# Planning of Brick Raw Material Supply Based on Available Land Volume in Brick Business

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*Abstract*— In production always pay attention to the quality of raw materials, because raw materials can affect the quality of production results. Then the raw materials are sought from the land itself. This is done because there is a lot of competition in similar businesses, but the bricks business manager does not estimate how long the raw material needs will still be available on their land.

To get the right volume of raw material inventory and available at the time needed, with good quality, and achieve company goals, it is necessary to control inventory. In addition, it is necessary to carry out production planning according to land requirements by knowing when raw materials run out on available land.

In order to be able to meet demand and from the point of view of the required costs, optimal profits will be achieved. In this case for an ongoing business or business.

This study aims to plan the volume of raw materials for the production of the next 5 years and calculate the shortage of the amount of brick production based on the results of the forecast.

*Keywords*— Brick Business, Raw Material Volume, Available Land, Forecasting.

## I. INTRODUCTION

In today's highly competitive industry environment, PPC Systems is an important instrument to meet the increasing needs and expectations of consumers. PPC system. Typical tasks include material requirements preparation, ultimatum management, performance tuning and work arrangement and sequencing [1]. What to produce, when to produce, how much to produce and so on are various aspects of production planning. To fully maximize the production process, a view a longer time of production preparation is required. To achieve throughput goals, production control uses a variety of control approaches to obtain optimal performance from production system.

[2] Research on inventory systems that consider factors such as expiration date, co-order, and all unit discounts have been made, for example [3, 4, 5, 6], and [7]. Research on inventory control models that considers limited warehouse capacity on deterministic demand has been carried out by [8], while probabilistic demand has been carried out by [9] and [10]. the discovery model with probabilistic demand is considered more representative of the actual condition [11]. Here, to deal with probabilistic demand, organizations usually prepare safety stock, which is determined directly from estimates [12, 13]. This statement is supported by other studies conducted by [14, 15], by implementing inventory management, companies are able to increase work productivity and streamline company costs [16]. This statement is supported by research conducted by [17 – 18].

Conventional brick has a basic ingredient in the form of clay (clay), which is used as a building material which is the main component in a building structure, especially the construction of walls [19]. According to the Indonesian National Encyclopedia [20] There are 4 types of conventional bricks, namely ordinary bricks, face bricks, aluminum silicate bricks, and bricks fire. Technological developments are increasingly advanced, making construction experts create innovations as quoted from A.

Short & W. Kinniburgh. Lightweight Concrete [21], as a replacement conventional bricks and adobe bricks, namely in the form of lightweight bricks. Lightweight

brick is a similar material concrete and has strong properties, water and fire resistance, durable. Bricks are building materials such as houses, shops and other buildings with raw materials made of clay that has been fired in a furnace to thigh temperature. Brick shape is square of a certain size.

The dimensions of the bricks have variations from the usual sizes up to jumbo size. In this research, we will analyze how big the demand for jumbo bricks is for the next five years at the jumbo brick production site in the Kulim area of Sail Village [22].

## II. LITERATURE REVIEW

### The process of making bricks

Materials for making red bricks used on this type of clay, however clay containing sand it is better to use as a mixture basic material. Sandy soil will more profitable because reduce shrinkage at the time drying and burning. Clay too plastic can cause a lot of depreciation and experience shapeshifting [23].

The process of making bricks with burned through several stages [24]. As for the stages brick making is as follows:

1. **Extraction of Raw Materials**
   Excavation was carried out with using a hoe on the ground the top layer is 40-50 cm thick then dig down to a depth of 1.5-2.5 m. Land excavated and stored in protected place as weathering process.

2. **Raw Material Processing**
   Processing of brick raw materials i.e. mixed clay with sand and water evenly by being trampled by people.

3. **Brick Forming**
   Processed clay cast on the molding frame to fulfill all corners of the room on the molding frame. Furthermore, the mold is lifted and the raw bricks from the mold start dried.

4. **Brick Drying**
   The process of drying bricks will be better if it takes place step by step. After sufficiently dry, the bricks are stacked criss-cross one another to catch the wind.

5. **Brick Burning**
   The burning was carried out not only for the purpose to reach that temperature chill, but also pay attention to the burning speed, to achieve that temperature.

### Measurement of Land Planes

Measurement is an observation of measurements made using equipment in a place with certain limitations [25]. Take measurements of an area is to determine the elements of distances and angles from points that exist in an area in sufficient quantities, so that the area can be drawn with a certain large scale.

Dugouts and stockpiles can be obtained from the Situation Map supplemented with contour lines or obtained directly from field by measuring the flat cross section of the profile along the project path.

Calculation of excavation and embankment can be done by using a situation map with the method depiction of the cross-profile along the project path or by using the griding method that reviews excavations and fills from the top view and calculates the difference between the height of the contour line and the height of the project where the contour lines intersect with the project line [26].

### Soil Volume calculation method

The calculation of the volume of soil is a process Calculations are complicated because the elevation of the ground surface is different on every surface.

The first surface is usually original land surface or existing topography, meanwhile the second ground surface shows the ground level plan or design of the excavation or embankment to be carried out. There is There are several methods commonly used in calculations soil volume namely [27].

1. **Depth Area Method**
   The Depth Area method is the simplest method to calculate the volume of the soil. This approach multiplies the area the surface with the thickness of the excavation or embankment done. The formula used is:

   $$V = A \times T \quad \text{......................................} \quad (2.1)$$

   Where:
   $V$ = Soil volume (m3)
   $A$ = Land surface area (m2)
   $T$ = Thickness of excavation and embankment (m)

2. **Grid method**
   The grid method or what is often referred to as the method Borrow Pits. As with the Depth area method, so is the grid method using thickness or depth values, but thickness or the depth may vary across the area profession.

   The grid method is performed by volume interpolation using a grid by overlaying both counting surfaces using the prismoidal of all grid volume sums.

## 3. Average End Area Method

This technique does not calculate volume from top to bottom but instead calculates the volume in a way vertical slices are cut regularly at certain intervals, volume is the product of the multiplication of the distance or interval to the average cut area. The formula used is:

$$V = D \times \left(\frac{A1+A2}{2}\right) \dots\dots\dots\dots\dots\dots (2.2)$$

Where:

V = Soil volume (m3)

A = Cut area (m2)

D = Distance / interval (m)

## 4. Contour Method

The contour method is similar to the Average method End Area, but has a difference in orientation, where end area method calculates horizontally, whereas on Contour method is vertical between the two surfaces. The contour method can be calculated as follows:

$$V = H \times \left(\frac{A1+A2}{2}\right) \dots\dots\dots\dots\dots\dots (2.3)$$

Where:

V = Soil volume (m3)

A = Cut area (m2)

H = Elevation / Interval between contours (m)

## Definition of Projection and Forecast

Forecasting is a method for estimating a value in the future using the data the past. Fortune telling can also be interpreted as an art and the science of predicting events at the time the future, while forecasting activities is a business function that strives Estimating the sales and use of a product so that those products can be made in the right quantity [28].

Forecasts are made always strived to be able to:

1. Minimizing the effect of uncertainty on company.

2. Forecasting aims to get forecasts that can minimize errors forecast error that is normally measured with MSE (Mean Squared Error), MAE (Mean Absolute Error), and so on [29].

## III. RESEARCH METHODS

How to solve the problem the need for coal based on the existing land area is as follows:

1. Calculating the volume of Bricks by calculating the cubication of bricks based on the volume per brick.

2. Calculating the volume of available land, where field measurements are obtained using the average and area method with cross sections per 60 meters.

3. Forecasting modeling using Statistical Program for Social Science (SPSS) version 16. Forecasting modeling in this study chose the smallest Mean Square Error (MSE) and the chosen forecasting method are: Linear Quadratic Method, because it has the smallest MSE.

## IV. RESULTS AND DISCUSSION

### Calculating the Volume of Brick Raw Materials

This calculation is carried out to calculate the total cubication of raw materials for bricks with reference to the number of bricks produced annually.

**Table 1:** *Calculation of brick cubication: Calculation of the total cubication of bricks in 2017 – 2019.*

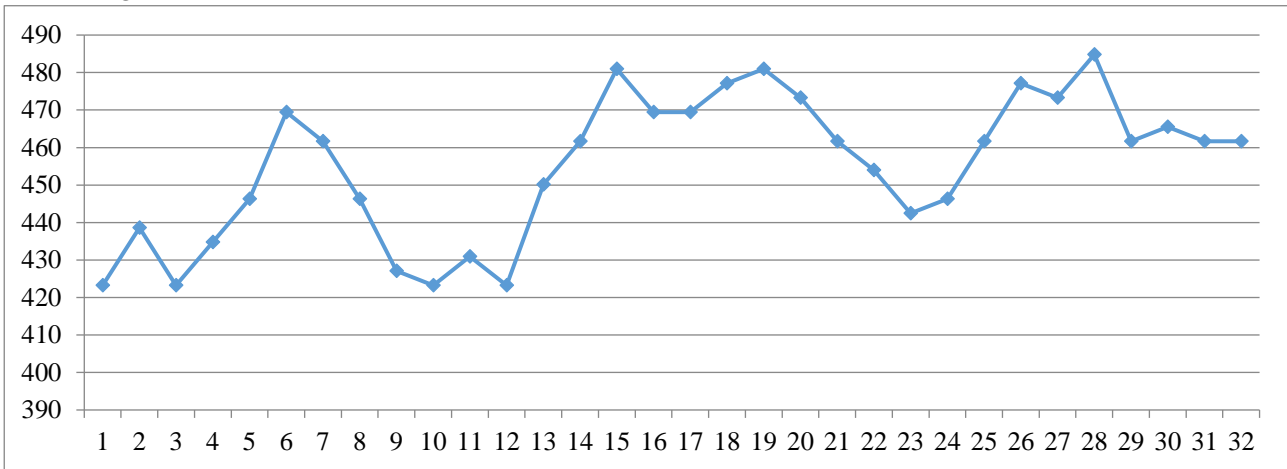| Month | Years | | |
|---|---|---|---|
| | 2017 (m³) | 2018 (m³) | 2019 (m³) |
| **January** | 423,225 | 450,158 | 461,7 |
| **February** | 438,615 | 461,7 | 477,09 |
| **March** | 423,225 | 480,938 | 473,243 |
| **April** | 434,7675 | 469,395 | 484,785 |
| **May** | 446,31 | 469,395 | 461,7 |
| **June** | 469,395 | 477,09 | 465,548 |
| **July** | 461,7 | 480,938 | 461,7 |
| **August** | 446,31 | 473,243 | 461,7 |
| **September** | 427,0725 | 461,7 | |
| **October** | 423,225 | 454,005 | |
| **November** | 430,92 | 442,463 | |
| **December** | 423,225 | 446,31 | |

*Forecasting*



***Figure 1:*** *The results of forecasting the need for brick raw materials*

- The forecasting data pattern above, it can be seen that the shape is a trend, so forecasting is carried out using SPSS software with the Trend method, the following is the output result from SPSS.
- From the output above, a forecasting model for linear and quadratic can be made as follows:
- Quadratic model $= 429,943 + 3,013X_1 - 0,055X^2$
- The total forecast volume using the quadratic method from September 2019 to December 2023 is $21,294,444$ m$^3$. With a total of $27,673,092$ bricks.
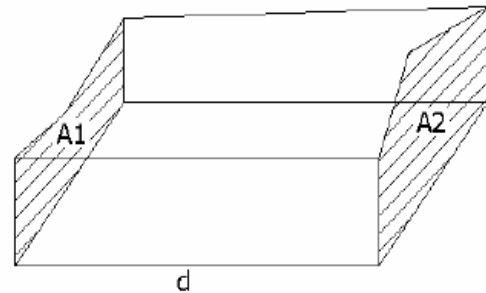
### *Calculating Available Soil Volume and Comparing with Forecasted Volume Results.*

From the results of surveys and measurements in the field, the volume of soil in the field is obtained using the "Average and Area Method" with Cross Sections per 60 meters, where the soil map available is as follows:



***Figure 2:*** *Soil map*

## V. CONCLUSION

### *So to get a cross section of 1and 2*

Section 1(A1) = 65 m x 65 m = 4225 M$^2$ and section 2 (A2) = 65m x 65m = 4225 m$^2$, then the volume for station 1 is: Volume = 4225 m x 4225 m x 135 m = 570.375 m$^3$

***Table 2:*** *For further calculations can be seen in the table below*

| Soil Volume | | | | |
|---|---|---|---|---|
| **Cross** | | Area (m$^2$) | Distance (m) | Volume (m$^3$) |
| **Station 1** | 0 - 65 | 97.5 | 135 | 13.162,5 |
| **Station 2** | 65 - 125 | 93.75 | 135 | 12.656,25 |
| **Station 3** | 125 – 185 | 93.75 | 135 | 12.656,25 |
| **Station 4** | 185 - 245 | 93.75 | 135 | 12.656,25 |
| **Total Soil Volume** | | | | 51.131,25 |

- Total volume of available land x soil volume conversion factor: 51,131.25 m$^3$ x 1.25 = 63,914.06 m$^3$
- To find out the total number of bricks that can be predicted is Amount that can be produced: (Total Volume of Bricks) / (Volume of bricks per piece).

- Amount that can be produced: 63,914.06 m3 / 0.0007695 m$^3$/brick = 83,059,207 bricks.
- If the average monthly production of the brick business produces 600,000 bricks and the number that can be produced; 83,059,207 bricks, it is estimated that production can be carried out for the next 12 years from 2019 to 2031.

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