

## **74. PROFILE ON GRANITE CUTTING**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of 30,000m<sup>2</sup> of granite per annum.

The current demand for the proposed product is estimated at 208,363m<sup>2</sup> per annum and it is projected to reach at 469,274m<sup>2</sup> by the year 2016.

The plant will create employment opportunities for 41 persons.

The total investment requirement is estimated at Birr 33.82 million, out of which Birr 25 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 18% and a net present value (NPV) of Birr 17.21 million, discounted at 10.5%.

## **II. PRODUCT DESCRIPTION AND APPLICATION**

Dimension stone is the collective description of natural stone, which has been extracted from the earth in an orderly manner, further worked by cutting and processing, then used in various building activities either structurally or for decorative purposes. It includes panels and tiles from marble, granite, slate, sandstone basalt and other related materials.

The term "Granite" is derived from Latin word "Granum" meaning "grain" because of its granular nature. Granite occupies a prominent place among dimensional stones on account of its hardness, durability, capability to take mirror polish and fascinating colours.

Most common applications of granite are in the manufacture of slabs and blocks for the building construction sector.

Block sizes may vary according to the deposit. The most common block size is 22 tonnes of a size approximately 3.0m x 1.5m x 1.5m. However, blocks as small as 6 tonnes and often 11 tonnes could be produced, 22 tonnes is generally the largest due to transport requirements.

### **III. MARKET STUDY AND PLANT CAPACITY**

#### **A. MARKET STUDY**

##### **1. Past Supply And Present Demand**

Throughout history stone was chosen as a principal building material because of its availability, beauty and long lasting features which are the guiding requirement of architecture in any age. Granite is composed of minerals, yielding excessive resistance to abrasion, making it the material of choice.

Granite buildings are preferred for their beauty, durability, permanence and prestige. Granite is used in floor tiles, landscape products, tumble stones, building interiors, church features, paving materials, counter top slabs, cemetery features, and cobblestones and in other industrial applications. Granite products are supplied in different colours and finishes.

Official statistics on granite is not available although granite is known to be produced locally at small scale level.

Granite demand is directly related with the construction industry in general and the building sector in particular. According to the housing census conducted by CSA, the majority of housing units in Ethiopia are made from wood and mud (see Table 3.1).

**Table 3.1**  
**HOUSING UNITS BY CONSTRUCTION MATERIAL**

Materials	Country Level			BGRS		
	Total	Urban	Rural	Total	Urban	Rural
Wood and Mud	7244051	1190729	6053330	49275	6489	42786
Wood and Thatch	1930196	45724	1884472	10256	131	10125
Wood and Bamboo	345804	5281	340523	34914	1124	33790
Stone and Mud	867555	82500	785044	204	30	174
Stone and Cement	54246	45266	8880	265	182	73
Blocket	46912	40395	6547	156	131	25
Bricks	14715	12297	2424	17	17	-
Others	220563	46846	173747	4523	200	4323
Note Stated	42687	13554	29133	621	185	466
<b>Grand Total</b>	<b>10766729</b>	<b>1482592</b>	<b>9284100</b>	<b>100231</b>	<b>8489</b>	<b>91762</b>

*Source:- CSA 1994 Population and Housing Census.*

Due to the low level of income persisting in this country, granite is rather a product which has to be targeted for industrial institutions and higher income group housings. Recently, however, more and more buildings are utilizing granite. Therefore, only urban housing units are assumed to utilize granite. As can be seen from Table 3.1 at the time of the census, there were 1,482,592 housing units in the urban areas of Ethiopia. Assuming the number of houses constructed each year grows in level with the growth of the urban population, which is 4% per annum. The number of housing units in urban areas is estimated to be 2,194,598.

To determine the present demand for granite, housing units made of stone and mud as well as stone and cement are considered. As per the data provided in Table 3.1 housing units made of the above materials constitute about 8.6%. Hence, current number of urban housing units made of stone and mud and stone and cement is estimated at 188,735. Due to the reasons previously mentioned only 20% of the 188,735 housing units are assumed to utilize granite.

According to building contractors, construction of a common house on average consumes 5.25m<sup>2</sup> of granite for different purposes. Accordingly the present domestic demand for the product is estimated to be 208,363m<sup>2</sup> per annum. In addition to the domestic market there is a possibility of selling to the export market mainly to neighbouring countries such as Sudan.

## 2. Projected Demand

The construction sector is one of the fast growing sectors of the economy, exhibiting 7% growth rate in 1991-2003. In fact, building construction is booming as a result of policy reforms related with urban land, creating opportunities for building materials supply. Accordingly the demand for granite products is assumed to grow by 7%, which is parallel to the growth rate registered by the construction sector during the resent past (See Table 3.2).

**Table 3.2**  
**PROJECTED DEMAND FOR GRANITE PRODUCT**

<b>Year</b>	<b>Projected Demand ( m<sup>2</sup>)</b>
2005	222,949
2006	238,555
2007	255,254
2008	273,122
2009	292,241
2010	312,698
2011	334,586
2012	358,007
2013	383,068
2014	409,883
2015	438,574
2016	469,274

## 3. Pricing and Distribution

Considering the current retail price of the product and margin for distributors and transportation cost a factory-gate price of Birr 325 per m<sup>2</sup> is recommended for the envisaged

plant. The product can be distributed through direct delivery to construction companies as well as through the existing building material shops.

## **B. PLANT CAPACITY AND PRODUCTION PROGRAMME**

### **1. Plant Capacity**

Due to economy of scale limitations, it is recommended that a plant with a capacity of 30,000 m<sup>2</sup> of granite slabs per annum is proposed. Production capacity is based on a schedule of 300 working days per annum and a single shift of eight hours shifts of eight hours.

### **2. Production Programme**

The envisaged production programme is given in Table 3.4 below. The schedule is worked out in consideration of the time required for gradual build-up in labour productivity and fine-tuning of machinery. Production starts at 75% of plant capacity in the first year of operation and reaches full-gear in the 3<sup>rd</sup> year of operation and then after.

**Table 3.4**  
**PRODUCTION PROGRAMME**

Year	1	2	3-10
Capacity Utilization [%]	75	85	100
Production [m <sup>2</sup> ]	22500	25500	30000

## **IV. MATERIALS AND INPUTS**

### **A. MATERIALS**

The raw materials required for the production 30,000m<sup>2</sup> of granite slabs per annum is indicated in Table 4.1 below. The abrasives are supposed to be obtained from foreign sources.

**Table 4.1****ANNUAL MATERIALS REQUIREMENTS AND COSTS**

Sr. No.	Description	Unit of Measure	Qty	Unit price (Birr)	Cost ('000 Birr)		
					L.C	F.C	Total
1	Royalty (3% of sales)	-	-	-	292.5		292.5
2	Abrasive, 1000LUX	Pieces	75	18.00	0.47	0.88	1.35
3	Abrasive, 16-220	Pieces	125	10.00	0.44	0.81	1.25
4	Abrasives, 320-800	Pieces	113	15.00	0.59	1.10	1.70
<b>Grand Total</b>					<b>294.0</b>	<b>2.79</b>	<b>296.79</b>

**B. UTILITIES**

Electricity and water are the two major utilities required by the plant. Table 4.2 below shows annual requirements and associated costs at full production capacity.

**Table 4.2****ANNUAL UTILITY REQUIREMENT AND COSTS**

Sr. No.	Description	Unit of Measure	Qty	Unit Price (Birr)	Cost ('000 Birr)
1	Electricity	kWh	720,000	0.335	241.20
2	Water	m <sup>3</sup>	24000	1.50	36.00
<b>Grand Total</b>					<b>277.20</b>

**V. TECHNOLOGY AND ENGINEERING****A. TECHNOLOGY****1. Production Process**

The successful and economical working of granite quarries depends upon an intelligent application of a knowledge of the structure of the rock and its natural divisions in the mass, as well as upon improved methods, tools, and machinery for quarrying. The topographical location of the quarry and its relation to facilities for transportation are important factors



that affect the productiveness and greatly modify the actual cost of operations in a given place.

The manufacturing process of granite blocks and slabs involves the following operations: quarry opening; blasting; cutting; polishing and ornamenting.

Quarrying for dimension stone requires a specialized method of extraction. Normal quarrying methods use large quantities of explosives to move huge volumes for breaking down into aggregate. This creates cracking throughout the stone, which renders it unsuitable for our purpose. Many a dimension stone quarry has been rendered useless by the over use of explosives.

Wire sawing is used for primary block extraction. The system consists of a long stranded wire or diamond tipped wire fed through a series of pulleys and assisted by abrasives. Stranded wire has been used for many years in marble and sandstone, whilst improvements in diamond technology, has seen the recent introduction of wire sawing in granite quarries. The yield from wire sawing is much higher and gives a semi finished surface which allows a close examination of the material before further working.

Cutting is performed by a gang-saw for producing granite slabs. Gang sawing uses a reciprocating frame with up to 120 steel blades working their way through the block. It can take up to one week to saw each block.

Granite cutting has no adverse impacts on the environment.

## **2. Source Of Technology**

Granite processing machinery could be obtained from a number of suppliers in Europe and Asia. One renowned supplier is Mordenti Exporting s.r.l., which is based in Italy. Its address is:

Mordenti Exporting s.r.l.

Via G. Emanuelli, 15-19020

Piano di Valeriano (SP), Italy

Tel.: +39-0187-992276

Fax: +39-0187-991045

e-mail: [mordenti@col.it](mailto:mordenti@col.it)

## B. ENGINEERING

### 1. Machinery And Equipment

The list of machinery and equipment required for the manufacture of granite slabs is given in Table 5.1 below. For an annual capacity of 30000 m<sup>2</sup> of slabs, total cost of machinery and equipment is estimated at Birr 25 million, out of which Birr 16 million is in foreign currency.

**Table 5.1**  
**LIST OF MACHINERY AND EQUIPMENT**

Sr. No.	Description	No.
1.	Gang block cutting machine	2
2.	Slide cutting machine	2
3.	Trolley type cutting machine	2
4.	Polishing machine, pneumatic	2
5.	Polishing machine, hand operated	2
6.	Auto polisher, twin head	2
7.	Quarry equipment	Set
8.	Tools	Set
9.	Mining equipment	Set
10.	Auxiliary equipment	Set

### 2. Land, Building And Civil Works

Total land requirement of the project is estimated at 4,000m<sup>2</sup> out of which 1,500m<sup>2</sup> is built-up area. Cost of building construction at the rate of Birr 2,000 per m<sup>2</sup> is estimated at Birr 3 million. Total land lease cost, for a period of 70 years at the rate of Birr 2 per m<sup>2</sup>, is estimated at Birr 560,000. Thus, the total investment cost for land, building and civil works assuming that the total land lease cost will be paid in advance is estimated at Birr 3.6 million.

### 3. Proposed Location

The Assosa and Metekel zones of the region are known to have significant deposits of granite stone. The Dehan granite deposit in Metekel is estimated at about 7 million tonnes. Hence, Metekel town is proposed to be the project location.

## VI. MANPOWER AND TRAINING REQUIREMENTS

### A. MANPOWER REQUIREMENT

Table 6.1 below shows the list of manpower required and the estimated annual labour costs. Total manpower requirement, including skilled and unskilled labor, is 41 persons. Correspondingly total annual labour cost, including fringe benefits, is estimated at Birr 355,500.

**Table 6.1**  
**MANPOWER REQUIREMENT AND LABOR COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Req. No.</b>	<b>Monthly Salary [Birr]</b>	<b>Annual Salary [Birr]</b>
1.	General Manager	1	2000	24000
2.	Production & Technical Manager	1	1800	21600
3.	Finance & Administration Manager	1	1600	19200
4.	Commercial Manager	1	1600	19200
5.	Accountant	1	600	7200
6.	Sales Person	1	600	7200
7.	Purchaser	1	500	6000
8.	Clerk	3	900	10800
9.	Secretary	2	1000	12000
10.	Production Foreman	3	2400	28800
11.	Quality Controller	1	800	9600
12.	Operator	5	3000	36000
13.	Mechanic	2	1400	16800
14.	Electrician	2	1400	16800
15.	Unskilled labor	10	2000	24000
16.	Guard	3	600	7200
17.	Diver	3	1500	18000
	<b>Total</b>	<b>41</b>	<b>23700</b>	<b>284400</b>
	Worker's Benefit = 25% of Basic Salary		5925	71100
	<b>Grand Total</b>		<b>29625</b>	<b>355500</b>

## **B. TRAINING REQUIREMENT**

An on-site training programme can be arranged for key production, maintenance and quality control personnel in consultation with the machinery and technology supplier. The training can be best carried out during commissioning and performance testing of the factory. Cost of an on-site training of this nature is estimated at Birr 100,000.

## **VII. FINANCIAL ANALYSIS**

The financial analysis granite cutting project is based on the data provided in the previous chapters and the following assumptions:-

Construction period	2 years
Source of finance	30% equity 70% loan
Tax holidays	3 years
Bank interest	10.5%
Discounted cash flow	10.5%
Repair and maintenance	5 % of Plant machinery and equipment
Accounts receivable	30 days
Raw materials (import)	90 days
work in progress	5 days
Finished products	30 days
Cash at hand	5 days
Accounts payable	30 days

## **A. TOTAL INITIAL INVESTMENT COST**

The total initial investment cost of the project including working capital is estimated at Birr 33.82 million, out of which about 48% will be required in foreign currency. Details are indicated in Table 7.1.

**Table 7.1**  
**INITIAL INVESTMENT COST ('000 BIRR)**

<b>Sr. No.</b>	<b>Cost Items</b>	<b>Foreign Currency</b>	<b>Local Currency</b>	<b>Total</b>
1	Land	-	560.00	560.00
2	Building and Civil Work	-	3,000.00	3,000.00
3	Plant Machinery and Equipment	16,000.00	9,000.00	25,000.00
4	Office Furniture and Equipment	-	100.00	100.00
5	Vehicle	-	250.00	250.00
6	Pre-production Expenditure*	-	4,761.60	4,761.60
	Total Investment Cost	16,000.00	17,671.60	33,671.60
7	Working Capital	100.00	53.00	153.00
	<b>Grand Total</b>	<b>16,134.00</b>	<b>17,724.60</b>	<b>33,824.60</b>

## **B. PRODUCTION COST**

The annual production cost at full operation capacity of the plant is estimated at Birr 6.31 million (see Table 7.2). The material and utility cost accounts for 8.42 per cent while repair and maintenance take 6.73 per cent of the production cost.

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\* *Pre-production expenditure include interest during construction (Birr 4.51 million ), training (Birr 100,000) and cost of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

**Table 7.2**  
**ANNUAL PRODUCTION COST**  
**(‘000 BIRR)**

Items	Year			
	3	4	7	10
Raw Material and Inputs	222.59	252.27	296.79	296.79
Labour Direct	128.00	145.00	170.60	170.60
Utilities	207.90	235.60	277.20	277.20
Maintenance and repair	375.00	425.00	500.00	500.00
Labour overheads	53.30	60.40	71.10	71.10
Administration cost	85.30	96.70	113.80	113.80
<b>Total operating costs</b>	<b>1,072.12</b>	<b>1,215.07</b>	<b>1,429.51</b>	<b>1,429.51</b>
Depreciation	2,743.00	2,743.00	2,743.00	2,693.00
Cost of Finance	2,617.00	2,355.30	1,570.20	785.10
<b>Total Production Cost</b>	<b>6,432.09</b>	<b>6,313.34</b>	<b>5,742.69</b>	<b>4,907.58</b>

## C. FINANCIAL EVALUATION

### 1. Profitability

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as the percentage of net profit to total sales, net profit to equity (return on equity) and net profit plus interest to total investment (return on total investment) will show an increasing trend throughout the production life of the project. The income statement and other profitability indicators show that the project is viable.

## 2. Break-even Analysis

The break-even point of the project is estimated by using income statement projection.

$$\text{Be} = \frac{\text{Fixed Cost}}{\text{Sales-Variable Cost}} = 35 \%$$

## 3. Pay-Back Period

The investment cost and income statement projection are used to project the pay-back period, the project will fully recover the initial investment and working capital within 7 years time.

## 4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 18 % and the net present value at 10.5% discount rate is Birr 17.21 million.

## D. ECONOMIC BENEFITS

The project can create employment opportunities for 41 persons. In addition to supply of the domestic needs, the project will generate Birr 21.83 million in terms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue.