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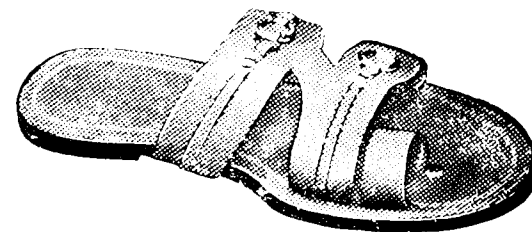
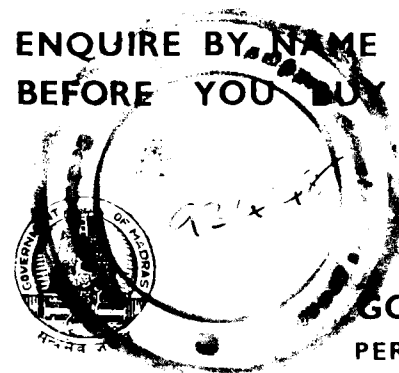


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UNITED NATIONS SEMINAR ON INDUSTRIAL ESTATES IN THE ECAFE REGION

The United Nations Seminar on Industrial Estates in the ECAFE region which was inaugurated by Shri Manubhai Shah, Union Minister of Industries, on the 1st November, 1961 concluded its session on the 11th November, 1961 at the Childrens' Theatre, Madras.

★

THE Seminar was attended by participants from Burma, Ceylon, Republic of China, Federation of Malaya, France, India, Indonesia, Iran, Japan, the Republic of Korea, Laos, Nepal, Netherlands, Pakistan, Philippines, Thailand, the Union of Soviet Socialist Republic, the United States of America, the Republic of Viet Nam, Hongkong, Sarawak and Singapore. An observer from Israel and representatives of the I.L.O., UNESCO, ECLA, the International Chamber of Commerce and World Federation of Trade Unions attended the Seminar. Experts from the Industrial Co-ordination Bureau and the Ford Foundation also attended as observers. The Indian delegation which was the largest at the Seminar consisted of Directors of Industries of all the State Governments and some

officers of the Central Small Industries Organisation.

Dr. P. C. Alexander, Development Commissioner, Small Scale Industries, Government of India and Leader of the Indian Delegation was elected as Chairman of the conference. Mr. Mohammad Aslam Khan, Leader of the Delegation from Pakistan and Mr. Arshad Bin Ayub, Leader of the Delegation from the Federation of Malaya were elected first and second Vice-Chairman respectively.

Dr. D. K. Malhotra, Mr. Igor Kerstovosky and Mr. I. F. Tang acted as Consultants at the Seminar.

The main subjects discussed at the Seminar were objectives and policies in establishing Industrial Estates, planning of

Industrial Estates, organisation, management and financial arrangements, integration of industrial projects with programmes of urban or regional development and the role of international and regional co-operation in the development of Industrial Estates. The following are some of the important conclusions and recommendations of the Seminar:—

Objectives and Policies in Establishing Industrial Estates

The Seminar observed that in most countries of the ECAFE region the objectives of Industrial Estate programme were to promote the development of small scale industry and to influence industrial location in accordance with policies of decentralisation. The Seminar felt that Industrial Estates were also suitable for developing large scale industrial centres and complexes, promoting industrialisation projects connected with the development of ports, airports, large power plants, petroleum refineries etc. and encouraging subsidiary manufacturing activities around such projects. The Seminar was of the view that in order to promote large industries it would not be necessary for public authorities to provide the services and assistance usually extended to small scale industries in Industrial Estates. In such cases public authorities might acquire land, develop it and give it on sale or lease basis for development as Industrial Estates. These projects might be called "Industrial Areas" to be distinguished from "Industrial Estates".

Planning of Industrial Estates

Feasibility Studies and Location Policies: The Seminar considered that an essential prerequisite for planning Industrial Estates was that there should be a formulation of Government policy regarding the purpose, type and geographical distribution of the

Estates proposed to be set up. Within the framework of such a policy certain surveys should be undertaken for ascertaining the feasibility, prerequisites and industrial growth prospects for each proposed Estate. The Seminar emphasized the importance of location for the successful establishment and operation of Industrial Estates. It should be ensured as a part of advance planning that conditions favourable for the success of an Estate existed or could be created. Among these conditions the more important were availability of basic facilities like power, water supply and transport, proximity to market and sources of supply of labour and raw materials.

Types of Estates: The Seminar recommended that the facilities offered in Industrial Estates should vary with the level of industrial development of the localities in which they were to be established. It might not be necessary for the Government to provide ready-built industrial accommodation or certain common services in industrially advanced urban areas. In less developed localities like smaller towns or rural areas publicly sponsored Industrial Estates might be provided with general purpose factories and the necessary common services.

The Seminar recognised the importance and usefulness of Industrial Estates in rural areas, but recommended that in view of the comparative shortage of the basic facilities it would be prudent to adopt a selective approach in this field.

Engineering and Economic Aspects: The Seminar noted that the cost of development and servicing per unit in a smaller Industrial Estate was usually higher than those in a large Estate. It felt that, except for special considerations, an Estate should be large enough to achieve practical economies of scale in the provision of services, special

buildings and public utilities. The Seminar emphasized the importance of economic and efficient utilisation of land in the planning and layout of Industrial Estates. Design should be such as would enable physical expansion as well as modifications in layout. The Seminar stressed the need for a continued exchange of information among the countries of the region on the results of research and norms adopted for layout and building designs.

Social Overhead Investments: The Seminar recognised that provision of social overheads in the Industrial Estates and in their vicinity was an important factor in the success of the Estate. These overheads would include housing, transport, schools, hospitals, canteen, recreational facilities etc.

Organisation, Management and Financing of Industrial Estates

The Seminar noted that in the countries of the ECAFE region, the initiative and responsibility for starting Industrial Estates had been generally taken by the Government. The Seminar recognised the need for such initiative in the early stages, but recommended that the Governments should progressively encourage the entrepreneurs to assume such responsibility by joint action through the formation of companies or co-operatives.

Admission policies: The Seminar noted that policies of admission to Industrial Estates varied considerably from country to country and sometimes from one Estate to another. It considered that both existing and new industries should be eligible for admission to Industrial Estates. However, preference could be given to new types of production as against traditional ones and to industries which earn foreign exchange. The Seminar emphasized that big concerns should not be permitted to gain foothold in

Estates for small scale industries whether by direct or indirect investment or control.

Sales and lease policies: The Seminar observed that in most countries of the region improved sites or factory buildings are offered on rental basis and sale or hire purchase was comparatively on a limited scale. The Seminar recognised that lease and sales policies would vary according to the special circumstances of the Estates concerned. It recommended that these should be for as short a period as possible and on a reducing scale.

Financing: The Seminar noted that in the countries of the ECAFE region financing for Industrial Estates was almost entirely done by Government agencies. It recommended that banking institutions as well as insurance companies should be induced to take up the financing of Industrial Estates. If necessary Governments might stand guarantee for such institutional loans.

Special Inducements to units in the Estates: The Seminar felt that while the Industrial Estate had a developmental object, the intention was not to create a privileged section of entrepreneurs. Provision of ready-made factory accommodation should be regarded as sufficient inducement to make the programme attractive and it would not be desirable to provide special concessions and facilities which were not available to units outside the Estate.

Integration of Industrial Estate Projects with Programmes of Urban or Regional Development

The Seminar emphasized the need for co-ordinating or integrating Industrial Estate projects with programmes of broader scope. It considered that Industrial Estates should be planned as part of the economic and social development programmes at the local, regional or national levels.

International and Regional Co-operation in the Development of Industrial Estates

The Seminar was of the view that there was considerable scope for international and regional co-operation in the field of Industrial Estates and that the countries which have gained experience in this programme should assist others in accelerating the development. The Seminar made the following specific recommendations in this regard:

(a) Study tours and observation teams should be organised for the benefit of the countries who were new in this field.

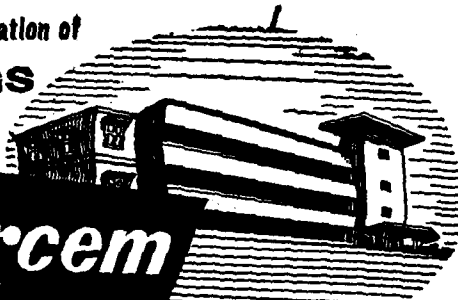
(b) Research Centres and Institutions should be requested to help developing

countries in drawing up norms for layouts, factory designs, specification for building materials etc.

(c) The United Nations and other International Agencies might be requested to undertake detailed studies of the specific problems of small industries and Industrial Estates like financial arrangements, promotion of ancillaries, problems of Industrial Estates in rural areas and administration and management problems of Industrial Estates.

(d) Regional panels of experts might be constituted by the United Nations and the ECAFE to examine specific aspects of the development of Industrial Estates in the region.

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PLANNING OF INDUSTRIAL ESTATES

RELATED SOCIAL OVERHEAD INVESTMENT

The immediate objective of Industrial Estates is to provide land and buildings, water and power for the installation of factories and thus enable entrepreneurs to set up industries. The provision of common facilities like Tool Room, Heat Treatment, Godown, a Servicing Corporation for supply of raw materials etc., are ancillary to the immediate objective. Having planned for these the question that arises is what about the people who work and live in these Estates. They spend the major portion of their time each day in and around the Estate. Should they not be provided with the normal amenities. To the extent to which these are provided the amenities would constitute an overhead to the Industrial Estate.

WHAT is a social amenity? Is it the same as social security? Is it necessary to provide them in an Industrial Estate? If they are to be, what are the advantages? To what extent can an Industrial Estate bear the overheads on account of social amenities? These are the questions which would have to be considered by this Seminar. Social security is that which relates to the individual whereas a social amenity is associated with the benefits derived by a group or community. Social security is a combination of old age pension, disability insurance and life insurances. What a worker and his family gets will be (within the minimum and maximum limits) in proportion to his earnings in work covered by the Social Security Act, with additional allowances for dependents. What the worker gets, more over is as of right, like any other insurance. The worker does not have to apologise for asking for it. It bears no relation to relief or public assistance. The worker does not have to account to any one how he spends the money. The worker has to remember that he has to build up his rights in advance in the form of contributions against his name on the files maintained by the Social Security Office and that his earnings are all recorded so that when the time comes that benefit can be demanded by the worker. Having defined what social security is as it would be apparent to the

By
Sri P. SABANAYAGAM, I. A. S.,
Director of Industries and Commerce, Madras

distinguished delegates present that it is more a subject relating to employer-employee relations and the social welfare policies of a Nation and do not come under the ambit of overheads of an industrial estate. Social amenities are more in the nature of recreation and athletic services, medical plans, company stores, restaurants etc. which are intended to provide services that the employers are likely to neglect, which are inadequate in the community, or otherwise unobtainable at reasonable cost. The need and extent to which social amenities would have to be provided for in Industrial Estates would depend on the general development of social services around the area where the Estate is located. If the amenities mentioned above are within the easy reach of the workers employed or living in the Industrial Estates then the extent to which they would have to be provided in the Industrial Estates would be limited. If, however, the Estate is far removed from a town where the services can be expected then it would be necessary to make the Estate self-sufficient in this respect consistent with the financial implications. Our aim should be two-fold—(1) to ensure that the workers in the Industrial Estate are able to enjoy the same services and comforts as are provided in neighbouring well developed area—the workers should not feel that they are at a disadvantage because they are in the Estate which has been set up for the purpose of encouraging industries, (2) to ensure a high standard in the health of the workers both physical and mental and to some extent spiritual in so far as the actual production in the units is concerned it is imperative that the health and morale of the workers is maintained at the highest level so that they can give of their best.

I shall now take up each one of the social amenities and discuss its merits:

1. Provision of recreational, social and athletic services serves a double purpose. They make for a well-rounded life for employees and they provide a contact with employees who are better equipped to perform the daily tasks. The affording of such opportunities makes the worker physically sound and healthy, provides a change in the tempo of living that brings renewed vigour to employees and encourages gregariousness among employees. Hence in the Industrial Estates sufficient area should be earmarked for recreational (including reading room) social and athletic services.

2. The workers normally work on a 8-hour shift basis. Providing hot, wholesome and nutritious food at low cost at timings conforming to the normal meal timings is a great and essential amenity in Industrial Estates. Considering the nature of work and high productivity that is to be attained the energy of the worker is fast depleted and he has to recoup. Unless good food at reasonable cost is available the health of the worker and in due course his morale is likely to deteriorate.

3. The need for an integrated scheme of public health and medical services covering both preventive and curative aspects is another special amenity which should be thought of when establishing Industrial Estates. The workers and their families should be protected against small-pox, cholera, tetanus etc. If in spite of the protection the worker, or his family members fall sick he should have facilities for medical service at home and if necessary in hospital. The scheme of Employees' State Insurance whereby contribution is made by the worker based on the wages enables the worker not only to get medical attendance but also hospital facilities. It

would be of interest to the delegates to go through the Employees' State Insurance Act of 1948 passed by the Parliament of India.

4. Shopping centres which would serve the needs of the workers enabling them to purchase the daily necessities of life.

5. Services such as laundry, hair-dresser, tailors etc., would also be necessary.

6. Schools: For the establishment of Industrial Estates far away from the centre of existing well developed areas it would be necessary to have schools where the children of the workers say upto the age of 10 when they normally finish middle school may attend. The workers should have the satisfaction that although he is removed, in the initial stages, from the normal community life he is not deprived of educational facilities for his children or that they (their children) are exposed to unnecessary hazards. Children above the age of 10 may be expected to find their way to school a few miles away. Transport may have to be provided.

7. Creche: The need for providing a creche where children below four to five years can be looked after when their mothers or their parents are working is an essential requirement. In the creche provision should be made not only for watching the children but also to feed them and keep them engaged with small toys in healthy surroundings.

8. Cycle stands and garages for cars is another amenity which should be provided from the inception of the Estate.

9. It is stated music during working hours relieves the worker of the monotony and results in increased production. It would, therefore, be a salutary recommendation if it is stated that in all Industrial Estates a centralised radio broadcast with speakers installed in the various Industrial units is provided.

10. Transport: In regard to Estates which are removed from big towns arrangements should be made for buses to leave at convenient hours.

11. Low-cost housing: The most important of all social amenities is provision of homes for the workers. Low-cost housing should be an integral part of the Estate. Sufficient provision should be made in the areas earmarked for low cost housing, for parks, play-ground and a meeting place. Supply of good water and lighting should be ensured.

(1) Tenements: 600 tenements were constructed so far in various Industrial Estates in Madras State at a cost of rupees 2 million which is 10% of the total investment on Industrial Estates. During Third Plan period 630 more tenements will be constructed. The rent of the tenements varies from Rs. 11 to 25.

(2) Canteens—250 thousand rupees.

(3) First-aid-centre—a Hundred thousand rupees.

The questions which the Seminar would have to consider are whether the social amenities listed by me are essential, whether some more have to be provided and some other cut out, whether the provision of these amenities would be considered as an unnecessary overhead (in so far as the occupants of the sheds are concerned) and hence a deterring factor; what should be the quantum of social amenities in respect of each one of them; when should they be introduced—whether they should all be provided even before the Units are allotted to the entrepreneurs or whether they should be provided for after all the units are occupied. It would be agreed that the answers to these and other questions would provide for the well-being of the people for whom the Industrial Estates are being set up and the level and quality of production by these workers would be at its highest.

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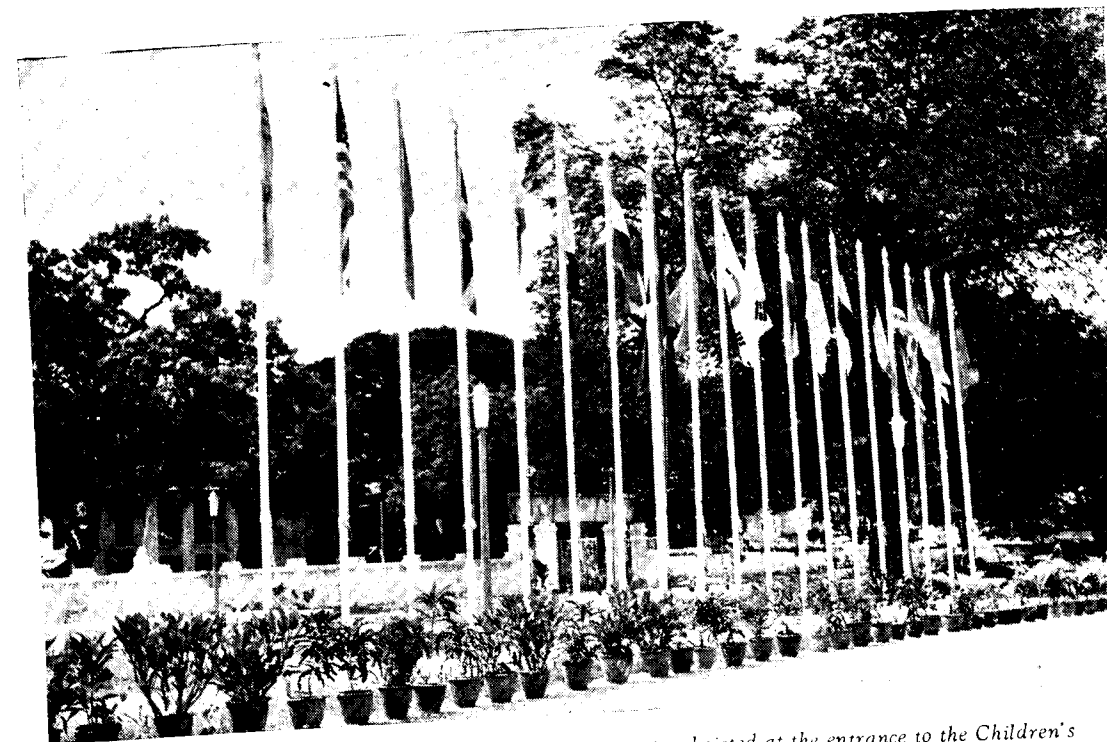


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ECAFE SEMINAR ON INDUSTRIAL ESTATES

(From 1-11-'61 to 11-11-'61)

NEWS IN PICTURES



The National flags of the countries in the ECAFE region hoisted at the entrance to the Children's Theatre, Madras, the venue of the Seminar



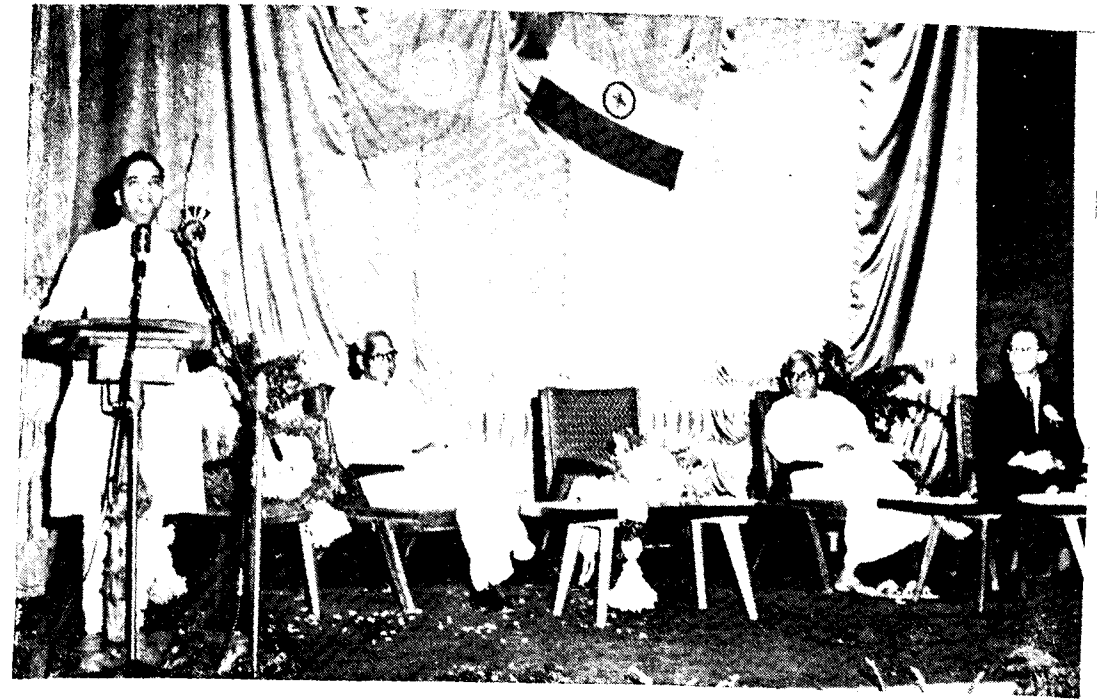
Sabanayagam, Director of Industries and Commerce, Madras is seen garlanding Janubhai Shah, Minister for Industries, Government of India, who inaugurated the Seminar.

(Continued)



Sri M. Bhaktavatsalam, Home Minister, Government of Madras, welcoming the delegates to the Seminar. Also seen in the picture are (from left to right) Sri K. V. Venkatachalam, Sri Manubhai Shah and U Nyun, Executive Secretary of the ECAFE.

(Continued)



Sri Manubhai Shah delivering the inaugural address.



A view of the gathering.

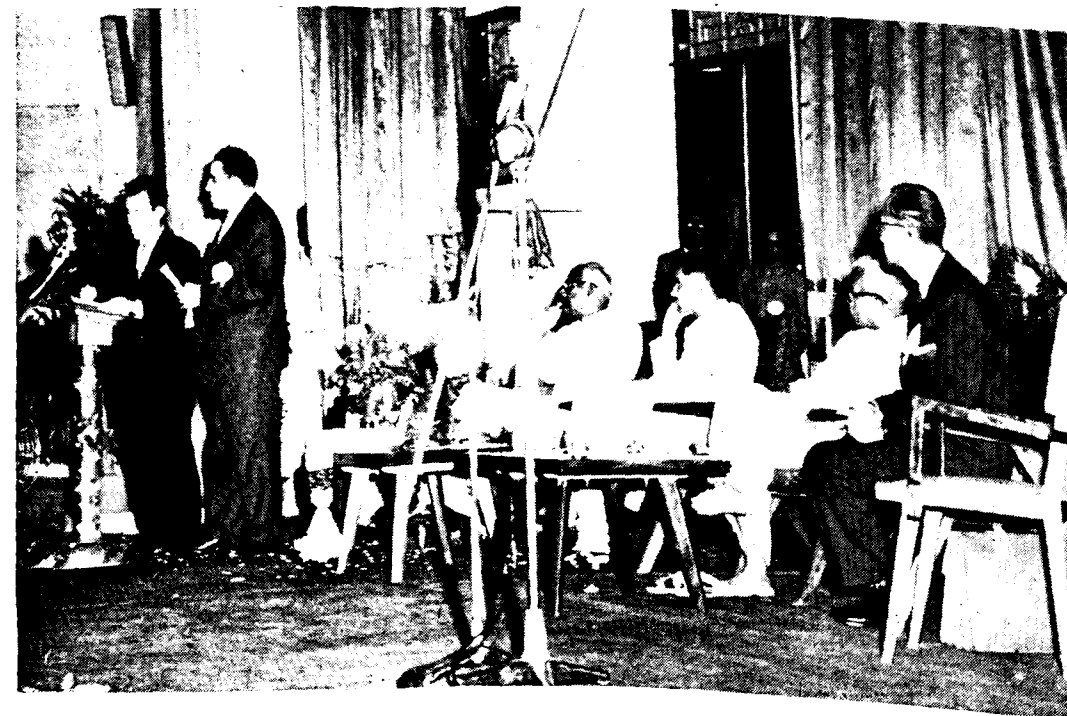


Another view of the gathering.

(Continued)



U Nyun is seen welcoming the delegates to the Seminar on behalf of the ECAFE.



A delegate from the Soviet Union addresses the opening session of the Seminar.



Left to right:—Sri K. V. Venkatachalam, Sri P. Sabanayagam (third), U Nyun, Sri Manubhai Shah, Sri T. K. Palaniappan, Secretary to Government, Industries, Labour and Co-operation Department, Government of Madras, and Dr. P. C. Alexander, Development Commissioner (Small Scale Industries), Government of India.

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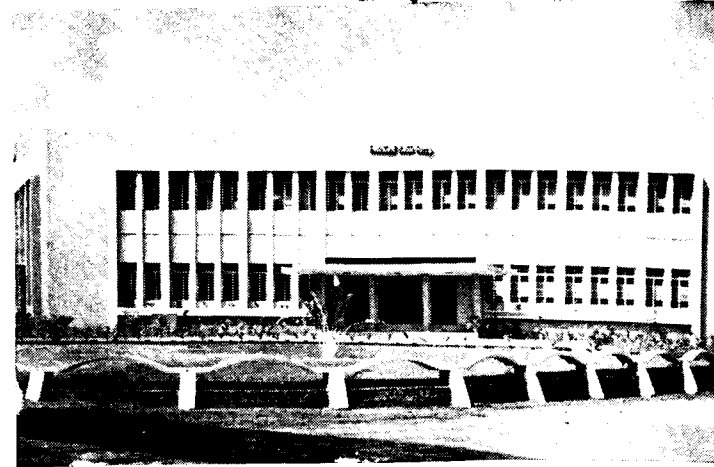
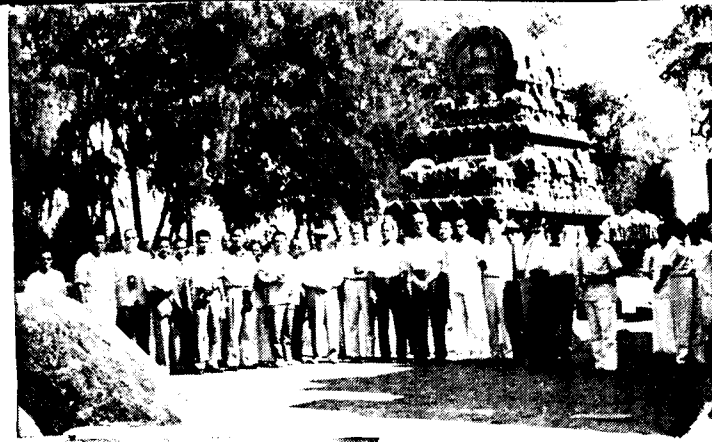
*From left to right—
Mr. I. F. Tang of the ECAFE Secretariat, U Nyun, Dr. P. C. Alexander, Mr. Krestovsky of the ECAFE Secretariat and Dr. Malhotra, United Nations Consultant in India, at a group discussion.*



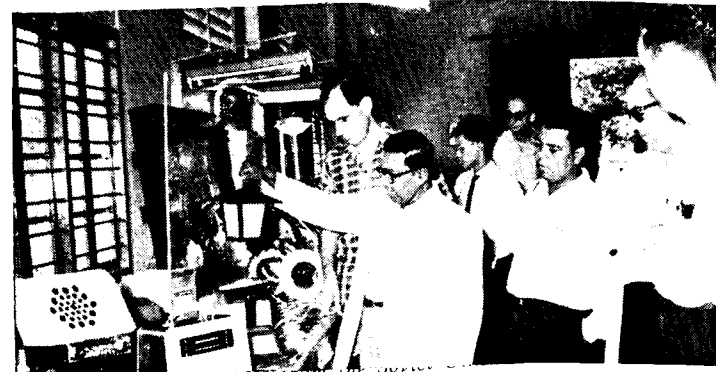
Some of the delegates at the Seminar.

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The delegates at Mahabalipuram.



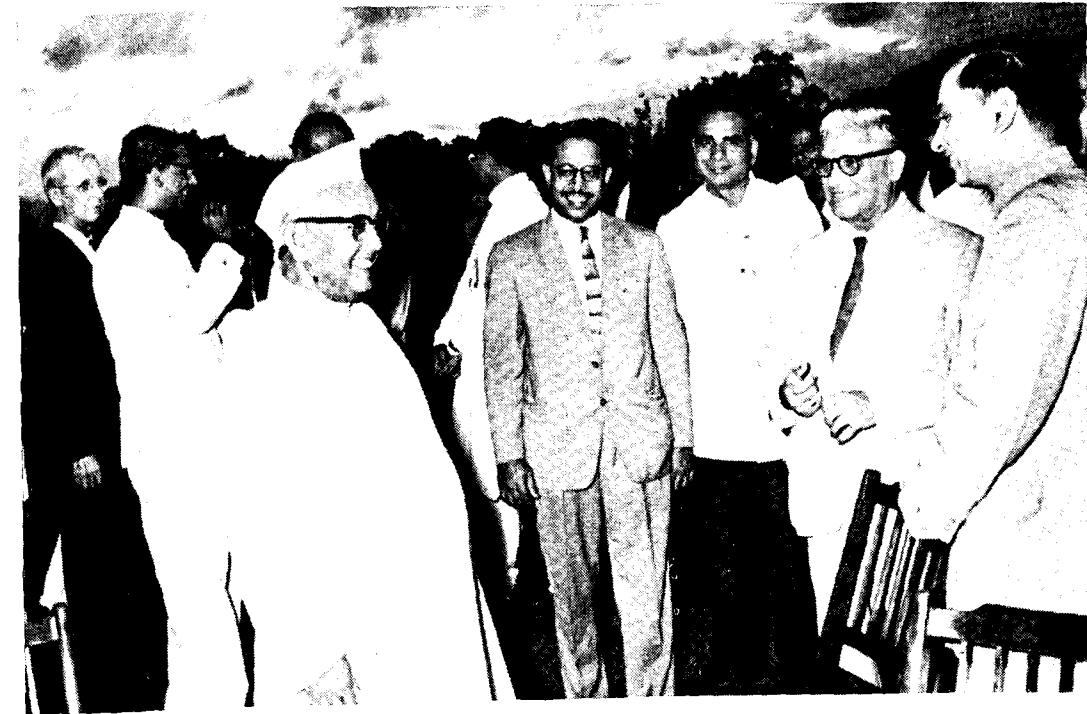
The new Administrative Block, Industrial Estate, Guindy, Madras.



A delegate from the Soviet Union winning.

The delegates at the Estate Exhibition Hall, Guindy.

(Continued)



Sri Bishnuram Medhi, Governor of Madras, entertained the delegates at a party at Raj Bhavan. Picture shows the Governor with some of the invitees.





Srimathi Medhi (extreme left) with the guests at Raj Bhavan party.



A State dinner was given in honour of the delegates by the Government of Madras. Picture shows the invitees being introduced to Sri K. Kamaraj, Chief Minister of Madras, by C. J. D. Srinivasa.

ARTICLE

PLANT LAY-OUT AS A TOOL OF MANAGEMENT

By
Sri M. A. NATARAJAN,
Inspector of Factories (Productivity), Madras.

"Plant Lay-out" may be defined as a floor plan for determining and arranging the desired machinery and equipment of a plant, whether established or contemplated, in the one best place, to permit the quickest flow of material at the lowest cost and with the least amount of handling in processing the product, from the receipt of raw material to the shipment of finished products.

A study of plant and equipment layout is essential as the savings obtained through increased production by better job performance can easily be wasted by needless materials handling and transportation caused by poor layout, and many of the improvements in job performance itself cannot be brought about without the re-layout of equipment department and work places. That is why progressive management devote a great deal of time in deciding the economical working arrangements of machinery and plant in completely new factories but also towards the improvement of layouts already in use.

Layout problems occur when designing a new plant; when additional space is needed to meet increased output requirements; when an existing plant or department is

moved to a new area of different shape and size; when existing facilities have to be rearranged due to change of product line or model or when existing methods are to be improved to attain higher efficiency. The tools and techniques used for layout planning are process charts, flow diagrams, string diagrams, building drawings and site plans and visual aids such as templates and scale models. These methods can be used to try various ideas, to convince management of new ideas; to show employees what is involved in a change and plan how to make it and to store information on a proposal. String diagrams, templates and three dimensional models are especially useful in interesting management in their own plant and to stimulate them into suggesting changes.

In deciding upon a layout, factors such as the nature of manufacturing processes and products, continuity of flow and balance of operations, quantity and rate of production, future requirements etc. should be taken into consideration. The basic principles underlying an efficient layout and certain factors that influence layout are discussed below.

A good layout leads to economies in handling. The best and cheapest way to handle materials is 'not to handle them'. But, under this ideal situation, production is not possible as "production" to put it in general terms, is "material on the move". But it is always possible through careful study to eliminate the particular handling operations altogether or to cut down the distance the material has to travel from one machine to another. Whatever be the

objective of the management studying layout problems, the result is a lower cost for sq. ft. of useful area.

Inadequate spacing of machines, cramped storage space and congested aisles, contribute to difficulties and delays in handling materials from one stage to the next in the process. In certain other cases, poor handling, inadequate storage space or the pace of the operator may create bottlenecks resulting in production delays and lower out-put. An improved layout would ensure a smooth and steady flow of work in progress and help to meet the delivery schedules. Further, careful layout planning would facilitate introduction of an effective and at the same time simple production control system. By these control procedures, production delays are reduced to the minimum and the machine time and

man hours are utilised to the maximum possible.

Layout has a definite bearing on the number of men that a supervisor can handle. For instance, if a particular operation is divided between two floors or in 2 different buildings, two supervisors, instead of one may be required. The location of the supervisor's office in relation to the whole shop should be such as to help discharge his main functions viz., discipline and inspection, with the minimum of effort. If machinery is to be installed in a vacant factory building, as is very often the case in many industries, care in layout must be exercised before occupying the building and not afterwards. Making alterations in a structure to facilitate rearrangement of machinery and handling of materials after the equipment is installed, is not only costly, but results in avoidable expense from lost-time of men and machines. In the case of new factories, possible expansion needs should be taken into consideration at the time of construction and the processes so arranged that structural alterations are kept to the minimum.

Careful study of layout problems lead to opportunities for improvements in processes and methods. For instance, it may be possible to eliminate certain operations and combine a few others. These improvements

lead new machines, which take the materials through manufacturing process in lesser time, resulting in a cheaper, but at the same time better product.

In planning the layout of a shop or department, the principles of "building safety into the plant" should not be overlooked as poor layout continues to be the cause of several accidents. Injuries to workers and damage to the machinery, result in loss of machine time and man hours and these in turn, to lower productivity. Machinery and equipment damaged beyond repair must be scrapped and charged to operating losses, thus adding to the cost of manufacture. On the other hand, safe and healthy working conditions incorporated in the layout of the plant help to achieve higher standards of employee performance leading in turn to reduced cost of production, and higher productivity.

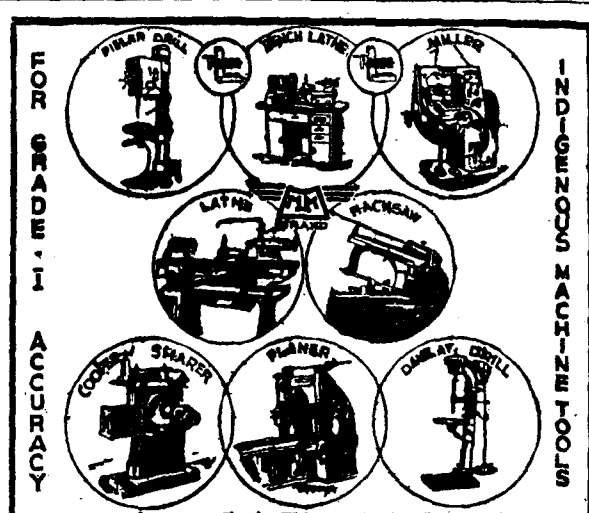
Plant Lay-out engineering has become a major function of plant management. Plant lay-out is a recurrent and ever-present problem of decisive influence on plant operations. For this and other reasons already advanced, the responsibility for recognising and solving plant lay-out problems calls for management engineering talent of the highest order, from the stand-points of technical knowledge and ability, to visualise operating advantages from the scientific arrangement of plant facilities.

BINNY'S ENGINEERING WORKS LTD., MEENAMBARKAM

Binny's Engineering Works Ltd., Meenambarkam, has been manufacturing under a licence granted by the Government of India complete sugar mill machinery in addition to fabrication of such items as steel work, vessels, etc., required for industries generally. Consequent on the over production of sugar in the country, the Government of India have stopped the issue

of licences for the expansion of the sugar industry and as a result Binny's have surplus production capacity and they are anxious to utilise this for the manufacture of other items of steel work required for industry. Binny's are therefore, in a position to effect delivery of plant and machinery in much shorter time than the fabricators in the 'North.'

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It also manufactures and supplies Brass and Stainless Steel domestic ware, Wheel cocks, Taps, Machine screws, Spot-welded assemblies and other allied Engineering requirements.



Service Centre for
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KUMBAKONAM.

A UNIT OF THE SMALL-SCALE INDUSTRIES,
GOVERNMENT OF MADRAS.

VYASARPADI CO-OPERATIVE INDUSTRIAL ESTATE

**SPONSORED BY THE SMALL SCALE
INDUSTRIES ASSOCIATION, MADRAS**

The Vyasarpadi Co-operative Industrial Estate Society Limited sponsored by the Small Scale Industries Association, Madras was inaugurated by the Chief Minister Sri K. Kamaraj at the premises of the Association in Mount Road, Guindy on the 20th November, 1961.

The new Industrial Estate will be situated at Vyasarpadi near Sarma Nagar, within City limits on a 30 acre site. The scheme is estimated to cost Rs. 18 lakhs of which Rs. 3.75 lakhs are to be subscribed by the members. A sum of Rs. 1.5 lakhs has already been subscribed by the members.

Sri R. Ganesan, President of the Small Scale Industries Association, said that just as the Guindy Industrial Estate was to-day a landmark of its kind in the whole country, so also he was confident the new venture would be a landmark of its kind undertaken by private industrialists on a co-operative basis with the help of the Government. Giving details of the scheme, he said that except for 140 grounds, the remainder would be divided in to units of five, three, two and one grounds each. The low price at which the land would be given namely Rs. 1,000 per ground for sites within the

city municipal limits would be unprecedented. Loans would be advanced to the members by the Government, repayable in 15 years.

The Chief Minister said that with a view to giving encouragement to small scale industries, steps were being taken in the Third plan period to start co-operative industrial estates in which small industrialists could become members.

Sri M. Bhaktavatsalam, Home Minister, stressed the importance of small industries. He appealed to the members to strive their utmost to make the venture a success.

Sri P. Sabanayagam, Director of Industries urged the members to realise that the success of the co-operative industrial estate depended on their own efforts.

Sri V. V. Nathan, Secretary, giving details of the scheme, said that the loans given by the Government would bear interest at 3 per cent during the first five years, and thereafter it would be stopped up periodically until it reached a rate of 4½ per cent. The loans were repayable in 15 years. He added that the authorities were taking steps to expedite land acquisition proceedings in the area.

BOLTS AND NUTS FACTORY AT SRIPERUMBUDUR

The Bolts and Nuts Factory at Sriperumbudur sponsored by the Sriperumbudur Bolt and Nut Manufacturers Co-operative Industrial Society was inaugurated by the Home Minister of Madras, Sri M. Bhaktavatsalam on the 30th November, 1961. Sri P. Sabanayagam, Director of Industries & Commerce, was present on the occasion.

The factory has been set up by the financial assistance of the Sriperumbudur Taluk Co-operative Society. The total cost of the scheme has been estimated at Rs. 2.75 lakhs. Government have so far advanced Rs. 1.74 lakhs and a further loan of Rs. 0.80 lakhs will be obtained from the Government very shortly. The Director of Industries & Commerce has given a subsidy of Rs. 5,000 towards reserve fund. A total sum of Rs. 20,590 has so far been received by way of share capital from worker-members and other leading non-officials in the districts of Chingleput and Madras.

On the special efforts of the office bearers of the factory and with the co-operation of the Department of Industries it has been possible to acquire a land measuring 1.94 acres for Rs. 633 and to erect a shed at a total cost of Rs. 20,000.

A complete set of machines required for the manufacture of bolts and nuts has been imported from Japan for a total cost of Rs. 1.5 lakhs. One engineer, one foreman and three worker-members of this factory have already undergone training in this line of productions at the Government factory at Erode and have acquired necessary skill and experience to carry on the work in the factory without any interruption. The Director of Industries & Commerce has arranged for the supply of sufficient quantities of tested rods and other materials from the Government stocks at the Industries Department Servicing Corporation at Guindy.

The production capacity of the factory for a single shift of 8 hours is half a ton a day employing about 25 skilled workers besides the technical and supervisory staff. After a few months the factory is expected to work with two shifts employing another set of workers. It is proposed to train 25 worker-members for a period of six months by paying a stipend of Rs. 30 per month per trainee. Government have generously given a subsidy of Rs. 4,500 towards the payment of stipends to the worker-members during the training period.

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IND-COM JOURNAL

RAW FILM FACTORY AT OOTY

Production by the end of 1962

Among public sector projects of a pioneering character which will commence production early during the Third Plan, will be the Raw Film Factory, located on the outskirts of the hill station of Ootacamund in South India. Work is proceeding briskly on this project which when completed will meet the bulk of our requirements of a large variety of photographic materials and help us to save much of Rs. 5 crores foreign exchange which the country now spends on import of raw film and photo materials.

Construction work has already started on the site of 250 acres to house the factory and ancillary units. It is expected that towards the end of 1962 the factory would commence the production of a large variety of photographic sensitised material, including cinematographic film, roll and sheet film, photographic paper, materials for photographic arts, etc. The target of Rs. 5 crores output will be reached during

the third plan itself. A total investment of Rs. 7 crores—Rs. 4 crores in foreign exchange and Rs. 3 crores by way of rupee costs, will be required for the project.

The largest single item in the production programme is cinematographic film and a start will be made with black and white materials. Before the end of the Third Plan period the production of film for colour process will also be taken up.

X-Ray Films

The factory will also manufacture X-Ray films for which there is growing demand in the country. In this case production from the factory would be more than enough to meet our entire requirements and will leave some surplus for export.

The production of cinema and photo films involves highly complex processes, and it is of utmost importance that in a venture like this, the greatest attention should be paid

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OCTOBER-DECEMBER 1961

to ensure high quality of the product. The Government of India have secured the collaboration of the well known French firm Messrs. Bauchet. The designs for the different sections of the factory have been completed and specialised items will be supplied from the U. S. A., West Germany, Switzerland and Austria. Shipments will be made as each item is completed and tested. It is expected that the first consignment will reach India by March, 1962. Import of the necessary equipments for the factory will be financed under the French Credit Scheme Payments for the equipments are due to start only after the factory has gone into production and will be spread over five years.

A special feature of this project is that from the very outset it will be manned and operated by Indian personnel. A number of scientists and engineers have already been recruited from all parts of India and sent to France to work in the factories of

the consultants. Since most of them have already experience in allied industries to their credit, these technicians will devote their time in France to the actual manufacture of photographic materials, starting from the making of film base right upto the control and checking of the final product.

Arrangements have been made for the production of necessary raw materials within the country. For a number of these materials such as cellulose, triacetate, plasticisers, solvents and photographic gelatine the Government have already granted manufacturing licences to units in private sector. Some of the materials like silver nitrate will be manufactured in the film factory itself. It is planned that from the beginning the value of raw materials to be imported will be only a small fraction of the price of the finished product and that by the end of the plan period practically 99 per cent of the raw materials will be produced in this country.

(By courtesy—The Hindu).

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A UNIT OF THE SMALL-SCALE
INDUSTRIES
GOVERNMENT OF MADRAS

Please Contact:

The Superintendent,
GENERAL PURPOSE ENGINEERING WORKSHOP
RAJAPALAYAM.

WHAT SMALL SCALE INDUSTRIES CAN YOU START?

INTRODUCTION

During the Second Five Year Plan, all-round development of small scale industries has taken place in the country on account of demands generated by investment outlays in the public sector. It is now felt that sufficient tempo of development has been generated in the small scale sector, especially in the light engineering industries. The stage has now come to guide small entrepreneurship into selected channels which offer best scope for development. With this end in view, a list of small scale industries having scope for development has been prepared. It is expected that about a 1,000 new small units can be started in those industries.

The lists on pages 20 to 28 give information on investment per unit, cost of machinery per unit and total capital cost per unit.

The selection of items included in this list has been made on the basis of likely demand for the products to be manufactured during the Third Plan Period, techno-economic feasibility for manufacture of the items on small scale basis, possibilities for replacing imports and promoting exports. Prospective entrepreneurs may contact any of the Small Industries Service Institute for further technical advice and assistance in starting these industries. They should contact the State Director of Industries for suitable factory accommodation, supply of raw materials, loans, supply of machinery on hire-purchase basis, etc.

Figures of investment given against each item are those required for a model unit. The extent of investment required in each case will have to be suitably modified having

regard to the location of the unit, size of output and the production-programme of the unit.

The enclosed list should not be regarded as complete by any means. Further possibilities are being examined. The list would be reviewed every six months and necessary additions and deletions will be made after taking into account the development in the intervening period. Suggestions in this regard will be gratefully received.

The list includes items for consumer markets as well as those which can be undertaken only as ancillary industries. In most of the cases, the imperative need for maintenance of quality standards is to be emphasised. Several items included will find a ready market only if standards of precision and tolerance are maintained. In some cases, foreign technical collaboration may be necessary not only to keep up the quality, but also to be able to compete with reputed imported brands.

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LIST OF SMALL INDUSTRIES HAVING SCOPE FOR DEVELOPMENT

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
1.	Machine vices	250 Nos. per month	Rs. 48,000	Rs. 1'28 lakhs	
2.	Collets	9,000 Nos. per annum	1'14 lakhs	1'75 lakhs	
3.	Steel furniture	30 Nos. per day	40,000	1'07 lakhs	
4.	Spanners, wrenches & tyre openers	30 tons per day	1'33 lakhs	2'24 lakhs	
5.	Drawing boards and 'T' squares	2,400 Nos. per annum	9,000	46,000	It will be desirable that the units take up the manufacture of drafting stands also.
6.	Bicycle hubs	200 pairs per month	1'43 lakhs	2'11 lakhs	
7.	Wrought iron pulleys	400 Nos. per month	40,000	70,000	
8.	Cutlery items	300 Nos. a day	70,000	1'16 lakhs	
9.	Grease nipples	40,000 Nos. per month	36,000	48,000	
10.	Spring washers	25,000 Gross per month	76,000	1 lakh	
11.	Water meters	6,000 per annum	1'45 lakhs	2'28 lakhs	
12.	Brass cocks	5,000 per annum	28,000	52,000	
13.	Improved hand tools	400 Nos. per month	2'50 lakhs	2'74 lakhs	

(Continuation)

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
14.	Hypodermic needles	5,000 Nos. per day	Rs. 32,000	Rs. 66,000	
15.	Bottle cleaning brushes	25,000 Nos. per month	17,000	61,000	
16.	Staple pins	5 lakhs pins per day	29,000	35,000	
17.	Umbrella ribs	200 sets per day	30,000	41,000	
18.	Expand metal or welded wire mesh	2'4 lakhs sq. ft. per month	2'45 lakhs	3'57 lakhs	
19.	Brass lead hinges from brass sheets	1,880 doz. per month	51,000	96,000	
20.	Hexagonal and square wire netting	515 cwt. per month	1'25 lakhs	2'75 lakhs	
21.	Pressure gauges	1,000 Nos. per month	1'5 lakhs	2'4 lakhs	F.C. *
22.	Gudgeon pins for internal combustion engines and other similar items	5,000 Nos.	1 lakh	1'55 lakhs	
23.	Mechanical toys	6,000 Nos. per month	1'06 lakhs	1'54 lakhs	
24.	Building machines & other machine tools	30 Nos. per month	4 lakhs	6'20 lakhs	
25.	Wire drawing units (non-ferrous)	300 tons per year	1'8 lakhs	6'8 lakhs	
26.	Wire drawing units (ferrous)	1600 tons per year	2'2 lakhs	6'5 lakhs	

* Foreign collaboration desirable.

(Continuation)					
No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
27.	Wood screws	100 gross per day	Rs. 60,000	Rs. 2.20 lakhs	
28.	Machine tools	100 gross per day	56,000	2.12 lakhs	
29.	Bolts and nuts	44 tons per month	2.6 lakhs	4.68 lakhs	
30.	Tapes and dyes	750 Nos. per month	1.5 lakhs	2.5 lakhs	
31.	Non-ferrous castings	192 tons per annum	1.4 lakhs	5 lakhs	
32.	Light foreges	500 tons per annum	2.20 lakhs	4.90 lakhs	
33.	Survey instruments (Dumpy levels, telescopic levels, simple theodolites, telescopic compass and prismatic compass)	900 instruments per annum	1.15 lakhs	1.73 lakhs	
34.	Drawing instruments (Compass with two needle points, pen & pencil points, spring bars, drawing pins, lengthening bars.)	250 sets per month	1.01 lakhs	1.31 lakhs	
35.	Agricultural implements (iron ploughs and plough spares)	100 ploughs plus 24 tons GI plough spares plus 3.5 tons MS plough spares per month.	86,000	1.06 lakhs	
36.	Graphite crucibles	250 tons per month	1 lakh	4 lakhs	

(Continuation)					
No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
37.	Metallic measuring Tapes	1600 pieces per annum	Rs. —	Rs. 50,000	
38.	Paper pins	120 lbs. per day	13,000	25,000	
39.	Drums and barrels	280 Nos. per day	30,000	1 lakh	
40.	Distributors	Rs. 20000 per month	51,000	1.35 lakhs	
41.	Automobile leaf springs	500 per month	3.60 lakhs	5 lakhs	
42.	Automobile strids and screws	Rs. 25000 per month	1.60 lakhs	2.50 lakhs	

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(Continuation)

B. ELECTRICAL INDUSTRIES

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
			Rs.	Rs.	
1.	House Service meters	2000 Nos. per month	2.1 lakhs	3.76 lakhs	
2.	Panel instruments like ammeters & volt- meters.	200 per month	1.7 lakhs	2.8 lakhs	
3.	Relays for automatic control circuits	1000 per month	1 lakh	2 lakhs	
4.	Record changers	200 per month	1.2 lakhs	3.25 lakhs	F.C. *
5.	Tone controls and volume controls	10000 per month 5000 per month	54,000	1.12 lakhs	
6.	Jewel lamps and auto- mobile bulbs	2000 per day	12,000	40,000	
7.	Resisters wire-wound fixed and adjustable viterous enamel type	10000 per month	13,000	1.5 lakhs	
8.	Resisters composition type	5 lakhs per month	2 lakhs	4 lakhs	
9.	Paper condensers	8000 per month	20,000	60,000	
10.	Electrolytic condensers	6000 per month	1 lakh	2.5 lakhs	F.C. *
11.	Gang condensers	1000 per month	50,000	2 lakhs	
12.	Mica condensers and trimmers	900 gross per month	40,000	1.2 lakhs	
13.	Metal ractifiers	1,000 per month	15,000	40,000	
14.	Coil packs	200 gross per month	20,000	60,000	

* Foreign collaboration desirable.

(Continuation)

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
			Rs.	Rs.	
15.	Valve holders	600 gross per month	30,000	1 lakh	
16.	Wave and switches rotor & push button type	6,000 per month	30,000	1 lakh	
17.	Solder (cold solders)	6,000 lbs. per month	20,000	80,000	F.C. *
18.	Flourescent tubes	25,000 per month	1.57 lakhs	3.68 lakhs	
19.	Mercury vapour lamps	20,000 per month	1.69 lakhs	3.50 lakhs	
20.	Neon signs	2,000 per month	30,000	60,000	
21.	Flood lights reflectors and studio equipment	600 per month	1.25 lakhs	2.75 lakhs	
22.	F. H P. motors	300 per month	98,000	1.83 lakhs	
23.	Auto transformers	200 per month	50,000	95,000	
24.	Pen type electrical potential testers	100 per month	30,000	1 lakh	

* Foreign collaboration desirable.

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EXPORTERS, GOVERNMENT CONTRACTORS AND SUPPLIERS

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
			Rs.	Rs.	
25.	Automobile dynamos	100 per month	75,000	1.25 lakhs	
26.	Battery charges	150 per month	11,000	58,000	
27.	Screen wipers	600 per month	16,000	36,000	
28.	Blinkers	600 per month	30,000	1 lakh	
29.	Industrial furnaces with temperature control	50 per month	1 lakh	2.5 lakhs	
30.	Electrical iron with steam, heaters and testers	500 per month	16,000	1.5 lakhs	
31.	Hot plates	500 per month	14,000	54,000	
32.	Refrigerators (1.5 c. ft. costing about Rs. 600)	300 per month	1.45 lakhs	4 lakhs	
33.	Paper clips, crocodile clips and clips for electrical wiring	30,000 per month	12,000	24,000	
34.	Enamelled copper wire	484 kgs. per day in three shifts of 8 hours.	3.24 lakhs	6.10 lakhs	

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(Continuation)

C. NON-ENGINEERING INDUSTRIES

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
			Rs.	Rs.	
1.	Footwear (mechanised unit)	4 lakhs	1½ lakhs	2 lakhs	
2.	Leather goods (mechanised unit)	3 lakhs	50,000	1 lakh	
3.	Tanning units	8 lakhs	1 lakh	2 lakhs	
4.	Ceramics (crokery, electrical porcelain glasware)	3 lakhs	1 lakh	2 lakhs	
5.	Pigments (organic and inorganic)	8 lakhs	2 lakh	3 lakhs	
6.	Industrial finishes (including paints, resins and inks)	8 lakhs	1½ lakhs	2½ lakhs	
7.	Detergents (from semi-finished intermediates)	4 lakhs	1 lakh	2 lakhs	
8.	Insecticides, weedicides, plant protection formulates	8 lakhs	2 lakhs	3 lakhs	
9.	Mercury salts	2 lakhs	50,000	1 lakh	
10.	Inorganic chemicals	2 lakhs	1 lakh	1½ lakhs	
11.	Vegetable oil based industries (soap solvent extraction, boiled and bodied oils, cosmetics etc.)	12 lakhs	1 lakh	2 lakhs	
12.	Electroplating units	1 lakh	50,000	1½ lakhs	

(Continuation)

No.	Industry	Capacity per unit	Cost of machinery per unit	Total Capital cost per unit	Remarks
1	2	3	4	5	6
			Rs.	Rs.	
13.	Plastic fabrication (moulding extrusion etc.)	3 lakhs	1 lakh	1½ lakhs	
14.	Rubber contraceptives	6 lakhs	2 lakh	3 lakhs	
15.	Rubber products (moulded & extruded)	5 lakhs	1 lakh	2 lakhs	
16.	Rubberised coconut coir	8 lakhs	3 lakhs	4 lakhs	
17.	Rubber canvas shoes	5 lakhs	2 lakhs	2½ lakhs	
18.	Fruit and vegetable canning and preserva- tion	6 lakhs	1 lakh	2 lakhs	
19.	Essential oils & aroma- tic chemicals B-Ion- one etc.	2 lakhs	70,000	1 lakh	
20.	Fine organic chemicals	3 lakhs	1 lakh	2 lakhs	
21.	Artiste materials such as water colours, paints, water proof inks etc.	2½ lakhs	50,000	1 lakh	
22.	Gypsum boards	2 lakhs	50,000	1 lakh	
23.	Bone products (glue & ossetine)	4 lakhs	2 lakhs	3 lakhs	
24.	Paper conversion unit	6 lakhs	1 lakh	2 lakhs	
25.	Drawing papers, filters	2 lakhs	1 lakh	2 lakhs	
26.	Sensitised paper like doszo blue print and tracing papers.	4 lakhs	1 lakh	2 lakhs	
27.	Clinical thermometers	1 lakh Nos. per annum	25,000	50,000	
28.	Paint brushes	Rs. 50,000 per annum	25,000	4 lakhs	
29.	Industrial brushes	Rs. 75,000 per annum	30,000	60,000	

LIST OF SMALL SCALE INDUSTRIES

ANALYSES AND PLANNING REPORTS COMPLETED SO FAR

1. Agricultural implements (N.R., W.R., E.R., S.R.)
2. Automobile batteries (A.I.)
3. Automobile leaf spring (A.I., N.R., W.R., E.R., S.R.)
4. Artificial diamond cutting (S.R.)
5. Automobile body and trailer building (S.R.)
6. Ad hoc report on fertiliser mixtures (S.R.)
7. Bicycles and parts (N.R., W.R., E.R., S.R., Bihar)
8. Boot polish (A.I., N.R., W.R., E.R., S.R.)
9. Beam scales (N.R., W.R., E.R., S.R.)
10. Brass electric lamp holders (N.R., E.R., S.R., A.I.)
11. Brushware (A.I.)
12. Builders hardware (N.R., E.R., W.R., S.R.)
13. Bell metal industry (Madhya Pradesh)
14. Bakelite electrical accessories (S.R.)
15. Cotton textile machinery spare parts (A.I.)
16. Cutlery (N.R., W.R., E.R., S.R.)
17. Centrifugal pumps (S.R.)
18. Domestic wireless receiver sets and components (A.I.)
19. Domestic utensils (N.R., W.R., E.R., S.R.)
20. Diesel oil engines (N.R., W.R., E.R., S.R.)
21. Domestic electrical appliances (heater type) (N.R., W.R., E.R., S.R.)
22. Domestic electrical appliances (mortor type) (N.R., W.R.)

(Continuation)

23. Electric fans (A.I., S.R.)
24. Electrical porcelain-ware (N.R., E.R., S.R.)
25. Electric motors (A.I., S.R.)
26. Fruit and vegetable preservation and canning industry (A.I. Bihar)
27. Flash-light torches and parts (E.R.)
28. Fountain pens and nibs (S.R.)
29. Furniture and other wood based industry (S.R., N.R.)
30. Fish curing (S.R.)
31. Ferrous and non-ferrous foundries (S.R.)
32. Glass bangles (N.R., E.R., S.R.)
33. Glass beads (N.R., E.R., S.R., W.R.)
34. Glass scientific apparatus (S.R., E.R., W.R. N.R.)

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(Continuation)

35. G. I. Malleable pipe fittings (N.R., S.R.)
36. Hosiery (A.I.)
37. Hand tools (N.R., W.R., E.R., S.R.)
38. Industrial fasteners (N.R., W.R., E.R., S.R.)
39. Industrial rubber goods (W.R.)
40. Leather footwear (N.R., W.R., E.R., S.R.)
41. Leather tanning (S.R.)
42. Leather goods (S.R.)
43. Machine tools (A.I., N.R., W.R., E.R., S.R.)
44. Mineral acids (N.R.)
45. Oil stoves and pressure lamps (A.I.)
46. Paints, varnishes and laquers
47. Plastic and rubber covered wire (N.R., W.R., S.R.)
48. Padlocks (N.R., E.R., S.R.)
49. Preparatory machinery for art silk and silk weaving (W.R.)
50. Picking band and leather belting (W.R.)

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Road, Bangalore-2. | 4. No. 46, Bazaar Road, Mattancheri,
Cochin. |
| 2. No. 1, Rashtrapathy Road, Secunderabad
(Dn.). | 5. T. S. No. 10/764, Bunder Road,
Mangalore. |
| 3. Rangayya Appa Rao Street, Vijayawada. | 6. No. 4/2, Race Course Road,
Coimbatore-1. |

(Continuation)

51. Plastic goods and toys (S.R.)
52. Surgical instruments (A.I.)
53. Scientific instruments (A.I.)
54. Sewing machine and parts (N.R., W.R., E.R., S.R.)
55. Sports goods (N.R., S.R.)
56. Soap (N.R., E.R., S.R.)
57. Sanitary fittings (N.R., S.R.)
58. Toys and dolls (A.I.)
59. Umbrella ribs (A.I., S.R.)
60. Umbrella assembly (S.R.)
61. Wood screws, wire nails and panel pins (N.R., W.R., E.R., S.R.)

A.I.—All India.

N. R. — Northern Region.
E. R. — Eastern „
W. R. — Western „
S. R. — Southern „

Please Contact For

**ALL TYPES OF INDUSTRIAL
IMPORTED
MAKES AND NBC BEARINGS**

SALES SERVICE COMPANY,

NBC OFFICIAL STOCKISTS,

39, Thambu Chetty Street

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MADRAS-1.

Phone : 3508

Grams : LUBRICATOR

(SPECIAL RATES FOR THE MANUFACTURERS)

**LIST OF MACHINES WHICH ARE NOT SUPPLIED
BY THE NATIONAL SMALL INDUSTRIES
CORPORATION AS A MATTER OF POLICY**

- (a) Oil mills and equipments.
- (b) Rice mills and equipments.
- (c) Flour mills and equipments.
- (d) Oil engines to be used as motive power for the above three industries (e. g. a. b. c.)
- (e) Agricultural implements and tractors.
- (f) Vehicles of all types.
- (g) Photographic equipments.
- (h) Stone crushers are not supplied for construction work and where they are required to be moved from place to place but can be supplied when required for crushing lumps of chemicals or for the manufacture of concrete pipes and tiles etc.
- (i) Cinematographic equipment.

In view of the expressed recommendations of the D. C. (SSI) that there is sufficient installed/licensed capacity for the under-mentioned industries or that there is acute shortage of raw materials and machines for the manufacture of items detailed below are not supplied on Hire Purchase basis.

(a) Brass circles, sheets, brass utensils and brass rolling industry.

(b) Tin containers and tin cans.

(c) Stainless steel utensils.

Machines banned for supply under direction of the Textile Commissioner:

(1) Manufacture of wool yarn.

(2) Ginning Plant.

(3) Hosiery machines (if the existing units desire to replace their out-model machines by the latest models, the same is considered on merits taking into consideration the overall foreign exchange available.

(4) Power looms (to be worked on cotton yarn) and hand looms.

Besides, what has been indicated above, schemes for bicycles and sewing machines in the small scale sector which involve import of components, require the specific approval of D. C. (SSI) before the application of the S. S. Units can be entertained.

For

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OCTOBER-DECEMBER 1961

3

33

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- * Volumetric Wares
- * Ground Glass Wares
- * Graduated Wares
- * High Vacuum Apparatus
- * And all types of Scientific and Laboratory Glassware

and Special Glass Apparatus of your design
to serve your specific purpose if standard
items are not suitable

Please contact:

GOVERNMENT SCIENTIFIC
GLASS TRAINING CENTRE,
GUINDY — MADRAS-32.



A Division of the
Department of Industries
and Commerce, Madras.

SMALL SCALE INDUSTRIES

FACTS AND FIGURES

The development of small scale industries is the responsibility of State Governments. The Union Government, however, plays an increasingly important role in planning and co-operating programmes of development, in providing technical and marketing services and financial assistance. Besides the Small Scale Industries Board, which co-ordinates and plans development, the Central Small Industries Organisation and the National Small Industries Corporation provide technical assistance and machinery on hire-purchase system.

The estimated expenditure on development of small scale industries during the Second Plan period was Rs. 44.4 crores.

Over the period of the Second Plan, several units expanded manifold; the increase in production varying between 25 to 50 per cent per annum. On individual basis, the number of small scale units engaged in the Production of bicycles increased from 44 to 150, sewing machines from 35 to 75, machine tools from 344 to over 500, electric motors from 6 to 74 and electric fans from 22 to 47. The production of bicycles in this sector increased from about 25,500 in 1956, to 228,000 in 1960 and sewing machines from 23,600 to 52,000.

For stopping up development of this sector, a programme for the preparation of 2,000 schemes suitable for small scale units was launched during 1959. By the end of 1960, 309 schemes had been finalised by a screening committee out of 415 schemes prepared.

In the sphere of industrial extension service, 15 Small Industries Service Institutes, four Branch Institutes and 50 Extension Centres, including Production Centres and a Central Footwear Training Institute, were set up during 1960-61.

The programme of industrial estates also received considerable emphasis during the Second Plan period. By 1960-61 about 60 industrial estates were completed of which 52 with about 1,035 factory sheds employing about 13,000 persons started functioning. Another 60 industrial estates, started or sanctioned during the Second Plan period, are due to be completed.

During the Third Plan, a provision of Rs. 62.6 crores has been made for programmes of States and Union Territories and Rs. 22 crores for the schemes of the Centre, bringing the total outlay for small scale industries to Rs. 84.6 crores.

During the next five years, it is proposed to set up 300 more new industrial estates of varying sizes and types. For promoting small ancillary industries, it is proposed to start some 'functional estates' for the specific purpose of getting small units which would be working as ancillaries to related large scale industries.

The Third Plan also contains specific schemes for building up and expanding organisation for the development of small industries and streamlining facilities for the provision of credit, supply of machines and development of marketing and stores purchase.

RECORD PURCHASES

The total purchases made by the Directorate-General of Supplies and Disposals touched an all time record of Rs. 222 crores while the share of imports was only Rs. 42 crores. In 1958-59 the total purchases were of the order of Rs. 182 crores. Purchases of small scale industries by the Directorate amounted to Rs. 6.46 crores in 1960-61, an increase of 50% over the previous year. This was disclosed by Mr. N. E. S. Ragavachari, Director-General, Supplies and Disposals, at the sixth meeting of the Regional Purchase Advisory Council, Northern Zone, held at New Delhi on 23rd

October, 1961. The major part of these purchases according to Mr. Ragavachari, is free of price preference.

In order to augment the production of small scale industries the Directorate will soon increase the number of articles reserved for purchase exclusively from them from 27 to 44. Further to facilitate registration of more small scale industries with the Directorate, the procedure for registrations has been simplified and liberalised. Such industries can now obtain forms for registration from the State Directors of Industries.

P. O. Box No 1965

Telegram: "KIRKARI"

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MADRAS-1

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A TRIAL ORDER IS ALWAYS SOLICITED

INDUSTRIAL ESTATES

CO-OPERATIVES PROPOSED

As many as 100 Industrial Estates will be set up on a co-operative basis during the Third Plan Period. According to an official press release, avenues are also being explored to get institutional finance for these co-operative industrial estates.

Special attention, has of late, been given to the question of providing adequate finance, a factor of vital importance for the development of industrial co-operatives on a much larger scale. Co-operative Banks are now being used for routing Government loans in several States.

A scheme has been sponsored for sanctioning share-capital loan by the Government to members of industrial co-operatives. These loans are repayable in easy instalments through monthly contributions deducted from members' earning.

The Reserve Bank has offered facilities of financial accommodation available to the co-operative banks to the handloom co-

operatives as well. With a view to allowing the co-operative banks to lend to industrial co-operatives at a concessional rate of 2½ per cent, the Government has offered a subsidy to cover the difference between the bank rate and the concessional rate.

Guarantee Scheme

A guarantee scheme has also been evolved, under which 90 per cent of the loss incurred by the co-operative banks on loans to the industrial co-operatives would be borne by the Government. This scheme is separate from the Credit Guarantee Scheme which the Reserve Bank is operating in selected districts for the promotion of small industries.

Another step which has been taken relates to the setting up of industrial co-operative banks at the State level in Mysore, Uttar Pradesh, Rajasthan and Madras and at district or regional levels in Gujarat, Maharashtra and Mysore.

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OCTOBER-DECEMBER 1961

IND-COM JOURNAL

APPLICATIONS FOR LICENCES

In order to ensure speedier consideration of applications for licences under the Industries (Development and Regulations) Act, 1951, the Union Ministry of Commerce and Industry has advised the industrialists that while submitting their applications to the Ministry the parties should forward a copy each of their applications to the Director of Industries of the State concerned and to the Technical authorities such as Development Wing or Textile Commissioner

or Iron and Steel Controller etc., as the case may be. While forwarding a copy of the application, it may be indicated that the original together with the requisite treasury receipt, has been forwarded to the Ministry of Commerce and Industry. Similarly the original applications submitted to the Ministry of Commerce and Industry should indicate the authorities to whom copies of the applications have been sent.

TRAINING FACILITIES

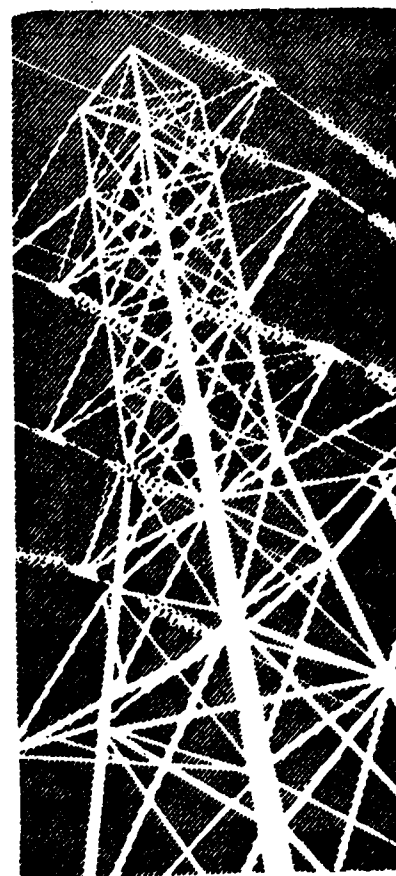
Training facilities for meeting the requirements of technical and managerial personnel in the field of village and small scale industries are proposed to be considerably enlarged. Emphasis is being laid on the introduction of improved tools and equipment, process of manufacture, design etc. Credit facilities essential for proper development, are proposed to be organised on a large scale to be made available on reason-

able terms and with the minimum of procedural delay. The progressive enlargement of programmes of positive assistance is expected to make it possible to reduce the role of subsidies, sales relations etc. Special attention will be paid to promote small industries as ancillaries. Various aspects of integration between large and small industries will be considered in detail for each industry.

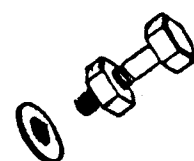
TRAINING IN DOLL MAKING—CENTRE FOR MADRAS

Government have sanctioned Rs. 48,200 for the opening of a Training Centre at Madras to impart advanced training in the making of dolls and toys. The objects of the scheme are to develop the doll and toy

making industry in the State and to improve its quality to stand comparison with similar products made in advanced countries like Japan, and to give advanced training to a few candidates who are already proficient

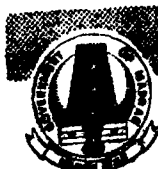


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in doll designing and doll making and who have already had some training and are actually in touch with the industry. Under the scheme fifty such candidates will be trained in Madras for a period of six months in the art of doll making under a team of Japanese instructors consisted of one

expert and one technician. The candidates will be paid a stipend of Rs. 60 per mensem each for the period of their training. The question of continuing the Centre beyond six months will be considered, after watching the result of its working.

HAND MADE PENCILS

NEW SET OF TOOLS DEVELOPED

The Forest Research Institute at Dehra Dun has developed a set of tools for the production of hand made pencils at the cottage industry level.

The set consisting of a simple carpenter's hard plane three tools for grooving, shaping and rounding of pencils, a simple wood press and a small workman's bench, costs in all Rs. 100.

According to a publication of the Institute all the operations of pencil making with these tools could be done by one person and the cost of production would vary between Rs. 7.50 and Rs. 9 per gross.

The Institute offers free training and demonstration to those interested.

MUSK FACTORY FOR MADRAS

The first musk factory in India is proposed to be started by a private limited company near Madras with the technical collaboration of a Dutch firm which has agreed to

supply machinery worth Rs. 3 lakhs. Production is expected to start by the middle of 1962. Prior to the import curbs, India was importing musk worth Rs. 3 lakhs it is stated.

FOREIGN COLLABORATION

The total number of industrial schemes for which foreign collaboration has been approved was 304 during January—Septem-

ber 1961 of this as many as 107 cases were in the field of engineering industries.

NON-FERROUS VIRGIN METALS AND CAMPHOR

The supply position of non-ferrous virgin metals and camphor is poor due to the difficulties of foreign exchange. With the small quota allotted to Madras State it would be possible to meet only a portion of

the demand of the existing industries. The public are, therefore, informed that assistance in the supply of non-ferrous virgin metals and camphor cannot be given for 'new comers' till the position of supply improves.

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A DIVISION OF THE DEPARTMENT
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TURRET LATHES
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The General Superintendent incharge of



IND-COM JOURNAL

AUTOMOBILE COMPONENTS

AN OPPORTUNITY FOR INDIGENOUS MANUFACTURERS

As a measure to develop ancillary industries M/s New India Motors (P.) Ltd., Post Box No. 296, Scindia House, New Delhi, manufacturers of jeep trailers, have agreed to purchase their requirements of some parts and components from indigenous sources, provided the quality is acceptable and the prices are competitive and regular supplies are assured. The component parts required by them are given below.

2. Brake drum with shoe assembly.
3. Rim and disc wheel assembly.
4. Taper roller bearing.
5. Rear dust retainers.
6. Shock absorber assembly.

Indigenous manufacturers, who wish to supply the components mentioned above, may contact M/s. New India Motors (Private) Ltd., directly.

1. Hub and drum assembly.

Telephone: 55053

Grams: EMGISHA

M. G. SHAHANI & Co. (Bom) Private Ltd.

62, MALAYAPERUMAL STREET, MADRAS-1.

Show Room: 289, STRINGERS STREET, MADRAS-1.

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CARDS, AND OTHER STATIONERY

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| * 'ARYAN' BRUSHES | * 'SWAN' INK AND PENS |
| * 'STAMCO' PRODUCTS | * 'CHIFFON' PRODUCTS |
| * 'KOLES' PRODUCTS. | |

OCTOBER-DECEMBER 1961

43

**"AN IMPORTANT ANNOUNCEMENT
TO HANDLOOM WEAVERS"**

*The Government of Madras have set up a
Factory at Salem (in the Foulke's Com-
pound) for the Manufacture of essential
Handloom Parts. The Factory is in a
position to supply the Parts to Weavers
at competitive rates.*

Please Contact :
**THE SUPERINTENDENT,
Govt. Handloom Parts Factory,
SALEM.**



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CHALASA INDUSTRIES

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PLASTIC MANUFACTURERS AND FABRICATORS OF
TUBE-LIGHT FITTINGS FOR STREET LIGHTING USEFUL
FOR MUNICIPALITIES AND PANCHAYAT BOARDS
(Patent Regd.)

SRI CHAKRAPANI SOUTH, KUMBAKONAM.

LICENSING OF INDUSTRIES

List of industries in respect of which licences under the Industries
(Development and Regulation) Act, may ordinarily be rejected
or granted without reference to the Licensing Committee

**PART 'A'—Rejection List
ENGINEERING INDUSTRIES**

- | | |
|--|--|
| 1. A.C.S.R. and all aluminium conductors. | 17. Bolts, nuts and rivets (reserved for development in the small scale sector except high tensile and auto bolts). |
| 2. Air compressors (below 500 cu. ft/minute capacity). | 18. Car lifts. |
| 3. Agricultural implements (manually operated). | 19. Calculating machines. |
| 4. Agricultural tractors. | 20. Circles, sheets, rods and utensils of non-ferrous metals and stainless steel. |
| 5. Antimony. | 21. Chaff-cutter blades (except under export condition). |
| 6. All non-ferrous metals, alloys. | 22. Copper. |
| 7. Aluminium extruded sections, sheets, rods and circles (to be ordinarily reserved for producers or primary aluminium metal). | 23. Commercial vehicles (except for expansion). |
| 8. Aluminium foils. | 24. Conduit pipes |
| 9. Automobile leaf-springs. | 25. C. I. Spun pipes. |
| 10. Bare copper strips. | 26. Copper wire for non-electrical purposes. |
| 11. Bare copper conductors. | 27. Crawler tractors. |
| 12. Barbed wire. | 28. Cotton and hair belting and rubber ply transmission belting. |
| 13. Bearings—thin-walled. | 29. Domestic refrigerators. |
| 14. Brass/copper pipes and tubes (extruded all types). | 30. Dash board instruments. |
| 15. Bifurcated rivets. | 31. Drums and barrels and tin containers excepting those where manufacture is for making the applicant's own requirements. |
| 16. Bicycle and bicycle parts (except steelballs and juvenile and racing bicycles). | |

32. Dry batteries.
33. Dumpers and scrapers.
34. Earth moving machines.
35. Electric cables.
36. Electric lamps of the following types:
 - (a) Fluorescent tubes.
 - (b) Mercury vapour and other gaseous discharge lamps.
 - (c) Miniature lamps (excluding auto head lamps and sealed beam lamps).
 - (d) Photo flash bulbs.
37. Electric fans.
38. Electric motors below 20 H. P.
39. Electric transformers upto 500 KVA
40. Expanded metals.
41. Flash light and torch containers.
42. Ferrous domestic utensils.
43. Ferro manganese.
44. Fractional horse power motors.
45. Hurricane lanterns.
46. Jeeps and station wagons (except for expansion).
47. Large scale and small scale paper making plants including wire cloth for paper machinery.
48. Lead.
49. Machine screws, set screws, coach screws.
50. Machinery for paper making including wire cloth for paper machinery.
51. Motor cycle, scooters, three wheelers, etc.
52. Paper insulated power cables.
53. Paper capacitors for fans, fractional horse power motors and lighting fittings.
54. Power driven pumps (including kerb side petrol pumps, but excluding piston pumps and boiler feed pumps).
55. Passenger cars.
56. Power factor correction capacitors.
57. Radio receivers and P. A. equipment (except components).
58. Railway wagons and railway wagon parts.
59. Railway mechanical signalling equipment.
60. Razor blades.
61. Rigid containers.
62. Room air-conditioners.
63. Rolling shutters.
64. Single phase and polyphase K. V. H. meters.
65. Saws of all types.
66. Shovels.
67. Solvent extraction plant.
68. Steel pipes and tubes.
69. Storage batteries.
70. Sugar machinery (except milling plant and centrifugals).
71. Spark plugs.
72. Steel doors and windows.
73. Stranded wire (unless drawn from wire manufactured by applicant).
74. Tea processing machinery.
75. Tyre tube valves.
76. VIR and PVC cables.
77. Washing machines and drying machines.
78. Water coolers.
79. Wheels and rims.
80. Wire ropes.
81. Welded wire mesh (unless drawn from wire manufactured by applicant).
82. Wire nails.
83. Wood screws.
84. Zinc strips.
85. Zinc.

NON-ENGINEERING INDUSTRIES

1. Abrasive grains.
2. Activated bleaching starch.
3. Antibiotics viz., penicillin, streptomycin, tetracyclines.
4. Automobile tyres and tubes.
5. Asbestos cement sheets and pipes including pressure pipes.
6. Beer.
7. Beta naphthylamine.

8. B. H. C.
9. Bismuth salts.
10. Bichromates (except for expansion of existing units).
11. Carbon black.
12. Carboxy methyl cellulose.
13. Calcium carbide.
14. Calcium carbonate (precipitated and activated).
15. Cashew kernels.
16. Cellulose acetate flakes.
17. Caustic soda.
18. Camphor (synthetic).
19. Chloral hydrate.
20. Chlorine.
21. Calcined petroleum coke.
22. Chip board (particle board).
23. Cigarettes.
24. Citric acid.
25. Copper sulphate.
26. Cotton mesh fabrics.
27. Cough syrup.
28. D. D. T.
29. Derivatives of 8-hydroxyquino—line viz., 8-7 di-iodo and 5 chloro, 7.
30. Dyestuffs (based on imported intermediates).
31. Dextrone powder.
32. East Indian tanned (semi tanned) kips and skins.
33. Empty hard gelatine capsules.
34. Formaldehyde.
35. Fire works and paper caps.
36. Gelatine—technical, edible and photographic.
37. Glass and mineral wool.
38. Graphite electrodes.
39. Hollow ware including table and pressed ware and glass bottles made on semi-automatic machines.
40. Hard board.
41. Hydrogen peroxide.
42. Glass tubes—hand made (mouth blown).
43. Industrial explosives.
44. Liquid glucose.
45. Liquified fractions by processing gas.
46. Match industry.
47. Menthol.
48. Methanol.
49. Myrobolan extract.
50. Newsprint.
51. Nitric acid.
52. Oxalic, citric and formic acids.
53. Phenol.
54. Paper and paper board.
55. Pulp.
56. PAC acid and its sodium salts.
57. Pesticidal formulations.
58. Phehol formaldehyde moulding powder.
59. Photographic raw film and paper.
60. Plasticizers.
61. Potassium chlorate.
62. Poly-vinyl acetate.
63. P.V.C. and P.V.C. resins/compositions.
64. Polystyrene.
65. Polyethylene.
66. Power and industrial alcohol.
67. Pathalic anhydride.
68. Rayon tyre cord.
69. Rayon and staple fibre.
70. Security paper.
71. Soda ash.
72. Sanitary ware and glazed tiles.
73. Soaps.
74. Sodium hydro-sulphite derivatives.
75. Sulpha drugs.
76. Sulphuric acid
77. Superphosphate.
78. Synthetic hormones.
79. Surgeon's requisites, viz., adhesive tapes, plaster of paris bandages.
80. Salicylic acid, sodium salicylate acetyl salicylic acid.
81. Sodium sulphite, bi-sulphite and sulphide.
82. Sodium thiosulphate.
83. Sulphur dioxide.
84. Sodium aluminate.
85. Synthetic resins.

- | | |
|---|---|
| 86. Sheet glass including wire and figured glass. | 92. Vitamin 'A'. |
| 87. Textiles made of artificial silk. | 93. Vitamin 'C'. |
| 88. Urea formaldehyde moulding powder | 94. Vacuum brake hoses. |
| 89. Urea formaldehyde resins adhesive, | 95. Water proof fabrics. |
| 90. Vanaspati. | 96. Wide hessian gunny bags and webbings. |
| 91. Vegetable oils (other than cotton seed and rice bran oils). | 97. Wollen and worsted yarn. |
| | 98. Yeast. |
| | 99. Zinc oxide. |

**PART 'B'—* Approval List
ENGINEERING INDUSTRIES**

- | | |
|--|--|
| 1. Conveyors—chain belt and screws. | lopment and Regulation Act, 1951) except house service meters). |
| 2. Construction machinery. | 8. Small tools such as cutters and cutting tools (except saws of all types). |
| 3. E.O.T. cranes and warf cranes. | 9. Sluice gates and gearings. |
| 4. Fabricated structurals (Heavy). | 10. Structural rope ways. |
| 5. Industrial machinery, i.e., all items falling under the serial No. 8 (A to C) of the first schedule to the Industries (Development and Regulation) Act, 1951—Except items included in 'Rejection List' and the following: Sugar, textiles, jute, tea and small paper making machinery, refrigeration plants for industrial use, fire fighting equipment and appliances including fire engines, ball roller and taper bearings, small power driven pumps, and grinding wheels and abrasives. | 11. Tungsten carbide brazing of tips. |
| 6. Machine tools (special types). | 12. Winches (land and marine). |
| 7. Precision industrial instruments, i.e., all items falling under item No. 15 of the first schedule to the industries (Deve- | |
- NON-ENGINEERING INDUSTRIES**
- | |
|--|
| 1. Camel back (tyre retreading material). |
| 2. Crockery—stone ware, earthenware, China (provided no import of equipment required). |
| 3. Finished leather. |
| 4. Rubber prophylactics. |
| 5. Solvent extraction from cotton seed and cake provided the State Government concerned certify the availability of oil seeds and cakes in the area. |
| 6. S. W. pipes. |

* Only letters of intent and not actual licences would be issued in respect of items requiring foreign exchange in excess of Rs. 10 lakhs.



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AND COTTON COVERED WIRES
CONFORMING TO ALL STANDARDS**



Service facilities available for Manufacturers



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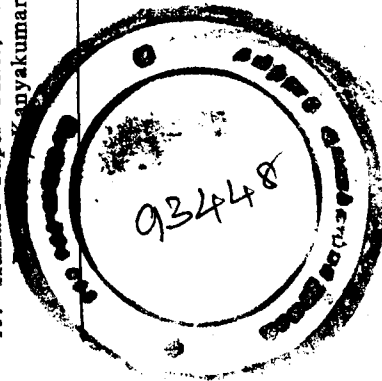
The Superintendent,
GOVERNMENT ELECTRICAL GOODS UNIT,
GUINDY :: MADRAS-32

A DIVISION OF
THE DEPARTMENT
OF INDUSTRIES
& COMMERCE.

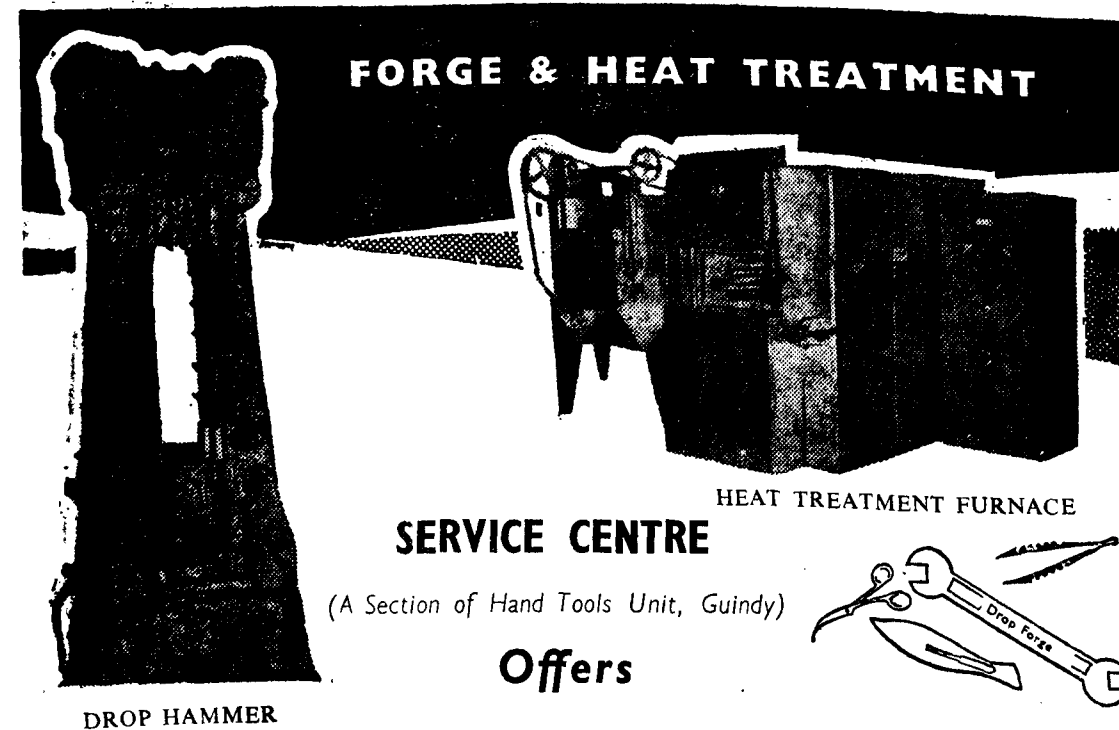
LIST OF LICENCES GRANTED TO INDUSTRIAL CONCERNS IN MADRAS STATE
FROM 1-7-1961 to 30-9-1961.

Sl. No.	Name and address of the industrial undertakings.	Location of the industrial undertakings.	Licence No. & Date	Type of Licence/permission i.e. N.U./S.E./N.A./carrying on/shifting.	Lines of manufacture and capacity licensed/permitted.
1	2	3	4	5	6
1.	Shri V. Pandurangiah, Dr. Nair Road, Madras.	Madras	L/1A(6)/M13/61. Dt. 4-8-1961	N.U.	Saw Blade Steel, Spring Steel etc. 7,000 tons p. a.
2.	Shri D. Balasundaram, Salem, Coimbatore.	Madras	L/1A(6)/N-17/61. Dt. 5-8-1961	N.U.	Tool steels Constructional steel 7,000 Other alloy steel 12,500 Alloy steel castings 17,600 12,900
3.	Kancheepuram Co-operative Spinning Mills, Kancheepuram, Dt. Chingleput.	Madras	L/23(1)132/61.Tex(B) Dt. 3-8-1961	N.U.	12,000 Spindles for manufacture of cotton yarn.
4.	Thiyagi Industries Ltd., Erode.	Madras	L/1A(7)/10/61.EI(M), Dt. 3-8-1961	N.U.	Transmission towers 5,000 tons per annum on single shift.
5.	Shri S. Balasubramaniam, Tallakulam, P. O. Madurai, Tiruchi.	Madras	L/1A(7)N-249/61. Dt. 14-8-1961	N.U.	15,000 tons of bars and rods including wire rods
6.	Southern Switchgear Ltd., S-A, Patulla Road, Madras-2.	Madras	L/5(1)42/EEI/61, Dt. 8-8-1961	N.U.	Low voltage switch gear 1,200 Nos. p. a. Busbar chambers 1,200 Nos. p. a. Motor starters 6,000 Nos. p. a. Iron clad switches 6,000 Nos. p. a.
7.	Amaravathi Sri Venkatesa Paper Mills (P) Ltd., Udamalpet (Dt. Coimbatore), Madapadi Village, Palni Tk. Madurai Dt.	Madras	L/24 (1) 57/61-Ch(I), Dt. 9-8-1961	Shifting within same State	Printing and writing paper 3,000 tons p. a. pulp 3,000 tons p. a.
8.	Gopal Rice, Oil and Fertilizer Co., Sankottai, Kumbakonam, Madras.	Madras	L/28(1)5/61, Ch. II Dt. 16-8-1961	N.U.	Rice bran oil by solvent extraction 50 tons rice bran per day.
9.	Rane (Madras) Ltd., Madras.	Madras	L/7(5)73/61-AEI, Dt. 6-9-1961	S.E.	Tie rod ends for automobiles—Total Monthly capacity after expansion shall be 20,834 pairs p. a. (2,50,000 pairs p. a.)

10.	Seshasayee Brothers (P) Ltd. District—Chingleput, Madras	Madras	L/8 A-9/27/61-AEI, Dt. 6-9-1961	N.U.	Rayon grade caustic soda plants—100 per day on double shift. Sulphuric acid plants—100 tons per day in unit sizes of 25, 50, or 100 tons per day. Miscellaneous corrosion resisting chemical equipment specially lined with rubber, ebonite, PVC, plastics and other compositions 600 tons.
11.	Shri M. Ct. Muthiah, Arkonam, Madras	Madras	L/8 (C.1) 10/61 MEI Dt. 17-8-1961	N.U.	Ball bearing ... 4,50,000 Nos. pa. Roller bearings ... 3,00,000 " " Tapered rolling ... 1,80,000 " " Thrust and pressure type bearings ... 2,40,000 " " Not more than 1/3 of the production of ball bearings shall have bore diameter 1" or less.
12.	Southern Rajamani Transport (P) Ltd., Pudukkottai.	Madras	L/27(4)5/61. Ch. II Dt. 14-9-1961	N.U.	Wheat products (maida, sooji, atta etc.) 50 tons per day in terms of wheat.
13.	Laxmi Flour Mill, Tirunelveli, Madras.	Madras	L/27(4)6/61. Ch. II Dt. 14-8-1961	N.U.	Wheat products (maida, sooji, atta etc.) 50 tons per day in terms of wheat.
14.	Mahindra and Mahindra Ltd., Calcutta-16, Madras State.	Madras State	L/1A(6)/N-22-61 Dt. 4-9-1961	N.U.	Alloy constructional 25,000 tons p. a. in terms of ingots 15,000 tons steel and casehardening steel.
15.	Kumari Paper Mills, Thuchalay post, Kanyakumari Dt. Madras.	Thuchalay Kanya. Dt. Madras	L/24(1)/62/61 Ch. Dt. 27-9-1961	N.U.	Printing and writing (i) paper 1,500 tons per annum, (ii) pulp 1,500 tons per annum.



JL
18m 22, 1961
No. 16/9



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THE GENERAL SUPERINTENDENT
HAND TOOLS UNIT
INDUSTRIAL ESTATE, GUINDY, MADRAS-32.

MALTED MILK POWDER AND ALLIED PRODUCTS

PROCESS DEVELOPED AT
CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE

(INDIAN PATENT NOS. 64457 AND 64458)

Because of their high nutritive value and pleasing flavour, malted milk products are popular as infant and invalid foods and as food beverages. Malted milk powders are used as a food for invalids and convalescents and malted milk beverages flavoured with cocoa are employed as a substitute for coffee, tea, etc.

Imports and Indigenous Production:

During the past years considerable market has been developed for these products in India. The demand has, however, been so far met mostly from imports. During 1957 imports of malted milk and malted milk powder were 32957 cwts. and 873 cwts. valued at Rs. 87,94,797 and Rs. 7,55,612 respectively. Imports have been considerably reduced since, licences for importing malted milk foods during 1958 and 1959 being 5 and 10 per cent of the established quota.

Three firms have already been given licences for the manufacture of malted milk

products by the Government under the Industries (Development and Regulation) Act. Their total licensed capacity is 2424 tons per annum.

Existing Technique:

The method of manufacture of malted milk products, usually employed involves the preparation of malt extrat by mashing barely malt with gelatinised wheat and concentrating the mash liquor under vacuum. Fresh milk and salts are added to the mash liquor. The mix is concentrated under vacuum to a viscous mass. This material is then stirred with large volumes of air and a high vacuum is applied when the whole mash swells up and dries. The dried product is powdered and packed.

These hitherto known methods however, can be worked only in places where a plentiful supply of fresh milk is available. Moreover, they require elaborate machinery like mashing vats for obtaining mash liquors,

pasteurisers and milk handling equipment, concentrators and a special vacuum pan for final drying.

Progress Developed :

With a view to minimise some of the drawbacks, Central Food Technolgical Research Institute has developed a process which consists in mixing concentrated malt extract with milk powder fats and carbohydrates and drying in vacuum drier. The product is powdered and packed in suitable containers.

The salient features of the process are the use of milk powder in place of liquid milk and concentrated malt extract in place of mash liquor prepared from green or kilned malt, which reduces amount of water to be removed.

Scale of study, Consumer trials, etc :

The process has been tried on a bench scale unit where batches of 50 lbs. have been

successfully prepared. The product has been subjected to limited consumer trials at the Institute and is reported to compare favourably with similar products of foreign origin both in taste and flavour. The shelf life of the product is about one year at 37° C.

Availability of Raw Materials :

Raw materials required for the process, namely milk, rag, jowar, barley and wheat are all available in the country.

Capital Investment, Plant and Machinery :

Total capital outlay for a plant having a capacity of 300 tons per annum is estimated at about Rs. 6'05 lakhs. Major equipments required are vacuum shield driers, powder filling unit, mixers, seamers and granulator.

Parties interested in taking up the commercial development of the process are invited to correspond with:

Secretary,
NATIONAL RESEARCH DEVELOPMENT CORPORATION OF INDIA,
Mandi House, Lytton Road, NEW DELHI-8.

PHARMACEUTICALS

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1. Name of project :

Manufacture of malted milk
2. Products contemplated :

(a) Malted milk powder
(b) Malted milk powder with cocoa
3. Working days :

300 per annum
4. Production basis :

(a) Out-put per working day (8 hours)—1 Ton
(b) Out-put per annum—300 tons

Capital Outlay for the Project				Rupees
(a) Buildings (Area 4,000 sq. ft. with type of construction) at Rs. 15 per sq. ft.	...	...	...	60,000
(b) Plant and machinery (as per details attached)	...	...	...	1,51,000
(c) Laboratory equipment, accessories essential, spares and other sundries	...	...	...	10,000
(d) Furniture and fofice equipment	...	...	...	5,000
(c) Installation and erection charges (10% of plant and equipment)	...	...	...	15,100
(f) Land	...	...	...	Extra
Investment on Block				
Working capital to cover cost of raw materials, consumable stores, spares, fuel, labour and supervision etc., bassed on three months working costs.				3,64,000
Total capital outlay for the project.				6,05,100

COST OF PRODUCTION

Particulars	Quantities Required/day	Rate	Per	Amount per day
PRIME COST				
A. (1) Raw Materials for 1 Ton of Malted Milk Powder with Cocoa				
(a) Skim milk powder	193 Kg.	2.20	Kg.	434.50
(b) Sugar	193 Kg.	1.10	Kg.	212.30
(c) Cocoa	143 Kg.	6.60	Kg.	943.80
(d) Malt extract (80% solids)	448 Kg.	2.20	Kg.	985.60
(e) Butter fat	92 Kg.	4.40	Kg.	404.80
(f) Caramel	41 Kg.	2.20	Kg.	90.02
Total of 'A' (1)				3,061.12
(Or)				
(2) Raw Materials for 1 Ton of Malted Milk Powder				
(a) Skim milk powder	230 Kg.	2.20	Kg.	506.00
(b) Sugar	230 Kg.	1.10	Kg.	253.00
(c) Malted extract (80% solids)	535 Kg.	2.20	Kg.	1,177.00
(d) Butter fat	110 Kg.	4.40	Kg.	484.00
Total of 'A' (2)				2,420.00

Particulars	Quantities Required/day	Rate	Per	Amount per day
B. Utilities :				
(a) Electrical power (for process)	100 (KHW)	0.09	KWH	9.00
(b) Steam	6 tons	9.00	ton	54.00
(c) Water	5×1000 Glns.	0.50	1000 Glns.	2.50
(d) Engineering at 5% on plant				25.00
services at 3% on building				6.00
	Total of 'B'			96.50
C. Labour and Supervision :				
(a) Direct labour } As per details.				95.00
(b) Direct supervision }				
	Total of 'C'			95.00
D. Packing :				
(a) Material 2240 tins at 0.62 per tin (1 lb.)				1,390.00
Crating at Rs. 2 per 24 tin				187.00
	Total of 'D'			1,577.00
Total price cost for malted milk with cocoa				4,829.62

OVERHEADS

E. Factory Overheads Variable :				
(a) Indirect labour	} 100% on labour and supervision			95.00
(b) Indirect supervision and administrative expenses				
(c) Rent, rates, insurance, taxes, etc.	2% fixed capital			16.00
(d) Stationery and allied expenses				10.00
(e) Other welfare amenities	15% on labour and supervision			15.00
	Total of 'E'			136.00
F. Factory Overheads (Fixed)				
(a) Depreciation at 10% on plant and equipment				50.00
at 5% on building				10.00
(b) Interest on working capital at 6%				73.00
	Total of 'F'			133.00
Total overheads				269.00
Total cost				5,098.62

(Prime and Overheads)

For 1 ton malted milk with cocoa.

Cost per unit (Kg.)
of malted milk powder with cocoa (packed)

Total cost for 1 ton malted milk powder only	4,457.50
Cost per Kg. of malted milk powder (packed).	4.46

Details of Labour and Supervision

	Amount per day.
1 Plant Superintendent at Rs. 400 p.m.	16.00
Shift Chemist-Cum-Plant Engineer at Rs. 300 p.m.	12.00
Machanic at Rs. 200 p.m.	8.00
Operators (2) at Rs. 200 p.m.	16.00
Store Clerk at Rs. 100 p.m.	4.00
Office Staff (2 Clerks) at Rs. 75 p.m.	6.00
Skilled Labours (4) at Rs. 3 per day	12.00
Unskilled Labours (8) Rs. 2 per day	16.00
Carpenter and Assistant at Rs. 5 per day	5.00
	95.00

Details of Plant and Machinery

Capacity :—1 Ton of Malted Milk Powder with Cocoa per day of 8 hours

(or)

300 tons of Malted Milk Powder with Cocoa per annum

S. No.	Equipment	Qty.	Capacity or Specifications	Estimated Cost.
1.	Mixers	2	Capacity 100 glns. S. S. Kneader type with motor starter etc.	10,000
2.	Vacuum shield driers	2	Size of shelves. 6'×6'×6' Nos. of shelves —6. provided with vacuum pump. Hot water circulation system with condenser. Thermostatic control	50,000
3.	Granulator	1	Capacity—100 lbs. per hour. Hammer type with electrical motor etc.	8,000
4.	Powder filling plant	1	Capacity to fill powder in 1 lb tin and same at 500 tins per hour—semi automatic	25,000
5.	Air conditioning of packing room	1	—	20,000
6.	Boiler	1	5 NHP—Press 0.100 P sig.	10,000
7.	Equipment for control laboratory	—	—	5,000
8.	Stainless steel trays weighing machines and other	—	—	20,000
				1,51,000

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Govt. Pressure Die - Casting Unit

INDUSTRIAL ESTATE
GUINDY, MADRAS - 16



THE STORY OF SALT-WATER CONVERSION

A recent and striking example of industry and science coming together in the service of man is to be seen in the experimental plant at Freeport, Texas, to produce fresh water from sea water.

Civilised man has always looked to the sea as a source of food and as one of the earth's highways for commerce and travel. But for the most part, sea water has remained untapped, for it is salty, undrinkable, and useless for agriculture and industry.

For at least 2,000 years man has sought a way to make fresh water from the sea. Historical records show that the Roman legions of Julius Caesar utilised primitive solar stills for their drinking water at Alexandria in 49 B. C. Queen Elizabeth I of England offered a prize of Rs. 9,50,000 to the inventor of a salt-water conversion machine which would allow the vessels of the English navy to stay at sea for longer periods.

Thomas Jefferson, before he became President of the United States, reported that he had witnessed an experiment where 22 pints of fresh water were obtained from the same quantity of sea water. A secret formula involved was not known to him; nevertheless he conducted his own experiments, obtaining 31 pints of fresh water from 32 pints of sea water. Thus America's interest in the conversion of sea water had begun as early as 1791, but the first concrete success came only in 1961 when the Freeport plant set up by the Office of Saline Water went into operation last June.

The Freeport unit bodes well for future progress through scientific and technological

research. A peculiar looking maze of plumbing, the plant draws its supply from the Gulf of Mexico and produces clear, sparkling water for the people of that city. It turns out more than a million gallons a day at a cost of about one dollar (Rs. 4.75) per 1,000 gallons.

The 14,000 residents of the town already know the Freeport water conversion plant is a success. They have tasted the water, taken baths in it, and used it to launder clothing without noting any difference from the water they have been using from the deep wells.

A 1,00,000 gallon a day commercial plant in southern California is setting cost standards for low cost water conversion. Installed in December, 1959, the unit has been operating at well over capacity frequently achieving 1,60,000 gallons of fresh water during a 24 hour period.

Actual cost data for the plant is continually maintained, and these show that the plant would provide fresh water at less than a dollar per thousand gallons.

The Freeport plant is the first of several others which the United States Government plans to build with the Rs. 35 crores authorised for research and development over the next six years. A different process will be tried at each plant to find out which would be the most efficient and cheapest.

Meanwhile, industrial establishments in different parts of the United States are carrying on extensive research to discover cheaper ways of converting sea water into fresh water.

The General Electric Company has developed a wiped film technique of distillation. The machine consists essentially of two tubes, one inside the other, and a set of blades similar to those of an automobile windshield wiper. The blades extend the length of the inner tube.

Sea water is pushed through narrow outlets at the edges of the centre tube, where the wiper blades the water in a thin film. The wall is heated by steam confined in the space between the two tubes. Vapour given off by the hot film of sea water is directed into a cooler where it condenses into fresh water.

The Fairbanks Whitney Corporation uses a freezing technique in its pilot project for the Negev Desert in Israel. The idea conceived by the Israeli scientist, Alexander Zarchin, is based on the fact that when sea water freezes, the resulting ice is free of salt. In operation, cooled sea water is sprayed into a vacuum tank. Some of it evaporates and is sucked into a condenser where it becomes fresh water. Part of the sprayed water is frozen by the cooling effect of evaporation. It falls to the bottom of the vacuum container where it is separated by screening. This ice is then melted as pure water.

Syracuse University has been experimenting with a chemical process. By adding chemicals to sea water a solid is created

which does not absorb salt. The solid is later melted to yield water separately, the chemical being re-used in the same process. Yet another process is the biological one where algae (microscopic one-celled plants) injects the salt, considerably reducing its concentration in sea water. If this experiment now under way at the University of California succeeds, it will have the advantage that no outside energy for heat, refrigeration, etc., would be needed.

In arid zones all round the world there is considerable interest in the experiments now being conducted in the United States. Besides Israel, another desert country that has sought American collaboration for setting up a conversion plant is Kuwait, rich in oil but poor in water resources. Kuwait purchased a giant salt water conversion plant in September this year from a Massachusetts firm which will provide water for irrigation as well as for human consumption. The Kuwait plant is the largest commercial water desalting unit consumption commissioned so far.

Inaugurating the Freeport plant, President Kennedy, cited its role in world efforts to make 'desert bloom'. He expressed the hope of all mankind when he said that success of the plant would prove a blessing to 'people all around the globe, especially those who live in deserts or on the edge of oceans.'

EXPORT PROMOTION

PROCEDURE FOR EXPORT OF EXCISABLE GOODS

EXPORT UNDER CLAIM FOR REFUND OF CENTRAL EXCISE DUTY

The excisable goods can be exported outside India either under claim for rebate of excise duty or in bond. Under rule 12 of the Central Excise Rules, 1944 the Central Government, may, by notification grant rebate of duty paid on excisable goods if exported out of India. The notification that has been issued for this purpose specifies the extent of rebate and the safeguards, conditions and limitations.

EXPORT UNDER BOND

Similarly, under rules 13 and 14 of the Central Excise Rules, 1944 excisable goods other than salt, v.n.e. oils and tea can be exported without payment of duty from a factory or a warehouse subject to the observance of the procedure prescribed in Chapter IX of these rules. The difference between these two procedures is that in the case of former the duty is first paid and its refund obtained after exportation and in the case of latter the goods are allowed to be exported without payment of duty for the payment of which a bond with sufficient surety/security is obtained from the owner in case he fails to produce sufficient proof of export within the prescribed time limit. The procedural formalities attendant on both these procedures for obtaining refund of duty already paid or for affording credit in the bond account are:

1. Before removal, each consignment of excisable goods is required to be presented to the Central Excise Officer having jurisdiction over the factory together with an application in form A. R. 4.

2. One copy of the above application together with the goods is presented by the export to the Customs Collector, Border Examiner or other duly authorised officer, who certifies on that application that the goods have been duly exported.

3. The certified copy of the application is then presented by the exporter to the Assistant Collector having jurisdiction over the factory for obtaining rebate of duty or for getting credit in his bond in case the goods were removed by him for export without payment of duty.

4. The Assistant Collector before sanctioning the refund or affording credit in the bond account satisfies himself about the correctness of exporter's claim with reference to the certified copy of application received by him direct from the Customs Collector/Border Examiner. In the case of export under claim for rebate of excise duty he forwards the application to the Chief Accounts Officer who trades from his records the relevant ARI document under which duty was paid. If he finds that the sanction of rebate is in order, he returns the

application to the Assistant Collector concerned.

5. The Assistant Collector then sanctions the refund and returns the application to the exporter for encashment at the treasury where payment is desired. He also advises the treasury accordingly.

6. The exporter then presents the application to the Treasury for payment.

The procedure outlined above is also applicable to exports by land to Butan, Sikkim, Tibet and Afghanistan. An additional condition that is however required to be fulfilled in the case of such exports is that the exporter has to furnish evidence of the fact that the goods have reached the destination. For export of excisable goods to Nepal, the rebate of excise duty is not allowed to the exporter, but under the special agreement with the Nepalese Government it is credited to the account of that Government.

SIMPLIFIED PROCEDURE

As the normal procedure for exports sometimes gave rise to delays in the settlement of the exporter claims for refund, a simplified procedure for export was evolved and put into effect from the 1st February, 1957 which aimed at elimination of delays by

(i) centralising the refund work in the hands of the maritime Collectors of Central Excise i.e. the Collectors at the Ports of Shipment.

(ii) securing the Customs certificate of shipment on the A R 4 applications by the personal intercession of a representative of the Maritime Collector of Central Excise who would personally visit the Customs House every day for the purpose and

(iii) by resorting to post-audit in the matter of verification of entries in the

Treasury accounts and raising suitable debits against the original duty-paying documents.

The simplified procedure also takes into account the difficulties of exporters who prefer to export the goods under bond. The execution of bond and maintenance of the account against it has itself been centralised in respect of all independent exporters (as opposed to the manufacturers) with the Maritime Collectors of Central Excise concerned. This step has tended to eliminate the delays which were sometimes unavoidable in the earlier procedure for affording timely credits in the bond accounts maintained with the Factory Officers or Divisional Officers.

A special procedure was also prescribed and put into account from 1st February, 1957 in respect of the exports of vegetable non-essential oils on which rebate of duty is allowed at an adhoc rate. Under this procedure the exporter, whether he is the manufacturer or not becomes entitled to the grant of the specified rate of rebate on furnishing proof of export.

The vegetable product has been allowed the facility of being exported (i) under claims for rebate of excise duty paid on it as well as on its vegetable non-essential oil contents under the normal procedure, or the simplified procedure or (ii) in bond so far as the excise duty on vegetable product itself is concerned with the additional facility of obtaining refund of excise duty on V. N. E. oil contents. The exporters can also avail of the facility of drawback of combined Customs and Central Excise Duties in respect of the tin containers used for vegetable product on one and the same export application.

A special procedure has also been prescribed under rule 191 of Central Excise Rules 1944, for granting rebate of duty on sugar going into the manufacture of confectionery.

Another special procedure that has been prescribed and put into effect is in regard to the manufacture of aluminium utensils out of imported aluminium ingots/sheets etc. under Customs bond without any liability towards Central Excise duty provided the utensils thus manufactured are exported.

AD HOC REFUNDS

Besides allowing exportation of excisable goods as such either under claim for rebate of duty or under bond, the Central Government under rule 12-A of the Central Excise Rules, 1944 also allows ad hoc rebates of duty in respect of excisable materials used in the manufacture of articles which by themselves are not excisable and which may be exported out of India. So far this has been applied to (1) fruit products in respect of duty on sugar (2) ribbons in respect of duty on cotton fabrics (3) paper bags etc., in

respect of duty on paper (4) paints and varnishes in respect of duty on linseed oil (5) woollen carpets in respect of duty on woollen yarn, cotton yarn and dyes derived from coal-tar.

While rules 12, 13 and 14 of the Central Excise Rules, 1944 envisage export of excisable goods as such.

1. Rule 191-A of the said rules provides for a procedure for grant of rebate of duty in respect of excisable goods used in the manufacture of articles intended for export and has since been extended to (a) cotton bags, pillow covers, bed sheets, tents etc., in respect of duty on cotton fabrics (b) plastic manufacture in respect of duty on plastics, all sorts (c) utensils of copper and copper alloys.

2. Rule 191-B of the said rules provides for a procedure for manufacture of articles

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OCTOBER-DECEMBER 1961

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in bond from excisable goods without payment of duty and the articles brought under this rule are (a) cigarettes, cigars and cheroots, hookah, tobacco etc., (b) umbrellas, cotton blankets, ready-made apparels etc., made from cotton fabrics (c) plastic products (d) utensils of copper alloys.

CUSTOMS AND CENTRAL EXCISE DUTIES

DRAWBACK (GENERAL) RULES, 1960
Some articles are manufactured from indigenous as well as imported goods. The Customs and Central Excise procedures have been dovetailed for the purpose allowing adhoc rates of draw back of duties and the Customs and Central Excise Duties Export Drawback (General) Rules 1960 have been framed for the purpose. The scheme under these rules at present covers a wide range of articles numbering more than 100 e.g radio receivers, bicycles, and parts thereof, tissue paper, cement tiles, air conditioners, cosmetics preparations, refrigerators, footwear, paints of various kinds, playing cards etc.

The trade will no doubt appreciate that the Government is doing everything possible

"THE CHARIOT OF INDIA MARCHES ON"

Commending the Third Five Year Plan, our Prime Minister observed "With a strong base laid for sustained development under the first two Plans, the country could look forward with confidence to a faster rate of growth in the Third and Successive Plans."

Mr. Nehru said that in two-years time, the 15-year perspective Plan, now being drawn by the Planning Commission, would be ready. That Plan would deal with the estimates of population and indicate how the increased population could be absorbed in industry and agriculture. It would also indicate generally the Nation's growth in various sectors.

Despite difficulties and deficiencies the Chariot of India marches on, the people of India march on. There had been a general

to grant rebates of duty wherever admissible and for simplification of the procedures for claiming such rebates. The simplified procedure introduced in 1957 has been acclaimed to be a great success. The exporters are able to get their refunds/credits in their bond accounts within a period ranging from 24 hours to 3 days. Where the delay is more, the reasons for the same are generally omissions by the exporter in following the prescribed procedure. This procedure was initially applied to exports through the ports of Bombay, Calcutta and Madras only and on persistent requests from the trade, the same has already been extended to other minor ports namely, Kakinada, Visakhapatnam, Cochin, Jamnagar, Mangalore, Bhavanagar, Veraval and Porbunder, also and the question of its extension to Tuticorin and Dhanushkodi is under active consideration. The success of the simplified procedure does not however, necessarily imply that there is no further scope for improvement. The procedural difficulties if any can be further minimised, and concrete suggestions therefore are welcome from the trade/exporters.

improvement in conditions of living in the country.

"HEARTENING FEATURE"

The "heartening feature", Mr. Nehru said was that the country had got into a "rhythm" of progress through planning. The broad strategy of the Third Plan was the development of agriculture which was of basic importance, and of heavy industry even at the cost of slowing down the processes of medium industry. Small Scale Industry had already recorded a spectacular rise and many parts of the country were humming with small industries.

Mr. Nehru said that while statistics showed a sustained growth—and 1960-61 had recorded an overall increase over

the previous year—they should try to make it faster.

About exports, he said that India was confronted with the possibility of its exports being affected by the proposed entry into the European Common Market by the United Kingdom.

Mr. Nehru said that the country could not all the time depend on foreign help. "We must depend for 5, 10 or 15 years on outside assistance but ultimately we must become self-dependent."

EXPORT POSSIBILITIES

MARKET POSSIBILITIES FOR INDIA TILES IN THE FEDERATION OF MALAYA, SINGAPORE, SARAWAK & NORTH BORNEO

A report on the survey of the market for baked clay roofing tiles in Malaya, Singapore, Sarawak and North Borneo has been received from the Commercial Councillor, High Commission for India, Singapore.

The salient features of the report are summarised below:

Indian clay tiles may play an important role in the housing developments of Malaya where population is increasing at the rate of 3.3 per cent per annum. Compared to asbestos cement roofing or flat concrete roof, roofing with clay tile is preferred on account of its higher heat resistance quality and lower replacement cost. Indigenous cement tiles, though cheaper in cost, are higher in porosity and are liable to crack when excessive expansion and contraction are caused by radical fluctuations of weather conditions.

In 1959, Malaya imported 14,443 tons of roofing tiles worth M 1,184,000 and India supplied about 95 per cent. During the same period, Singapore's net imports of roofing tiles were 1,885 tons (gross 4,538 tons) worth M 199,500 and India's share was 99 per cent. Sarawak buys tiles in alternate years of high and low imports, mostly from Singapore although direct purchases from France and India are not insignificant. Of the total imports of clay products in North Borneo, the share of imports from India is about 60 per cent.

Apparently there is not much scope for increasing the sales of Indian tiles in Malaya except for the housing needs of the additional population but increased demand can be brought about if other types of roofing are replaced by Indian tiled roofing. This change over can be induced only by cutting down the manufacturing cost of the Indian tiles to a minimum and by reducing the handling charges and breakages.

Indian tile manufacturers may devote themselves in improving the finish and quality of their products. In particular they may see that the defects such as rough appearance, warped surface, crooked alignment cracks, air bubbles holes for wiring, are remedied. They may study methods of cheapening glazing cost so that the tiles can be glazed without increasing costs materially. This will not only improve appearance and finish but will render the tile almost impermeable.

Indigenous cement tiles caught the fancy of the public by their various attractive colours. Indian manufacturers may examine whether Indian red clay will accept pigmentation treatment.

Clay floor tiles and glazed wall tiles are the popular and standard covering in this area and Indian exporters have not so far entered this market. Although the import is not large (350 tons worth M 80,500) Indian exporters may easily compete in this field.

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Sri M. Bhaktavatsalam, Home Minister, Madras, inaugurated the Seventh All-India Handicrafts Week on 20th November 1961. In the picture the Minister is seen inspecting one of the products exhibited on the occasion.



The Home Minister of Madras, Sri M. Bhaktavatsalam inaugurated the Bolts and Nuts Factory at Sriparumbudur, sponsored by the Sriparumbudur Bolts and Nuts Co-operative Society, on 30-11-1961.



Drilling for limestone at Paravani



Contortion of calciphyre the mother rock of limestone, Kollapatti



Limestone at Paravani



Wide expanse of limestone, Gajalampatti

REPORT

LIMESTONE OCCURRENCES IN KULITHALAI TALUK, TIRUCHIRAPALLI DISTRICT AND ADJOINING PARTS OF DINDIGUL, MADURAI DISTRICT.

BY

Sri N. K. N. AIYENGAR, State Geologist
AND

Sri T. S. PARAMASIVAN, Assistant Geologist
Department of Industries & Commerce,
GOVERNMENT OF MADRAS

SYNOPSIS

This is a report on the crystalline limestone deposits of the Kulithalai and adjacent Dindigul taluks of the Tiruchirapalli and Madurai Districts. The investigation which lasted for three months has revealed the existence of large deposits of limestones in this area. From the estimation of the reserves, these deposits appear to be one of the largest of its kind in the State.

From the key map, it is seen that these limestones run more or less east to west for nearly eighteen miles, midway between Karur and Dindigul. Thus, these limestones lie about fifteen miles distant from the Karur broad-gauge and Tiruchirapalli-Dindigul meter-gauge lines. There are also main roads cutting across these bands from Karur to Dindigul.

These limestone exposures vary in breadth from 35 feet to 900 feet. They are also associated with very impure limestones and other country rocks.

Mapping has been done in fairly detailed manner on the village maps 16"=1 mile. This has been reduced to 8"=1 mile. For the purpose of mapping and calculation of the reserves, only the limestones which might be useful in industries have been taken into consideration, leaving the inferior varieties. Care has also been taken to plot on the map, the sampling localities, percentage of the calcium-oxide and also the revenue survey numbers through which the limestone bands run, as ready-reckoner, to facilitate further work.

The limestones under consideration are generally white, greyish white, grey or pink

in colour and vary in texture from fine to coarse grain or saccharoidal. The percentage of the foreign materials in the limestones vary according to the quality of the limestones, they being in greater proportions in the inferior grades and least in the higher grade.

Quality of the limestones.—As these deposits extend to a great distance, it is reasonable to expect great variations in the quality of the material. Some may be taken to be nearly of high grade, some of cement grade and others may be of inferior grade. Those that contain 49 to 52 per cent of CaO less than 6 per cent of Silica, and still smaller percentage of MgO, are taken to be of nearly high grade; whereas the limestones with CaO between 45 to 48 per cent, and silica ranging between 6 to 10 per cent, as cement grade and the rest containing CaO between 42 to 45 and Silica more than 10 per cent, and MgO more than 4 per cent, as of inferior grades.

Reserves.—Though drilling has not been carried out to find out the actual depths to which these limestone deposits extend, experience has shown that similar deposits in other parts of the State have been found to extend to depths more than 100 feet. Therefore, the depth assumed for calculation of the reserves is 100 feet. Further, large parts of the ground along the run of the bands are covered by soil. It is probable that the limestones continue below the soil. Therefore, the assumed depth of 100 feet is reasonable. According to this calculation, the total reserves of usable

limestones in this area may be of the order of 187.07 million tons, out of which roughly, we may take about 10 to 20 million tons as of nearly high grade limestone, occurring near Devarmalai, Ayyampalayam and Tarakkampatti, while the rest may be regarded as suitable for cement industry.

In this connection, caution is necessary. Though as many as 243 chemical analyses have been done, considering the great length and width of the bands, the intervals of sampling are rather long. It is, therefore, suggested that those who are interested in exploiting the limestones of any particular grade, or area, are advised to take up more detailed sampling at shorter intervals. Further, to confirm the depth to which the limestone extends, and its quality, drilling has to be resorted to.

Though this area is not noted for its abundance of water yet it is not far away from the Cauvery and Amaravathy rivers as seen on the key map. There seems to be a proposal to harness one of the main streams that originates from the Kadavur hills and passes through this area near Devarmalai.

INTRODUCTION

The Government desired that the main limestone deposits in the State should be investigated in detail with a view to find out the quality and reserves of each deposit so as to enable them to chalk out a plan to utilize them in various types of industries. The State Geologist considered that the previous information available regarding the limestones in the Devarmalai area was insufficient. Therefore, it was decided to examine the

whole region in detail and find out the true potentialities of limestone in this area.

This work was entrusted to the second author who carried out the entire field work for about 3½ months under the guidance of the first author and was assisted by Sri M. Natarajan, Geological Assistant.

Previous Work

The Geological Survey of India had made a general survey of the limestone bearing area between the villages of Devarmalai and Allinagaram during the field season 1943-44. Further extensions beyond these places had not been examined.

Mapping

The entire belt has not been geologically mapped as it is generally done. Only the limestones suitable for industrial purposes have been mapped, in view of the urgency of the work. Therefore, the associated rocks have not been marked on the plates. For this investigation, village map of 16"=1 mile or 1"=330 feet scale was chosen. After demarcating the bands on this scale, they have been reduced to 8"=1 mile or 1"=660 feet scale. The Survey of India sheets (1"=1 mile scale) have been employed as reference maps.

Location

The limestone deposits comprise mainly three bands which are mostly confined to the Kulithalai Taluk (former Kadavur Zamindari) and are covered by Survey of India sheets 58J/2 (C/1) and 58J/5 (A/3). These extend into the adjoining Dindigul Taluk (Madurai District) through the village of Palaiyam (78°8'; 10°43' 36"). They pass through several villages from Gejjilampatti (10° 41' 36"; 78°3') on the west up to Muttampatti (10°46' 45"; 78°19' 37") on the east for a distance of nearly eighteen miles.

Physical Features

The topography is made up of a series of low linear rocky-knolls in a gently rolling plain. The Kadavur hills form a fascinating landscape.

The major drainage in this area is the Amaravathi river flowing about sixteen miles north of the limestone area. Besides there are a number of small *nala* which are mostly dry, except during the monsoon. Two appreciable streams rise from the Kadavur hills and flow in a NNE direction almost following the general slope of the country. These are 1. "The Sitapatti Odai" named after the village close by, and 2. "The Mailampatti Odai". The latter flows a mile west of Mamarathupatti.

The area is dotted with tanks and ponds of various dimensions and their outflow join the Poongar river about 7 miles north of Kiranur (10°47'; 78°17').

Climate

The area receives scanty rainfall only during the monsoon season and is mainly an arid tract.

General Geology

Mica Schists interbanded with granitic gneisses form the predominant types of country rock throughout the area traversed. Several granitic and pegmatitic intrusions also are found to traverse the schistose rocks. The general succession of the rock units appears to be as follows:—

3. Younger granitic intrusions. Pegmatites and quartz veins.

2. Gneisses ... Biotite-Hornblende gneisses Feldspathic gneisses.

1. Older schistose

rocks ... Basal metamorphics—
Amphibolites Epidiorites.

Crystalline limestone.
and calc-gneisses.
Quartzites

Hornblende Schist and
Mica Schist.

Description of Rock Types

(a) *Mica schist*—This is essentially made up of biotite mica with subordinate amount of muscovite (white mica) and covers a wide area of the country. The regional foliation strike is ENE/WSW with steep sotherly dip. Associated with mica schists are thin bands of hornblende schist.

(b) *Quartzites*—These are irregularly banded and are often admixed with schistose and gneissic rocks. These are found to be extremely fine grained with a saccaroidal texture. White varieties are the most common.

(c) Besides the above mentioned acidic rocks, the basic types like amphibolites and epidiorites are often observed as thin lenses among the gneisses. Perhaps these may be xenoliths.

(d) *Calc-gneisses*—Next in abundance to the gneisses are the calc-gneisses. They stand out as ridges and knolls of various dimensions along this entire belt. Intimately admixed with the calc-gneisses and the crystalline limestones are the calciphyres (impure limestones).

These are brownish, greenish grey to dark grey in colour and are irregularly weathered. The associated minerals are quartz, plagioclase, feldspar, biotite and other calc-silicates with hornblende.

(e) *Granitic intrusions*—Several pegmatites and quartz veins have intruded into the limestone bands and the calc-gneisses as seen near the Devarmalai temple, and have caused re-crystallisation of the calciphyres resulting in pure crystalline limestone at the contacts. The limestone bands are found to terminate abruptly wherever the intrusions cross them.

(f) *Crystalline limestone*—There are three main bands of limestone in this area. They are (a) Gejjiliyampatti—Pannirpatti band, (b) Kiranur—Meenakshipuram band and (c) Tarakampatti band.

General Characters of the Limestone

The crystalline limestones are distinctly banded and run more or less uninterruptedly for very long distances (extending for nearly eighteen miles with an invariable strike of ENE/WSW for its greater part with slight local variations. The calc-gneisses are raised due to their greater hardness while the limestones form typical hummocky outcrops. Some of the hummocks seen north of Palaiyam and near Gejjiliyampatti are nearly 5 to 6 feet high. Very often the junction of these bands with the calc and granite gneisses is intervened by the pegmatites. At places, however, the limestone bands are bordered by schistose and gneissic rocks as well.

Minerological and Textural Characters

The limestones are generally light coloured; the varieties are white greyish-white, grey and pink. The Chief associated minerals are dark green ferro-magnesian diopside (cocolite?), flakes of brown mica (phlogophite) with grains of pyrite matter. Flakes of graphite are not uncommon. They exhibit a fresh and superimposed vitreous lustres. These are distinctly crystalline and

exhibit good cleavage. In texture, the limestones are generally coarse to medium grained tending to become extremely fine grained and occasionally marble-like (saccaroidal) as seen near Tarakampatti, Varavanai and Ayyampalayam.

Mode of Origin

The calc-gneisses and calciphyres are commonly associated in South India with other archaean rocks. These show an unusual high preponderance of lime silicates, diopside, hornblende, labrodorite, epidote, garnet and other alumino silicates. For such a composition they are believed to be formed as para-gneisses, i.e., formed by the metamorphism of a pre-existing calc and argillaceous series of sediments. The associated crystalline limestone is also the result of such a type of metamorphism on calc sediments.

Description of the Limestone Bands

With Palaiyam as the centre, detailed descriptions of the main bands from Gejjiliyampatti upto Pannirpatti and other ancillary bands have been furnished broadly under (a) Palaiyam east and (b) Palaiyam west groups.

I. Palaiyam

Three separate bands are well exposed east of Palaiyam and north of the Palaiyam—Kurunikulathupatti unmetalled road in the Muttampatti hamlet. These are found to run up to the Devarmalai—Narasimhaswami temple on the east, and further beyond with an almost consistent trend of ENE/WSW. These bands are described as Palaiyam white bands 'A' 'B' and 'C'.

After a wide gap of soil cover to the north, another set of three narrow bands are exposed. These are the Palaiyam Pink bands

'A' 'B' and 'C' in view of their characteristic pink colour.

(i) *Palaiyam white bands*:—*Palaiyam white band 'A'*.—This band has a total length of nearly 6,000 feet from Palaiyam to the Palaiyam—Devarmalai border, and has an average width of 115 feet. Between this band and the band 'B' there is intervening calc gneiss. This appears to be covered by soil up to Devarmalai on the east.

The limestone is highly weathered in several places and on the surface it is very much strained, and so it is dark in colour. However, freshly broken limestone is greyish-white to white in colour.

Quality.—From the chemical analyses of the samples from this band, CaO is found to range between 48.31 per cent to 51.14 per cent and SiO₂ is found to be less than 7.54 per cent except near the sample place (locality) PA4 where SiO₂ is 8.44 per cent and MgO is 4.77 per cent.

Quantity—

Reserves in tons. Length—5,990 feet.
Average width 115 feet. Depth assumed—100 feet.

— $5,990 \times 115 \times 100$

13.5 (tonnage factor for limestone)

— Nearly 5 million tons.

Out of this reserves about 3/4th, i.e., 3.75 million tons is of industrial grade.

(b) *Palaiyam white band 'B'*.—Adjoining the Palaiyam—Devarmalai cart track is the Palaiyam 'B' band. It runs parallel to band 'A'. This is traced in an ENE/WSW direction for a total length of 5,511 feet up to the Palaiyam—Devarmalai border and it continues beyond further east. This limestone band is found to have an average width of 129 feet.

The limestone is not hummocky in nature; most of this is found as outcrops on ground level. The limestone has a greyish white colour and contains common impurities like mica flakes.

Quality.—The chemical analysis have given the following range:—

for CaO	SIO ₂	MgO
48 to 51%	7.5 to 8.7%	1.38 to 1.74%

Quantity.—Length:—5,511 feet. Average width:—129 feet. Assumed depth:—100 feet.

$$\text{Reserves in tons} = \frac{5,511 \times 129 \times 100}{13.5}$$

—52,66,066 or 5.2 millions.

(c) *Palaiyam white band 'C'*.—This is the narrowest of the three bands but has a sizable exposure length of nearly 6,600 feet. This is separated from the 'B' band by a narrow strip of soil cover which perhaps obscures the limestone.

The limestone is of the same nature as those of 'A' and 'B' bands.

Quality.—CaO content ranges between 47.79 per cent to 50.03 per cent while SIO₂ ranges between 5.51 to 9.41 per cent for all the samples collected from this band except for the sample No. PC4, i.e., strikingly siliceous.

Quantity.—Length—6,600 feet. Average width—97 feet. Assumed depth—100 feet.

Probable reserves from this band are—

$$\frac{6,600 \times 97 \times 100}{13.5} \text{ — Nearly 4.7 million tons.}$$

(2) *Palaiyam pink bands*—(a) *Palaiyam pink band 'A'*—About two furlongs north of Palaiyam white band 'C', there is a narrow

pink band described here as Palaiyam pink band 'A'. This runs in the general strike of ENE/WSW. This is the first of the three pink bands exposed north-east of Palaiyam and is traced up to the Palaiyam-Devarmalai border beyond which covered by soil. However it could be discontinuously followed on the west to the Karur-Dindigul highways through Narasingaperumal Kovil (east of the road). Further west of the road the band shows a pronounced change in the trend and runs as KOI band less continuously for a short distance before being concealed under soil cover. This has an exposure length of 2,970 feet nearly and the average width is calculated to be 35 feet.

The limestone is very fine grained and possesses a distinct pink colour. The common impurities associated with the limestone are found in very small proportions. The CaO percentage is 50.88 while it has a low silica content of 4.63 per cent. On the whole it should contain fairly good material for one-third the total length.

Quantity.—Length—2,970 feet. Average width—35 feet. Assumed depth—100 feet.

$$\text{Reserves} = \frac{2,970 \times 35 \times 100 \times 1}{13.5} = 3$$

— 2,56,666 or 2.5 lakh tons.

(b) *Palaiyam pink band 'B'*—This band is exposed north of pink band 'A' and follows the general trend of ENE/WSW from the Karur-Dindigul metal road upto the Palaiyam-Devarmalai border. This measures 6,336 feet in length and has an average width of 98 feet. The limestone in this band is similar to the limestone of pink band 'A' in colour and texture.

Quality.—The band is fairly pure near the road side while it appears to be rather impure on the east.

Quantity.—Though for a length of 6,336 feet and an average width of more than 96 feet, the total reserves of 4.6 million tons could be expected, perhaps 1/4th of it only (portion close to the road on the east) may be considered for industrial purposes. (1.15 million tons.)

(c) *Palaiyam pink band 'C'*.—About a furlong north of the previous band, pink band 'C' is exposed for a total length of 4,785 feet and is followed on the east up to Devarmalai border. This band is covered by soil in Devarmalai village.

On the west, this runs for a length of nearly 4,000 feet before becoming soil covered.

The limestone is distinctly pink coloured and is mostly medium to fine grained in texture.

Quality.—From the analyses, it is seen that the band contains limestone with CaO percentage 50.25 and SIO₂ 6.87 per cent while between sample localities PPC2 and PPC3 the CaO percentage varies between 45.81 to 46.82 while SIO₂ varies between 10.08 to 11.34 per cent.

Quantity.—For purposes of calculation, the portion east of sample localities PPC1 is alone considered.

Length—4,785 feet. Average width—100 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{4,785 \times 100 \times 100}{13.5}$$

3.5—million tons.

II. Devarmalai.

North of the Narasimhaswami temple in Devarmalai, there are good exposures of limestone to the east and west of the Sitapatti Odai which flows in a north east direction. They are distinctly banded and invariably show a trend of East-North-

West-South-West from the Palaiyam border up to Varavanai for a total length of nearly 2 miles north of the temple the following three bands are seen from south to north—

- (1) Devarmalai 'A' band;
- (2) Devarmalai 'B' band; and
- (3) Devarmalai 'C' band.

These limestone bands are flanked on the north and south by prominent bands of calc-gneisses.

The bands are hummocky in appearance and collectively these attain extraordinary width along the Sitapatti odai. Individual bands too are also very wide nearing a width of 250 feet in places.

1. *Devarmalai 'A' band.*—This is exposed for a total length of 9,240 feet and is perhaps the continuation of the combined Palaiyam white B and C bands. This becomes covered by soil near the Varavanai village border.

Along the southern border are seen frequent granitic and quartz intrusions and the limestone is also very much intercalated with calciphyres and calc-gneisses here and there, along its entire length.

The band becomes very wide north-west of the Narasimhaswami temple. The average width for this band is 236 feet.

The limestone is highly weathered and stained on the surface. This is generally white to greyish white in colour and medium to fine grained in texture.

Quality.—The results of the chemical analysis of the samples collected from this band are indicated below:—

Sample number.	CaO %	SIO ₂ %
DA1 ...	51.96	4.67
DA2 ...	45.65	9.43
DA3 ...	46.83	6.46
DA4 ...	51.54	4.44
DA5 ...	51.78	4.95

From this table, it is seen that the band is rather siliceous west of the Narasimhaswami "Thiruthottai" up to sample locality DA3, and is also impure on the east till sample locality DVA1. This impure stretch is about 4,731 feet in length.

Reserves.—Length—9,240. Average width—236 feet. Assumed depth—100 feet.

$$\text{Reserves,} \frac{9240 \times 236 \times 100}{13.5}$$

—Nearly 16 million tons.

Out of this reserves, half of it, i.e., 8 million tons may be of industrial grade.

2. *Devarmalai 'B' band.*—This is observed as a distinct band north of 'A' band. Between this band, and 'A' band, are the calc-gneissic and calciphyric patches. This has the same trend as 'A' band and is exposed for a total distance of 9,370 feet.

This is narrower than the 'A' band and has only an average width of 143 feet.

The limestone is greyish white in colour and is fine to medium grained.

Quality.—Chemical analyses of the samples from this band show that the CaO averages 48 per cent while SiO₂ percentage varies between 3.79 to 7.22 except for sample DB5 (11.73 per cent).

Quantity.—Length—9,370 ft. Average width—143 ft. Assumed depth—100 feet.

$$\text{Reserves in tons} \frac{9370 \times 143 \times 100}{13.5}$$

—9.9 millions.

3. *Devarmalai 'C' band.*—This has a similar trend of band 'A' and 'B' and runs for a greater distance than the southern bands

(A and B). The total length of exposure of this band is nearly 9,990 feet. To its north are seen high knolls of calc-gneisses interbanded with the limestone.

The band is very wide on the west towards Palaiyam, while east of the Sitapatti odai this becomes progressively narrower until it gets truncated by the 'B' band which in turn becomes proportionately wider beyond sample locality DVB4.

The limestone is greyish white to white in colour and mostly fine grained in texture.

Quality.—Chemical analyses of the samples indicate that the CaO averages nearly 50 per cent while silica being less than 6 per cent. MgO content varies between 0.50 and 1.91 per cent.

Quantity.—Length—9,990 feet. The average width is taken as 113 ft. for purposes of calculation of reserves. Depth assumed—100 feet.

$$\text{Reserves in tons} \frac{9,990 \times 113 \times 100}{13.5}$$

—8 millions.

III. Viralipatti.

This band is seen about 1,000 feet N50° W of the Devarmalai 'C' band and runs in East-North-East/West South-West direction for a very short distance and is covered by cultivated tracks. Again, the same reappears where the Sitapatti odai makes a loop and extends up to Viralipatti and further east for a furlong before it pinches out. This band has a total length of one mile and two furlongs and attains its maximum width of 275 feet near Viralipatti. It is fairly wide at the eastern extremity while along its strike, it narrows to 50 feet at places.

On the southern border of this limestone band, calc gneisses and calciphyre bands run

parallel while on the north, granites and pegmatites occur.

This limestone has a distinct pink colour with fine to medium grained texture. The common impurities observed are ferro-magnesian minerals like coccolite, hornblende and flakes of brown mica (phlogopite).

Quality.—CaO content varies between 50.01 to 50.99 per cent between the sample localities of the band DVP1 to DVP5 while it becomes progressively lower beyond DVP5. The silica content of the limestone appears to be low towards the western border, while it appears to be on the increase on the eastern side. Allowing for the impure portion nearly half of this band should contain limestone of industrial grade.

Quantity.—Length—7,600 ft. Average width assumed 200 feet.

Depth assumed—100 feet

$$\text{Reserves} \frac{7,600 \times 200 \times 100}{13.5}$$

—11,259,259 or 11.25 million tons.

Industrial grade limestone is 1/2 the total reserves.

—1/2 × 11.25 × 5.62 million tons.

III (a) *Karungalpatti*—Two bands of limestone run south of Karungalpatti. These are the continuation of Devarmalai bands but are re-named as Karungalpatti bands at this place. Their trend is east-north east-west south west. The bands extend westwards for nearly half a mile towards Devarmalai beyond which they are obscured under an elevated ground of cultivated fields. For convenience of description the band is divided into (a) the northern strip and (b) the southern strip. A fairly wide stretch of soil cover intervenes between these two.

The northern strip runs for nearly 4,125 feet with an average width of about 175 feet, while its southern counterpart has a length of about 2,772 feet, its average width being 159 feet. The Southern strip is much intercalated with bands of calc-gneisses.

Both these bands contain pink limestone of medium grain, while some portions are distinctly white. These include the common ferro-magnesian minerals as impurities to a small extent.

Quality.—The CaO per centage varies between 48.41 to 50.59 while SiO₂ ranges between 5.59 to 9.09 per cent. MgO is less than 2.56 per cent for all the samples collected from these bands except for sample locality KD2 where silica shows 11.5 per cent.

Quantity.—(a) Karungalpatti northern band—Length—4,125 feet, Average width 175 feet.

Depth assumed 100 feet.

$$\text{Reserves in tons} \frac{4,125 \times 175 \times 100}{13.5}$$

= 5,347,222 tons or 5.3 millions.

(b) Karungalpatti Southern band—Length—2,772 feet Average width—159.

Depth assumed—100 feet.

$$\text{Reserves in tons} \frac{2,772 \times 159 \times 100}{13.5}$$

= 3,264,800 or 3.2 million tons.

IV. Varavanai.

Here the limestone bands run north of Varavanai. These bands are actually split up into the Varavanai western bands and Varavanai eastern bands by the Karur-Mailampatti metalled road, about a furlong north of Varavanai.

The western portions of the bands are in fact the continuation of the Karungalpatti bands, while on the east they are traced continuously up to Mamarathupatti.

Varavanai west.—Karungalpatti bands, east of the NS flowing *Nala*, from the main Varavanai bands which comprise three distinct almost parallel bands with a ENE/WSW trend. These are described as (a) Varavanai 'A' band, (b) Varavanai 'B' band and (c) Varavanai 'C' band. These intercept the Karur-Mailampatti metalled road and run further east.

Band 'A' is traced along its strike for a distance of 5,940 feet with an average width of 220 feet.

Band 'B' is comparatively narrower than bands 'A' and 'C' and is less continuous, being interrupted here and there by wide patches of calc-gneisses and other rocks. This is the narrowest and is completely broken up between sample places DVB3 and DVB4 by a linear hillock (vide map No IV)* of calc-gneisses. Beyond the eastern border of this low hillock, this band runs for about a furlong and is not traceable further.

'B' and 'C' is appreciably wide with a width of 200 feet on an average. This has a total length of 6,095 feet.

Fine grained limestone, almost saccaroidal in texture, is observed at places along 'C' band close to the metalled road on the west. Limestones of A and B bands are comparatively of larger grain size and contain visible ferro-magnesians and silica grains. The common varieties of limestone here are, greyish white, pale bluish and pink in colour.

Quality.—From the analyses of the samples collected from these bands, it is seen that it is possible to get fairly good grade of limes-

tone from band 'C'. CaO averages 49.32 per cent and SiO₂ averages 7.42 per cent with MgO less than 2.89 per cent for this band. Bands 'A' and 'B' are made up of less pure material than 'C' band. The average CaO, SiO₂ and MgO are shown below:—

	CaO %	SiO ₂ %	MgO %
Band 'A'	49.84	7.51	1.46
Band 'B'	48.77	6.81	3.24

Note.—Though the average MgO content is 1.46 and 3.24 for bands A and B respectively, it is observed that at sample localities viz., DVA8, DVB2, and DVB3, the MgO content is rather high 3.38.

Reserves.—Varavanai 'A' Band.—Length—5,940 feet. Average width—220 feet.

$$\begin{aligned} \text{Assumed depth—100 feet.} \\ \text{Reserves—} & \frac{5,940 \times 220 \times 100}{13.5} \\ & = 9,680,000 \text{ or } 9.6 \text{ million tons.} \end{aligned}$$

Varavanai 'B' Band—

Length—2,310 feet. Average width—79 feet.

$$\begin{aligned} \text{Assumed depth—100 feet.} \\ \text{Reserves—} & \frac{2,310 \times 79 \times 100}{13.5} \\ & = 1,351,777 \text{ or } 1.35 \text{ million tons.} \end{aligned}$$

Varavanai 'C' Band—

Length—6,095 feet, Av. width—200 feet.

$$\begin{aligned} \text{Assumed depth—100 feet.} \\ \text{Reserves—} & \frac{6,095 \times 200 \times 100}{13.5} \\ & = 9,029,629 \text{ or } 9 \text{ million tons.} \end{aligned}$$

Varavanai east.—On a fairly elevated barren tract east of the Karur-Chinthamanpatti metalled road, there is no outcrop of limestone for a distance of nearly a furlong which is perhaps covered by soil. After this distance the two bands re-appear and run uninterruptedly in an east north east/west south west direction towards Mamarathupatti. The bands are described as (a) Varavanai-Mamarathupatti band and (b) Varavanai band. These two bands run almost parallel to each other for a distance of 3,000 feet beyond which there is a marked change in the general trend of the limestone bands to E10° N/W10° S trend from East-North-East/West-South-West.

(a) *Varavanai—Mamarathupatti band.*—This band was examined in detail being the more promising band of the two. This is fairly wide (100 feet) and thins out towards the approaches of the Mailampatti odai and runs as small band (35 feet towards Kalingapatti hamlet).

(b) *Varavanai band.*—This is an ancillary band and can be traced from the sample place VI, a furlong north of Varavanai village, for a length of approximately 2,949 feet with an average width of 35 feet. This is very narrow throughout its entire length and becomes calciphyric east of the odai. This is bordered by calc gneissic bands on the south and are often intruded by pegmatite and other intrusives.

In general, the limestone in these bands is medium grained and greyish white in colour. Visible ferro-magnesian minerals are negligible; mica flakes and silica grains are observed distinctly in these limestones.

Quality.—The chemical analysis of the samples from this area are furnished hereunder:—

	CaO %	SiO ₂ %	MgO %
(a) <i>Varavanai-Mamarathupatti Band—</i>			
VM1	48.74	9.23	1.02
VM2	47.34	12.27	1.54
VM3	48.21	9.02	1.44
VM4	50.86	5.80	1.91
VM5	49.69	6.86	1.45
(b) <i>Varavanai band—</i>			
V1	48.96	8.80	2.06
V2	51.00	6.25	2.03

Reserves.—(a) *Varavanai—Mamarathupatti band—*

Length—5,000 feet.

Average width—80 feet.

Assumed depth—100 feet.

$$\begin{aligned} \text{Reserves in tons—} & \frac{5,000 \times 80 \times 100}{13.5} \\ & = 2,962,962 \text{ or } 3 \text{ millions nearly.} \end{aligned}$$

(b) *Varavanai band—*

Length—2,940 feet.

Average depth—35 feet.

Assumed depth—100 feet.

$$\begin{aligned} \text{Reserves in tons—} & \frac{2,940 \times 35 \times 100}{13.5} \\ & = 6,860,000 \text{ or } 7.6 \text{ lakh tons.} \end{aligned}$$

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V. Mamarathupatti.

The Varavanai ancillary band is traced beyond the Mailampatti odai for a distance of nearly two furlongs and further east it is probably under soil cover. But, the Varavanai-Mamarathupatti band runs East 10° North-west 10° S trend as far east has the hamlet of Kalingapatti. North of this band at VM6 sample locality, a very small limestone band (VMII) of fairly good quality is seen to run for a distance of approximately 150 yards before being truncated against the main band. Yet another band runs about 20 yards north of this small band, almost parallel to the Varavanai-Mamarathupatti band and is described as VMIII band. This is exposed for a length of about 2000 feet and passes through the Kalingapatti temple area and merges with the Mamarathupatti main band about a furlong west of the Panjapatti-Mailampatti unmetalled road. The combined band is obscured by cover and cultivated fields for a short distance and re-appears west of the sample place VM14. This is persistent for 2 furlongs east of the Mamarathupatti village thereafter the band thins out considerably and the remnants of this are seen as detached out crops of negligible width.

Mamarathupatti-Ammapatti band is seen about half a furlong north of Ammapatti hamlet from Mamarathupatti odai and is followed along its strike for nearly 2½ furlongs. Thereafter this band becomes very much admixed with calc-gneisses and granitoid gneisses up to Allinagaram.

(i) *Varavanai-Mamarathupatti band.*—This is the largest of the bands in this area with an average width of 170 feet. The limestones are pinkish in colour and medium grained. The analyses indicate that the limestones are less siliceous between sample

localities VM6 and VM7 while on the east the band is highly siliceous between VM8 and VM14 (SiO₂ per cent 10 to 14). As regards CaO content this is found to be above 48 per cent between sample locality VM6 and VM7 while the same varies in the sample places mentioned below:—

			CaO. %
VM8	...	...	43.58
VM9	...	...	46.17
VM10	...	...	45.75
VM11	...	...	47.21
VM12	...	...	48.60
VM13	...	...	49.41
VM14	...	...	48.90
VM15	...	...	48.07
VM16	...	...	49.66

Reserves.—Though the reserves are of the order of 6.6 million tons for the entire limestone band, only one-fourth of this may be suitable for industrial purposes.

Reserves in tons—

Length—5,280 feet.

Average width—170 feet.

Assumed depth—100 feet.

Reserves— $5,280 \times 170 \times 100 \times \frac{1}{4} \times \frac{1}{13.5} = 1.65$ million tons.

(ii) *VM III band.*—This band runs north of V. Mamarathupatti band for a total distance of 3,762 feet and has an average width of 75 feet. The band contains pink coloured limestone of fine to medium grain size. The limestone contains visible ferro-magnesian impurities in very small quantities.

Quality.—The chemical analyses of the samples collected from this band are shown below:—

Sample numbers	SiO ₂ %	CaO %	MgO %
VM III-1	6.95	48.50	2.02
VM III-2	5.58	50.25	1.53
VM III-3	7.45	49.40	1.54
VM III-4	8.55	49.05	1.02

Reserves.—For a length of 3,762 feet, average width 75 feet and an assumed depth of 100 feet the total reserves that could be expected from this band are

$$\frac{3,762 \times 75 \times 100}{13.5} = 20,90,000$$

nearly 2 million tons.

(iii) *Mamarathupatti-Ammapatti band.*—This band is exposed interruptedly from Ammapatti up to south-east of Mamarathupatti for a distance of 2,310 feet, on the east it is broken by granite and pegmatite rocks while it is obscured by soil west of the Mamarathupatti odai.

The common variety of limestone is greyish white to clear white in colour and is free from visible ferro-magnesian.

Quality.—The CaO content varies from 46.78 to 48.63 per cent while SiO₂ ranges between 6.95 and 9.74 per cent. MgO for the samples found to be less than 2.28 per cent.

Reserves—

Length—2,310 feet.

Average width—84 feet.

Assumed depth—100 feet.

$$\frac{2,310 \times 84 \times 100}{13.5} = 1,447,337$$

or nearly 1.4 million tons.

VI. Samipillayur.

A fairly wide band is seen well exposed east of the Kiranur-Pothurauthanpatti cart track north of the village of Allinagaram (since abandoned). This is found to run on the east as a narrow band through the heart of Samipillayur village and further east. South of this band runs another band of more or less the same width for a short distance before being covered by soil. These bands are described as Allinagaram-Samipillayur 'A' band and Allinagaram-Samipillayur 'B' band respectively.

The two bands are found to have a common trend of E10° N/W10° S with steep dip towards south along their strike, frequent intercalations and admixture of calc-gneisses are observed. These impure portions have not been considered for the estimation of the reserves.

(i) *Allinagaram-Samipillayur 'A' band.*—This band appears as a very narrow band with a meagre width of 55 feet near the track but opens south considerably after a distance of about 1,600 feet. Only this band continues up to Samipillayur. This band has an average width of 200 feet.

(ii) *Allinagaram-Samipillayur 'B' band.*—This band is less continuous and is covered by soil about 1,320 feet east of the track. It has an average width of 460 feet.

The limestone in these bands comprise grey, greyish white and pinkish coloured varieties, and are generally medium to fine grain. A marble like texture is exhibited by the limestone between sample localities ASA 1 and ASA 2.

Quality.—CaO content for the samples for these bands varies between 49 to 52.24 per cent while SiO₂ content ranges between 5 and 7 per cent. It is seen from the analyses that these bands contain limestone of highest purity for the whole of the area.

Reserves.—Large reserves may be expected from this area in view of the extraordinary width and considerable length of the bands.

(i) A. S. A. band.—Length—5,412 feet. Average width—200 feet.

Depth assumed—100 feet.

$$\text{Reserve in tons} = \frac{5,412 \times 200 \times 100}{13.5}$$

= 8,017,777 or 8 million tons.

(ii) A. S. B. band.—Length—1,320 feet. Average width—460 feet.

Depth assumed—100 feet.

$$\text{Reserves in tons} = \frac{1,320 \times 460 \times 100}{13.5}$$

= 4,497,777 or 4.5 million tons.

Total reserves for the Allinagaram-Samipillayur band — 12.5 millions.

VII. Ayyampalaiyam.

East of Samipillayur Kovil and west of Ayyampalayam is an elevated stretch of barren land where no limestone is found to out crop. However a big band is traced on the west of Ayyampalaiyam village for nearly 7 furlongs, and on the east this is covered by soil between Ayyampalaiyam and Pannirpatti hamlet. Just two furlongs east of Pannirpatti, the band re-appears as a narrow band. In our opinion, the band is presumably continuous between Ayyampalaiyam and Pannirpatti under the alluvium of the Muttampatti tank (vide map No. VII)*. The western portion is described as the Ayyampalaiyam band while the eastern portion is treated as the Ayyampalaiyam-Pannirpatti band.

(a) Ayyampalaiyam band.—This runs in the east-north-east/west-south-west direction for a total length of 5,000 feet, and has an

average width of 75 feet. The limestone is greyish to distinct white in colour and is fine and medium grained.

Quality.—The CaO content for most of the samples is above 48.57 per cent and up to a maximum of 50.65 per cent. Silica content ranges between 5.59 and 7.59 per cent for most of the samples. However, SIO 2 is more than 9 per cent in sample localities AY 4 and AY 6. MgO percentage is always less than 1.55 except for sample locality AY 2 (3.06 per cent).

Quantity.—Length—5,000 feet. Average width—75 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{5,000 \times 75 \times 100}{13.5}$$

= 2.7 million tons.

(b) Ayyampalaiyam-Pannirpatti band.—This band appears 1,000 feet west of the Muttampatti tank and is followed up to the band of the Ayyampalaiyam-Muttampatti cart-track. No exposure of limestone could be seen after this bend till 1,200 feet east of Makkulam tank near Pannirpatti. However this re-appears at the sample locality AYM3 and runs in an east-north-east/west-south-west direction. This band has a total exposure length of 2,970 feet and has an average width of 70 feet. This is very much intercalated with calc-gneisses; some of them forming high knolls like the "Kallan rock" (vide map No. VII)*. Traverses across the strike reveal frequent intercalations of calciphyres with limestone bands. These have been carefully eliminated while calculating the average width.

Limestone in this band is white in colour and is fine grained in texture.

Quality.—The CaO content varies from 49 to 52.8 per cent while SIO2 ranges between

2.75 and 6.41 per cent for the sample collected from this band. MgO is found to be less than 3.24 per cent for the samples. In view of its high CaO content and low silica content this band constitutes fairly good quality limestone.

Quantity.—Length—2,970 feet. Average width—70 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{2,970 \times 70 \times 100}{13.5}$$

= 15,40,000 or 1.5 million tons.

Bands west of Palaiyam:—(1) Palaiyam.—The Palaiyam bands described under "Palaiyam east" show an abrupt variation in the trend. Further the Palaiyam white bands merge together and the combined band is seen well exposed in the heart of Palaiyam village.

(i) Palaiyam-Kolinjivadi band.—This band is traced from 28/6 mile stone on the Dindigul-Karur road and is seen exposed for a distance of two furlongs along the cart-track to Kolinjivadi. The total length of the exposed band is nearly 1,320 feet while it has an average width of 110 feet. East of Kolinjivadi the band is much intercalated with wide bands of calc-gneisses as seen near sample locality PK3. Though this band is exposed for a distance of 2 furlongs N-W of Mochakayanur, this has not been taken into consideration in view of its highly impure nature and very small width. (Average width 20 feet.)

The limestones form hummocky outcrops along the cart-track. These are mostly white in colour and fine grained. There is little visible ferro-magnesian impurity in the limestone.

Quality.—The CaO content of the sample ranges between 48 and 52 per cent while silica is less than 6 per cent.

Quantity.—Length—1,320 feet. Average width—119 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{1,320 \times 110 \times 100}{13.5}$$

= 10,75,555 or 1 million tons.

(ii) Kolinjivadi-Palaiyam 'A' band.—This band is seen as a continuation of the Palaiyam pink band 'A' and is traced for distance of 2,700 feet. Further exposures are not seen beyond this distance. The average width is 100 feet.

The limestone is pink coloured and fine to medium grained.

In this band, the limestone is fairly pure with a high CaO content (nearly 50 per cent) and low silica content (5 per cent).

Reserves.—Length—2,700 feet. Average width—100 feet. Assumed depth—100 feet.

$$\text{Quantity in tons} = \frac{2,700 \times 100 \times 100}{13.5}$$

= 2 millions.

(iii) Kolinjivadi-Palaiyam 'B' band.—This band is exposed near the border stone 931/909 of Palaiyam/Dholipatti, and is seen to continue as a fairly wide band crossing the Palaiyam-Servaikaranpatti metal road at the 0/3 road mile. This merges with the subsidiary bands viz. KPC and KPD bands on the north and forms the Palaiyam pink band 'B' on the east. This has an exposure length of 5,142 feet and trends ENE/WSW in direction. The band is very wide throughout its entire length and the average width is 220 feet.

The limestone is found to be mostly white in colour while near sample place KPB 2 it is somewhat pinkish. The limestone is distinctly coarsely crystalline with

well defined calcit crystals. Visible ferro-magnesian impurities are seen in small amounts in the limestone.

Quality.—On analyses, CaO is found to vary between 41.81 and 51.42 per cent though at sample locality KPB6 CaO is depressingly low (45.24 per cent). SiO₂ per cent is 5.08/at KPB2) while it is 7.12 at KPB4. However, the silica percentage is rather high at sample locality KPB6 (10.45 per cent). MgO is generally below 3/5 per cent.

Quantity.—Length—5,142 feet. Average width—220 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{5,142 \times 220 \times 100}{13.5}$$

= 8.36 millions.

(iv) *Kolinjivadi-Palaiyam 'C' band.*—This is seen north of the KPB band and is traced from the Dholipatti-Palaiyam border. This appears to merge with the Southern KPB band at 0/3 road mile on the Palaiyam-Servakaranpatti road. This has a general trend of ENE/WSW and is admixed with calc-gneisses at places.

The limestone is generally pink coloured and medium grained.

Quality.—The chemical analyses of the samples are indicated below :—

Samples	CaO %	SiO ₂ %	MgO %
KPC 1	52.53	4.80	2.17
KPC 2	45.76	10.09	3.00
KPC 3	48.10	7.40	2.60
KPC 4	48.53	6.56	1.80

Quantity.—Length—3,960 feet. Average width—90 feet. Assumed depth—100 feet.

$$\text{Reserves} = \frac{3,690 \times 90 \times 100}{13.5}$$

= 26,40,000 or 2.64 million tons.

(v) *Kolinjivadi-Palaiyam 'D' band.*—After a gap of soil cover for nearly 400 feet is another Kolinjivadi-Palaiyam band exposed. This is described as KPD band. This runs almost parallel to the south band merges with KPB band and continues as the Palaiyam pink band 'B' east of the Dindigul-Karur highways.

This runs in an ENE/WSW direction for a total length of 6,930 feet. It has a uniform width of nearly 50 feet. At KPD4, there is a change in its trend (observed as N30° E/S30° W).

The limestone in this band is similar to the other Kolinjivadi-Palaiyam bands in colour and texture.

Quality.—The chemical analyses of the samples are furnished below :—

Sample number	CaO %	SiO ₂ %	MgO %
KPD 1	48.95	6.03	1.59
KPD 2	48.72	6.44	2.80
KPD 3	50.95	4.42	2.80
KPD 4	51.92	3.61	1.80
KPD 5	48.45	5.18	3.75
KPD 6	48.15	7.08	2.60
KPD 7	48.72	6.03	2.40
KPD 8	48.66	5.58	3.00

Quantity.—Length—6,930 feet. Average width—50 feet. Assumed depth—100 feet.

$$\text{Reserves in tons} = \frac{6,930 \times 50 \times 100}{13.5}$$

= 25,56,000 or 2.5 millions.

(vi) *Kalathur band.*—Kalathur is a small hamlet one mile west of Palaiyam. The Kalathur band is a prominent band crossing the Karur-Dindigul asphalt road north of Palaiyam at 15/6 road mile and runs in an ENE/WSW trend for a distance of 4,125

feet towards Kalathur on the Palaiyam-Servakaranpatti road (1/1 road mile). This band runs uninterruptedly up to sample place KL5 (vide Plate No. I). Beyond this is concealed by soil cover and re-appears after a gap of 1,650 feet.

The limestones form long and tall boulders, some of the borders are 3 to 15 feet long and about 4 feet tall. The limestone is generally greyish white in colour and fine grained.

Quantity.—The following table gives the chemical analyses of the samples collected from this band :—

Sample number	CaO %	SiO ₂ %	MgO %
KL 1	50.67	4.32	1.61
KL 2	50.60	5.42	1.20
KL 3	49.57	7.70	1.00
KL 4	48.35	7.01	2.99
KL 5	48.39	5.74	2.20
KL 6	47.34	6.09	4.30
KL 7	48.05	6.76	2.00

$$\text{Quantity. Length} = \frac{4,125 \times 310 \times 100}{13.5}$$

= 8.5 million tons.

(vii) *Dholipatti band.*—The main Dholipatti band is exposed between the villages of Dholipatti and Kalathur for a distance of 6 furlongs west of the Palaiyam-Servakarnpatti road at 1/1 road mile. The Kalathur band runs 300 feet north of this. A wide stretch of soil cover separates these two bands. The average midth is 135 feet.

The limestone is mostly pink in colour and fine to medium grained. The common ferro-magnesian impurities are observed in small quantities.

Quality.—The chemical analyses of the samples are tabulated below :—

Sample number	CaO %	SiO ₂ %	MgO %
DK1	46.70	8.73	2.14
DK2	46.34	6.30	2.99
DK3	48.79	6.56	2.19
DK4	48.00	7.10	2.27

Quality.—Length—3,960 feet. Average width—135 feet. Assumed depth—100 feet.

$$\text{Reserves in tons :—} = \frac{3,960 \times 135 \times 100}{13.5}$$

= 39,60,000 or 3.9 million.

Dholipatti (KO band).—South of the main band and north of the KPD band, a wide strip of very impure limestone (mostly calciphyric) is exposed for a length of about 5 furlongs. This has an appreciably large width nearing at places 475 feet. A representative sample collected from this band (Kol) in Map No. I* on analyses has shown the CaO to be less than 47 per cent and SiO₂ to be more than 9 per cent. At each of the sample locality KO₁, the band becomes further impure and grades into a typical calciphyre.

In view of its poor quality, no detailed sampling was undertaken. However, the reserves for this impure band (length—5 furlongs; average width—400 feet, Assumed depth—100 feet) could be about 7½ million tons.

VIII. Kurumbapatti.

The area between Dholipatti and Kurumbapatti is devoid of any limestone band. It could be only per-sumed that the continuous bands from Palaiyam are concealed under soil cover.

However, a fairly wide and long impure looking limestone is exposed about 2 furlongs west of Kurumbapatti along the nullah

sections (like Vasavanaikenpatti nulla. This is traced rather interruptedly on the west up to the border of Mallapuram village. The bands have a general East-North-East-West-South-West trend while it takes a different trend of N 30°W/S30°E in SF. No. 1388 of Karikkali village. The limestone is found to be very much intercalated and interbanded with wide bands of calc-gneisses and calciphyres. The calc-gneisses form prominent ridges like 941. On the northern boundary, this band is very frequently traversed by granite and pegmatite rocks.

The band is very wide and attains width of 600 feet (KU8) and 900 feet (KU 10).

The limestone forms very high hummocky outcrops, some of them being as tall as 6 to 8 feet. The limestone is greyish white to white in colour and fine to medium grained. Silica grains are visibly seen as chief impurities.

Quality.—The chemical analyses of the samples are tabulated below:—

Sample number	CaO %	SiO ₂ %	MgO %
KU1	47.73	7.53	4.07
KU2	46.17	11.49	4.43
KU3	46.23	16.39	2.50
KU4	44.36	12.52	2.97
KU5 (North)	49.62	6.66	2.30
KU5 (South)	49.34	5.67	2.43
KU6	45.05	15.80	2.41
KU7	48.68	6.48	3.14
KU8	46.70	11.86	2.97
KU9	50.12	8.28	1.99
KU10 (East)	48.45	9.99	2.18
KU10 (West)	52.61	8.52	1.07
KU11	48.83	8.76	1.84

The limestone is highly siliceous with an average MgO content of 3.5% between Kurumbapatti and the hillock 941. However its quality improves considerably towards Karikkali-Mallapuram border, vide analyses KU7 to KU11.

Quantity.—The area occupied by the limestone band is, 7.3* 660 × 660 sq. ft. For an assumed depth of 100 feet, the total reserves from this band could be

$$\frac{7.3 \times 660 \times 660 \times 100}{13.5}$$

$$= 23.4 \text{ million tons.}$$

Out of this total reserves perhaps 1.3 of it should yield limestone of industrial grade, i.e., nearly 7.8 million tons.

IX. Gejjalampatti.

About three furlongs north-east of Gejjalampatti village is an extensive stony waste between Gejjalampatti and Kurumbapatti on the east. The calcgneisses from several detached hillocks in this area. A very wide limestone band is exposed on the lower ground and shows a North-North-East/South-South-West trend. This band is perhaps the continuation of the Kurumbapatti band beyond the soil cover on the Mallapuram-Karikkali border. The abrupt change in the trend from East-North-East/West-South-West to North-North-East-South-South-West is quite perceptible, West of the "Perumal rock", and this is explained away by a phenomenon of 'folding' during the process of Metamorphism. This band is described as the Gejjalampatti band in this report. This is further traced on the north in the Alambadi village and beyond the calc-gneiss ridges on the Mallapuram village boundary in the same trend for a total length of 4,290 feet and 2,586 feet in the two villages. It should be mentioned that the area South of the Mallapuram-Alambadi

village boundary upto Sulapuram-Servaik-karanpatti cart-track has not been considered for reckoning the length of the band as this is considered unworthy of exploitation. Further extension of limestone towards Karur has been noticed since submission of the report.

The band has the maximum width in the entire belt. The average width on the South is 795 feet while the same increases to 900 feet on the north.

The limestone is greyish white to white in colour. This contains the common impurities in small quantities.

Quality.—The chemical analysis of the samples are furnished hereunder:—

Sample number	CAO %	SiO %	MgO %
G1 (east) ...	47.18	9.87	2.99
G1 (west) ..	47.03	7.11	3.00
G2 (east) ..	49.87	5.72	2.80
G2 (west) ...	49.59	6.51	1.80
G3 (east) ...	48.43	5.50	3.21
G3 (west) ...	48.74	5.24	2.99
G4 (east) ...	46.09	7.71	2.91
G4 (west) ...	47.12	5.55	4.10
G5	48.43	6.18	3.21
G6 (east) ...	46.95	9.34	2.77
G6 (west) ...	50.12	7.41	0.74
G7 (east) ...	50.81	7.15	1.11
G7 (west) ...	47.78	6.79	3.34
G8 (east) ...	50.94	7.69	0.74
G8 (west) ...	48.32	8.48	2.20
G9	48.07	9.75	0.14

Reserves—(a) Reserves in south—Length—4,200 ft. (upto sample locality G3).

Average width—795 feet.

Assumed depth—100 feet.

$$\frac{4,200 \times 795 \times 100}{13.5}$$

$$= 24,733,333$$

or 24.7 million tons.

(b) Reserves in north.—Length—2,586 ft.

Average width—900 ft

Assumed depth—100 ft.

$$\frac{2,586 \times 900 \times 100}{13.5}$$

$$= 17,240,000 \text{ or } 17.2 \text{ million tons.}$$

X. Kiranur Meenakshipuram

This is a much smaller band than the main Gejjalampatti-Pannirpatti band. This band is traced in an East-North-East-West-South-West direction west of Kiranur along the cart track from Mamarathupatti to Kiranur and east of the blue-stone pits. This band is nearly two miles long and is fairly wide just south of Kiranur village (10°47' : 78°70').

Very good exposures are observed along the Kiranur odai and also north of Meenakshipuram. Thereafter the band becomes highly calciphyric east of Kiranur and thins out. The bands are described as (a) Kiranur band and (b) Kiranur-Meenakshipuram band. The Kiranur band has a total exposure length of nearly 4,620 feet while the Kiranur-Meenakshipuram band has a total length of 5,280 feet.

The limestone is fine to medium grained in texture and is greyish white to white in colour.

Quality.—On analyses, it is found that the good limestone is confined to the west of the odai while the band tends to become rather

impure east of the odai. The analyses are shown below:—

Sample number	CaO %	SiO ₂ %	MgO %
(a) Kiranur band—			
K1 ...	50.30	6.63	1.48
K2 ...	51.69	5.66	0.99
K3 ...	46.23	11.40	1.00
K4 ...	45.96	10.10	4.47
K5 ...	47.28	87.3	4.97
K6 ...	49.34	8.26	1.57
Kiranur 'A' band—			
KA1 ...	48.19	6.58	2.50
KA2 ...	47.12	8.23	2.97
KA3 ...	49.41	5.86	1.33
(b) Kiranur-Meenakshipuram band—			
KM1 ...	50.76	5.29	1.48
KM2 ...	51.95	4.62	1.48
KM3 ...	51.63	5.49	1.52
KM4 ...	49.57	7.33	2.08
KM5 ...	47.50	7.77	2.93
KM6 ...	49.21	6.20	1.46
KM7 ...	48.78	4.87	2.32
KM8 ...	50.24	6.27	1.05
Kiranur-Meenakshipuram 'A' band—			
KMA1 ...	51.29	5.72	1.58
KMA2 ...	49.91	7.21	1.57
KMA3 ...	47.03	6.17	2.44
KMA4 ...	47.01	6.26	3.39
KMA5 ...	51.16	6.42	2.06

Reserves—(a) Kiranur band.—Length, 4,620 ft. Average—width, 50 feet.

Assumed depth—100 feet.

Reserves in tons $\frac{4,620 \times 50 \times 100}{13.5}$

= 1.7 millions.

(1/5 of this reserves may yield good limestone i.e., 3.4 lakh, tons.)

(b) Kiranur - Meenakshipuram band.—

Length—5,280 feet.

Average width—47 feet.

Assumed depth—100 feet.

Reserves in tons

= $\frac{5,280 \times 47 \times 100}{13.5}$

= 1.8 millions.

XI. Tarakkampatti

This is the smallest of the three bands in the Kulithalai taluk and is well exposed about six furlongs south of Tarakkampatti (10° 42' 30" : 78° 14' 30"). The band is fairly long and runs about half a mile. This is not well exposed to the east of the road. East of the road, the band is traced only for a short distance towards Kalutharigaipatti and is covered in the village. This is fairly wide west of the Tarakkampatti-Palaviduthi road and has a maximum width of 300 yards of which the greater portion on the north, is made up of calc-gneiss, calciphyre and mica gneiss. The limestone is restricted only to the south. This band has an east-north-east/west-south-west trend and shows a steep dip of nearly 75° towards south.

The common varieties of limestone are the white, pale grey and pale bluish in colour. This is mainly very fine grained and saccharoidal at places.

Quality—Chemical analysis.

Sample number	CaO %	SiO ₂ %	MgO %
T 1 (south) ...	50.59	2.53	3.55
T 2 (north) ...	50.56	2.31	3.51
T 2 (south) ...	49.80	4.56	2.47
T 3 ...	48.25	7.40	2.56
T 4 ...	48.80	5.53	2.49

The above chemical analyses indicate that this band contains very good material.

Quantity.—The reserves for the exposed strip between the Palaviduthi tank road and east of Mavathur rank is as follows:—

Reserves in tons:—Area X Depth

13.5

= $\frac{26}{64} \times 660 \times 100 \times \frac{13.5}{13.5}$

= 13,10,883 or 1.3 million tons.

It can be reasonably expected to continue under the alluvium of the Mavathur tank, perhaps prospecting at a future date may confirm the continuation of the band for some more distance than what has actually been exposed now.

* Maps not published.

impure east of the odai. The analyses are shown below:—

Sample number	CaO %	SiO ₂ %	MgO %
(a) Kiranur band—			
K1 ...	50.30	6.63	1.48
K2 ...	51.69	5.66	0.99
K3 ...	46.23	11.40	1.00
K4 ...	45.96	10.10	4.47
K5 ...	47.28	87.3	4.97
K6 ...	49.34	8.26	1.57
Kiranur 'A' band—			
KA1 ...	48.19	6.58	2.50
KA2 ...	47.12	8.23	2.97
KA3 ...	49.41	5.86	1.33
(b) Kiranur-Meenakshipuram band—			
KM1 ...	50.76	5.29	1.48
KM2 ...	51.95	4.62	1.48
KM3 ...	51.63	5.49	1.52
KM4 ...	49.57	7.33	2.08
KM5 ...	47.50	7.77	2.93
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KM8 ...	50.24	6.27	1.05
Kiranur-Meenakshipuram 'A' band—			
KMA1 ...	51.29	5.72	1.58
KMA2 ...	49.91	7.21	1.57
KMA3 ...	47.03	6.17	2.44
KMA4 ...	47.01	6.26	3.39
KMA5 ...	51.16	6.42	2.06

Reserves—(a) Kiranur band.—Length, 4,620 ft. Average—width, 50 feet.

Assumed depth—100 feet.

Reserves in tons $\frac{4,620 \times 50 \times 100}{13.5}$

= 1.7 millions.

(1/5 of this reserves may yield good limestone i.e., 3.4 lakh, tons.)

(b) Kiranur - Meenakshipuram band.—Length—5,280 feet.

Average width—47 feet.

Assumed depth—100 feet.

Reserves in tons

$\frac{5,280 \times 47 \times 100}{13.5}$

= 1.8 millions.

* Maps not published.

XI. Tarakkampatti

This is the smallest of the three bands in the Kulithalai taluk and is well exposed about six furlongs south of Tarakkampatti (10° 42' 30" : 78° 14' 30"). The band is fairly long and runs about half a mile. This is not well exposed to the east of the road. East of the road, the band is traced only for a short distance towards Kalutharigaipatti and is covered in the village. This is fairly wide west of the Tarakkampatti-Palavuduthi road and has a maximum width of 300 yards of which the greater portion on the north, is made up of calc-gneiss, calciphyre and mica gneiss. The limestone is restricted only to the south. This band has an east-north-east-west-south-west trend and shows a steep dip of nearly 75° towards south.

The common varieties of limestone are the white, pale grey and pale bluish in colour. This is mainly very fine grained and saccharoidal at places.

Quality—Chemical analysis.

Sample number	CaO %	SiO ₂ %	MgO %
T 1 (south) ...	50.59	2.53	3.55
T 2 (north) ...	50.56	2.31	3.51
T 2 (south) ...	49.80	4.56	2.47
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T 4 ...	48.80	5.53	2.49

The above chemical analyses indicate that this band contains very good material.

Quantity.—The reserves for the exposed strip between the Palavuduthi tank road and east of Mavathur tank is as follows:—

Reserves in tons:—Area X Depth

$\frac{26}{64} \times 660 \times 100 \times \frac{13.5}{13.5}$

= 13,10,883 or 1.3 million tons.

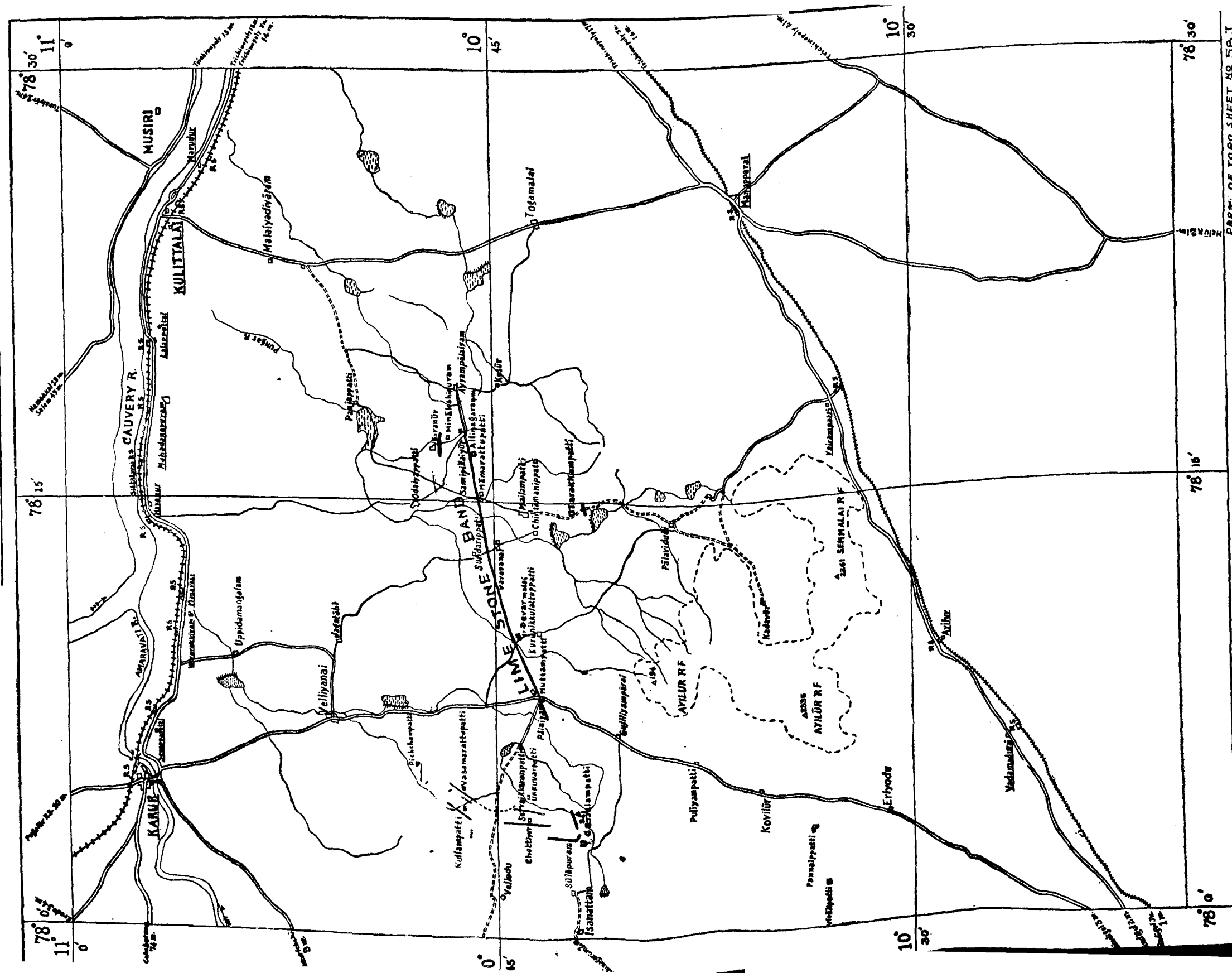
It can be reasonably expected to continue under the alluvium of the Mavathur tank, perhaps prospecting at a future date may confirm the continuation of the band for some more distance than what has actually been exposed now.

IND-COM JOURNAL

KEY MAP SHOWING THE LIME STONE BANDS AND THE COMMUNICATION LINES

SCALE:—4"=1 MILE

PLATE XII



Traced by M. GATENDRAN
STATE GEOLOGIST OFFICE, GOVT. OF MADRAS.

INDEX
Crystalline Lime stone

PART OF TOPO SHEET NO. 5B J

**A. RESERVES OF LIMESTONE FOR THE BANDS
EAST OF PALAIYAM**

Locality	Name of the band	Total reserves in million tons	Reserves of industrial grade in million tons
I. Palaiyam	1. Palaiyam white bands—		
	(a) Palaiyam white band 'A'	5.00	3.75
	(b) do. 'B'	5.20	5.20
	(c) do. 'C'	4.70	4.70
	2. Palaiyam pink bands—		
	(a) Palaiyam pink band 'A'	0.25	0.25
	(b) do. 'B'	4.60	1.51
	(c) do. 'C'	3.50	3.50
	Total	23.25	18.55
	...		
II. Devarmalai	1. Devarmalai 'A' band	16.00	8.00
	2. do. 'B' band	9.90	9.90
	3. do. 'C' band	8.00	8.00
		33.90	25.90
III. Viralipatti III-a Karungalpatti	Viralipatti band	11.25	5.62
	(a) Karungalpatti northern band	5.30	5.30
	(b) Karungalpatti southern band	3.20	3.20
		19.75	14.12
IV. Varavanai	Varavanai West—		
	(a) Varavanai 'A' band	9.60	9.60
	(b) Varavanai 'B' band	1.50	1.35
	(c) Varavanai 'C' band	9.00	9.00
	Varavanai East—		
	(a) Varavanai-Mamarathupatti band	3.00	3.00
	(b) Varavanai band	0.76	0.76
		23.71	23.71

(Continuation)

Locality	Name of the band	Total reserves in million tons	Reserves of industrial grade in million tons
V. Mamarathupatti ...	(i) Varavanai-Mamarathupatti band	6.60	6.60
	(ii) V. M. III band	2.00	2.00
	(iii) Mamarathupatti-Ammappatti band	1.40	1.40
		10.00	10.00
VI. Samipillayur ...	(i) A. S. A. band	8.00	8.00
	(ii) A. S. B. band	4.50	4.50
		12.50	12.50
VII. Ayyampalaiyam ...	(a) Ayyampalaiyam band	2.70	2.70
	(b) Ayyampalaiyam Pannirpatti band	1.50	1.50
		4.20	4.20
Total reserves east of Palaiyam :—			
I. Palaiyam		23.25	18.55
II. Devarmalai		33.90	25.90
III. Viralipatti		19.75	14.12
IV. Varavanai		23.71	23.71
V. Mamarathupatti		10.00	5.05
VI. Samipillayur		12.50	12.50
VII. Ayyampalaiyam		4.20	4.20
		127.31	104.03
VIII. Kurumbapatti ...	Kurumbapatti band	23.40	7.03
IX. Gejjalampatti ...	(a) Gejjalampatti South	24.70	24.70
	(b) Gejjalampatti North	17.20	17.20
		41.90	41.90

(Continuation)

Locality	Name of the band	Total reserves in million tons	Reserves of industrial grade in million tons
X. Kiranur-Meenakshipuram—			
	(a) Kiranur band	1.70	0.34
	(b) Kiranur-Meenakshipuram band	1.80	1.80
		3.50	2.14
XI. Tarakkampatti ...	Tarakkampatti band	1.30	1.30
B. RESERVES OF LIMESTONE FOR THE BANDS WEST OF PALAIYAM			
Locality	Name of the band	Total reserves in million tons	Reserves of industrial grade in million tons
I. Palaiyam ...	(i) Palaiyam-Kolingivadi band	1.00	1.00
	(ii) Kolingivadi-Palaiyam (A) band	2.00	2.00
	(iii) do. (B) do.	8.36	8.36
	(iv) do. (C) do.	2.60	2.64
	(v) do. (D) do.	2.50	2.50
	(vi) Kalathur band	9.50	9.50
	(vii) Dholipatti band	3.90	3.90
	Dholipatti KO band	7.50	—
		37.40	29.90
Total reserves west of Palaiyam :—			
I. Palaiyam		37.40	29.90
VIII. Kurumbapatti		23.40	7.80
IX. Gejjalampatti		41.90	41.90
X. Kiranur-Meenakshipuram		3.50	2.14
XI. Tarakkampatti		1.30	1.30
		107.50	83.04
Total reserves of 'A' and 'B' ...			
		234.81	187.07

CHEMICAL ANALYSES (In Percentage)

S.G.No.	Locality	Moisture	LOI	SiO ₂	R ₂ O ₃	Fe ₂ O ₃	CaO	MgO
1 DA 1	Devarmalai 'A' Band	0.05	39.87	7.05	1.05	0.63	51.98	Traces
2 DA 2	Do.	0.12	37.17	9.43	6.15	0.87	45.65	1.59
3 DA 3	Do.	0.16	40.54	6.46	2.65	0.76	46.89	1.34
4 DA 4	Do.	—	40.22	4.45	2.65	0.68	51.54	0.98
5 DA 5	Do.	—	41.23	4.97	1.17	0.64	51.78	1.20
6 DB 1	Devarmalai 'B' Band	0.08	39.19	5.56	6.15	0.83	48.43	1.22
7 DB 2	Do.	0.09	39.52	5.32	4.18	0.94	49.57	1.51
8 DB 3	Do.	—	42.06	3.79	5.34	0.60	48.52	0.60
9 DB 4	Do.	0.02	40.21	7.22	1.63	0.82	50.00	1.20
10 DB 5	Do.	0.30	38.28	11.37	1.53	0.95	45.27	2.33
11 DC 1	Davarmalai 'C' Band	0.08	39.28	7.56	3.21	0.88	49.43	1.13
12 DC 2	Do.	0.14	40.89	6.01	8.12	0.84	45.32	1.91
13 DC 3	Do.	0.10	41.50	4.89	4.46	0.69	47.63	0.46
14 DD 1	Devarmalai 'D' Band	0.10	40.12	5.88	7.42	0.68	46.46	0.50
15 DVA 1	Devarmalai/Varavanai (DVA Band)	0.12	39.31	8.37	5.27	0.96	46.31	0.98
16 DVA 2	Do.	0.10	39.80	8.75	1.73	0.84	49.00	0.63
17 DVA 3	Do.	0.08	39.02	8.51	1.85	0.92	49.32	0.70
18 DVB 1	Devarmalai/Varavanai (DVB Band)	0.07	39.96	6.57	1.84	0.84	50.55	0.97
19 DVB 2	Do.	0.09	40.44	6.05	1.38	0.84	51.37	1.06
20 DVB 3	Do.	0.06	39.78	7.33	1.41	0.84	50.36	1.30
21 DVB 4	Do.	0.11	39.99	7.59	2.75	1.03	48.91	0.21
22 DVC 1	Devarmalai/Varavanai (DVC Band)	0.06	41.19	5.09	4.39	0.88	49.41	Traces
23 DVC 2	Do.	—	40.50	5.58	2.35	0.87	50.55	0.08
24 DVC 3	Do.	0.04	40.30	6.49	1.54	1.10	50.90	0.13
25 DVC 4	Do.	—	39.98	6.90	1.61	1.03	50.75	0.11
26 DD 2	Viralipatti	0.09	38.95	9.68	2.24	1.01	48.84	0.20
27 K 1	Karungal (DVC Band)	0.01	39.15	6.04	1.41	0.48	52.09	1.23
28 K 2	Do.	—	40.23	7.59	1.15	0.48	50.95	1.33
29 DVP 1	Viralipatti (Devarmalai-Varavanai Pink Band)	0.01	39.97	7.26	1.25	0.55	50.99	0.83
30 DVP 2	Do.	0.04	40.33	6.54	0.80	0.25	50.53	1.90
31 DVP 3	Do.	0.01	39.57	7.98	0.42	0.31	50.01	1.48
32 DVP 4	Do.	0.74	40.37	6.74	0.51	0.21	50.09	1.40
33 DVP 5	Do.	0.06	41.43	4.61	0.49	0.16	49.69	4.24
34 DVP 6	Do.	0.08	38.59	11.64	0.92	0.32	45.11	2.82
35 DVP 7	Do.	0.09	39.76	8.90	0.84	0.25	47.40	2.82
36 DVP 8	Do.	0.13	39.77	6.64	1.89	0.13	47.62	3.42

37 DVP 9	Do.	0.05	39.61	8.72	0.93	0.47	50.41	0.81
38 DVP 10	Do.	0.07	38.94	10.52	1.09	0.38	47.44	1.43
39 DVP 11	Do.	0.08	39.93	8.58	2.11	0.50	48.63	1.02
40 KD 1	Karungalpatti (Devarmalai Band)	0.24	39.15	9.09	1.22	0.80	48.54	1.02
41 KD 2	Do.	0.22	38.67	11.50	0.69	0.67	48.41	1.53
42 KD 3	Do.	—	41.02	5.53	1.00	0.63	50.17	1.54
43 KD 4	Do.	0.19	40.29	7.63	0.93	0.48	49.29	1.23
44 KD 4 (North)	Do.	0.16	40.76	7.52	0.74	0.29	49.21	1.54
45 KD 5 (South)	Do.	0.19	40.18	7.30	0.82	0.18	50.42	1.79
46 KD 5 (North)	Do.	0.14	40.83	5.74	0.74	0.29	49.53	2.56
47 KD 6 (South)	Do.	0.14	40.37	6.94	0.85	0.59	50.59	2.04
48 DVA 1 (South)	Varavanai (Devarmalai-Varavanai A Band)	0.01	38.61	9.28	1.05	0.15	49.45	1.67
49 DVA 2	Do.	—	39.28	7.67	2.04	0.18	51.02	0.88
50 DVA 3	Do.	0.04	39.63	7.27	1.26	0.16	50.56	0.88
51 DVA 4	Do.	0.03	39.79	6.47	1.25	0.13	51.04	1.26
52 DVA 5	Do.	0.02	40.76	5.12	1.61	0.11	51.25	1.66
53 DVA 6	Do.	0.08	38.91	9.43	1.45	0.37	48.41	1.24
54 DVA 7	Do.	0.04	41.52	5.94	0.63	0.21	50.85	0.77
55 DVA 8	Do.	0.08	39.49	9.40	2.18	0.31	46.16	3.38
56 DVB 2	Varavanai (Devarmalai-Varavanai B Band)	0.08	39.04	9.02	0.49	0.31	48.35	3.45
57 DVB 3	Do.	0.07	41.41	5.59	0.41	0.22	48.01	4.08
58 DVB 4	Do.	0.01	40.70	5.61	0.60	0.20	50.91	2.51
59 DVB 5	Do.	0.01	39.90	7.03	0.34	0.27	49.84	2.95
60 DVC 1	Varavanai (Devarmalai-Varavanai C Band)	0.15	38.79	11.14	2.06	0.31	46.71	1.15
61 DVC 2	Do.	0.14	40.24	6.68	1.21	0.42	49.80	2.31
62 DVC 3	Do.	0.20	40.80	6.89	1.19	0.34	48.89	1.50
63 DVC 4	Do.	0.11	39.80	7.18	1.07	0.37	49.66	2.52
64 DVC 5	Do.	0.15	40.78	6.26	0.80	0.15	50.48	0.92
65 DVC 6	Do.	0.61	40.67	6.26	0.69	0.42	49.99	1.44
66 DVC 7	Do.	0.11	40.78	8.22	0.91	0.26	47.09	2.89
67 DVC 8	Do.	0.12	40.16	6.92	0.90	0.04	50.82	1.03
68 DVC 9	Varanai (Devarmalai-Varanai C Band)	0.70	40.64	6.26	1.88	0.29	49.95	1.24
69 DVC 10	Do.	0.16	40.98	6.98	0.75	0.24	49.65	1.03
70 DVC 11	Do.	0.01	40.85	5.24	0.63	0.19	50.84	1.90
71 DVC 12	Do.	0.06	38.82	9.66	1.54	0.63	48.58	1.02
72 DVC 13	Do.	0.09	38.41	8.47	1.95	0.63	48.73	0.82

S.G.No.	Locality	Moisture	LOI	SiO ₂	R ₂ O ₃	Fe ₂ O ₃	CaO	MgO
73 V 1	Varavanai Band	0.03	38.92	8.80	1.40	0.28	48.96	2.06
74 V 2	Do.	0.04	39.40	6.25	2.08	0.30	51.09	2.03
75 V 3	Do.	0.20	41.53	6.91	1.47	0.31	48.77	2.06
76 V 4	Do.	0.46	41.65	6.10	1.24	0.45	47.74	2.35
77 VM 1	Varavanai (Varavanai Mamarathupatti Band)	0.17	38.99	9.23	1.20	0.58	48.74	1.02
78 VM 2	Do.	0.16	37.35	12.37	1.20	0.64	47.34	1.54
79 VM 3	Do.	0.05	37.99	9.02	2.61	0.55	48.21	1.44
80 VM 4	Do.	0.50	39.87	5.80	1.70	0.35	50.86	1.91
81 VM 5	Do.	0.03	39.96	6.86	1.81	0.32	49.69	1.45
82 VM 6	Mamarathupatti (Varavanai—Mamarathupatti Band) South	0.32	40.38	5.95	0.91	0.40	48.25	3.55
83 VM 7	Mamarathupatti (Varavanai—Mamarathupatti Band)	0.03	40.40	7.04	1.71	0.39	48.45	2.55
84 VM 8	Do.	0.02	36.52	14.76	3.28	1.42	43.58	2.60
85 VM 9	Do.	0.05	39.97	10.64	3.99	0.33	46.17	2.06
86 VM 10	Do.	0.03	38.90	10.44	1.64	0.44	45.75	2.40
87 VM 11	Do.	0.79	36.91	10.77	2.00	0.73	47.21	1.99
88 VM 12	Do.	0.14	39.54	8.36	1.75	0.54	48.60	2.11
89 VM 13	Do.	0.12	38.75	7.77	2.02	0.61	49.41	1.51
90 VM 14	Do.	0.18	39.45	6.84	2.09	0.56	48.90	2.05
91 VM 15	Do.	0.14	40.60	6.57	2.27	0.47	48.07	2.08
92 VM 16	Do.	0.17	40.65	5.76	1.77	0.36	49.66	2.02
93 TM 1	Mamarathupatti (Talayariyur Mamarathupatti Band)	0.18	40.55	5.80	1.52	0.39	50.00	2.05
94 TM 2	Do.	0.11	40.04	5.78	1.95	0.57	51.17	1.02
95 TM 3	Do.	0.10	40.01	6.94	2.39	0.32	47.83	2.55
96 TM 4	Do.	0.14	40.02	7.03	2.17	0.34	49.34	1.53
97 VM/II	Varavanai-Mamarathupatti IInd Band	0.38	39.96	7.16	1.97	0.22	48.73	1.54
98 VM III/1	Varavanai-Mamarathupatti IIIrd Band	0.40	40.35	6.95	1.44	0.41	48.50	2.02
99 VM III/2	Do.	0.12	40.85	5.58	1.89	0.19	50.25	1.53
100 VM III/3	Do.	0.16	39.82	7.45	2.39	0.27	49.40	1.54
101 VM III/4	Do.	0.17	39.50	8.55	1.81	0.19	49.05	1.02
102 MA-1	Mamarathupatti-Allinagaram Band	0.08	39.64	7.58	2.75	0.35	48.55	1.54
103 MA-2	Do.	0.13	37.97	9.74	3.00	0.45	46.78	1.99
104 MA-3	Do.	0.09	39.69	6.95	3.27	0.36	48.63	2.28
105 ASA-1	Allinagaram-Samipillaiyoor 'A' Band	0.16	38.51	8.04	3.19	0.65	49.91	1.03



106 ASA-2	Do.	0.19	38.10	7.60	2.10	0.24	50.29	1.04
107 ASA-3	Do.	0.13	38.21	8.14	1.46	0.19	50.14	2.10
108 ASA-3	Do.	0.15	38.77	9.67	1.02	0.23	48.82	1.04
109 ASA-4	Do.	0.20	39.31	7.67	1.64	0.08	47.95	2.02
110 ASA-4	Do.	0.28	40.07	6.55	1.18	0.49	50.31	2.03
111 ASA-5	Do.	0.15	40.17	5.05	1.52	0.40	52.24	1.56
112 ASA-5	Do.	0.20	40.97	3.98	0.77	0.17	52.24	1.56
113 ASA-6	Do.	0.09	40.21	5.43	1.94	0.64	51.47	1.04
114 ASA-7	Do.	0.10	39.94	6.46	1.69	0.69	50.11	1.56
115 ASA-8	Do.	0.13	39.61	6.40	1.84	0.64	50.65	1.55
116 ASB-1	Allinagaram—Samipillaiyoor 'B' Band	0.12	39.80	5.33	1.80	0.37	51.44	1.58
117 ASB-1	Do.	0.11	40.24	5.85	2.05	0.66	50.86	1.05
118 ASB-2	Do.	0.16	39.76	7.83	1.70	0.51	48.57	1.38
119 ASB-2	Do.	0.19	39.13	6.13	1.08	0.55	50.30	2.78
120 ASB-3	Do.	0.10	39.61	7.48	0.75	0.34	50.21	1.56
121 ASB-3	Do.	0.14	39.98	5.09	1.85	0.80	50.99	1.56
122 AY 1	Ayyampalayam Band	0.04	40.66	5.59	1.64	0.69	50.65	1.55
123 AY 2	Do.	0.21	39.22	7.59	1.39	0.77	49.23	3.06
124 AY 3	Do.	0.20	40.24	6.55	1.22	0.53	49.96	1.02
125 AY 4	Do.	0.10	38.15	9.96	2.25	0.69	47.82	1.53
126 AY 5	Do.	0.62	40.47	6.52	0.82	0.55	49.91	1.28
127 AY 6	Do.	0.19	39.02	9.39	1.96	0.71	48.57	1.53
128 AYM 1	Ayyampalayam-Pannirpatti Band	0.12	40.95	6.34	1.45	0.36	49.21	2.68
129 AYM 2	Do.	0.02	41.43	2.75	1.00	0.51	52.83	0.91
130 AYM 3	Do.	0.11	40.20	6.41	1.69	0.66	49.17	2.07
131 AYM 4	Do.	0.05	40.37	4.80	1.75	0.63	49.55	3.24
132 AYM 5	Do.	0.10	40.19	5.05	2.95	0.65	50.49	1.30
133 PA 1	Palaiyam 'A' Band	0.11	40.03	6.14	1.79	0.78	50.08	1.63
134 PA 2	Do.	0.08	40.82	5.76	1.35	0.71	50.29	1.73
135 PA 3	Do.	—	39.50	6.94	1.72	0.56	50.40	1.59
136 PA 4	Do.	0.22	36.63	8.44	1.49	0.29	48.31	4.77

S. G. No	Locality	Moisture	LOI	SiO ₂	R ₂ O ₃	Fe ₂ O ₃	CaO	MgO
137 PA 5	Palaiyam 'A' Band	0.21	39.27	7.54	1.17	0.26	51.14	1.02
138 PB 1	Palaiyam 'B' Band	0.10	39.49	8.76	1.44	0.86	48.89	1.38
139 PB 2	Do.	0.10	39.98	7.53	1.80	0.79	49.03	1.74
140 PB 3	Do.	—	37.95	8.15	1.57	0.88	51.21	1.48
141 PB 4	Do.	0.24	39.11	7.11	1.00	0.26	49.19	3.06
142 PB 5	Do.	0.25	39.76	7.40	0.83	0.32	49.28	2.09
143 PC 1	Palaiyam 'C' Band	0.11	39.05	9.41	2.31	0.96	48.03	1.68
144 PC 2	Do.	0.03	36.92	8.60	1.86	0.47	50.03	1.70
145 PC 3	Do.	0.01	41.90	5.51	1.50	0.72	48.91	2.40
146 PC 4	Do.	0.25	37.54	11.20	1.63	0.34	47.79	2.53
147 PPA 1	Palaiyam 'A' Band	0.06	40.74	4.63	1.15	0.64	50.88	3.03
148 PBB 1	Palaiyam 'B' Band	0.09	41.38	4.43	1.29	0.32	50.31	2.78
149 PPC 1	Palaiyam 'C' Band	0.06	40.33	6.87	1.66	0.63	50.25	1.43
150 PPC 2	Do.	0.03	37.87	10.08	1.63	0.60	46.82	3.11
151 PPC 3	Do.	0.07	37.06	11.34	3.80	0.40	45.81	1.98
152 PK 1	Palaiyam—Kolinjivadi Band	0.05	41.06	4.14	1.45	0.75	52.25	1.31
153 PK 2	Do.	0.11	41.36	4.62	2.55	0.71	51.08	0.71
154 PK 3	Do.	0.06	39.72	5.40	1.07	0.66	48.40	4.80
155 KPB 1	Palaiyam—(Kolinjivadi-Palaiyam 'B' Band)	0.05	38.92	5.10	1.16	0.72	51.42	3.20
156 KPB 2	Do.	0.12	40.50	5.08	1.60	0.71	49.18	2.60
157 KPB 3	Do.	0.04	39.81	7.00	1.28	0.80	50.62	3.56
158 KPB 4	Do.	0.03	40.01	7.12	1.34	0.88	48.50	3.16
159 KPB 5	Do.	0.50	39.26	6.77	1.00	0.59	48.81	3.00
160 KPB 6	Do.	0.10	37.67	10.45	3.00	0.52	45.24	3.20
161 KP 1	Palaiyam (Kolinjivadi-Palaiyam 'A' Band)	—	39.52	5.84	1.59	0.67	50.50	2.37
162 KPC 1	Palaiyam (Kolinjivadi-Palaiyam 'B' Band)	0.08	39.04	4.80	0.72	0.55	52.53	2.17
163 KPC 2	Palaiyam (Kolinjivadi-Palaiyam 'C' Band)	—	39.00	10.09	1.82	0.74	45.76	3.00
164 KPC 3	Do.	0.02	40.29	7.40	1.02	0.84	48.10	2.60
165 KPC 4	Do.	0.15	39.66	6.56	3.50	0.38	48.53	1.80
166 KPD 1	Palaiyam (Kolinjivadi-Palaiyam 'D' Band)	0.05	40.72	6.03	2.35	0.33	48.95	1.59
167 KPD 2	Do.	0.09	40.61	6.44	1.30	0.24	48.72	2.80
168 KPD 3	Do.	0.12	41.46	4.42	0.80	0.19	50.95	2.80
169 KPD 4	Do.	0.14	41.78	3.61	0.55	0.26	51.92	1.80
70 KPD 5	Do.	0.14	41.25	5.18	1.13	0.33	48.45	3.75
171 KPD 6	Do.	0.18	40.87	7.08	1.55	0.22	48.15	2.60
172 KPD 7	Do.	0.14	41.03	6.03	1.70	0.60	48.72	2.40

173 KPD 8	Do.	0.13	40.94	5.58	1.15	0.37	48.66	3.00
174 KO 1	Palaiyam (Dholipatti Band)	0.08	39.71	9.74	2.02	0.72	47.26	0.86
175 DK 1	Palaiyam (Dholipatti-Kalathur Band)	0.06	39.15	8.73	3.78	0.31	46.70	2.14
176 DK 2	Do.	0.10	40.78	6.30	2.09	0.25	46.34	3.99
177 DK 3	Do.	0.07	40.64	6.56	2.12	0.18	48.79	2.19
178 DK 4	Do.	0.05	40.48	7.10	1.99	0.23	48.00	2.27
179 KL 1	Palaiyam (Kalathur Band)	0.07	42.10	4.32	1.27	0.35	50.67	1.61
180 KL 2	Do.	—	40.91	5.42	1.50	0.51	50.60	1.20
181 KL 3	Do.	0.06	40.10	7.70	0.90	0.52	49.57	1.00
182 KL 4	Do.	0.03	39.97	7.01	2.04	0.47	48.35	2.99
183 KL 5	Do.	0.09	41.70	5.74	1.44	0.56	48.39	2.20
184 KL 6	Do.	0.19	41.12	6.09	1.04	0.26	47.34	4.30
185 KL 7	Do.	0.11	40.56	6.76	1.84	0.39	48.05	2.00
186 Band	Do.	0.11	40.49	4.85	0.99	0.22	49.53	4.18
187 KU 1	Kurumbapatti (Kurumbapatti Band)	0.34	39.97	7.53	1.26	0.32	47.73	4.07
188 KU 2	Do.	0.02	37.36	11.49	2.29	0.30	46.17	4.43
189 KU 3	Do.	0.04	34.75	16.39	1.76	0.25	46.23	2.50
190 KU 4	Do.	—	38.65	12.52	1.46	0.24	44.36	2.97
191 KU 5	Do.	0.01	38.87	6.66	1.89	0.20	49.62	2.30
192 KU 5	(North)	0.05	39.47	5.67	1.73	0.19	49.34	2.43
193 KU 1	(South)	0.04	37.30	10.41	1.55	0.22	47.90	1.99
194 KU 6	Do.	0.05	35.27	15.80	2.41	0.32	45.05	2.41
195 KU 7	Kurumbapatti (Kurumbapatti-Band)	0.06	39.01	6.48	1.64	0.28	48.68	3.14
196 KU 8	Do.	0.03	37.30	11.86	2.02	0.20	46.70	2.97
197 KU 9	Do.	0.02	38.51	8.28	1.98	0.25	50.12	1.99
198 KU 10	Do.	0.05	38.00	9.99	1.86	0.28	48.45	2.18
199 KU 10	Do.	0.03	36.96	8.52	1.46	0.16	52.61	1.07
200 KU 11	Do.	0.04	39.41	8.76	1.49	0.18	48.83	1.84
201 G 1	Gejilampatti (Gejilampatti-Band)	0.12	39.22	9.87	1.49	0.16	47.18	2.99
202 G 1	Do.	0.06	40.77	7.11	1.85	0.24	47.03	3.00
203 G 2	(West)	0.16	40.62	5.72	1.10	0.26	49.87	2.80
204 G 2	(East)	0.02	41.02	6.51	1.44	0.40	49.59	1.80
205 G 3	(West)	0.09	41.14	5.50	1.60	0.32	48.43	3.21
205 G 3	(East)	...	...	...	...	...	...	...

S. No.	S.G.No.	Locality	Moisture	LOI	SiO ₂	R ₂ O _n	Fe ₂ O ₃	CaO	MgO
206	G 3 (West)	Do.	0.10	41.15	5.24	1.54	0.37	48.74	2.99
207	G 4 (East)	Do.	0.16	39.39	7.71	2.19	0.51	46.09	2.91
208	G 5 (West)	Do.	0.12	47.10	5.55	1.04	0.41	47.12	4.10
209	G 5	Do.	0.11	40.64	6.18	1.49	0.49	48.43	3.21
210	G 6 (East)	Do.	0.07	39.24	9.34	1.57	0.25	46.95	2.77
211	G 6 (West)	Do.	0.04	39.98	7.41	2.19	0.21	50.12	0.74
212	G 7 (West)	Do.	0.06	39.38	7.15	1.51	0.18	50.81	1.11
213	G 7	Do.	0.07	40.09	6.79	1.77	0.16	47.78	3.34
214	G 8 (West)	Do.	0.03	39.96	7.69	0.90	0.27	50.94	0.74
215	G 8 (East)	Do.	0.07	39.42	8.48	1.76	0.21	48.32	2.20
216	G 9 (West)	Do.	0.04	39.68	9.75	1.91	0.22	48.07	0.14
217	K 1	Kiranur (Kiranur Band)	0.11	40.28	6.63	1.04	0.54	50.30	1.48
218	K 2	Do.	0.05	40.47	5.66	1.86	0.51	51.69	0.99
219	K 3	Do.	0.14	38.50	11.40	2.05	0.47	46.23	1.00
220	K 4	Do.	0.14	37.53	10.10	2.39	0.27	45.96	4.47
221	K 5	Do.	0.17	37.23	8.73	1.89	0.44	47.28	4.97
222	K 6	Do.	0.16	39.13	8.26	1.28	0.42	49.34	1.57
223	KA 1	Kiranur (Kiranur 'A' Band)	0.11	40.29	6.58	1.42	0.43	48.19	2.50
224	KA 2	Do.	0.18	40.23	8.23	1.04	0.47	47.12	2.97
225	KA 3	Do.	0.10	40.74	5.86	3.30	0.44	49.41	1.33
226	KM 1	Kiranur (Kiranur-Meenakshipuram Band)	0.12	40.80	5.29	1.26	0.68	50.76	1.48
227	KM 2	Do.	0.12	41.06	4.62	0.67	0.46	51.95	1.48
228	KM 3	Do.	0.16	40.39	5.49	1.80	0.84	51.63	1.52
229	KM 4	Do.	0.20	38.53	7.33	1.98	0.53	49.57	2.08
230	KM 5	Do.	0.22	39.57	7.77	2.52	0.46	47.50	2.93
231	KM 6	Do.	0.16	40.56	6.20	1.55	0.43	49.21	1.46
232	KM 7	Do.	0.18	41.66	4.87	2.15	0.30	48.78	2.32
233	KM 8	Do.	0.15	40.37	6.27	0.44	0.01	51.24	1.05
234	KMA 1	Kiranur (Kiranur-Meenakshipuram 'A' Band)	0.07	40.62	5.72	1.29	0.33	51.29	1.58
235	KMA 2	Do.	0.13	39.63	7.21	1.27	0.40	49.91	1.57
236	KMA 3	Do.	0.18	40.70	6.17	1.76	0.25	47.03	2.44
237	KMA 4	Do.	0.21	40.11	6.26	2.56	0.27	47.01	3.39
238	KMA 5	Do.	0.13	39.14	6.42	1.17	0.36	51.16	2.06
239	T 1	Tarakampatti (Tarakampatti Band)	0.17	41.73	2.53	1.25	0.24	50.59	3.55
240	T 2 (South)	Do.	0.11	42.56	2.31	1.05	0.30	50.56	3.51
241	T 2 (North)	Do.	0.13	41.59	4.56	1.20	0.23	49.80	2.47
242	T 3 (South)	Do.	0.12	40.01	7.40	1.22	0.91	48.25	2.50
243	T 4	Do.	0.12	41.39	5.53	1.25	0.19	48.80	2.49

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INDEX TO LOCALITIES

S.No.	Locality	Latitude.	Longitude.	S.No.	Locality	Latitude.	Longitude.
1	Aiyampala-yam	10° 46' 21"	78° 9' 0"	24	Kuronikulathu-patti	10° 43' 30"	78° 10' 30"
2	Alambadi	10° 44' 23"	78° 16' 15"	25	Mallapuram	10° 40' 45"	78° 2' 37"
3	Allinagaram	10° 46' 30"	77° 54' 36"	26	Mamarathu-patti	10° 45' 30"	78° 15' 7"
4	Aravakurichi	10° 46' 30"	77° 54' 36"	27	Mailampatti	10° 44' 0"	78° 14' 30"
5	Ammapatti	10° 45' 12"	78° 14' 52"	28	Mavathur	10° 41' 2"	78° 14" 0"
6	Ayilur	10° 29' 7"	78° 7' 22"	29	Manaparai	10° 36' 30"	78° 25' 30"
7	Bodipatti	10° 42' 40"	78° 2' 37"	30	Mochaikayanur	10° 42' 37"	78° 7' 22"
8	Devaramalai	10° 44' ...	78° 10' ...	31	Muttampatti	10° 43' 40"	78° 8' 24"
9	Dholipatti	10° 43' 57"	78° 5' 45"	32	Palaiyam	10° 43' 30"	78° 8' 9"
10	Chintamani-patti	10° 43' 37"	78° 14' 0"	33	Palaviduthi	10° 38' 45"	78° 14' 15"
11	Gejjilampatti	10° 41' 53"	78° 3' ...	34	Panjapatti	10° 49' 45"	78° 18' 22"
12	Gujjiliyam-parai	10° 40' 45"	78° 7' 0"	35	Pannirpatti	10° 46' 37"	78° 20' 9"
13	Jagadabi	10° 50' 30"	78° 10' 0"	36	Salikkarpatti	10° 45' 0"	78° 10' 23"
14	Kadavur	10° 35' 38"	78° 11' 30"	37	Samipillaiyur	10° 46' 0"	78° 17' 22"
15	Kalingapatti	10° 45' 30"	78° 14' 58"	38	Servaikkaran-patti	10° 44' 15"	78° 6' 30"
16	Kalathur	10° 43' 41"	78° 6' 38"	39	Sulapuram	10° 42' 24"	78° 1' 38"
17	Kalutharigai-patti	10° 41' 45"	78° 15' 7"	40	Talayariyur	10° 44' 53"	78° 14' 11"
18	Kalingapatti	10° 45' 30"	78° 14' 58"	41	Tarakkampatti	10° 42' 30"	78° 14' 25"
19	Karur	10° 57' 30"	78° 5' 0"	42	Vaiyampatti	10° 32' 33"	78° 13' 45"
20	Karikkali	10° 42' 0"	75° 5' 45"	43	Varavanai	10° 44' 48"	78° 13' 37"
21	Kiranur	10° 47' 0"	78° 17' 0"	44	Vasavanayak-kamapatti	10° 43' 0"	78° 5' 15"
22	Kolinjivadi	10° 43' 3"	78° 6' 45"	45	Vendapatti	10° 47' 2"	78° 22' 3'
23	Kurumbapatti	10° 37' 18"	78° 14' 7"	46	Viralipatti	10° 45' 16"	78° 11' 52"

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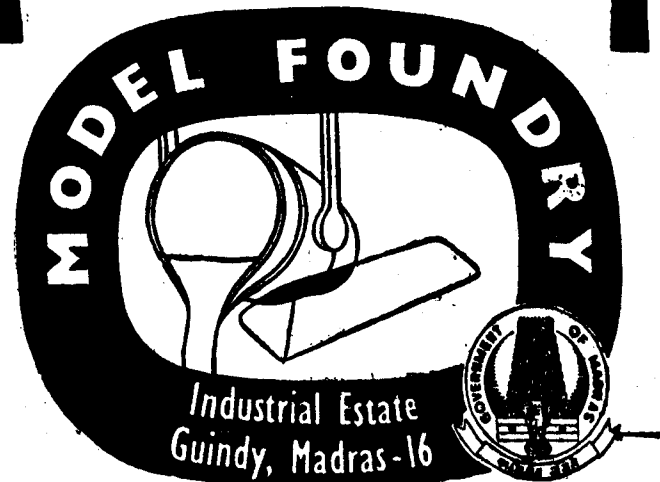
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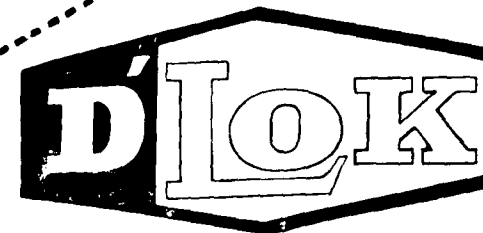


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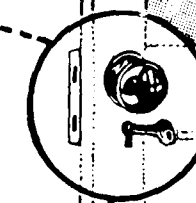
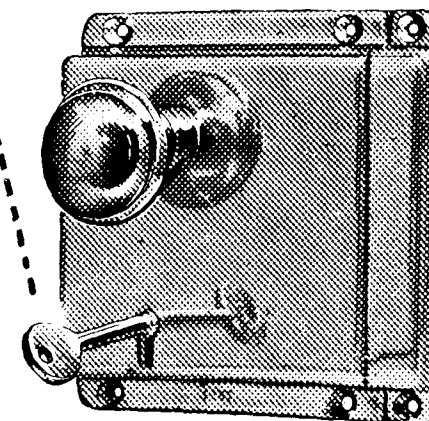
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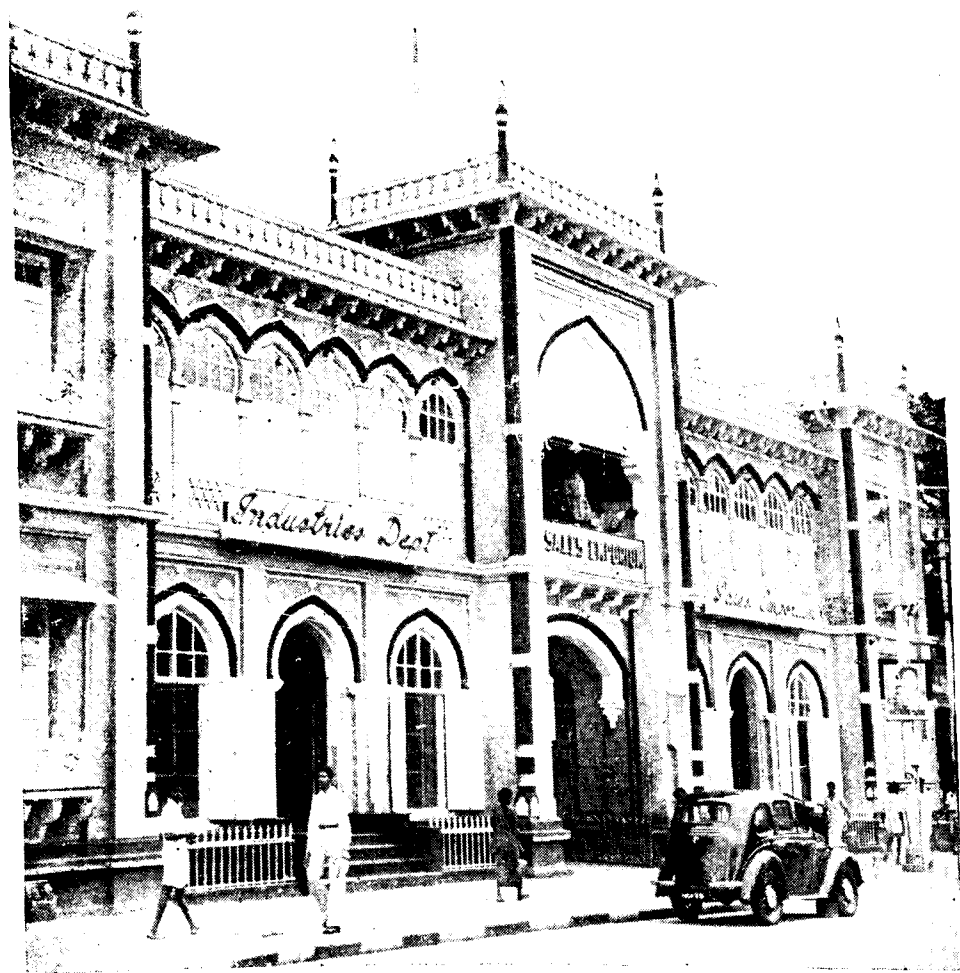


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