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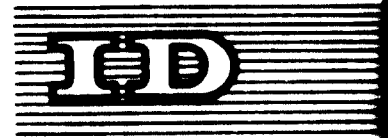
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CONSTRUCTION ACTIVITY IN INDIA

PRESENT SITUATION AND TRENDS<sup>1/</sup>

by

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<sup>1/</sup> The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat. This document has been reproduced without formal editing.

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CONTENTS

	<u>Page</u>
Summary. ....	iv
I. <u>INTRODUCTION</u> .....	1
- Scope of this paper.	
II. <u>DEVELOPMENT OF CONSTRUCTION IN INDIA.</u> .....	1
- Role of Construction in National Development and Economy.	
- Development of construction in India	
- Role of construction industry in major development sectors in the country.	
III. <u>CONSTRUCTION ADMINISTRATION IN INDIA.</u> .....	6
- Role of Government in Construction.	
- Outlay in Public and Private Sectors.	
- Construction a complex Process.	
- Participants.	
- Methods of Processing.	
- Non-availability of Data and Statistics on Construction.	
IV. <u>MAJOR COMPONENTS OF CONSTRUCTION INDUSTRY AND THEIR PRESENT STATUS AND TRENDS.</u> .....	12
- Major components of the Construction Industry.	
- Building materials Industry and present position in India.	
- Construction Tools, Plant and Machinery.	
- Man Power.	
- Finance.	
V. <u>GOVERNMENT AND PRIVATE CONSTRUCTION AGENCIES</u> .....	26
- Government and Private Construction Agencies.	
- Development of Private Construction Agencies.	
- Problems of Private Construction Industry.	
- Problems voiced by owners or clients about the Private Contractors' Agencies.	
- Consultancy Services.	
- Construction Agencies in the Public Sector.	
- Research Institutes and Organizations.	
VI. <u>CONCLUSIONS AND RECOMMENDATIONS</u> .....	38
- Conclusions.	
- Recommendations.	

## ANNEXURES

- Annexure 1 .. Achievement in Construction Activity during Plan Periods.
- Annexure 2 .. Pattern of Investment-Third and Fourth Plans. Outlay and Investment in Fourth Plan: Public and Private Sectors. Estimated Construction Component in Fourth Plan.
- Annexure 3 .. building materials requirement in the Fourth Plan (1969-74).
- Annexure 4 .. Assessment of Building Materials Requirements in the fifth Plan.
- Annexure 5 .. Construction Equipment position in India.
- Annexure 6 .. Major Construction Equipment and Production.
- Annexure 7 .. 1971 Census Facts at a glance.
- Annexure 8 .. Seasonal Nature of Employment in Construction.
- Annexure 9 .. Norms for the Building Sector.
- Annexure 10 .. Growth of Private Construction Companies.
- Annexure 11 .. Public Sector undertakings connected with Construction.
- Annexure 12 .. Some important Government and Public Undertaking Organizations connected with Construction: Research and Design.
- Annexure 13 .. References.

SUMMARY

1. Construction activity is complex and is inter-related very closely with overall National Development. There are limitations in establishing and explaining the overall concept of construction on account of its special characteristics.
2. In India construction activity is second only to agriculture in importance. The Planning Commission has recognized that construction, both public and private, accounts for about 50% of the total outlay in any plan, and has made a comprehensive and objective analysis of this activity.
3. The political set-up and inflow of outsiders into the country has had great influence on construction. India was known for its construction materials from by-gone days. After Independence the country launched massive socio-economic development plans. The development, in the use of materials, methods of construction, manufacture and use of construction equipment has been impressive.
4. Construction activity has played a great role in the growth of different sectors of national development of the country.
5. The overall economy of the country is governed by the policies of the Government. The Government has a dual role to play in construction and it acts both as a legislative authority and also as a participant.
6. The role played by private and public sectors in construction varies according to their respective places in the different sectors of National Development. The finance for most of the construction is provided directly or indirectly, by the Government.
7. Construction is a complex process, may be not for technological reasons, but because of the involvement of a large number of participants with differing requirements and attitudes. Construction activity is the one where the end product is 'sold' before it is built, unlike a manufacturing industry, where the product is made first and then sold. This characteristic has given rise to the origin of 'Contract bond'.
8. The Agency that handles planning of overall construction activity has to manage the different attitudes or requirements of different constituents to get a co-ordinated result.

9. The methods of construction processing is different in Housing, Irrigation and other heavy Civil Works, Bridges, and maintenance. The process of construction depends on the number of participants and their approach to the construction activity, materials, finance and construction methods.
10. Data and statistics in construction are scanty on account of the special characteristics of the construction activity. It is not always clearly defined, many of the agencies are involved, both big and small. There is an overlapping of authority to which professional institutions are not paying enough attention. The construction activity is mobile, seasonal, and varying volume and intensity. It is a 'Contract system' of work.
11. All aspects of both direct and indirect components of construction have to be planned properly.
12. Building material forms 65% to 75% of the Construction outlay which in turn is about 50% of the total Plan outlay. The local production, selection of alternate material on final cost analysis, planning in advance and development of new materials are matters needing careful study.
13. Construction tools, plant and machinery manufacturer and their use, are important for modern methods of construction and fast growth. India is now self sufficient in most of the tools and equipment except for some special items.
14. The Construction Industry is labour intensive in India. It is mostly contract work. Data is not available on account of special nature of construction activity. The Building Trades training programmes need greater attention. The wage structure of workers are in general low. There is a predominance of unskilled workers. The workers are not organized. There are too many labour laws applicable with the result they are either not applied or are overemphasized.
15. The problem of finding adequate finance at reasonable terms has been one of the main difficulties faced by construction in India. The planning commission and private contractors' have suggested short term and long term measures, the short term by a change in prevalent contract conditions and improvement in the existing banking facilities, and in the long term by setting up a Construction Finance Corporation.
16. The relationship and co-operation between the Government and the private construction agencies which carry out most of the construction

- need greater study to effect improvement in the over-all interest of construction.
17. The construction agencies range from a small private unit to a well organized corporate company. On account of this gap, and its region-wise and state-wise distribution, the construction industry has remained organized and has not achieved its rightful place in the Nation. A distinction has to be made between contractors engaged in the real estate and building activity, and those engaged in Civil Engineering Construction. Contracting firms of All-India standing are few, but statewide there are many well established construction agencies. There are very few joint ventures and the big firms handle all kinds of work themselves and this has given rise to some problems in development of specialization, sharing of risk, finance and employment. There are no well established institutions to voice the problems of construction agencies. The Planning Commission has brought out a standard contract form to regulate tendering method but it is not made universally applicable. The problems raised by the construction men are, that: construction is not recognized as Industry, financial institutions do not render adequate financial assistance, tendering process is out-moded and one-sided, material supply etc. by the owner often irregular, no relief for escalating prices of material, no co-ordination among different participants resulting in delays. The labour laws for construction do not take into consideration that construction is contract work, that it is seasonal, that its volume of work changes and that it is mobile. There are nearly 15 separate laws that apply to a construction site, so a comprehensive single law is necessary. The wage structure is low and not clearly defined. The acceptance of the lowest bid without considering competency, is another cause for problems that arise on construction works.
  18. The owners have on their side to state that, the contractors do not employ qualified men, do not have proper management of works, do not adopt modern technique of management, are not safety conscious, disregard specifications, and do sub-standard work. There is no code of ethics among private contractors and no strong organization to represent their case. It is also alleged that contractors mis-use the construction material and plant given in trust for their use.
  19. The consultancy services in India have developed from the foreign-owned



or based consultancy services. It is suggested that design departments of the Government should make more use of the expertise available. Indian Consultancy Services are also capable of rendering services even to less-developed countries.

20. The Government has set up under different ministries public sector construction agencies with the object of controlling costs, modernizing the construction, to act as a check and guide to private construction agencies.

However until now they have attained their objectives although of late their performance is improving.

21. There are a number of research institutions connected with construction activity which are rendering valuable service.
22. In conclusion it has to be said that in India, construction activity has developed so rapidly after Independence, that it is necessary for it to learn much from more developed countries. In its turn, it has much to offer also to developing and under-developed countries.
23. Considering all aspects of the construction activity in India, its present situation and trends, the following lines of action should be considered as important and essential for integrated construction activity in any developing or under-developed country.
- a) Pre-planning in the overall aspects of the sector of national development and the construction factor involved.
  - b) Some of the present methods of construction are out-moded, some designs are over-burdened with safety factors. These have to change in the light of newer techniques and methodologies.
  - c) There is a necessity for proper estimates of requirement of construction materials and much scope for higher productivity in the manufacture of building materials and also introduction and promotion of new materials.
  - d) Evolving short term and long term measures to extend financial assistance on reasonable terms to the construction industry.
  - e) Mechanization is vital for development and modernization of construction. Measures have to be taken to reduce idle time, and minimise under-utilization of equipment. The formation of construction equipment pools, rationalizing spare procurement, building up after sales services is vital. The manufacture of indigenous equipment has to be selective.
  - f) Administrative processing within the industry in the form of

tender documents and contract forms, standards in specifications etc. need a bold approach and change of attitudes on the part of Government and other owners.

- g) The Labour laws have to be compensative taking into consideration the special nature of construction activity.
- h) The training programme for construction trades needs a different approach, taking into account the different trends in construction activity.
- i) Construction management has to undergo a radical change in its approach to suit fast development. The present outmoded system of public administration of construction has to give place to the professional men taking over with full power and responsibility.
- j) The private construction agencies form the mainstay for the execution of works. They have to develop on right lines with proper codes of ethics and gain a rightful place in society.
- k) The technical associations which give more attention to design and research aspects have to give the due attention to construction methods also.
- l) The construction activity has to be organized as an Industry, so that it develops properly and utilises all aids and services which engineering management has at its disposal for the overall development of the industry.

## CONSTRUCTION ACTIVITY IN INDIA-PRESENT SITUATION AND TRENDS.

I

### INTRODUCTION:

1. Scope of this Paper: Construction activity in any Nation is a complex activity as it is very closely inter-related with the over-all National Development. Various attempts have been made to define the complexities of the construction activity, and define guide lines to establish the overall concept of construction but all of these could be likened to the proverbial "Blind men and the Elephant". Each blind man touched only a part of the elephant and described his total concept of the elephant in terms of his experience of the part. This paper is an attempt to high-light the total concepts of construction Industry or activity with the full realization that the concept is not based on blindness but perhaps on a limited vision. I have been directly involved in the construction of heavy Civil Engineering Projects, spreadover different parts of the country while working for the foremost private construction company of the country. I wish to limit my presentation to the Complexities of the construction activity in my country as I conceive them.

II

### DEVELOPMENT OF CONSTRUCTION IN INDIA:

#### 2. The role of construction in National Development and Economy:

The Construction activity in any nation is guided by the overall National Development. Sufficient data and statistics are often however not available for correlating the construction activities with the National Economy. Construction activity may be second only to the Industrial Sector in any developed Nation. In India, the construction activity is the second most important economic activity, next to Agriculture. It is well recognized by the Planning Commission, the top planning body of the country, that Construction accounts for a major share of expenditure in any plan for Socio-Economic development. Along with the increase in the total outlay in each personal plan, expenditure on construction has also recorded a steady increase. Construction Programmes are inter-woven in a large measure in all sections of development; be it housing, transport, industry, irrigation, power, education, health, defence or as a matter of fact any

activity of the country. The Planning Commission has recognized that construction, both public and private, accounts for about 50% of the total outlay in any plan. Construction activity covers not only new construction but repair and maintenance of old works also. The latter may form a fairly big percentage of overall construction activity depending on what importance and priorities are given to this aspect of preserving the old construction.

### 3. Development of construction in the Country:

The political set-up and the inflow of outsiders into the country had great influence on the development of the construction in the country.

#### (1) Pre-independence Period:

India is known for its construction skills from by-gone days. The temples, Palaces, Irrigation Works, Canal systems, Ports testify to this. Indians knew how best to use in construction the basic construction materials like earth, lime, stone, and timber. The use of earth for building of water storage reservoirs, fortifications, and housing was well developed. Admixtures like grass, cowdung, lime, etc. to give requisite properties were also in use all over the country. The burning of lime, clay for bricks was an important village industry. The selection of stone, working on different kinds of stones, handling of heavy stones for buildings, temples and forts was very ably done. The use of stones with hydraulic lime mortat and surkhi for dams and other hydraulic structures was a far-reaching development.

The technique of tunnelling was an evolution of the ancient method of digging secret escape passages for the safety of rulers. The tunnelling methods adopted are evidenced by the famous cave temples also in many parts of India. But in all these works, time factor was of no great importance, but the keynote was quality, fineness and granduer. The construction men and workers took great pride in their work and had great self-satisfaction. The local kings and landlords were the owners and made use of the construction men both local and outside in special cases, for the construction of structures. There was no regular construction

agency as such to undertake works. The advent of Muslim rule brought in the construction methods, materials and architecture of the countries where they had migrated from. the skilled workers were brought or came from the countries of the Middle East.

During the British time, the construction of irrigation and power Projects, roads, railways, and ports and so on, brought in a technological change in the construction methods. Use of better hand tools, steam-power, winch and pile driving etc., came in with the British engineers planning and supervising the execution of the works. There were no established construction agencies to undertake construction. The State Public Works Department and the Railways were mainly carrying out such construction works. The work was carried out by employing small gangs of labour of different trades and paying them only daily wages or on task work. The materials, tools and plants wherever used were all owned and supplied by the department. The Railways were the pioneers in construction of Bridges and tunnels. The method of construction adopted by the Railway engineers was mostly based on British practice.

A great change in the method of construction, and use of construction equipment came about only after the 2nd World War when American influence of size, speed of construction and eagerness to use better and faster methods of construction were seen all over the World in some form or another and also in different stages of application. The great increase in the use of reinforced concrete brought in new ideas and methods of construction.

(ii) Post Independence Period:

After independence, India launched extensive Five-Yearly programmes for economic and social developments. The outlay in the last three five-year plans is about Rs. 210,000 million which is more than what was invested during the 150 years before independence. After the independence, the country has made great strides in methods of construction, use of different construction equipment. In building and Housing

and the high rise and the multi-storey buildings dot the skyline of most cities. The use of reinforced concrete, precast units to replace steel and brick work, designing mixing and placing of scientifically controlled concrete mixes, use of building hoists, tower cranes, steel tubular scaffoldings and steel form work, use of polishing machines, use of glass panelling, aluminium and metal window frames, etc. is in vogue. For factories, structures of ingenious shapes are being designed and constructed either in reinforced concrete, prestressed concrete, steel or a combination of these. Special structures like cooling towers, nuclear, shell structures, hangers, silos etc., are being designed and constructed.

In road building, India has developed methods to suit the varying conditions of the country. Starting with the traditional materials and manual methods for rural roads, the high-ways and express-ways are being built using earth moving equipment consolidation by machines, and paving by machines. In many areas, combinations of both are used to balance the speed of construction with employment needs. New construction methods have been devised to build roads in border areas, at high elevations, and in unstable mountain terrain. The Central Road Research Institute, Delhi, has evolved various methods to tackle problems arising due to different soil conditions and load factors.

Bridge construction for roads and railways, ranging from short R.G.C. decking span resting on open foundations, to large span bridges founded on caissons built by use of floating, pneumatic sinking methods with prestressed concrete superstructure have been designed and constructed. All equipment needed for these are manufactured in the country. In the field of foundation engineering precast or bored concrete piles, in the construction of sand drains, stone columns are in use. But in this case the outside technical know-how and equipment is imported. Of late some construction firms and Research Institutes are developing indigenous methods and equipment, in ports and harbours, the designs for marine works are prepared with the assistance of foreign consultants. The equipment and know-how

for dredging is not indigenously developed. However the construction methods for piling, breakwater construction are being carried out by Indian Construction firms without any foreign collaboration.

On the irrigation front, India is widely known for its irrigation works, storage dams and canal systems. The country possesses all the technical skill for designing as well as construction of all types of hydraulic structures. Indian Construction Companies have carried out massive earth dams using sophisticated earth equipment, rockfill dams and concrete dams using all modern methods and construction equipment. The country has very well developed the technology for building massive concrete dams and hydraulic structures. Except for some high-capacity batching and mixing plants and big crushers, most of the equipment also is available in the country and methods to use them to the fullest extent are being adopted.

**4. ROLE ON THE CONSTRUCTION INDUSTRY IN MAJOR DEVELOPMENT SECTORS OF THE COUNTRY:**

The total investment and approximate break up of construction estimates in different sectors during the last three 5 year plans will show how the construction activities have been generated as a result of the outlay in the development plans.

**Outlays on plans and estimated components of construction in some major sectors:**

	Total Investment in Rs. Millions current Prices			Estimated Construct- ion Com- ponent. %	Estimated Con- struction Component Rs. in Millions		
	<u>2nd Plan</u>	<u>3rd Plan</u>	<u>4th Plan</u>		<u>2nd Plan</u>	<u>3rd Plan</u>	<u>4th Plan</u>
1. Housing and construction.	7250	11000	17800	100	7250	11000	17800
2. Transport + communication	14100	17360	36400	55	7760	9530	20000
3. Organized Industry	15450	25700	62810	25	3860	6430	15720
4. Power	4850	10620	20800	43	2090	4570	8960
5. Irrigation	4200	6500	9640	80	3360	5200	7710
6. Agriculture	8350	14600	24750	47	3920	6860	11630

The financial outlays in different sectors and subsectors and the physical achievements in construction activity are detailed in Annexure 1.

### III. CONSTRUCTION ADMINISTRATION IN INDIA:

#### 5. The Role of the Government in Construction:

As the overall economy of the country is governed by the policies and guidelines laid down by the Government, the public or private sector has to act in consonance with these policies. The Government plays the dual role in that it acts as a legislative authority imposing constraints on construction and as a participant in the construction process. It has not given by any special consideration to construction, even though it is evident that practically all human activities take place in, on or around the products of construction.

#### 6. Outlay in Public and Private Sectors:

The outlays in Public Sector and Private Sector in the plans indicate the trend of investment and participation in different sectors. As stated earlier the share of construction activity in the outlay for the various sectors varies, so does the role played by Public and private construction agencies participating in the construction. During the first two five year plans of the country out of total Rs. 1,01,100 million, Rs. 52,100 million were spent in public sector and Rs. 49,000 million in private sector. The investment and outlay in 3rd and 4th five year plans in the public and private sectors and also the estimated construction component in 4th plan under different sectors are shown in Annexure 2.

The Government is usually committed to provide finance for the construction process as a part of the activity of any sector of development. They may act as direct clients as in case of all public investment either directly or through State or Local Government or through public agencies founded by the Government. But in case of housing, both living accommodation and factories, private construction is encouraged by making available capital at reasonable rates of interest and over long periods as is done by such sources as Life Insurance Corporations, Housing boards, and Metropolitan development Boards.



## 7. Construction as a complex process

Construction is a complex process, not for technological reasons but because of the large number of participants involved and the conflicts arising out of their differing requirements and attitudes. Another complexity is the contractual relationship linking the participants concerned. Construction activity is one where the product, for example, a building, a factory or a power station is "sold" before it is built. This is quite unlike manufacturing industry where the product is made first and then sold and so the product cost is known. This is characteristic to the origin of a "contracted bond" associated with construction in all countries, at all levels of development. Because of this special nature, there is the complicated process of written which are very detailed in defining contractual obligations, specifications both general and technical, bills of quantities drawings, legal and financial conditions, and so on. In these documents all the characteristics of the final product must be described and qualified in unequivocal terms, to enable the contracting agency to offer a firm price for the product envisaged. The scope, quality and substance of information exchanged among the participants is largely embodied in the form of contract linking them.

## 8. The Participants:

The construction activity involves many participants or constituents the main being (1) the owner, (2) the user, (3) the sanctioning authority, (4) the planning authority, (5) the design team, (6) the supervising team, (7) the contractor, (8) the sub-contractor, (9) the manufacturers of building materials, (10) the manufacturers of equipment, (11) suppliers of stores, (12) electricity and water supply services, (13) the labour Unions, (14) the financial institutions, (15) the Taxation authorities, and most important, (16) the Government and its policies and plans. The requirements of each constituent are quite different and the approach or attitude to the activity at hand will always vary. The Agency that handles planning of the overall constitution has to see that these different attitudes or requirements are well co-ordinated.

9. Administrative Methods:

The works to be constructed may be by an individual for his own use or by the State for the use of the people of the State. Hence the process of operation of construction businesses varies depending on the number of participants and their approach to the construction activity, materials, finance and construction methods adopted.

(i) In small hamlets: A private owner who wants to build his own house makes use of the local material like earth, grass, bamboos and local timber, etc., and the construction is carried out by the owner himself and his family. In bigger villages or rural areas, local carpenters and masons are engaged. In this area the mason or the carpenter usually evolves his own design and becomes a planner for the house. In many of the towns an experienced mason becomes the contractor, who takes over the overall management. He arranges material, men, gives the plan and carries out the entire work. This same method applies to the digging of wells or land improvement or irrigation feeder canals to the fields.

(ii) In bigger towns, having municipal status, the building plans have to be approached by a chartered engineer or architect before sanction is given for construction. In such areas quite a number of experienced contractors, who are either graduate engineers or qualified overseers or retired people from the Government engineering services act as consultants or Contractors and do the entire work. The purchase of materials, and the arrangement of men is usually done by the contractor. In bigger cities the architect prepares the design after discussing with the owner or user. He obtains a sanction from the local authority, the municipality or the corporation as the case may be. He may then invite bids from local contractors, allot the work on negotiated rates to one of the contractors known to him. He supervises the work, certifies the bills and gets the structure completed.

(iii) The co-operative type of construction is nowadays adopted for the multi-storied building. Here the promoter invites people in need of housing to form a co-operative society. He acts as a promoter and/or manager. He will partly finance the work, and collect money in instalments from members of that Co-operative Society and get the construction of building completed. He may engage architects and consultants also.

(iv) Housing Boards, Life Insurance Corporations and Urban Development Councils are playing a rapidly increasing part in housing for low income groups. Here financing is done by these authorities, and land belonging to the Government is developed into a Community area. Buildings are constructed in a modular system and after the entire building is ready, it is then sold out-right or given on instalment basis either against security of insurance or, in the case of the Government employees on loans against Provident Funds. Some Industrial houses give loans to their employees at a low interest rate repayable in easy instalments, so that they can own their own homes. It can thus be seen that in a vast country like India, housing development is moving forward steadily from the primitive dwellings to the most modern buildings.

(v) In the case of factories the situation is quite different. In large factories, the design for the factory building and layout varies depending on the location, type of factory and the process adopted. It may so happen that the factory has a foreign collaboration and foreign technical know-how being involved, the foreign consultant will have a say in the layout. Once the factory layout is finalized, the preparation of drawings, details etc., is done by the local consultants or the engineering department of the company, or the Government. In such cases usually a limited number of bids or contracts are negotiated with builders known to the factory owners or consulting engineers. The work is not always awarded to the lowest bidder. In the case of public sector factories, tenders are invited in the normal bureaucratic Governmental pattern, and work awarded to lowest bidder.

(iv) In the case of construction of irrigation works, ports, harbours, transport, shipyards, airfields etc., the procedures are entirely different. These are undertaken by the Government either State or Federal. The investigation, survey, feasibility studies both technical

and financial, are undertaken by the appropriate Government Departments. On the basis of this data, the general layout plan of the particular project is made out. In this case, the local bodies, the Central Government, the State Government service departments like geological survey, communications and electric water supply departments, railway usually also come into picture. All these factors control the construction processes methods to be adopted on the project. Tender documents containing specifications, terms and conditions and drawings are prepared by the Department entrusted with the execution of the project. Bids are invited and between one month and three months time is allowed to the bidders for their investigations and preparation of bids. The bids are expected to conform to the specifications laid down and contain all technical information. After the bids are opened, a comparative analysis of the bids is made and usually the lowest bid is accepted, irrespective of whether he is competent or not.

(vii) In highways, bridges and port constructions, water supply, treatment works and other specialized works the owner may ask contractors to bid on a turn key basis i.e. including the design and construction based on the requirements of the owner. The entire responsibility for design and construction at a fixed or lump sum price then rests with the contractor, who has the necessary engineering skill and who can co-ordinate specialists and equipment supplies. In such cases the work is awarded after discussing with the two or three of the low bidders to ascertain the soundness of the contractor's proposal and the overall cost.

(viii) Maintenance work execution varies both in financial allocation and methods of execution depending on the agency owning or undertaking the maintenance work and the structure. The maintenance costs are fixed either as a percentage of the cost of the structure or based on the experiences on similiar structures. The central Public Works Department gets about 55% of the maintenance work done through contractors and the rest departmentally. The Railways carry out all works within their department. The practice with some State Governments is to get the work done through contracts, in Military Engineering Service about 68% through contracts and the rest departmentally.

Where the maintenance work is carried out through contracts, the system of contracts varies. In some cases a term contract on a zonal basis is entered into and requisitions placed from time to time. In other cases contracts are for particular work. The trend is to get normal maintenance programmes executed through contracting agencies and ad hoc repairs departmentally.

10. Non availability of Data and Statistics on Construction:

Data statistics in construction are scanty on account of the special characteristics of the construction activity in the country.

- (a) Even though so many participants are involved, scant attention is paid by most of them to the important aspect of the construction for the fast economic and social development. There are no defined targets for construction in National Plans.
- (b) In India, the construction industry is not well defined. It is often difficult to clearly identify what is construction because, as stated earlier, it covers activities from building a small hut, to building a sophisticated Nuclear Power station. Data and statistics for construction activity are not available nor serious attempts made to collect them by proper definitions and introduction of norms.
- (c) The construction activity is carried out by a number of agencies right from a individual on his own to a group of men, for a village administrative council to the central Government. It may be for changing a floor tile of small building or maintenance of a dam, or a canal system.
- (d) There is over-lapping of authority of controlling, sanctioning, executing and using and as such collection of statistics is difficult. The agencies that undertake actual construction also are not properly organized. The agencies may be from an individual worker himself to a huge public limited firm, from a small sub-contractor or tradesman to a big department of the Government.
- (e) Even though construction work has been carried out by contracting firms for a long time, there is no effective and proper organizations that exist do not work for the industry as a whole. The interest of their individual members are given more importance than the interest of the industry as a whole.

- (f) the professional institutes of technical men connected with construction have not given serious thought to the construction industry. They have mostly engaged themselves in the design and research aspects but not in construction aspects, and problems of the construction industry.
- (g) The construction activity is mobile. As soon as a work is over, the construction agency is either would up or moves to a new construction site. It is also seasonal. The demand for construction materials and labour varies according to demands of the construction activity generated by the different sectors of national development.
- (h) On account of the contract system of work, and its seasonal nature, the labour front in construction has not been organized. There is no comprehensive legislation also to protect the labour force.

#### IV. MAJOR COMPONENTS OF CONSTRUCTION INDUSTRY AND THEIR PRESENT STATUS AND TRENDS.

11. The major components of the Construction Industry are:

- i) materials
- ii) machinery
- iii) man-power and
- iv) finance

which may be considered as direct inputs. The supporting industries such as the manufacturers and processers of machinery and materials, and the supporting institutions like educational and research, form the indirect inputs.

All these aspects of the construction industry should be given adequate consideration in planning the economic strategy and has to be done at District level plans for success of any development plans.

#### 12. Building materials (industry and present position in the Country):

The material inputs are in the form of earth or soil, rock, bricks and clay products, lime cement, puzzolans, wood-based hardboards, steel, plastics glass, ceramics, hard-ware, aluminium, brass-fitting, electrical goods and so on. As stated earlier, the type of material used or the quantities put in vary depending on the development in the particular material, climatic conditions, technical skill available and the

finances. Construction forms 45% to 60% of fixed capital formation. Of this amount building materials account for between 55% to 75% of the total value of construction. Thus the building materials industry is very closely connected with the process of development of construction industry. Materials like clay products, rock and aggregates, bricks, lime and cement, timber and steel are the basic building materials constituting anything between 50% to 80% of the total materials used depending on the structure.

The other materials are still imported even though they may not be used in large quantities, shortage of them may affect very critically many construction works.

i) Local production or production at zonal centers: In a vast country like India, with different climatic conditions, natural resources, technical skill and cultural and historical background, the types of materials vary. The usage of materials also varies according to the State of Construction. In many cases the building materials industry and the construction industry cannot be separated, particularly when the construction agency itself manufactures the building materials at site. Construction materials being bulky, invariably the use of local materials are preferred or production at site is undertaken. But special building materials cannot be made locally and have necessarily to be transported. Such items are hardware, glass, cement, wood, steel and other metal products. In such cases production centres should be specified to serve the particular surrounding area to avoid transport costs. Even in the use of bricks, ceramics, lime and other clay products, the local production cannot be adjusted to varying construction outputs. These will create complication in investment, labour layoffs, and development. In these cases also, it may be worthwhile to have production centres where quantity and quality could be controlled and cost could come down on account of mass production. These centres would take care of variation in construction volume in different parts of the zone to which these centres supply. Since most building materials are bulky and have a high volume-weight ratio, which controls the transport cost, it is necessary to seek out the overall optimum cost

to decide whether to produce locally or at the zonal centre and how big the zone would be.

For any successful implementation of economical and timely construction of the planning of construction material production and where it should be carried out is vital.

ii) Alternate material selection on final cost analysis:

Another aspect is the adoption of alternate materials to serve the requirements. There are cases where stone materials are transported over a distance of 300/350 kms. on railways for river protection works where concrete blocks made from local sand and local river bed aggregate could be used. If proper planning and cost analysis is done in such a case it would be evident that there is no difference in ultimate cost. Similiar cases arise in selection of aggregates for concrete manufacture, whether to have local aggregates even though some extra cement is needed to obtain the strength or to transport it from long distance only on superficial consideration of excessive cost of cement. In such a case it would be prudent to work out designs and carry out tests to find out the economical solution. The final costs has to take into account the road transport bottle-necks, different authorities and local Governments involved and the hold ups thereof. Hence a proper evaluation of final cost in place of the material is very essential for proper utilization and planning of building materials.

iii) Demand and supply of building materials: The problems involved were not a matter of serious study and planning till the end of the Indian Second Plan Period. The National Building Organization made a good start on estimation of material requirements during the Fourth Plan as per Annexure 3. The advance approximate estimates of fifth Five Year Plan are shown in Annexure 4.

iv) New materials od construction are being developed as conventional materials only, will not be sufficient, for example modern clay products such as high strength bricks, perforated bricks are being considered. These would be produced only by mechanical means. Number of factories are being set up in all parts of the country. Similiar is the case with sand-lime bricks in Kerala. Cellular bricks and panels using lime and fly ash are produced in Madras and another factory is coming up in West Bengal. One plant



\* using the Swedish "Siporex" process is established in Poona. The Hindustan Housing Factory of the Government of India is making light-weight concrete blocks. Wood based panel products to overcome shortage of timber are being taken up in different parts of the country. Asphaltic corrugated sheets for low cost housing have been developed and production started in three factories. Plastic products are replacing building hardware, piping for sanitary water supply, hand rails and in floor tiles, and so on. The use of deformed steel bars to save steel in reinforced concrete is being encouraged.

### 13. Construction tools, plant and machinery:

Construction activity in this vast country being in all stages of development, varied types of equipment and tools are in use.

- i. Hand tools: Hand tools are made in the country for a long time and there has been no improvement. Wheel carts and wheel barrows have been in use only lately but are not very common. Head load method of conveyance of materials in baskets is used extensively in most of the building operations and even for carrying earth and concrete.
- ii. Animal power: In many parts of the country, donkeys, mules and camels are used for transport of material like bricks, sand, earth. They were used for earth consolidation also in the early days.
- iii. Hand operated machines: The hand operated tabkles have been used, and are now in use in many parts of the country for hoisting materials, sinking of tube wells, pile driving, erection etc.
- iv. Power driven construction plant and equipment could be broadly classified into two categories.
  - (a) Buildings.
  - (b) Other civil engineering works.

The plant for building construction is not heavy or varied whereas for Civil Engineering Works where heavy transport of materials and different operations are involved the equipment is specialized.

iv. (a) Plant on buildings: for most dwelling houses and not too-high buildings the only plant used is a concrete mixer, material hoist, pump for dewatering and mortar mills if lime is used. As taller buildings started coming in, the use of Tower Crane and Travelling Cranes became necessary. Tower Cranes have facilitated the introduction of precast construction techniques, as heavier units can be handled.

Tower Cranes are of recent origin and the use of these on tall buildings has changed the concept of building construction and time schedules required.

v. (a) Construction plant and machinery in civil engineering works:

The plant and equipment used for construction ranges from a small concrete mixer or a motor mill to a excavator, hauling and concrete placing units, stone crushing and aggregate processing plants, automatic concrete batching and mixing plants, equipment like cableways, cranes beltcrete etc. In the early days even pumps and concrete mixers of small capacity were being imported. Now most of the small construction plant like pumps, vibrators, concrete mixers, mortar mills, builders hoist, scaffolding, winches are all being manufactured in India. They are available in different sizes with either electric or diesel drive.

(b) Heavy construction plant and equipment:

The employment of equipment depended on factors like skill, education level and service facilities available for operation of the equipment and the overall development in different sectors.

Some construction equipment and mining equipment brought in the earlier days was mostly steam operated. Some of them can still be seen in some parts of the country.

With the advent of industrialization and the agricultural revolution, Irrigation and Hydro-Electric Projects such as Bhakra Nangal, D.V.C. and Rihand, Steel Plants, Fertiliser factories, and Refineries were taken up and equipment started coming into the country. Many of these projects were taken up with technical and financial assistance from developed countries and International Aid Organizations and United Nations agencies. The report of the construction plant and machinery committee of 1954 states "The mechanization of projects is a new sphere in which Indian engineers are not yet fully oriented. It should be realized that we are attempting to adopt 1953 techniques in this country with a background which is 50 years behind the times in the countries we try to follow. The entire approach is in a process of evolution." Until 1948 there was scarcely any heavy earth moving equipment in India whereas in 1954, its value was of Rs. 400 million. After independence in India there was a great pressure for development in all fields. But there was no definite programme of selection or manufacture of heavy equipment. The equipment then available was mostly left over by the allies after the Second World War. Hence a definite

policy could not be laid down for equipment imports as to type of equipment, standardisation, training of manpower, or spare parts. This was on account of the varied types of equipment under different stages of development coming into the country depending on the agency that was giving aid or loan or technical advice. The different types of equipment from different countries gave rise to a problems of foreign exchange requirement later for spare parts with the result the utilization factor was very low.

Another aspect is the scarcity of foreign exchange available to such a vast country, to cover so many fields of development. So a large number of smaller items of equipment spread over number of development projects, would seem to be the better solution, rather than going in for a lesser number of big and sophisticated units which may be locked up in only a few projects. Even now in all parts of the country the technical skill has not yet improved to handle such sophisticated equipment. The auxiliary industries also have not developed so fast. Metallurgy is still at a low stage of development. The sizes of the units have to be considered in the overall economics depending on planned indigenous manufacture of such equipment in the country.

The export market to less developed countries and the marketable products in these countries and the technical skill the country can easily spare for such countries has to be also a guide line in taking up the manufacture of indigenous equipments.

Earth moving equipment were almost unknown in the country up to 1930 except for small wheel tractors used for agriculture purposes. It has now all assorted makes and types and sizes of earth moving equipments. The indigenous manufacture of earth moving equipment has started and the country is self sufficient in this (see Annexure 5).

(i) Automatic mixing and batching plants: There are very few fully automated mixing and batching plants. The total number of plants may be about ten, all of them were imported.

(ii) Crushing Plants: Earlier the large crushing plants needed for mining and irrigation and hydro electric projects were being imported, capacities varying from 100 tons to 800 tons per hour. Gyratory crushers for primary, and gyrospheres for secondary crushing and rod mills for sand processing were imported during 1950-60.

No new plant has been added of late. Crushing plant of smaller capacities making use of jaw crushers of smaller sized manually fed are numerous in the country. Even though these were being imported earlier, the country now produces sufficient number of crushers of different sizes the maximum being with opening of 15" x 30". Gyratory and gyrasphere crushers are now being manufactured in India.

(iii) Aggregate processing plants: These were being imported earlier. Now there is enough capacity as well as know-how to design and manufacture the aggregate processing plant consisting of screens, conveyors and elevators.

(iv) Concrete placement equipment: For the large dams trestles and cranes have been used since 1954. These were imported earlier either new or second hand from the U.S.A. Now, cranes are manufactured in India to local requirements. Blinding or cableways were always used for concrete placement. These are imported. There are about 12 cableways in the country of capacities ranging from 5 ton to 20 ton capacity and from 1000 to 3000 foot spans. These were all imported. No cableway has been imported in the last 8 to 10 years and the available cableways are being utilized on different projects by suitable modification.

(v) In tunnel equipment, even though earlier all items were being imported, during last 5 to 6 years many of the equipments have been made in the country. The tunnelling mole has not yet been brought to India.

Current extent of manufacture in India of major construction equipment and the range and numbers is indicated in Annexure 6.

14. **Man Power:** Construction Industry, as stated earlier is labour intensive and the employment potential is great but it has its own special nature.

(i) Special nature of Construction employment:

Construction work is essentially a contract work. The term of employment is purely temporary and no one can be sure of retention beyond the contract period. There is a constant change in working sites both for the employer and employees. Everyone moves away immediately after the job is over.

The construction operations are seasonal. The volume and intensity of work depends on the climate and vagaries of nature. The employment is casual as on any construction work. All the different

works and process cannot take place at the same time, or continue together for long intervals, so employment is restricted only to the duration of that activity. Employees work in groups and work measurement and payment is made also mostly on a group basis. Compensation for work is always in cash, and no other benefits are usually available to any one. This is particularly so for unskilled workers with the result that the unskilled workers have maintained their land and village ties to be able to return to them when necessary. Due to low wages, and piece rate system of payment, workers encourage their women folk and children also to join them in increasing the output and consider it as a family assignment. The recruitment is mostly through intermediaries and not direct employment.

(ii) Volume and pattern of construction employment:

The data available on the employment aspect of construction is scanty. The one comprehensive source which gives some idea of the employment in construction activity is the decennial census of population. As per the 1951 census, out of 139.4 million workers about 1.3 million or 0.93 percent are shown as employed in construction. The figures for 1961 are 187 million, 2.1 million or 1.1 percent respectively and the provisional figure for the 1971 census is 1.23 percent (see annexure 7).

It may be of interest to note what the UNIDO Monograph on Construction Industry has to observe on this problem of data on Construction employment.

"Statistics for less developed countries are less accurate than those for industrialized; further more, they are not likely to cover the considerable construction activity that occurs in the subsistence sector of the economy. There are no reliable estimates of the number of self employed and "do it yourself" builders. Even in industrialized countries much construction work is carried out in this way. Thus in the United Kingdom it has been estimated that 10 percent of total construction output and approximately 30 percent of all maintenance work, particularly of current maintenance and repairs, take place outside the construction industry".

(iii) Seasonal and casual nature of employment:

The construction employment is seasonal and casual. The volume with intensity depends on the climate and vagaries of nature.

This is particularly so in irrigation and road works and may not be so pronounced in building activity. A construction project has different works and processes all of which may not take place at the same time or continue together for long intervals. In the case of a building or a bridge or a dam, the excavation of foundations has to be completed first before the superstructure starts. Every different item of work such as excavation, masonry, concreting, reinforcement work, wood work finishing, are carried out by different workers and their employment is restricted only to the duration of that activity. The situation is the same whether the particular work is carried out by labour intensive or mechanized methods or a combination of both. A field investigation by S.N. Guha Thakurta shows that on an average the skilled workers in construction industry are employed for 9.3 months and the unskilled workers for 7.5 months in a year. The rest of the year they may have to seek non-construction jobs or remain unemployed. The casualness and seasonal nature can be seen from the number of men employed on different types of work. (see annexure 8).

(iv) Building trades and training of construction workers:

There was no organized of training in construction skills. Mostly it was hereditary, on a father to son basis. As the volume of work load increased the construction agencies also started their own training programmes for apprentices, training and helpers under each trade. Almost every district in the country has a Government training institute or centre for craftsmen. Special talents in building trades have developed in different parts of the country. The Southern States, Gujarat and special skills in masonry have developed as buildings, bridges and dams are usually built there in stone. Similarly the technique of tunnelling and handling of tunnelling machinery. In north India, where stone is costly and brick work is common, and the bricklayers are highly skilled. Of course the mobility of the labour has now increased and on any big project one can see construction workers from all parts of the country doing different specialized items of works.

(v) Wage structure of construction workers: In general the wage level is lower than the organized industrial section. The construction worker, particularly the unskilled which form the major part, was drawn from the agricultural sector. The wage level of

construction was higher than agriculture. In addition for the agricultural worker construction work was a supplementary work and extra earning opportunity. Now there are safe-guards being sought for the agriculture labourer, and his wage level is increasing.

Skilled workers originally were the masons, carpenters and blacksmiths in rural areas, and for them also construction work was a complimentary work. But now with increasing construction volume, speed, techniques, processes, material and mechanization, being developed, more and more skilled workers and different craftsmen or tradesmen are coming into the construction industry. The skills and trades in both construction and industry are becoming similar such as welders, electricians, and machine operators. The construction agencies will have to offer better wages to draw them to project areas where the worker has to work under difficult conditions, away from his home town, in a place where he has to build up amenities for others, at the cost of his own living conditions.

In general, the wages of a skilled worker is about one and half times to twice that of an unskilled worker. The highly skilled may earn even 2 to 3 times the unskilled. The wage level of an unskilled worker varies in different parts of the country but is now mostly between Rs. 2.50 and 3.00 per day. The ratios of skilled workers to unskilled workers in construction works are shown in annexure 9.

(vi) Labour laws and the construction workers:

There is no comprehensive labour legislation to govern and control the overall aspects of construction employment and the worker. The nature of the employment being seasonal, casual, temporary uncertain, and unorganized, construction labour was not able to muster a strong front to fight for better conditions, unlike workers in other more organized sectors of industry. In the developed countries, organized construction labour is a big force and has a great bargaining power. The wage rise is much higher than in other sectors. The construction agencies in India on account of their peculiar nature of business with time-bound and rate-bound contracts with heavy penalty clauses are forced to accept higher wage demands. It is now being realized that the industry cannot bear the burden, and this trend has given rise to low productivity and high demand for overtime. This trend is seen wherever strong Unions have been formed in the construction agencies like the National Project Construction Corporation and Building Department of Public Sector Undertakings and some well

established private construction firms like The Hindustan Construction Co. Ltd.

In general in India, the various Unions of industrial workers are sponsored, lead or guided by one of the political parties. In the construction field, because of its special nature no political party has taken much interest. Construction workers are casual and the activity in any particular area being for a small period, the politician is not interested in these workers as they do not form any electorate voting strength. But in some States, the construction workers of the Government organization and building trade have been taken care of by the political parties.

On account of these reasons the construction activity is not under any comprehensive Labour Law. There are as many as fifteen laws and acts, which could be made applicable to a construction site. When all these acts and laws, each of which is made specially for a particular type of worker, are made applicable to a construction site there is considerable confusion and conflict. The protection and benefits offered by the various laws such as wage scales, overtime, leave, provident fund, gratuity and protective wear are different even for workers of the same trade. The mobility of the worker to different sections of work becomes difficult. There are pressures built up to get the best of all acts. There are cases where the construction agency will make full use of this complexity of law and not make any provisions of law applicable to its workers and then exploit the labour. This is particularly so in case of small works and housing and building sector of the industry. Because of the number of laws, enforcement is difficult. So where the unions are strong and organized as in the big private construction companies or Government construction agencies the managements are put under pressure and fully exploited, and where it is a case of small works with no organized labour force the workers are fully exploited and in both cases the construction activity or industry is ultimately the loser.

#### 15. Finance

The problem of finding adequate finances at reasonable terms has been one of the main difficulties faced by the construction industry in India and this has been appreciated by a study group of the Planning Commission.



At present the construction agencies obtain finance mostly from private parties at exorbitant rates of interests. As construction is not treated as an 'industry' and contractors are looked upon as traders, banks do not give loans or permit advances against fixed assets as security. The development of the construction industry is very necessary with the increased outlays in plans, measures have to be adopted to afford financial assistance to the construction industry.

(1) Present facilities available:

The financial facilities available to the construction agencies vary according to the type of the construction agencies.

(a) Public limited. Joint Stock Construction Companies

These companies are able to secure financial arrangements as under:

(i) Borrowing from their Bankers against immovable and movable assets, but this is only available to a limited extent as fixed assets are far less than movable assets.

(ii) Ad hoc advance payments from the owners or the clients against machinery and plant brought to site, amounts limited to maximum 5 to 10% of the contract value and advance against non-perishable material brought to site to the extent of 50% to 75% of the value of the material.

(iii) Their own working capital.

(iv) "Private" deposits with high rates of interests and for short periods.

(b) Partnership and proprietary concerns: In the case of partnership and proprietary concerns finances are arranged mostly from private loans at exorbitant rates of interests and there are only limited resources. Generally banks do not finance such concerns.

(2) Measures that are being taken considering that a very limited amount of finance is available from the Banks or the Owners end also the difficulty of raising funds on reasonable terms from other sources.

(a) Short terms measures by way of advance payments to contractors working for Central Governments departments, Public Sector bodies, autonomous bodies, etc. against:

(i) supply of acceptable non-perishable material brought to site and not incorporated in the work;

- (ii) Bank Guarantees or idemnity bonds from insurance companies;
- (iii) machinery and plant brought to site;
- (iv) excavation, preliminary items of work, labour camps, site offices, foundation for equipment.

The amount to be paid against each or all could be limited to a percentage of the entire contract value depending on the type of work and the method of construction either manual or mechanized, to avoid blockage of maney and to afford liquid cash to the construction agencies. Earnest money, security deposit, retention deposits should be in terms of bank guarantees or bonds from Insurance Companies. A Committee of the Planning Commission which went into standard forms of contracts for construction works have suggested some of these short term measures to be incorporated in the standard contract documents.

(b) Long terns arrangement are also necessary as the existing financial institutions such as the Industrial Development Bank, Industrial Finance Corporation, Industrial Credit Investment Corporation, National Institute of Development Corporation, State Financial Corporation, do not cater to the needs of the construction industry as they do not treat construction as an industry. Even though there are special institutions like Agricultural Re-finance Corporation, Agricultural Export, Credit and Guarantee Corporation, Industrial Reconstruction Corporation, Rural Electrification Corporation, Smaller Firms Development Agencies, and many such financial institutions to cater to the needs of other sectors of national development, special financial institutions to cater for the construction industry, have not been established. Hence a Committee of the Planning Commission has suggested that a Construction Finance Corporation should be set up to cater to the need of this industry. If a construction finance corporation is established for the benefit of contractors engaged in construction, construction material industries and even consulting engineers, it will help in establishment of a more economically and financially sound construction industry in the country.

By providing funds both for short and long-term periods the Construction Financial Corporation would help in mechanization in certain fields of construction which are essential in the interest of economy, and also to its speeding-up. This will also bring down the cost at the present financing is done by raising loans at interests ranging from 15% to 24%. It will also help the economic growth. How exactly the Finance

Corporation will advance and the mode of advance and the guarantees required by the Corporation are details that have yet to be worked out and are under study.

V. GOVERNMENT AND PRIVATE CONSTRUCTION AGENCIES:

16. In general, it can be said that in terms of technical competency, and know-how indigenous talent is fully available, except in some specialized fields where special plants and techniques have to be imported. The successful execution of construction activity involving large scale, and huge and complex structures during the previous plan periods have infused great confidence in Indian construction agencies, both private and public. The owners in most of the cases, except for buildings and factories, are Government either Central or State. The main volume of construction is carried out mostly by private construction agencies. The Government also has its own construction firms in the public sector as well as departmental agencies, to carry out the works. However, even the private sector construction firms as well as Government departments do not directly carry out the works but employ contractors either big or small. So, whether it is Government agency or a private agency, the problems faced are common to the construction activity as such. Previously, the role of the Government and the effect of Government policies on the construction processing has been dealt with. The relationship and co-operation between the Government and the private institutions dealing with construction require more detailed study, since most of the construction industry is in the hands of the private construction agencies.

17. Development of private construction agencies:

The construction activity is spread throughout the country from the smallest village to a big city. The smallest unit consists of a mukadam or a headman, heading a team of 5 to 20 workers either skilled or unskilled. The big units are well established corporate bodies employing several engineers, technical supervisory personnel, skilled and unskilled workers, and also own heavy and the more sophisticated construction equipment. The general term "contractor" covers any construction agency covered under these two extremes. On account of a very wide gap, and its regionwise and statewide distribution, the construction activity remains substantially an unorganized industry. It has failed to acquire its rightful place in the nation; even though this activity is contributing so much for the Fixed Capital formation

of the nation and to its growth. Another aspect already mentioned is that construction activity extends from a simple dwelling to the sophisticated Nuclear station or a massive Dam structure. The private construction agencies could be broadly classified into those dealing with buildings involving small dwelling to multi-storey and townships on the one hand, and other civil engineering works involving all other construction activities like ports, highways, bridges, dams, power stations, airports, open marine works and dredging on the other. The duration of construction activity on any work lasts a few months or a few years. So, in many cases the life of local private construction agency is that of the construction activity it undertakes unless it develops into an organization to take up further work. Some firms operate statewide, and a very few on the All-India basis.

(a) The contractor, that is whosoever is interested to take up the construction contract can register with the authority who assign works. Mostly all works are for Government or quasi-Government or local bodies. Here the system is that a registration is necessary according to the value of work the agency can handle or rather intends to handle.

Tendering authority in case of private sector construction is the owner himself or the architect or consulting engineer who handles the work on the behalf of the owner. The general rules made by the authorities were meant for works where no capital equipment was envisaged, as mostly the work undertaken was fully labour oriented or even in some small plant was needed, it was made available by the owner, namely the Government. So, if a contractor could raise 10% to 15 % finance he could easily carry out the work equivalent to 5 to 8 times his initial investment. The money was received mostly from private money lenders. But this situation has changed now with the advent of long duration work, wherein more technical skills and new sophisticated tools and equipment are needed. The owner, who was the Government, was able to give the plant and tools when the works were not so many and the volume handled was less. Now with so much construction going on, it is finding it difficult and is encouraging the contractor to provide these. Hence it is necessary at this stage to identify the expressions "contractor" and "construction industry". A fundamental distinction must be made between contractors who are engaged on real estate and buildings and the well established construction firm in organized or corporate sector. Those engaged in civil engineering construction as a whole, rather than only in real

estate and buildings, must be considered as constructors rather than contractors. But it must also be mentioned, that there is no suitable word to describe them other than 'contractor'.

This word 'contractor' is so compact in conveying the complete sense of undertaking the obligations to carry out certain works, at a pre-determined price, within specified time, conforming to specifications and conditions with all its legal and penal provisions when a contract is entered into by a 'constructor' with the 'owner'. Contracting firms of All-India standing are few. There are many well-known small firms of contractors doing building works in the different states and major cities.

Some of the construction firms working on All-India basis can handle any type of civil engineering works. (Annexure 10 gives an idea of this aspect).

(b) One special feature of Indian construction firms is that there are very few joint ventures taken up by a combination of firms as in United States or Europe. The construction firms handle single contracts valued about Rs. 250 to Rs. 300 million. Some well known construction firms have a well trained and qualified engineering personnel, management personnel and technicians and skilled labour, and their services are utilized all over the country from job to job. Such firms own their own heavy construction equipments. On any big project, the construction firm does all works itself, from setting up of camps to production of aggregates, electric supply through to completion. In a joint venture, the main contractor need not build up all men and equipment. This also spreads the risk among many. The risks are less as specialist firms in their own lines handle different aspects of the job. Another problem that arises for a contractor operating on All-India basis is the question of accomodation at job sites for all personnel and famalies. In jobs of longer duration, provision of family accomodation is a must. This in turn calls for other facilities such as schools, and big hospitals with maternity wards. Since workers are drawn from all parts of the country their food habits are different and the running of common messes are not head cost of construction agencies. The Government can well reduce this burden by building compact model townships near to major projects both for its own personnel and contractors' which could be well utilized later for rehabilitating the people of the area.

(c) Institutions to voice the contractors problems are few:

The private construction companies have not been able to join hands and better their status and solve their problems with the Government. There are many small associations of contractors' in different States or for different Government Departments but they are not very effective. There is the All-India body "The Builders purpose and is getting the recognition of the Government and other authorities.

(d) The methods of tendering and construction that are being followed even now, were suitable when works were not so sophisticated and were small in nature and magnitude, and time schedules were not so tight. The contracts were probably suitable when wages and price rises was more suitable.

Now things have changed but the conditions of contract have not. Even though the Planning Commission brought out a revised standard contract form it is not yet implemented anywhere in spite of changed conditions, although heavy construction works will be involved in the ensuing plan of the country. The works are becoming more and more capital-intensive and financing has become difficult.

18. Problems of private construction industry: that are brought out by the private construction agencies through their associations and individually are:

(i) Constriction an an 'industry':

'Construction' which is now treated as a 'trade' must be recognized as 'industry'. Construction companies are not deemed to fall within the statutory definition of Industrial companies to which certain privileges and concessions in taxation, import regulations, and other matters are applicable. The inclusion of the construction activity as a 'priority industry' under Industrial Development Bank of India Act is voiced by the construction men. It has been said that this will have a salutary effect when this field of basic economic activity is taken under the preview of 'Priority Industry' which will give to it a status to attract more young educated entrepreneurs. The nature of the industry is changing with its high content of material and labour and of late involvement of construction equipment. This should put it on a par with any other industry in its financial operations. Construction also contributes the greatest share in capital formation of the country. Thus with all these changed conditions, when small scale

industries are also covered under priority industries, one may ask why not 'Construction'?

(ii) Financial institutions and private construction agencies:

In the absence of any credit policy applicable to this industry, there is almost no opening with banks and financial institutions to serve the construction activity in the country.

(a) There are 3 stages at which the contractor requires finance viz:

- (i) Registration fees - "Earnest" money;
- (ii) Security deposit or retention deposit;
- (iii) Procurement of plant and equipment and working capital for contract execution.

(b) The owners, the banks and financial institutions should be able to help in these by adopting uniform codes for Bank Guarantees and insurance fidelity bonds instead of cash deposits;

(c) The registration fee and earnest money for each contract could be avoided by introducing a central registration system. This would help reduce the lock-up of finance;

(d) At present some of the manufacturers enjoy the facilities of the Industrial Development Bank Scheme to sell machinery on deferred payment basis with reasonable interest rates. This facility is available only to certain heavy-earth moving machinery. This facility should be extended to other construction equipment and vehicles so that it will be of help to improve the methods of working of medium and small size contractors also;

(d) Another problem is financing the contract itself. Tight money conditions deprive contractors the facility of even the short term credits from suppliers and manufacturers of construction materials, stores and spares. This is particularly so with nationalized industries like steel, oil, cement etc. Even on equipment the nationalized industries ask for 20% to 30% advance payment with orders. This leads to heavy borrowings from private money lending agencies at exorbitant rates of interest which affects the contractor's efficiency and zeal for good work. So, it would be desirable for normal banking to provide channels/funds

on the contract. At the same time of registration the contractors could obtain the certificate of financial stability and establish the personal or institutional standing and solvency. Any contract or contracts he or the institution undertakes could be made over to the Bank and all bills and payment be routed through the Bank. The recoveries could be phased depending on the type of work and duration of contract.

(f) The financial problem to a great extent can be eased if the owners make timely payments and settle rates of extra items and stop unilateral deductions from the payments.

(g) The proper advance against machinery and plant and materials by the owners and proper phasing of recoveries also will help to a great extent. Even though in some big contracts these conditions are being accepted of late, it is not followed in all contracts. With the present day tight money conditions, ultimately it will help the owner himself in reducing ultimate costs if such methods are adopted.

(iii) Tendering procedures:

Problems in tendering is another valid complaint of construction agency, private or public, that the tender conditions are not always fair and sound. The following items may be mentioned that arises out of the tender procedures and documents.

(a) The tender papers are not prepared with due care and diligence as the clauses incorporated safe-guards only for the owner from all his own short comings.

(b) The soil conditions, sub-soil conditions, hydrology materials resources etc. are not properly investigated and proper data is not available in the tender documents, particularly the sub-soil data. The project has been undertaken after careful investigation by the owner and he is expected to have fully detailed and accurate information. This is often not given and contractor is asked to do his own investigation. This is not a practical proposition. Most of the disputes on contracts arise due to the wrong, vague or incomplete data provided by the owner in his contract specifications.

(c) The material requirements, and their availability are not estimated and planned by the owner or even for items of materials to be supplied by him. The delay in supplies like steel, cement sheet-piles, structural steel, electricity, land, quarry rights etc., retards progress but the conditions of contract do not hold the owner responsible. On the other hand, all such delays on owners



part also are made the responsibility of the contractor.

(d) In most of the cases, the projects are sanctioned with no proper investigation and model studies. After the work has been started the entire scope of work may be changed, making the contractor's plight extremely difficult as the contractor may not have technical know-how and skill and equipment for such work.

(e) The construction drawings are never ready in time. Changes in construction drawings is an accepted privilege of the owner. This again leads to claims and disputes.

(f) Since the contractor has to invest heavily on labour and equipment and finances, any delay on the part of the owner will put him to heavy loss. Delays on projects due to the owner not fulfilling his obligations, are on the increase every where.

(g) Any construction work involves the co-ordinated effort of so many Government departments, that the often lack of understanding of the problems involved, and co-ordination affects the work. Further the attitude that "it is after all the contractor who will suffer" has to undergo a change. In reality, the contractor is only a part of the entire system and ultimately Society and the Nation suffers, in an unfair and one-sided system.

(h) The contract conditions do not allow for escalation of wages and materials. This is particularly necessary in projects of duration of more than one year, as it is seen that Government policies on taxation, import and export, priorities, agriculture, and cost of living, affect the price so much. The escalation could be provided by introduction of suitable clauses based on cost of living and other index figures published by the State and Central Governments.

(iv) Labour laws for construction workers:

The labour laws have a great effect on construction, which is labour intensive and of a special nature.

(a) At present there are no comprehensive labour laws for construction works. Any big contractor on a project has to follow as many as 8 to 15 different labour laws enacted by state and central Governments. Each law has its own interpretation of the

applicability and interpretation of wages, leave and safety rules, etc. On a single project, different works are covered under different labour acts and laws and safety acts and rules. The fact that construction is of seasonal nature, varying labour load, is not taken cognisance of in the existing laws as most of the labour acts and laws are drawn up for established industries. It is also true that the absence of labour and safety laws included some contractors to exploit labour.

(b) The labour laws have also to take into account that the construction industry is an assembly industry. It involves the service of many specialists. This brings in the question of sub-contracting of different jobs. The sub-contracting is mostly in skilled trades. So, a group of workers are engaged as sub-contractors to perform a particular job in a particular time schedule at a particular price. The labour laws therefore have to take into consideration this special aspect of the construction activity. This has particular reference to the present contract labour abolition and regulation act. Of course, a regulation is necessary to safe-guard the interest of the workers under the sub-contractor, but its abolition is not warranted.

(c) There are no regional minimum wages or fair wages specified. Each Government department has its own wage structure which is given in tender document. So within a small area or even under the same project, where two or three Government Departments are involved the wages and conditions of employment vary. This created problems for the workers as well as contractors. So a well defined fair wage for a region, applicable to all departments must be established. This will avoid the exploitation of labour both by contractors as well as unions.

(v) Accepting lowest bid. The acceptance of the lowest bid irrespective of other consideration, such as experience and competence, is another problem. On account of the uncertainties mentioned above, a contractor has to gamble in his bidding rather than work out on a scientific basis allowing for known variables and risk and time schedules. This gambling may make his bid either too high or too low. If a contractor has a bitter experience of the problems enumerated earlier, he will try to cover himself against all these risks and then his bid tends to be too high.

The financial rules insist on the acceptance of lowest bid unless the accepting authority can justify otherwise. The lowest bidder may not be able to complete the work due to insolvency and the project will thus be prolonged and ultimately become costlier than the highest original bidder, if one could check this back. Most Government contracts throw a disproportionate share of the burden of unforeseen expenditure and risks on the contractors and in consequence tenders tend to be too high. All this could be avoided by proper tendering procedure, use of the system and of limited tenders to contractors selected by pre-qualification method.

19. Problems voiced by owners or clients about the private contractors agencies are that:

(a) "Normally the private contractor, except for a few who are well organized have no qualified men with them.

All contractors do not employ engineers and technically qualified men to carry on the works. Such cases however are now very few, at the insistence of the Government.

(b) The contractors do not attention to the planning of work and site and office management."

Site organization and management of a contractor play a big part. In some instances contractors have failed to understand the significance of technical know-how.

(c) The construction industry in India is not organized to the extent that it can normally apply Modern Management techniques like PERT, CPM, even for integrated complex projects."

(d) Haphazard construction practices are adopted which become responsible for failures of structures during construction."

Particular mention may be made of scaffolding, centering, framing and mixing and placing of concrete.

(e) "The failure on the part of the contractors men to understand and apply the code of practice is a frequent reason substandard work.

(f) "There is no code of ethics among the contractors".

"Their associations are not able to enforce this, with the result very unhealthy practices are adopted by many contractors, to the detriment of the contracting industry and profession itself."

(g) "The contractors have not paid attention to the welfare of the workers and their wage and living conditions".

(h) "The contractors exploit their labour."

(i) "Many contractors quote so low bids and try to make up by bad workmanship and use of sub-standard materials."

(j) "With the present scarcity of materials, the materials issued by the owners in trust are misused."

(k) "Not frequently the contractor agency acts merely as a middle man and sublets large portions of work and earns profit without making any proportionate contribution."

#### 20. Consultancy Services:

Indian consultancy services began to receive increasing encouragement with the formation and implementation of technologically oriented five-year plans. Under the first three 5 year plans Indian consultancy services came to be developed, but could not keep pace with the economic growth of the country because of the indiscriminate foreign collaboration arrangement under various Aid and Loan often insisted, or implied, employment of foreign consultants. The Indian engineers associated with such foreign consultants have gathered considerable experience in the course of planning and detail engineering of such major projects. Many foreign consulting firms trained Indian engineers in their offices of origin or their offices in India.

When the lessening of direct Aid programmes, and the foreign consultants started withdrawing, and the Indian engineers began organizing themselves into public and private consulting organizations. The Government also started encouraging the training of engineers in consultancy and have set up their own consulting organizations.

The State owned undertakings usually make use of their own organizational or departmental design and planning cells as consultancy services for the development or expansion of their schemes.

Since technology is changing very fast, there is bound to be costly delays if specialized jobs are not executed by specialist organizations with the expertise available in those special fields.

Most of the Ministries and Departments of Government however have not encouraged private Indian consulting agencies in their field of work. The utilization of services of independent consulting agency should not be considered however as a reflection on the working of the public departments. The departmental agencies have experiences limited to their own department, whereas a competent outside consulting agency will have a wider and more varied experience. A Government organization once it is set up, cannot readily be changed according to the needs of changing technological methods, and new blood infused without entailing heavy expenditure. If a competent consulting firm is selected, not on low-bid basis but solely on the basis of competency, the definite costs are known and there is no need to carry extra and may be later redundant personnel. The full utilization of consultancy services of construction agencies is essential for the development of construction technology. The consultancy services managed by construction agencies have an added advantage that the practical construction aspect is taken when formulating designs.

Indian private consultancy is being used for most of the building and factory works. The Government departments utilize and accept the designs of the consulting engineers or the construction agencies in case of bridges.

Of late, even the port and harbour authorities are asking for alternate designs from the contractors. In the field of Public Health i.e. water supply and treatment and sewage treatment and disposal the services of private consultancy agencies are being utilized more and more.

The Indian consultancy services are capable of rendering services to less developed countries as the technological development, skill material, material resources of the less developed countries in the areas match with that of India.

The Indian consultancy engineers have their own All-India forum called "The Association of Consulting Engineers (India)" which started in 1958.

#### 21. Construction Agencies in Public Sector:

The Government has set up under different Ministries public

sector construction agencies with the object of controlling costs, modernizing the construction and also and also to act as a check and guide to private construction agencies. The list of such undertakings and their activities are detailed in annexure 11.

22. Research Institute and organizations dealing with design and construction aspects are also mostly under the Government. The activities of such institutions are in annexure 12.

#### VI. CONCLUSIONS AND RECOMMENDATIONS:

23. Conclusions: In any developing country that has a socioeconomic aim in its development plans, construction accounts for a major share of expenditure. Construction programmes are interwoven in a great measure in all sectors of development of a country. It is estimated that construction both public and private sector accounts for about 50% of total outlay on plan expenditure.

Construction activity in India which has developed so rapidly in the four plan periods after independence has much to learn from developed countries and has much to give also to developing and under-developed countries. The country being so vast the construction activity, in its volume, method, approach modernity, in building materials and construction equipment can be discerned in all stages from medieval, through national to modern international. Even though construction activity is next only to agriculture in terms of inputs of finance, materials and man-power there has not been a co-ordinated and organized development of the construction activity. The reason lies in special characteristics of this activity. Construction is an implied activity of all sectors of National Development but it is not yet considered as an Industry essential for over all socio-economic development of the country. The volume and intensity of construction activity depends on the importance given to the different sectors in National development plans.

There is no regular and defined inputs as in the case of other industries.

Construction work is essentially a contract work. The terms of employment of the construction agency along with its men, material and finances are purely temporary and often no continuity can be foreseen beyond the contract period. This situation exist not only for private contracting and construction agencies but also to Governmental Organizations.

Construction activity is mobile. It is seasonal and casual depending on the vagaries of nature. The construction activity ranges from a small hutment to complicated and massive structures, from a self-employed builder to big private construction agencies and Government undertakings. The construction material requirements estimation, programming, planning has only recently been given the necessary importance. In the field of development, manufacture and use of new construction materials, much still needs to be done.

Construction tool and plant manufacture has gained momentum and most of the needs of the country can be met by indigenous manufacture except for special types of equipment. But the spare parts and after-sale service is not properly organized. The country has construction equipment of different makes and sizes from different countries and the spare part arrangement for the same, which involve foreign exchange, have created problems with the result that availability and use of these equipment is of low order. On the man-power front, on account of special of construction activity, there is no continuity of employment. The training programmes are not sufficient to create a team of construction workers that can work as combined tradesmen. There are no comprehensive labour laws. The wage structure is also not well defined. The labour is mostly agriculture and rural based. There are no strong organized labour unions as in other industries. The nature of contract work which is so inherent of construction activity has its own special problems in work force, labour laws, wage structure, etc. On the financial side there are no regular institutions to finance the construction industry, unlike other industries. There is a case for financial institutions and the owners to come forward to help in financing the construction industry if it has to develop and become efficient and economical in construction costs. The private construction industry which is the main stay of construction activity in the country is saddled with its own problems regarding of contractors registration, contracting procedures, conditions of contract that throw a disproportionate share of burden of unforeseen expenditure and risks on the contractor. The owners or clients on the other hand are faced with the problems about unrealistically low bids, non-standard work, disregard of specifications, non-observance of labour laws and safety rules by the construction agencies. There is a lack of proper

construction management personnel both in Government and private construction industry and for modernized and organized development, construction management personnel is essential.

Considering all these aspects the Planning Commission, the Builders Association and similar organizations have put forth a number of proposals for development of construction industry as it has a great part to play in the Fifth Five Year Plan and the plans ahead.

24. Recommendations:

The present development plans and successive plans will carry an almost 50% component in construction and an efficiently organized and modern construction industry can play a great part in relieving the strain on the nation's resources and in assisting large development programmes of a developing country.

In this connexion the following lines of action may be considered for intergrated construction activity.

(a) Preplanning: The most important aspect on any activity is preplanning within the total concept. Every construction project should be planned as completely as possible before its execution is begun so that essential requirements are not overlooked and physical targets are achieved phase by phase.

This is possible only if:

(i) Planning is done in the concept of a decade, five year, or one year plan.

(ii) Continuity in planning is maintained by data collection, and a time-table is set out for investigation, reports, designs, contracts, material assessment and so on.

(iii) Sufficient funds, men and time are available to preplan task forces.

(iv) Proper phasing of projects so that benefits accrue in phases from the earliest stage.

(v) The best talent and professional expertise in the country whether in Government or private industry, is made available to the planning "cell" so that major changes during the execution periods can be avoided or minimised.

(vi) Methodology to assess construction components of different sectors of the natural economy is developed. This will assist in pre-planning finance, construction materials, manpower and equipment and organizing to undertake construction.

(vii) Prior consultations are held with participants involved



in the project, as on any construction work there are several participants with different attitudes and approaches to the problem and any one can stop or delay the construction work during execution. Sufficient powers are to be given to the planning cell to be effective in dealing with all aspects.

(B) Designs and technology of construction:

- (i) Preparation of designs in detail well before embarking on construction is vital in order to ensure economic and orderly construction and speedy completion.
- (ii) There should be no hesitation on the part of the Government and semi-government agencies to make use of the consultancy agencies available in the country, particularly for works of special nature.
- (iii) The designs adopted should take into consideration the available construction resources like finance, material, technical skill and plant and equipment available, and it is no use designing the structure needing sophisticated know-how and materials or plant, which will have to be imported.
- (iv) Standard design criteria have to be formulated and adopted for all designs and construction. The Indian Standard Institute the Railways and the Road Congress have formulated the standards. There must be full co-ordination and collaboration among these organizations. The codes should be reviewed at an interval of 5 to 8 years and revised based on experience.
- (v) Standard National Builders Code that has been developed should be made applicable all over the country.
- (vi) The by-laws of local self-government are out-dated and widely different from place to place and so standard by-laws are necessary.
- (vii) If there is to be improvement and evolution in design and technology of construction, there should be better collaboration and communication of results and experience between various engineering, research and construction organizations, and a co-ordinating authority should be set-up.

(C) Construction materials:

As the cost of the building materials accounts for about 60%

to 70% of the total cost of any construction the assessment, development and production of building materials should receive the utmost attention. It may be worth considering setting up of construction material development corporation to deal with overall control and development.

- (i) From the construction component of each sector, the norms to assess construction material components have to be prepared.
- (ii) Construction materials assessment and development cell to be set up in every district and co-ordinating cells in States and centre.
- (iii) A greater degree of mechanization and research in the fields of manufacture of bricks, lime, clay products, pre-cast units to be undertaken, and in all aspects of quarrying, handling, transport etc.
- (iv) Economy and better utilization of steel.
- (v) Cement production and distribution, research and development of economical concrete design, use of puzzolona.
- (vi) Development of new materials using locally available raw materials.
- (vii) Timber being an important and scarce material greater attention to be given to treatment of secondary species, drift and hard-boards, ply-woods partition boards, etc.

(D) Finance.

In order to modernize construction activity, to speed up construction, to induce valuable competition, to draw in better qualified technical persons and lower construction costs, it is essential to adopt measure to provide financial assistance to construction. It is best done by giving the status of an Industry to the construction activity and treating it on par with other industries so that all financial and other statutory safe-guards available to industry are available to construction.

- (i) Short term finance by the Government or the clients out of the funds allotted to the project in the form of advances against materials, machinery, preliminary works etc., and phasing the recovery in such a way as not to affect the cash flow of the construction agency for running the job.

- (a) Advances against bank guarantees, insurance bonds etc.

(c) Accepting bank guarantees towards earnest money and security deposits etc.

These could be achieved by introducing these in the 'Contract form.'

(ii) Long term measures to comprise setting up of an independent construction finance corporation to advance finance for the development and expansion of the construction industry= in general and in particular to advance funds to construction firms and contractors, consulting engineering agencies and the building material industry.

E. Construction tools and equipment:

Mechnaization is vital for the development, modernization of construction. Unless measures are taken to reduce idle time and minimize under-utilization, expensive construction plant and equipment becomes uneconomical. The following measures should be considered.

(a) Not to permit imports of all types to and all makes of equipment from different countries. This leads to idle machinery due to lack of technical know-how in maintaining and operation of so many different types and also in arranging spares, particularly when foreign exchange is scarce.

(b) It is not in the interest of the country to import very sophisticated equipment which cannot be fully employed for its useful life.

(c) Indian machinery and equipment industry must turn out makes and sizes of equipment that can be utilized in any works and stock the standard spares and services built up so that individual user is required to have a large inventory of spares which tie up hard to get capital and may become a dead loss if equipment changes.

(d) It is unwise to embark on special equipment that are needed in small numbers. Such equipment should rather be imported.

(e) Proposals are made for setting up of equipment pools on commercial lines and on a zonal basis so that machinery is maintained scientifically and operation is efficient. This may

not be possible the existing set-up where so many authorities own equipment but a new unit will be necessary.

F. Construction Administration:

Construction is basically a 'contract' form of work; whether a private firm or public undertakings perform the construction. Even in the case of Governmental works, it may be piece work or task work, i.e. payment of work by measurement and not time rate. So, the 'contract form' is an important item that controls the development of construction.

(a) Different government departments use different contract forms. The present form throws on contractors an undue share of the risk for unforeseen conditions, terms of payment, settlement of disputes on inequitable terms and capital gets unduly locked up in the form of 'earnest' money and security and retention deposits. These need revision and the construction division of Planning Commission has brought out a stand and contract form which is yet to be adopted by all authorities.

(b) The specifications of items of work are not well defined. The use of I.S.I. Standard specification in all contracts will avoid confusion.

(c) The classification of contractors, the registration of contractors, the prequalification for contractors are essential in the overall interest of the construction as modern construction demands specialized techniques and modern methods of management.

(d) "Contracts should contain the specifications, the qualifications both general and special, bills of quantities, and authority delegated to the contractor in well defined terms so that there is no confusion, unnecessary disputes and stoppage of work.

G. Labour Laws:

It is not in the interest of industry to have so many conflicting labour laws as at present.

The Industry is labour intensive. It has its special characteristics. It is necessary that comprehensive labour laws to cover the construction industry be enacted taking into consideration the fact that construction is 'contract' work, seasonal and casual, involving different work loads, all kinds of tradesmen and that the activity is mobile.

#### H. Training programme.

(i) On account of the special nature of the construction industry, it is advisable to consider special training programme for construction workers who should get training in two or three trades, so that they can be continuously employed.

(ii) The technical personnel and supervisory personnel should get special training in construction methods and techniques. Their present education is more on theory and design. Special courses dealing with construction planning, methods and management of men, material and equipment and finance be instituted in the technical education centres.

#### I. Construction management.

The construction activity covers so many spheres and the participants are so many with varied attitudes. If any construction is to be economical and efficient, timely proper co-ordination, co-operation of all concerned is very essential. This could be done only by proper construction management organization which can administer with sufficient powers and responsibilities.

The present approach of Government departments dealing with construction has to be modified. The present system provides for unnecessary checks and restraints, which leads to lack of faith and confidence and to a marked tendency to avoid taking decisions. It does not permit of bold action and trials of new ideas and scientific advance. The accounting procedures are outmoded and unsuitable for speedy and economical execution.

The Secretariat control, has to give place to full responsibility and authority vested in Head of the technical department handling construction.

In the present system of public administration, the supremacy of administrative personnel over technical personnel, acts as a deterrent where exercise of initiative by the latter is concerned. Terms and conditions of service construction management personnel has to be equal to, if not better than administrative personnel. The construction management has to be so framed that there is maximum centralization of policy making and maximum decentralization of executive authority with full responsibility and powers.

J. Private construction agencies

As most of the construction work is carried out by private construction agencies, it is necessary that a proper organization to represent these agencies is formed and developed on right lines with a proper code of ethics to control the activities of the members, so that the image of the construction in society is not tarnished. The organization should be able to present the problem, supported by enough data and facts.

The Government should also recognize the National Organization of the contractors and builders, and membership to this organization be made compulsory for registration for work. These organizations should initiate and help in development, research and training programmes.

K. Technical Associations:

There are many technical associations like the Institutes of Engineers, Consulting Engineers, Surveyors, etc., but most of them do not give due importance to construction industry. The activities of these institutions are implied in the total activity of construction and more interest ought to be taken by these institutions in construction industry in its over all concept.

L. Construction as industry

The construction activity meets the requirements of Government Organizations and the private sector involving a wide variety of clients. At present there is no single Government organization which is in a position to influence its performances substantially, and to assist and promote it, or to be able to speak with unquestioned authority on its behalf and on the wide range of problems which concern the industry as a whole. There is no organization to encourage the development of modern techniques and materials with confidence, and to ensure proper utilization of available resources. The training and use of technical manpower, the communication of technical information, the collection and utilization of statistics the intensification of research and its application are dealt with in piece-meal manner because so many authorities consider themselves entitled to deal with these. The construction activity has to be organized as an Industry so that it develops properly and utilises all aids and services which engineering management has at its disposal as in the case of other Industries.

ANNEXURE - I

Achievement in Construction Activity during Plan Periods.

The development in the construction both in terms of physical as well as financial in different sectors during the last twenty-five years after Independence are dealt in detail under each major sector.

1. Rehabilitation:

Migrations have taken place in the twentieth century on an unprecedented scale throughout the world for variety of reasons such as change in regime, alterations in frontiers of countries, political upheavals and persecution. Migrations into India during the last 25 years came under the political category. From 1947 to 1971, there was a constant stream of refugees from Pakistan, who sought shelter in India.

Housing constitutes the basic need of refugees, and has been the largest single item of rehabilitation expenditure.

Between 1948-1959, 19 Townships, 136 Colonies with 1,66,000 tenements and houses by Government and 45,000 houses by private organizations were constructed to house the refugees from West Pakistan. The expenses were Rs. 600 million which formed 41% of the total expenditure on rehabilitation.

The settlement of these 2.2 million on 3.31 million acres was also completed by 1954.

There were other connected works like setting up relief homes, industrial units, schools etc. Out of Rs. 2060 millions spent, only Rs. 660 millions were for relief and balance indirect rehabilitation expenses.

Between 1943 - 1970 about 5.3 million refugees left their homeland in Bangladesh and moved to India. In 1956, about 168 camps were built to house 3,00,000 refugees.

By 1960, over 430,000 residential houses were constructed spending Rs. 380 millions.

A number of land reclamations, rehabilitation and other works were undertaken.

There were between 1959 - 1972 refugees and repatriates from Burma, Ceylon, and Tibet who were housed and rehabilitation done either by giving agricultural land, or setting up of industrial units.

From Bangladesh, the inflow in 1971 was the greatest ever known in the world, 9.9 million in 8 months time. To house this multitude was a problem. About 1,200 camps were constructed with water supply and sanitation, starting with 300 in April 1971 it rose to 1,200 in June 1971.

So, the rehabilitation calls for quick and temporary construction in the beginning to provide immediate shelter.

Construction of houses and supply of amenities like water supply and sanitation is one of the basic needs of any society.

During the first plan period, it is estimated that about 700,000 houses and tenements were built. The Government itself built 120,000 houses spending Rs. 385 million.

During the second plan about Rs. 2500 millions were spent to build 500,000 houses by the Government and more than Rs. 10,000 millions was interested by private sector.

During 3rd plan the estimate of investment was private sector Rs. 11250 millions and Government and its agencies Rs. 4400 millions. This investment is expected to have used to construct 4.2 million units in urban and rural areas.

The shortage of houses at the beginning of the fourth plan was estimated to be of the order of about 11.9 million in urban and 71.8 million in rural areas.

Again the construction sectors contribution in repairs, alterations and maintenance of housing is fairly large and is difficult to evaluate properly.

The estimated requirement of houses with the present rate of population increased is about 3 million houses per year.

## 2. Education:

For any development and expansion of education, the construction has to come in the form of construction of buildings, amenities, hostels etc.

	<u>1950 -51</u>	<u>1968 - 69</u>
No. of Schools	232,400	518,800
No. of Colleges	595	2,143
No. of University	27	75



3. Health:

Over twenty years of planned development considerable progress was done in health Family Planning.

The number of hospital beds in 1956-57 was 13,000 and it rose to 255,700 in 1968-69. The family planning centres 1100 in 1961 to 4,848 in 1969.

The medical colleges being 30 in 1957 was 90 in 1969. During the 4th plan, it was proposed to add 25,000 beds and 508 new health centres and 10 medical colleges.

4. Shipping, ports and harbours:

In 1947 there was only 5 major ports and it has now increased to 58.

There are about 200 minor parts all along the coastline of about 5000 kms. and about Rs. 2,000 millions in the outlay in the fourth plan.

The investment done during the plan periods on the major port development in India (1949 to 1969)

	<u>Rs. in millions</u>
Calcutta	771.10
Paradip	257.60
Visakhapatnam	215.50
Madras	322.40
Cochin	86.60
Marmagoa	29.20
Bombay	496.70
Tuticorin	97.00
Mangalore	72.02

Major share of this outlay went to the construction industry. As shipping facilities impose the infrastructure in terms of harbours, ports, shipyard, warehouse and other auxilliary facilities also develop which has a great element of construction.

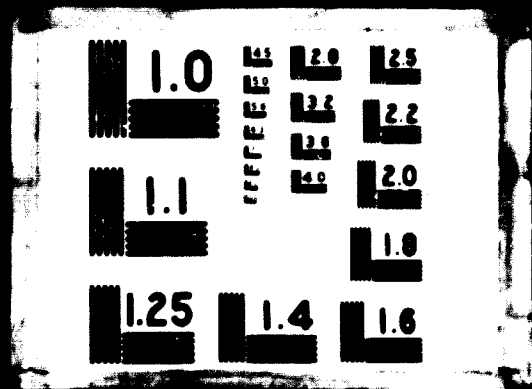
From 49 vessels and 192,000 G.R.T. in 1946, in 1971 it is 243 vessels and 2,435,000 G.R.T.

The Visakhapatnam shipyard having a capacity of 2-3 ships of



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12,500 DWT per year is being extended to build 6 ships of 12,500 - 140,000 DWT per year. The outlay is RS.77 millions.

A Graving Dock Project costing RS. 48 million is near completion.

A wet basin costing Rs. 30 million has been started.

At Cochin a building dock and repair dock to make 66,000 DWT ship has been started and is expected to cost Rs. 450 millions.

#### 5. Roads and Bridges

On roads and bridges the outlay in third five year plan was Rs. 4400 millions and in fourth five year plan Rs. 8290 millions. The progress of road construction in kilometers:

	<u>1947</u>	<u>1956</u>	<u>1966</u>	<u>1970</u>
Surfaced	145,855	183,023	283,385	325,837
Unsurfaced	242,371	315,321	551,380	638,670
Total	388,226	498,344	834,765	964,507

During this period about 174 major bridges and large number of minor bridges are to be built.

#### 6. Railways:

The first railway was opened in 1853 with 32 KMS of track.

The railways have developed and the construction involved being in physical target as under:

Total track lengths:	59,684 KMS
Number of Stations:	7,060
Total bridges :	1,04,299 with 8,420 major bridges.

No. of Staff quarters built during three plan periods :	1,68,500
Hospitals :	97
Schools :	749
Health Centres :	597

The expenditure of civil works:

	<u>Rs. in millions</u>		
	<u>2nd plan</u>	<u>3rd plan</u>	<u>Annual plans</u>
1. Track renewal	1542	2152	948
2. Bridge works	320	279	143
3. New lines	778	2119	457
4. Line capacity work including doubling	1734	3204	1086

7. Communications:

The postal, telegraph, telephones, air and T.V. development indirectly support the construction activity.

	<u>1951</u>	<u>1968</u>	<u>1970</u>
Post Offices Urban Rural	5284	9116	9891
Rural	30810	80717	95064
KMS of overhead lines	120243	2422506	2250950
KMS of underground lines	120000	655244	8119870
Telephone exchange	507	3161	3722

The outlay of Rs. 260 millions in fourth plan provides Rs. 173 millions for construction of postal buildings.

8. Industrial Sector:

Any industrial activity must have a factor - either in the form of an open shed complex building structure. A factory has again its own auxilliary services like roads, railway siding water supply, housing for its employees etc. Further there are always additions, alterations, maintenance and repairs to the factory and its services.

(i) Major industries:

Cotton industry growth:

	<u>Spinnles</u>	<u>Looms</u>
1880	14.8 millions	0.03 millions
1947	10.3 "	0.20 "
1970	17.75 "	0.21 "

In 1970, there were 657 mills.

Jute started with 21 mills in 1880 in undivided India and had about 95 in 1965.

Sugar - In 1951 India had 139 sugar factories and in 1968 the number was 205.

Paper - India had 15 mills in 1948 and in 1970 - 57 mills.

Cement with 2.7 millions tons has grown to 14.3 million tons. The central Government itself has 91 units in 1970 with an investment of Rs. 43000 millions, whereas at the starting of the first five year plan it was 5 units with investment of Rs. 290 millions.

The growth of small scale industries being:

<u>Year</u>	<u>No. of units</u>
1961	36,109
1965	106,883
1968	161,865
1971	241,516

The construction activity is very closely related with the expansion and development of Industry.

(ii) Fertilisers:

During the period 1951 to 1968, 5 units were constructed and 4 units are under construction and 5 more are to start.

(iii) Oil refining:

Before independence, the entire demand of the country for petroleum was met by imports.

Two refineries in 1954, one refinery in 1957, the output being 7.5 million tons in 1970. Five more refineries came on stream between 1958 and 1970.

At Haldia now a refinery of a capacity of 2.5 million tons is being constructed.

Over 3300 K.M. of pipes have been laid for the transport of crude oil, petroleum product and natural gas. Then the outlet centres and retail centres have been constructed all over the country.

9. Power:

Electricity either hydro, steam, diesel or nuclear contribute about 50% of its outlay towards construction. The transmission, transformation and distribution also has to depend on construction in varying degrees.

The progress of installed capacity by type of plan in millions KW.

	<u>1951</u>	<u>1955</u>	<u>1961</u>	<u>1966</u>	<u>1968</u>	<u>1971</u>
Hydro	0.56	0.94	1.92	4.19	5.49	6.60
Steam	1.59	2.27	4.43	5.47	5.49	
Oil	0.15	0.21	0.30	0.44	0.71	9.6
Gas	-	-	0.13	0.39		
Nuclear	-	-	-	0.13		

Transmission lines of 11 K.W. and above in K.M.

1955	..	58,400
1961	..	1,34,400
1966	..	2,78,000
1968	..	3,54,209

The total number of towns and villages electrified by 1951 was 4637, and by 1970, it rose to about 93,000 and 1,21,000 by March 1972.

The outlay on power which during the 1st year plan was Rs. 3020 millions rose to 4th plan period to Rs. 21,350 millions.

The fourth plan outlay is Rs. 10,160 millions for power generation Rs.3630 millions for rural electrification.

10. Irrigation and flood protection:

Irrigation is an important factor in National planning and development. If the agriculture sector and also the other sectors have to develop, the country has to be self sufficient in food and raw material for agriculture.

Construction has a big share in the irrigation sector. Whether it be a small tank, well or a big dam or a canal system, construction forms anywhere between 45% to 80% of the outlay.

The proper maintenance and upkeep of the irrigation system is another important sector where construction has a big share.

The physical targets achieved in irrigated area is an idea of the development.

At the end of	Area in Millions Major + Medium Schemes.	h.a. Minor Schemes.
<u>Preplan period</u>	<u>9.5</u>	<u>12.88</u>
First five year plan	12.16	14.05
Second five year plan	14.30	14.74
Third five year plan	16.53	17.00
Annual plans	18.15	19.12
Fourth plan target	22.15	22.23

About 88 major medium schemes were taken up during the plan period ending 1970 and 22 major and 329 medium schemes have been completed and rest are under construction. On minor irrigation, the irrigation by tanks is 8.12 millions and by wells and deep-wells 11.00 millions.

ii. Flood protection:

Flood protection is another section where construction has to play an important part.

Pre-independence there were embankments of 5300 KMS length. During plan periods 7300 KMS embankment and 10150 KMS drainage channels were constructed. 197 town protection works and raising of 4600 villages above flood level were completed. The outlay in plans on flood control and irrigation.

	<u>Rs in millions.</u>			<u>Total.</u>
	<u>Major and Medium.</u>	<u>Flood Control.</u>	<u>Minor</u>	
First plan	3800	130	550	4480
Second Plan	3800	480	950	5230
Third plan	5830	820	2700	9350
Annual plan	4140	430	3140	7710
Fourth plan target	9540	1330	5760	16039

11. Agriculture and allied sector:

Agriculture and allied activities on which 70 percent of the people of India are dependent for their living, account for really a half of the country's national income.

The outlay in the recent of this sector is:

<u>Progress.</u>	<u>Outlay in plans.</u>		<u>Rs. in millions</u>
	<u>Third Plan (1964-66)</u>	<u>Yearly Plan (1966-69)</u>	<u>Fourth Plan (1969-74)</u>
Agricultural production (including of research and education)	2030	2520	5100
Soil Conservation	770	880	1510
Area development	20	130	290
Animal Husbandry	430	340	910
Fisheries	230	370	840
Forests	460	440	920
Warehouse marketing and Storage	270	150	650
Community development and Panchayats	2880	990	1160

(i) Agricultural land utilization in India

Total land area	329.79	M. ha.
Cultivable area	194.24	M. ha.
Under cultivation	156.61	" "
Irrigationable area	75.67	" "
Under irrigation end of 1966	35.61	" "
Uncultivable area	135.5	" "



(ii) Soil conservation in project catchments:

The soil conservation programme on country-wise search started out towards end of 1st Plan:

2nd Plan	..	0.294	H.ha.
3rd Plan	..	0.980	"
4th Plan	..	5.000	"

The levelling of land, small bunds, water leading channels, cross drainage works all form a part of construction. These are carried out by Agriculturist himself using mostly locally made tools and materials.

An area of about 9.5 million H.a was treated with soil conservation methods at a cost of Rs.1863 millions upto 1968-69. An outlay of Rs.1580 millions to cover an area of 6.4 millions h.a is planned in fourth plan.

(iii) Fisheries:

Any development fisheries will involve mechanised boating, better harbour facilities and cold storage. Construction of major finishing harbours have been taken up at Madras, Bombay, Tuticorin, Vahinjin and Karwar. A total of 40 sites are taken up for fishing harbours.

(iv) Ware-housing:

On warehousing storage, construction plays a major part. In community development, the building of road communication, construction of buildings and other amenities for about Rs.200 millions.

12. Defence:

The Defence outlay has a considerable amount spent on construction of accommodation for its forces, training centres, defence outposts, roads on the border, improvement in Naval Dockyard, Air Force aerodromes etc.

Further the Defence has its Ordnance Factories and other manufacturing factories.

ANNEXURE - 2.

PATTERN OF INVESTMENT - THIRD AND FOURTH PLANS.

(In crores of Rupees)  
[Crore = Ten Million

Sl. No.	Kind of Development.	THIRD PLAN			FOURTH PLAN			TOTAL	Percentage distribution.
		Public Sector	Private Sector	Investment	Public Sector	Private Sector	Investment.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10
1.	Agriculture & allied sectors.	6,60	3,00	14,60	14.0	21,18	16,00	37,18	16.4
2.	Irrigation and flood control.	6,50	-	6,50	6.3	10,73	-	10,73	4,7
3.	Power	10,12	50	10,62	10.2	24,48	75	25,23	11.2
4.	Village & small industries.	1,50	2,75	4,25	4.1	1,86	5,60	7,46	3.3
5.	Industry & minerals.	15,20	10,50	25,70	24.7	32,98	20,00	57,98	23.4
6.	Transport & communications.	14,86	2,50	17,36	16.7	31,97	9,20	41,17	18.2
7.	Social Services & other programmes.	6,22	20,75	16,97	16.3	13,35	22,25	35,60	15.7
8.	Inventories.	2,00	6,00	8,00	7.7	-	16,00	16,00	7.1
9.	Total	63,00	41,00	1,04,00	100.0	1,36,55	89,80	2,26,35	100.00

(Source: India A Reference Annual 1971-72) Table 107.

**OUTLAY AND INVESTMENT IN FOURTEEN PLAN : PUBLIC AND PRIVATE SECTORS.**

(In Crores of Rupees) (Crore = Ten Millions)

SR. No.	Public Sector			Private Sector			Total			Public & Private Sectors	
	Total outlay	Current Outlay	Investment	Investment	Percentage of total outlay	Investment	Investment	Investment	Total outlay	Percentage distribution.	
	3.	4.	5.	6.	7.	8.	9.	10.	11.		
1. Agriculture & allied Sectors.	27,28	6,10	21,18	17.1	16,00	17.8	37,18	43,28	17.4		
2. Irrigation & flood control	10,87	14	10,73	6.8	-	-	10,73	10,87	4.4		
3. Power	24,48	-	24,48	15.4	75	0.8	25,23	25,23	10.1		
4. Village & Small Industries.	293	1,07	1,86	1.8	5,60	6.2	7,46	8,53	3.4		
5. Industry & Minerals.	33,38	40	32,98	21.00	20,00	22.3	52,98	53,38	21.4		
6. Transport & Communications	32,37	40	31,97	20.3	9,20	10.2	41,17	41,57	16.7		
7. Education.	3,23	5,45	2,78	5.2	50	0.6	3,28	8,73	3.5		
8. Scientific Research	1,40	45	95	0.9	-	-	95	1,40	0.6		
9. Health.	4,34	3,03	1,31	2.7	-	-	1,31	4,34	1.7		
10. Family Planning.	3,15	2,62	53	2.0	-	-	53	3,15	1.3		

(11)

	3.	4.	5.	6.	7.	8.	9.	10.	11.
11. Water Supply & Sanitation.	4,07	2	4,05	2.6	-	-	4,05	4,07	1.6
12. Housing, Urban & regional development.	2,37	2	2,35	1.5	21,75	24.3	24,10	24,12	9.7
13. Welfare of backward classes.	1,42	1,42	-	0.9	-	-	-	1,42	0.6
14. Social Welfare	41	41	-	0.3	-	-	-	41	0.2
15. Labour Welfare and craftsmen training.	40	20	20	0.3	-	-	20	40	0.2
16. Other programmes	1,92	74	1,18	1.2	-	-	1,18	1,92	0.8
17. Inventories.	-	-	-	-	16,00	17.8	16,00	16,00	6.4
18. Total.	159,02	22,47	136,55	100.0	89,80	100.0	226,35	2,48,82	100.00

(Source : India A Reference Annual 1971-72 - Table 105 )

Estimated Construction Component in Fourth Plan.

1. <u>Agriculture.</u>	<u>Construction Component.</u> <u>Rs. Crores (Crore=10 L.)</u>
i) Agriculture production.	220
ii) Minor irrigation.	380
iii) Forests.	10
iv) Animal Husbandry.	40
v) Dairying & Milk supply.	40
vi) Agriculture Marketing.	10
vii) Fisheries.	50
viii) Community Development.	150
ix) Co-operation.	50
x) Sugar & Sugarcane, subsidiary food & storage & warehousing.	<u>10</u>
Total Public Sector	960
Private Sector	<u>300</u>
Total Public plus private sectors.	1260
 2. <u>Irrigation &amp; Flood Control</u>	
i) Irrigation.	750
ii) Flood Control.	<u>100</u>
Total.	850
 3. <u>Power.</u>	
i) Power Generation.	450
ii) Transmission and distribution.	400
iii) Rural electrification.	<u>200</u>
Total.	1050
 4. <u>Small Industries.</u>	
i) Public Sector.	100
ii) Private sector	<u>100</u>
Total.	200
 5. <u>Organised Industries.</u>	
i) Public sector.	600
ii) Private sector.	<u>750</u>
Total	1350
 6. <u>Transport &amp; Communication.</u>	
i) Railways.	1150
ii) Roads.	650
iii) Ports.	60
iv) Ferekka Barrage.	50
v) Shipping	30
vi) Air transport	10
vii) Tourism.	<u>10</u>
Total Public Sector	1960
Private Sector	<u>550</u>
Total Public plus Private Sector	2510

7.	<u>Education Programme.</u>	
	i) Public Sector.	250
	ii) Private sector.	<u>20</u>
	<b>Total</b>	<b>270</b>
8.	<u>Scientific Research.</u>	30
9.	<u>Health.</u>	
	i) Water supply and sanitation.	340
	ii) Health other than water supply and sanitation.	<u>180</u>
	<b>Total.</b>	<b>520</b>
10.	<u>Housing &amp; Construction.</u>	
	i) Public Sector.	550
	ii) Private sector.	<u>1450</u>
	<b>Total</b>	<b>2000</b>
11.	<u>Welfare of Backward Classes.</u>	50
12.	<u>Social Welfare.</u>	50
13.	<u>Craftsman training &amp; Labour Welfare.</u>	30
14.	<u>Miscellaneous such a development Works for rural programmes etc.</u>	100
15.	<u>Construction under Revenue budgets.</u>	600

Construction during Fourth Plan in the Public Sector at the Centre and the States and in Private sector.

Sr. No.	Item.	(All figures in Crores)			Private Sector.
		Centre	States	Total	
1.	Agriculture.	160	800	960	300
2.	Irrigation & Flood Control.	60	790	850	-
3.	Power	200	850	1050	-
4.	Small Industries.	50	50	100	100
5.	Organised industries.	700	50	750	600
6.	Transport & Communication	1700	260	1960	550
7.	Education.	80	170	250	20
8.	Scientific Research	30	-	30	-
9.	Health	90	90	180	-
10.	Water supply sanitation.	20	320	340	-
11.	Housing & Construction	320	230	550	1450
12.	Welfare work	30	20	50	-
13.	Social Welfare.	15	5	20	-
14.	Training	20	10	30	-
15.	Miscellaneous.	70	30	100	-
16.	Construction under Revenue budget.	500	100	600	-
<b>Total</b>		<b>4045</b>	<b>3175</b>	<b>7220</b>	<b>3020</b>

Total Public and Private Sector Rs. 10340 Crores.

SAZ .. Rs. 11000 Crores.

(Source - Builders Association of India )

Paper by A.N. HALHOTRA - Former Director,  
Planning Commission.

ANNEXURE - 3.

Building Materials Requirement in the Fourth Plan (1969-74)

- I. Total investment in the Plan Rs. 22,635 Crores.  
 II. Estimated investment in:  
 (a) Construction Rs. 13,600 Crores. \*  
 (b) Residential buildings Rs. 2,800 Crores. \*\*.

SR NO	Materials.	Bricks	Cement	Iron and Steel	Timber.
-------	------------	--------	--------	----------------	---------

Weight.

2. Residential.++.		16	21	10	18
3. Total construction.+++		7.4	12.38	15.4	7.2

Total value of materials required for construction (in crores of rupees)

4. Residential Col.(2)x(b)	448.0	588.0	280.0	504.0
5. Others Col.(6)-Col.(4)	558.4	1034.8	1814.4	475.2
6. Total Col.(3) x (a)	1006.4	1672.8	2094.4	979.2
7. Prices & Unit(as on 1.1.70) ++.	Rs.75.00 per 1000 Nos.⊙	Rs.21.21 per Quintal.	Rs.89.3 per quintal.	Rs.892.96 per cu.mt.

Quantity required (in million).

8. Residential.Col(4)/Col.(7)	60,000 Nos.	27.7 tonnes	3.1 tonnes.	5.6 cu.mt
9. Others Col.(1)-Col.(6)	74,000 Nos.	51.2 tonnes.	20.4 tonnes.	5.4 cu.mt.
10.Total.Col.6/Col.(7).	134,000 Nos.	78.9 tonnes.	23.5 tonnes.	11.0 cu.mt.



SR No	Materials	Bricks	Cement	Iron and Steel	Timber.
-------	-----------	--------	--------	----------------	---------

Estimated production  
(in million).

11. at current rate of production.	100,000 Nos.	75.0 tonnes.	22.5 tonnes.	13.5 cu.mt.
12. during the Fourth Plan.	100,000 Nos.	80.0 tonnes.	22.5 tonnes.	13.5 cu.mt.
13. Shortage or surplus (in million)	-3400 Nos.	+1.1 tonnes.	-1.0 tonnes.	+2.5 cu.mt.

\* It has been assumed that Rs. 13,600 Crores, i.e. 60 percent of the total investment (Rs. 22,635) during the Fourth Plan will be in construction.

\*\* On the basis of Report on Fourth Plan, it has been broadly estimated that Rs. 2,800 crores will be invested in the residential buildings.

++ Source: Central Public Works Department.

+++ Weight for bricks, iron and steel and timber computed in the N.B.O. from the Paper "Growth of construction industry in India-1950-51 to 1964-65", Prepared by Shri R.N.Lal and others for "Sixth Indian Conference on Research in National Income" held at Bangalore, May 1968.

£ Weight for cement has been computed by the National Buildings Organisation.

● Average of the prices prevailing in Delhi and Calcutta.

(Source: N.B.O. Journal.)

ANNEXURE - 4.

15.3.73.

Assessment of Building Materials Requirements in the 5th Plan.

At the instance of the Planning Commission an assessment was made by the NBO of the requirements of Building Materials and manpower for the construction component of the 5th Five Year Plan. Norms of consumption for key building materials have been computed in the NBO from data collected from the CSO and other sources.

The investment in construction is expected to be 55 percent of the total out-lay in the Five Year Plan. Of this the expenditure on building materials would be 70 percent of the cost of construction.

The assessment revealed that -

- (1) Brick production will have to be increased from 24,000 million to 37,500 million per year. To accomplish this in addition to improving the production of the traditional industry, it will be necessary to establish 50 mechanised brick plants at specific locations. Also to produce additional masonry materials 10 sand line brick plants and 5 cellular concrete plants will be required to be established.
- (2) The production of cement is to be stepped up from 16 million tonnes, to 27 million tonnes. Ten split location cement grinding units at Metropolitan Centres will be required. In addition 10 plants for the production of flyash pozzolana cement and 10 plants for the production of dry hydrated lime will help to augment the supply of cement. Also 15 plants for the manufacture of reactive clay pozzolana (Surkhi) will be required.
- (3) The availability of steel for construction will have to be increased by 2.9 million tons in the 5th Plan. In order to conserve steel, production of high strength deformed bars would have to be increased by one million tons as their use results in considerable economy of steel.

(4) The primary species of timber will not be able to meet the requirements in the 5th Five Year Plan. A gap of 2 million cu.m. is expected; this could be met by using secondary species of timber after seasoning and preservative treatment. Ten integrated plants for conversion, seasoning and treatment of secondary species of timber would have to be set up.

(5) Establishment of plants to manufacture other new building materials like light weight aggregates, asphaltic corrugated roofing sheets and plastic pipes to augment the requirements of building materials have been suggested.

Since the gestation period for the establishment of plants is 4 to 5 years it would be necessary to take immediate action as proposed to implement the construction programme. In this regard the proposal made earlier by NBC for the establishment of building materials development corporation may be considered.

(Source: National Building Organisation - Brief no.70)

ANNEXURE - 5.

Construction Equipment position in India.

The value of equipment added -

1956-1960 ..	Rs.	350 millions.
1960-1965 ..	Rs.	1000 "
1965-1970 ..	Rs.	1300 "

The major addition of equipment have been made in the last decade during the year 1961 to 1970. The addition during this period were almost 80% of the total. The average number of machines added annually was over 1100. Prior to year 1956, the addition were less than Rs.10 millions a year except for 1953 and 1955 when there were about Rs.20.7 million and Rs.14.6 million lakhs, whereas it touched Rs.240 million to Rs.370 million annually after 1963.

Mostly the equipment is in use in the Government Department and Agencies and Public Sector Organisation. The owing by private is low.

The distribution is -

	<u>Rs. in Millions.</u>	<u>Numbers.</u>
1. State Government including Irrigation and Power Dept.	1327	7542
2. Central Government including Irrigation and Power.	445	3788
3. Government Bodies, Public Sector undertakings.	888	2897
4. Private Bodies.	265	1438
5. Irrigation and Power sectors only.	1393	7474

Multiplicity of Makes:

The equipment now in the country is an exhibition of assorted makes of machine of different countries and different makes and capacities. The reasons for this state of affairs has been dealt with earlier. There are about 35 makes of Power Shovels, Drag Line Buckets, Wheel Excavator etc., varying from capacity of 3/8 cyd. to 35 cyd. bucket size. In case of Crawler Tractors, which forms almost 1/3rd of the Heavy Construction Equipments there are types from many countries. Of the highway dumper there are

about 24 different makes with capacities varied from 7 tons to 72 tons. . Among the motorised scrapers there are about 16 makes and capacities varying from 7 cyd. to 24 cyd. The indigenous manufacturing of Motorised Scrapers has started since 1966 in the Public Sector factory of Bharat Earth Mover. In respect of towed scrapers, they were started sometimes in 1963/64.

ANNEXURE - 6.

MAJOR CONSTRUCTION EQUIPMENT AND PRODUCTION CAPACITY.

I. Earthmoving Equipment.

Type.	Size.	Manufacturer.	Per Annum Licensed/ Installed Capacity.
a) Excavators.			
	3/4, 1 1/2, 2 1/2 Cyd.	Teico, Jamsheerpur.	100 Nos.
	2 1/2 to 3 Cyd.	Hindustan Motors.	25 to 50 nos.
	4 1/2 Cyd. & above.	Heavy Engineering Corporation Ltd.	25 Nos.
		Jessops & Co. Ltd.	45 Nos.
		Mukand Iron & Steel, Works Ltd.	12 Nos.
		The above are in production stage.	
	3/4 Cyd.		
		These two have letters of intent only, and no tangible progress has been made till now.	
b) Bulldozers with other attachments.	i) 60-120 HF	Sharat Earth Movers Ltd. (S.E.A.L)	90 H.F. .. 300 Nos.
		Hindustan Motors	90 H.F. .. 200 Nos.
			50 H.F. .. 200 Nos.
		Britannia.	70 H.F.) .. 150 Nos.
			50 H.F.)
	ii) 120-200 HF	B.B.M.L.	165 H.F. .... 300 Nos.
	iii) 225-300 HF	B.B.M.L.	225 H.F. .... 200 Nos.
		Hindustan Motors.	227 H.P. .... 200 Nos.
	iv) above 300 HF	Hindustan Motors.	454 H.F. .... 40 Nos.

Type	Size	Manufacturer.	Per annum Licensed/ Installed capacity.
c) <b>Heapack Rear Dumpers</b> (Conventional)	i) 15-16 tons.	Ashok Leyland (15 tons) Hindustan Motors (20 tons) Bharat Earth Movers Ltd. (30-35 tons)	80 Nos.
	ii) 20-25 tons.		240 Nos.
	iii) 30-35 tons		150 nos.
d) <b>Off-the-Highway dumpers-articulated type.</b>	22 tons.	Bharat Earth Movers Ltd.	125 Nos.
e) <b>Motorised Scrapers</b>	i) 7-12 Cyd.	Hindustan Motors (7-9 tons)	150 nos.
	ii) 12-20 Cyd.	B.S.A.L. (14-18 tons)	150 nos.
f) <b>Towed Scrapers.</b>	i) 8-12 Cyd.	Construction Equipment Co.	60 Nos.
	ii) 15-21 Cyd.		
	iii) 24-30 Cyd.		
g) <b>Tractor scrapers.</b>	250-300 h.P.	Bharat Earth Movers Ltd.	58 Nos.
<b>II. <u>Compaction Equipment:</u></b>			
a) <b>Diesel Road Rollers.</b>	i) 8-10 tons.	Jessops.	600 Nos.
		Britannia.	400 Nos.
		AGRIIND.	400 Nos.
		Jessops.	180 Nos.
ii) Tandem 6-7 T2. Vibratory 4-6 T.	iii) 3-4 T Tandem 1.5 - 4 T Vibr. iv) Tractamount 4 - 5 ton.	Garlicks	50 Nos.
		Garlicks	50 Nos.
		Kamani.	360 Nos.

<u>Type</u>	<u>Size</u>	<u>Manufacturer.</u>	<u>Per Annum Licensed/ Installed capacity.</u>
b) Sheep-foot Rollers.	Various capacities.	Construction Equipment Co. Larsen & Toubro Ltd.	120 Nos. 120 Nos.
<u>III. Material Handling Equipment.</u>			
a) Mobile Crane.	12 tons.	Coles Cranes of India Ltd.	140 Nos. (Prod.)
The following have received letters of intent, but productions yet to start.			
	7 tons. )	S. Sengupta.	120 Nos.
	3.5 tons. )		20 Nos.
	6 tons. )	Kumardhubi	60 Nos.
	10 tons. )		40 nos.
	5 tons. )		
	10 tons.	Jessops.	30 Nos.
b) Truck mounted.	4 tons.	Cole Cranes.	48 Nos.



ANNEXURE - 7.

1971 CENSUS FACTS AT A GLANCE.

Population of India.	Persons	548 Billions.
	Male	234 "
	Females	264 "
Decennial growth rate 1961-71	24.80 percent	
Density of population	178 per sq.km*	
Sex ratio	930 females	
	per 1000 males.	
Literasy rate(including age group 0-4)	Persons	29.45 percent
	Males	39.45 "
	Females	18.70 "
Proportion of urban population to total population.		19.91 percent
Percentage of workers. to total population (main activity only)	Persons	32.92 percent.
	Males	52.50 "
	Females	11.85 "
Category of workers	Percentage to total workers.	
I. Cultivators.	Total	43.34
	Males	38.20
	Females	5.14
II. Agricultural Labourers.	Total	26.33
	Males	17.57
	Females	8.76
III. Livestock, Forestry, Fishing, Hunting, Plantations, Orchards and allied activities.	Total	2.38
	Males	1.95
	Females	0.43
IV. Mining and Quarrying.	Total	0.51
	Males	0.44
	Females	0.07
V. Manufacturing, Processing, Servicing and Repairs.		
(a) Household Industry.	Total	3.52
	Males	2.78
	Females	0.74
(b) Other than Household Industry.	Total	5.94
	Males	5.46
	Females	0.48
VI. Construction.	Total	1.23
	Males	1.12
	Females	0.11
VII. Trade & Commerce.	Total	5.57
	Males	5.26
	Females	0.31

VIII. Transport, Storage and Communications.	Total	2.44
	Males	2.36
	Females.	0.08
IX. Other Workers.	Total	8.74
	Males	7.50
	Females.	1.24

\* Density worked out after excluding the figures of Jammu and Kashmir as the figures of the area beyond the cease-fire line are not available.

ANNEXURE - 8.

A. SEASONAL NATURE OF EMPLOYMENT IN CONSTRUCTION.

	No. of months of		No. of months of	
	Employment in		unemployment.	
	Construction	Others	Voluntary	Involuntary
Skilled(All male):	<u>9.30</u>	<u>1.06</u>	<u>0.15</u>	<u>1.49</u>
1. Masons.	9.29	0.71	0.16	1.84
2. Carpenters.	9.88	0.67	0.12	1.33
3. Fitters.	9.90	0.60	0.10	1.40
4. Khalasis.	8.00	2.19	0.18	1.63
5. Others.	9.43	1.15	0.19	1.23
<u>Unskilled:(Male &amp; Female)</u>	<u>7.48</u>	<u>2.32</u>	<u>0.07</u>	<u>2.13</u>
1. Male.	8.17	1.65	0.13	2.05
2. Female.	6.80	3.00	-	2.20
3. All Workers.	3.39	1.69	0.11	1.81

"Employment in Construction Industry-Does it have to be so Stable,"

SOURCE: ECONOMIC AND POLITICAL WEEKLY."

B. Number of Men employed on different types of work.

	<u>Barrage</u>	<u>Water Supply</u>	<u>Port Work.</u>
August	351	400	3290
September.	691	820	2928
October.	895	1100	3607
November.	1064	1500	3843
December.	1290	1400	4016
January.	1505	1555	3416
February	1681	1663	3472
March.	1852	1657	3672
April	1949	1418	3507
May	1820	1058	3572
June.	1203	580	3061
July	986	411	3100

(COURTESY : Hindustan Construction Co.Ltd.)

ANNEXURE - 9.

TABLE 1.

Norms for building sector.

Norms.	Period	
	March 1966 to June 1966	1968
1. Skilled to unskilled workers.	1:2.2	1:2.2
2. Investment per man-day(₹.)	18.50	23.00
3. Wages to value of materials to overhead charges.	2.5:9.0:1.0	3.0:12.0:1.0

TABLE 2.

Norms for building and non-building sector.

Norms	Period	
	March 1966 to June 1966	1968
1. Skilled to unskilled workers	1:2.8	1:3.7
2. Investment per man-day(₹.)	17.60	21.25
3. Wages to value of materials to overhead charges.	2.3:8.1:1.0	3.0:11.0:1.0

TABLE 3.

Number of workers on different works.

<u>Type of work</u>	<u>Skilled</u>	<u>Unskilled</u>	<u>Total</u>
1. Water Supply and Pipe line.	83	359	442
2. Cement Factory Construction.	95	143	238
3. Barrage.	935	3940	4875
4. Port-work	452	3097	3549
5. Concrete Dams.	1650	2569	4219
6. Tunnel Work.	95	263	358
7. Bridge.	70	305	375
8. Tunnels-Dams-Power House-Combined Scheme. 1200		2691	3891

(COURTESY : Hindustan Construction Co.Ltd.)

ANNEXURE-10.

GROWTH OF PRIVATE CONSTRUCTION COMPANIES.

(NOTE: The data in Table I, II and III are based on account of (i) 11 units for the period 1960-61 to 1964-65, (ii) 14 units for the years 1965-66 to 1969-70, and (iii) 8 units for 1970-71.

COST STRUCTURE.		TABLE -I.			Rs. Crores.	
Y E A R	Total Cost.	Raw materials, and Others Construction Expenses.	Salaries, Wages & Other Benefits	Depreciation.	Interest	Other Expenses.*
1960-61	23.33 (100.0)	14.52 (62.2)	6.46 (27.7)	0.71 (3.0)	0.15 (0.6)	1.49 (6.5)
1961-62	26.37 (100.0)	17.03 (64.6)	6.65 (25.2)	0.84 (3.2)	0.20 (0.8)	1.65 (6.2)
1962-63	31.22 (100.0)	19.98 (64.0)	8.16 (26.1)	1.01 (3.2)	0.20 (0.6)	1.87 (6.1)
1963-64	35.24 (100.0)	22.91 (65.0)	9.14 (25.9)	0.99 (2.8)	0.25 (0.7)	1.95 (5.6)
1964-65	39.82 (100.0)	26.81 (67.3)	9.34 (23.5)	1.10 (2.8)	0.28 (0.7)	2.29 (5.7)
1965-66	59.38 (100.0)	37.74 (63.6)	14.49 (24.4)	1.79 (3.0)	0.49 (0.8)	4.87 (8.2)
1966-67	61.76 (100.0)	38.91 (63.0)	15.43 (25.0)	1.92 (3.1)	0.64 (1.0)	4.86 (7.9)
1967-68	59.65 (100.0)	37.02 (62.1)	14.78 (24.8)	2.18 (3.7)	0.91 (1.5)	4.76 (7.9)
1968-69	55.75 (100.0)	33.60 (60.3)	13.94 (25.0)	2.57 (4.6)	1.29 (2.3)	4.35 (7.8)
1969-70	62.35 (100.0)	38.28 (61.4)	15.06 (24.2)	2.55 (4.1)	1.63 (2.6)	4.83 (7.7)
1970-71	57.11 (100.0)	40.90 <sup>0</sup> (71.6)	12.31 (21.6)	2.32 (4.1)	1.58 (2.8)	Nil

\* Includes repairs to machinery, bad debts. etc.

0 Inclusive of other expenses.

NOTE: Figures in brackets are percentages to total cost.

**TABLE II.**  
**Allocation of Profits.**  
PRIVATE CONTRIBUTION  
COMPANIES (in Crores)

Year	Profit before Tax.	Taxation	Dividends	Retained Profits
1960-61	1.76 (100.0)	0.94 (53.4)	0.37 (21.0)	0.45 (25.6)
1961-62	1.88 (100.0)	1.03 (54.8)	0.40 (21.3)	0.45 (23.9)
1962-63	2.96 (100.0)	1.79 (60.4)	0.40 (13.5)	0.77 (26.0)
1963-64	3.08 (100.0)	2.08 (67.5)	0.53 (17.2)	0.47 (15.3)
1964-65	4.24 (100.0)	2.92 (68.9)	0.76 (17.9)	0.56 (13.2)
1965-66	5.01 (100.0)	3.82 (63.6)	1.06 (17.6)	1.13 (18.8)
1966-67	5.30 (100.0)	3.43 (64.7)	0.92 (17.5)	0.94 (17.7)
1967-68	2.75 (100.0)	1.81 (65.8)	0.84 (30.5)	0.10 (3.6)
1968-69	1.55 (100.0)	1.25 (80.6)	0.57 (36.8)	-0.27 (-17.4)
1969-70	1.14 (100.0)	1.00 (87.7)	0.59 (51.7)	-0.45 (-39.5)
1970-71	1.32 (100.0)	0.83 (65.7)	0.58 (43.9)	-0.14 (-10.6)

**NOTE:** Figures in brackets are percentages to profits before tax.

TABLE III.  
Key Profitability Ratios.

Year	Gross Profits as % of Sales.	Gross Profits as % of Capital Employed	Net Profits as % of Net Worth.	Dividends as % of Net Worth.	Retained Profits as % of Profits after Tax.
1960-61	8.1	5.5	12.6	5.7	54.9
1961-62	7.7	5.6	12.1	5.7	52.9
1962-63	9.7	8.1	14.5	5.0	65.8
1963-64	9.0	7.1	10.9	5.8	47.0
1964-65	10.8	8.4	13.4	7.7	42.4
1965-66	12.7	7.3	14.5	7.0	51.6
1966-67	9.7	6.3	11.4	5.6	50.3
1967-68	6.6	3.6	5.4	4.8	9.4
1968-69	5.4	2.7	1.7	3.2	-90.4
1969-70	4.9	2.5	0.8	3.3	-321.4
1970-71	5.1	5.3	2.5	3.3	-31.8

SOURCE: "Industrial Times" - JULY 24, 1972.

ANNEXURE - 11

ANNEXURE - 11.  
PUBLIC SECTOR UNDERTAKINGS CONNECTED WITH CONSTRUCTION.

SR. No.	Name of Company and registered Address.	Administrative Ministry.	Year of Registration	Year of Principal Business.	Financial Data (Rs. Crores)		= Rs. 10 Millions.	
					Income.	ASSETS	Profits Before Tax	Profits
1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Bharat Earth Movers Ltd. Unity Bldg., Sri Jayachama-rajendra Road, Bangalore-2.	Defence	1964	Rail coaches and rolling stock, diesel rail cars, reer dump, trucks, etc.	26.68	42.10	4.43	
2.	Engineers India Ltd. Allahabad Bank Bldg, 17 Parliament St. New Delhi.	Petroleum & Chemicals	1965	Providing Engineering, Procurement & construction Services to the Petroleum, Chemicals Petro-chemical, Fertiliser Industries.	2.73	1.67	0.69	
3.	Engineering Projects (India) Ltd., Himalaya House, Kasturba Gandhi Rd., New Delhi.	Industrial Development	1970	Consortium of leading Govt. of India Enterprises.	nil	0.05	0.02	



(ii)

1.	2.	3.	4.	5.	6.	7.	8.	9.
4.	Hindustan Housing Factory Ltd. Jangpura, New Delhi-14.	Works & Housing.	1953	Housebuilding components & F.C.C. Electrical poles.	March 1971	1.87	1.80	0.17
5.	Hindustan Steel-works Constn.Ltd. 5/1 Commissariat Road, Hastings, Calcutta-22.	Steel & Mines.	1964	Construction Works of Steel Plants	March 1971	32.32	42.81	0.65
6.	Indian Consortium for Power Project Pvt.Ltd.Chandrolek Janpada, New Delhi-1	Industrial Development.	1969	Electric Power Projects and ancillary services.	March 1971	nil	0.04	-0.05
7.	National Building Construction Corporation Ltd., 44, Ring Road, Lajpatnagar, III New Delhi-24.	Works and Housing.	1960	Construction, Civil Engineering Works.	March 1970	2.51	1.57	-0.20
8.	National Projects Construction Corporation Ltd. E-9 Defence Colony. New Delhi-3	Industrial Development	1957	Construction of River valley Projects and other allied works.	March 1969	8.07	11.01	-1.05

(iii)

1.	2.	3.	4.	5.	6.	7.	8.	9.
9.	Water & Power Development Consultancy Services(I) Ltd., L18 South Extn., Part II, Ring Road, New Delhi	Irrigation & Power.	1965	-	March 1971	Negligible	0.18	Negligible (-)
10.	Haryana State Minor Irrigation (Tubewells) Ltd., The Mall, Karnal.	Development of Irrigation & Power.	1970	-		Recently Established	-	-
11.	Mysore State Construction Corporation Ltd., 5 Edward Road, Bangalore-1.	Department of Public Works.	1968	-		All kinds of Construction Works.	No	No
12.	Orissa Concrete Products Ltd., Rasulpur Bhubaneswar, Dt. Puri.	Development of Industries.	1959	-	1957-68	0.04	2.43	NIL
13.	Orissa Construction Corporation Ltd. Gopabandhunar, Bhubaneswar.	Development of Irrigation & Power	1962	-	1969-70	85.32	159.35	- 7.00

(Commerce - Year Book of Public Sector 1972)

ANNEXURE - 12.

Some Important Government and Public Undertaking Organisation.  
connected with Construction Research and Design.

**Central Road Research Institute, New Delhi.** The main function of the Institute is to find solutions for the varied problems of road construction, maintenance and improvement. It undertakes research on new methods of road construction, traffic and road safety and on standards and specifications for road building plant and machinery.

**Central Building Research Institute, Roorkee.** The Institute undertakes research on building and allied branches of civil engineering including building materials, foundation engineering, building techniques, design and functional efficiency, building economics and management and other user requirements. Its field research station is located at Calcutta and extension cells at Ahmedabad and Bhopal.

**Structural Engineering Research Centre, Roorkee.** This Centre conducts research in specialised design and structural problems connected with buildings, bridges and other structures and undertakes the development of utility computer programmes for the analysis and design of 'repeat' structures, such as, multi-storeyed buildings, pre-stressed beams, shell roofs, folded plates and transmission line towers. Its regional centre is located at Madras.

**Research Associations.** Research associations in different industrial fields are being provided financial assistance by the CSIR. The Council also renders assistance by way of technical advice, preparation of plans and procurement of expertise and materials.

**Geology.** The Geological Survey of India, with headquarters in Calcutta and established more than 120 years ago, conducts geological geo-physical and geochemical surveys; prospecting, exploration and assessment of mineral resources, including water, by drilling and exploratory mining; and research to develop and adopt new techniques and methods leading to advances in research and exploration and fundamental research in geology, geochemistry and allied fields. The results of these studies are disseminated through different publications of the GSI. The department functions through five regional offices and 23 circle offices.

**Hydraulic Research.** There are eleven hydraulic research stations under the Central Board of Irrigation and Power. The Central Water, Power and Irrigation Research Centre at Knadkvasla near Poona, is the pioneer hydraulic research station in India. Work on fundamental and basic research schemes on problems of river valley projects, power stations and transmission system is connected through 20 irrigation and 18 power research stations in the country under the supervision of the Central Board of Irrigation and Power.

**Railways.** The Railway Board has established a research centre at Lucknow known as the Research, Designs and Standards Organisations with sub-stations at Chittaranjan and Lonavla to investigate problems referred to them by the railway workshop and the Central Standards Office (Railways)

**Roads.** The problems of road development and road materials, highways and bridges, engineering ports and harbours, etc., are dealt with by the Indian Roads Congress functioning under the Ministry of Transport.

**General.**

The Central Board of Irrigation and Power, constituted in 1927, is responsible for the initiation of fundamental research in the field of irrigation and power and the co-ordination of the work of 38 research stations established in different parts of the country.

The Central Water and Power Commission (C/W & P) is charged with the responsibility of initiating, co-ordination and furthering, in consultation with the State Governments concerned, schemes for the control, conservation and utilisation of water resources throughout the country for the purpose of flood control, irrigation, navigation and hydro-power generation. It is also responsible for the schemes of thermal power development and of transmission and utilisation of electrical energy throughout the country.

The C/W & P has undertaken the assessment of surface water resources and their utilisation for major and medium river valley schemes and the co-ordination of the data collected by the Ministries of Agriculture, Health and Transport pertaining to minor irrigation works and domestic and navigational purposes. The ultimate aim is to draw up a balance sheet of water to be utilised for additional benefits in the country.

**Standardisation.**

The Indian Standards Institution (ISI) functions under the Union Ministry of Industrial Development with headquarters at New Delhi and branch offices at Ahmedabad, Bangalore, Bombay, Calcutta, Hyderabad, Kanpur, and Madras. Established in 1947, the Institution lays down national standards for commodities, materials, practices, processes, etc. and promotes standardisation, quality control and simplification in industry and technology. Over 80 percent of the standards

formulated by ISI have been adopted by public and private sector organisations for their production and procurement programmes.

The Institution also operates the ISI Certification Marks Scheme under an Act of Parliament and issues licences to manufacturers for applying the ISI Certification Mark on the products as a third party guarantee about their quality. So far, nearly 7000 standards have been formulated which include about 1000 standards of consumer interest.

The Institution also imparts detailed training in standardisation methods and techniques to company executives and technical personnel, Engineers and technologists from Burma, Ceylon, Kenya, Malaysia, Philippines, Singapore, South Yemen, Thailand, Egypt, and Zambia have also undergone training under the centralised training programme.

**Research  
and  
Training.**

The Railway Board has set up a Research, Design and Standards Organisation at Lucknow with sub-stations at Lonavla and Chittaranjan to investigate problems referred to it by the railway work-shops and the Central Standards Office (Railways).

**Research  
Activities.**

The Central Road Research Institute, Delhi, was opened on 16 July 1952 for research on road engineering. The Institute also gives technical advice to the State Governments on various problems concerning road works, etc. The Central Designs Office of the Roads Wing deals with the type designs for route making for the national highways, principles to be followed

in the erection of advertisement boards on road sides, form of recording data on bridges, security of designs for bridges, production of road rollers, manufacture of road-making machinery, etc.

**National  
Buildings  
Organisa-  
tion.**

The National Buildings Organisation was set up in 1954 to collect study and disseminate results of research in buildings and housing with a view to bringing about quality improvement and cost reduction in buildings through improvements in design and construction techniques and building materials. The Organisation also conducts studies in various socio-economic aspects of housing like investment, finance, taxation, rent control, speculation in land prices, etc., and also collects and compiles housing statistics. Its five regional rural housing wings are working at Bangalore, Calcutta, Anand, Chandigarh and New Delhi for research, training and extension in rural housing.

The Organisation has set up a permanent building exhibition Nirman Bhuvan, New Delhi, where building materials are exhibited along with display of new materials and construction techniques evolved by research organisations. Typical house designs for small size plots are also available at this exhibition. The Organisation maintains a well-documented technical book library and a film library. It disseminates information through publications, symposia and training courses. To promote introduction of improved construction methods and of new materials, the Organisation gives grants to Government bodies up to 75% of

of the cost of construction for experimental projects. The Organisation also functions as "UN Regional Housing Centre" for ECAPF region and some of its activities cover the entire SCAPF region.

(SOURCE: INDIA 1973 - Publication Division Govt. of India.)



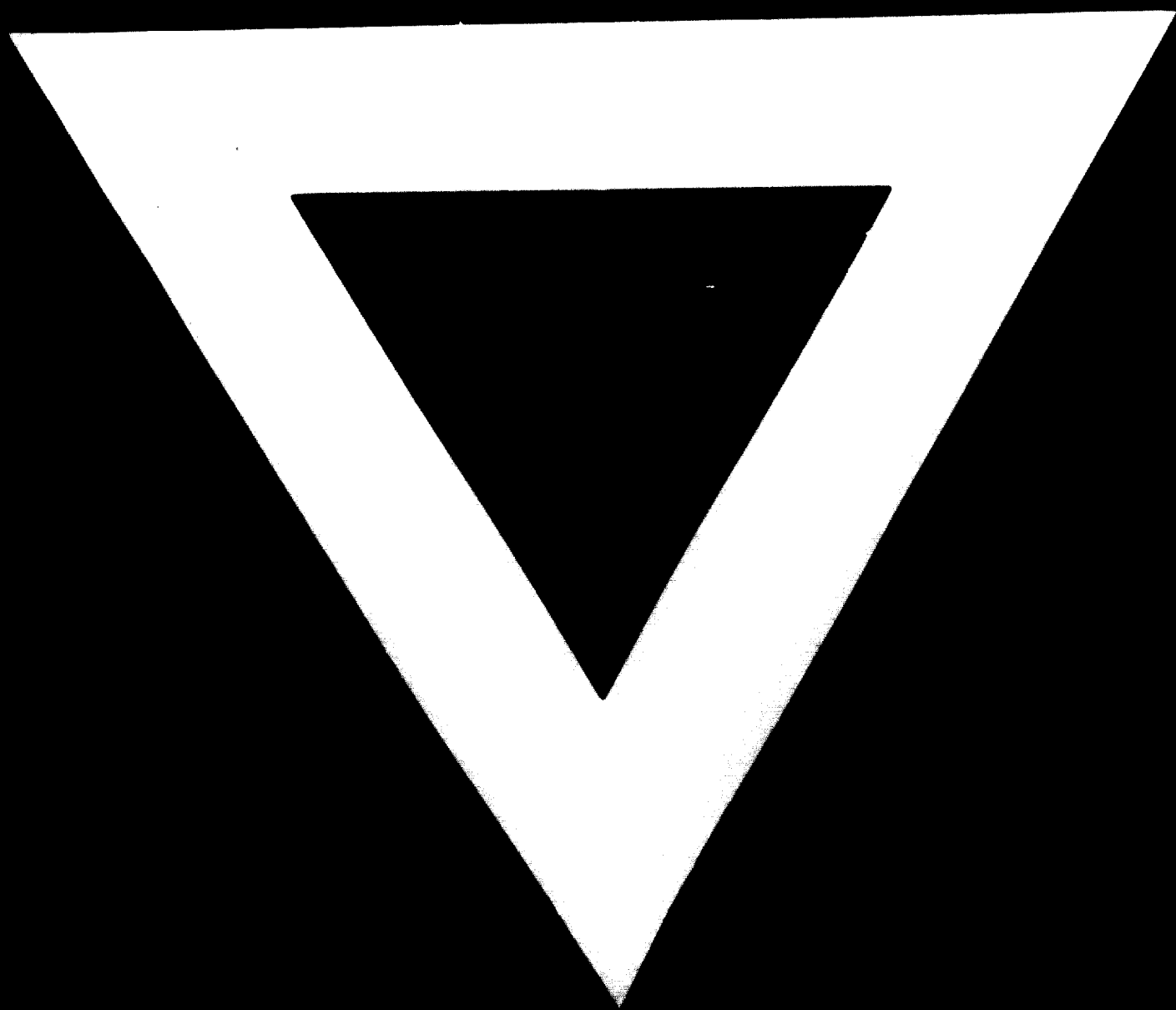
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