# B I C Y C L E  T Y R E  P R O J E C T

DISSERTATION SUBMITTED

BY

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# C O N T E N T S

## Preface

Though this report has been prepared strictly from the point of view of a 'PROJECT REPORT', I have deliberately put some extra details in the technical aspects of the process of manufacture, which I think is called for from the wider perspective of a dissertation report of a technical course.

I do not claim this exhaustive in all respects. However, I hope that this will serve as a guideline for action to be followed.

My thanks are due to Shri.V.Bhaskara Pillay, Secretary, Shri. CM George and Shri. EV Thomas, Deputy Directors, Shri.MK Balagopalan Nair, Chemical Engineer and Shri.RG Unny, Statistician, of Rubber Board, and Shri. KS Radhakrishanan, Project Manager, Trivandrum Rubber Works Ltd. for the valuable guidance and assistance given by them in preparing this report.

KT Varghese

Kottayam,
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# 1 INTRODUCTION

11 General:- Bicycle tyres are one of the most important and widely known products of the rubber industry. Next to automobile tyres and tubes, cycle tyres and tubes consume the largest amount of rubber. The cycle tyre industry is favoured with a vast domestic market, comparitively low capital outlay, easier production techniques, high labour input and an export market. The present production of cycle tyres in the country is around 35 million numbers and it is expected to cross the 50 million mark by the end of the 5th plan.

12 Prospects:- The bicycle is a ubiquitous vehicle, economical and efficient at the same tyre time. Bicycles are the most popular conveyance for the masses and this is going to be the case for quite a long time to come. The ever increasing demand for bicycle tyres can be attributed to several reasons:-

1 higher mobility requirements of individuals in rural areas.

2 cycle rickshaws have become a "Janta" transport.

3 animal driven passenger transport in villages being replaced by bicycles.

4 all important cities in India are attracting more bicycles as a mode of daily conveyance.

5 national economic growth has not yet become favourable to "auto" for a common man.

6 increasing demand for Indian bicycles and bicycle tyres in foreign market.

The hike in petrol price has resulted in a tilt of individual mobility from auto to bicycles. Since there is no sign of a reversal in petrol price, bicycles and hence bicycle tyres will have very high demand in future.

According to the policy of the Government, small industry is expected to play a vital role in the next five year plan. It is precisely for this reason that the Government has announced a package of concessions and removal of many of the administrative obstacles for small industry. The investment limit in machinery and equipment of small industry has been increased from Rs.7.5 lakhs to Rs.10 lakhs.

In the above circumstances, a bicycle tyre project in the small scale sector offers tremendous possibilities and therfore there is no need to have any doubt regarding its prospects.

13 Product Description:- A cycle tyre is a fabricated composite unit consisting of tread, sidewall, fabric and beads. The function of the tyre is to give the "ride" by protecting the tube and providing adequate cover when the tube is under inflation. The bead wire performs the job of holding the tyre to rim and thus has to be rigid and strong. The carcass (fabric + rubber) provides strength and flexibility, while the tread and sidewall protect carcass from abrasion and other service hazards. All these components are fabricated and bonded suitably so that they function in unity.

The rickshaw tyre (classified as Grade I cycle tyre in ~~the~~ I.S.I specification) is exactly similar to bicycle tyres, except that it contains 4 layers of fabric instead of 2 in bycicle tyres. It can be produced in the same way as cycle tyres with the same machinery and with the same process.

## 2 MARKET SURVEY

21 General:- India is presently one of the world's largest producers of bicycle tyres. We manufacture a wide range of tyres to suit most varities of bicycles manufactured in India and abroad. A large number of units are working successfully throughout the length and breadth of the country.

26 x $1\frac{1}{2}$, 28 x $1\frac{3}{4}$, 26 x $1\frac{1}{2}$ and 26 x $1\frac{3}{4}$ are the different sizes and black, coloured, translucent etc are the important varities of cycle tyres manufactured in India.

22 Users/Customers-Geographical extent:- The bycicle travelling public is the "market" for cycle tyres. Since bicycles are within the reach of the low and medium income groups of people, the market for bicycle tyres is spread throughout the urban and rural areas. To suit different types of customers, market segmentation by which the market is divided into smaller divisions by slight product variation and / or price discrimination is possible with bicycle tyres.

23 Statistical Data:-

1 Rubber consumption (natural, synthetic and reclaim)

figures for cycle tyres and tubes for the last 8 years, are given below.

| Year | Rubber consumption in tonnes | |
|---|---|---|
| | Cycle tyres and tube | Total |
| 1966 - 67 | 12569 | 103190 |
| 1967 - 68 | 14602 | 109704 |
| 1968 - 69 | 16632 | 128022 |
| 1969 - 70 | 16168 | 130734 |
| 1970 - 71 | 17014 | 134745 |
| 1971 - 72 | 18723 | 149435 |
| 1972 - 73 | 18808 | 151507 |
| 1973 - 74 | 22241 | 165672 |

2 Number of pieces of cycle tyres produced by the organised sector during the last certain years are also given below.

| Year | Production in million Nos. |
|---|---|
| 1965 - 66 | 18.46 |
| 1968 - 69 | 24.57 |
| 1973 - 74 (estimated) | 25.20 |
| 1978 - 79 (target) | 30.00 |

3 The total production of cycle tyres in 1973 - 74 was 34.20 million pieces.

From the figures cited the following conclusions can be drawn.

1 the cycle tyre and tube industry has an annual growth rate of 9.6% (average of 8 years).

2 in 1973 - 74 the industry consumed 13.43% of total rubber.

3 the organised sector accounts for 74% of total production

4 the non-DGTD segment accounted for 26% of total production (with an annual turn out of 9.0million pieces in 1973 - 74.)

5 Assuming that 90% is the actual production, installed capacity of small scale sector is 10.0 million tyres in 1973 - 74.

24 Future Demand Assessment:- The task force appointed by the Government of India has estimated the demand for 1978 - 79 at about 50.0 million tyres. Since the future growth of this industry is exclusively reserved for small sela scale sector, the licensed capacity of the organised sector is limited to 35 million tyres by 1978 - 79 (28.0 million present capacity + 7.0 million expansion) Out of this the expected actual production in the organised sector by 1978 - 79 is 30.0 million numbers only.

Hence the balance of 20.0 million tyres will have to be produced by the small scale sector. The present production by the small scale sector is 9.0 million tyres. Therefore another 11.0 million tyres have to be produced by this sector in the immediate future. For this an additional capacity of about 12.0 million

tyres has to be installed in the small scale sector before 1978 - 79.

25 Competitive Situation:- There are at present 20 large scale concerns engaged in the production of cycle tyres and tubes and about 122 small scale units (non-DGTD segment) producing either bicycle tyres or tubes or both.

The list of the 20 large scale manufacturers with their installed capacities are given below. (The figures are for tyres and tubes and refer to year 1972)

| | Name of the manufacturer | Installed Capacity |
|---|---|---|
| 1 | Dunlop India Ltd., Calcutta | 7386600 |
| 2 | Dunlop India Ltd., Ambattur | 4284000 |
| 3 | National Rubber Manufacturers Ltd. Calcutta | 5000000 |
| 4 | Trivandrum Rubber Works Ltd., Trivandrum | 270000 |
| 5 | Premier Rubber & Cable Industries Bombay | 900000 |
| 6 | Ruby Rubber Works Ltd. Changanacherry | 900000 |
| 7 | Associated Rubber & Plastics Ltd. Calcutta | 240000 |
| 8 | R.B.S. Rubber Mills Howrah | 216000 |
| 9 | Oriental Rubber Industries Pvt Ltd. Bombay | 600000 |
| 10 | Imperial Tyres & Rubbers Company Pvt Ltd. Bombay | 600000 |
| 11 | Cosmos India Rubber Works Pvt Ltd. Bombay | 900000 |

| | | |
|---|---|---|
| 12 | Good year India Ltd. Ballabhgarh | 2000000 |
| 13 | Universal Tyres Ltd. Allahabad | 2000000 |
| 14 | Fort Gloster Industries Ltd. Calcutta | 600000 |
| 15 | Marshal Cycle Ltd. Ghaziabad | 400000 |
| 16 | Ralson Industry Ltd.Ludhina | 400000 |
| | | 2,66,96,600 |

(Capacity - Licensed)

| | | |
|---|---|---|
| 17 | Madras Rubber Factory Ltd.Madras | 2000000 |
| 18 | Ceat Tyres of India Ltd. Bombay | 2000000 |
| 19 | Premier Tyres Ltd Bombay | 2000000 |
| 20 | Chaurasia Rubber Works Ltd. Mirzapur | 750000 |

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The small scale units are widely scattered around the country. In Kerala the number of small scale units manufacturing cycle tyres and tubes is 9 with an installed capacity woth Rs.125 lakhs.

As already stated, further additions in the list of large scale manufacturers are not expected. The possiblity of expansion within the large scale sector is also limited. Further, the demand is expected to mise rapidly within a few years. Under these circumstances, tight competition in market will not be there in the near future. Even then a well organised marketing set up and quality production are called for to achieve success in setting up a project for producing cycle tyres and tubes in the country.

26 Export:- The export of rubber products accounts for only less than 3% of the total turn over of Rs.400 crores of the rubber industry. Of these Cycle Tyres and tubes are one of the major export items.

Indian bicycle tyres compete successfully in international market in regard to quality, appearance and price.

Export figures for the last 5 years is given below.

| Year | Export in '000 Rs.(Post devaluation) | |
|---|---|---|
| | Cycle tyres and tubes | Total Rubber Products |
| 1969 - 70 | 4360.1 | 79100 |
| 1970 - 71 | 4364.2 | 98600 |
| 1971 - 72 | 4710.9 | 112300 |
| 1972 - 73 | 5435.2 | 105100 |
| 1973 - 74 | 9576.4 | 128450 |

In 1973 - 74 cycle tyres and tubes contributed to 7.5% of total export of rubber products and the figure is expected to rise further in 1974 - 75.

At present we export over 1½ million bicycle tyres and tubes and the figure is expected to rise to about 3 million by 1978 -79.

Our major export countries with their share of export of cycle tyres and tubes are shown below. There has been steady increase in our export to Bangladesh, Ghana, Peru, Roumania Iraq and Bolivia.

The figures shown refer to 1973 - 74.

| | Countries | Export | | Countries | Export |
|---|---|---|---|---|---|
| 1 | USA | 1850.9 | 11 | Malawi | 177.3 |
| 2 | Bangladesh | 1846.7 | 12 | Greece | 114.0 |
| 3 | Ghana | 1183.5 | 13 | West Indies | 106.3 |
| 4 | Roumania | 961.1 | 14 | Nepal | 103.8 |
| 5 | Afghanisthan | 558.4 | 15 | West Germany | 88.0 |
| 6 | Iraq | 481.0 | 16 | Austria | 54.0 |
| 7 | Peru | 448.8 | 17 | Hong Kong | 40.4 |
| 8 | Nigeria | 397.6 | 18 | Bolivia | 32.0 |
| 9 | Iran | 228.0 | 19 | Escuador | 24.4 |
| 10 | Guyana | 188.8 | 20 | Mozumbique | 17.0 |

Export Values in '000 Rs.

For cycle tyres, export incentives and concessions and/or entitlements amount to 19% of export value and therefore the prospects for export of the cycle tyres are also bright.

27 Product Prices:- During the last 5 years product price has changed from Rs.7 to Rs.10 or 12 in accordance with the change in raw material price.

## 3 PROCESS OF MANUFACTURE

31 Process details:- The important steps for the manufacture of cycle tyres are the following.

1 Bead preparation

2 Stock mixing

3 Fabric preparation

4 Tread preparation

5 Tyre building

6 Curing

7 Finishing and Inspection.

The Flow Diagram showing the manufacturing process is given in Appendix I.

311 Bead Preparation:- Bead wires are copper coated high tensile steel with a tensile strength of 155 $Kg/mm^2$, and having 0.375 gms of copper per kilogramme. Generally for cycle tyres 15 SWG wires are used and for rickshaw tyres 13 SWG.

Beads are available from local small concerns who get the wires and fabricate them. Here the wires are cut into specified length, that is, 2000 mm for 28 x 1½ and 1449 mm for 26 x 1½ and joined by butt welding or gas welding. Though gas welding is preparable, butt welding is generally employed being the cheapest and quick source of production. The joint is then cooled, annealed and the upset of the bead joint is grinded away using a grinding wheel. Then nippling is done using GI thin sheet (66.7 mm long x 0.457 mm guage with bevelled edges)

The weight of cycle tyre bead wire is 40 gms and its diameter 0.075".

In addition to the above treatments degreasing of original

wires, soldering of nippled joint, coppering of joints, bead coating and wrapping are also practiced in large scale production.

312 Stock mixing:- The two different compounds for cycle tyre manufacture are tread compound and cord insulation compound or carcass compound. A third compound is used for curing bag.

Mastication of natural rubber can be carried out on the warming mill so that cycle time can be reduced in actual mixing operation. Compounding ingredients are incorporated on the mill and mixed well to get a homegenised stock. Correct quantity of ingredients, temperature control, cycle tyres- time etc. are the important factors to be considered in mixing.

313 Fabric Preparation:- The moisture content of the fabric should be ensured below 3%. In case of higher moisture content drying is carried out over steam heated drums at 120 - 140$^{0}$C.

Coating of the fabric with carcass compound can be done either by spreading or by calendering.

In spreading the mixed compound is kneaded into a dough in a suitable solvent (SBP). The dough so prepared is spread over the fabric by means of a spreading unit with a doctor knife arrangement controlling the thickness of the spread. The spread fabric goes into a drying chamber where the solvent is evaporated and wound on a roll with a liner. Both sides are coated in separate operations. Development of static

electricity should be discharged by suitable device.

In the calendering method rubber is coated on the fabric using a calender. A 3-bowl vertical calender of size 42" x 16" or more can be used for this purpose. Since three roll calender applies rubber only to one side, a 4-bowl calender is necessary to get both sides coated simultaneously.

In spreading though the machinery is very cheap, the working cost is very high becuase of the very high cost of solvent oil. Calender is too costly to accomodate within the small scale limit of the cycle tyre manufacturing unit. But it has the advantage of low working cost. In fact calendering can lead to a reduction of Rs..50 per tyre.

Many of the small scale units now get their fabric calendered outside. This is a very practicable idea especially where there is calendering unit near the concern.

In this project the spreading method is selected.

The coated fabric is split into specified width (128.5 mm) on the Tearing and Rerolling machine and wound on spools.

314 Tread Preparation:- The tread stock is mixed and warmed on the warming mill. Tread is produced from this either by profile calendering or by extrusion process.

A 3-bowl profile calender of 6" x 18" size with the outline of the shape of the tread inscribed within the roll of the calender can be used. The calendered tread is cooled to avoid scorching and cut at specified length. Important tread dimensions are

| | |
|---|---|
| width | 9.4 cm |
| length | 198 cm |
| edge gauge at profile | 1.2 mm |

315 Tyre Building:- Building is carried out either by Monoband machine or by hand operated case former. Monoband gives faster production at lower labour input and is now generally used.

In Monoband building, bead wire, cord fabric and tread are joined to form the tyre.

The two bead wires are placed in drum grooves with both the nipples staggered at a distance of 3" minimum and tension applied by air pressure of small magnitude. The fabric spools are placed in a revolving head and wrapped around the bead wire with a bias angle between 48 - 49°. The starting splice has to be broad enough to give a hold to the fabric to prevent movement during subsequent operations. The number of laps is 12. The finishing lap is to be cut with 9.5 mm to 13 mm overlap. The edge of the finishing lap is to be pulled tight and wrapped around the bead.

Tread must be fitted centrally, and cut to length at correct bewel of 45°. The tread joint must be passed once through the tread pressure roller and cord type consolidation roller.

| | |
|---|---|
| casing weight | 0.188 Kg |
| raw cover weight | 0.767 Kg |

316 Mouldings:- The built up tyre is shaped with the help of an air bag. The outside of the green tyre is treated with a mould lubricant

which is usually a dilute solution of silicon emulsion. Curing is carried out in 4 daylight press with suitable moulds. Here the tyres are pressed against the mould by air pressure in the air bag.

Very high pressure applied by hydraulic pump is used for moulding (i.e. of the order of 1500 lbs.)

Cure time depends on steam pressure. 4 minutes at 160°C can be adopted for reasonable productivity. After cure, the press is opened, the cured tyre is removed with air bag and then debagged.

An air bag lasts about 200 cure cycles and hence has to be replaced. Air bags are made by extruding a suitable compund, inserting the valve cutting to specified length, joining the cut ends and vulcanising in a separate mould with air pressure inside the bag.

Bag-O-Matic cures are also practised for cycle tyre production.

317 Finishing and Inspection:- All tyres produced are removed of excess flash and inspected. Tyres with no defects are passed as first quality. Tyres having any of the following defects are classed as second quality.

1 Foreign matter 2 Open ply joint 3 Hydraulic failure not prominent and affecting locally only 4 Rubbery bead 5 Heavy or open tread joint 6 High wire 7 bad setting 8 blister 9 demoulding splits. 10 bareness 11 deformed bead 12 double mould 13 undercure 14 Split on bead.

Of the total production about 5 to 8% generally comes under second quality.

Tyres that can not be used becuase of any of the following serious defect are classed as scrap.

1. broken wire 2. deformed bead 3. general bareness
4. hydraulic failure 5. damaged letters 6.high wire
7. rubbery bead 8. bad setting 9. sevre blister
10. badly under cured 11. heavy bareness on bead
12. heavy or open tread joint.

Scrap tyres are below 0.5% in normal production.

332 ISI Specification & Quality Control:- The ISI specifications ISI. 2414-1969 comprise of Grade II cycle tyres and Grade I cycle tyres (Rickshaw tyres). These specifications recommend the minimum requirements of most of the essential properties of types.

The various tests and specifications are listed below (Specificati refer only to GradeII cycle tyres.)

a. Non destructive testing.

| Normal size | Circumference mm | Section width mm |
|---|---|---|
| 28 x $1\frac{1}{2}$ | 2250 $\pm$ 20 | 30 $\pm$ 3.0 |

Circumference and Section Width are also specified for other sizes of tyres.

b. Destructive testing

1 Crown thickness 4.8mm minimum

2. Cord strength 2 Kg minimum

3. Casing strength 120 Kg/25 mm minimum

4. Tensile strength and Elongation at break of tread compound.

   Tensile strength 80 Kg/$cm^2$ minimum

   Elongation at break 300% minimum

5. Breaking strength of bead wires 250 Kg minimum

6. Bending strength of Bead wires (Denision test)

   Must withstand at least 10 right angle bends.

7. Tension set 20% maximum.

8. Accelerated ageing.

   Tensile strength not very more than $\pm$ 20%

   Elongation at break not very more than $\pm$ 30%

Detailed sampling and testing procedures are given in ISI - 2424-1969 and can be refered to. It is planned to test sample production for ISI specification in laboratories where facilities are available. The services of Rubber Research Institute of India and Common Facility centre for Rubber and Plastics can be made use of in this regard.

ISI certification mark on product can lead to better consumer acceptance by assuring the quality of the product.

33 Compounding for Cycle Tyres:- The main requistes of cycle tyre tread compound are the following.

1. uniform plasticity to ensure that the tread which is either extruded or calendered maintains its dimensions within very narrow limits and plasticity

low enough to get sharp mould design with lower air pressure (7 Kg/cm$^2$)

2. ability to be cured at high temperature without reversion

3. faster cure rate with good processing safety.

4. good resistance to flex cracking,abrasionand ageing.

Fillers are very important from the cost point of view. In the tread compound, the filler ranges from the cheapest to relatively more expensive types selected from furnace blacks. China clay is being used extensively in bicycle tyres tread because of its low cost and its ability to import a reasonable high order of stiffness. The disadvantages are poor tear resistance and tensile strength. Cheapest type of black and coloured tyre can be manufactured using china clay as the sole filler apart from small amounts of carbon black or colour. By gradually replacing china clay with furnace blacks such as HPF, SRF, FEF or HAF tyre performance and service life can be improved so that high quality cycle tyre can be produced.

Reclaim is used in black cycle tyre treads to cheapen the compounds and to improve its processing and moulding properties. The actual amount used depends on the composition of the compound and on the quality of tyre being produced.

Pine tar is most effective in natural rubber compounds to impart high tack and efficient processing.

Wax is being frequently used in bycycle tyre treads in small proportions to give profection against ozone cracking.

Nonox B, PBN,BL etc. are used as antioxidants.

Zinc oxide, Stearic acid and Sulphur are used at normal levels.

34 Accelrator Systems:- Conventional accelerator systems were

thiazoles with gunadine (MBT, MBTS with TMT or DPG) The present trend is to use sulfenamides and it has the following advantages.

1. better scorch safety
2. faster cure cycles
3 better physical properties
4 lower accelerator cost.

Accelerator dosages are very important with regard to processing and cure characteristics.

An HBS/TMT system can be used effectively.

35 Cycle Tyre Formulations:-

| Ingridient | Tread | Carcass Compoun |
|---|---|---|
| Natural Rubber | 60 P.b.w | 100 p.b.w |
| Renacit VII | - | 0.25 |
| Reclaim WTR - 100 | 80 | - |
| China Clay | 60 | - |
| Whiting | - | 80 |
| GPF Black | 20 | 5 |
| ZnO | 3.5 | 3.5 |
| Stearic acid | 1.5 | 1.5 |
| PEN | 0.75 | 1.0 |
| HFN | 0.75 | - |
| Pine tar | 2.0 | 2.5 |
| Aromatic oil | 7.0 | - |
| Paraffin Wax | 1.0 | - |
| HBS | 0.80 | 0.8 |
| TMT | 0.25 | 0.3 |
| Sulphur | 2.50 | 2.5 |

(Cure: 4 minutes at 158 -160°C)

## Curing bag compound

| | |
|---|---|
| NR | 100 |
| GPF | 15 |
| Clay | 40 |
| ZnO | 15 |
| Mgo(light) | 15 |
| Stearic acid | 2.0 |
| ELN | 1.25 |
| PBN | 1.0 |
| MBTS | 0.75 |
| S. | 2.0 |

Cure:- 30 minutes at 50 psi steam.

Other formulations which can be considered are given in appendixes II, III & IV.

36. Problems in cycle Tyre manufacture.

Common problems arising in cycle tyre manufacture, their cause and remedies are given below:

| TROUBLES | REASONS | REMEDY |
|---|---|---|
| 1. Rough surface of Tread during extrusion. | 1. High Reclaim. | Improve new polymr Ratio. |
| | 2. Inferior quality of Reclaim. | Reject low quality Reclaim. |
| 2. Blister on tread during extrusion. | 1. Low viscosity. | Reduce oil level. |
| | 2. High temperature extrusion. | Reduce temp.by water cooling. |
| 3. Mould flow marks on side wall. | 1. Too fast curing system. | Reduce booster level. Design safer accelerator system. |

| | | |
|---|---|---|
| | 2. Low pressure or leakage of air pressure in curing bag. | Adjust air pressure min. 120 psi. Check air bag for leakage and replace. |
| 4. Low adhesion in plies. | 1. Heavy filler loading in carcass compound. | Filler loading should not exceed 40-50 parts. |
| | 2. Carcass undercure. | Carcass should be faster curing than tread. |
| | 3. Carcass overcure. | Reduce acceleration level and adjust with tread. |
| 5. Shifting of beadwire. | 1. Overdiameter of beadwire. | Check beadwire for proper diameter. |
| | 2. Beadwire joints separated. | Check beadwire joints. |
| 6. Bursting of tyre. | 1. Too deep tread depth. | Tread depth should be 2-3 mm. |
| | 2. Overcuring of Tread & Carcass | Reduce accelerator dosage or reduce curing time and temperature. |

37. Some important Aspects of Manufacture.

1) Specific gravity of the tread may be between 1.17 to 1.25

2) The weight of tyre should be between 725 to 850 grams. The total weight should be controlled giving high crown thickness rather than by high specific gravity of the compound;

3) Total crown thickness with plies should be distributed proportionately by giving high button depth, low bridge thickness and adequate ply thickness. A total cronw thickness of 4.8 to

5.2 mm. can be covered up by ply thickness 0.65 to 0.80 , button depth 2.75 to 3.00 mm. and bridge thickness 1.8 to 1.4 mm.

4) Performance can be increased by maintaining minimum 300% elongation at break with high tensile strength and modulus.

5) De Mattia flex for separation of cords from tread should be minimum 100 Kilo cycles for flex performance of tyre.

6) ply to ply adhersion strength should be minimum 4 Kgs/inch width and tread to ply strength should be minimum 5 Kg/inch.

38. Process loss and Waste Disposal:-

Lowsses can occur in different stages of operation.

1) Weighing,mixing - material loss by ply off and otherwise (loss approximately 1%)

2) Dough preparation- a small quantity of mix will adhere to the mixer.

3) Curing and Finishing- about 1.5% is lost as residual flash or marks. Some amount of mould lubricant is also lost.

The total process loss is less than 5%.

Defective tyres are the major waste material. It comes to about 0.5% of total production. Since reclaims factories are not interested in cycle tyre scrap the waste has to be disposed off otherwise. Separate area outside the factory building has to be provided for this .

Scrap curing bags are another items which can be disposed off to reclaim factories. This comes to about 7500 Kgs per annum.

## 4. PRODUCTION REQUIREMENTS.

Location of the plant, layout of the factory and selection of equipment and of the methods and process of manufacture are very important decisions because of their long-term nature and commitment of capital. All these depend on the production capacity.

### 41. Estmated production.

The proposed project is to produce 2000 cycle tyres per day in 3 shift working.

### 42. Plant location.

Site selection is important because of two factors.

1. A factory is relatively immobile and when once constructed and for occupied, it is difficult to abandon the site.
2. The impact of plant location on operating costs and profits are considerable. Operating costs may vary up to 25% or even 50% from one location to another.

The choice must fall on the one which answers as closely as possible the following further requirements.

1. Proximity to markets.
2. Proximity to raw matrials and vendors of spare parts, general stores items, tools etc.
3. Facilities for transportation.
4. Availability of unskilled and skilled labour.
5. Availability of power, water and fuel.

A small scale concern for cycle Tyre production can be conveniently located in Industrial Estates because of the following advantages.

1. Lower capital investment-land and building are available at very reasonable rent.
2. Electricity, water and transport facilities available without delay, and without spending money.
3. Reduce over head costs to minimum.
4. Availability of labour in the grade and quantity required.
5. Industrial Estae provides accommodation for banks, post and telegraphs Office, canteens, shops, dispensaries, recreation facilities, reading rooms etc.
6. Availability of testing facitlites and training facilities for labour.
7. Collective purchase of raw materials.

The proposed project can therefore be advantageously be located in an inustrial Estate in Kerala.

43. Building

The advantageous of wide bamys, natural illumination and fexibility of layout and easier handling should be taken into consideration in building selection. Factory premises, nearby factories etc. are also important factors.

The total building area should be 750 Square meteres. In an industrial estate this may be obtained at a rent of Rs.1000/ month.

The available area is split as follows for the different departments.

| DEPARTMENT | AREA IN SQUARE METRES. |
|---|---|
| Compounding Room | 60 |
| Mixing and Tread Calendering | 125 |
| Spreading | 60 |
| Tyre building | 40 |
| Tyre moulding | 100 |
| Boiler Room | 40 |
| Packing, Stores, Testing, Office etc. | 300 |
| Worker's amenities | 25 |
| | 750 |

44. Plant Layout.

The important points to be remembered in fixing a layout are

1. materials handling (both external and internal) should be minimum
2. continuous flow of materials.
3. storage capacities and their location.
4. expansion at a later date which should dovetail into existing operations.

The proposed layout is shown in appendix V.

45. Raw Materials.

The important raw materials required for cycle tyre manufacture are the following.

451 Cycle tyre Cord:- 4 Cord x 145, 30 TPI 1½ picks per inch. Width 62". Cord strength above 2 Kgs.each. Available as rolls of length 137 metres and weight 28 Kgs. 1 roll gives approximately 250 tyres.

452 Bead Wire. :- Copper coated high tensile steel with a tensile strength of 155 $Kg/mm^2$ and having 0.375 grams of copper per Kilogram . 0.072" dia. 250 Kg minimum breaking strenght and capable of at least 10 rightangle bends, without break. Available either as wires or as beads with inside dia 1998 ± 2 mm.

453 Compounding ingredients:- The compounds are cycle tyre tread, cycle tyre carcass and curing bag. The ingredients can be classified as follows:

1. Polymer:- Natural rubber (RMA grade, crepe or modern solid block rubber) and reclaim(WTR).
2. Fillers:- China clay, whiting, GPF black and Magnesium oxide.
3. Accelerations:- HBS, TMT, MBTS.
4. Activators:- Zincmx oxide and stearic acid .
5. Curing agent: Sulphur
6. Antioxidant:- PBM, HFN, BLN & Wax.
7. Peptiser:- Renacit VII
8. Processing aids. Pine tar and Aromatic oil.
9. Solvent oil.

454, Quantity Required and Price:

The quantity of raw materials required is calculated on the basis of a typical tyre weight analysis and on the total production per annum. The amount of compounding iggredients are calculated basing on the formulations.

The annual requirement of cord, bead, and ingredients of tread, carcass and curing bag are computed and given in Annexures V,VI and VII.

The prices of raw materials are also given in the above annexures.

A Typical tyre weight analysis is as follows:-

| | |
|---|---|
| Tread Compound | 0.5 Kgs, |
| Spread compound | 0.120 Kgs. |
| Cord | 0.100 Kgs. |
| Beads | 0.080 Kgs. |
| | 0.800 Kgs. |

455. Source of supply.

The source of supply of the raw materials required is shown in Appendix VI.

456 Terms of Purchase.

Raw material purchase is done through banks. The purchased materials will be kept in the banks godwon and materials in small quantities are withdrawn whenver required, on payment of cash. The total amount has to be paid back in a defenite period. Details regarding this are easily available from bank sources.

46 Plant & Machinery

The machinery size, capcaity and number are primarly determined by the production capacity. The machinery required for 2000 cycles tyres per day in 3 shifts. is listed below:

461 Machinery Details.

1. Mixing Mill size 16" x 42" complete with imported cast iron rolls, reduction gear 60 HP motor, starter with electromagnetic breake, safety dvices and other accessories.

The batch weight is 40 Kgs. and cycle time 22 minutes(mastication of natural rubber is done on the warming mill provided). The

mill. working in two shifts can mix 40 batches and has capacity in excess of than the total mix required for a day.

2. Mixing mill size 12"x30", 30 HP motor, other specifications as above.

This mill is aimed as a warming mill for tread calender and cure bag extruder and also formastication.

3. 3-bowl vertical tread calender, size 6"x18" complete with drive arrangements, reduction gear and accessories. 7.5 HP motor. Has excess capacity and can be worked for one shift.

4. 4-daylight cycle tyre press with 4 sets of moulds duly engraved. One hydraulic pump common to two presses. Two presses can turn out just above 2000 tyres in three shift working with a cure cycle of five minutes at 158-160 ° C.

5. Monoband tyre building machine with motor and standard accessories. It takes less than one minute for a tyre to be built on monoband. Two monobands working in three shifts can very well turn out more than 2000 tyres.

6. Spreading machine, platen size 1750x2150 mm, steam heated with driving motor 3 HP, reduction gear, the rubberised rolls of 125mm dia x 1900mm. Output per minute 8 to 9 metres. Close up to 62" width can be rubberised. Worked only for one shift.

7. 2 Churning mills-50 gals capacity complete with 2 HP motor and accessories.

8. Extruder size 2½" with 7HP motor, D.C. drive and other accessories. Worked only when necessary (curing bag extrusion).

9. Curing bag press with mould and other accessories.

10. Tearing and rerolling machine with motor and accessories.

11. Boiler 400 Kgs/hr. 100 psi. ?

12. Air compressor 20 cfm,100 psi.

13. Auxillaries,conveyors,cooling water equipments,steam piping,compressed air piping,miscellaneous tools and other equipments.

462 Sources of supply:

The sources of supply of machinery are shown in appendix 7(VII)

463 Terms of purchase:

Terms of purchase may vary slightly from one manufacturer to another. However general rules can be summarised as follows:-

1. Quotation pris es are exclusive of packing,transportation, coasts, sales tax,octroi,excise duty etc.

2. 30% of the prise should be paid in advance and the remaing at the time of purchase.

3. Purchaser has the right to inspect the machinery.

4. Supplier has the right for cancellation,changing delivery time and price,due to unforeseen Seasons.

5. Warranty against manufacturing defects assured.

6. Liabilites passes to customer immediately after despatch.

7. Payments can be done through banks.

464 Machinery prises:

Machinery price vary considerably depending on the manufacturer. Quality,efficiency,durability and other peculiarities are important in machinery selection. The help of an experienced machanical engineer is

very helpful in machinery selection.

The current prices of machinery are given in annexure-I

47. Personnel requirements

471 Managerial, technical and other staff are shown in table form below:

| | No |
|---|---|
| 1. Manager-cum-Technologist | 1 |
| 2. Head Foreman-cum-Engineer | 1 |
| 3. Store in charge | 1 |
| 4. Mechanic | 1 |
| 5. Clerk/typist | 1 |
| 6. Cashier/Accountant | 1 |
| 7. Shift in charge | 3 |
| Total | 9 |

472 Labour Force required is shown below:

| Department | Working shift | Requirement/Shift | | |
|---|---|---|---|---|
| | | Unskilled | Semiskilled | Skilled |
| 1. Compounding | 2 | 1 | 1 | -- |
| 2. Mixing | 2 | 1 | -- | 2 |
| 3. Tred Calender & Cure bag extruder | 1 | 1 | 1 | 2 |
| 4. Spreading | 1 | 1 | 1 | 2 |
| 5. Fabric tearing | 2 | -- | 2 | -- |
| 6. Building | 3 | 1 | -- | 2 |
| 7. Moulding | 3 | -- | 2 | 2 |
| 8. Triming, buffing, packing etc. | 2 | 2 | 1 | -- |

| | | | | |
|---|---|---|---|---|
| 9. Stores | 1 | 2 | -- | -- |
| 10. Boiler room | 3 | 1 | -- | 1 |
| 11. Watchman | 3 | 1 | -- | -- |
| Total/3 Shifts | | 21 | 16 | 23 |

473 Training programme:

Skilled workers are necessary in compounding, spreading, calendering, building and moulding. Fresh workers should be given adequate training in institutions like common facility centre or other sources. A certain number of experienced hands will be helpful in a new concern. Adequate time should be given for the workers for factory and process familiarisation.

48. Other facilites

481 Roads

Roads are important from the point of view of easy accessibility to raw materials source, market, railway station etc. Main roads near to factory reduces transportation problems.

Since the proposed project is in an Industrial Estate accessibility problems do not arise.

482 Water

Water is required for mixing mills and for boiler feed. Water is also required for workers and staff. The Industrial Estate supplies water at a very nominal charge.

483 Steam

Steam is required for cycle tyre moulding through out the day. A 400Kg per hour boiler supplies steam to the presses for moulding.

484 Electricty :- Power is easily available in Kerala. Industrial Estates ensure power without expenditure on transformer and other electrical accessories. Separate connections are necessary for high tension and low tension lines.

## 5 SELLING AND DISTRIBUTION

The most commonly adopted methods of sales are:-

1 Direct sales by opening sales depots

2 Through agents on commission basis.

Opening sales depots in important cities and towns is more practicable for large scale manufactures. For small scale concerns this will involve more overheads. Therefore for the proposed concern the second method of sales through agents on commission basis is preferred. The commission on sales given to the distributors is about 12.5%.

Since cycle tyre has good local sales possibilities, a local sales depot can be opened which can cater effectively local demand.

Distribution can be on f.o.r. basis.

Transportation by truck is advantageous for timely supply of meterial.

## 6 CAPITAL REQUIREMENTS

### 61 Fixed Assets

Fixed assets include capital expenditure on purchase of land,

construction of building, purchase of machinery and other fixed items.

Since the project is located in an industrial estate no capital is involved in land and building.

Fixed capital details are shown in Annexures I, II, III, IV.

An additional 5% is added to machinery cost to account for price escalation, due to unforseen reasons. 15% of the cost of machinery is accounted for tax (7.5%), electrification (5%) and transportation (2.5%).

Office machinery, equipments, furniture etc, are also included in fixed capital. An approximate amount of Rs.50,000 is allotted for preliminary and preoperative expenses. A period of 6 months is taken as idle time for building and machinery before actual production starts.

'Plant and Machinery' cost is Rs.8,52,600. Therefore the proposed project comes under the small scale limit of Rs.10 lakhs.

Total fixed capital expenditure is estimated to be Rs.10,38,000.

62 Working Capital:- This includes money spent on raw material, salaries and wages, utilities (steam, power and water) and overhead expenditure. Overheads include repairs, maintainence advertisement, stationary and supplies, travelling expense, postage telephone, telegrams and other miscellaneous expenses. Maintainence and repairs cost around 5% of machinery cost. 1% of fixed capital is accounted as insurance.

A rent of Rs.1000/month for building is accounted in working capital.

Working capital details are shown in annexures V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV.

Working capital is computed for 3 months which is the time supposed to be taken for recirculation of money.

Total working capital works out to be Rs.11,15,000.

63 Gross Capital:-

| | | |
|---|---|---|
| Fixed Capital | Rs. | 10,38,000 |
| Working Capital | Rs. | 11,15,000 |
| | | 21,53,000 |

## 7 FINANCING PLAN

71 Financial Assistance - Sources :- The following sources can be approached for financial assistance.

1 National Small Industries Corporation

Machinery on hire purchase to small scale manufacturing unit. Repayable in seven years on easy instalments . Interest 7%.

2 State Small Industries Corporation

Offers machinery on hire purchase on a marginal money or deposit of 20%. Repayment starts after two years and should be complete within 7 years. It offers special concessions to technically qualified persons. Interest 7½%.

3 State Financial Corperations

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 10-12 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 aginst the pledge of raw materials at 16% interest. Factory type advance, Advance against Bills, Grant of clean credit etc. are the other types of loan facilities available.

Co-operative Bank gives loan to industrial co-operatives.

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

72 Financing of the Project:- Gross capital of Rs.21,53,000 is proposed to be realised in the following manner.

721 Borrowings:- The whole machinery cost of Rs.8,52,600 is obtained from Kerala State Financial Corporation (KFC) at an interest of 10%.

100% of the working capital of Rs.11,15,000 is supposed to be taken from a Nationalised Bank.

722 Own Fund:- The balance of the total capital is contributed by the entrepreneur. This is Rs.1,85,400. This amount of the fixed capital is used for preliminary and preoperative expense.

| | | | |
|---|---|---|---|
| A | Borrowings | | |
| | 1 KFC | Rs. | 8,52,600 |
| | 2 Nationalised Bank | Rs. | 11,15,000 |
| B | Own Fund | Rs. | 1,85,400 |
| | | | 21,53,000 |

## 8 PRODUCT PRICING

Product price is fixed based on current market price, cost of production, production capacity, profit consideration, sales commission, sales tax, excise duty and other considerations. The current market prices of cycle tyres produced by important manufactures is shown in appendix VIII.

For first quality product the price is fixed as Rs.10-25 and for second quality Rs.8-75.

## 9 PROFITABILITY

The project is expected to have a gross profit of Rs.4,32,969 and a net profit of Rs.3,03,000.

With a capital investment of Rs.21,53,000, this works out to be 14.09% profit on total capital. The rate of return on own capital (Rs.1,85,400) is 163.4%.

Profit ratios on fixed capital, working capital, total capital Annual sales and Own fund are worked out and shown in Annexure XIX.

## 10 ECONOMIC VIABILITY

The feasibility of the proposed project can be assured from the profit ratios and from the following details.

101 Interest Commitments :- Annual interest commitments are as follows.

| | | |
|---|---|---|
| 1 | Term loan for machinery @ 10% | Rs85,260 |
| 2 | Working capital loan @ 16% | Rs.1,78,400 |
| | | 2,63,660 |

Rounded off 2,63,500

102 Payback Period :- The term loan on machinery is paid back within the prescribed period. Interest can be saved if payback is done as early as possible. Of the total surplus approximately 25% is retained and 75% used to payback term loan. The ability to payback borrowings increases in subsequent years as cash inflows are higher due to decrese in interest commitments.

Payback

| | |
|---|---|
| Annual net profit | Rs. 3,03,000 |
| Depreciation | Rs. 91,000 |
| Total surplus | Rs. 3,94,000 |
| 25% retainment | 98,500 |
| Amount used for repayment | Rs. 2,95,500 |

| | |
|---|---|
| Term loan to be paid back | Rs. 8,52,600 |
| Payback period | 2.88 year's |

Payback period is calculated based on first year's surplus. Since capability to payback is more in subsequent year's, the actual period will be even less than that shown.

## 14 SOCIAL BENEFITS

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 wealths.
3 Contributes to nation's revenue earnings through taxes, excise duty etc.
4 earns foreign exchange through export
5 develops entrepreneurship and entrepreneurial skills.
6 personal profit to entrepreneur.

## 12 CONCLUSION

The scheme can be given in a nutshell as follows.

| | | | |
|---|---|---|---|
| 1 | Fixed Capital | Rs. | 10,38,000 |
| 2 | Working Capital | Rs. | 11,15,000 |
| 3 | Total Capital | Rs. | 21,53,000 |
| 4 | Plant and Machinery | Rs. | 8,52,600 |
| 5 | Location | An Industrial Estate in Kerala. | |
| 6 | Building Area | 750 square metres | |
| 7 | Labour force | 60 | |
| 8 | Staff | 9 | |
| 9 | Annual Production | 6 lakhs cycle tyres | |

The Project as shown is economically sound and feasible.

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# A N N E X U R E S

# ANNEXURE - I

## LAND, BUILDING & MACHINERY

1. LAND AND BUILDING - Rented (Accounted in working Capital)

| 2. MACHINERY | No. | Rs. |
|---|---|---|
| 1. Mixing mill, size 16" x 42" | 1 | 1,40,000 |
| 2. Mixing mill, Sixe 12" x 30" | 1 | 70,000 |
| 3. 3 Bowl Tread Calender | 1 | 30,000 |
| 4. 4-day light press with mould | 2 | 2,70,000 |
| 5. Monoband | 2 | 60,000 |
| 6. Spreading Maching | 1 | 40,000 |
| 7. Churning mills 50 gals. | 2 | 15,000 |
| 8. Extruder, size 2½" | 1 | 12,000 |
| 9. Tearing and Rerolling machine | 1 | 35,000 |
| 10. Boiler, 400 Kgs/hr., 100 psi | 1 | 65,000 |
| 11. Air compressor, 20 c/m, 100 Psi | 1 | 20,000 |
| 12. Weighing balance and equipments | | 5,000 |
| 13. Auxillaries, conveyors for tyre tread cooling water arrangements, steam piping compressed air piping etc. | | 15,000 |
| 14. Otherequipments and facilities miscellaneous tools etc. | | 20,000 |
| 15. Curing bag press with mould | 1 | 15,000 |
| Total | | 8,12,000 |
| Add 5% Price escalation | | 40,600 |
| Total Machinery Cost | | 8,52,600 |

## ANNEXURE - II

### OTHER FIXED EXPENSES

| | Rs. |
|---|---|
| 1. Office Machinery, Equipments and others. | 5,000 |
| 2. Furniture and other mischllaneous expenses | 2,500 |
| Total | 7,500 |

## ANNEXURE - III

### PRELIMINARY AND PREOPERATIVE EXPENSES

| | Rs. |
|---|---|
| 1. Interest on block capital loan at 7.5% for 6 months | 31,000 |
| 2. Taxes | 1,000 |
| 3. Travelling expenses | 5,000 |
| 4. Postage, Telegrams and Telephones | 1,000 |
| 5. Local charges | 2,000 |
| 6. Printing and typing | 2,000 |
| 7. Establishment charge | 6,000 |
| 8. Miscellaneous | 2,000 |
| | 50,000 |

# A N N E X U R E - IV

## FIXED ASSETS

| | | Rs. |
|---|---|---|
| 1. Land and building | (Annexure -I ) | (Rented) |
| 2. Machinery | (Annexure -I) | 8,52,600 |
| Tax 7.5% | | 63,945 |
| Electrification and erection 5% | | 42,630 |
| Transportation 2.5% | | 21,315 |
| 3. Other Fixed Expenses | (Annexure-II) | 7,500 |
| 4. Preliminary and Pre-Operative Expenses | ( Annexure III) | 50,000 |
| | Total | 10,38,990 |
| | Round off | 10,38,000 |

## ANNEXURE-V

RAW MATERIAL - COMPOUNDING INGREDIENTS

| Ingredient | Rate/Kg. Rs. | Tread Compound Kgs. | Tread Compound Cost | Spread Compound Kgs. | Spread Compound Cost. |
|---|---|---|---|---|---|
| NR | 9.00 | 250 | 2250.00 | 126.9 | 1142.1 |
| WTR | 3.30 | 333 | 1098.00 | -- | -- |
| Clay | 0.30 | 250 | 75.00 | -- | -- |
| GPF | 4.50 | 83 | 373.50 | 6.325 | 28.46 |
| ZnO | 16.10 | 14.5 | 233.45 | 4.45 | 71.64 |
| St.acid | 11.50 | 6.25 | 71.87 | 1.903 | 21.85 |
| PBN | 36.00 | 3.125 | 112 .50 | 1.569 | 56.52 |
| HFN | 33.10 | 3.125 | 103.44 | -- | -- |
| Pinetar | 5.0 | 8.3 | 41.50 | 3.17 | 15.85 |
| Oil | 9.0 | 29 | 261.00 | -- | -- |
| Wax | 4.5 | 4.08 | 18.36 | -- | -- |
| HBS | 44 | 3.33 | 146.52 | 1.015 | 44.66 |
| TMT | 29.54 | 1.04 | 30.72 | 0.38 | 11.23 |
| Sulphur | 2.0 | 10.4 | 20.80 | 3.17 | 6.34 |
| Renacit VII | 23.38 | -- | -- | 0.317 | 7.41 |
| Whiting | 0.35 | -- | -- | 101.75 | 35.61 |
| Solvent oil | 3.46 | -- | -- | 400. | 1384.00 |
| Quantity /day | | 1000 | 4836.61 | 250 | 2825.37 |
| Annual | | 3,00,000 | 14,51,000 | 75,000 | 8,47,600 |

## ANNEXURE - VI

### RAW MATERIAL - CORD & BEAD

| | Quantity | Rate.Rs. | Cost Rs./day | Annual cost |
|---|---|---|---|---|
| 1. Tyre Cord | 200 Kgs. | 20/Kg | 4,000 | 12,00,000 |
| 2. Bead | 4000 (number) | 300/1000 | 1,200 | 3,60,000 |

## ANNEXURE- VII

### RAW MATERIAL - CURING BAG

| Ingredeient | Rate/Kg Rs. | Quantity Kg. | Annual Cost Rs. |
|---|---|---|---|
| NR | 9. | 3870 | 34830.0 |
| GPF | 4.5 | 588 | 2646.0 |
| Clay | 0.35 | 1560 | 547.2 |
| ZnO | 16.10 | 588 | 9307.2 |
| MgO | 17.68 | 588 | 10364.0 |
| Stear.Acid | 11.50 | 78 | 900.0 |
| BIN | 34.24 | 48 | 1668.0 |
| PBN | 36.00 | 39 | 1404.0 |
| MBTS | 31.24 | 29 | 912. |
| S | 2 | 78 | 156 |
| | | 7500 | 62734.40 |
| | | Rounded Off | 62700. |

## A N N E X U R E- VIII

### RAW MATERIAL EXPENSE- ( Annual)*

| | Rs. |
|---|---|
| 1. Tyre Cord (Annexure VI) | 12,00,000 |
| 2. Bead ( " ) | 3,60,000 |
| 3. Tread Compound (Annexrue V) | 14,51,000 |
| 4. Spread compound (Annexture -V) | 8,47,600 |
| 5. Curing bag (Annexrue -VII) | 62,700 |
| Total | 39,21,300 |
| Add 2% loss | 78,426 |
| | 39,99,726 |
| Round off | 40,00,000 |

* Transportation expenses of raw materials included.

# ANNEXURE - IX

## MAN POWER REQUIREMENTS - ANNUAL.

| A. S T A F F. | No. | Rate of pay p.m. Rs. | Total per annum Rs. |
|---|---|---|---|
| 1. Manager-cum-Technologist | 1 | 1200 | 14,400 |
| 2. Head foreman-cum-Engineer | 1 | 700 | 8,400 |
| 3. Store in charge | 1 | 400 | 4,800 |
| 4. Machanic | 1 | 350 | 4,200 |
| 5. Clerk/Typist | 1 | 350 | 4,200 |
| 6. Cashier/Accountant | 1 | 350 | 4,200 |
| 7. Shift in charge | 3 | 350 | 12,600 |
| | 9 | | 52,800 |
| **B. LABOUR** | | | |
| 1. Unskilled in 3 shifts | 21 | 8/day | 50,400 |
| 2. Semi skilled in 3 shifts | 16 | 10/day | 48,000 |
| 3. Skilled in 3 shifts | 23 | 12/day | 82,800 |
| | | Total | 2,34,000 |
| | | Fringe benefit 20% | 46,800 |
| | | | 2,80,800 |
| | | Round off | 2,81,000 |

# ANNEXURE-X

## UTILITIES - POWER(ANNUAL)

| | KW. | Hrs.of working | KWh/day. |
|---|---|---|---|
| 1. Mixing mill 16" x 42" | 45 | 16 | 720 |
| 2. Mixing mill 12" x 30" | 22.5 | 16 | 360 |
| 3. Tread calender | 5.5 | 8 | 44 |
| 4. Spreading machine | 2.5 | 8 | 20 |
| 5. Tearing and Remolling machine | 1.5 | 16 | 24 |
| 6. Monobands | 1.5 | 24 | 36 |
| 7. Presses | 9 | 24 | 216 |
| 8. Compressorss | 3 | 24 | 72 |
| 9. Boiler | 2.5 | 24 | 60 |
| 10. Bax Churner | 3. | 24 | 72 |
| 11. Extroder | 7 | 1 | 7 |
| 12 Additional | - | - | 10 |
| | | | 1641 |
| 13. Lighting, fan etc. | | | 40 |

**Cost of Power**

| | | |
|---|---|---|
| A. Power per annum | | 492300 Kwh. |
| Assuming 80% utilisation | | 3,93,840 " |
| Cost at Rs.0.15/Kwh | Rs.- | 59,076.00 |
| B. Lighting per annum | | 12,000 Kwh. |
| Cost at average rate of Rs.0.25 | Rs. | 3,000 |
| .'. Total cost for power A + B | Rs. | 62,076 |
| Round off | Rs. | 62,000 |

## ANNEXURE- XI

### UTILITIES - FUEL (ANNUAL)

| | |
|---|---|
| Fuel consumption | 70 litres/day |
| Annual consumption | 21000 litres. |
| Furnace oil price | Rs. 1.05/litre. |
| Transportation | Rs. 0.05/litre. |
| Total Fuel cost per annum | Rs. 22,100 |
| Round off | Rs. 22,000 |

## ANNEXURE- XII

### UTILITIES - WATER( ANNUAL)

| | |
|---|---|
| Annual water consumption | 3000 Kilo litres |
| Total cost for water at Rs. 60/Kilo litre . | Rs. 1800 |

## ANNEXURE- XIII

### OVERHEADS- ANNUAL.

| | Rs. |
|---|---|
| 1. Repairs and Maintanance on Machinery 5% | 42,600 |
| 2. Insurance 1% of fixed capital | 10,380 |
| 3. Audit fee and legal charges | 3,000 |
| 4. Postage, Telephone telegrams | 4,000 |
| 5. Advertisement | 5,000 |
| 6. Stationary and supplies | 5,000 |
| 7. Travelling expense | 5,000 |
| 8. Miscellaneous | 5,000 |
| | 79,980 |
| Round off | 80,000 |

## ANNEXURE - XIV

WORKING CAPITAL (3 Months expense)

| | Rs. |
|---|---|
| 1. Raw Material (Annual annexure VIII) | 40,00,000 |
| 2. Man Power (Annual annexure IX) | 2,81,000 |
| 3. Utilities | |
| Power (Annual annexure X) | 62,000 |
| Fuel ( " annexure XI) | 22,000 |
| Water (" annexure XII) | 1,800 |
| 4. Overheads ( " annexure XIII) | 80,000 |
| 5. Rent (annual) | 12,000 |
| Rs. 1000/month. | 44,58,800 |
| Working capital (3 months expenses) | 11,14,700 |
| Round off | 11,15,000 |

## ANNEXURE- XV.

FINANCING PLAN-

A. BORROWINGS

| | Rs. |
|---|---|
| 1. Machinary Expense 100% term loan from KFC (Annexure I) | 8,52,600 |
| 2. Working capital 100% from commercial banks (Annexure XIV) | 11,15,000 |
| B. OWN FUNDS. | |
| Fixed expense other than machinary (Annexures I, II, and III) | 1,85,400 |
| Total | 21,53,000 |

## ANNEXURE XVI.

### DEPRECIATION AND INTEREST(ANNUAL)

| | Rs. |
|---|---|
| **1. DEPRECIATION** | |
| Machinery @ 10%(Annexure-I) | 85,260 |
| Other fixed capital @ 10% (Annexure II & III) | 5,750 |
| | 91,010 |
| Round off | 91,000 |
| **2. INTEREST** | |
| Termx loan for machinery @ 10% (Annexure XV) | 85,260 |
| Working capital loan 16%(annexure XV) | 1,78,400 |
| | 2,63,660 |
| Round off | 2,63,600 |

## ANNEXURE- XVII

| ANNUAL COST OF PRODUCTION | Rs. |
|---|---|
| 1. Raw Material (annexure VIII) | 40,00,000 |
| 2. Man Power (annexure IX) | 2,81,000 |
| 3. Utilities | |
| Power (annexure X) | 62,000 |
| Fuel (annexure XI) | 22,000 |
| Water (annexure XII) | 1,800 |
| 4. Overheads (annexure XIII) | 80,000 |
| 5. Rent | 12,000 |
| 6. Depreciation(annexure XV) | 91,000 |
| 7. Interest ( " ) | 2,63,500 |
| | 48,13,300 |
| Round off | 48,13,000 |

## A N N E X U R E - XVIII

### SALES TURNOVER- ANNUAL *

| | | Rs. |
|---|---|---|
| 1. Total production | 6,00,000 tyres. | |
| 2. First Quality @ Rs.10.25 per tyre | | |
| | 5,67,000 tyres | 58,11,750 |
| 3. Seconds (5% of total production) | | |
| at the rate Rs.8.75 per tyre | 30,000 tyres | 2,62,500 |
| 4. Defective (0.5% of total production) | 3000 " | - - |
| | Total sales | 60,74,250 |
| Less 12.5% commission | | 7,59,281 |
| | | 53,14,969 |
| Less frieght and other expenses @ Rs. 150/ton(480 ton) | | 72,000 |
| | | 52,42,969 |
| Add sale of scrap curing bags | | 3,000 |
| | | 52,45,969 |
| Less cost of production | | 48,13,000 |
| | GROSS PROFIT | 4,32,969 |
| Income Tax at an average of 30% | | 1,29,890 |
| | | 3,03,079 |
| | Round off | 3,03,000 |

NET PROFIT Rs. 3,03,000

(* Product price is exclusive of sales tax and excise duty)

## ANNEXURE - XIX

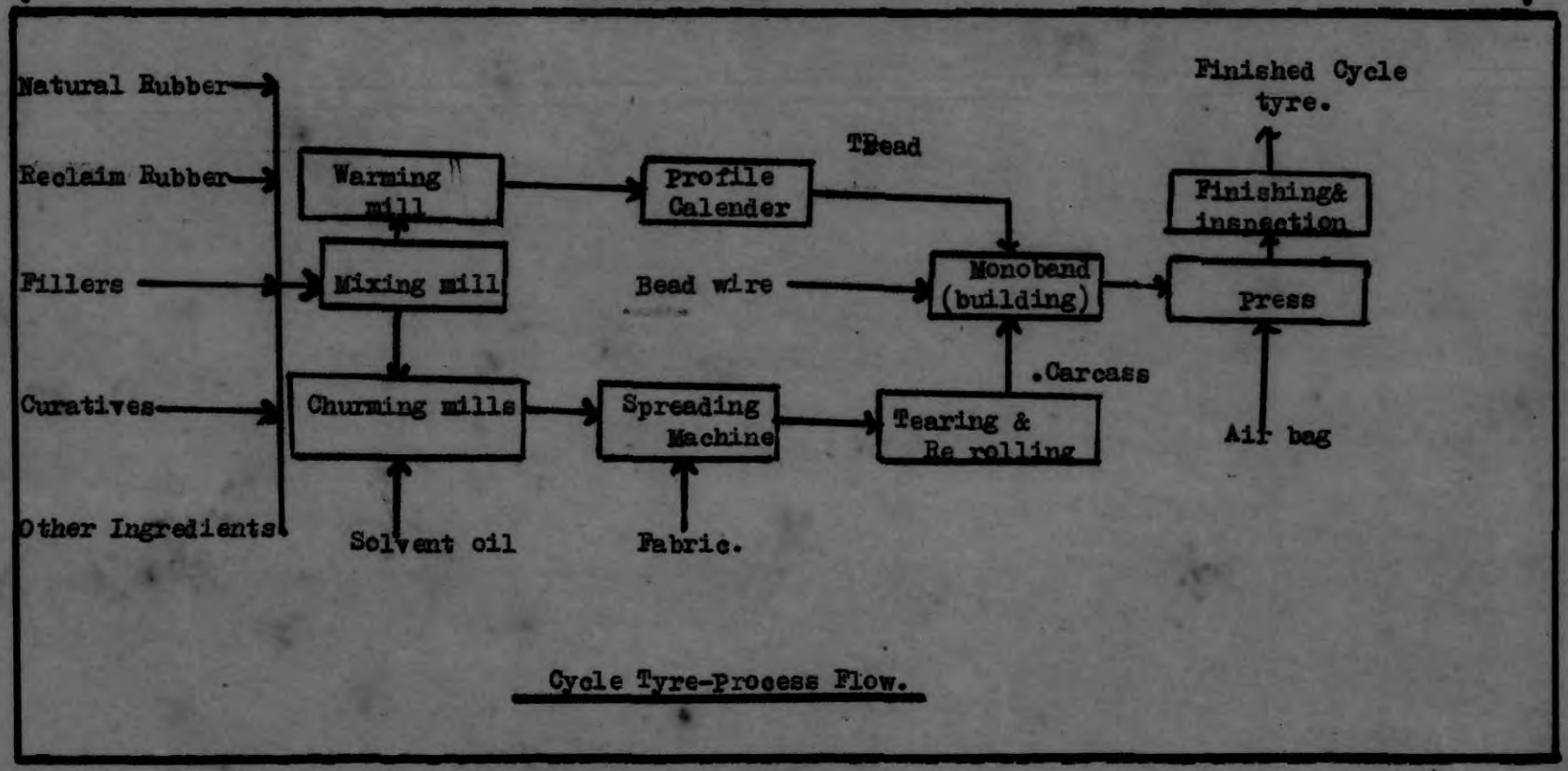
### PROFITABILITY RATIOS

| | Rs. |
|---|---|
| Net Profit (Annexure XVIII) | 3,03,000 |
| Fixed Assets (annexure XIV) | 10,38,000 |
| Working capital (3 months)Annexure XIV) | 11,15,000 |
| Total Capital | 21,53,000 |
| Annual sales turnover | 60,74,250 |
| Own fund(annexure XV) | 1,85,400 |

1. Percentage Profit on Fixed Assets. = 29.19
2. Percentage profit on working capital = 27.17
3. Percentage profit on Total capital = 14.09
4. Percentage profit on Annual sales = 4.99
5. Percentage profit on own fund = 163.4

# APPENDICES

## APPENDIX - I




Cycle Tyre-Process Flow.

## APPENDIX - II

### TYPICAL FORMULATIONS FOR BLACK OR GREY BICYCLE TREADS

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| | Low quality | | Medium quality | | High Quality | |
|---|---|---|---|---|---|---|
| Natural Rubber | 90.0 | 90.0 | 100.0 | 80.0 | 100.0 | 100.0 |
| W.T. Reclaim | 20.0 | 20.0 | - | 40.0 | --- | --- |
| Stearic Acid | 1.0 | 1.0 | 1.5 | 1.5 | 2.0 | 2.0 |
| Zinox Oxide | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 |
| HAF Black | -- | - | 20.0 | -- | - | 30.0 |
| FEF Black | - | - | - | - | - | - |
| GPF Black | - | 20.0 | - | - | - | - |
| China Clay | 40.0 | 20.0 | 20.0 | - | - | - |
| Forcal S | - | - | - | - | 10.0 | 10.0 |
| Nonox BL | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Nonox BLN | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Pine Tar | 1.5 | 1.5 | 1.5 | 1.5 | 2.0 | 2.0 |
| Paraffin Wax | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

| | | | |
|---|---|---|---|
| Curing systems: | Vulcafor HBS | 0.65 | 0.65 |
| | Vulcafor TMT | - | 0.125 |
| | Sulphur | 2.5 | 2.5 |
| | Cure @ 153 ° C. (Mins.) | 11-12 | 7-8 |

## APPENDIX - III

## COLOURED & TRANSPARENT BICYCLE TREADS

| | Coloured Treads | | Translucent Treads. | |
|---|---|---|---|---|
| Smoked Sheet or Crepe | 100.00 | 100.0 | - | - |
| Pale crepe | - | - | 100.0 | 100.0 |
| Stearic Acid | 1.0 | 1.0 | 1.0 | 1.0 |
| Zinc Oxide | 10.0 | 3.5 | 2.5 | - |
| Active Zince Oxide | - | - | - | 1.0 |
| China Clay | 40.0 | 40.0 | - | - |
| Lithopone | 3.0 | - | - | - |
| Titanium Dioxide | - | 2.5 | - | - |
| Magnesium Carbonate | - | - | 40.0 | - |
| Hydrated Aluminium Silicate | - | - | - | 35. |
| Mineral Oil | 1.5 | 1.5 | - | - |
| Paraffin Wax | 1.5 | 1.5 | 1.5 | 1.5 |
| Diethylene Glycol | - | - | - | 2.0 |
| Vulcafor Colour | as required | | | |
| Vulcafor Fast Yellow GTS | - | - | 0.002 | - |
| Nonox B | 1.0 | 1.0 | 1.0 | 1.0 |
| Vulcafor HBS | 1.0 | 1.0 | 1.0 | - |
| Vulcafor MBTS | - | - | - | 1.5 |
| Vulcafor TMT | 0.125 | 0.125 | 0.125 | 0.125 |
| Sulphur | 2.5 | 2.5 | 2.5 | 2.5 |
| Cure at 153°C (minutes) | 7-8 | 7-8 | 7-8 | 7-8 |

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## APPENDIX - IV

### CURING BAGS

| | | | |
|---|---|---|---|
| Smoked Sheet | 100.00 | 100.00 | 100.00 |
| Stearic Acid | 2.00 | 2.00 | 2.00 |
| Nonox BL | 4.00 | 4.00 | 4.00 |
| Vulcafor MBTS | 0.75 | 0.75 | 0.75 |
| Magnesium oxide(light) | 15.00 | - | - |
| Zinc oxide | 30.00 | 30.00 | 70.00 |
| Vulcatac CH | 5.00 | 5.00 | 5.00 |
| GPF Clack | - | 45.00 | 15.00 |
| China Clay | - | - | - |
| Sulphur | 2.00 | 2. | 3 |
| Mineral Rubber | - | - | 5 |

Press Cure: 30-35 minutes at 50 lb. P.s.i. steam pressure.

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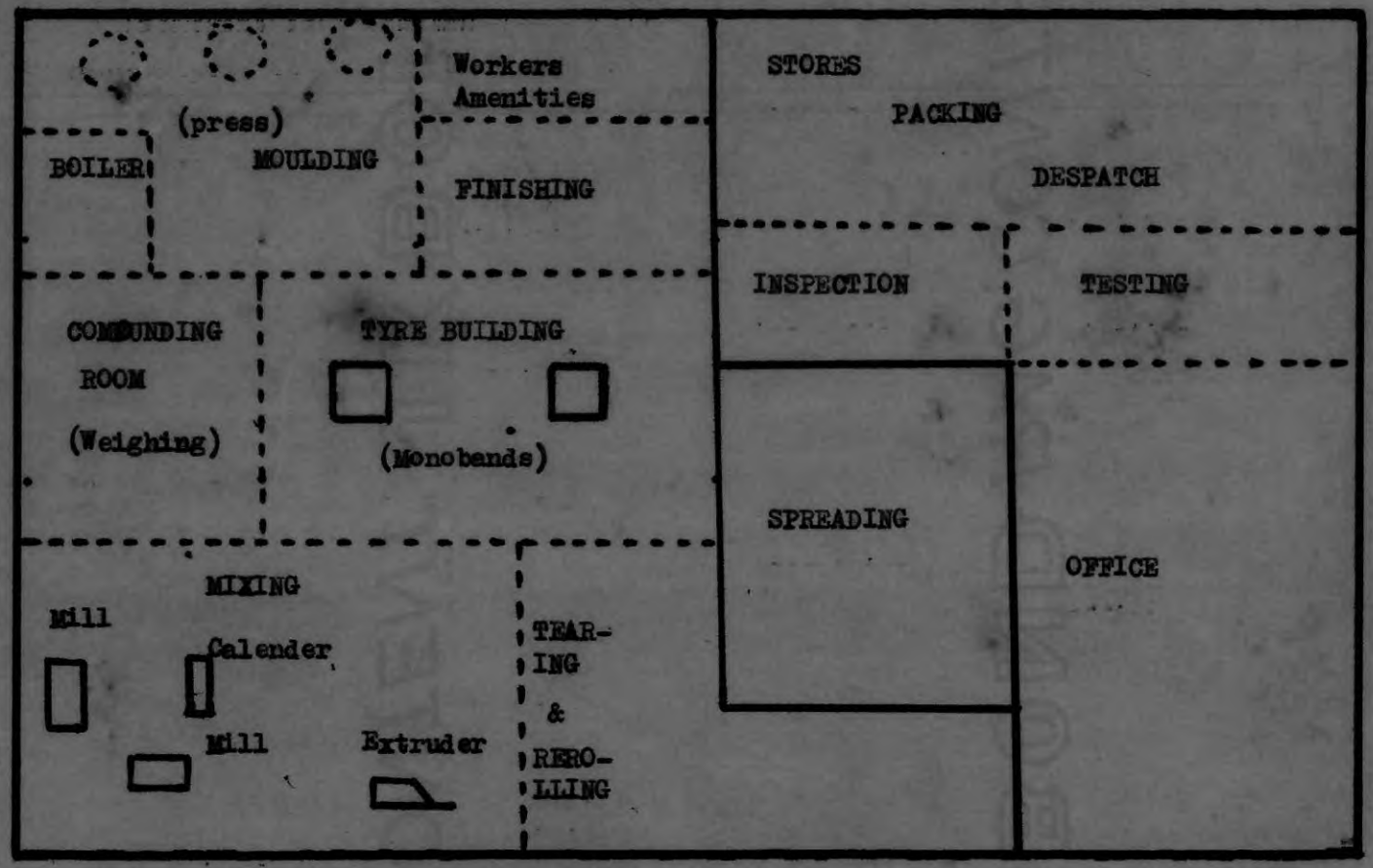


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CYCLE TYRE MANUFACTURE - LAYOUT.

APPENDIX - V..

## APPENDIX VI.

## SUPPLIERS OF RUBBER CHEMICALS AND OTHER COMPOUNDING INGREDIENTS.

| | |
|---|---|
| 1. M/s. ICI India (Pvt.)Ltd. P.O.Box No.310, Cresent House, Ballard Estate, Bombay-1. | Rubber Chemicals |
| 2. M/s.Bayer India Ltd; Express Towers, Nariman Point, Bombay-400 001. | " |
| 3. M/s.Mindia Chemicals Ltd; Wakefield house, Sprott Road, Bombay-[illegible] | " |
| 4. Indian Rubber Regenerating Co; Ltd; Wagle Industrial Estate, Thana, 400 604(Maharashtra) | Reclaimed Rubber |
| 5. Organo Chemicals Industries, Sonepat(Delhi)- Agents, Rishiroop Chemical Co., 160 D.N. Road, 1st Floor, Bombay- 400 001. | " |
| 6. United Carbon India Limited, N.K.M. International House, Backbay Reclamation, Bombay-400 020. | Carbon Black. |
| 7. Philips Carbon Black Ltd; Duncan House, 31 Netaji Subhash Road, Bombay-400 001 | " |
| 8. Kamani Metallic Oxides Pvt.Ltd; Kamani Chambers, Nicol Road, Bombay -400 001. | Zinc Oxide. |
| 9. Godrej Soaps Private Ltd; Vikhroli, Bombay- [illegible].400 079. | Stearic Acid. |
| 10. Esso Standard Eastern Inc., 17 J. Tata Road, Bombay- 400 001. | Solvent and Rubber Process oils. |
| 11. Burmah shell oil Storage & Distb., Company of India Limited, Burmah Shell House, Bombay- 400 001 | Solvent and Rubber process oils,Paraffin wax |
| 12. I.A. IC. Private Limited, I.A.M. 241 Backbay Reclamation, Bombay- 400 001. | Sulphur. |

TYRE CORD:

Suppliers:

1. Gokak Mills Limited,
   P.B. No.79, Forbes Bldg.
   Home Street, Bombay-400 001.

2. Madura Mills Co., Ltd;
   Mfg.Agents; A.F. Harvey Ltd; P.O.B.No.35,
   Madurai Madras.

3. Balammal Mills,
   Trivendrum- 695 001(Kerala)

BEAD:

Suppliers:

1. National Standard Duncan Ltd;
   F4, Wagle Industrial Estate,
   Thana - 400 604(Maharashtra)

2. Hindustan Wires Limited,
   16/5 Chowringhee Road,
   Calcutta.

READY MADE CYCLE TYRE BEADS:

Suppliers:

1. Mitra Shilpa Kutir,
   Calcutta.

2. Sarvodaya Technical Centre,
   3 Lake Road, Bhandup,
   B o m b a y.

## APPENDIX - VII

SUPPLIERS OF MACHINERY:

| | |
|---|---|
| 1. Richardson & Crudas Ltd;<br>Byculla Iron Works,<br>Bombay- 400 008 | Mixing mills,<br>Extruders. |
| 2. Sohal Engineering Works,<br>Tulsi Pipe Road,<br>Off Haines Road,<br>Mahalaxmi, Bombay-400 013. | Mixing mills,<br>Extruders, Cycle<br>Tyre presses<br>(without moulds) |
| 3. Indian Expeller works,<br>17 A, Saitafalwadi,<br>Mazgaon, Bombay-400 010. | Mixing mills<br>Extruders. |
| 4. Battacharaya & Company,<br>55/7, Sashitula Road,<br>Calcutta - 700 011. | Cycle Tyre Presses,<br>Moulds, Building<br>drums. |
| 5. Agarwal & Company,<br>Merchantile Buildings,<br>Calcutta. | " |
| 6. National Engg. & Moulding Co.<br>24, Sashitula Road,<br>Calcutta. | " |
| 7. Brawa & Company,<br>108 Patwarbagan Lane,<br>Culcutta- 700 019. | " |
| 8. Industrial Corporation,<br>Barangar Truck Road,<br>Calcutta. | " |
| 9. Blue Bird Industries,<br>11, Bruce Street, Fort,<br>Bombay-400 001. | Spreading machines,<br>Churning mills,<br>Boilers etc. |
| 10. Batliboi & Co.Private Ltd.<br>Forbes Street, Fort,<br>Bombay- 400 001. | Boilers and Air<br>Compressors. |
| 11. Varsha Boilers Privat ltd;<br>Green House,Green Street,<br>Bombay-400 001. | Boilers. |

## APPENDIX VIII.

### CURRENT PRICE OF CYCLE TYRE(8-3-1975)

| | Rs. |
|---|---|
| Dunlop Roadster | 12.87 |
| Dunlop Goldseal | 12.60 |
| Goodyear Roadking | 11.37 |
| Goodyear | 11.50 |
| Sawhney | 12.87 |
| NRM Road grip | 10.25 |
| NRM Road finder | 10.25 |
| Ceat Samrat | 10.62 |
| Stara Extra Hy Duty | 11.75 |
| Radhu Super | 11.87 |
| Ruby Super Deluxe | 9.81 |
| Cosmos | 10.00 |
| Metro Deluxe | 11.75 |
| International | 11.25 |

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