	1401.71	1942.04	2093.57
(iv) Other fixed (Rs.in lakhs).	21.02	68.30	90.99	111.42	129.08
(v) Total fixed (Rs.in lakhs)	491.45	1245.82	1824.89	2035.46	2763.29
(vi) Total working (Rs.in lakhs).	188.42	350.89	497.58	749.42	950.94
(vii) Total capital (Rs.in lakhs).	679.87	1596.71	2322.47	2802.98	3714.22
(viii) Percentage index (1956-57 = 100)	100	234.9	341.5	377.7	553.6
(ix) Total employment.	3780	6593	8582	9801	10578
(x) Percentage of index. (1956-57 = 100)	100	174.4	227.0	259.2	279.8
(xi) Employment of Engineers.	102	214	289	262	310
(xii) Percentage of Index (1956-57 = 100)	100	209.8	283.8	256.8	303.9

[Based on relevant data provided by 8 establishments only]

TABLE NO. 73

Inter-se Ratios of Engineering Craftsmen
to total employment.

Occupational Code No.	Percentage to the total
730	1.77
731	0.20
732	0.21
733	2.80
734	2.79
735	0.37
739	0.56
740	0.29
750	4.74
751	6.24
752	6.79
753	8.86
754	1.20
756	0.71
757	2.30
758	1.08
759	11.78
760	2.90
761	1.20
762	0.40
764	4.75
769	2.85
770	6.95
870	2.36
871	3.36
Total	100

Source:- State Employment Market Information Data, 1963.

Please see Appendix 'A',

TABLE NO. 8.

Intake Capacity of Degree courses according to
Speciality 1958-71 (including Fourth Plan
proposals).

Year	Degree				
	Civil.	Mechanical.	Electrical.	Chemical.	Metallurgical.
1958	240	115	157	65	22
1959	242	118	157	106	19
1960	432	194	236	127	41
1961	432	234	260	127	41
1962	463	269	312	129	41
1963	517	392	342	152	92
1964	577	482	495	152	92
1965	582	497	537	152	100
1966	582	497	537	152	100
1967	582	497	537	152	100
1968	582	497	537	152	100
1969	672	587	627	152	100
1970	742	657	697	152	100
1971	742	657	697	152	100

TABLE NO. 9.

Outturn of Engineers (Degree) for the years
1961-76.(including Fourth
Plan proposals)

Year	Degree				Total.
	Civil.	Mechanical	Electrical	Others	
1961	209	119	124	71	523
1962	118	131	143	105	497
1963	265	243	210	98	816
1964	336	325	265	134	1,060
1965	343	218	240	140	941
1961-65	1,271	1,036	982	548	3,837
1966	370	285	264	178	1,097
1967	408	359	343	192	1,302
1968	123	150	156	138	567
1969	342	322	329	206	1,199
1970	445	433	444	208	1,530
1966-70	1,688	1,549	1,536	922	5,695
1971	445	434	446	208	1,533
1972	445	434	446	209	1,534
1973	480	476	485	209	1,650
1974	526	528	555	209	1,818
1975	552	556	560	209	1,877
1971-75	2,448	2,428	2,492	1,044	8,412

TABLE NO. 10

Intake Capacity of Diploma courses according to Speciality - 1958-71.
(including Fourth Plan proposals)

Year	Diploma				
	Civil	Mechanical	Electrical	Metallurgical	Mining.
1958	793	204	275	4	-
1959	766	219	288	10	-
1960	1050	310	320	10	-
1961	1230	310	320	10	-
1962	1250	375	385	10	-
1963	1250	990	660	30	40
1964	1420	1000	870	30	40
1965	1420	1060	870	30	40
1966	1420	1060	870	30	40
1967	1600	1240	1050	30	40
1968	1780	1420	1230	30	40
1969	1960	1600	1410	30	40
1970	1960	1600	1410	30	40
1971	1960	1600	1410	30	40

TABLE NO. 11

Outturn of Engineers (Diploma) for the years 1961 - 76
(including Fourth Plan proposals)

Year	Diploma				Total.
	Civil	Mechanical	Electrical	Others	
1961	337	121	138	6	602
1962	257	144	150	12	563
1963	393	240	207	12	852
1964	494	247	200	12	953
1965	827	273	273	7	1,380
1961-65	2,308	1,025	968	49	4,350
1966	831	503	368	26	1,728
1967	890	558	508	40	1,996
1968	923	769	609	47	2,348
1969	941	839	670	49	2,499
1970	1,003	911	743	49	2,706
1966-70	4,588	3,580	2,898	211	11,277
1971	1,098	1,021	841	49	3,009
1972	1,212	1,150	965	49	3,376
1973	1,272	1,232	1,057	49	3,610
1974	1,297	1,272	1,102	49	3,720
1975	1,303	1,282	1,121	49	3,755
1971-75	6,182	5,957	5,086	245	17,470

TABLE NO. 12

Requirements and Availability of Engineers according
to Speciality and level of Education.

Speciality.	Requirements			Availability		
	Degree	Diploma	Total.	Degree	Diploma	Total.
THIRD PLAN						
Civil	2,221	3,332	5,553	1,272	2,308	3,579
Mechanical	1,541	2,312	3,853	1,036	1,025	2,061
Electrical	771	1,155	1,926	982	968	1,950
Others	393	50	443	548	49	597
Total	4,926	6,849	11,775	3,837	4,350	8,187
FOURTH PLAN						
Civil	3,603	5,405	9,008	1,588	4,588	6,276
Mechanical	2,500	3,750	6,250	1,549	3,580	5,129
Electrical	1,249	1,875	3,124	1,536	2,898	4,434
Others	637	81	718	922	211	1,133
Total	7,989	11,111	19,100	5,695	11,277	16,972
FIFTH PLAN						
Civil	5,848	8,772	14,620	2,448	6,182	8,630
Mechanical	4,057	6,085	10,142	2,428	5,957	8,385
Electrical	2,029	3,043	5,072	2,492	5,086	7,578
Others	1,033	133	1,166	1,044	245	1,289
Total	12,967	18,033	31,000	8,412	17,470	25,882

TABLE NO. 13

Inter-se proportion of Craftsmen.(31-9-1963)

<u>Occupational Code No.</u>	<u>Total Workers.</u>	<u>Inter-se proportion</u>
730	3,446	1.77
731	392	0.20
732	417	0.21
733	5,443	2.80
734	5,424	2.79
735	719	0.37
739	1,088	0.56
740	588	0.29
750	28,612	14.74
751	31,538	16.24
752	13,189	6.79
753	17,202	8.86
754	2,327	1.20
755	1,375	0.71
756	4,930	2.54
757	4,458	2.30
758	2,103	1.08
759	22,868	11.78
760	5,606	2.90
761	2,324	1.20
762	774	0.40
764	9,217	4.75
769	5,525	2.85
770	13,499	6.95
870	4,584	2.36
871	6,531	3.36
Total	1,94,149	100.00

Source:-Percentage Average of the primary data collected under E.M.I. Scheme for September 1962 and September 1964 about pattern of employees in Public Sector and for Private Sector in September 1963 data.

TABLE NO. 14

Requirements of Craftsmen by category during Third,
Fourth and Fifth Plans.

Occupational Code No.	Requirements		
	Third Plan	Fourth Plan	Fifth Plan.
730	1,380	2,209	3,561
731	156	250	402
732	164	262	423
733	2,183	3,495	5,634
734	2,175	3,482	5,614
735	289	462	744
736	437	699	1,127
740	226	362	584
750	11,493	18,398	29,658
751	12,663	20,270	32,676
752	5,294	8,475	13,662
753	6,908	11,059	17,827
754	936	1,498	2,414
755	554	886	1,429
756	1,981	3,170	5,111
757	1,793	2,871	4,628
758	842	1,348	2,173
759	9,185	14,703	23,702
760	2,261	3,620	5,835
761	936	1,498	2,414
762	312	499	805
764	3,704	5,928	9,557
769	2,222	3,557	5,734
770	5,419	8,675	13,984
870	1,840	2,946	4,748
871	2,620	4,194	6,761
Total ...	77,974	1,24,816	2,01,207

T A B L E NO. 15.

Intake and out-turn of Craftsmen during the IVth Plan

	I N T A K E - C A P A C I T Y.						T O T A L Outturn I
	February 1965.	November 1965.	August 1966.	May 1967	February 1968.	November 1968.	
-smith	352	365	384	384	448	448	2,381
nter.	656	704	704	704	768	768	4,304
(Civil)	304	336	336	336	400	400	2,112
smen(Mechanical)	406	480	496	496	560	560	2,993
rician.	832	1,120	1,376	1,456	2,096	2,160	9,040
roplater	43	43	96	123	123	123	576
r.	2,128	1,968	3,344	4,032	5,568	5,632	22,672
er.	72	84	540	924	1,020	1,034	3,724
an.	160	176	480	364	1,152	1,216	4,048
nist.	1,088	1,176	1,848	2,768	3,680	3,744	14,304
(I.C.E.)	288	288	512	960	1,088	1,152	4,288
(Instrument)	64	48	208	208	272	272	1,072
(Refri.)	64	48	48	48	48	48	304
(Motor).	304	304	560	960	1,024	1,088	4,240
(Radio).	96	80	80	80	80	80	496
er.	352	318	382	458	778	788	3,066
er and Decorator.	64	64	80	80	80	80	448
rn Maker.	320	320	384	560	880	880	3,344
metal worker.	160	160	192	192	256	256	1,216
yor.	200	160	160	176	208	208	1,112
r.	1,280	1,356	2,076	2,448	3,408	3,472	14,040
and clock rer.	48	32	32	32	32	32	208
r.	864	916	1,204	1,312	1,792	1,856	7,944
ess operator.	48	48	48	64	64	64	336
er.	64	32	32	48	112	112	400
T O T A L :	10,262	10,631	15,602	19,718	25,942	26,518	1,08,673

ber 1959, August 1960, May 1961,
ary 1962, November 1962,
t 1963, May 1964.

Actual appeared
Total.

Actual passed
Total.

% Ratio
outtr

Blacksmith.	169	160	94.7
Carpenter.	540	507	93.8
Draftsmen (Civil).	900	830	92.2
Draftsmen (Mechanical)	1,209	1,153	95.3
Electrician.	1,773	1,712	96.5
Electroplater.	103	102	99.0
Fitter.	4,010	3,644	90.8
Grinder.	114	107	93.8
Wireman.	435	409	94.0
Machinist.	1,467	1,362	92.8
Machinist(I.C.E.)	467	443	94.8
Machinist (Instrument.)	70	49	70.0
Machinist (Refrigerator).	161	150	93.1
Machinist(Motor)	832	790	91.6
Machinist (Radio).	224	195	87.0
Moulder.	706	687	97.3
Painter and Decorator.	92	92	100.0
Pattern maker.	627	593	94.5
Sheet metal worker.	298	291	97.6
Surveyor.	362	347	95.8
Turner.	2,335	2,149	92.0
Watch and clock repairer.	25	23	92.0
Welder.	1,435	1,388	96.7
Wireless Operator.	106	90	84.7
Plumber.	13	12	92.3

T O T A L:

18,503

17,285

	Actual appeared Total.	Actual passed Total.	% ratio of outturn
blacksmith.	169	160	94.73
carpenter.	540	507	93.83
craftsmen (Civil).	900	830	92.22
craftsmen (Mechanical)	1,209	1,153	95.36
electrician.	1,773	1,712	96.55
electroplater.	103	102	99.02
letter.	4,010	3,644	90.87
printer.	114	107	93.85
seaman.	435	409	94.02
mechanic.	1,467	1,362	92.84
mechanic(I.C.E.)	467	443	94.86
mechanic (Instrument.)	70	49	70.00
mechanic (Refrigerator).	161	150	93.16
mechanic(Motor)	832	790	91.64
mechanic (Radio).	224	195	87.05
plumber.	706	687	97.30
painter and Decorator.	92	92	100.00
pattern maker.	627	593	94.57
sheet metal worker.	293	291	97.65
surveyor.	362	347	95.85
turner.	2,335	2,149	92.03
watch and clock repairer.	25	23	92.00
welder.	1,435	1,383	96.72
wireless Operator.	106	90	84.70
woodworker.	13	12	92.30
TOTAL:	18,503	17,285	

TABLE NO.15

Intake and out-turn of Craftsmen during the IVth Plan

	I N T A K E - C A P A C I T Y.						Total intake.	O U T - T U R N Outturn for the IVth Plan
	February 1965.	November 1965.	August 1966.	May 1967	February 1968.	November 1968.		
(1) Black-smith	352	365	384	384	448	443	2,331	2,252
(2) Carpenter.	656	704	704	704	763	763	4,304	4,036
(3) D'men. (Civil)	304	336	336	336	400	400	2,112	1,943
(4) Draftsmen(Mechanical)	406	480	496	496	560	560	2,993	2,353
(5) Electrician.	832	1,120	1,376	1,456	2,096	2,160	9,040	8,723
(6) Electroplater	43	43	96	123	123	123	576	571
(7) Fitter.	2,128	1,963	3,344	4,032	5,563	5,632	22,672	20,602
(8) Grinder.	72	34	540	924	1,020	1,034	3,724	3,494
(9) Wireman.	160	176	430	364	1,152	1,216	4,043	3,805
(10) Mechanist.	1,033	1,176	1,343	2,763	3,630	3,744	14,304	13,279
(11) Mech.(I.C.E.)	283	288	512	960	1,033	1,152	4,238	4,067
(12) Mech.(Instrument)	64	48	208	203	272	272	1,072	750
(13) Mech.(Refri.)	64	48	48	48	48	43	304	233
(14) Mech. (Motor).	304	304	560	960	1,024	1,033	4,240	3,885
(15) Mech. (Radio).	96	30	30	30	30	30	496	431
(16) Moulder.	352	313	332	453	773	733	3,066	2,933
(17) Painter and Decorator.	64	64	30	30	30	30	443	443
(18) Pattern Maker.	320	320	334	560	380	330	3,344	3,162
(19) Sheet metal worker.	160	160	192	192	253	256	1,216	1,137
(20) Surveyor.	200	160	160	176	203	203	1,112	1,065
(21) Turner.	1,230	1,356	2,076	2,443	3,403	3,472	14,040	12,921
(22) Watch and clock repairer.	48	32	32	32	32	32	203	191
(23) Welder.	364	916	1,204	1,312	1,792	1,356	7,944	7,633
(24) Wireless operator.	43	48	48	64	64	64	336	235
(25) Plumber.	64	32	32	48	112	112	400	369
T O T A L :	10,262	10,631	15,602	19,713	25,942	26,518	1,08,673	1,01,283

T A B L E NO.16

Intake and outturn of Craftsmen during the Vth Plan.

	I N T A K E							O u t t u r n	
	August 1969.	May 1970.	February 1971.	November 1971.	August 1972.	May 1973.	February 1974.	Total	Total outturn.
(1) Black-smith.	443	443	448	448	448	443	448	3,136	2,970
(2) Carpenter.	768	768	768	768	768	768	768	5,376	5,046
(3) Draftsman(Civil)	400	400	400	400	400	400	400	2,800	2,736
(4) Draftsman(Mechanical)	560	560	560	560	560	560	560	3,920	3,738
(5) Electrician.	2,160	2,160	2,160	2,160	2,160	2,160	2,160	15,120	14,598
(6) Electro-plater.	128	128	123	128	128	128	128	896	887
(7) Fitter.	5,652	5,652	5,652	5,652	5,652	5,652	5,652	39,424	35,224
(8) Grinder.	1,084	1,084	1,084	1,084	1,084	1,084	1,084	7,588	7,121
(9) Wireman.	1,216	1,216	1,216	1,216	1,216	1,216	1,216	8,512	8,002
(10) Machinist.	3,744	3,744	3,744	3,744	3,744	3,744	3,744	26,208	24,331
(11) Mech. (I.C.E.)	1,152	1,152	1,152	1,152	1,152	1,152	1,152	8,064	7,649
(12) Mech.(Instrument)	272	272	272	272	272	272	272	1,904	1,332
(13) Mech.(Refri.)	43	43	43	43	48	43	43	336	313
(14) Mechanic(Motor)	1,033	1,033	1,088	1,088	1,033	1,033	1,033	7,616	6,979
(15) Mechanic(Radio)	80	80	80	80	80	80	80	560	487
(16) Moulder.	773	773	773	773	773	773	773	5,446	5,298
(17) Painter and Decorator.	80	80	80	80	80	80	80	560	560
(18) Pattern maker.	880	880	880	880	880	880	880	6,160	5,825
(19) Sheet metal worker.	256	256	256	256	256	256	256	1,792	1,749
(20) Surveyor.	206	206	206	206	206	206	206	1,456	1,395
(21) Turner.	3,472	3,472	3,472	3,472	3,472	3,472	3,472	24,304	22,366
(22) Watch and clock repairer.	32	32	32	32	32	32	32	224	206
(23) Welder.	1,856	1,856	1,856	1,856	1,856	1,856	1,856	12,992	12,565
(24) Wooden operator.	64	64	64	64	64	64	64	448	380
(25) Plumber.	112	112	112	112	112	112	112	784	723
T O T A L:	26,513	26,513	26,513	26,513	26,513	26,513	26,513	1,85,626	1,73,080

T A B L E NO. 17

Actual outturn of craftsman in Third Plan.

November 1959, August 1960, May 1961, February 1962, November 1962, August 1963, May 1964.	Actual appeared Total.	Actual passed Total.	% Ratio of outturn.
(1) Blacksmith.	169	160	94.73
(2) Carpenter.	540	507	93.88
(3) Draftsmen (Civil).	900	830	92.22
(4) Draftsmen (Mechanical)	1,209	1,153	95.36
(5) Electrician.	1,773	1,712	96.55
(6) Electroplater.	103	102	99.02
(7) Fitter.	4,010	3,644	90.87
(8) Grinder.	114	107	93.85
(9) Wireman.	435	409	94.02
(10) Machinist.	1,467	1,362	92.84
(11) Machinist(I.C.E.)	467	443	94.86
(12) Machinist (Instrument.)	70	49	70.00
(13) Machinist (Refrigerator).	161	150	93.16
(14) Machinist(Motor)	832	790	91.84
(15) Machinist (Radio).	224	195	87.05
(16) Moulder.	706	687	97.30
(17) Painter and Decorator.	92	92	100.00
(18) Pattern maker.	627	593	94.57
(19) Sheet metal worker.	293	291	97.65
(20) Surveyor.	362	347	95.85
(21) Turner.	2,335	2,149	92.03
(22) Watch and clock repairer.	25	23	92.00
(23) Welder.	1,435	1,388	96.72
(24) Wireless Operator.	108	90	84.70
(25) Plumber.	13	12	92.30
<u>T O T A L:</u>	<u>18,503</u>	<u>17,285</u>	<u>-</u>

TABLE NO. 18

Requirements and Availability^② of Craftsmen by Trades during Third,
Fourth and Fifth Plans.

Occupational Code No.	Third Plan		Fourth Plan		Fifth Plan	
	Avail- ability	Require- ments.	Avail- ability	Require- ments.	Avail- ability	Require- ments.
730*	-	1380	-	2209	-	3561
731*	-	156	-	250	-	402
732*	-	164	-	262	-	423
733	193	2183	2373	3495	2970	5634
734	772	2175	3245	3482	5298	5614
735*	-	289	-	462	-	744
739*	-	437	-	699	-	1157
740	79	226	990	362	1538	584
750	4740	11493	22692	18398	35824	29658
751	3231	12663	18145	20270	2987	32676
752*	-	5294	-	8475	-	13662
753	2869	6908	21988	11059	39272	17827
754	344	936	1377	1498	1749	2414
755	14	554	389	886	723	1429
756	1400	1981	7708	3170	12565	5111
757*	-	1793	-	2871	-	4628
758	102	842	571	1348	887	2173
759*	-	9185	-	14703	-	23702
760	1864	2261	9098	3620	14598	5835
761*	-	936	-	1498	-	2414
762	195	312	431	499	487	805
764	540	3704	4148	5928	8002	9557
769*	-	2222	-	3557	-	5734
770	1162	5419	7518	8675	10871	13984
870*	-	1840	-	2946	-	4748
871*	-	2620	-	4194	-	6761

② Inclusive of outturn under Apprentice training Schemes.

* There are no training courses for these occupations at the I.T.I.S. at present.