B. Tech. COURSE

I N

RUBBER PROCESSING AND TECHNOLOGY

P R O J E C T R E P O R T

O N

A SMALL SCALE UNIT

T O

MANUFACTURE RUBBER FLOORTILES

IN KERALA

DISSERTATION
SUBMITTED BY,
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UNI: REG: NO: 62
In Partial Fulfilment of
B. Tech Degree.

15th March 1977.

FOREWORD

This Project Report is prepared and submitted in the form of a dissertation unlike projections to procure loan to start new Industries. The primary mission, therefore, for obvious reasons, is the partial fulfilment of an academic technical degree. This I believe justifies the inclusion of information on technical aspects of product manufacture. I don't claim this report to be exhaustive and complete in all respects. However it is felt that the information contained therein is sufficient to start and operate the project.

My thanks and gratitude are due to several persons, who helped me in my endeavour. I express my appreciation and acknowledgement to all of them and particularly to Mr.C.M. George, Project Officer, Mr. E.V. Thomas Deputy Director, Mr. M. K. Balagopalan, Chemical Engineer, Mr. P. U. George, Cost Accountant, Rubber Research Institute of India and Rubber Board and Mr. K.S. Radhakrishnan, General Manager, Trivandrum Rubber Industries, Trivandrum.

KOTTAYAM. 9
15.3.1977.

PHILIP KURIAN.

C O N T E N T S

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SECTION. A.

INTRODUCTION

A.1 PROJECT

The proposed project is intended for the production 3 lakh numbers of rubber floor tiles of size 30 cm x 30 cm x 0.4 cm. per Annum.

A.2 GENERAL

Natural rubber attracts the builders and architect because of the way in which it minimises noice, absorbs vibrations and insulates against electricity, temperature variations and moisture. Rubber floors of well selected colours and pattern are often recommended as the ideal material in a variety of positions in building applications.

A. 3 PRODUCT DESCRIPTION

Rubber floortile is a moulded product manufactured by the compression moulding technique. The rubber flooring materials are available both in sheet and file form. The sizes of sheets and tiles available are given below.

a. Dimensions of Sheet Rubber flooring:

Thickness	Minimum length	Width
2.5	5.0	900
3 to 5	3.5	900
5 to 6.5	2.5	900

b. Dimensions of Rubber floor tiles

200 x 200 mm Thickness of tile vary

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300 x 300 mm from 3 mm to 5 mm

500 x 500 mm

Rubber floor tiles are available both in chipped and mottled designs.

The proposed project is intended for the production of chipped rubber floor tiles of 30 cm x 30 cm x 0.4 cm size. The weight of each tile is 450 gms.

The service life of the rubber flooring is usually related to the thickness of the flooring material and the traffic density. The durability of rubber floor is increased, if the tile is laid correctly and maintained carefully.

Laying and fixing of Rubber Tiles

Before commencing the laying operations, the subfloor shall be examined for evenness and dryness. The subfloor shall then be cleaned with a dry cloth. The layout of rubber flooring on the subfloor to be covered should be marked with guide lines. The rubber tiles shall be first laid for trial without using the adhesive according to the required layout. The adhesive shall be applied to the subfloor and the backside of the tile. When set sufficiently for laying, the adhesive will be tacky to touch, but will not mark the fingers. In general the adhesive will require half an hour for setting, it should not be left after setting for too long a period as the adhesive properties will be lost owing to dust films and other causes.

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When the adhesive is just tackfree, the rubber flooring tile shall be carefully taken and placed in position from one end onwards slowly so that the air will be completely squeezed out between the tile and the back-ground of the surface. After laying the tile in position it shall be pressed with suitable roller to develop proper contact with the sub-floor. The next tile with its back side applied with the adhesive shall be laid and fixed in exactly the same manner as the first tile was fixed. The tile shall be laid edge to edge so that there is minimum gap between joints. The alignment should be checked after laying of each row of tile is completed.

It is preferable to start laying of tiles from the centre of the room. Care should be taken not to slide them as it may result in adhesive being squeezed up between the joints. Any adhesive contaminating the face of the tile should be removed as the work proceeds, care being taken to avoid smearing of adjacent surfaces.

A minimum period of 24 hours shall be given after laying the rubber flooring for developing proper bond of adhesive. During this period, the flooring shall not be put to service. A wax emulsion polish shall be used for polishing the rubber floor.

A. 4. CLASSIFICATION

Rubber floor tiles are classified into five types with regard to the topping and backing.

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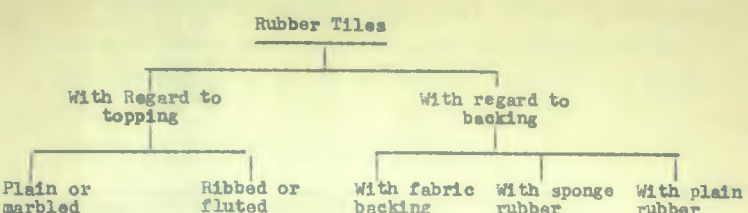

The proposed project is intended for the production of chipped Rubber floor tiles.

SECTION . B.

M A R K E T S U R V E Y

B. 1. USERS/CUSTOMER'S ANALYSIS

The rubber floor coverings are mainly used in domestic buildings and those of non-industrial character such as schools, hospitals, offices, where the traffic is expected to be essentially pedestrain and also in ships. Floor tiles made of antistatic rubber compounds are used for electric power stations. Ship builders and Building contractors are the main consumers of this product.

B. 2. MARKET SURVEY

Rubber floor tiles consume only a very little part of the total rubber consumed in the country. There are 15 units manufacturing rubber floor tiles in India. There are no units producing this item in Kerala, so home market can be reasonably exploited.

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Market Survey conducted shows that the mostly accepteed colour is yellow with white, black and pink colour patterns. Also the chipped tiles are more popular than plain or mottled tiles.

B.3. PROSPECTS OF THE PROPOSED PROJECT

Main competitors of rubber floor tiles are the mossaic tiles and PVC tiles. Even though the mossaic tiles has good appearance, they are non-resilient and hard. The good resilience obtained with soft PVC is balanced by its poor resistance to high point loads of furniture and footwear, plastics generally tend to melt and char when subjected to a lit of cigratte.

Rubber mossaic, which comprises of rubber chipping of selected colours are exactly like the mossaic tiles in appearance and better in service and properties.

Most of the good qualities of rubber like noice suppression, resilience and abrasion resistance make it superior for flooring. Rubber floor tiles are durable, impervious to water, does not harbour dirt and are immune from pest attack. The law specific gravity of rubber floor tiles make them suitable for multistoried buildings and ships. It is warmer and more comfortable than ordinary concrete floorings. A lit of cigratte generally allowed to self extinguish itself on the rubber surfaces causes no permanent damage or blistering. Rubber floorings are highly scratch and crack resistant than ordinary flooring materials.

Based on the above service properties and comparatively moderate price, rubber floor tiles are more advantageous than other flooring materials.

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Eventhough the proposed project is specially prepared for the production of rubber floortiles, any type of moulded item can be manufactured with the existing machinery. In the case of moulded items like Automobile bushes, Microcellular sheets, Straps etc. moulds are the only additional equipment required.

B.4. MARKETING MARKET

The main market places will be cities like Bombay, Madras, Delhi etc., where a large number of buildings are newly constructed and ship building places like Cochin and Visakapattanam.

SECTION. C.

P R O D U C T I O N M A N A G E M E N T

C. 1. LOCATION:

The basic considerations in the selection of Location of any type of factory are the following.

(i) A factory is relatively immobile

(ii) The impact of location on operating costs may vary upto 25% or even 50% between location.

(iii) Building costs, maintenance costs and taxes on land and building are large and fixed.

The important points to be considered in selecting a factory site for the production rubber floor tiles are the following.

(i) Availability of Raw materials

(ii) Availability of skilled and unskilled labour.

(iii) Availability of Power and Water

(iv) Facilities for transportation by rail and road.

(v) Availability of communication facilities

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Considering all these factors the best compromise offering almost all the above advantages is a place in Ernakulam district.

C.2. PLANT LAYOUT

In order to keep the operating costs at the minimum, the following points should be taken into account in determining the layout of the plant.

(i) Material handling is to the minimum

(ii) Room for further expansion

(iii) Ensure an easy flow of materials through the factory

A layout of the plant is shown in Appendix II.

C. 3. LAND AND BUILDING REQUIREMENTS

C. 3.1. Land:

Total land requirement is estimated as 5,000 Sq.ft. considering future expansion.

C. 3.2. Buildings

For finalising the requirements of built up area for the factory the following consideration are taken into account.

(i) The minimum built up area required for each machinery.

(ii) The expansion programme in the coming years.

(iii) Layout of the plant.

(iv) Space to be provided for keeping the maximum amount of inprocess inventories.

Based on these considerations the following areas are adopted for the specified machineries.

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Raw material storage	:	400 Sq.ft.
Millroom and stock storage	:	300 "
Blank preparation table and Hydraulic Press		250 "
Inspection and packing	:	200 "
Finished goods storage	:	225 "
Boiler	:	100 "
Office	:	125 "
Toilet and other facilities	:	100 "
Total	:	1700 Sq.ft.

C.4. REQUIREMENT OF RAW MATERIALS

The total estimated production per annum including process losses is 140 tonnes.

(i) Polymer: For the estimated production the firm requires 35320 Kgs. of natural rubber. Natural rubber is available from the local market at a price of Rs. 7.00 per Kg.

(ii) Fillers: The fillers used are whiting and soft clay. For the estimated production 21190 Kgs. of whiting and 70640 Kgs of soft clay are required.

(iii) Process Aids: Naphthenic oil and paraffin wax are used as process aids. 3530 Kgs of Naphthenic oil and 350 Kgs. of wax are required for the estimated production.

(iv) Curatives and other Chemicals: Accelerators required are MBTS and TMT. Soluble Sulphur is used as the crosslinking agent Zinc Oxide, Stearic acid combination is used for cure activation.

The other chemicals required are Antioxidant, colours, Titanium dioxide etc. The annual consumption and cost of these chemical are listed in Annexure II. A.

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The semicured rubber sheets of thickness 0.25 mm for making designs on tiles are obtained by issuing orders to factories which has facilities for calendering and autoclave curing. For the estimated production the firm requires 300 kgs. of this material/Annum.

Terms of Purchase of Raw materials

All negotiations related to purchase of raw materials are done through banks on a margin money of 30%, the bank will advance 70% for the purchase of materials. The amount has to be paid back from sales within 70 days with interest. The purchased materials will be kept in the bank's godown in the factory and materials are withdrawn on payment of cash whenever required.

C.5. MACHINERY SELECTION

The selection of machinery is most important since maximum utilization of machinery gives better return for the money spent. The selection of each machinery is based on the following considerations.

(i) The estimated capacity.
(ii) The accepted standard dimensions of the product.
(iii) The type of production.
(iv) Its effect on utilization of all other machinery.

Based on these considerations the following machineries are selected for the production of 500 tiles per shift.

C.5.1. Mixing mill

For mixing and warming of 466 kgs. of the compound per day this unit requires one 16"x42" mill working two shifts each.

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C.5.2. Hydraulic Press:

The accepted standard dimensions of the tile, curetime and number of tiles to be manufactured per day are taken into consideration for the selection of Press. Based on these considerations a 30"x30" hydraulic press with four daylight working in two shift is sufficient.

C.5.3. Moulds:

Sixteen tiles can be cured at the same time with the above hydraulic press, so eight double cavity moulds are required for curing.

C.5.4. Boiler:

Following factors are considered for the selection of Boiler.

(i) Amount of steam required to heat the press platens and moulds up to 150°C with steam at 150°C.

(ii) Amount of steam required to heat 0.4 cm. thick rubber sheet of specific heat 0.5.

(iii) Steam consumed for heating the mould and rubber for complete cure cycle.

(iv) 30% steam losses due to conduction and radiation.

Based on these considerations boiler with a capacity of 100 K/hr at a pressure of 100 K/cm^2 is selected.

In addition to the above mentioned machinery, the following are also essential.

Weighing balances:- A 50 K. dial balance for checking bulk arrivals of Raw materials and weighing rubber and filler for compounding. A 5 K dial balance for weighing the compounding ingredients.

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Water pump, cutting knifes etc.

A separate transformer is not required for the proposed plant since the installed power is only 74 HP.

Terms of Purchase of Machinery

(i) Quotations are made and satisfactory quotations are confirmed.

(ii) Price quoted are exclusive of packing, transportation costs, sales tax, excise duty etc.

(iii) 30% of the Price should be paid in advance and the remaining at the time of purchase.

(iv) Purchasor has the right for inspecting machinery.

(v) Supplier posses the right for cancellation, changing delivery time and price due to unforeseen reasons.

(vi) Warranty against manufacturing defects is assured.

(vii) Liabilities passes on to customer immediately after despatch and shortages should be notified within one week.

C.6. MANPOWER REQUIREMENT

The total manpower requirement are classified under the following heads.

1. Administrative Staff
2. Technical Staff
3. Labourers.

C.6. 1. Administrative Staff

The head of the administrative staff is the manager who handles the over all management of the factory. He should be a technologist as well so that the additional salary incurred on a separate technologist can be eluminated. The other staff involved in administration are given below:

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Job discription	Total Staff/ Shift	Number of Shift	Total Staff/ day
Manager cum Technologist	1	1	1
Sales Cum Accounts Officer	1	1	1
Clerk Cum Typist	1	1	1
Peon	1	1	1

C.6.2. Technical Personnel

The only one technical personnel is the production supervisor, who looks after the production. An experienced and able personnel should be selected for this purpose.

Job discription	Total Staff/ Shift	Number of Shift	Total Staff/ day
Production Supervisor	1	2	2

C.6.2. Labour requirement

The labourers are the people involved in the actual production operation. According to the skill and experience requirement they are classified into three classes skilled, semi-skilled and unskilled. Details of the distribution of labour for various job is given below:

Job discription	Number of Shift	Number of labourers/day		
		Skilled	Semi-skilled	Unskilled
1. Mixing and Warming	2	2		2
2. Blank preparation and curing	2	2	2	

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3. Boiler Operator	2	2		
4. Inspection, Packing and despatch	2	2		4
TOTAL		8	2	6

C.7. UTILITIES

The Utilities required are water, electricity and steam. The requirement of these are given below.

C.7. 1. Water requirement per day:

Water consumption in mixing	..	8000 Lrs.
Water consumed by Boiler	..	1000 Lrs.
Water required for employees amenities	..	5000 Lrs.
Total water requirement	..	14000 Lrs.

So water tank with a capacity of 15,000 lrs will serve the purpose

C.7.2. Power Requirement

Total Power consumption is as follows:

Machine		HP
1. 16"x42" Mill	..	60
2. 30"x30" Press (Power pack motor)	..	5
3. Boiler, 100 k/hr.	..	2
4. Water pump	..	4
5. Fan, Light and others	..	3
Total	..	74

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So, maximum kilowatt consumption	.. 55.18 KW
Assuming a load factor of 0.7,	
Power consumed per hour	.. 38.63 Kwh
∴ Total power consumption per day	.. 618.08 Kwh
Power consumption per Annum.	.. 1,85424 Kwh.
Power cost per Annum at the rate of Rs. 0.15/Kwh	.. Rs. 27810.00
Rounded off	Rs. 27800.00

C.7.3. Steam requirement

Steam requirement per hour	.. 45 Kg.
Assuming 300 working days,	
Steam requirement per Annum.	..216000 Kg.
Steam production per litre of furnace oil.	.. 10 Kg.
∴ Total oil consumption per Annum	.. 21600 Lr.
Cost of fuel per Annum at the rate of Rs. 1.10/lr.	.. Rs. 23760.00

SECTION. D.

DESCRIPTION OF THE PROCESS OF MANUFACTURE

D.1. PROCESS DETAILS

The flow chart of the process of manufacture of rubber floor tiles is given in Appendix I. The important steps in the manufacture of floor tiles are listed and discussed below:-

1. Compounding
2. Mixing
3. Maturing
4. Warming
5. Blank Preparation

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6. Moulding

7. Inspection and Finishing

8. Packing and despatch.

D. 1.1. Compounding

The choice of rubber and compounding ingredients depends upon the following requirements.

(i) High abrasion resistance

(ii) Satisfactory tear strength

(iii) Low material cost

(iv) Easy processing

(v) Better colour

(a) Polymer: For the best combination of the above properties it is necessary to use natural rubber.

(b) Filler : For getting good colour and appropriate hardness a mixture of whiting and clay is used as the filler.

(c) Process aids: Naphthenic oil is used as a process aid because of its non-staining nature.

(d) Accelerators: MBTS boosted with TMT is used for getting safe stock and shorter curing cycle.

(e) Antioxidant: Because of the non-staining character styrenated phenol is used as the antioxidant.

(f) Colours: Generally organic colours are preferred than inorganic types. It is desirable to include TiO_2 in the recipe to obtain desired shades.

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D. 1.2. Mixing

Rubber and other ingreadients are weighed out as per the predetermined formula and batch weight. Mixing is carried out at a specified Schedule. Mixing includes mastication, addition of ingreadients, blending and batch removal. The cooling water is passed through the mill to prevent Premature vulcanization. The sequence of mixing is mastication of rubber alone, followed by addition of antioxidant, activator, fillers and process aids. The curatives are added at the end of the mixing cycle. The mixing cycle is approximately 40 minutes for this compound. The mixed stock is then slabbed off and allowed to mature.

D.1.3. Maturing

The maturing period is usually 24 hrs. This improve the uniformity of the stock.

D.1.4. Warming

After maturing the batch is taken to the mill for approximately 5 minutes warming. It is advisable to blend different batches to ensure overall product uniformity.

D.1.5. Blank Preparation

The warmed stock is taken and blanks having the mould size are cut using a metal plate of 30 cm. x 30 cm. size. This ensures that the blanks are uniform in dimensions and weight so that the mould is correctly filled and wastage due to overflow or rejects due to under filling of the mould are avoided.

The semicured sheets are cut to small pieces and fixed on the top of the blank. Pieces with different colours are arranged in definite order to get good colour patterns.

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D.1.6. Moulding

The blank is loaded into the hot mould and the mould is inserted between the press platens. The platen is closed under pressure, then released and bumped up and down once or twice to remove entrapped air from the rubber stock and then full pressure is supplied. The cure time of the stock is 9 minutes at 150°C. The optimum time and temperature of cure has to be determined initially by trial.

After completion of cure the pressure is released, mould is taken out, opened and stripped out the product. The mould is cleaned, loaded with blank and inserted between the platens.

The product is deflashed, and sent for inspection, finishing and packing.

D.1.7. Inspection and finishing

The vulcanized tiles are inspected for the following defects.

(i) Blister

(ii) Crack

(iii) Rough surface

(iv) Hardness

(v) Discolouration

(vi) Correct dimensions.

The inspector may also finish the product by removing any residual flash or marks.

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D.1.8. Packing and dispatch

The rubber tiles are packed in wooden boxes slightly higher in size than that of the tile. The extreme endtiles are faced back to avoid damage to the surface of the tile.

D.2. PROCESS LOSS

Perfect elumination of the process losses costs more than what is lost by it. So the aim is to reduce the losses to economic level. The extent of losses depends on the product and process. The losses in the case of floor tiles are classified as follows.

(i) Handling losses: This include fly losses during transportation, handling, weighing and mixing

(ii) Losses during moulding: These involves losses due to flash and rejects of the product.

The effective losses due to all these reasons for the tiles may be taken as 4%.

D.3. QUALITY CONTROL AND SPECIFICATION

Quality is the surest foundation of success in an industrial venture. So proper care has to be taken to ensure better qualities at economic costs. The hardness of the tiles are checked using a durometer.

Hardness, compression set and water absorption resistance are the tests specified by I.S.I.

D.4. WASTE DISPOSAL

The main losses are occured due to flash cutting and product rejects. These waste materials could not be reworked since they are vulcanised. They can be used as a filler after grinding.

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SECTION. E.

DISTRIBUTION ARRANGEMENTS

Distribution of tiles outside the state will be done through train on F.O.R. basis. However inter-state distribution will be through Parcel agencies. With this distribution arrangement the firm could fulfill any order within two weeks from the date of receiving the order.

SECTION. F.

CAPITAL REQUIREMENT

The financial aspects of the firm can be given in the following heads.

1. Fixed Capital requirement
2. Working Capital requirement.
3. Gross capital requirement.
4. Total manufacturing cost.

F.1. FIXED CAPITAL REQUIREMENT

It is the sum of the expenses incurred for plant, Machinery, Land, building and Pre-operative expenses that can be capitalised. Pre-operative expenses are accounted for the costs incurred during the idle time of plant and machinery before regular production starts. The estimated fixed capital requirement in the above head are as follows:-

1. Land and building	..	67,250.00
2. Plant and Machinery	..	3,64,000.00
3. Pre-operative expenses	..	27,200.00
4. Miscellaneous fixed assets.	..	6,000.00
Total fixed capital	..	4,64,450.00

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Details of the fixed capital is shown in Annexure I

F.2. WORKING CAPITAL REQUIREMENT

The working Capital requirement depends on

(i) The duration for which raw material inventory has to be kept optimum so as to ensure un intrupted production.

(ii) The duration involved in purchasing, manufacturing, and selling.

(iii) The duration for which finished goods should be stocked to ensure uninterrupted supply.

(iv) The duration between selling of the goods and the payment to be received.

It also depends to a great extent on credit facilities available from the bank, from raw material suppliers and the credit terms between the firm and the customer.

The costs involved during this interval is called working capital. In the present case since all materials are available indeginiously one month raw material inventory is enough. The duration involved in manufacturing storing, selling and cash payment is usually two months for floor tiles. So the working capital may be taken as the total variable expenditure involved during the period of three months and are classified in the following heads.

1.	Raw material cost, cost of purchase, transportation, inventory carrying cost etc.		5,00,225.00
2.	Manufacturing cost		
	a. Cost of utilities	51,560	1,50,560.00
	b. Salaries and wages	99,000	
3.	Other over heads.		30,240.00
	Total working capital (Annual)		6,81,025.00
	Working Capital for 3 months.		1,70,260.00

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Details of the working capital component are given in Annexure II.

F.3. GROSS CAPITAL REQUIREMENT

It is the sum of the fixed capital requirement and working capital requirement and is the total investment on the scheme. Gross Capital requirement is given in Annexure III.

F.4. TOTAL MANUFACTURING COST

It comprises of all direct and indirect costs involved in the manufacturing operation. Annual manufacturing costs can be classified in the following heads

1. Raw material cost.
2. Personnel cost - Salaries and wages.
3. Utilities - It involves total cost incurred in power, water and steam.
4. Overhead expenses- It includes maintenance of building and machinery, insurance etc.
5. Other fixed costs and interest on loans - It consists of factory depreciations, interest on term loan and interest on working capital.

The Annual costs involved in these heads are as follows.

1.	Raw material cost.	.. 5,00,225.00
2.	Personnel cost	.. 99,000.00
3.	Utilities	.. 51,560.00
4.	Overhead expenses	.. 30,265.00
5.	Other fixed costs and interest on loans.	.. 1,04,207.00
	Total cost of Production	.. 7,85,260.00

Details of the total manufacturing costs are given in Annexure IV.

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SECTION . G.

FINANCING PLAN

G. 1. Before starting the Project Sufficient Planning should be done to finance it. Normally an interepreneur cannot meet all the financial requirements needed for an industry from hisown pocket. One can get financial assistance from the following sources.

1. State Small Industries Corporation

Offers machinery on hire purchase on a margin money deposit of 20%. Repayment starts after two years and should be complete within 7 years. It offers special concessions to technically qualified persons. Interest 7.5%.

2. Kerala Employment promotion Corporation

They provide 95% of the cost involved in purchasing, servicing, taxes, insurance and transportation of all machinery and equipment as loan on an interest of 7.5%

3. State financial Corporation

Offers financial assistance as cash to small and medium scale industries. Provide 100% machinery cost, 75% building cost and 40% working capital at 7 to 10% interest. Repayment to be completed in 10 to 12 years.

4. Commercial and Co-operative banks

Nationalised banks provide cash loans for machinery, loans are given on 25% margin money and 12% to 16% interest.

For working capital any amount can be drawn. Payable period is 3 years.

Key loans are made against the pledge of raw materials at 16% interest.

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Details of the terms and conditions of financial assistance can be obtained from concerned sources.

6.2. FINANCING OF THE PROJECT

Gross Capital of Rs. 634700 is proposed to be realised in the following manner.

6.2.1. Borrowing

The whole machinery cost (Rs. 297150) and 75% of the land and building cost (Rs. 50850) are obtained from Kerala Financial Corporation at an interest of 7.5%.

100% of the working capital (Rs. 170260) is supposed to be taken from a nationalised bank. Interest is 15%.

6.2.2. Own funds

The balance of the total capital is contributed by the entrepreneur. This is Rs. 116450. This amount of the fixed capital is used for preliminary and pre-operative expenses.

1.	Borrowing	
	Loan from KFC	Rs. 3,48,000.00
	Loan from Nationalised bank	Rs. 1,70,260.00
2.	Own fund	Rs. 1,16,450.00
	TOTAL	Rs. 6,34,710.00

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SECTION . H.

PRODUCT PRICING

There are three strategies for pricing a product in the domestic market. They are:-

(i) Cost oriented pricing

(ii) Competition Oriented Pricing

(iii) Demand Oriented pricing

Which one of these strategies should be adopted for a particular product depends on various considerations. For rubber floor tiles cost oriented pricing is more relevant. The price of floor tile produced is fixed as Rs. 3.50 per tile.

SECTION . I.

PROFITABILITY

Financial viability of the Project can be gauged through profitability. The following factors are examined in this.

1. Rate of return on own capital
2. Rate of return on capital employed
3. Percentage Profit on Sales turnover.

I.1. RATE OF RETURN ON OWN CAPITAL

Own Capital	1,18,450.00
Net Profit.	1,00,870.00
Rate of return on own capital	86.56% (0.8656)

I.2. RATE OF RETURN ON CAPITAL EMPLOYED

Gross Capital	6,34,710.00
Net Profit	1,00,870.00
Rate of return on Capital employed	15.89% (0.1589)

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I. 3. PROFIT ON SALES TURNOVER

Annual receipts from sales	..	10,50,000.00
Net Profit	..	1,00,870.00
% Profit on sales turnover.	..	9.61% (0.0961)

I.4. BREAKEVEN ANALYSIS

Breakeven quantity is that quantity which if produced and sold will give neither a profit nor a loss.

$$B.E. = \frac{F}{P-V}$$

Where F = Annual fixed costs.
P = Price per tile
V = Variable cost per tile.

Total sale of Product	10,50,000.00
∴ Price per tile.	N. 3.50

The total variable cost

(i)	Raw material	5,00,225.00
(ii)	Utilities	51,560.00
(iii)	Direct labour.	76,560.00
(iv)	Distribution cost.	63,000.00
	Total	6,91,345.00
	Variable cost per tile	N. 2.30

Fixed Cost (F)

(Cost of Production + distribution cost) - Variable cost
2,11,035.00

Calculation

$$B.E. = \frac{F}{P-V} = \frac{2,11,035}{3.50 - 2.30}$$

= 1,75,900 tiles/annum.

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SECTION . J.

ECONOMIC VIABILITY

J.1. INTEREST COMMITMENTS

7.5% Interest on loan from K.F.C	₹	26,100.00
16% Interest on working capital from banks	₹	27,240.00
Total		53,340.00

J.2. ABILITY OF PAY BACK BORROWED FUNDS

The terms loan has to be paid back with in the prescribed time. The payback period is to be kept at the minimum time possible to save the interest to be paid year after year. Once the pay back is started, year after year the ability to pay back the borrowing increases since cash inflows are higher due to decreased interests.

J.3. PAYBACK PERIOD

1. Annual Net Profit	1,00,870.00
2. Depreciation	50,870.00
Available surplus (1+2)	1,51,740.00
3. Less Drawings	35,740.00
4. Amount used for repayment	1,16,000.00
Term loan to be paid back	3,48,000.00

Payback period 3 years.

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SECTION.K.

S O C I A L B E N E F I T S

Any industrial concern is an asset to the nation . A small scale industry does certain special services to a developing country like India.

(1) Larger employment with less investment

(2) Mobilises local resources, Skills and Savings and effects a wider dispersion of wealth.

(3) Contributes to nation's revenue earning through taxes, excise duty etc.

(4) Develops entreprenurship and entrepreneurial skills.

(5) Personal profit to entrepreneur.

SECTION. L.

C O N C L U S I O N

The proposed project can be concluded in the following manner.

1.	Total fixed investment	Rs. 4,64,450.00
2.	Working Capital required	Rs. 1,70,260.00
3.	Total investment	Rs. 6,34,710.00
4.	Working shift/day	Two
5.	Personnel Required	22
6.	Annual production	3,00,000 tiles
7.	Annual Sales	Rs.10,50,000
8.	Break even production	1,75,800 tiles
9.	Rate of return on investment	15.89%

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ANNEXURES

ANNEXURE I. FIXED ASSETS.

	Item	Cost, Rs.
1.	Land and Building	67,250.00
2.	Plant and Machinery	3,64,000.00
3.	Pre-operative expenses	27,200.00
4.	Miscellanious fixed assets	6,000.00
	Total fixed Capital	4,64,450.000

ANNEXURE I.A. Land and Buliding

	Item	Cost, Rs.
1.	Cost of 5000 Sqft of land @ Rs. 0.75 per Sqft.	3,750.00
2.	Cost of 1700 Sqft of built up area @ Rs. 35 per Sqft	59,500.00
3.	Site leveling, fencing, approchroad etc.	2,000.00
4.	Over head tank (15,000 Lrs Capacity)	2,000.00
	Total	67,250.00

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ANNEXURE I. B. Plant and Machinery

	Item	Price Rs.
1.	Mixing mill (16" x 42") with all accessories	1,55,000.00
2.	Hydraulic Press (30"x30" size 4 day light) with Power pack motor	75,000.00
3.	Moulds	4,000.00
4.	Boiler (100 kg/hr) with softening Plant and other accessories	40,000.00
5.	Weighing balance	
	(a) 50 kg. dial balance	2,500.00
	(b) 5 kg. dial balance	1,500.00
6.	Water Pump	2,500.00
7.	Hardness tester	1,000.00
8.	Miscellaneous equipments	1,500.00
	Total	2,83,000.00
	5% Provision for Price escalation	14,150.00
	Total	2,97,150.00
	Installation, transportation etc. 10%	29,715.00
	Sale Tax, at 7.5%	22,286.00
	Distribution of power, lighting cabling etc., at 5%	14,857.00
	TOTAL	3,64,008.00
	Rounded off	3,64,000.00

Contd.....30

ANNEXURE I. C. Pre-Operative Expenses

Item	Cost Rs.
1. Interest on loan @ 7.5% for 6 months	13,050.00
2. Establishment	3,000.00
3. Property taxes	500.00
4. Travelling Expenses	1,500.00
5. Postage, telephone, telegram and legal charges	1,000.00
6. Advertisement, Printing and typing	1,750.00
7. Building Insurance	500.00
8. Provision for meeting unexpected increase in building cost 10%	5,900.00
T O T A L	27,200.00

ANNEXURE I. D. Miscellaneous fixed assets

Item	Cost Rs.
1. Equipment for supplying and distribution of water and steam	1,000.00
2. Cutting knife, scissors and other tools	500.00
3. Fire fighting equipment	2,000.00
4. Office machineries and furniture	2,500.00
T O T A L	6,000.00

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ANNEXURE II WORKING CAPITAL

	Item	Cost Rs.
1	Total Raw material cost	5,00,225.00
2	Manufacturing Cost	1,50,560.00
3	Other overheads.	30,240.00
	Total working capital (Annual)	6,81,025.00
	Working Capital (3 months)	1,70,256.00
	Rounded off	1,70,260.00

ANNEXURE II. A. Raw material Cost (Annual)

	Material	Annual Requirement Kgs.	Price/ Kg.	Cost/Annum Rs.
1	Natural Rubber	35,320	7.00	2,47,240.00
2	Zinc Oxide	1,413	14.50	20,480.00
3	Stearic Acid	532	12.00	6,360.00
4	Styrenated phenol	353	19.80	6,990.00
5	Paraffin Wax	353	3.00	1,060.00
6	Soft Clay	70,640	0.25	17,660.00
7	Whiting	21,190	0.40	8,470.00
8	Naphthenic Oil	3,532	10.00	35,320.00
9	Ethylene Glycol	530	10.00	5,300.00
10	Sulphur	970	2.00	1,940.00
11	MBTS	440	28.40	12,540.00

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12	TMT	53	27.60	1,460.00
13	TiO_2	7,064	10.00	70,640.00
14	Colour	88	100.00	8,800.00
	TOTAL			4,44,260.00

Cost of 300 Kgs. of Semi cured sheet of thickness 0.25 mm @ Rs. 7.00/Kg	21,000.00
Packing material cost	15,000.00
Cost of purchasing, transportation, inspection, ware housing etc.	20,000.00
Total cost of Raw material	5,00,225.00

ANNEXURE II. B. Manufacturing Cost (Annual)

	Item	Cost Rs.
1	Cost of Utilities	51,560.00
2	Salaries and wages	99,000.00
	T O T A L	1,50,560.00

Contd.....33

ANNEXURE II B.1 Cost of Utilities

	Item	Cost Rs
1	Cost of 1,85,424 Kwh power @ Rs.0.15/Kwh	27,800.00
2	Cost of 21,600 lrs of furnance oil at the rate of Rs. 1.10/lr.	23,760.00
	T O T A L	51,560.00

ANNEXURE II.B.2. Salaries and wages

a. Salaries of administrative and technical Staff

	Position	No. of Shift.	Total personnel per day	Monthly Salary/ Staff Rs.	Total Salary Rs.
1	Manager cum Technologist	1	1	800.00	800.00
2	Sales cum Accounts Officer	1	1	450.00	450.00
3	Clerk Cum Typist	1	1	300.00	300.00
4	Peon	1	1	150.00	150.00
5	Production Supervisor	2	2	450.00	900.00
	T O T A L				2,600.00

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b. Wages of labourers

	Position	No. of Shift	Total workers per day	Wages/ month K	Total Salaries/ month K
1	Skilled	2	8	350.00	2,800.00
2	Semiskilled	2	2	300.00	600.00
3	Unskilled	2	6	250.00	1,500.00
		T O T A L			4,900.00
	Total Salaries and wages per month				7,500.00
	Total salaries and wages per Annum				90,000.00
	Benefits and allowances @ 10%				9,000.00
	Total Salaries and wages (Including benefits)				99,000.00

Contd.....35

ANNEXURE II. C. Other Overheads

	Item	Cost Rs.
1	Repairs and maintenance of building at 1%	595.00
2	Repairs and maintenance of machinery at 5%	14,857.00
3	Travelling and advertising expenses	2,000.00
4	Insurance; 2% on fixed Capital	9,290.00
5	Property taxes	1,000.00
6	Stationery, Postage and Telephone	1,500.00
7	Miscellaneous	1,000.00
	Total overheads	30,240.00

ANNEXURE III GROSS CAPITAL REQUIREMENT

	Item	Cost Rs.
1	Total fixed capital requirement	4,64,450.00
2	Total Working Capital requirement	1,70,260.00
	Gross Capital requirement	6,34,710.00

Contd.....36

ANNEXURE IV. TOTAL COST OF PRODUCTION (Annual)

	Item	Cost Rs.
1	Raw material cost (Annexure II.A)	5,00,225.00
2	Utilities (Annexure II.B.1	51,560.00
3	Personnel cost (Annexure II.B.2)	99,000.00
4	Overheads (Annexure II.C)	30,265.00
5	Other fixed costs and interest on loans (Annexure IV.A)	1,04,210.00
	Total Cost of Production	7,35,260.00

ANNEXURE IV.A. Other fixed costs and interest on Loans

	Item	Cost Rs.
	a. Depreciation:	
1	Depreciation on machinery @ 15%	44,572.00
2	Depreciation on building @ 5%	2,975.00
3	Depreciation on other fixed assets and Pre-operative expenses @ 10%	3,320.00
	b. Interest on loan	
1	Interest on working capital @ 16%	27,240.00
2	Interest on estimated term loan @ 7.5%	26,100.00
	T O T A L	1,04,207.00
	Rounded off	1,04,210.00

Contd....3

ANNEXURE V. SALES INCOME AND PROFIT

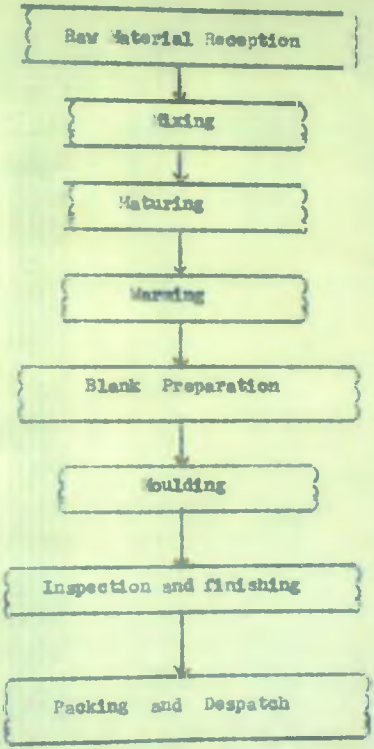
		Rs
Sales :		
3 lakh Rubber floor tiles @ Rs.3.50 per tile		10,50,000.00
Less Selling cost (Freight distribution etc) @ 6%		63,000.00
		9,87,000.00
Less : Cost of production		7,85,260.00
	Gross Profit.	2,01,740.00
Less Tax incidence @ 50%		1,00,870.00
	Net Profit.	1,00,870.00

Contd.....38

APPENDICES

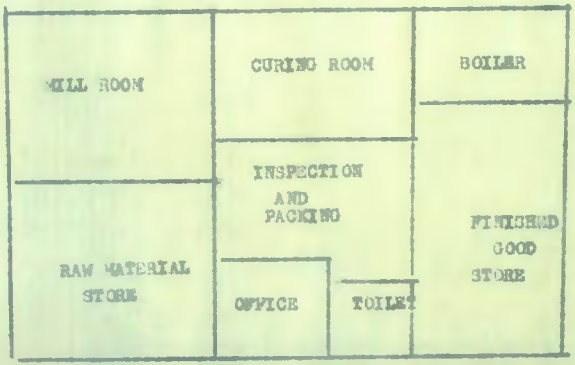
APPENDIX. I

FLOW DIAGRAM OF THE PROCESS OF MANUFACTURE



APPENDIX II

PLANT LAYOUT



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APPENDIX. III

COMPOUNDING FORMULATION

	Materials	Parts by weight, gms.
1	Natural Rubber	100.0
2	Zinc Oxide	4.0
3	Stearic Acid	1.5
4	Styrenated Phenol	1.0
5	Paraffin Wax	1.0
6	Whiting	60.0
7	Soft clay	200.0
8	Naphthenic Oil	10.0
9	Ethylene Glycol	1.5
10	Sulphur	2.75
11	MBTS	1.2
12	TMT	0.15
13	Titanium dioxide	20.0
14	Colour	0.25

Cure time 9 minutes at 150°C

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APPENDIX. IV

TOTAL STAFF AND LABOUR REQUIREMENT

	Catagory	Total Staff/day
1	Administrative Staff	4
2	Technical Staff	2
3	Labourers	16
	T O T A L	22

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APPENDIX V

TOTAL COMPOUND REQUIREMENT

Estimated production per Annum @,	3,00,000 tiles
Total weight of 3 lakh number of tiles @ 450 gms. per tile	135 tonnes
Process loss, 4%	5 tonnes
T O T A L COMPOUND REQUIREMENT	140 Tonnes

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APPENDIX VI

LIST OF RAW MATERIAL SUPPLIERS

1. Natural Rubber - Available in the local market

2. Accelerators and Antioxidants

   i) I.C.I. (India) Ltd.
   Mishra, Hoogly Dist.
   West Bengal.

   ii) Bayer India Ltd.,
   Thane, Bombay.

   iii) Hindia Chemicals Ltd.
   Wakefield House,
   11, Sprott Road,
   Ballard Estate, Bombay. 1.

3. Zinc Oxide

   i) Kamani Metalic Oxides Pvt. Ltd.,
   Kamani Chambers, Nicol Road,
   Bombay. 1.

   ii) Bajaj Minerals,
   Bharat B/2,
   170-191, Sion East,
   Bombay. 22.

   iii) Para Chemicals,
   Ernakulam,
   Cochin. 1.

4. Stearic Acid

   i) Blow Chem Enterprises,
   9/63, Lalakutty Street,
   Madras. 3.

Contd....44

ii) Godrej Soaps Pvt. Ltd.
Eastern Express Highway,
Vikhroli, Bombay. 79.

5. Paraffin Wax

Aristo enterprises,
10th Khetwadi,
Bombay. 4.

6. Nephthenic Oil

Hollawala Associates,
12, Hill Officers Colony,
Ashram Road,
Navarangpura,
Ahamedabad. 9.

7. Sulphur

Asiatic Chemicals Co.
71, Canning Street,
Calcutta. 1.

8. Titanium dioxide

i) Travancore Titanium Products Ltd.,
P.B. No. 64, Trivandrum.

ii) Paramount Commercial Corporation,
12-B, Fort Chambers,
Dean Lane, Fort-Bombay. 1.

9. Mineral Fillers

Hindustan Chinaclay Works,
Pappinisseri, Cannanore,
Kerala.

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APPENDIX VII

LIST OF MACHINERY SUPPLIERS

1. Mixing Mills and Presses

   i) Bohal Engineering Works,
   L.B.S. Marg,
   Bhandup, Bombay. 78.

   ii) Richardson and Crudas Ltd.,
   Byculla Iron Works,
   Sir J.J. Road,
   Bombay. 8.

   iii) Kalachandra Iron and Steel Works,
   Chingavanam, Kottayam, Kerala.

   iv) Ekonech Engineers,
   Govt. Industrial Estate,
   Kandivili West,
   Bombay. 67.

   v) Indian Expeller Works Pvt. Ltd.,
   A/4, Baroda Industrial Estate,
   Baroda, Ahmedabad.

2. Boiler

   Varsha Boilers Pvt. Ltd.,
   Green House, Bombay. 1.

3. Testing equipments

   i) Blue Steel Engineers Pvt. Ltd.,
   144 A-Z Industrial Estate,
   Ferguson Road, Bombay. 3.

   ii) Hiroshima Instruments,
   Bombay. 67.

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