6. Fisheries

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6. Fisheries:-

6 - 1. General

6 - 1 - 1. Summary:

The survey on actual operations of sea fishery has found in every place that they are in general very primitive and conventional. In other words, the methods of fishing are very primitive and the fishing grounds are extremely limited. Therefore, fish caught are limited to coastal fish, and practically no oceanic resources have been explored. Most of the fishing grounds are along the sea coast and are within a distance of one day's trip. The fisheries in general can be called "Primitive coastal fisheries".
The State Government authorities have been undertaking painstaking work in developing the primitive fisheries, and actually, leaders who have acquired high degree of fishing knowledge in the advanced countries are making strenous efforts in working out the way to apply the advanced fishing methods to the present under-developed fisheries in the State of Orissa. The followings are to discuss actual fishing operations in the places where the survey was made.

(1) Coastal Fishing at Puri, Gopalput:

The Team had an opportunity to observe "Catamaran" and "Erigeli", but all are conventional and primitive with small catches: All the fishing nets are hand-made cotton nets with working life of one year or so. Though "Erigeli" is called gill-net, it is more like a driving net, and the catch is very small. Further study should be made for the improvement of the specifications of fishing implements and methods of fishing. Fishermen on the coast live primitively in general. A continuous effort must be made to attain effective development of coastal fishery.

Beach-seine in the coast of Gopalpur:

As in the case of operation in Puri mentioned above, the beach-seine

fishing in this district is in poor condition. It looked as if the fishermen in this district paid no attention to the time and wind direction in operating the beach seine. It is very unscientific to operate the beach seine at the time when the sun is high above in the sky and the transparency of sea is high and also wind is blowing from the back hills toward sea at a speed of 4 - 5 m/sec.

(Note: The beach-seine, in Japan, is the oldest coastal fishing method, and since as early as Tokugawa era, it has been considered most important to take advantage of the morning quiet and evening calm of the sea.)

(2) Fishery in Chandipur:

(a) Fishery in this district is far advanced than those found in the above two places. Gill-net operation is made along the sea coast by using motor-fishing boat to attain a good result. Fish caught are of good size and include such high-class fishes as Hilsa Sp. (Indian Shad), Pampus Sp. (Pomfret), Chirocentrus Sp. (Silver Bal), etc. The catch of 200 Kg. per gill-net fishing boat is considered excellent in this district. Since the catch is for a whole year, however, it is not clear if the catch increases at the time when certain kind of fish migrates to the coast in shoals for spawning. If this much catch is maintained throughout a year, the fishing ground is very profitable. The catch consists largely of coastal fishes with few off-shore fish except sharks, which fact proves that off-shore fishing grounds have not yet been cultivated.

(b) Gill-nets and set-nets with small meshes (they are called gill-nets in this district) are used, and synthetic fibre (Nylon) and floats made of vinyl chloride are used to some extent. It was especially interesting to find that gill-nets with non-contraction knots were in use because in the theory of gill-net fishing, contraction of knots is extremely important problem. Matters subject to further study are contraction, appropriate mesh, and the kind and size of net materials.

(c) At the time of survey, this area was found to have extremely large ebb and flow (according to the marine chart of the Bay of Bengal No. 814 "The Sandhead, False Point to Malta River"), but with the installation of a make-shift pier from the shore to the moorage and construction of such facilities as unloading yard, fresh-water supply, ice storage, power generators, this area can be made into a high-level fishing base. It is also important to employ other fishing methods which will enable to catch more oceanic fish than the present kinds when the base has been established. For instance, it is important to undertake such different fishing operations as drift gill-net fishing, trolling, long-line fishing, etc. depending on the season.

(3) Fishery at Chilka Lake:

(a) Aquatic products of Chilka Lake is considered to be very important not only to the State of Orissa but also to the entire India. Fishing there includes trap fishing for shrimp and gill-net and drag-net fishing for mullet depending on the season. As regards the catch, according to the official statistics for 1957 - 1961, in 1957, shrimp occupied about 1,120 metric tons or 25% of the total production of 4,400 metric tons in Chilka Lake. The amount of catch in the subsequent years showed a gradual decline, and, in 1961, the total catch amounted to 2,600 metric tons, of which shrimp occupied about 32%. It is noteworthy that shrimp occupied about 30% of the total catch in Chilka Lake during the period between 1957 and 1961. The fishes in Chilka Lake include 140 kinds which are classified by the scientists of both Central and State Governments, and the shrimps include such kinds as Peneus Indicus, P. Semisulcatus, Metapeneus Dobsoni, M. Monoceros, etc.

(b) The scientists of the research center there are not concerned about the gradual decline of production as they expect that the catch will show as increase again. However, a steady decline in the production without any change in the proportion of shrimp to fishes presents a question if there

are any outside causes for such decrease. There are also questions as to a possible unreasonable fishing operation and also the existence of any special factor in the relation between the Lake and open sea. Since these problems are beyond the capacity of survey with limited time, study and solution to these questions are left with the scientists who are in charge of the Lake.

(c) The Biological Station at Chilka Lake is apparently undertaking the research work on such subjects as estimation of plankton, soil study, analysis of water (Quantitative analysis of such nutritive salts as salt, nitrogen, phosphate, etc.), but they should also conduct ecological study of shrimp and other high-class fishes and hydraulics of Chilka Lake so that a constant maximum productivity of Chilka Lake resources may be attained. The continued operation of reasonable fishing at Chilka Lake is believed to be the most important point in the aquatic economy of the State of Orissa.

(4) Fisheries at Paradeep (Fishing Base):

(a) With an aim to launch into off-shore fishing, the State Government of Orissa intends to establish a fishing base at Paradeep. For this end, construction of tinning factory and refrigiration plant is already underway.

The scale of operation with small trawling boats/(32 Feet 52HP) is small and limited to the fishing grounds of less than 15F deep. Though fishes caught by these boats are of more than 10 kinds, what is noticeable is that all the fish are of small size and look as if they were young fish, which are hardly of any economic value. Since shrimp is the only product which has an economic value, the most important task of trawling in Paradeep is how to get a large catch of shrimp. If the present fishing operation is continued, there is hardly any justification for establishing a fishing base at this district.

(b) The fishing grounds where the trawling boats are in operation are shallow by accumulation of drift sand brought by rivers and the salinity is low. Thus the density of fry and young fish is apparently very large. The proble

would not be solved unless fishing grounds are explored at places with larger water depth and also the scale of fishery is expanded to allow several days' operation. If the State Government intends to build a fishing base at this place as a result of fixed point survey of fishing grounds, the above matters should be taken into due consideration.

The trawling boats in operation are North-European type and look like reduced copies of large boats, and they do not seem to be the products of the actual fishing experience in this district. Although it is not intended to deny the North-European type trawling boats, the boats should be copied from those which are in use at a place of similar physical condition and with successful fishery operation.

(c) Another problem in catching fishes of higher value is "trap fishing of shrimp". The fishing method may vary depending on the locality but the method to be studied is the one which is most effective in catching large size prawns and lobsters. The refrigiration plant and tinning factory in the base will be of no use unless the present fishing operation is improved.

(d) Though sythetic fibre (Terilen) is used for some fishing nets, the nets are all handwoven with coase thread in double knots, and no attention is paid to the loosening of knots and meshes.

Further study should be made on the relationship between the type of boat and the size, type and weight of nets because an effective underwater operation of nets can be attained only through a perfect integration of these factors. As regards the materials for synthetic fibre fishing nets, study should be made on the use of different synthetic fibers for different parts of the trawling nets by making the best use of the characteristics of each fiber.

(5) Natural Oyster at Sonapur:

Sonapur has a place where natural oysters live. The oyster bed is

said to be four-mile long, and the inhabitants in the district take the oysters freely. Nothing has been planned as to the utilization of oysters there. Being in a remote place, it may not be surprising to find that the methods of gathering and shucking oysters are extremely careless, and the handling is not at all sanitary. It is necessary for the State Government authorities concerned to be familiar with biological data of oysters such as spawning season, development of fry, seasonal changes of flesh, etc. The place is connected to the open sea by a route of 300 yeards and the sea bottom is a rock where oysters live, and it may be used for gathering of fishing boats. (However, attention should be paid to the fact that the place is so remote that there is not even electricity supply.)

6 - 1 - 2. Fresh-water Fishery:

The survey concerning fresh-water fishery was made on two places, namely, Kausalya Gang which is a fishing farm of carp for Mahanadi River and Hirakud Reservoir. When one considers the fact that the object fishes of these places are originated in Mahanadi River, he can not help being impressed by the important role played by the big rivers in the State. River fishing in the State is the most prospective industry with a bright future.

(1) Kausalya Gang (Fishing farm of carp for Mahanadi River) and Biological Station:

It is really an excellent achievement to have converted swamps which have been in existence in large number since old days into a fishing farm by obtaining seeds from Mahanadi River. The efforts made in building 250 acre pond that has taken three long years should be appreciated very highly.

At present, one-year rearing of yearlings of Cyprinus Carpio imported from Thailand and Indian Carp (Calta Calta, Labeo Rohita, Cirrhina Mrigala, and Labeo Calbasi) is made in the order of nursery - rearing - stocking-tank

- marketing-tank to bring them up to 2Kg = 3Kg with excellent results.

Furthermore, since the Indian Carp do not spawn naturally in a tank, pituitary injection is given to accelerate spawning. As a result, one million yearlings were supplied in 1962. The work of Dr. Hiralal Chowdhury (Research Officer- Central Fisheries, Cuttack) who is responsible for this excellent achievement is very highly appreciated. Nothing is disclosed as to the kind of animals from which pituitrin used for acceleration of spawning is obtained. Remarks: (A similar study was made about twenty years ago in Japan. Although it is theoretically recognised, no remarkable effect has been obtained in Japan. In some cases, the irritation by injection itself is considered to be effective rather than the effect of hormone. Though study is made on the use of pituitrin of frogs and salmon for various kinds of fishes, it is not so highly rated in Japan where temperature fluctuate seasonally. The pituitrin has no effect at all in the case of eels, and experiments are made with almost every kind of fresh-water fish. Incidentally, Dr. Hiralal Chowdhury once visited Japan for the observation of Japanese fisheries.)

The staff of the Biological Station are of biologist type, who make specimens of fishes in this district and conduct ecological study of various kinds of fish. The most important subject of study in future will be the countermeasures against fish diseases which are anticipated to develop under the natural circumstances of the fish farm. It is suggested to make further study on this particular subject.

(2) Hirakud Reservoir:

The reservoir is as large as about 400 square miles, which is surrounded by more than 100 fishing villages. The stock of fishes in this large reservoir is preserved with the resources from Mahanadi River and several 100,000 fry supplied every year.

What should be done to carry on permanently effective fishing operations with such locked resources? In some part of the reservoir, gill-net fishing

which was apparently undertaken as a means of stock sampling was observed. At every 200 m of the 600 m long gill-net, the net has strech mesh of 4 - 6" to investigate the rate of fish caught in these meshes. The fishing net is made of Terilen with the attachment of 3mm nylon rope. Mr. N.K.Mohanty, Assistant Director of Fisheries (Headquarters is in Hirakud), who is responsible for the work is the engineer who made study on fishing implements and fishing methods in Tokyo under the Colombo-plan. Attention was directed to the fact that investigation and study were made on the selectivity of fish by mesh. The fishes caught include:

(i) Silundia Silundia (Local-name: Bachua),

(ii) Gadusia Chapra (Local-name: Polei), and

(iii) Labeo Calbasu (Local-name. Kalabansi).

With the large number of those who are engaged in fishery in the vicinity of the reservoir, large area of the reservoir and fishes caught, the reservoir is very valuable place where useful fresh-water fishes are preserved, and efforts should be made, under the administrative guidance of the State Government, to maintain a continued maximum production by rearing the fish resources.

6 - 1 - 3. Development Policy for Fisheries:

(1) Summary:

As it is clear from the foregoing discussions, the present status of the fisheries in the State of Orissa is not in the established form of industry but is in a primitive stage. In order to develop and promote the marine fishing of the State of Orissa, it is necessary to launch into the materialization of an ideal plan of modern fisheries which is worked out with great prudence and initiative. The followings are some of the basic problems considered at this moment:

(a) Construction of a modern central fishing port.

(b) Motorization of fishing boats and improvement of fishing gear and

methods of fishing.

(c) Education of fishermen and extention work of technical improvements.

(d) Cooperative Organization of Fishermen.

(e) Strengthening of testing and research facilities.

(f) Inducement of foreign fishing technology.

(2) Construction of a modern central fishing port:

Fishing port is the prerequisit to the development of the present status of fisheries. Although it is difficult to make an accurate forecast as to which of the places surveyed will be the best port to satisfy all the future requirements, it is safe to name at least Chandipur, a part of Paradeep and Sonapur. However, it should not be forgotten that the construction of a modern central fishing port is one of the means to construct the fishing village economic sphere in close connection with the overall development program of the district. The fishing port must be the center to link the production at sea with the processing and circulation of the aquatic products on land. As the State Government is fully aware, it will play very important role as the basis of production in the fishery industry. Therefore, the base should be the center of fisheries and be fully equipped with the fishing port facilities as well as with refrigiration plants, processing factories and other facilities.

If the off-shore fishery is to be undertaken positively, consideration should be made on the construction of housing accommodations for fishermen. It is also necessary to establish fishery road network as a part of the overall development program to link fishing villages with the central fishing port and also to relate the fishing port with consuming districts so that "Quick handling" at the unloading place, which is the important task in circulation, may be achieved. In brief, effort should be made in working out an ideal plan for the establishment of modern fishing villages centering around the central fishing port.

(3) Motorization of Fishing Boats and Improvement of Fishing Gear and Methods of Fishing:

Although the subject has been discussed in the foregoing paragraph of "Summary", further discussion is made on this particular subject.

In the district where fishery industry is advanced, the set-up of fishery production is very complex and the technique of fishing differs depending upon the locality. However, since the fishing methods in the State of Orissa are very simple and still primitive, various improvements of fishing methods which will be accompanied by the progress of fishing gear and materials may be made on the basis of the present fishing methods. Unless the basic problem of fishing base (fishing port) has been solved, any practical conclusion can be reached as to further advancement of fishing implements and methods of fishing, but the followings are some of the immediate tasks to be considered:

(a) Fishing Nets to be Improved:

A gill-net is the most popular fishing gear in this district. Some of the gears are very primitive and involve many things to be improved. As pointed out in the foregoing general discussions, it is advisable to study a method to set the gill-net at the sea bottom or surface as well as to change the structure of nets to that of tangle net with more gathering. Migration of sharks is seen in this district, but damages of nets by the sharks should be avoided by adjusting the setting depth of nets with the past experience.

A netting implement called "Erigelli" was also observed. The net is apparently used to take advantage of ebb and flow, but it is necessary to work out more effective operation by employing a method of set-net. It must also be considered to study functional improvements such as possible change of material and size of net-thread to facilitate the flow of current, etc.

Trap fishing implements are also in use at some places. Since these

are very effective for lobster and prawn fishing and various kinds of implements are in practical use in various countries, further investigation and study should be made.

A dragnet is the implement which will be used increasingly in the future. Although Scandinavian type trawl nets are used in the coast of Orissa State, it is believed to be important to make a study on the Japanese trawlnet of small dragnet type for lobsters and prawns which is considered very effective.

Synthetic fiber nets are not so popular, which is especially true with the district of Paradeep fishing base. The synthetic fiber industry which has attained a remarkable advancement in the recent years supplies excellent materials of fishing implements. Size of net thread has an important effect on the catch: Once it was believed that the net made of extremely thin thread was most effective, but now the net of transparent thread is more effective. It is a great surprise to the Japanese fishery people to find in the State of Orissa that one pound of synthetic fibre (Terilen) costs fishermen as much as Rs.15.

(b) Angling Gears:

The survey did not find any angling in the coast of Orissa State. Presumably, angling as we consider is not undertaken. But, judging from the fishes caught, we can not understand why the angling is not operated. For example, Coryphaena sp. (such as Dorados), Lateolatsrax sp. (such as Perch) found in Chandipur are the fishes to be caught by angling. One of the most popular methods of coastal fishing, besides gill-net fishing, is trolling, the operation of which is subject to the motorization of fishing boats. Small-size motor fishing boats will stimulate full-fledged operation of fishing. In another words, study should be made in future on the Japanese type simple method of trolling with gig and also more mechanized full-scale trolling as those found in the Pacific coast of North American Continent.

course the initiative of fishermen, a constant administrative guidance is required to develop such initiative of fishermen. For example, if a group of those who are studious is organized among fishermen to undertake jointly improvement of means of production, rational operations, etc. it will bring about a noticeable effect without fail. And the important thing is to give the administrative guidance to encourage and foster such group campaign into larger scale. In practice, the competent government officials should be given the task of educating young fishermen. Besides the above mentioned physical improvements, qualitative improvement of fishermen themselves is also essential.

(Remarks): In Japan, the technical improvement program is carried out by officially employed instructors through the self-study groups. The total number of various study groups organized by fishermen was 1,310 in 1961, most of which consisted of young men (55% occupied by 20 years age group and 30% by 30 years age group).

(5) Cooperative Organization of Fishermen:

Although there are apparently many cooperative organizations in the coast of Orissa State, it is not clear if these cooperatives are operated for the welfare of fishermen which is closely related to a sound operation of fisheries. The survey failed to obtain sufficient knowledge on the activities of the cooperatives. The actual promotor in the fishing villages is the group organized by those who have enthusiasm and ingenuity. This is the study group mentioned above which can be developed and strengthened by the cooperatives under close connection with them. Such group movement will also develop into the cooperative.

The cooperative organization of fishermen can not be advanced without the fishermen's own initiative and enthusiasm. In the course of fishery production, necessity arise, as a means to earn income with the products, to make a joint sales and cooperative purchase of materials, which will

pave the way for the loan and credit transactions. The cooperatives of fishermen will require, especially during the stage of development, the administrative guidance of the government such as granting of subsidy, arrangement of loans, etc. The development of fishermen's cooperative organization is the prerequisit to a sound operation of fisheries.

(6) Strengthening of Testing and Research Institutions:

Testing and research work in the fishery industry covers very extensive field including aquatic products, fishing grounds, production and processing as well as such fields of economics as circulation and operation. The State Government of Orissa has, in its organization, Biological Station, Technological Research Station, etc. which are undertaking various studies of their own. Although both administrative institutions and investigation, testing and research institutions should work toward the same goal, the research institutions are often seggregated and left alone.

The subject of research and testing work has two distinct categories, one is a fundamental study and the other is the practical application and popularization. Unless the distinction of concept and operation is made, the testing and research institution is not considered to be carrying out its task satisfactorily. (Are the Central Fisheries in the State of Orissa in close connection with fundamental study departments and practical application & popularization departments of the State Government institutions? Or, are they entirely different with no relationship at all?)

In view of the present status of the fisheries in Orissa State, the task of the research institutions should be based on the study of the measures to cope with those discussed in the foregoing 4-1-1. The followings are some of the additional points which are considered to be very important.

(a) Investigation and Study on the Fishing Grounds:

Fisheries resources in the coast of Orissa State is still on the way

of progress and can not be judged from the present status of fisheries industry. If the fishermen intend to attain a sound operation, they should carry out a positive investigation of the development of fishing grounds. The progress of fishing operation begins with coastal operation and proceed to off-shore and then to pelagic fishing. Therefore, investigation and research should be made progressively step by step from the beginning. Before the development of off-shore resources of Bengal Bay is considered, the development of fishing grounds within the continental shelf should be taken up as the immediate task.

(b) Investigation and Research on Pelagic Fishing:

The pelagic fishery is the focus of attention of all those concerned with the fishery industry. Under the present circumstances of the fisheries in Orissa State, it is very difficult to launch into the pelagic fishery. Nevertheless, however, the investigation and research on the pelagic fishery must not be neglected same as the study of resources and fishing grounds.

From the regional consideration, long-line fishing of tuna is believed to be prospective: A systematic study on the required fishing boats, implements, etc. is most important.

(c) Study on the Processing Technique of Aquatic Products:

Although emphasis is likely to be placed on the fishing technique in view of the actual condition of fishery in the coast of Orissa State, the most retarded part of the fishery is the maintenance of freshness of fishes caught, on which nothing has been done. Is there any possibility of changing the structure of consumption from fresh fish to the processed products? Is it possible to increase the demand for processed products if a new enterprise is established for fish processing? There are many subjects to be studied, but the main research work to be undertaken by the testing and research institutions will be fundamental studies and the solution of technically unsolved problems. The field of food-processing with aquatic pro-

ducts by making the best use of abundant spice is truly very interesting subject to study.

(d) Reinforcement of Research Staff, Research Machines and Instruments and Other Facilities:

Research on fisheries coveres diversified fields. Observation of the research institutions in Orissa State indicates that all the institutions are fairly new and they are not yet certain as to what target they should aim at in carrying out their work. Aside from such subjective matter, the machines and instruments and other facilities for research work at the institutions should be reinforced by establishing a yearly plan. Some of the research center visited were not equipped with even the necessary equipment for basic research work. The immediate task is the reinforcement of research equipment at various research organizations. It is believed that all the research staff are assigned to the right work. Every one of the research staff interviewed to exchange opinion during the survey were very impressive. It was keenly felt that if they were given a chance to study their own research theme in the advanced countries as in the case of administrative officials, greater effect could be expected.

(7) Inducement of Foreign Fishing Technique:

(a) As far as fishing technique is concerned, the conclusion reached as a result of the survey of fisheries in the State of Orissa is that there are many things which will be remarkably developed if foreign technique is induced from the advanced countries. As discussed above, for example, the followings are some of the points considered:

i. Matters relating to pelagic fishery.

ii. Matters relating to motorization of coastal fishing boats.

iii. Synthetic fiber fishing implements.

iv. Improvement of fishing technique and its popularization.

v. Processing of aquatic products.

(b) Technical training has been carried on under the inter-governmental technical cooperation program based on such plans as Colombo Plan, etc. However, experience reveals that in some cases the scope of requirements of the trainee is too extensive and also in other cases the object of training desired by the trainee is not necessarily same as that is considered by the trainer country: Such problems should be solved if more effective training is to be attained.

Judging from the present status of the fishery industry of Orissa State, the above mentioned (i) - (v) are the immediate tasks to be carried out. Technical collaboration should be requested to the advanced countries with strong desire. The State Government should make its effort in having the officials in charge trained in the advanced countries systematically. Depending on the problem, it is advisable, in the case of inducement of new methods of fishing for example, to invite fishermen from the advanced countries for the demonstration of actual operations. In Japan, for instance, those who are called fisheries specialists are in charge of various different fields, some are the specialists of fisheries administration, and the others are technicians who can actually undertake fishing operations with fishing gears. In view of the actual circumstances of the fisheries of Orissa, it may be advisable, in the case of lobster and prawn fishing, to invite a group of Japanese fishermen who are familiar with such conditions as the coast of Orissa for the demonstration of trolling of lobsters and prawns.

Inducement of fishing technique from abroad is believed to make a great contribution to the development of fisheries industry of the State of Orissa.

6 - 2. Refrigeration Processing:

6 - 2 - 1. Present Status:

(1) As regards the refrigeration facilities for fishery use, the State of Orissa has 10-odd private and governmental ice plants. Most of them are equipped with simple ice storage equipment except a few plants which have cold storage equipment.

Since only several of the plants were surveyed and also because detailed data on each plant were not available at the government offices, this report can not present a detailed discussion as to their scale and capacity. But it is guessed that these plants are of small scale with daily ice manufacturing capacity of less than five tons.

(2) As for the refrigeration facilities for inland fisheries, a small scale ice plant is under construction at Hirakud, but there is no facility in particular in other districts. There is no refrigeration facility in consuming districts.

(3) Almost all of the refrigeration facilities employ ammonia system and are ordinary manual operation type, except some which have float control system.

As an exception, Paradeep fishery base has a continuous automatic ice manufacturing machine made by Atlas Company, Denmark, which was provided under the American technical assistance program.

(4) There are refrigeration trucks which were also offered by the United States, but they are not fully used as the trucks are too large to travel on narrow roads in local districts.

India has in all only six refrigeration waggon, and the use is still in an experimental stage. The State of Orissa use those for Calcutta. There is no fishing boat with refrigeration equipment in India.

6 - 2 - 2. Development of Refrigeration Facilities for Fisheries:

(1) The refrigeration facilities should be planned in accordance with the

circumstances and scale of fishery or consumption in the district. Therefore, unless future fishery plan in Orissa State has been established (including transportation and consumption), it will be of no use to make a plan for refrigeration facilities independently.

However, since the fisheries in the State of Orissa is not expected to make a great stride in a short period of time, it may be possible to make an approximate estimation on the future trend. Should a big-scale fishing operations be undertaken for export purpose, appropriate equipment should be planned individually according to such projects.

Thus, this report assumes a gradual development of the present condition, and discusses the refrigeration facilities necessary for various departments.

(2) Refrigeration Facilities for Coastal Fishery:

Fishery population is comparatively large and spreads over extensively, but individual catches are very small. Accordingly, there are few cases where fishes caught are cold stored for several days, and most of them are either shipped out immediately or treated for salting or drying.

The progress in transportation facilities will reduce the necessity of refrigeration of fishes at the bases. Even if refrigeration facilities are installed at every fishing base, it will result in nothing but the rise of fish price owing to very low level of utilization.

The facilities should be installed only when the catches at various places have shown remarkable increase or the unloading places have been well established concentratedly. For the time being until such time comes, it is more convenient and economical to make the best use of ice by installing small-scale ice manufacturing plants at the fishing bases.

With sufficient supply of ice, the demand from fishing boats and land transportation can be met, and fishes can be stored for a short period of time by assorting them with ice in a wooden box. Small cabins with insula-

tion will serve the purpose much better. Storing in wooden box has long been employed at fishing villages and fish markets in Formosa, and it is still found in some part of Southeast Asia. When the time comes to necessitate full-scale refrigeration facilities, the demand for ice will show further increase and the ice manufacturing plants will remain to be useful.

(3) Refrigeration Facilities for Inland Fishing:

Since fishes are caught and sold on order in the case of fish farms, the necessity of refrigeration facilities is very small. Instead, installation of equipment for transportation should be planned. Fishery at Hirakud Dam is of different condition from other inland fishing operations. However, as in the case of coastal fishery, many small fishing villages are scattered over an extensive area, and the installation of refrigeration facilities is not considered urgent for similar reasons: Ice manufacturing and transportation equipment should be built first.

(4) Refrigeration Facilities for Consuming Districts:

In the consuming districts, there will inevitably be a necessity for cold storage for the preservation of left-over fishes depending on the demand. Besides, as the districts have a direct contact with consumers, it is ideal to install refrigerators or refrigerated display-cases even for demonstration of commodity value. However, in view of the small transaction by local markets of street-stall type and also from the living standard of consumers, such sales system can hardly be expected.

Even in such comparatively big cities as Cuttack, the sales stores under direct operation of the Fisheries Development Corporation, Ltd. which we observed are of temporary hut construction, and are far behind of stores with display cases. Even if the stores are well established, as long as the consumers are indifferent of the freshness of fish, those at cheaper price with less freshness will be better received by them. Thus, not only producers but also consumers should be enlightened as to the importance of freshness,

and, until such time comes, the most economical and effective way will be to use sufficient ice in most rational way.

(5) Transportation Facilities:

Such refrigeration trucks as planned by the Fisheries Development Corporation, Ltd. are of course very effective transportation facilities. However, when all the fishing bases have been fully equipped with ice plants, it will be economical to use trucks with insulation cabins for ice storage transportation.

It will be advantageous to limit the use of refrigerated truck only to the transportation from a fishing base where the installation of ice plant is not economically feasible or to long distance transportation.

(6) Freezer Equipment:

Except for testing and research work, there is no need for the freezer equipment. Such equipment should be individually engineered if fishing operations for export purpose has been planned in future.

6 - 2 - 3. Capacity, etc. of Refrigeration Facilities to be Constructed.

(1) Capacity of Ice Manufacturing Plant:

Trolling base for coastal fishing:	2 - 5 ton/day
Other bases for coastal fishing:	1 - 2 ton/day
For inland fishing:	1 ton/day or less
For consuming districts:	1 ton/day or less

(2) Kind of Ice Manufacturing Equipment:

Automatic manufacturing equipment of flake or tube ice is desirable and not cube ice manufacturing equipment.

In the coastal area where raw water possibly contains some salt, the machine should have high efficiency and long durability for the use of such water.

In view of the low level of fishermen's technical knowledge and shortage of repair shops, the equipment should be of simple construction and easy

to handle.

(3) Others:

It is preferrable to install ice storing facilities for one or two days supply.

As for the construction of equipment, the full-scale facilities are to have mechanical cooling system but if the equipment is capable to manufacture supercooled ice, a insulated space will be sufficient. Further, if the equipment is capable to produce ice in short time after the start of operation and ice is used in small quantity, wooden boxes will meet the purpose.

In the districts where no electricity is supplied, it is necessary to install diesel engine or diesel - generator unit. In the places where sufficient supply of cooling water can not be expected, condensers of suitable type or cooling towers should also be installed.

(4) Transportation Facilities:

In view of the width of road, the refrigeration truck should be of a size similar to that of two-ton trucks. They should be driven by diesel engine. The refrigerators should be of such type as to use "Freon-12" refrigerant and be driven by the main engine. They should be capable to maintain the temperature of cabinet at -5°C under the outside temperature of +40°C.

Trucks for ice storage transportation without refrigerator should have insulation layer of 4" thick carbonized cork board or equal.

6 - 2 - 4. Education of Technicians:

Operators of the existing ice manufacturing plants are not necessarily well acquainted with the operation of refrigeration equipment. Besides, construction of additional ice plants will require expeditious education of the operators. Although the operation of small automatic equipment is very simple, the operators are required to have substantial knowledge for repair and adjustment of machine in case of any mechanical trouble.

As the operation of the existing ammonia refrigerators involve a danger of explosion if they are mal-operated, those who have received right education should be assigned for the maintenance and control of the machines.

The best way will be to send young engineers who have studied mechanical engineering at university to the advanced countries for a complete study of refrigeration engineering so that they may take charge of education and training of technicians and technical control of the plants in the State. Study in foreign country should include not only theoretical work but also actual operation and repair and adjustment work. For this end, they should also be trained at a refrigerator manufacturing plant and refrigeration plant for considerable period of time.

The period of study abroad may vary depending on the capability of individual person, but two to three years should be considered.

6 - 2 - 5. Others:

The most important reason for using refrigeration facilities is to maintain freshness of fishes, but the fisheries in the State of Orissa involves some fundamental problem to be solved before attempting to maintain freshness of fishes by machines. The task is to enlighten the producers as well as consumers on the freshness of fish. Having observed the existing circumstances, we can not but conclude that they are completely indifferent to freshness. For example, fishermen are not concerned bout fishes getting muddy at the landing place, and the retailers display fish under direct sun shine; while, the consumers buy such fish without even a slightest hesitation. Washing of fish during their transfer from the landing place to retailers has never been observed nor any of such facilities has been found. A little more attention to the handling of fish will raise the value of commodity a great deal.

Judging from the excellent way of handling of fish observed at the fishing port of Bombay, the indifference is not considered to be a common thing throughout the entire India but is the result of public's ignorance due to

the under-developed condition of fisheries in the State of Orissa.

Unless this fundamental problem is solved, the installation of refrigeration facilities will invite nothing but higher price of fish and no rational utilization can be expected as discussed above. Further effort should be made in solving the problems lying before the technical development.

7. Small Industries

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7. Small Industries

7-1 Introduction

This time I myself was a guest of the State of Orissa for 30 days and stayed for 15 days in other states. As a result, it was possible to compare the situation of Orissa with those of other states, such as New Delhi, Madras, Bungalore, Vishakhpatnam and Calcutta.

After having received orientation for a few days in the State capital of Bhubaneswar, I started for a 3,000 kilometer motor tour accompanied by an officer who explained and replied to my many questions while driving and introduced me to local directors who in turn took me all over factories or institutes.

Though my visit did not cover extensive areas and industries, I can say that I had seen enough to make fairly good conclusion, as I have travelled from south to north to reach as far as Rourkela and Berampur, and visited industries of every conceivable size and shape.

I put more weight to personal inspection of fact-finding than to the statistics which might lead strangers to wrong conclusions regardless of whether they are amply reliable sources.

This report is compiled for the sake of the Indian Government as well as for the Japanese Government which despatched the "Japanese Survey Mission for Orissa State Development Planning."

In Orissa it was repeatedly requested that my mission to study small scale industries should not result in a mere description of situations, but should rather be to find out the key to the solution of the problem of how to develop the backward State of Orissa.

7-2 Definition of Small Scale Industries

Though there were many different opinions and discussions as to the definition of small scale industries some arguing that number of employees

should be the criterion and others arguing that the power used in the factory should be adopted as the standard, it was settled by the law that the capital investment of Rs. 500,000 or less should be the criterion for this category.

Under this definition, there are still many different opinions as to how to classify small scale industries. Here, however, we are going to proceed in accordance with the terms which are used in the "Third Five-Year Plan" (A Draft Outline), in which the total amount of Rs. 596.68 lakhs is allocated to Village and Small Industries as follows:

Division	Rs. lakhs
1. Handlooms	130.00
2. Small Scale Industries	242.00
3. Industrial Estates	150.00
4. Handicrafts	30.00
5. Coir	3.00
6. Sericulture	16.68
7. Grants to Orissa Khadi and Village Industries Board	25.00
Total	Rs. 596.68

7-3 Position of Small Scale Industries

7-3-1 General remarks

In orissa, ten years ago, large and heavy industries being unknown, century-old small scale industries held their own position with their own markets to sell their products, and could continue their traditional methods peacefully without any keen competition as long as they produced consumer goods for the benefit of local inhabitants. However, the opening of Hindustan Steel Plant at Rourkela and the construction of Hirakud Multi-purpose Dam have come to stimulate exploitation of rich mineral resources

and to develop cement and fire brick industries. Fine roads for transportation and housing schemes for big towns are being planned.

At Chouder near Cuttack, construction of large scale textile milles, tube plants and paper mills created the atmosphere of modern industrialization. After completion of Hirakud Dam, Orissa has erected one gigantic monument worthy of pride, and electricity generating facilities have marked the dawn of reformation in industries to replace man labour with electric power. Aluminium industry supplying new kind of materials for the utensil industry near the dam will drive away fragile potteries.

Besides, the multi-purpose dam controls flood in rainy seasons and reserves irrigation water to increase crop production. It is beyond our present scope to discuss matters other than small scale industries. However, part time workers in the village industries and seasonal employees must rely on the ground for their living and all materials handled in this agricultural State and directly connected with commercialized crops. The following table shows the production of commercialized crops.

Commercialized crops

Kind of Crops	1955-1956		1965-1966	
	acres	lakh bales	acres	lakh bales
Jute	110,000	2.65	155,000	4.65
Cotton		1.00		3.00
Oil seeds		90,000 (tons)		2.00 (lakh tons)
Sugarcane		1.0 (lakh tons of gur)		2.00 (" ")
Coconut and arecanut	12,000 200		30,500	
Green manures	1,000,000		6,000,000	

Note: Other crops are: tobacco, turmeric, ginger, arrow-root, coffee, cocoa, cashewnut, etc.

The above table shows that an overall increase of more than twice is

expected 10 years ahead. The contribution of chemical fertilizers and green manures, (fruits of human labour and diligence) should not be overlooked.

7-3-2 Details of Village and Small Industries

1) Handlooms for cloth weaving in the co-operatives are on the increase as below in response to the State's encouragement.

	1955-56	1960-1961
Production	6 mil. yards	33 mil. yards
Number of looms	25,000	50,000 (23,000 weavers)

Much effort has been made by the State to develop and increase the number of weavers and looms in the co-operatives with great success. Taking this opportunity I wish to say that I fully support the government's policy to put all looms and weavers under the control of the co-operatives.

Since there are great many varieties of operations involved in this handloom work, the mutual co-operative members is extremely important, and the State must encourage it though it might not be the only means to attain prosperity in competition with factory system industries.

During my visit of the co-operative at Bargarh, I found that my dream was not shattered, since the brightness and promising atmosphere were vividly observed. The office was well organised, and the full account of each member was so clearly indicated that the co-operative could receive the whole hearted support from the weavers. It can not be denied that the success of the co-operative is partly due to the personalities of the staff.

Besides dyeing and calendering works, a village school surrounded by an envious environment full of flower and vegetable gardens is found. The co-operative is prosperous enough to give very neat and comfortable housing to some of their members. A new roomy factory was also under construction.

It is not a utopia for a village to have such kind of facility through which the villagers consolidate themselves and protect their interests

without forgetting their mutual welfare and friendship. This co-operative is the only measure of self-defence on the occasion when a big industry on the same line comes in and Tries to wipe out small factories. New design and technique must be studied to bring about improvement, and full advantage of the government centres must be taken. The marketing of their products is well organized because it is carried out through several emporiums and branches. The government gives a benefit of 5% rebate for the sale of their handloom cloth, while levying 10% tax on the factory-made cloth. Under the Third Five Year Plan, Rs. 130 lakhs are allocated for the purpose of bringing additional 25,000 weavers into new 250 co-operatives in addition to financial assistance or other benefits to old co-operatives.

In the case of spinning mills, the government becomes a share holder of the mills. In addition to this, loans are provided for 2,000 existing factories, new 25,000 cotton weavers and 1,000 silk weavers. New sales depots, central ones and interstate ones are also proposed to be set up.

7-3-3 Small Scale Industries

The main features of the government's policies for the small scale industries under the 2nd Five Year Plan and the drafted 3rd Five Year Plan are explained below:

1) Pilot Projects Scheme introduced under the 2nd Five Year Plan.

The State Industry Aid Act provides that in the case of a collaboration among private entrepreneurs having no adequate means for starting a factory, while qualifying for manufacturing and administration, 90% of the capital is invested by the State.

This scheme is one of the most advanced aid programme for developing top ranking industries requiring comparatively high skill. Otherwise their establishment would be impossible. This is a typical government assistance sometimes known as "Spoon-fed." But in my opinion, such

accusation is unfair, because the green house or spoon-fed is imperatively necessary at the initial stage of industries. Important industries must be protected from the outside severe climate, and they must be encouraged to be independent as soon as they are capable of standing a severe competition alone.

Generally speaking, however, central figures or intellectual entrepreneurs are rather conservative in participating in risky enterprises, and will prefer to confine themselves in a laboratory for research works on electronics, electro-chemistry, etc.

It is necessary to induce inventors to bring their bright idea or technique into practice. Most of the factories under this program are making profits. Though some of them do not go beyond the laboratory scale production, at least 10% profit on the government investment constitutes an additional revenue source. It must be remembered that the entrepreneurs are entitled to increase their shares in the enterprise by using the profits from the production.

More than 37 companies were started under the Pilot Project Scheme of the State. They are engaged in manufacturing various types of goods: phenyle, ink and other chemicals, furniture and building materials, electrical accessories, cycle parts, cutlery, manufacture of bolts and nuts, trunks, aluminium wares, pre-stressed concrete poles, collapsible gates and shutters, storage batteries, tin products, drugs, etc. Five new cast iron factories are also proposed. By the end of the Second Five Year Plan the State will have invested as much as Rs. 53-55 lakhs in this scheme.

For the development of small industries the State Third Five Year Plan provides as much as Rs. 242 lakhs in order to finance small scale industries as well as to purchase shares under the Pilot Projects Scheme. It is hoped to pay due attention to the organization of Industrial co-operatives for the reason as given above.

Provisions are also made for modernization and establishment of industrial schools.

2) Industrial Estates

The construction of industrial estates marks an epoch in the history of Small Scale Industries as factory colonies, or "combinats."

The way in which a factory is speedily started is conspicuous, as the government facilities provide not only the building and utilities but eliminate the tedious procedures for obtaining approval of plans, permission and licences.

In Orissa, under the 2nd Five Year Plan, one each was planned at Cuttack, Rourkela, Berhampur, Kerandrapara and Jhaisuguda. I visited the first three out of five areas to inspect factories about 30 in number. For the sake of comparison, Okhla near New Delhi, Guindy in Madras, Howrah near Calcutta and Bangalore were visited. I have learned what we can do in a few years time in Orissa from what they have done in the past.

3) Credit Facilities to Small Industries

Though there are several financial institutions providing loans to the small scale industries through the State Government, State Financial Corporations, and the State Bank of Indian Scheme, the Government has founded another credit guarantee scheme intended to provide protection of their advances against possible losses for a period of 2 years on a trial basis.

In comformity with a part of recommendations from the All-India Small Scale Industries, funds are provided as below under the 3rd Five Year Plan.

Number of Estates	Unit/Estate	Unit	Rs.lakhs/Estate	Rs.lakhs
14 small estates	12	168	5	70
5 medium	15	75	10	50
Expansion of Berhampur and Rourkela		40		18
Carried-over expenditure of States since the start of 2nd F.Y.P.				12
Total		283		150

In order to explain industrial estates, one at Madhupatna (in Cuttack) is taken as an illustration.

The estate was formally inaugurated on the 15th, October, 1958. There are 39 factories covering 60 units employing about 500 laborers. The Government of India established an Extension Centre for the common use with expensive machines, forging, plating, etc. as a Training-Production Centre for small industries. The total area covers about 40 acres including employees' quarters calling for an expenditure of Rs. 3,146,879.

Details of the Type of Buildings in the Industrial Estate, Madhupatna, Cuttack

Type	Floor space (sq. ft.)	Dimensions in Ft.			Rent per month	Number of Units
		Length x	Width x	Height		
A (Small)	750	30	25	14	Rs. 63	32
B (Medium)	2,400	60	40	15	202	12
C (Large)	4,200	80	60	20	403	16
						60 (39)

Annex at Jagatpur

B (Medium)	5
C (Large)	6
	11

(4) Handicraft

There are as many as 60 classes of artisan groups, out of which 36 are recipients of an allotment amounting to Rs. 20 lakhs under the 2nd Five Year Plan. Design centres and training-production centres were established.

Local colour and good taste must be expressed in the handicrafts to attract travellers and foreign buyers wishing to obtain sourvenirs for their homes. To my liking and others also, some colour combinations are over-emphasized. The design shall not be simple copies of those of their ancestors. Creations should always be fresh and unique. The pride of their native land and the rememberance of their traditional culture should be retained.

Propaganda of historical relics and arts accompanied by comfortable accommodations and convenient transporting means will encourage tourist industry resulting in natural increase in the sales of sourvenirs and exports. In these days we must spend much money for advertisement of goods for sale.

Under the 3rd Five Year Plan Rs. 30 lakhs will be allocated to handicraft industries through co-operatives. I express my full approval of this step. An individual is too weak in purchasing materials or in selling products, and at the same time it is always easier for the government to deal with small number of groups.

In this connection, I suggest that more modern processing method should be introduced in the major part of the work so that quality of handicraft may be maintained. In doing so, it is always possible to save time and labour, thus contributing towards lowering price and promoting efficiency.

(5) Coir

The coir industry can not be ignored, as the products are very useful for household or export purposes. In the State, out of six existing

co-operatives five are women co-operatives showing how women labour dominates in this industry. Two production-training centres are scheduled to be completed under the 2nd Five Year Plan.

Under the 3rd Five Year Plan, Rs. 300,000 rupees will be spent for assisting co-operatives compared with Rs. 165,000 rupees under the 2nd Five Year Plan.

(6) Sericulture

Co-operatives are absorbing 6,000 weavers, and Rs. 1,668,000 rupees (more than twice compared with the previous year) are appropriated as the result of the participation of 3,000 Tassar and 600 Eri rearers in the co-operatives. Fortunately no direct influence of growing synthetic fibres is being felt among the industry in this country as in the case of Japan where the industry which has recovered from the long depression is expected to continue the present business tunes for sometime.

Grants to Orissa Khadi and village Industries administer the following:

a) Khadi
b) Processing of cereals and pulses
c) Ghani oil industry
d) Village leather industry
e) Cottage match industry
f) Gur-Khandsari industry
g) Palm-gur industry
h) Non-edible oils and soap industry
i) Handmade paper industry
j) Village pottery industry
k) Bee-keeping
l) Fiber industry

m). Blacksmith and carpentry

n) Manure and use of manure

o) Cottage industry of lime-stone and its products.

Among these items there are several industries which must particularly be protected for preservation of national resources. Otherwise those upholding old tradition and of psychological value may not survive in competition with mechanized and mass-production process.

Bee-keeping is a promising and rapidly growing industry with flowers all the year round in Orissa and all other places even in the mountain areas. The instructors are being trained at the special centres and numerous substations for proper management.

7-4 Conclusion

7-4-1 Recommendable Industries

The state government is very anxious to create new small industries with the industrial estates as a nucleus. The government's policy is to induce civilians to do so by their own initiative. However, once one starts an enterprise at his own risk, the government subsidizes and protects him too profusely: as it was pointed out before, this may be described as wrapped in silk or spoon fed.

Under the Pilot Project Scheme, an entrepreneur is assisted by the government in capital as much as 90%, namely he can start the work with only 10% investment. And the long-term-hire and purchase scheme is available also. I wonder why industrialists are timid and overcautious in starting their work under these favourable conditions in contrast to the big industries controlled by the central government. If they starts a new industry, the majority usually succeed in making profit. Why do they hesitate in deciding? Trained labour is abundant. They can be trained in

the government training centres, or in some cases under technical assistance program they may be sent abroad or foreign technicians may be invited as in the case of prototype production and training centres and demonstration farms. However in so far as metal fields which I had occasion to visit are concerned I can not, even though I want to, offer words of praise or commendation. As for the sources from which the fund comes there are various banks including State, central and private banks besides credit guarantee systems.

Does it not show the lack of smooth financial systems that there are plenty of people looking for money lenders demanding exorbitant interest rates? Bonding storehouses with padlock under the control of money lenders in many factories show how materials and products are guarded. It is evident that these procedures require extremely complicated process (presence of bank representatives). On the spot I recommended small industries as recommended by Mr. Iwatake and the Japan Consulting institute such as plywood factory, paper from bagasse, rayon from bamboo, BHC plants etc. However, the local government did not express any opinions a reaction. We recommend herewith the industries listed below.

In the conclusion of this report I again emphasize the following plants to be installed though existing ones are excluded in order to avoid repetition.

Primarily more accurate market research in each item as well as local demands and flow of goods from neighbouring states which are most formidable competitors will be necessary.

Demands for some articles may not come to our expectation for a few years. However, by raising general standard of living luxuries may become necessities. They may work harder, save more and start to buy such merchandizes. On the part of entreneurs perseverance, industry and

intellectual control or management are essential. The 1st part of the list may appear too ambitious in the production programs. However, since you are a late commer, the only chance to make up for the handicap in competition with Madras, Calcutta, Bombay etc. is to start with a production program suitable for the market and then gradually increase the volume of production at the same time decreasing the unit price in the future. On the other hand, the local government shall give priority to local production in order to promote industry.

A. Strongly Recommended

	Capacity of Production	Number of Employees		Cost of Machinery
1. Hasp, door roller	50,000 dz./month	20		stg. £ 13,000
2. Plastics Moulding (injection & compression)	9,000 kg./m.	45		15,000
3. Concrete pipe	2,500 ton/m.	150		30,000
4. Lead pencil	9,000 gross/m.	50		13,000
5. Steel wire products (nail)	100 ton/m.	40		20,000
6. Bicycle tyres & tubes	200 pairs/day	60		25,000
7. Assembly of T.R. radio	2,000 sets/m.	40		1,500 (equipment)
8. Malleable C.I. Foundry	100 ton/m.	100	*	100,000
9. Toilet Soap	50,000 pc./day	50	*	80,000

B. Recommended

1. Textile
   a. Hosiery and Hosiery Needle plants
   b. Shirt making factory (ready made)
   c. Fishing net

2. Chemicals
   a. Alcohol Distillation plant
   b. Tanning and wax extraction
   c. Leather curing
   d. Agricultural insectitude (BHC, etc.)

3. Paper & Wood	a.	Straw board and wrapping paper mill (rice straw and bagasse)
	b.	Corrugated board manufacturing plant
	c.	Cardboard box factory
	d.	Plywood manufacturing plant
	e.	Boat building
4. Metal Products	a.	Wire drawing plant
	b.	Sewing needle factory
	c.	Umbrella skelton manufacturing factory
	d.	Press (snap) button manufacturing factory
	e.	Razor blade manufacturing plant
	f.	Zip fastener manufacturing plant
	g.	Steel foundry
	h.	Forging shop
	i.	Ferrous and non-ferrous die-cast shop
	j.	Can and tin manufacturing plant
	k.	Aluminium sheet metal shop
	l.	Cycle parts manufacturing plant
	m.	Engineering Tools (hammer, wrench, screw-driver, etc.)
	n.	Farm implements (spade, fork, etc.)
	o.	Pipe construction plant, including pipe joints & fittings using "Papcon" (automatic lathe)
5. Food	a.	Fish and vegetable Canning factory
	b.	Confectionary factory
	c.	Milk and Cheese plant
6. Rubber	a.	Contraceptive manufacturing plant
7. Ceramics	a.	Refractory bricks kiln
	b.	Sanitary ware kiln
	c.	High tension Insulator kiln
	d.	Crockery manufacturing factory
8. Miscellaneous	a.	Dry cleaning and laundry shop
	b.	Printing accessories shop
	c.	Stationery pins, clips, etc.
	e.	Bone mill
	f.	Metal lath and wire net.
	* g.	Ball-point pen.

Post Script

There was a strong request to open a model factory in the line of the Japanese Demonstration Farm. This will be a matter to be discussed between the two governments. I believe that Japanese skill and efficiency are best demonstrated in metal works.

7-4-2 Industrial Estate

Your government's industrial development policies placing main weight on the co-operatives on one hand, and on the Industrial Estates on the other hand, are correct and I express my full approval. These policies should be actuated on the right track without any hesitation or doubt.

1) Upon inspection of a few industrial estates, I felt rather disappointed at the fact that no organic chain is found among the units within or between units and large factories outside. Some southern industrial estates claim that there exists close connection among them. Without good connection, their minds would be concentrated or the marketing and they could not devote their energy to the improvement of production.

As I mentioned before small industries are protected too much and entrepreneurs are inclined to lose courage to face squarely with the strong competition from other parts of India and other countries. However, in connection with the industrial estates, I would like to advise that unity and collaboration among entrepreneurs be further promoted. This might come out under I.S.I.: for example, assistance should be rendered in connection with materials, fuels, and even transportation in order to cut expenses and improve distribution systems.

2) Co-operation

The co-operative movement is another subject which attracted our attention since the State Government has decided to include all rural families in the co-operatives under the 3rd Five Year Plan according to the National Development Council's decision on the 9th November 1958.

7-4-3 2-shifts, 3-shifts; 3-crops and 4-crops

In order to give employment to more people, an 8-hour day work system

and 48 hours per week shall be adopted. Why not 2 shifts and 3 shifts in the case of large factories whose products are in strong demand? If materials are supplied smoothly, high turnover rate of the invested capital is the true key to success in business. I came across cases where not only a fine machinery but an expensive factory was idle after the day's work for 8-hours due to the shortage in supply of materials. On the other hand, in the farming in which three or four crops are possible, farmers have not enough means to purchase fertilizer or seeds in spite of the fact that the country as a whole is importing wheat from abroad. Instead of establishing many more industrial estates in a town with a population of 5,000, it is better to try to select small industries which act as subcontractors to near-by big factories. Mistrust among them is the main obstacle to the smooth running of the scheme, though similar examples are found in other states.

Quite recently it is reported that the Central Government is planning to construst "Mig" aircraft works on the mountainside of the State of Orissa. If it is true, this will be a golden opportunity for giving the above scheme a fair trial. The planners of the big project do not run the risk of relying on the local manufacturers. They will try to produce in the new plant under direct and strict supervision or to purchase the parts from well known domestic makers which may not be inside the State of Orissa. It will be necessary for the local government to insist that their own state should be the supplier. For this purpose, it will be required that a suitable industrial estate be established near by.

As the proposed aircraft factory will start assembling knockdown components, there will be ample time for training high class engineers, metallurgists, electrical engineers, inspectors, etc., besides all kind of mechanics and artisans for the industrial estate, who can be assigned to

the Industrial Training Institute. Say 100 units of the industrial estate will contribute much to the production to begin with, and then another 50 to 100 will be increased to be ready before the finalization of the aircraft factory. Sectionalization or break-down in production of parts which require high standard of technique from all technicians is easier than the case where the big parent factory trains a big number of men under one supervision. As the central Government spends a huge sum of money for the construction of the plant, the local government has to assist using their native people most effectively. If the facilities in the industrial estates could be used for other civilian works in their spare time, they can be kept busy all the time. In the past, fine expensive machineries in the government works have been left idle in the dust except in emergency.

If the aircraft factory fails to materialize in Orissa, a tructor factory which the State is so anxious to have will be a good substitute. Besides, there are several articles which could be manufactured in a big factory with the units of the industrial estates as subcontractors, e.g., water pumps for irrigation, electric motors for modernization of villages, etc.

7-4-4 Independence of India

Wherever I went, I was always asked about the secret of Small Scale Industries in Japan. However, it is quite true that there are no other secrets than the struggles for cost reduction by rationalization and competitive power in export nurtured through long year's domestic competition. At one time, cotton goods produced in Japan swept the world market for price and quality, but India has developed to become a strong competitor since then. It was only the last century (one hundred years ago) that existence of Japan became known to the world. The marking or turning point was the Meiji

Restoration. You call this "élan vital". Our seniors cast off everything they thought was old political, spiritual, or otherwise. The caste system of the feudal age was discarded in order to catch up with the advanced European countries; many national treasures were carried away overseas which we lamented too late. Among rapid reformations, it was the greatest that the elementary education was made compulsory. As a result, today hardly any illiterate person is found, with the near 100% of school attendance. The general diffusion of the elementary education contributed toward the present development of Small Scale Industries in Japan.

After the last war, our one-time small industries have astonished the world by the emergence of Sony for transistor radio, Honda for bycicle, Canon for camera, Matsushita for electrical appliances, etc. These industries all believe in high wages and employees' welfare along with mass production by automation and intensive researches. On the other hand, average small scale industries are always struggling for existance. In the coming Tokyo Governor election campaign, one of the main issues is the policy for small scale industries. In India, big strides as well as efforts have been made since the long-fought independence was regained. Many ambitious programmes are devised under the Third Five Year Plan to cope with the unfavourable foreign exchange situations, especially after the Indo-Chinese frontier campaign. Since there is no factor which may interfere with the consolidation and unity of the country, the development and prosperity of the country is assured though there may be many obstacles in the way. For this purpose, especially for the sound development of Small Scale Industries in India, priority must be given to the following three schemes. Though your government has recognized their importance, we are dubious about the direct connections between them.

1. Compulsory elementary Education.
2. Family Planning.
3. Improvement in Cattle (and Poultry) Breeding.

(1) Compulsory education

We must get rid of loafing youngsters from the street during the next five years. In dry season they can be taught under the shade or in the tent. A fine concrete building is not necessary. There are many unemployed educated people who can served as temporary teachers or they can be trained as such in a short time. When youngsters are removed from work, men and women can take their place more efficiently. When the children complete their education after 5 years, we shall see a big difference. If their suggestion and advancement are encouraged, they will find more interest in their work. During my inspection tours I have seen so many good but robot like workers with their pupils open as I gazed them. I have heard that many defective articles were produced during the night shift without supervisor. There are many cases where workers failed to stop the machine, and they blamed the machine for it the next morning.

(2) Family Planning

The housewives suffer most from the large families. They over work only for the sake the families and consume their energy. It is not a luxury to let the ordinary people enjoy sport in spare time and engage in healthy recreations. Whenever I visited the industrial estates, I asked if sport competition among employees of the estate or libraries or clubs existed. I was surprised to see many villages near the capital poorly illuminated at night, though there were

electrical facilities: bicycle shops, drapery shops, and drug stores are among those well lighted, while the rest are pitch dark. The nights are too long.

(3) Improvement in Cattle and Poultry Breeding

Why do you keep so many unproductive cows? What I am concerned about is not the number which is half the Indian population. I was told that in Australia the number of cows was 1.5 times that of the population. In Argentina, cows are 5 times as many as the population. Why do we say too many? The cows here specially in Orissa are dwarf in appearance and unproductive. The Shetland pony in Scotland is appreciated due to its rarity and is kept as a pet. By keeping less number of productive cows, we can save green grass and rice straw for feed to be utilized as green manure and materials for making paper. In this way poor farmers can obtain good fertilizer and make the soil more fertile without spending a rupee but with hard labour.

Note: Statical tables from the "THIRD FIVE-YEAR PLAN" issued by the Government of Orissa are reproduced.

ENROLMENT OF PUPILS

Year	Enrolment in Orissa (per 100,000 people)			Percentage			All-India enrolment			All-India percentage		
	6-11	11-14	14-17	6-11	11-14	14-17	6-11	11-14	14-17	6-11	11-14	14-17
1	2	3	4	5	6	7	8	9	10	11	12	13
1950-51	4.85	0.39	0.16	26.9	4.09	1.9	192	31	12	43.31	12.9	5.4
1955-56	6.81	0.535	0.239	36.5	5.4	2.3	252	43	20	51.0	16.3	8.1
1960-61 (Estimated)	10.00	0.85	0.40	50.0	8.8	3.7	330	61	30	60.0	22.6	12.0
1965-66 (Estimated)	16.00	1.70	0.80	70.0	16.0	7.1	504	100	44	80.0	30.0	15.0

Reference Books

(In English)

1.	Techno-Economic Survey of Orissa	by National Council of Applied Economic Research, New Delhi
2.	INDIA - A Reference Annual 1962	Publications Division - Gov. of India
3.	THIRD FIVE YEAR PLAN (SECOND " " ")	Government of India - Planning Commission
4.	THIRD FIVE YEAR PLAN (Draft Outline)	Government of Orissa
5.	Report on Small Industries in India	International Planning Team (The Ford Foundation)
6.	Report of Japanese Delegation on Small Scale Industries, 1959	Government of India
7.	Industrial Organization in India	Mahesh Chaud and Shri Dhar Misra
8.	The Discovery of India	Jawaharlal Nehru
9.	Small Industry Advisory Services International	Joseph E. Stepanek
10.	My India	Jim Corbett
11.	Prospects for Indian Development	Wilfred Malenbaum
12.	Consider Japan	The Economist, London

(In Japanese)

1.	Labor Situation in India	Institute of Asia Economic Affairs (Director: Dr. S. Tohata)
2.	Managing Agency System in India	
3.	Economic Development of India and her Financial Resources	
4.	Technical Level of Indian Industries	Institute of Asia Economic Affairs
5.	The Financial System in India	
6.	India's Machinery Industries and Trade Structure	
7.	Small Scale Industries in India	Institute of Asia Economic Affairs

etc.

8. Electric Industry

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8. Electric Industry

8 - 1. Present Status of Electric Industry in the State of Orissa, India

8 - 1 - 1. Demand for Electric Power

Keeping pace with a series of "Five Year Economic Development Program" undertaken since 1951, the demand for electricity in the State of Orissa has been showing a rapid growth. Annual sales of electricity by the electric enterprise showed a remarkable increase of 43.5 times during five years from 11,450,000 kwh in 1955 to 498,450,000 kwh in 1960: The total power demand in 1960 including generation by industry-owned power plants amounted to 760,200,000 kwh, with the maximum demand being 139,527 kw. The power demand including generation by industry-owned power plants in 1962 is estimated to some 1,000,000,000 kwh, with the maximum demand of 180,000 kw - 190,000 kw.

The industrial demand for power is by far the largest, occupying approximately 96% of the total consumption in 1960; while, demand from household lighting and power need accounted for 2.4%, Commercial lighting 1% and the demand from Public lighting, water works, irrigation occupied the remaining portion of the power demand.

The majority of industrial consumption is by such industries as aluminum, ferro-manganese and steel. Since the demand with high load factor such as that by aluminum and ferro-manganese industries occupies major portion of the demand, the over-all daily load factor is extremely high and is estimated to be around 90%. The annual load factor (public utilities only) in 1960 was 77.4%.

Although the power demand in the State of Orissa increased tremendously in the recent years, per capita consumption of electricity (public utilities only) in 1960 was 28.39 kwh, which was substantially lower than the average consumption in India of 31.62 kwh. Per capita consumption of electricity for commercial and household uses were 1.04 and 0.45 kwh respectively, much lower than the country's average of 3.13 and 1.94 kwh. On the other hand, industrial consumption of the power (including that by railway and water works) was 26.77 kwh as against the country's average of 23.93 kwh.

8 - 1 - 2. System of Electricity

The main electric power systems of the State are Hirakud and Machkund systems which are not inter-connected but are independent.

The Hirakud system is the main system of the State of Orissa with the Hirakud and Chiplima hydraulic power plants (Total capacity: 270 MW, partly under construction) by the use of Hirakud multi-purpose dam. A thermal power plant with 78 MW capacity for private use of Rourkela Steel Plant is connected as the other main source of power supply. The present demand under the system is estimated to be 170,000 kw - 180,000 kw.

The Machkund system is connected to the Machkund hydraulic power plant (Output: 114.75 MW) which was constructed jointly by Orissa State and Andhra Pradesh State. Though the distribution of power to Orissa State is 30%, the present demand under this system is about 10 MW as the present transmission system is not yet fully in order.

No connection to the systems of neighbouring states is made except that the Machkund system is connected with the system of Andhra Pradesh State through the Machkund power plant as stated above.

Transmission voltage of the systems in Orissa State is maximum 132 kv with secondary voltage of 66kv, 33kv, 22kv and 11kv: Distribution voltage is 6.6kv and 3.3kv, and low voltage supply is made with 3-phase 400v and single-phase 230v, 50~. In certain limited area, supply of direct current at low voltage is made, but is being changed to alternate current.

8 - 1 - 3. Power Generating Equipment

With the progress of the second stage work of Hirakund project, the power generating equipment in the State has increased remarkably in 1962. It is estimated that, as of November 1962, the total capacity of power plants including the portion of Machkund for Orissa State as well as industry-owned plants amounts to 350 MW, of which approximately 240 MW is by hydraulic power and 110 MW by thermal power. Accordingly, the ratio between hydraulic and

thermal power is 69:31 as against the nation's 34:66 (as of end of March 1961), which indicates relatively higher weight of hydraulic power in the State.

8 - 1 - 4. Present Situation of Demand and Supply of Electricity

The present generating capacity exceeds considerably the power demand. Even though there is a considerable lowering in the supply capacity of the Hirakud Power Plant during the rainy season (Supply capacity drops to approximately 145 kw as against generating capacity of equipment of 208.5 MW), the supply capacity exceeds the maximum demand by more than 20%, thus leaving substantial margin at the present stage.

8 - 1 - 5. Energy Resources

As for the energy resources, the State of Orissa has comparatively abundant hydraulic power and coal resources. Judging from the results of survey made by C.W.P.C. in 1953 and the survey made recently by the State Government, the potential hydraulic power is estimated to be 3,500 MW. As for the coal resources, the State has Talcher coal field being developed by the public corporation, N. C. D. C. The Talcher field, whose reserve is estimated to be several hundred million tons, presently produces 700,000 - 800,000 tons of high quality coal, but the production is planned to be increased to 2,000,000 tons under the Third 5-year Program. The increased production in future is mainly of low quality coal for thermal power generation.

8 - 1 - 6. Third 5-year Program

With the above mentioned energy resources, the development of electric power sources is undertaken as a part of the 5-year economic development program. Total expenditure for the electric power development included in the State's Third 5-year Program is estimated to be 446,200,000 Rp, of which 211,200,000 Rp. is expected to be financed by foreign exchange: The financing seems to be considerably difficult. The main construction work under the Third Program includes, besides the Hirakud generating plant in process,

new construction works at Talcher and Balimela as the power generation work, and other works such as expansion of power transmission and transformer equipment attendant upon the expansion of power generating equipment and electrification work of farming villages.

The Talcher Thermal Plant will be installed with additional 250 MW capacity (four units of 62.5 MW) to utilize low quality coal from the Talcher coal field: No.1 unit is expected to be commissioned in July 1965 with other units coming into operation every three months. The Balimela plan is to construct a hydraulic power generating plant of 360 MW (six units of 60 MW) to utilize Balimela dam to be constructed at the down-stream of the Machkund Power Plant jointly by Orissa State and Andhra Pradesh State. No.1 unit is expected to commence its operation in June 1966, with others starting operations every subsequent 6 months.

8 - 2. Future Development

At present, both the Central Government and State Government are conducting various studies in preparation for the Fourth Program: The followings are the outline of the future development plan:

8 - 2 - 1. Demand Forecast

The Central Government as well as the State Government has made various forecasts as to the long term prospect of the electric power demand in the State of Orissa. The studies, which forecast the maximum demand, include the forecast made by C.W.P.C. in 1956, the one conducted by the Electric Department, the study made by the Industries Department and the Techno-Economic Survey prepared by the National Council of Applied Economic Research in 1962: The estimates prepared by these studies are enumerated below:

	1960 - 61	1965 - 66	1970 - 71
C. W. P. C.	230	482	694
Industrial Department	200	500	-
Electricity Department	300	532	710
Techno-Economic Survey	190	500	860

As seen from the above table, all the estimates show similar values for the period of 1965 - 1966, and there is also little difference in the estimates for 1970 - 1971. Furthermore, the State Electricity Board considers that the forecast made in the Techno-Economic Survey is reasonable.

According to the study, annual rate of increase is considered to be 21% during the period of the Third Program (1961-62 - 1965-66), 11.5% during the Fourth Program period (1966-67 - 1970-71) and 10.4% during the Fifth Program period (1971-72 - 1975-76). The major portion of expected demand is assumed to be occupied by the industrial demand, and demand by such industries as steel, ferro-manganese, ferro-silicon and fertilizer and other chemical industries is expected to show a large increase.

8 - 2 - 2. Plans concerning Power Development and Power System

The followings are the outline of the plans concerning power development and power system:

(a) Hydraulic Power Project:-

C.W.P.C. recommends as the site to be surveyed under the Fourth Program sites in the Kolab and upper and lower parts of the Brahmani River. On the other hand, the State Government is planning the development of Tikarpara site on the Mahanadi River as the next development program, and intends to start the operation of this site in 1971 together with Bhimkund site on the Baitarani River.

The Tikarpara project is a huge plan to construct a generating plant with a capacity of 1,600 MW by building a multi-purpose dam (370' high) for the

purpose of flood control of the delta area at the downstream of Mahanadi River and the development of electric power at Baramul, downstream of the existing Hirakud dam. The Bhimkund project is a composite development plan for the irrigation of Baitarani River and electric power, and the Central Government prepared in 1958 a detailed survey report on the project. According to the report, the project is to construct a dam at Noapatra with a power generating plant directly below the dam, and also to build at three points in the downstream intake dams each with a generating plant so as to have in total four generating plants with aggregate capacity of 478 MW.

(b) Thermal Power Project:-

The thermal power plant in the State presently under consideration is the expansion work of Talcher Plant. C.W.P.C. recommends addition of 480 MW under the Fourth Program; while, the State Government contemplates additional installation of two 125 MW units.

(c) Power Transmission and Transformation Plan:

Upon the completion of both Talcher and Balimela plants now under construction, it is planned to connect the Balimela hydraulic power plant and Talcher thermal power plant by two circuits of 220 kv with the Joda substation which is expected to be the center of future load, and the Talcher thermal plant will be connected to the Chainpal substation by 132 kv in order to make connection with the existing Hirakud system; while, as for the Machkund system Chandli substation to be constructed on the transmission line between Balimela and Talcher will be connected with Rayagada substation by 132 kv. Thus it is contemplated to inter-connect the two systems which are now separated. With regard to the connection with systems of neighboring states, connection of the Hirakud hydraulic power plant with Amarkantak-Korba system of Madhya Pradesh State by 132 kv is now being studied.

8 - 2 - 3. Long Term Balance of Supply and Demand

According to the Techno-Economic Survey made by the National Council of

Applied Economic Research concerning the balance of supply and demand which is the basis of long term planning, it is recommended to construct, as the next development project following the Hirakud power plant, the Talcher thermal plant (60MW x 4) with the subsequent expansion of the plant (60kw x 2) and also subsequent construction of hydraulic plant of 100 MW every year, on the assumption that, during the period between 1960 and 1972, the output of supply equipment should be 1.15 time of the estimated maximum power demands. (Table-1.) Besides, as for the balance of demand and supply the annual consumption is calculated on the assumption that total annual operating hour of the power plants will be 3,000 hours in 1960, 3,500 hours in 1965 and 4,000 hours in 1970 in average. (Table-2.)

However, in view of the fact that the actual results of demand in the recent years has been considerably less than the above stated estimate and also that there have been some changes in the unit capacity of the Talcher thermal power plant (60 MW to 62.5 KW) and also in the commencement of construction of Balimela plant and time of completion of these plants, the above mentioned report should be reviewed with due consideration to these modifications.

8 - 3. Review of Development Plan

The foregoing discussion dealt with the present status of the development program as well as its future plan. The followings are some of the matters which are in need of further review:

1.) In order to study the scope and timing of the development of proposed sites from the view point of demand and supply of electricity, it is considered to be necessary to make a deliberation on the balance of KW at the time when the demand and supply becomes most imminent with due consideration to both demand and supply capacity of generating equipment as well as on the balance of demand and supply capacity of annual kwh. A trial calculation on

the following premises made from such viewpoints reveals the results as shown in Table-3 and Table-4.

(Premises):

(1) As for the future maximum electricity demand, the afore-mentioned estimate prepared by N.C.A.E.R. is assumed to be slowed-down by two years in view of the actual result during the recent years.

(2) Since the supplying capacity of the existing equipment becomes the lowest with the lowering in the capacity of Hirakud hydraulic power plant immediately before and during the rainy season, and because there is hardly any seasonal factor throughout a year which may cause a peak demand, study will be made on the balance of KW at the time of lowering in the capacity of hydraulic power generation.

(3) Annual load factor of the demand is assumed to be 70%.

(4) As for the commissioning of Talcher and Balimela plants, it is assumed that Talcher No.1 will come into operation in July 1965 with the remaining equipment starting operation every subsequent 3 months, and also that Balimela No.1 will start operation in June 1966 with other units coming into operation every 6 months.

(5) Reserve capacity of supply for the stabilization of supply is assumed to be 10% of the maximum demand or of the supply capacity of the largest unit in the system, whichever is greater.

The results of the calculation made on the above premises reveal the followings:

(i) The balance of demand and supply in 1964 and 1965 is expected to be considerably tight, and therefore, it is advisable to hasten the completion of the Talcher thermal power plant.

(ii) As for the supplying capacity during the Fourth Program period, the reserve of KW at the peak-load time is substantially excessive as compared with the margin of KWh, it is considered necessary to make further

review of the commissioning time of each unit included in the Balimela project.

(iii) During the Fifth Program period, since the shortage of KWh is larger as compared with the shortage of KW, it is especially necessary to consider the development of firm power as the increase of supply capacity. In case if any expansion of thermal plant is intended, increase of unit output (for example, 125 MW class) may be desirable in view of the scale of system and economy of thermal power generation.

The above are the results of calculation based on certain assumption; but in materializing the plan, a full study should be made not only on the trend of demand, especially of kwh and load factor as well as kw, but also on the required reserve capacity of supply with due consideration to possible drought of rivers, break-down of generating equipment, etc.

2.) Development of hydraulic power generation in the State of Orissa should be encouraged and promoted as the State is abundant in the resources and also the development project itself has a significant bearing on the flood control and irrigation plans. However, judging from the prospect of electricity demand as stated above, the need of hydraulic generation for the so-called peak demand is comparatively small.

Furthermore, since the output with 100% LF of the hydraulic generation of Hirahud system is, even at present, 127 MW as against the generating capacity of 270 MW, the peak capacity is anticipated to become potential even if consolidated operation with the domestic thermal power plant of Rourkela Steel Plant is undertaken. On the other hand, a study on the energy resources in the neighboring states shows that Bihar and West Bengal States are the largest coal producers in India and the recommendation prepared by C.W.P.C. concerning the electric power development under the Fourth Program indicates priority development of thermal power generation (Table-5). Madhya Pradesh State also plans systems mainly with thermal power generation, such as Korba system.

Therefore, for the future development of hydraulic power projects and effective utilization of the existing equipment in the State of Orissa, it will be necessary to consider an over-all development program including electric power development in the neighboring states as well as to study further parallel operation with the systems of the neighboring states.

3.) Because the survey made on hydraulic power potentials in the State is rather outdated, further investigation may result in a considerable change to the side to be developed, scale of project, etc. Therefore, in order to determine sites to be developed most economically and their priority from the long term viewpoint, it will be necessary to undertake further deliberate investigation on hydraulic power.

8 - 4. Others

On December 16, 1962, Mr. T. Mahapatra, Chief Engineer of Orissa State Electricity Board, made a request concerning joint construction with Japan of the following plants if Japan so desires:

(1) Distribution transformers mainly for the electricity supply to irrigation pump (To manufacture with a standardized specification of the most economical ones among static voltage of 33/11kv, 33kv/400v or 11kv/400v. Transformer capacity is about 3,000 kvA). 4,000,000 - 5,000,000 Rs. has been appropriated as the budget for the project under the Third 5-year Program.

(2) Watt-hour Meters (Single-phase 230v and 3-phase 400v; annual production: 40,000 with future increase). Budget of 2,000,000 Rs. has been appropriated under the Third 5-year Program.

(3) Electric bulbs and fluorescent lamps (220v, 230v and 250v).

(4) Cables (PILC (paper-insulated steel wire with lead coating or taped cable) for 3-phase and single-phase 400v and all-aluminum cable for low voltage use, ACSR for high voltage use).

(5) Arresters for low voltage use (400v, 11kv, 33kv, etc.)

As it is considered most appropriate to negotiate the above matters with Japan Consulting Institute, it is recommended inquiry should be made to Calcutta Office of Japan Consulting Institute on the above matters.

The mission was also asked to make a comment on the standardization of the distribution transformers for irrigation pumps; the prices of transformers for different voltages estimated by Japan Electric Machine Industry Association are as follows:

	Transformer Capacity (3,000 KVA)
33kv/400v	¥4,500,000 (59,500 Rs.)
11kv/400v	¥3,500,000 (46,300 Rs.)
33kv/11kv	¥3,600,000 (47,600 Rs.)

Therefore, it is advisable to select the most economical type of transformer with due consideration to the above costs, distributing line costs and electricity loss.

Table - 1.

	Max. Demand (MW)	Required Plant Output (MW)	Plant Output (MW)		Total
			Existing	Addition	
1960 - 61	190	219	264		264
61 - 62	230	265		147 a	411
62 - 63	278	320			411
63 - 64	337	388		60 b	471
64 - 65	410	472		163 c	634
65 - 66	500	575			634
66 - 67	558	642		60 d	694
67 - 68	621	714		60 e	754
68 - 69	692	796		100 f	854
69 - 70	772	888		100 f	954
70 - 71	860	989		100 f	1,054
71 - 72	950	1,093		100 f	1,154
72 - 73	1,050	1,208		100 f	1,254

Remarks: (1) a: Hirakud 2nd Stage Work (2 x 37.5 MW + 3 x 24 MW)

b: Talcher No.1 Unit (60 MW)

c: Talcher No.2 - No.4 Units (3 x 60 MW)

d: Talcher No.5 Unit

e: Talcher No.6 Unit

f: Hydraulic Power Generating Projects

(2) Required output of plant is 1.15 times of maximum demand.

(3) Average annual increase of demand: 21% (3rd Program)

11.5% (4th Program)

10.4% (5th Program)

Table - 2.

	1960 - 61	65 - 66	70 - 71
Plant Output (MW)	264	634	1,054
KWh/Plant Output (KW)	3,000	3,500	4,000
Power Generated (Million KWh)	792	2,225	4,216
Transmission Loss (12%)	95	267	506
Power Consumption	697	1,958	3,719

Remarks: Actual generating hours per plant output during 1959 - 60 are 2,830 hours, which will be gradually improved.

Table - 3.

(Unit: MW)

	Max.Demand	Required Supply Capacity	Existing Supply Capacity	Talcher	Balimela	Total Supply Capacity	Diference
62-63	190	214	224			224 a	10
63-64	230	254	320			320 b	66
64-65	278	306	320			320	14
65-66	337	395	320	58		378	-17
66-67	410	470	320	232	60	612	142
67-68	500	560	320	232	180	732	172
68-69	558	618	320	232	300	852	234
69-70	621	683	320	232	360	912	229
70-71	692	761	320	232	360	912	151
71-72	772	849	320	232	360	912	63
72-73	860	946	320	232	360	912	-34
75-76	1,160	1,276	320	232	360	912	-364

Remarks: (a)

	Plant Capacity	Supply Capacity
Hirakud	160.5 MW	97 MW
Chiplima	24.0	24
Machkund	34.4	10
Choudwar & Rajgangpur	11.5	10
Diesel	5.3	5
Industry-owned plants	93.4	78.4 *
Total		224.4

* excluding domestic consumption and margin for load fluctuation.

(b) New Additions:

Hirakud	37.5	24
Chiplima	48.0	48
Machkund	-	24
Total		96

Table - 4.

(Unit:100 million KWh)

	Annal Energy Requirement	Existing Supply Capacity	Talcher	Balimela	Total	Difference
62-63	11	13 a			13	2
63-64	14	17 b			17	3
64-65	17	"			17	0
65-66	21	"	4 c		21	0
66-67	25	"	14	3 d	34	9
67-68	31	"	"	9 d	40	9
68-69	34	"	"	12	43	9
69-70	38	"	"	"	"	5
70-71	42	"	"	"	"	1
71-72	47	"	"	"	"	-4
72-73	53	"	"	"	"	-10
75-76	71	"	"	"	"	-28

Remarks: (a) Hirakud 620 million KWh

Chiplima 200

Machkund 90

Rajgangpur) neglected
Diesel

Industry-owned Plants 410 (Plant Factor:60%)

Total 1,320 ≒ 1,300

(b) New Additions

Chiplima 280

Machkund 140

Total 420 ≒ 400

(c) Talcher : Plant Factor is assumed to be 70%

(d) Balimela: Plant Factor varies depending on construction schedule, etc. but is assumed to be 70% during construction.

Table - 5. (Unit: MW)

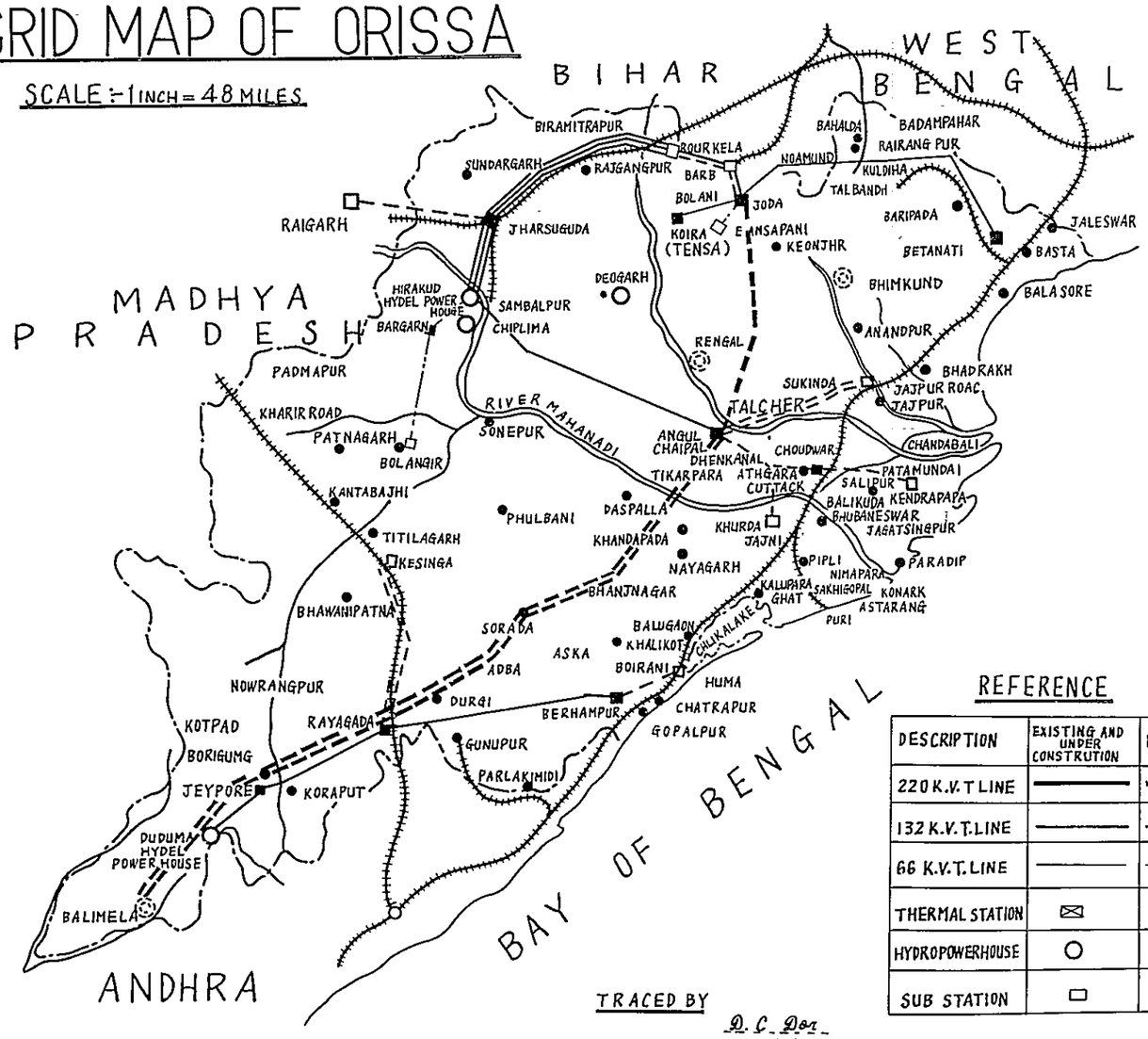
	Plant output as of the Final year of 3rd Plan			Plant output added under 4th plan			Plant output as of the Final year of 4th plan		
	Hydro.	Thermal	Total	Hydr.	Thermal	Total	Hydro.	Thermal	Total
Orissa (South) Andhra Pradesh (North) Madhya Pradesh (Middle South) Maharashtra (East)	235	865	1,100	690	660	1,350	925	1,525	2,450
Bihar West Bengal Orissa (North)	420	3,080	3,500	494	2,300	2,794	914	5,380	6,294

Remarks: C. W. P. C. Fourth 5-year Plan
Power Development Program 1962/4.

C.E.ELECS.DRG.NO.514/61

GRID MAP OF ORISSA

SCALE :- 1 INCH = 48 MILES



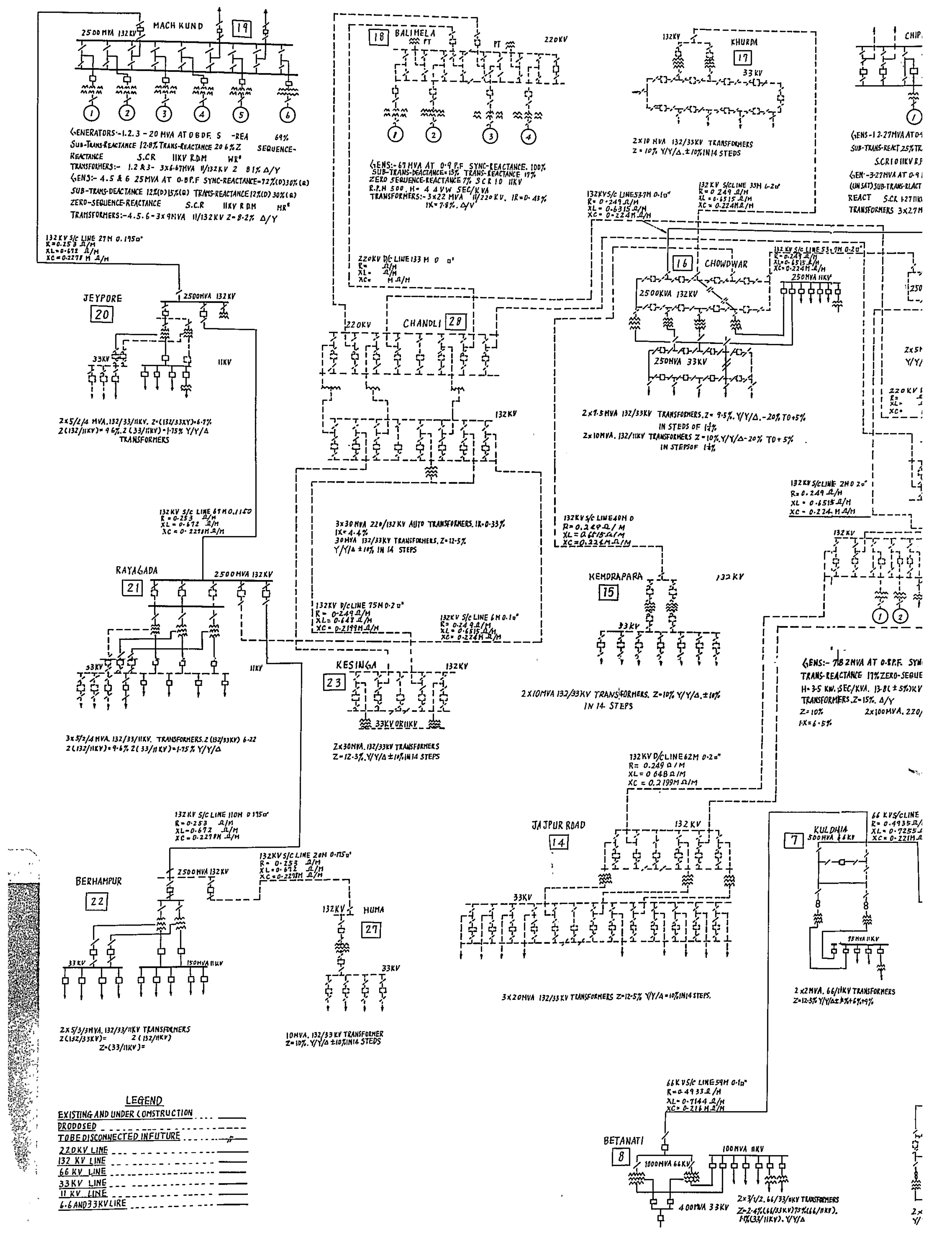
REFERENCE

DESCRIPTION	EXISTING AND UNDER CONSTRUTION	PROPOSED
220 K.V. T LINE	———	— — —
132 K.V. T. LINE	———	— — —
66 K.V. T. LINE	———	— — —
THERMAL STATION	⊠	⊠
HYDROPOWERHOUSE	○	⊙
SUB STATION	▭	▭

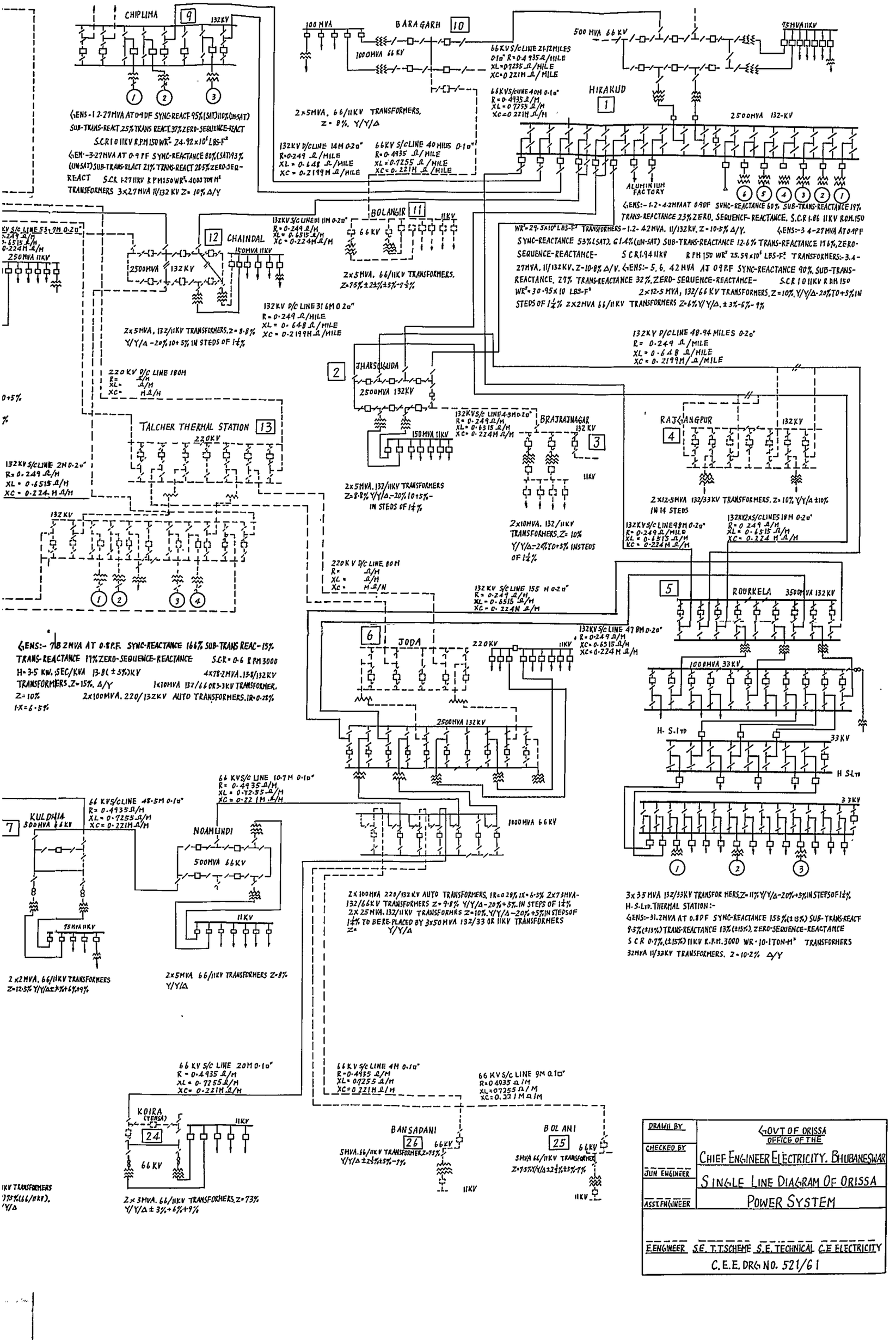
TRACED BY

D. C. Dey

DRAUGHTSMAN



MACH KUND
19
2500 MVA 132 KV
GENERATORS:-1.2.3 - 20 MVA AT 0.8 P.F.
SUB-TRANS-REACTANCE 12.8% TRANS-REACTANCE 20.6% Z SEQUENCE-REACTANCE S.C.R 11KV R.D.M
TRANSFORMERS:- 1.2 & 3- 3x6.67MVA 11/132KV Z 8.1% Δ/Y
GENS:- 4.5 & 6 25MVA AT 0.8P.F SYNC-REACTANCE=72%(D)30%(Q)
SUB-TRANS-REACTANCE 12%(D)15%(Q) TRANS-REACTANCE 12%(D) 30%(Q)
ZERO-SEQUENCE-REACTANCE S.C.R 11KV R.D.M
TRANSFORMERS:-4.5.6-3x9MVA 11/132KV Z=8.2% Δ/Y
132 KV S/C LINE 27M 0.115Ω"
JEYPORE
20
2500MVA 132KV
33KV
11KV
2x5/2/4 MVA, 132/33/11KV, Z=(132/33KV)=6.7%
Z(132/11KV)=9.6%, Z(33/11KV)=1.75% Y/Y/Δ
TRANSFORMERS
BALIMELA
18
220KV
PT
GENS:- 67 MVA AT 0.9 P.F SYNC-REACTANCE 100%
SUB-TRANS-REACTANCE=15% TRANS-REACTANCE 17%
ZERO SEQUENCE-REACTANCE 7% S.C.R 1.0 11KV
TRANSFORMERS:- 3x22 MVA 11/220KV, IR=0.43%
IX=7.8% Δ/Y
220KV D/C LINE 133 M
CHANDLI
28
220KV
132KV
3x30MVA 220/132KV AUTO TRANSFORMERS, IR=0.33%
IX=4.4%
30MVA 132/33KV TRANSFORMERS, Z=12.5%
Y/Y/Δ ±10% IN 14 STEPS
132KV D/CLINE 75M 0.2Ω"
R = 0.249 Ω/M
XL = 0.648 Ω/M
XC = 0.2199M Ω/M
132KV S/C LINE 6M 0.1Ω"
R = 0.249 Ω/M
XL = 0.6515 Ω/M
XC = 0.224M Ω/M
KHURDA
17
132KV
33KV
2x10 MVA 132/33KV TRANSFORMERS
Z = 10% Y/Y/Δ ±10% IN 14 STEPS
132KV S/C LINE 53.7M 0.1Ω"
R = 0.249 Ω/M
XL = 0.6315 Ω/M
XC = 0.224M Ω/M
132KV S/CLINE 33M 0.2Ω"
R = 0.249 Ω/M
XL = 0.6515 Ω/M
XC = 0.224M Ω/M
CHOWDWAR
16
2500KVA 132KV
250MVA 11KV
250MVA 33KV
2x7.5MVA 132/33KV TRANSFORMERS, Z= 9.5% Y/Y/Δ, -20% TO +5%
IN STEPS OF 1¼%
2x10MVA, 132/11KV TRANSFORMERS Z=10% Y/Y/Δ -20% TO +5%
IN STEPS OF 1¼%
132KV S/CLINE 2H0 2Ω"
R = 0.249 Ω/M
XL = 0.6515 Ω/M
XC = 0.224M Ω/M
132KV S/C LINE 40M 0
R = 0.249 Ω/M
XL = 0.6515 Ω/M
XC = 0.224M Ω/M
KEMDRAPARA
15
132KV
33KV
2x10MVA 132/33KV TRANSFORMERS, Z=10% Y/Y/Δ ±10%
IN 14 STEPS
RAYAGADA
21
2500MVA 132KV
132KV S/C LINE 61M 0.115Ω"
R = 0.253 Ω/M
XL = 0.672 Ω/M
XC = 0.227M Ω/M
33KV
11KV
3x5/2/4 MVA, 132/33/11KV, TRANSFORMERS, Z(132/33KV) 6.22
Z(132/11KV)=9.6% Z(33/11KV)=1.75% Y/Y/Δ
KESINGA
23
132KV
33KV OR 11KV
2x30MVA 132/33KV TRANSFORMERS
Z=12.5% Y/Y/Δ ±10% IN 14 STEPS
GENS:- 78 2MVA AT 0.8P.F.
TRANS-REACTANCE 17% ZERO-SEQUENCE
TRANSFORMERS Z=15% Δ/Y
Z=10% 2x100MVA, 220/
IX=6.5%
132KV D/C LINE 62M 0.2Ω"
R = 0.249 Ω/M
XL = 0.648 Ω/M
XC = 0.2199M Ω/M
JAJPUR ROAD
14
132KV
33KV
3x20MVA 132/33KV TRANSFORMERS Z=12.5% Y/Y/Δ ±10% IN 14 STEPS.
132KV S/C LINE 110M 0.115Ω"
R = 0.253 Ω/M
XL = 0.672 Ω/M
XC = 0.227M Ω/M
BERHAMPUR
22
2500MVA 132KV
33KV
150MVA 11KV
2x5/3/3MVA, 132/33/11KV TRANSFORMERS
Z(132/33KV)= Z(132/11KV)
Z=(33/11KV)=
132KV S/C LINE 20M 0.115Ω"
R = 0.253 Ω/M
XL = 0.672 Ω/M
XC = 0.227M Ω/M
HUMA
27
132KV
33KV
10MVA, 132/33KV TRANSFORMER
Z=10% Y/Y/Δ ±10% IN 14 STEPS
KULDHIA
7
500MVA 11KV
75MVA 11KV
2x2MVA, 66/11KV TRANSFORMERS
66 KV S/C LINE
R = 0.4935 Ω/M
XL = 0.7255 Ω/M
XC = 0.221M Ω/M
66KV S/C LINE 59M 0.1Ω"
R = 0.4933 Ω/M
XL = 0.7144 Ω/M
XC = 0.216M Ω/M
BETANATI
8
1000MVA 66KV
100MVA 11KV
400MVA 33KV
2x3/1/2, 66/33/11KV TRANSFORMERS
Z=2.4%(66/33KV) 7.5%(66/11KV),
1%(33/11KV), Y/Y/Δ
CHIP.
GENS-1.2-27MVA AT 0.9
SUB-TRANS-REACT 25% TR.
REACT S.C.R 1.27 11KV
TRANSFORMERS 3x27M
LEGEND
EXISTING AND UNDER CONSTRUCTION
PROPOSED
TO BE DISCONNECTED IN FUTURE
220KV LINE
132 KV LINE
66 KV LINE
33KV LINE
11 KV LINE
6.6 AND 33KV LINE


CHIPLIMA 9 132KV
BARAGARH 10
100 MVA
100MVA 66 KV
66KVS/CLINE 21·12MILES 0·1ø" R=0·4 935·Ω/MILE XL=0·7255 Ω/MILE XC=0 221M Ω/MILE
66KVS/CLINE 40M 0·1ø" R=0·4935 Ω/M XL=0 7255 Ω/M XC=0 221M Ω/M
2×5MVA, 66/11KV TRANSFORMERS, Z= 8%, Y/Y/Δ
132KV D/CLINE 14M 0·2ø" R=0·249 Ω/MILE XL= 0·648 Ω/MILE XC= 0·2199M Ω/MILE
66KV S/CLINE 40 MILES 0·1ø" R= 0·4935 Ω/MILE XL=0·7255 Ω/MILE XC= 0·221M Ω/MILE
500 MVA 66 KV
75MVA 11KV
HIRAKUD 1
2500MVA 132-KV
ALUMINIUM FACTORY
GENS:- 1·2·42MVA AT 0·9DF SYNC-REACTANCE 60% SUB-TRANS-REACTANCE 19% TRANS-REACTANCE 23% ZERO. SEQUENCE- REACTANCE. S.C.R 1·86 11KV R.P.M 150 WR²=29·5×10⁴ LBS-F² TRANSFORMERS-1.2-42MVA. 11/132KV, Z=10·5% Δ/Y. GENS:-3 4-27MVA AT 0·8PF SYNC-REACTANCE 53%(SAT). 61·4%(UN-SAT) SUB-TRANS-REACTANCE 12·6% TRANS-RFACTANCE 19·6%, ZERO-SEQUENCE-REACTANCE- S C R 1·94 11KV R P M 150 WR² 25·59×10⁴ LBS-F² TRANSFORMERS:-3.4-27MVA, 11/132KV, Z=10·8% Δ/V. GENS:- 5, 6, 42 MVA AT 0·9PF SYNC-REACTANCE 90%, SUB-TRANS-REACTANCE, 29% TRANS-REACTANCE 32%, ZERO-SEQUENCE-REACTANCE- S.C.R 1·0 11KV R P M 150 WR²=30·95×10 LBS-F² 2×12·5 MVA, 132/66 KV TRANSFORMERS, Z=10%, Y/Y/Δ-20% TO+5% IN STEPS OF 1½% 2×2MVA 66/11KV TRANSFORMERS Z=6% Y/Y/Δ, ± 3%-6%-9%
BOLANGIR 11
132KV S/C LINE 11M 0·2ø" R=0·249 Ω/M XL= 0·6515 Ω/M XC= 0·224M Ω/M
66 KV
11KV
2×5MVA, 66/11KV TRANSFORMERS. Z=7.5% ± 2½% ± 5% - 7½%
CHAINDAL 12
2500MVA 132 KV
150MVA 11KV
2×5MVA, 132/11KV TRANSFORMERS. Z= 8·8% Y/Y/Δ -20% TO+5% IN STEPS OF 1½%
132KV D/C LINE 31·6M 0·2ø" R= 0·249 Ω/MILE XL= 0·648 Ω/MILE XC= 0·2199M Ω/MILE
132KV D/C LINE 48·94 MILES 0·2ø" R= 0·249 Ω/MILE XL= 0·648 Ω/MILE XC= 0·2199M/Ω/MILE
220 KV D/C LINE 180H R= Ω/M XL= Ω/M XC= MΩ/M
JHARSUGUDA 2
2500MVA 132KV
132KVS/C LINE 4·5M 0·2ø" R= 0·249 Ω/M XL= 0·6515 Ω/M XC= 0·224M Ω/M
150MVA 11KV
2×5MVA. 132/11KV TRANSFORMERS Z=8·8% Y/Y/Δ-20% TO+5% IN STEPS OF 1½%
BRAJRAJNAGAR 3
132 KV
11KV
2×10MVA. 132/11KV TRANSFORMERS, Z= 10% Y/Y/Δ-2% TO+5% INSTEPS OF 1½%
RAJGANGPUR 4
132KV
2×12·5MVA 132/33KV TRANSFORMERS. Z= 10% Y/Y/Δ ±10% IN 14 STEPS
132KVS/C LINE 98M 0·2ø" R= 0·249 Ω/M XL= 0·6515 Ω/M XC= 0·224 M Ω/M
132KV2S/CLINES 18M 0·2ø" R= 0 249 Ω/M XL= 0·6515 Ω/M XC= 0·224 M Ω/M
TALCHER THERMAL STATION 13
220KV
132KV S/C LINE 2M 0·2ø" R= 0·249 Ω/M XL = 0·6515 Ω/M XC = 0·224 M Ω/M
132KV
220 KV D/C LINE 80H R= Ω/M XL= Ω/M XC= MΩ/M
132 KV S/C LINE 155 H 0·2ø" R= 0·249 Ω/M XL= 0·6515 Ω/M XC= 0· 224M Ω/M
ROURKELA 350 MVA 132 KV 5
1000MVA 33KV
H. S. LTD
33KV
H SLTD
3 3KV
3×35 MVA 132/33KV TRANSFORMERS, Z= 11% Y/Y/Δ-20%+5% IN STEPS OF 1½% H·S·LTD. THERMAL STATION:- GENS:-31.2MVA AT 0.8PF SYNC-REACTANCE 155%(±15%) SUB-TRANS-REACT 9·5%(±13%) TRANS-REACTANCE 13%(±15%), ZERO-SEQUENCE-REACTANCE S C R 0·7%,(±15%) 11KV R.P.M. 3000 WR·10·1TON-M² TRANSFORMERS 32MVA 11/33KV TRANSFORMERS. Z=10·2% Δ/Y
GENS:- 7 8 2MVA AT 0·8 P.F. SYNC-REACTANCE 166% SUB-TRANS REAC-15% TRANS-REACTANCE 17% ZERO-SEQUENCE-REACTANCE S.C.R = 0·6 R P M 3000 H= 3·5 KW. SEC/KVA 13·8(±5%)KV 4×78·2MVA. 13·8/132KV TRANSFORMERS. Z= 15%. Δ/Y 1×10MVA 132/66 OR 3·3KV TRANSFORMER. Z= 10% 2×100MVA. 220/132KV AUTO TRANSFORMERS. IR=0·28% IX=6·5%
JODA 6
220KV
11KV
2500MVA 132KV
66 KVS/C LINE 10·7M 0·1ø" R= 0·4935 Ω/M XL = 0·7255 Ω/M XC = 0·221M Ω/M
1000MVA 66 KV
2×100MVA 220/132KV AUTO TRANSFORMERS. IR=0·28% IX= 6·5% 2×75MVA-132/66KV TRANSFORMERS Z= 9·8% Y/Y/Δ-20%+5%. IN STEPS OF 1½% 2×25MVA. 132/11KV TRANSFORMRS Z=10%. Y/Y/Δ-20%+5% IN STEPS OF 1½% TO BERE-PLACED BY 3×50MVA 132/33 OR 11KV TRANSFORMERS Z= Y/Y/A
KULDHIA 7
500MVA 66KV
66 KVS/CLINE 45·5M 0·1ø" R= 0·4935 Ω/M XL= 0·7255 Ω/M XC= 0·221M Ω/M
75MVA 11KV
2×2MVA. 66/11KV TRANSFORMERS Z=12·5% Y/Y/Δ ± 3% + 6% + 9%
NOAMUNDI
500MVA 66KV
11KV
2×5MVA 66/11KV TRANSFORMERS Z=8% Y/Y/Δ
66 KV S/C LINE 20M 0·1ø" R = 0·4935 Ω/M XL = 0·7255 Ω/M XC= 0·221M Ω/M
KOIRA (TENSA) 24
11KV
66 KV
2×3MVA. 66/11KV TRANSFORMERS, Z= 7.5% Y/Y/Δ ± 3% + 6% + 9%
66 KV S/C LINE 4M 0·1ø" R=0·4935 Ω/M XL= 0·7255 Ω/M XC=0 221M Ω/M
BANSADANI 26
66KV
5MVA. 66/11KV TRANSFORMER Z=7.5% Y/Y/Δ ± 2½% ± 5% - 7%
11KV
66 KV S/C LINE 9M 0·1ø" R=0·4935 Ω/M XL=0·7255 Ω/M XC=0, 221 M Ω/M
BOLANI 25
66KV
5MVA 66/11KV TRANSFORMER Z=7.5% Y/Y/Δ ± 2½% ± 5% - 7%
11KV
132KV S/C LINE 47·8M 0·2ø" R=0·249 Ω/M XC=0·6515 Ω/M XC=0·224 M Ω/M
GOVT OF ORISSA OFFICE OF THE CHIEF ENGINEER ELECTRICITY. BHUBANESWAR
DRAWN BY
CHECKED BY
JUN ENGINEER
ASST.ENGINEER
SINGLE LINE DIAGRAM OF ORISSA POWER SYSTEM
E.ENGINEER S.E. T.T.SCHEME S.E. TECHNICAL C.E ELECTRICITY
C.E.E. DRG NO. 521/61

9. Industrialization Plan of Low Temperature Carbonization:

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9. Industrialization Plan of Low Temperature Carbonization:

9 - 1. Introduction:

According to the plan of the State of Orissa, it is planned to use, for the production of pig iron by a low shaft furnace, semi-coke manufactured by low-temperature carbonization of coal from Talcher Coal Field in the State.

Study made by the Central Fuel Research Institute has proven that semi-coke made of Talcher coal can be used satisfactorily for the low shaft furnace. This report includes a plan for low temperature carbonization industry based on the study data of the above mentioned C. F. R. I.

9 - 2. Test Data of C. F. R. I.:

9 - 2 - 1. Industrial Analysis of Talcher Coal:

Moisture	about	8%
Ash	"	11%
Volatile matter	"	37%
Fixed carbon	"	46%

Chemical Composition of Ash:

SiO_2	60.5%
Al_2O_3	21.4%
Fe_2O_3	6.8%
P_2O_5	0.11%
TiO_2	1.51%
SO_3	0.57%
CaO	1.58%
MgO	1.47%

9 - 2 - 2. Result of Low Temperature Carbonization of Talcher Coal:

Per 100 tons of Coal:

Semi-coke	63 tons
Tar	9 "
Gas Liquor	14 "

Gas Light Oil	1 ton
Gas	35,000 m^3

9 - 2 - 3. Composition of Low-Temperature Carbonized Products:

(1) Semi-coke:

Moisture	about	6 %
Volatile matter	"	3 %
Fixed carbon	"	72 %
Ash	"	25 %

(2) Tar:

a) Specific gravity (at 15°C): 1.024

b) Benzole insoluble matter: 1.34%

c) Distillation test:

Moisture	2.5 %
- 170°C	0.5 %
170 - 230°C	6.6 %
230 - 270°C	10.4 %
270 - 360°C	32.2 %
Loss	1.6 %
Pitch	46.2 %
Total	100.0 %

Oil distillate up to 360°C: 49.7 %

d) Composition of tar:

	% to tar	% to distilled oil
Tar acid	19.8 %	40.0 %
Tar base	1.8 %	3.5 %
Neutral oil	28.1 %	56.5 %
Total	49.7 %	100.0 %

e) Distillation test of tar acid:

	% to tar	% to tar acid
- 180°C	0.6 %	3.0 %
180 - 195°C	0.6 %	3.0 %
195 - 205°C	0.5 %	2.5 %
205 - 215°C	2.4 %	12.1 %
215 - 230°C	1.3 %	6.5 %
230 - 250°C	2.9 %	14.6 %
250 - 300°C	3.9 %	20.0 %
300 - 360°C	6.5 %	32.8 %
Loss	1.1 %	5.5 %
Total	19.8 %	100.0 %

f) Result of neutral oil distillation test:

	% to tar	% to neutral oil
Moisture	0.3 %	1.0 %
- 195°C	0.7 %	2.5 %
195 - 230°C	3.1 %	11.0 %
230 - 270°C	5.7 %	20.5 %
270 - 300°C	5.8 %	20.6 %
300 - 360°C	12.1 %	43.0 %
Loss	0.4 %	1.4 %
Total	28.1 %	100.0 %

g) Analysis of gas:

CO_2	3.6 - 8 %
CnHm	1.4 - 2.4 %
O_2	0.2 - 0.8 %
CO	16 - 22 %

CH_4	15 - 20 %
H_2	48 - 56 %
N_2	2.5 - 2.6 %
Calorific value:	3,700 - 4,000 Kcal/m^3

h) Composition of gas liquor:

Free ammonia	3,353 p.p.m.
Fixed ammonia	819 p.p.m.
Phenoles	3,357 p.p.m.

9 - 3. Fundamental Plan:

Estimated annual production of pig iron by the low shaft furnace using semi-coke in the State of Orissa is 500,000 tons. Since the expected coke ratio based on the study by C.F.R.I. (Tonnage of coke consumed per ton of pig iron) is 1.5, the amount of coke required for the production of 500,000 tons of pig iron will be 750,000 tons/year. Further, as the yield of semi-coke in the case of Talcher coal is 63%, material coal required for 750,000 tons/year of coke will be 1,200,000 tons. Products, other than semi-coke, of the low temperature carbonization of 1,200,000 tons/year of coal are estimated to be as follows on the basis of C.F.R.I. test results.

Low temperature tar:	120,000 tons/year	(approximate)
Gas liquor:	180,000 "	"
Gas light oil:	12,000 "	"
Gas:	420,000,000 m^3/year	"

Treatment of the products of carbonization is planned on the basis of the above figures.

9 - 4. Treatment of the Products of Carbonization:

Low temperature tar is distilled into light oil, middle oil and heavy oil, all of which are treated with caustic soda liquor for tar acid extraction and also with dilute sulphuric acid for tar base extraction. Then,

light oil and middle oil are distilled after having been treated with concentrated suphuric acid to produce fuel for gasoline engines and kerosene engines, respectively.

Heavy oil is used, after removing tar acid and tar base, as fuel for diesel engines and burners, but it may also be used as a wood preservative or insecticide and germicide without giving such treatments.

Pitch is used as a binder of briquette or as the material for road paving and pitch-coke making. Tar acid is distilled into phenol, cresols, xylenols and high boiling point tar acid for the manufacture of synthetic resin, medicines, plasticizer, intermediates of dyesttaffs, perfumery, weeding agents, refining agents of lubricating oil and agents for floatation concentrate.

Gas light oil is distilled, after its treatment with undiluted sulphuric acid, into fuel for gasoline engines. Tar acid is extracted from gas liquor through light-oil treatment and is given, together with that extracted from tar acid, such treatments as described above.

9 - 5. Production by Low Temperature Carbonization:

Fuel for gasoline engine:	10,000	tons/year
Fuel for kerosene engine:	8,500	"
Fuel for Diesel engine:	28,000	"
Pitch:	58,700	"
Phenol:	1,500	"
Creosols:	5,000	"
Xylenols:	3,500	"
High boiling point tar acid:	12,000	"
Total:	127,200	"

9 - 6. Raw Materials Required for Low Temperature Carbonization Products.

9 - 6 - 1. Raw Material:

Coal:	1,200,000 tons/year
Low temperature tar:	120,000 "
Gas light oil:	12,000 "
Gas liquor:	180,000 "
Gas:	420,000,000 m^3/year.

9 - 6 - 2. Other Materials:

(1) Caustic Soda (100%):

For tar acid products:	2,400 tons/year
For gasoline engine fuel:	200 "
For Kerosene engine fuel:	100 "
Total:	2,700 "

Remarks: Caustic soda used for oil extraction from tar acid is recovered by CO_2 and lime, and so the actual consumption is about 20% of theoretical amount.

(2) Sulphuric Acid (98%):

For tar acid products:	3,000 tons/year
For gasoline engine fuel:	1,000 "
For kerosene engine fuel:	300 "
Total:	4,300 "

(3) Lime:

For tar acid products:	8,000 tons/year

(4) Blast furnace gas:

For tar acid products:	23,000 m^3/year

(5) Steam:

For carbonization:	240,000 tons/year
For tar distillation:	36,000 "

For tar acid products:	30,000	tons/year
For gasoline engine fuel & Kerosene engine fuel:	10,000	tons/year
For dephenolation of gas liquor:	5,000	tons/year
Total:	321,000	tons/year

(6) Water:

For carbonization:	420,000	tons/year
For tar distillation:	240,000	"
For tar acid products:	180,000	"
For gasoline engine fuel:	250,000	"
For kerosene engine fuel:	17,000	"
For dephenolation of gas liquor:	270,000	"
For boiler use:	90,000	"
Total:	1,467,000	"

(7) Electric Power:

For Carbonization:	150,000	KWH/Year
For tar distillation:	240,000	"
For tar acid products:	1,260,000	"
For gasoline engine fuel:	100,000	"
For kerosene engine fuel:	80,000	"
For dephenolation of gas liquor:	900,000	"
Total:	2,730,000	"

(8) Fuel:

For carbonization -coke-	192,000	tons/year
For boiler -tar or heavy oil-	8,000	"
For tar distillation - " -	2,400	"
For Gasoline engine fuel - " -	0	"
For kerosene engine fuel - " -	800	"
For tar acid products - " -	10,000	"

9 - 7. Equipment & Facilities:

NAME		CAPACITY	QUANTITY
Low-temperature carbonization equipment:	(Coal)	120,000 tons/yr.	1
Gas light oil absorption equipment:	(gas light oil)	12 million t/yr.	1
Gas liquor & tar acid extraction equipment:	(gas liquor)	180,000 t/yr.	1
Tar distilling pipe still:	(tar)	350 t/day	1
Continuous tar extraction equipment:	(material oil)	100 t/day	1
	"	40 t/day	1
Tar acid soda liquor refining equipment:	(tar acid soda liquor)	100 t/day	1
Tar acid soda liquor CO_2-neutralization equipment:	(")	250 t/day	1
Tar acid soda liquor sulphuric acid-neutralization equipment:	(")	30 t/day	1
Sodium carbonate caustification equipment:	(sodium carbonate liquor)	80 t/day	1
Tar acid distillation equipment:	(tar acid)	30 t/day	2
	(tar acid)	15 t/day	5
Light oil washer	(light oil)	20 t/day	2
Light oil distillation equipment:	(")	50 t/day	2
Middle oil washer:	(middle oil)	20 t/day	2
Middle oil distillation equipment:	(")	30 t/day	2

Other equipment including boiler, water tank, oil tank, pump, motor, vacuum pump, air compressor, water drainage facilities, etc.

Conclusion

9 - 8. Seat for Low Temperature Carbonization Plant:

An iron-making plant is, in principle, attached with a coke oven plant. In order to minimize the cost of transportation which accounts for major part of coal price, it is advantageous to build the coke plant in the coal producing area. For this reason, it is considered that an iron-making plant together with a low temperature carbonization plant should be built in Talcher Coal Field.

However, the installation at Talcher area of a processing plant of low temperature tar, by-product of low temperature carbonization, should be carefully studied as to such problems as used water draining, industrial water supply, etc.

A chemical plant, in most cases, drains used water which contains components detrimental to living things, and the low temperature tar plant is no exception to this. The State of Orissa is a rice producing district and river water flows into paddies. Therefore, waster water from chemical plants can be drained only after its detrimental components have been removed, which requires a large amount of cost.

On the other hand, if the plant is located on the sea shore, the waste water may be drained to Indian Ocean without any treatment. Besides, as the large fresh water requirement by the tar plant can be replaced to some extent by sea water saving in water cost can also be attained.

Since there is a plan to create an industrial zone near the Paradeep Port and to lay railway between the industrial district and Talcher, the low temperature tar processing plant can be erected at the industrial district and transport tar and gas light oil by rail from Talcher. As the Mahanadi river runs near the industrial district, sufficient industrial water supply is available.

Furthermore, in anticipation of future development of chemical industry

based on the low temperature carbonization industry such as synthetic resin, medicines, agricultural chemicals, etc., it is considered advantageous to build the tar processing plant in the vicinity of the port with convenient transportation facilities.

10. City Development Project.....

Paradeep Harbor City Planning

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10. City Development Project ---- Paradeep Harbor City Planning

10-1 Introduction

The State of Orissa has such important cities as Cuttack, Rour Kela, Chowduar, Bhubaneswar, Barbil, Jharsujuda, etc. The State Government's plan concerning the character and scale of future development of these important cities is as shown in the Table (1).

Table 1 Character and scale of future development of important cities

City	Character	Present (1,000 persons) population	Future (1,000 persons) population *
Cuttack	commercial	100	200
Rour Kela	mining & industrial	100	200
Chowduar	industrial	20	100
Bhubaneswar	political & caltural	25	50
Barbil	mining & traffic	10	50
Jharsujuda		10	40

* Population after 20 years.

City planning to be carried out along with the development of iron ore resources includes, besides the existing city planning of such cities as Cuttack, Chowduar, Bhubaneswar, etc., construction of traffic center city in Paradeep area which would eventually become an importance harbor, and also city planning around the interchange of the ore roads.

The main effort of the 1st stage development project is focused on the new city planning of Paradeep, as sea port capable to ship iron ore of 2,000,000 tons a year, and then the layout and development plan of the forthcoming industrial new city group in this district will be made.

10-2 Planning of Paradeep New City

10-2-1 1st Stage Project

(1) Character

The city is to have a function of traffic center for the shipment of

iron ore of 2,000,000 tons a year.

(2) Scale

In determining the scale of its prospective development, Vizagapatam of Andhra Pradesh State is considered as a precedent. While Vizagapatam City handled in 1961 a total of 2,850,000 tons of cargo with the employment of about 6,000 persons, it is assumed that Paradeep will give employment to 4,000 people in consideration of the mechanization of cargo handling. Assuming that the number of those employed by the related secondary and tertiary industries will be 70%, the total number of those employed will be 6,800 persons (4,000 + 4,000 x 70%).

In this connection, according to a datum summarized by Demographic Training & Research Center in Bombay City, appropriate number of workers in urban area is considered to be 40% of the total city population. Therefore, a total city population of Paradeep City would amount to 17,000 (6,800 x 100/40).

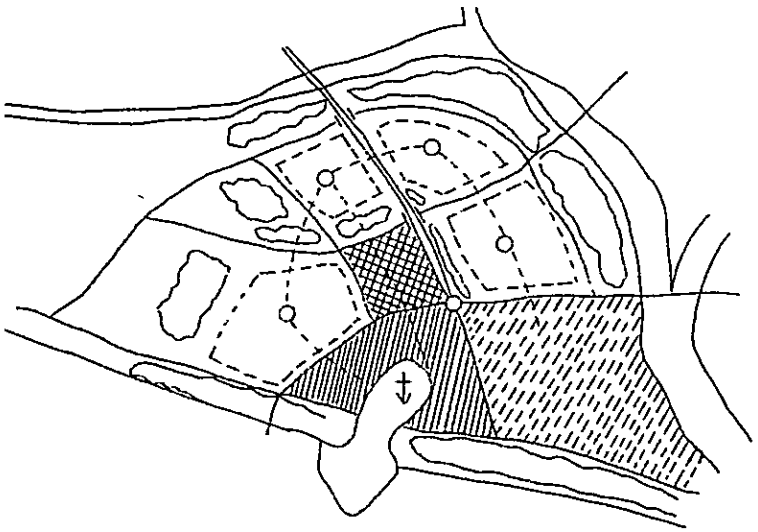
Since Paradeep City is in the process of further growth into a major harbor city with future expansion of petroleum industry in this area and completion of various municipal facilities, those who are engaged in the construction work should also be taken into account. Though at present 1,300 persons are employed for the construction work, it will be reasonable to assume that the number will increase, in the 1st stage project, to 3,000 including dependents. This provides sufficient justification for estimating the ultimate population to be 20,000.

(3) Utilization of land

Because the city is characterized as a traffic center, utilization of land may be divided into two major categories which are considered to be two main pillars of the utilization of land: i.e. (a) formation of harbor district which will be centered around iron ore shipment facilities and various related business district, and (b) formation of residential area. The future plan should also include the construction of industrial zone so that

the city may embody all the fields of commerce, industry and economy. In order to provide the city with better and healthier environment for living, plan should also be made to secure a green zone with an area comparable to the urban area. In laying out the city zone, buildings should be of medium-height brick buildings so as to have ample space underneath the floors for sufficient ventilation.

The industrial zone should be laid out in such a way, with main emphasis on the construction of petroleum industry, as to be linked with the harbor facilities on the lee as well as to have an easy drainage system. The following diagram-1 indicates a pattern of land utilization.



Legends:

- commercial & business district
- harbor district
- industrial district
- residential district
- green zone
- = ore road
- road for commuting
- rivers

The following table shows area of each district, its percentage to the whole city area, density of population, accommodation capacity, etc.

District	Area	Percentage	Population density	Accommodation capacity
Commercial & business	41.0 ha	5%	120	4,940
Harbor	100.9	12	-	
Industrial	174.0	21	-	
Residential	230.7	28	80	78,500
Parks & green zone	279.8	34	-	
total	826.4	100		23,440

(4) Planning of important facilities

(4)-1 Planning of Industrial fundamental facilities

Transportation facilities

* Roads and highways

Road planning involving the suburban area includes construction of ore road which will lead to Paradeep, Tomka Daiteri, and also a road leading to the commercial city of Cuttack.

As for the urban area, highway project is to be established in accordance with utilization of land. In other words, main streets and avenues should be planned with particular emphasis on transportation situation on the ore road down to harbor district, business relations between harbor district and commercial center district, commuting and traffic situation from residential district to business district to commercial and business center.

Main streets must be at least 27 meters wide for 6 driving lanes with a center separate zone.

* Railroads

Although the 1st stage program considers no railway transportation of iron ore, efforts should be made to secure a land necessary for railway installation (yard, and railway siding, etc.) so as to facilitate future by-rail contact with Nayagarh district.

* Port and Harbor

Port should have an ample space for future expansion to be an industrial harbor and a general merchandise handling port, other than the completion of regular port facilities required for the shipment and trailer trucking of iron ore and various terminal installations. More details are explained in the Port Planning.

Land Creation Plan

Since the city development zone is to a large extent a low land, the area should be filled with sand dredged from port so that it is free from

water during the mean tide. More details are given in the Port Planning.

Industrial Water-supply Plan

The first stage plan does not take up industrial water-supply plan as yet, but this must be established in future for the purpose of securing a water supply for petroleum industry. As for city water supply, assuming a per-head supply to be 50 gal (225 l) a day, total water requirement would be one million gal/day (or 4500 M^3). Since water supply for ships will be 500,000 gal (or 2250 M^3), total of 1.5 million gal (6750 M^3) is obtained from Mahanadi Beach to be sent to the city by pressure pump.

(4)-2 Living Accommodations

Drainage Planning

Drainage facilities will be installed for 2 million population and the disposal area will be set up at a low spot of convenience, such as one near Mahanadi River and Alhua Banka River.

Parks

Parks are to be built in accordance with the number of possible park visitors among the citizens, with main emphasis on community composition so that suitable parks and children's playgrounds for the city and neighborhood areas may be provided. Also, natural woods formation will be placed among the industrial district, harbor district and residential district.

10-2-2 Future Prospect

(1) Scale of development

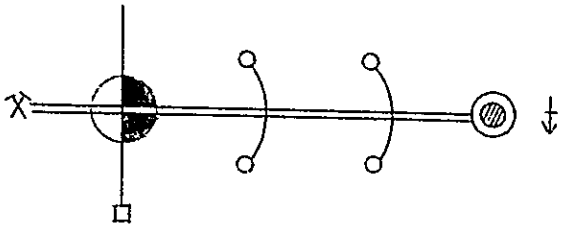
Ample allowance will be prepared in determining space for public facilities and urban area so as not to disrupt the original structure under the first stage program even in case the population far exceeds 2 million.

(2) Greater City-area lay out

By the time when Paradeep Port becomes a general major harbor and the ore road becomes expressways, Paradeep City, instead of being concentrated at port area, will have developed into a garden city having cluster pattern

toward inland side along expressways and take part in function as a general large city.

Remarks: Cluster patter city



Legends:

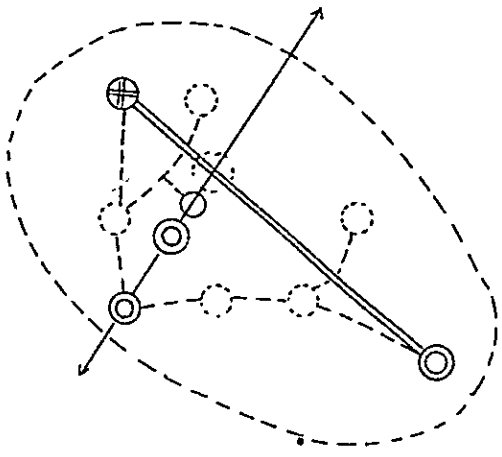
- Traffic city
- Residential city
- Inland industrial city
- Driveways

(3) In view of durability and other factors, most of the city buildings will be those of medium height, except some public institutional building with "Paradeep Tower" as a symbol of the new city. Such tower will serve the city function. i.e. as a first step, television tower is necessary as a means to guide vessels.

10-2-3 Development Plans for Other Cities

(1) Mahanadi Riverside City Planning

The area from both Tomka and Daiteri mines to Paradeep Port is the central and most active district of the State of Orissa. And, in view of the development of various natural resources and the amount of State investment, this area is considered to have increasing importance. It is desirable to expand the city, in the future, to have a well integrarated character covering industry, commerce as well as the center of locality. For that end, layout and character of the city must be planned as in the following diagram:



Legends:

- Political & cultural city
- industrial city
- commercial city
- mining city
- harbor city
- new residential city
- industrial & manufacturing city

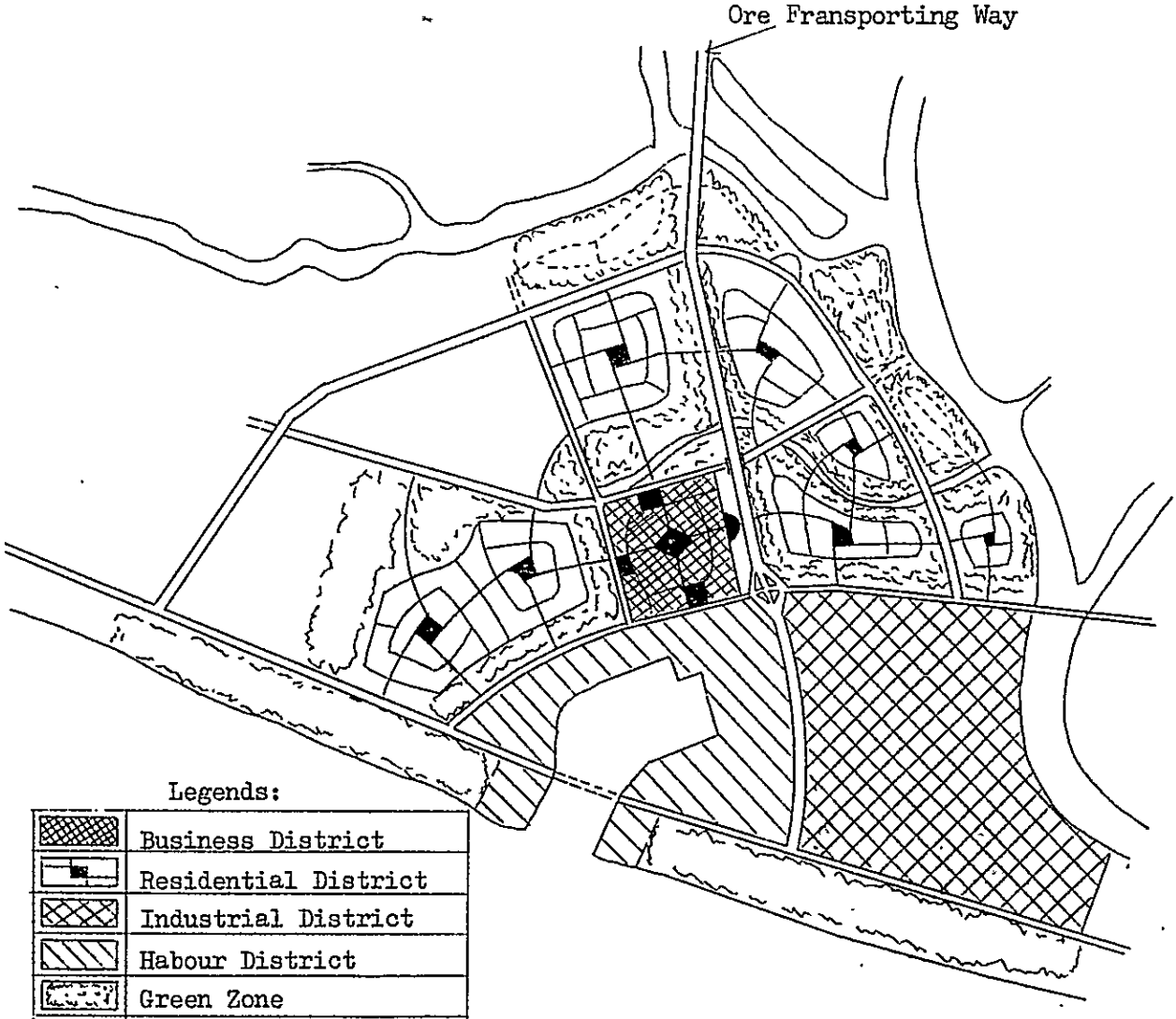
(2) Direction of development -- especially on new city Planning

* Due consideration should be paid on exclusive road system for automobiles, pedestrians and animals as a part of establishing public facilities.

* Since formation of commercial area tends to give excessive load on main roads, consideration should be made to lay out commercial area along park away from the main highways.

* Owing to the lack of sanitary facilities including drainage, it is necessary to endeavor to complete water and drainage services. For this end, it is advisable to plan new cities on hillside rather than in low land area.

Development Plan of New Paradeep



Legends:

	Business District
	Residential District
	Industrial District
	Habour District
	Green Zone
	Way
	Parkway