U N I V E R S I T Y O F C O C H I N

B. Tech Course

In Rubber Processing And Technology

PROJECT REPORT ON

A SMALL SCALE SOLID TYRE MANUFACTURING UNIT IN KERALA.

------ O ------

DISSERTATION

Submitted

by

K.U. UNNI MOHIYUDDEEN, B.Sc.

University Reg.No.67

In Partial fulfilment

of

B.Tech. Degree.

15th March, 1977.

F O R E W O R D

This Project Report is prepared and submitted in the form of a dissertation unlike projects to procure loans to start new industries. The primary mission is the partial fulfilment of my academic course. In this context, I belive that the inclusion of technical informations can be justified.

I do not claim this report to be an exhaustive and complete one, in all aspects. However I hope that this will serve as a guideline for action to be followed.

My thanks are due to all, who have helped me in my endeavour and in particular to Mr. C.M. George, Project Officer, Mr.K.V.-Thomas, Deputy Director, Mr. M.K. Balagopalan Nair, Chemical Engineer and Mr. P.U. George, Cost Accountant of Rubber Board and Rubber Research Institute of India.

KOTTAYAM - 9,
15th MARCH 1977.

UNNI MOHIYUDDEEN

Section	CONTENTS	Page.
A	Introduction	1
B	Market survey	4
C	Production Requirements	6
D	Process of Manufacture	12
E	Distribution Arrangements	18
F	Capital Requirements	19
G	Financing Plan	22
H	Profitability	20
I	Economic viability	21
J	Social Benefits.	23
	Conclusion	24
	Annexures	25
	Appendicegs	36

---------(- 0 -)---------

SECTION. A

INTRODUCTION.

Material handling may account for between 15 to 85% of the cost of an article. The sophisticated vehicles for material handling range from the humble wheeled trolley to giant fork-lift trucks. Between these extremes there are platform trucks, pallet-trucks, hand trucks and industrial tractors & trailers - all of them usually fitted with solid rubber tyres. Other important uses of solid tyres are for armoured fighting vehicles, mine cages, overhead cranes and aircraft tail - wheels. This project proposes a small scale industry manufacturing solid tyres for hand trucks and trolleys.

A.1. History and main object of the project.

Commercial vehicles usually had either metal wheel or solid rubber tyres. Later when the development from canvas to cord as a casing material for pneumatic tyres improved, their application to heavier kind of vehicles increased. But today because of its unique performance between the wheel and the ground, solid tyres have come back to the scene. Now it is used in cases where pneumatic tyre is unsuitable. Development in the field is progressing and Industrial cushion tyres is a new comer in the field.

The main object of the project is to produce solid tyres of the following types and targets, inorder to meet the possible increase in demand for them.

1. Solid tyres for hand trucks 160 Nos/day.
2. Solid tyres for trolleys. 160 Nos/day.

contd...2.

A.2. Product description and specification.

Solid tyre consists of a vulcanised rubber tread firmly affixed to the outer periphery of a metal wheel.

Basically there are two types. viz, the pressed-on band and bonded direct type. Band tyres consists of a metal base band with an outer rubber tread, which after vulcanisation is bonded directly to the band by processes designed to ensure maximum adhersion and service life. Bonded tyres have the tread rubber bonded directly to the wheel and rerubbering can be done only by the truck manufacturer.

At present there are wide range of standard sizes of solid tyres, geared to the demands of the market. The tyre outer diameter ranges from 4" to 56", tread width vary from 1" to 16" and load capacity vary from 25 kg to about 20,000 kg. They are designed for vehicles running at a speed of 6 - 10 mph. The temperature development of solid tyres is at a range of 75 - 185°c. The hardness of the tyre range from 70 - 75 IRHD. The load carrying capacity, which is the main cryterion in designing solid tyres can be judged from, 1. calculations based on the equation, 2. Acutual loading data and 3. from the Nomograph. The load rating depends on(a)tyre width, (b) tyre thickness and (c) tyre outer diameter. The specification of the products under evaluation are discribed below.

Nomograph is a figurative representation which gives easy way of calculating the dimensions of tyre for a given load and vice versa. Nomograph is developed using the equation $L = K (W - 0.5AT)D^{0.75}T^{0.33}$

contd...3.

Where L = load, W = tyre width, D = outer diameter, T = $\frac{OD - ID}{2}$ -0.5

and K is a constant equal to 68 for normal case.

Specifications.

1. Hand truck tyres:

tread width.	75 mm.
tread thickness	37.5 mm.
tyre outer diameter	275 mm.
load carrying capacity	200 kg/tyre, max.
type.	Pressed-on.
Pattern	Plain.

2. Trolley tyres.

tread width.	50 mm
tread thickness	37.5 mm
outer diameter	200 mm.
load carrying capacity	75 kg/tyre, max.
type	pressed-on.
Pattern	Plain.

A.3. Evaluation of the prospects.

The major field of application of solid tyres is various industries where there is handling of materials. The various industries today prefers solid tyres for their trucks and carts over metal wheels, because it suppresses noise, protects the factory floor space from damage and reduces physical exertion. Actually there is no substitute for solid tyres in these respects. The application of solid tyres, particularly the small ones does not confine to factories only.

contd..4.

It also finds application in port, railway station and villages for a wide variety of purposes too numerous to mention.

The ever increasing demand and more and more sophistication for material handling equipments gives an impetus to the solid tyre industry.

SECTION. B

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

B.1. Users and Consumer's Analysis.

Probably the most important application of solid tyres today is for the various kinds of trucks and trailers. Flow of inprocess materials in the factory, from raw materials to finished goods is made easy by using these equipments. Manufacturers of material handling equipments are the largest users of solid tyres, since the majority of material handling equipments are run on solid tyres. Hand trucks are universal and used for handling of bulky and relatively heavy materials, where as trolleys are employed in carrying relatively lighter materials.

The available statistics on the production of solid tyres themselves is incomplete. But based on the performances of the existing units and based on the enquiries made among the dealers, it is clear that there is good demand for the product.

B.2. Specific Market:

The main market areas are states like Maharastra, Panjab, Tamil nad and West Bengal, where industries are clustered. A good amount of local market is also available. The work can also be undertaken on specific orders according to the demand.

contd..5.

B.3. Geographical Extent of the market.

The export and import statistics of the solid tyres during the last few years are,

Import		Export.	
Years	Value '000Rs.	Year	Value'000Rs.
67 - 68	1428	1965	315
68 - 69	3142	66	778
69 - 70	2140	67	1996
70 - 71	3740	68	355
71 - 72	4842	69	901
72 - 73	5398	70	132
73 - 74	9994	71	87
74 - 75	12942		

While the import is steadily increasing year after year, the export value shows a wide fluctuation over the years, and a general decreasing trend for the last 3 years. This clearly reveals that the present production of these solid tyres are insufficient to satisfy the internal demand, and so there is good domestic market potential for solid tyres. Hence the product is easily sold within the country. But at all times the possibilities of export should be scanned.

B.4. Competitive Products:

The competitive products in this field are metal wheels, wooden wheels and pneumatic tyre. These products does not in any way affect the proposed industry, since, (1) Solid tyres minimise the jolts and jerks that are normally associated with the present set of wheels, by absorbing shock. Thus they avoid road damage. It increases the load bearing capacity and at the same time reduces driving force, (2) While the pneumatic tyre solves the problem of road damage, it has certain limitations.(i)It is too costly, (ii) it should be used on paved roads, othervice it is vulnerable to puncture.

contd..6.

3) Solid tyres a re increasingly robust.

4) Since the solid tyres will enable to carry heavier loads, the increased efficiency will be an incentive for the vehicle owners to switch over to rubber tyred wheels.

There is not a single unit in Kerala producing solid tyres at present. Bestowed with cheap and abundant power, labour and raw materials supplies, a new enterpreneur from Kerala will be in a commanding position to start a unit for producing this item.

SECTION. C.

P R O D U C T I O N R E Q U I R E M E N T S

C.1. LOCATION.

Decision of location is very important in any industrial undertaking, since (i) A plant is relatively immobile and once it is established, it is permanent. (ii) Location has a considerable influence on operating cost and productivity. When selecting the site for a factory, the following factors are to be taken into account.

1. Availability of electricity, water and fuel.
2. Nearness to high volume raw materials.
3. Facilities for transportation (Rail, Road and Water).
4. Availability of skilled and unskilled labour.
5. Proximity to market.
6. Satisfactory climate and surroundings.

The proposed unit can be located where solid tyres can be easily marketed or raw materials are easily available. As the market for solid tyres is not concentrated in a particular area, the best

contd..7.

suited location seems to be Kerala, a state blessed with ample supply of main raw materials, power and water. Many factories outside Kerala are seriously affected by powercut. An Industrial Estate in Kerala is selected for implementing the proposed project because of the following advantages there.

a. Land and Building are available at a nominal rent.
b. Undue delay in getting power and water connections can be avoided.
c. Reduced overhead expenses to the minimum.
d. Facilities available for transport and communication.
e. Availability of labour in the grade, quality needed.
f. Facilities for training labourers at less cost, and
g. Facilities for observations and consultations.

C.2. FIXED ASSETS

A. LAND AND BUILDING

Land and Building are rented from an appropriate Industrial Estate. The built up area required for the plant is estimated as shown in table C-1.

Table C-1.

Sl.No.	Section	Area. sq.ft.
1.	Rawmaterial storage & compounding.	450
2.	Mixing and Warming	450
3.	Blank preparation & Moulding.	390
4.	Inspection and storage.	360
5.	Toilet.	50
6.	Office	150
7.	Rest room	100
8.	Boiler.	150
	Total.	2100

contd...8.

So a B type Building in an Industrial Estate will suffice for the plant. A suitable layout for the plant is given in Appendix II.

B. PLANT AND MACHINERY.

The details of the machinery required (their number and costs) for the production of solid tyres are given in ~~Apendix~~ Annexure I.1. The main items of machinery are the following.

1. Mixing mill of size 14" x 36" with a batch weight capacity of 25 - 30 kgs with chilled cast iron rollers, driven by 40 HP motor, reduction gear and water cooling arrangements. Utilised mainly for mastication and mixing purposes.
2. Mixing mill of size 12" x 30" batch capacity approximately 16 kgs, 30HP motor etc. Mainly utilized for warming up the mixed up stock.
3. A boiler of 150 kg capacity, with water softener and accessaries.
4. 3-daylight hydraulic press of platen size 30" x 30", working with a 5 HP motor, meant for curing hand truck tyres.
5. 3-day light hydraulic press, 24" x 24" size, with 4 HP motor used for curing trolley tyres.
6. Suitably designed moulds for and truck tyres and trolley tyres.

The total cost of machinery is worked out to be Rs. 5,25,800.

Details of other fixed expenses and pre-operative expenses are described in Annextures I.2 and I.3. respectivejy.

Terms of purchase of Machinery.

1. Quatations are made and satisfactory quotations are confirmed.
2. Price quoted are exclusive of packing, transporation costs, sales tax, excise duty etc.
3. 30% of the price should be paid in advance and the remaining at the time of purchase. Payment can be done through banks.
4. Purchaser has the right for inspecting machinery.
5. Supplier has the right for cancellation, changing delivery time and price due to unforeseen reasons.
6. Warranty against manufacturing defects is assured.
7. Shortages should be notified with in one week after reception.

The sources of supply of machineries are given in Appendix IIIB

contd..9.

C.3. WORKING CAPITAL REQUIREMENTS

C.3.1. RAW MATERIAL REQUIREMENTS.

The basic raw materials required for production are Natural Rubber, Styren Butadiene Rubber and other important chemicals like stearic acid, zinc oxide, china clay, process aids, fillers, like stearic antidegradants and curatives.

Details of the raw material requirement are given in AnnexureII.1. Raw materials requirements are calculated based on standard formulation for solid tyre, given in table C-2, Current price of raw materials, and assuming the standard sizes of solid tyres and production pattern.

Table C-2.

Sl. No	Material	Formulation PHR
1.	N·R	60 .0
2.	SBR	40 .0
3.	Zinc Oxide	4 .0
4.	Stearic acid	1 .5
5.	HAF Black	25 .0
6.	SRF Black	25 .0
7.	PBN	1 .0
8.	CBS	0 .85
9.	TMT	0 .15
10.	Sulphur	2 .25
11.	China clay	100 .0
12.	Diethylene glycol	1 .5
13.	Aromatic oil	5 .0
	Total.	266 .25

The compound required for the two types of solid tyres assuming a 5% waste is calculated to be 220.5 tons /year.

The ingredients given in the formulation are possible to be

substituted with other ingredients also. A detailed description of the choice of ingredients is given in section D, dealing with process of manufacture. The choice depends on the availability, cost and quality of materials and service requirements of the end product.

Sources of supply:

All the raw materials are available indigenously. Several agents are available in the country to supply rubber chemicals. The rources of supply of different rawmaterials that can be used are given in Appendix. III.A.

Terms of Purchase.

All negotiations are done through banks. On a margin money of 30%, the bank will spend 70% for the purchase of materials. The amount has to be paid back in 70 days with interest. The purchased material will be kept in the banks godawn, and are withdrawn in small quantities on payment of cash.

C.3.2. MANPOWER REQUIREMENTS.

The man power requirement may be classified mainly into 2 catagories.(a)Managerial & Administrative. (b)Technical.

a) Managerial and Administrative personnel.

The owner himself is the manager of the firm. If the manager is also a technically qualified person he can do the job of technologist also. Supervisions help him in the production aspects. One typist cum clerk and a peon cum watch man forms the required administrative office staff.

b) Technical personnel.

This category of people are directly involved in production. All the production sheduling, supervision and controling is done by the supervisors.

contd..ii.

by the supervisors.

The direct labourers are of three classes - skilled, semi-skilled and unskilled. Mixing, blank preparation and curing, require skilled labourers. There are 15 labourers for two shifts, out of which 4 are skilled, 8 semiskilled and 3 unskilled.

The total annual cost towards wages and salaries with 30% benifits works out to be 1,14,000 Rs. The details of the manpower requirement and the wages and salaries are summarised in Annexure-II3.2.

Training Programme.

As the mixing, blank preparation and mould filling are skilled jobs, some training programe may be necessary for the workers. For efficient functioning, well experienced chemists and operators are necessary. Being a small unit which cannot afford to such an elaborate training, this may be arranged in institutions such an common facility service centres. Further training may be given in the factory itself with the one experienced hand available.

C.3.3. UTILITIES.

Transportation:

For efficient functhing of my industry, transport facility is essential, particularly to bring rawmaterials into the factory and to haul the finished product into the market. As this small unit cannot affort to making roads at its own cost, it is better to locate the factory in a place nearer to the main road which makes the market, port and railway station within the reach.

The question of transportation is not a problem in the present case as it is proposed to locate the project in an Industrial

contd..12.

Estate which will definitely have good accessibility.

Water. Water is required, (1) for cooling the mixing mills and for boiler working, (2) for toilet and other personal purposes.

Steam. Forhheating the hydraulic presses.

Electricity.

The driving power behind various machineries is electricity. Adequate supply of electricity is an essential requirement for all industries. The small industrialist has to face several problems in this case. He has to spend much time and money in getting connections, drawing three-phase line, installation of transformers etc. In this case also Industrial Estate is helpful.

The details of the working expenses on utilities are summarised in Annexure.II.3.

SECTION. D

P R O C E S S O F M A N U F A C U R E

The important steps in the manufacture of solid tyres are listed and discussed below.

1. Compounding.
2. Mixing and Maturation.
3. Prewarming and Blank preparation.
4. Moulding and Valcanisation.
5. Deflashing.
6. Inspection and finishing.
7. Packing and despatch.

The layout of the plant is given in Appendix.II.

D.1. Compounding.

The design of compound for solid tyres is important and is

contd..13.

concerned with securing an acceptable balance between (a) valcanisate properties required, (b) price and availability and (c) processability. The service performance demanded on the Product by the consumer determines the valcanisate properties and is obtained from a detailed market survey. The choice of rubber and compounding ingredients is geared to meet the following performance in the final valcanisate requirements.

1. Resilience-Maximum.
2. Heat build up and Abrasion loss-Minimum.
3. Cut growth resistance-Maximum.
4. Rolling resistance-Minimum.
5. Oxidative degradation-Minimum.
6. Uniform hadness with a range of 70-75 IRHD.

Since the speed of non-powered vehicles does not go beyond 10 Kmph and these vehicles are used for material handling only; factors like wet skid, riding comfort etc. are not much of a problem to be cared.

The desirable processing properties are cure safety, low nerve and good dispersion of ingredients.

Polymer selection.

Resistance to heat build up and rolling resistance encountered between tyre and running surface can be reduced by a resilient NR with low energy loss. But for the best combination of properties, it is necessary to use a mixture of NR and SBR. The ratio of NR/SBR depends upon the product requirement. For heavy duty solid tyres NR content should be high and for a light duty premium quality, 1:1 NR/SBR is a best combination. Reclaim rubber can also be used at low level inorder to cheapen the compound.

Fillers.

Build up of static electricity in solid tyres can cause

contd..14.

some damage and this danger in reduced by incorporating in the formulation, an antistatic carbon black. For increased wear resistance it is desirable to use fine particle size furnace blacks. Since HAF alone will reduce resilience, a combination of HAF and SRF are suggested. With a view to cheapen the compound, high amount of china clay is used, since it is available at a low price.

Protective system.

The protective agents include antiozonants and antioxidants. Under Indian conditions it is not necessary to add an antiozonant. Since solid tyre is a black compound staining type antyoxidant, PBN, is sufficient; this chemical at 1 PHR will give necessary protection from oxidative degradation.

Curing system.

Sulphur along with accelerater, forms the curing system. The accelerator must be chosen to give good scorch safety, high cure rate and a satisfactory plateau effect. The sulphenamide type accelerators give the desired protection. CBS, boosted with TMT imparts all the above properties.

Other additives.

The normal level of Zinc Oxide, being used as activator, is 4 PHR and stearic acid level is 1-2 PHR. A small amount of 5 PHR process oil is sufficient, since the furnace black level is not high. To counteract the effect of clay on accelerator absorption, a small quantity of diethylene glycol is desirable. Peptisers are not usually used in mill mixing. Retarders are not necessary at low processing temperaturers.

The rubber and other ingredients are weighed out as per

contd..15

the predetermined formula and batch weight. The batch weight for a 14" x 36" mill is about 25 kg. Typical formulation for solid rubber tyre compound and the weights of ingredients for 25 kg batch are shown in table D.1.

Table D-1-

sl.No.	Ingredients	Formulation PHR	Wt/25kg batch
1.	NR	60 .0	5.6330
2.	SBR.1500	40 .0	3.7560
3.	ZnO	4 .0	0.3750
4.	st.Acid	1 .5	0.1408
5.	PBN	1 .0	0.0939
6.	CBS	0..85	0.0798
7.	TMT	0 .15	0.0141
8.	S	2 .25	0.2113
9.	HAF	25 .0	2.3470
10.	SRF	25 .0	2.3470
11.	clay	100 .0	9.3890
12.	DEG	1 .5	0.1408
13.	A. Oil.	5 .0	0.4695
		266 .25	24.9938

D.2. MIXING AND MATURATION.

Natural rubber should be masticated before mixing, till the nerve disappears. Mixing time is around 30 minutes; usually one stage mixing is employed. Two stage mixing on mill can also be used. This will make easy processing and improve properties of the tread. The order of mixing is mastication of rubber followed by addition of antioxidant, activators, fillers and oil. The accelerators must be added towards end of the mixing cycle, just before the addition of sulphur; when blends of two polymers are used, blending should be done at comparable viscosities.

contd..16.

The mill should be cooled properly during mixing. After mixing the stock should be sheeted out and cooled. Then it is dusted with talc and kept overnight for maturation.

Maturation is to facilitate uniform dispersion of black, fillers, other ingredients and to reduce variation from batch and within each batch.

D.3. Prewarming and Blank preparation.

The matured compound is again warmed (replasticised) on the 12" x 30" mill. Inorder to get uniformity among batches it is advisable to blend different batches to ensure overall product uniformity. Proper uniform mixing makes stock preparation easy and reduce 'grain' effect. 5 minutes warming is sufficient.

Prewarmed stock is sheeted out from the mill and cut to the correct width of the tread. The strips are cut to the required length, equal to the circumferencial distance of the mould, by a knife. The blank is prepared by building these lengths of strips one over the other to the required thickness of the tread ensuring air entrapment. This ensures that the preform is of uniform dimension and weight from blank to blank, so that the mould is correctly filled and wastage due to overflow or rejects due to unfilling of the mould are avoided. Blanks are kept on clean table.

D.4. Moulding and valcanisation.

Moulding is the operation of shaping and valcanising the plastic rubber compound by means of heat and pressure in a mould of appropriate forms. Depending on the ways of introducing the material into the cavity there are (1) Compression moulding,(2) Transfer moulding and (3) Injection moulding. Compression moulding is the selected method in this scheme.

contd..17.

Moulds.

Moulds are of steel make, suitably hardned and finished with channels and spew grooves to accommodate the excess compound. Moulds are suitably designed and constructed for easy demoulding of the product.

Press. Since solid tyre is a some what heavier and thicker product, it should be moulded in hydraulic press as the hand press cannot attain required moulding pressure. Besides that, since the alignment of platen is never perfect in hand press,it is very difficult to get the perfect closure of mould. Therefore multi-day-light dydraulic presses are necessary for the production of solid tyres.

Moulding Operation.

The mould surface is cleaned and mould release agent applied. Either silicon emulsion, soap or detergents are used as mould releasing agents. The mould is dried and heated to the specified curing temperature. Now it is opened and blanks placed in mould cavity. Then mould is closed and transfered to the press platen and the press closed and required pressure is applied.

Since solid tyre is a thick product it is essential to give a long curing time at a lower temperature. Here the moulding temperature is adjusted to 130°c for a curing time of 55-58 minutes. When the tyre is properly cured the pressure is releasedy mould is taken from the press, and opened. Another blank is loaded in the mould as before.

D.5. Deflashing. Method of deflashing proposed are, (i)Hand-trimming and (ii) Mechanical deflashing, as a small scale

contd..18.

entereprenour cannot afford to meet the cost of a flash cutting machine.

D.6. Inspection and finishing.

The deflashed tyre is to be inspected for defects like uneven surface due to defective mould flow and cracks due to mould pinching etc. Small defects are buffed by using a buffing machine.

Packing and despatch.

The nondefective or buffed out tyres are packed and labelled as per orders from customers. Different types are seperately packed as per the class of product, and despatched.

Process loss and disposal.

The process loss are in the form of mould flash and scrap, both valcanised and scorched. The valcanised scrap can be sold for reclaiming. The losses may vary up to 5%.

SECTION. E.

DISTRIBUTION ARRANGEMENTS

Since a major part of the consummers of solid tyres are the manufacturers of material handling equipments, the most common method of selling through agents and by opening sales depots cannot be employed here. So the best method is to enter into long term contracts with the existing concerns using solid tyres, and the products are to be despatched to the consumers with minimum delay.

E.1. Pricing Policy.

The price of the product is to be fixed considering the following factors.

contd..19.

1. Current market price.
2. Cost of production.
3. Production capacity.
4. Distribution cost.

The firm is interested in selling the product at a price, lower than the current market price, considering the cost of production and marketing expenses. Since there is a risk of rejection of the product, the company has to account about 10% of the sales value as distribution cost, and 3% of the sales value as other selling expenses.

SECTION. F.

C A P I T A L R E Q U I R E M E N T S

The total capital requirement for the project can be evaluated under the following heads.

1. Fixed capital requirement.
2. Working capital requirement.

F.1. Fixed Capital.

It is the sum of the expenses incurred for land, building, plant and machinery, other fixed assets and preoperative expenses, that can be capitalised under company law. Pre-operative expenses are accounted for the costs incurred during the idle tire of plant and machinery before regular production starts. The estimated fixed capital requirement is as follows.

	Rs
1. Land and building	Rented
2. Plant and Machinery	5,25,800

contd..20.

	Rs.
3. Pre-operative Expenses.	27,100
4. Other fixed assets.	10,500
Total fixed assets.	5,63,400

Details of the fixed capital is shown in Annexure.I.

F.2. Working capital.

Working capital is the working expense for a definite period (usually 2-3 months) which depends on the time to market and get the sales value. It includes raw materials, utilities, wages and salaries and other overheads. The required working capital for 3 months in estimated as follows.

	Rs.
1. Raw material.	1,61,000
2. Utilities.	23,000
3. Wages and salaries.	28,900
4. Other over-heads.	14,500
	2,27,400

Details of the working capital is shown in Annexure. II.

F.3. Gross capital.

It is the total financial requirement and is the sum of fixed capital and working capital for 3 months. The gross capital of the project is Rs. 7,90,800

SECTION. H.

P R O F I T A B I L I T Y

I. Rate of return on own capital.

	Rs.
Own capital	1,23,400
Net Profit	1,22,780
.'. Rate of return on own capital.	99.51%

II. Rate of return on capital Employed.

Capital Employed.	7,90,800

contd..21.

	Rs.
Net Profit.	1,22,700
∴ Rate of return on capital Employed.	15.52%

III. Percentage Profit on sales turnover.

Annual return from sales.	14,40,000
Annual profit.	1,22,700
∴ Profit on sales turnover.	8.5%

SECTION. I.

E C O N O M I C V I A B I L I T Y

H.1. Interest commitments.

	Rs.
Interest on Block Loan, 7.5%.	33,000
Interest on working capital, 16%.	36,384
Total interest commitments.	69,384

H.2. Ability to pay back borrowed funds.

The block loan should be paid back in the prescribed period. However an early pay back of the loan will result in greater savings on interest. So the firm is interested in keeping 75% of its surplus to pay back block loan and the rest is retained.

H.3. Pay back period.

	Rs.
a) Annual profit.	1,22,700
b) Depreciation.	82,560
Surplus (a+b)	2,05,260
Less Drawings.	51,065

contd..22.

	Rs.
Amount used for repayment.	1,54,195
Block loan to be paid.	4,40,000
∴ Pay back period.(Round off):	3 Years.

SECTION. G

FINANCING PLAN .

For the development of small scale Industries, the Government of India have launched different programmes under which financial assistance is given at every stage from planning financeial assistances is given at every stage from planning financial aids from different sources for small scale enterpreneurs are:

1) Kerala State finanecial corporation.

Loans of up to 10 lakhs for aperied of 12 years can be obtained from this institution. They provide 100% of the machinery cost and 75% of the building cost and 40% of the working capital at 7-10% interest.

2) Kerala State small Industries corporation.

Machinery worth upto Rs. 10 lakhs can be obtained on a hire purchase scheme on a marginal money deposit of 20% (10% for technically qualified personnel) at 7.5% interest. Repayment starts after two years and should be completed within 7 years.

3. Kerala State Employment Promotion corporation.

They provide 95 % of the cost involved in the purchasing, servieing, taxes, insurance and transporation of all machinery and equipment as loan with interest of 7%.

4. Nationalised Banks.

whole working capital at 16% interest and loans for machinery on 25% margin money at 12% interest will be available from nationalised Banks.

cont.....

Other institutions helping small scale enterpreneurs are National small industries corporation, Industrial development bank of India, Unit trust of India etc.

Financing Plan of the Firm.

The whole machinery cost is proposed to be taken as loan from Kerala Financial Corporation and the entire working capital from Nationalised Banks.

KFC Loan, at 7.5% interest Rs.	4,40,000
Bank loan, at 16% interest Rs.	2,27,400
Own Fund.	1,23,400
Total capital	7,90,800

SECTION. J.

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

I. To the Enterpreneur.

It gives
a) Profit
b) Opportunity to use his ideas.

II. To the Nation.

It gives
a) Larger employment with less investment
b) Increase investment in revenue earnings of the nation.
c) More equitable distribution of national income.

contd..24.

CONCLUSION

The present scheme is a small scale one as per the definition. There is ample scope for expansion in the same lines of products with small capital investment. The project as such is sound, safe and prospectful.

The Project in a Nutshell.

	Rs.
Fixed capital.	5,63,400
Working capital.	2,27,400
Gross capital.	7,90,800
Plant & Machinery	5,25,800
Location	An Industrial Estate in Kerala.
Building area	2,000 sq.ft.
Labour force	18
staff	3
Annual Production.	96,000 Nos. solid tyres.

--------: 0 :--------

contd..25.

ANNEXURES

A N N E X U R E . I.

FIXED ASSETS

ANNEXURE.I.1.

I. Land and Building. Rented(Accounted in working capital)

II. Plant and Machinery

No.	Item	No.	Value. Rs.
1.	Mixing mill, 14" x 36" size, 40 HP motor, chilled cast iron rolls & Accessories.	1	1,10,000
2.	Mixing mill, 12" x 30" size, 30HP motor.	1	80,000
3.	Hydraulic press, 30" x 30" size, three day-light, steam heated, day-light gap 9", with 5HP hydraulic pump.	1	90,000
4.	Hydraulic press, 24" x24" size, three day-lights,day-light gap 8", with 4 HP pump.	1	75,000
5.	Boiler, 150 kg per/hour & Accessaries.	1	50,000
6.	Buffing Machine.	1	6,000
7.	Moulds - MS (a) Type I.	12	10,800
	(b) Type II.	12	9,600
8.	Durometer,(Shore A hardness tester)	1	1,000
9.	Weighing Balance.		
	(a) 50 kg dial balance.	1	3,500
	(b) 5 kg dial balance.	1	3,000
10.	Miscellaneous equipments.		3,000
	Total.		4,40,000
	Provision for price escalation @ 5%		22,000
	Erection and Installation charge @ 5%		22,000
	Sales tax and other taxes @ 7%		30,800
	Freight and transportation @ 2.5%		11,000
	Total.		5,25,800

contd..24.

ANNEXURE.I.2.

OTHER FIXED ASSETS

		Rs.
1.	Tools and Accessaries.	5,500
2.	Office Machinery and equipments.	3,000
3.	Furniture and others.	2,000
	Total.	10,500

ANNEXURE. I.3.

PRE-OPERATIVE EXPENSES.

		Rs.
1.	Interest on Blockloan, for Rs. 4,40,000 @ 7.5% for 6 months.	16,500
2.	Travelling expenses	2,000
3.	Postage, telegrams, telephone.	1,500
4.	Printing and stationary	2,000
5.	Advertisement	1,000
6.	Rent and Establishment	1,600
7.	Other miscellaneous Expenses	2,500
	Total.	27,100

ANNEXURE.I.4.

TOTAL FIXED ASSETS

		Rs.
1.	Plant and Machinery	5,25,800
2.	Other fixed Expenses	10,500
3.	Pre-operative Expenses.	27,100
	Total.	5,63,400

contd..25.

A N N E X U R E. II.

COMPONENTS OF THE WORKING CAPITAL REQUIREMENTS

TOTAL WORKING CAPITAL (For 3 months)

		Rs.
1.	Total Raw material cost.	1,61,000
2.	Cost of utilities.	23,000
3.	Wages and salaries.	28,900
4.	Other over-heads.	14,500
	Total.	2,27,400

ANNEXURE. II.1.

DETAILS OF WORKING CAPITAL ON RAW MATERIAL REQUIREMENT(For 3 months)

Sl.No.	Material	Formulation	Annual consumption (wt/210tons)	Price/ ton Rs.	Annual cost.
1.	NR	60.0	47.320	7000	331300
2.	SBR 1500	40.0	31.530	8500	268000
3.	Zinc Oxide.	4.0	3.153	15000	47000
4.	St. Acid.	1.5	1.182	12000	14190
5.	HAF Black.	25.0	19.700	5580	109900
6.	SRF Black.	25.0	19.700	3740	73690
7.	PBN	1.0	0.790	36000	28380
8.	CBS	0.85	0.670	40000	26810
9.	TMT	0.15	0.118	26850	3174
10.	S	2.25	1.772	2000	3544
11.	Clay	100.0	78.820	350	27580
12.	Diethylene glycol.	1.5	1.182	30000	35460
13.	A. Oil.	5.0	3.942	9000	45000
	Total.	266.25	210.0062		614328
	Waste(+5%)		10.5000		30716
	Total(Annual)		220.5000		645044
	for 3 months(Round off)				1,61,000

contd..26.

ANNEXURE. II.2

DETAILS OF WORKING CAPITAL ON MAN POWER REQUIREMENTS
(for 3 Months)

Staff.	shift	U.S	S.S	S	others	Total	Expense/ month
1. Administrative& Managerial.							
i)Manager cum Technologist.	1	..	..	..	1	1	1000
ii)Clerk/Typist	1	..	..	..	1	1	350
iii)Peon/watchman.	1	..	..	..	1	1	250
2. Technical.							
i)Compounding	2	2	..	..	..	2	500
ii)Mixing/warming	2	..	2	2	..	4	1300
iii)Curing/blank preparation.	2	..	4	2	..	6	1900
iv)Flash cutting	1	1	..	..	..	1	250
v)Boiler Attendent	2	..	2	..	..	2	600
vi)Packing	1	1	..	..	..	1	250
vii)Supervisors (Production)	2	..	..	..	2	2	1000
Total.		4	8	4	5	21	7, 400
Total for three months							22, 200
other benefits 30%							6, 660
				Total(Round off)			28, 900

contd..27.

Salary rate of different group of Personnel.

	Rate/P.M.
Unskilled	Rs. 250
Semi skilled	Rs. 300
Skilled	Rs. 350
supervisor	Rs. 500

ANNEXURE. II.3.

DETAILS OF WORKING CAPITAL ON UTILITIES

(for 3 months.)

		Rs.
1.	for water(Annual)	1,980
2.	for steam(")	44,160
3.	for Electricity(Annual)	46,310
	Total.	92, 450
.°.	for three months(Roundoff)	23, 000

ANNEXURE.II.3.1.

CALCULATION OF THE COST OF UTILITIES

1. **Total water requirement and its cost.**

	Litres/day
1. Mixing mill 14"x 36".	8,500
2. Mixing Mill 12"x 30"	6,000
3. Boiler working	2,500
4. Toilet and other purposes.	5,000
	22,000

.°. Annual cost of water @ Rs. 0.30/1000 litres = Rs. 1,980

contd..30.

2. Total fuel requirement and its cost.

Steam consumption per day.	kg/hr.
1. Hydraulic press 30"x30" size	45
2. Hydraulic press 24"x24" size	35
Total.	80
Annual steam consumption.	3,84,000 kg.
Oil consumption @ 1kg/10kg steam.	38,400 kg.
.'.Annual cost of steam @ Rs. 1.15/kg furnace oil,	44,160

3. Total Electrical requirement and its cost.

	Power, KW.
1. Mixing mill, 40 HP.	30.00
2. Mixing mill, 30 HP.	22.50
3. Hydraulic press 5 HP.	3.50
4. Hydraulic press,4 HP.	3.00
5. Pumping for boiler	1.00
6. Lighty fan etc.	5.00
7. Water pump.	2.00
Total.	67.00

Annual Electrical requirement. 2,57,280 KW.

.'. Cost for Electricity,@ Rs. 0.18/unit, Rs. 46,310

contd..29.

ANNEXURE. II.4.

DETAILS OF WORKING CAPITAL ON OTHER OVERHEADS

(for 3 months)

	Expenses Rs.
1. Repair and Maintenance on machinery @ 5%	6,600
2. Travelling and Advertisements	1,600
3. Printing and stationary	1,500
4. Postage, telephone etc.	1.000
5. Rent for Building	1,800
6. Audit fee, legal charges etc.	500
7. Miscellaneous Expenses.	1,500
Total.	14,500

A N N E X U R E. III.

GROSS CAPITAL

	Rs.
1. Total fixed capital	5,63,400
2. Total working capital. (for 3 months)	2,27,400
Total.	7,90,800

contd..30.

A N N E X U R E. IV.

TOTAL COST OF PRODUCTION (ANNUAL)

	Rs.
1. Raw material cost.	6,45,000
2. Salaries and wages.	1,15,600
3. Utilities	92,450
4. Other overheads.	58,000
5. Depreciation of fixed capital & Interest on working capital.	1,51,944
Total.	10,62,994
Round off	10,63,000

ANNEXURE. IV.1

DEPRECIATION AND INTEREST

	Rs.
1. Depreciation on Machinery @ 15%	78,800
2. Depreciation on other fixed assets and pre-operation expenses@ 10%.	3,760
Total.	82,560
3. Interest on term loan for machinery (@ 7.5% for Rs.4,40000)	33,000
4. Interest on working capital(@16% for Rs.2,27,400)	36,384
Total.	69,384
Total depreciation and Interest.	1,51,944

contd..31.

A N N E X U R E. V.

V. 1. SALES AND MARKETING EXPENSES

	Rs.
1. Distribution cost (freight, storage and packing @ 10% on sales)	1,44,000
2. Transit Insurance (@ 1% of total sales).	14,400
3. Other sales Expenses. (@ 3% of total sales.)	43,200
Total.	2,01,600

V.2. Cost of production + Marketing Expenses: (Round off) 12,64,600

A N N E X U R E.VI.

ANNUAL SALES TURNOVER & PROFIT

I. Total sales.

Item	Nos.	Rate of selling	Values.
1. Hand truck tyre	48,000	Rs. 20.5/tyre	9,84,000
2. Trolley tyre	48,000	Rs. 9.5/tyre.	4,56,000
	Total sales turnover.		14,40,000

II. Net Profit

Total income from sales.	14,40,000
Less Cost of production and sales & marketing expenses.	12,64,600
Profit before tax.	1,75,400
Less Tax incidence @ 30%	52,620
Net profit after taxation.	1,22,780

contd..32.

ANNEXURE-VII.

PROFITABILITY ANALYSIS

I. **Rate of Return on own capital.**

	Rs.
Own capital	1,23,400
Net Profit.	1,22,780
∴ Rate of return on own capital.	99.51 %

II. **Rate of Return on capital Employed.**

Capital Employed.	7,90,800
Net profit.	1,22,700
∴ Rate of return on capital Employed.	15.52 %

III. **Percentage Profit on sales turnover.**

Annual return from sales.	14,40,000
Annual profit.	1,22,700
∴ % Profit on sales turnover.	8.5 %

IV. **Break - even Analysis.**

Break-even quantity is that quantity which if produced and sold,will give neither a profit nor loss.

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

where F = Annual fixed cost.

P = Average price per unit of product.

V = Average variable cost per unit of product.

F= (Total cost of production + sales & Marketing Expense)- Variable cost.

= (10,63,000 + 2,01,600) - 10,30,000 = 2,34,600

contd..35.

Total variable cost.

		Rs.
1.	Annual raw material cost.	6,45,000
2.	Total expenses on utilities	92,450
3.	Direct labour cost	90,480
4.	Sales and marketing Expenses	2,01,600
	Total	10,29,530
	Round off	10,30,000

Annual sales turn over Rs. 14,40,000

Total No.of units produced per annum. 96,000 Nos.

$\therefore$ Average price per unit P $= \frac{14,40,000}{96,000}$

$= 15$

Total variable cost $= 10,30,000$

$\therefore$ variable cost per unit V $= \frac{10,30,000}{96,000}$

$= 10.7$

$\therefore\therefore$ Break-even quantity $= 54,550$ Nos.

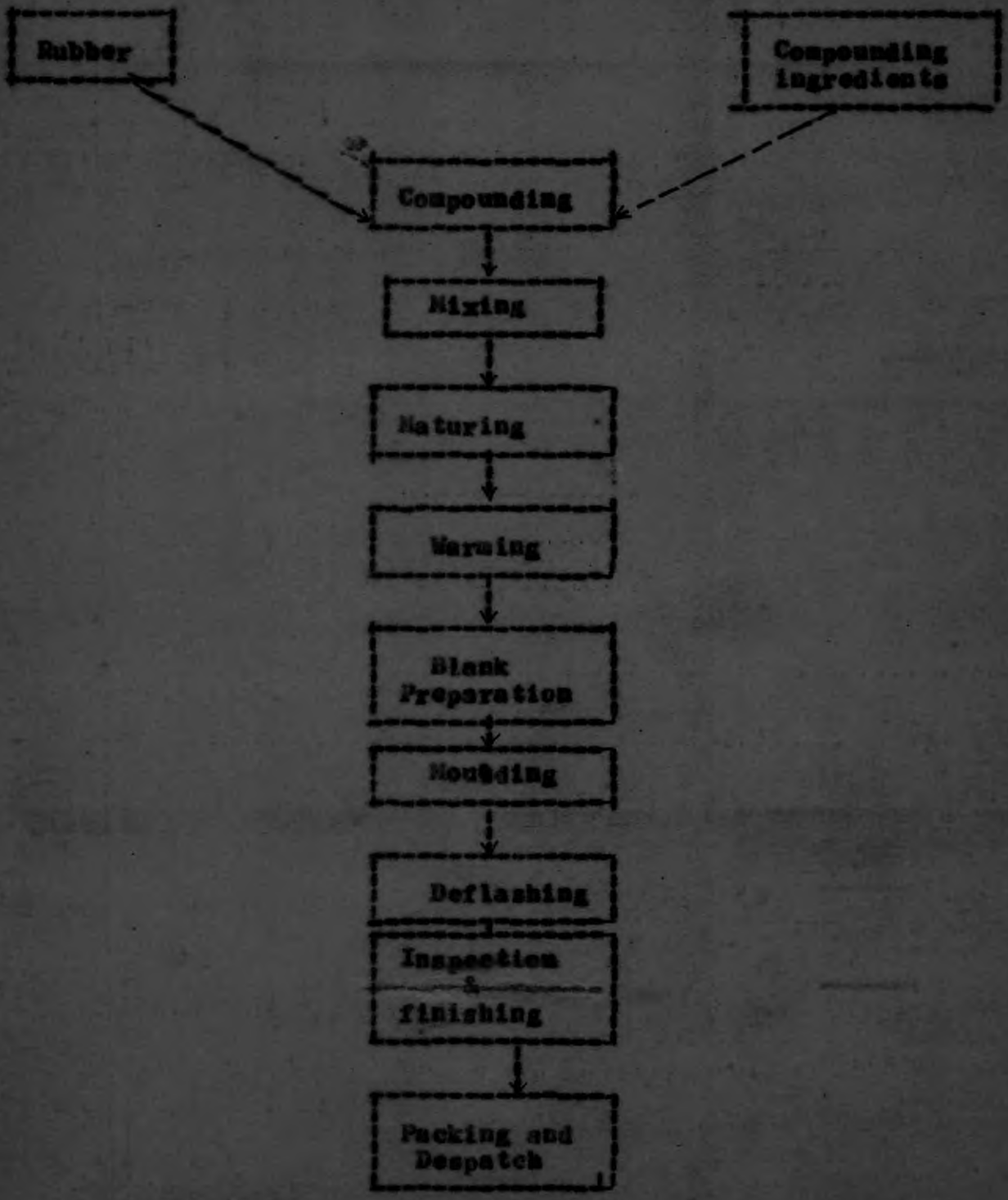
ie 56.8 %

contd..34.

APPENDICES

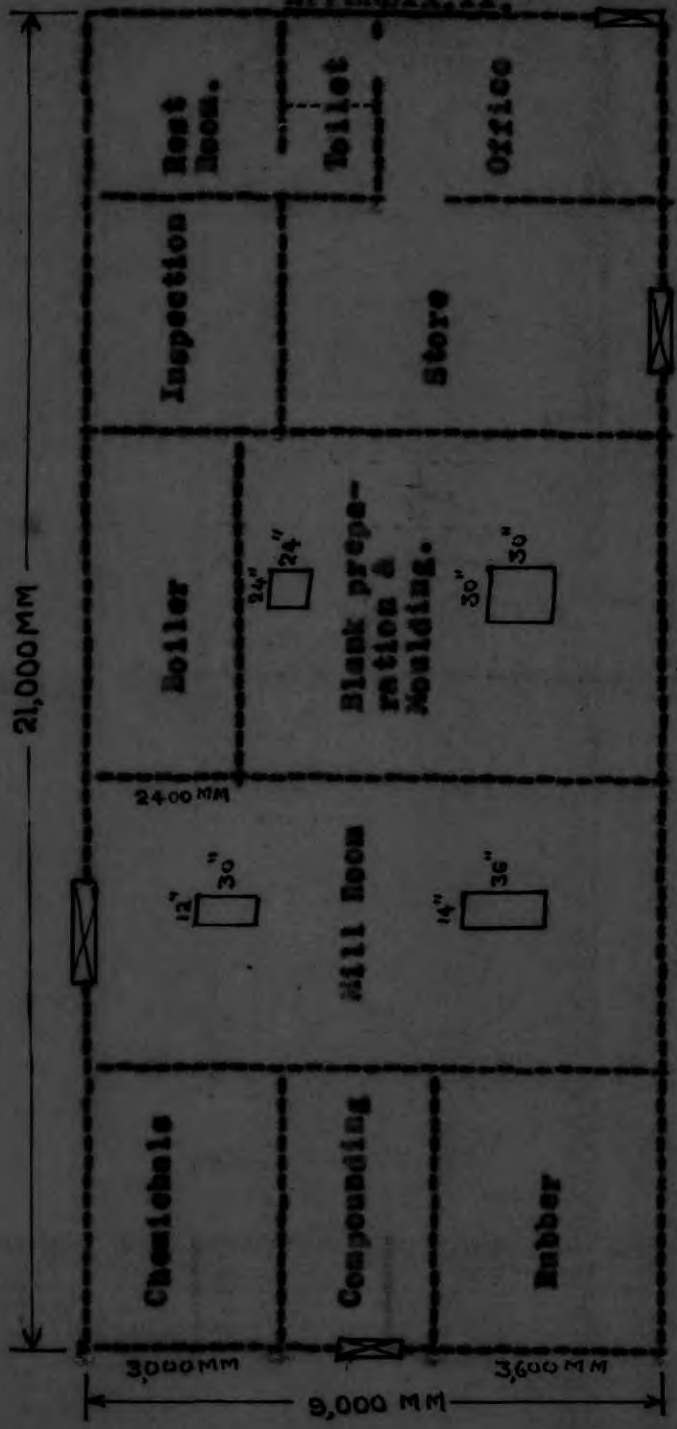
A P P E N D I X-I.

PROCESS FLOW SHEET



contd..35.

APPENDIX. II.



PLANT LAYOUT.

contd..36.

APPENDIX.III

A. LIST OF RAW MATERIAL SUPPLIERS

1. Natural Rubber. Available in the local market

2. STYREN BUTADIENE RUBBER

Synthetics and Chemicals Ltd.,
New Great Insurance Bldg,
7, Jamshedji Tata Road,
Bombay - 1.
(Sales office Kottayam,Kerala)

3. Accelerators and Antioxidants

a) Alkali & Chemical corporation of India Ltd.,
34, Chouringhee Road,
Calcutta -16.

b) Bayer(India) Ltd.,
82, Vir Nariman Road,
Bombay -1.

c) Mindia Chemicals Ltd.,
Wakefield House, 11 Sprott road,
Ballard Estate,
Bombay -1.

d) Para chemicals,
c/o Kerala Paints Pvt.Ltd.,
Ernakulam, Cochin 11,
Kerala.

4. Sulphur

a) Asiatic Chemical Co.,
71, canning street,
Calcutta -1.

b) Sulphur Mills(Pvt) Ltd.,
23, Kailash Darshan,
Bombay-7.

contd..37.

5. Zinc Oxide.

a) Anmad Chemicals,
8 Hartiman Circle, Fort,
Bombay -1.

b) Ashoka Chemical Products,
P-16, Kalakar Street,
Calcutta -7.

c) Para Chemicals,
Ernakulam, Cochin-11

6. Stearic Acid

a) Godrej Soaps(Pvt)Ltd.,
Vikhroli, Bombay-79

7. Carbon Black

a) Philips carbon Black Ltd.,
31, Netaji Subhas Road,
Calcutta -1

b) United carbon India Ltd.,
N.K.M. International House,
Backbay Reclamation,
Bombay-20.

8. China Clay.

a) Hindustan china clay works,
Pappinisseri, Cannanore,
Kerala.

b) Amex (Pvt) Ltd.,
P.B. No. 212, National House,
6,Thulloch Road, Appollo Bunder,
Bombay -1.

contd..38.

B. LIST OF MACHINERY SUPPLIERS

a)	Kelachandra Foundry, Chingavanam.P.O., Kottayam, Kerala.	Mixing Mills
b)	Sohal Engineering Works, Agra Road, Bandup, Bombay -78 MB.	Mixing Mills, Hydbaulic Press
c)	Richardson & Cruddas Ltd., Byculla Iron works, Bombay -8.	Mixing Mills Hydraulic Press
d)	SCA Private Ltd., Mahalakmi chamber, 3rd floor, Bhulabhai Desai Road, Bombay.	
e)	Varsha Boilers Pvt. Ltd., Green House, Green Street, Bombay-1	Boilers.
f)	Batliboi & Co. Pvt: Ltd., Forbess street, Fort, Bombay-1.	"