Project - 146

28

Detailed Project Report

SLICK

(A composite made of waste plastic and industrial by-products)

Under Guidance- PANKAJ PORWAL

(Principle Techno India NJR Institute of Technology)

Team Members			
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Introduction

Problems-

Waste plastic, demolition waste, fly ash, and marble slurry are among top wastes in the world in terms of annual generation. **Annually we generate 200 million tons of demolition waste, 8 million tons of waste plastic, 1.63 million tons of fly ash, and 6 million tons of marble slurry. Approx. 20,000 plastic bottles are manufacturing per-second in whole world. Only 7% water bottles are recycling in present scenario.**

Some applications have been identified for each of the waste but none of them have been successful enough to consume all the wastes. Thus large quantities of these wastes still go to the landfills or dumped in open yards. The problem is more severe in developing countries like India where lack on environmental awareness results in most of these wastes being dumped in open dumping yards or by the road sides and in empty plots.

Our innovative technology combines all these wastes in a synergistic manner to make bricks, paver blocks, tiles and panels for low cost housing. In these products the molten plastic acts as binder, the fly ash and crusher wastes act as filler and the marble slurry acts both as filler and fire retardant to improve the fire resistance properties of the final products.

The preliminary results obtained from the prototype bricks are very promising. The performance of these brick on parameters of strength, soundness, bonding with mortar, drop test, hardness test is comparable to first class bricks, which is a huge achievement at this stage. With detailed research and optimization of mix proportion we are confident that this technology can be commercialized for mass production.

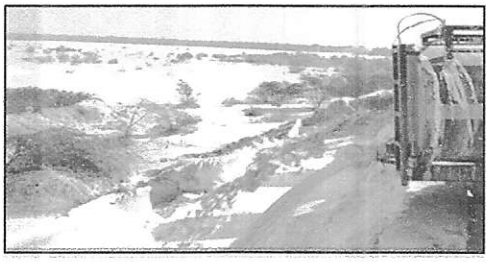


Fig.- Marble Slurry Waste

Fig.- Demolition Waste

Fig.- Plastic Waste

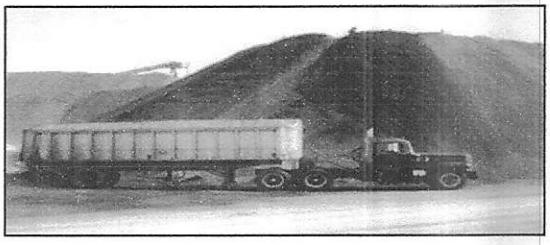
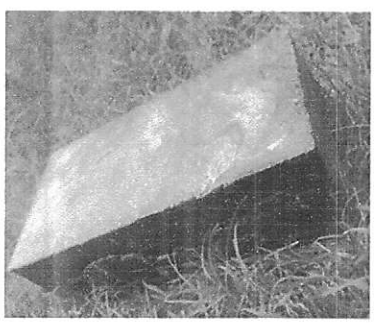


Fig.- Fly Ash Waste

Our Solution- SLICK

We have developed technology to make low cost & high quality bricks and other related products using misplaced resources-

1. Waste Plastic
2. Marble Slurry
3. Fly Ash
4. Crushed Demolition Waste.

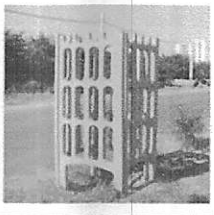


Slick

Kerb stons

Tiles

Benches

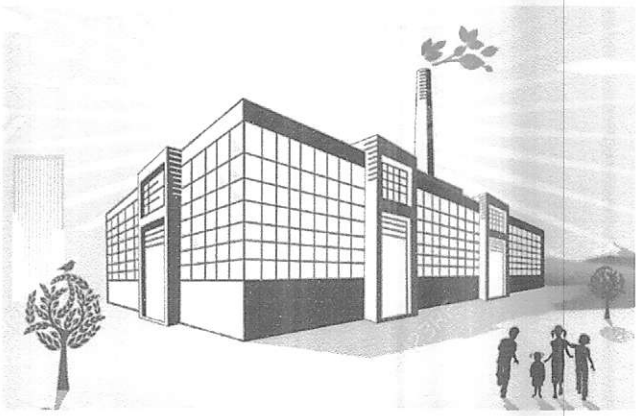


Trees gaurds

₹

Row material

₹



SLICK Private limited

Objectives

1. Study and select suitable filtering mechanism to minimum environmental impact of emissions.

2. Explore use of screw compounder for heating and mixing of the waste plastic and other waste materials.

3. Study and optimize various processing parameters like pre-heating time and temperature, mixing time and temperature etc. to minimize emission of gases and optimize the mechanical and physical properties of various products.

4. Enhance fire resistance of various products by using suitable admixtures to make them safe for residential and commercial construction.

5. Optimize the mix proportion and compaction pressure for different classes of bricks for corresponding strength and other mechanical and physical properties.

6. Develop and test new products like tiles and panels for low cost housing using optimized material.

7. Explore the effect of different plastics on properties of various products.

8. Market research on quantities and prices of different types waste plastics generated.

9. Explore other waste materials that can be used as filler and their effect on properties of our products.

10. Market research to identify quantities and cost of various waste material available to develop area specific cost estimate for various products.

11. Obtain quality certification for various products from accredited laboratories.

Technology

1. Raw Materials-

In making slick we used several raw materials as follows-

a) Marble Slurry

b) Waste Plastic

c) Fly Ash and

d) Crushed Demolition Waste.

a) Marble slurry-

Marble ranks the largest produced natural stone in the world and it accounts for 50% of the world's natural stone production. Around 90% of the world's production of marble comes from India and approx 85% of India's production is received from Rajasthan and almost all mining and processing activities are concentrated around Udaipur, where the proposed study is planned to undertake. Rajasthan has around 4000 marble mines and about 1100 marble gang saws (processing plants). The industry involves Mines, Processing plants, Cutters for the production of tiles for walls and floors, articles, waste reproduction and other ancillary works.

In a recent judgment passed by the Rajasthan High Court, Chief Justice Arun Mishra said:

"There are 250 marble processing units in the Sukher industrial area and they are dumping about 70 tones of slurry daily as a result of which about 700x500 meters of the valley has been ruined.

Properties - The average chemical composition (in %) of marble of Rajnagar – Kelwa belt near Udaipur is given below.

Sample No.	1 (in %)	2 (in %)	3 (in %)
Sio_2	7.58	11.44	0.32
Fe2O3	0.73	0.72	0.64
CaO	30.34	29.40	32.65
MgO	16.99	12.28	21.29
L.O.I	43.94	44.76	45.06
So3	-	0.34	-

b) Plastic Waste-

About 20,000 bottles being bought every second. More than 480 billion plastic drinking bottles were sold in 2016 across the world, up from about 300 billion a decade ago. If placed end to end, they would extend more than halfway to the sun. By 2021 this will increase to 583.3 billion, according to the most up-to-date estimates from Euro monitor International's global packaging trends report. Fewer than half of the bottles bought in 2016 were collected for recycling and just 7% of those collected were turned into new bottles. Instead most plastic bottles produced end up in landfill or in the ocean.

Waste plastic	**Available as**
Poly-ethylene terephthalate (PET)	Drinking water bottles etc.

Plastic properties-

S. No	Property	Value
1.	Density at 20°C	1.38 g/cc
2.	Elastic modulus	2.8 - 3 GPa
3	Tensile strength	55 – 75 MPa
4	Elongation at break (%)	50 – 150 %
5	Thermal conductivity	0.15 – 0.24 W m^{-1} K^{-1}
6	Ignition temperature	350° C

Note - Results were taken from Chennai central institute of plastic engineering and technologies

c) Fly ash-

Fly ash is the finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chamber by exhaust gases. Over 61 million metric tons (68 million tons) of fly ash were produced in 2001.

Fly ash is produced by coal-fired electric and steam generating plants. Typically, coal is pulverized and blown with air into the boiler's combustion chamber where it immediately ignites, generating heat and producing a molten mineral residue. Boiler tubes extract heat from the boiler, cooling the flue gas and causing the molten mineral residue to harden and form ash. Coarse ash particles, referred to as bottom ash or slag, fall to the bottom of the combustion chamber, while the lighter fine ash particles, termed fly ash, remain suspended in the flue gas. Prior to exhausting the flue gas, fly ash is removed by particulate emission control devices, such as electrostatic precipitators or filter fabric baghouses.

Properties-

Components	Fly ash class F (%)	Fly ash class C (%)
SiO_2	55	40
Al_20_3	26	17
Fe_2O_3	7	6
CaO (Lime)	9	24
MgO	2	5
SO_3	1	3

d) Demolition waste-

Demolition waste is waste debris from destruction of buildings, roads, bridges, or other structures. Debris varies in composition, but the major components, by weight, in the US include concrete wood products, asphalt shingles, brick and clay tile, steel, and drywall. There is the potential to recycle many elements of demolition waste.
Construction and demolition (C&D) activities generate a wide range of industrial waste materials including:

- Excavated material such as rock and soil.
- Waste asphalt, bricks, concrete, plasterboard, timber and vegetation.
- Asbestos and contaminated soil.

If not managed responsibly, these waste streams can pollute the environment, pose a public health risk (particularly asbestos and contaminated soil) and pose amenity issues.

Properties-

S.no.	Physical Properties	Test Results
1	maximum size(mm)	20
2	Fineness modulus	7.38
3	Specific gravity	2.64
4	Bulk density kg/m³	1356-1570
5	Water absorption(%)	0.55
6	Moisture Content(%)	4.2

2. Processing-

Most common method in which marble slurry is used in various products is with cement to make bricks and other related product. But such products exhibit high efflorescence leading to inferior quality. This happens because of presence of water and hydration process.

In our product we have all together eliminated the use of water and cement. Instead we use molten plastic as binding material and marble slurry + fly ash and demolition waste act as filler material. Use of marble slurry increases the density and reduces porosity of the final product and thus enhances the mechanical properties of the final product.

Composition Of Slick-

Materials	Plastic (PET)	Fine Aggregate		Coarse Aggregate	
		Fly Ash	Marble Slurry	Crusher Sand	Demolition Waste
Ratio	1	0.67(Combined)		1.67(Combined)	
Density	1.38 g/cm³	1.5 g/cm³	2.80 g/cm³	1.52-1.68 g/cm³	1.17-2.67g/cm³
Particle Size	20nm-1000microns	0.5 µm-300 µm	25-75µm	15mm	40-60mm
Melting Point	250°C	-	-	-	-
Boiling Point	350°C	-	-	-	-

Processing Steps of slick-

a) To make the bricks with marble slurry, waste plastic and demolition waste, the waste plastic was heated in oven up to 250° C.

b) The Demolition waste + Fly ash and marble slurry were added to molten plastic and this mixture was poured into a mould and compressed by applying 1kN load and allowed to cool down.

c) For preliminary study a block of size 70 mm x 70 mm x 65 mm was cast where the waste plastic, marble slurry + Fly ash, and Demolition waste were used in 1:0.67:1.67 ratio by weight.

d) The Fly ash was well graded and the particle size of slurry was less than 600 micron. The block was tested for compressive strength in Universal Testing Machine.

e) The compressive strength of the specimen was 6 MPa his is very close to the compressive strength of second class bricks.

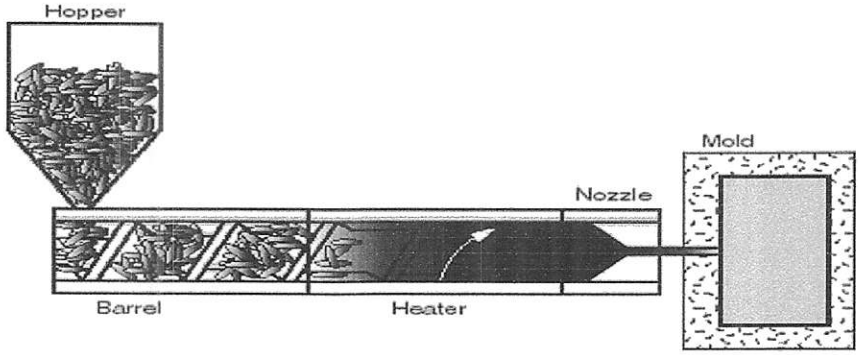
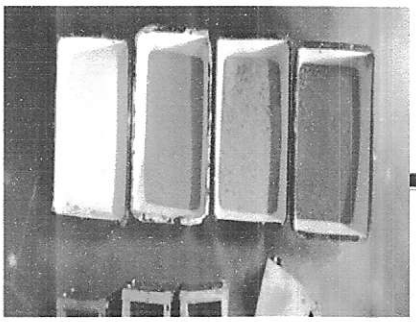


Fig: Typical moulding process

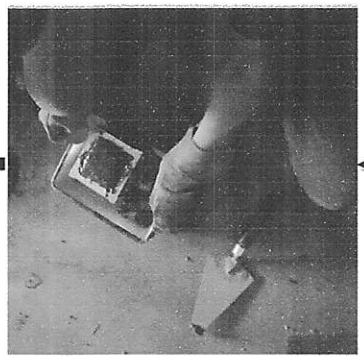


Raw material processing

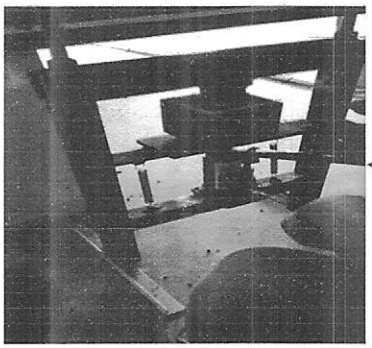
Plastic melting

mixing

Pouring



Moulding



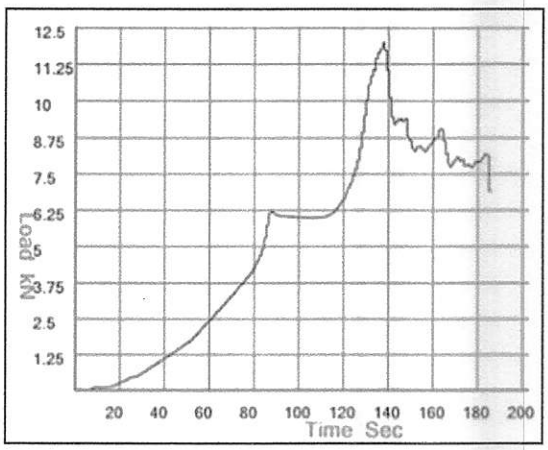
Compressing

Fig.- Production of slick

3. Preliminary Test -

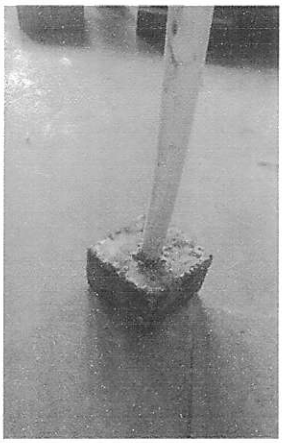
a) Compressive Test-

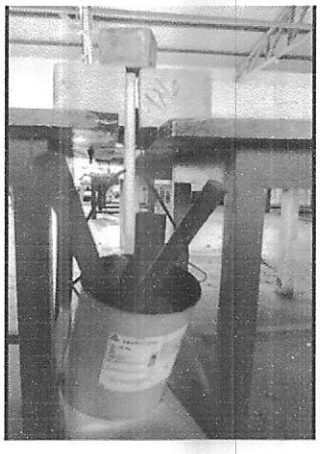
Compressive Strength- 6 MPa



b) Pull Out Test-

Bond strength - 0.14 Mpa





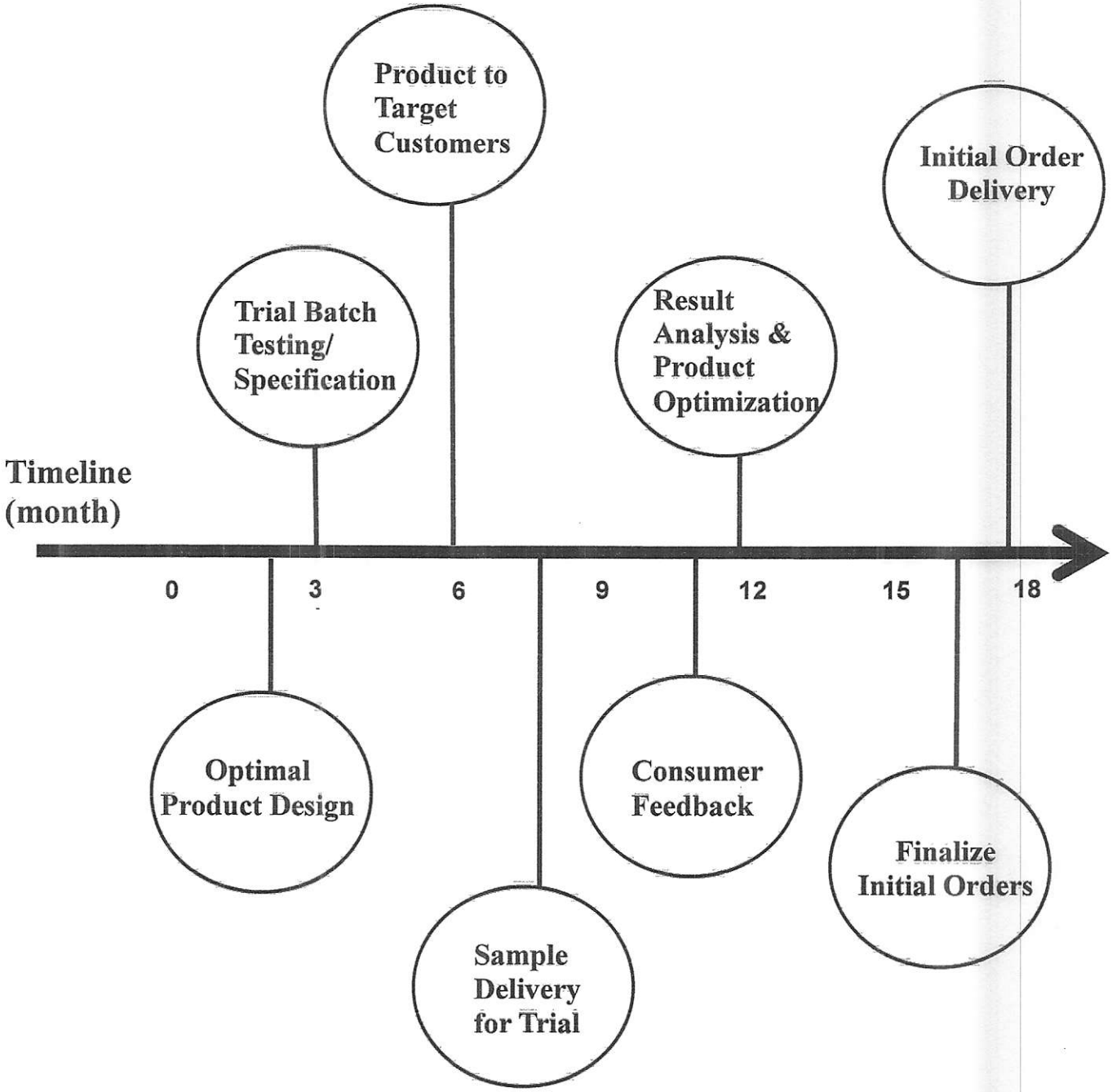
c) Hardness test- Not scratch from nails.

d) Soundness test- Good metallic sound.

e) Water Absorption Test- Almost no water absorption.

Planning

18 Month Plan-



Research & development

1. Optimal product design- To get Optimum Product Design we will cast several number of samples with different proportion of all constituents. As the maximum strength obtained out of different ratios, is finalized for further development of market available product.

2. Trial Batch testing Specification – In slick, we decided to test our product thoroughly before sending it to the main stream market because we think quality is important over quantity. For this purpose we decided to make some trial samples of each product and to perform various test on it. In testing we have plan to test sample timely and will note down the results and will study this results and try to improve our product.

3. Product to Target Customers – We decided to make our products customer friendly. Our all products are exactly like normal one with more eco-friendly material. The price of our product will be low as compare to the similar product in market. We are keep trying to reduce our product cost.

4. Sample Delivery for Trial- Review is very essential in any industry so we are planning to distribute our test samples to retailer, whole seller, customer to use it and evaluate it.

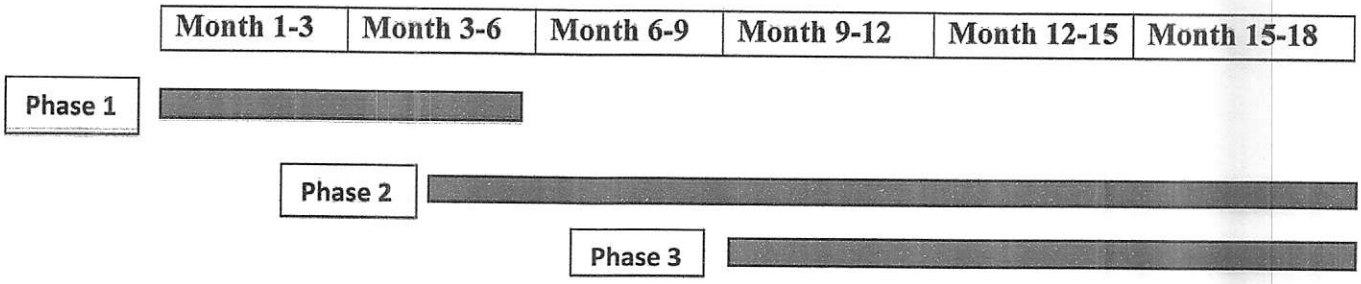
5. Consumer Feedback- Feedback reflects response of any product and we believe it is true. Delivering our products for trial, we will record all the reviews and suggestions through online portal, social media and verbally.

6. Result Analysis & Product Optimization- Timely analysis of product shows it pro and cons. we will analyse the feedback which was recorded in earlier trial period from customers. We will see what is customers demand and where we failed in our earlier trial stage. We will work on this requirement and try to optimize our product accordingly.

7. Finalize Initial Orders- Analyse and improving the product thoroughly now our product is ready to launch. We will start accepting orders from customers. Our plan is to received order offline and then will think to expand our business through online according to market response.

8. Initial Order Delivery – Accepting the orders from customer we will try to deliver products timely through our distribution channel i.e. factory to distributor then to whole seller, from whole seller to retailer and finally to customer.

Time frame



Phase 1: Design, settlement, develop components of solution

Phase 2: Fabrication and development of prototype

Phase 3: Testing, validation and fine tuning

Budget- 15,00,000

Stage 1- for 12 month

a	Machines & Equipments	1,90,000
b	Moulds ,Raw materials	44,300
c	Stipend & overhead	7,70,000
d	Lab testing & Labour charge	1,22,000
	Total	**11,26,295 ₹**

Stage 2- for 6 month

a	Moulds & Raw materials	76,263
b	Stipend & overhead	2,50,000
c	Lab testing & Laboure charge	86,000
	Total	**4,12,263 ₹**

Stage 1- 12 month plan

Quantity of Raw materials-

S. no.	Product	Ratio (Plastic : F.A. : C.A.)			sample Quantity (kg)	plastic (kg)	fine aggregate(kg)		coarse aggregate(kg)		No. of samples	total quantity for samples (kg)
							marble slurry	fly ash	demolition waste	crusher sand		
1	Planter	1	0.67	1.67	5.11	1.53	0.51	0.51	1.28	1.28	100	511.00
2	Louvers	1	0.67	1.67	6.89	2.06	0.69	0.69	1.72	1.72	100	689.00
3	Paver blocks	1	0.67	1.67	2.59	0.78	0.26	0.26	0.65	0.65	100	259.00
					Total	**436.83**	**146.34**	**146.34**	**364.75**	**364.75**	**300**	**1459.00**

Detailed Estimate-

s.no.	Activity	Quantity	unit	Rate	unit	Amount ₹
1	**Raw material**					
1.1	Marble slurry	146.34	kg	3	per kg	439.02
1.2	Plastic	436.83	kg	30	per kg	13,104.9
1.3	Fly ash	146.34	kg	4	per kg	585.36
1.4	Demolition waste	364.75	kg	2	per kg	729.5
1.5	crusher sand	354.75	kg	1.23	per kg	436.3425
2	**Mould**					
2.1	Paver Blocks	2	no.	7500	per piece	15,000
2.3	Planter	1	no.	10000	per piece	10,000
2.4	Louvers	1	no.	4000	per piece	4,000
3	**Machine & Equipments**					
3.1	Extruder	1	no.	100000	per piece	10,0000
3.2	Shredder	1	no.	40000	per piece	40,000
3.3	hydraulic press	1	no.	50000	per piece	50,000
4	**Lab testing**	1	no.	50000		50,000
5	**labour charge**	1	no.	72000	per person	72,000
6	**overhead charges**	1	no.	50000	per person	50,000
Total						**4,06,295.1225**
7	**Stipend (15,000 rs.)**	4		180000		720000
Grand total						**11,26,295.123**

Stage 2- for 6 month

S. no.	Product	Ratio (Plastic : F.A. : C.A.)			Sample Quantity (kg)	Plastic (kg)	Fine aggregate(kg)		Coarse aggregate(kg)		No. of Sam-ples	total quantity for Samples (kg)
							Marble slurry	Fly ash	Demolition waste	Crusher sand		
1	Garden pots	1	0.67	1.67	13	3.89	1.30	1.30	3.25	3.25	30	390.00
2	Bricks	1	0.67	1.67	2.65	0.79	0.27	0.27	0.66	0.66	30	79.50
3	Urinals	1	0.67	1.67	14.5	4.34	1.45	1.45	3.63	3.63	30	435.00
4	Tree guard	1	0.67	1.67	66	19.76	6.62	6.62	16.50	16.50	30	1980.00
					Total	**863.62**	**289.31**	**289.31**	**721.13**	**721.13**	**120**	**2884.50**

Detailed Estimate-

s.no.	Activity	unit	Quantity	Rate	unit	Amount ₹
1	**Raw material**					
1.1	Marble slurry	kg	289.31	3	per kg	867.93
1.2	Plastic	kg	863.62	30	per kg	25908.6
1.3	Fly ash	kg	289.31	4	per kg	1157.24
1.4	Demolition waste	kg	721.13	2	per kg	1442.26
1.5	crusher sand	kg	721.13	1.23	per kg	886.9899
2	**Moulds**					
2.1	Garden pot	no.	2	10000	per piece	20000
2.2	Brick	no.	2	3000	per piece	6000
2.3	Urinals	no.	1	7500	per piece	7500
2.4	Tree guard	no.	1	12500	per piece	12500
3	**Lab testing**	no.	1	50000		50000
4	**labour charge**	no.	1	36000	per person	36000
5	**Overhead charges**	no.	1	10000	per person	10000
Total						**172263.0199**
7	**Stipend (10,000 rs.)**		4	60000		240000
Grand total						**412263.0199**

Stage 1-Proposed Products

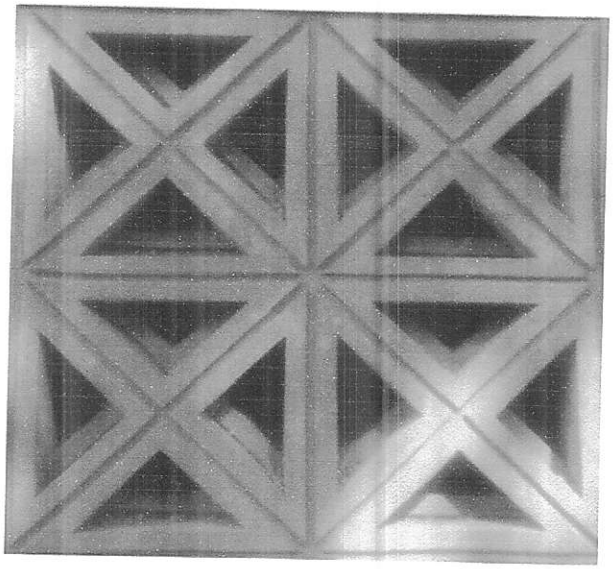


Fig.- louvers

Fig.- Paver blocks

Fig.- Planters

Stage 2-Proposed Products

Fig.-Urinals

Fig.- Tree Guards

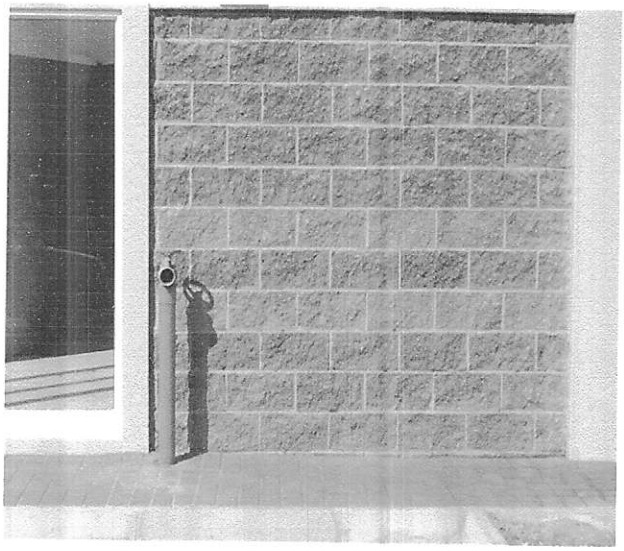


Fig.- Bricks

Fig.- Pots

Company Details

Government of India

Form GST REG-06

[See Rule 10(1)]

Registration Certificate

Registration Number : 08BMNPG8949N1Z1

1.	**Legal Name**	LOKESH PURI GOSWAMI			
2.	**Trade Name, if any**	SLICK			
3.	**Constitution of Business**	Proprietorship			
4.	**Address of Principal Place of Business**	NEAR PANI KI TANKI, 98, SHOBHAGPURA, BADGAON, Udaipur, Rajasthan, 313011			
5.	**Date of Liability**				
6.	**Period of Validity**	From	04/02/2019	To	NA
7.	**Type of Registration**	Regular			
8.	**Particulars of Approving Authority**	Rajasthan			

Signature

Signature Not Verified
Digitally signed by DS GOODS AND SERVICES TAX NETWORK(2)
Date: 2019.02.04 17:30:15 IST

Name	Manish Bakshi
Designation	Assistant Commissioner
Jurisdictional Office	Circle-A, Udaipur - Ward-3
9. Date of issue of Certificate	04/02/2019

Note: The registration certificate is required to be prominently displayed at all places of business in the State.

This is a system generated digitally signed Registration Certificate issued based on the approval of application granted on 04/02/2019 by the jurisdictional authority.

सत्यमेव जयते

Annexure A

GSTIN	08BMNPG8949N1Z1
Legal Name	LOKESH PURI GOSWAMI
Trade Name, if any	SLICK

Details of Additional Places of Business

Total Number of Additional Places of Business in the State	0

सत्यमेव जयते

Annexure B

GSTIN	08BMNPG8949N1Z1
Legal Name	LOKESH PURI GOSWAMI
Trade Name, if any	SLICK

Details of Proprietor

1

Name	LOKESH PURI GOSWAMI
Designation/Status	Proprietor
Resident of State	Rajasthan