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### Investigation of inventory control techniques in construction industry

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#### ABSTRACT

Materials management could be a critical component of the development industry. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labor productivity, better schedules, and lower project costs. To maintain effective management, a well-planned asset management system is required. This improves planning, high staff productivity, appropriate schedules and low project costs. This paper describes construction project asset management strategies using S Curve, ABC Analysis to clearly understand the management of the four key building materials

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#### INTRODUCTION

Material management is the process of planning, performing, and managing field activities in construction. The purpose of asset management is to ensure that building materials are available where they are used when needed. The asset management system strives to ensure that the right quality and quantity of selected items are properly selected, purchased, delivered and managed on site at the right time and at the right cost. Material management is a system for planning and managing all the necessary efforts to ensure that the right quality and quantity of materials are properly specified in a timely manner, is available at a reasonable cost and most importantly is available when used where necessary.

#### AIM AND OBJECTIVES

Studying Current Material Management Practices and through the process of establishing an inventory management system to analyze the impact of asset management on construction projects and project management costs

- To study the different material management techniques
- Find out the planned and actual cost of construction material
- To suggest remedial measures to overcome factors affecting material management on construction industry.
- Apply inventory control technique to minimize the total cost of inventory

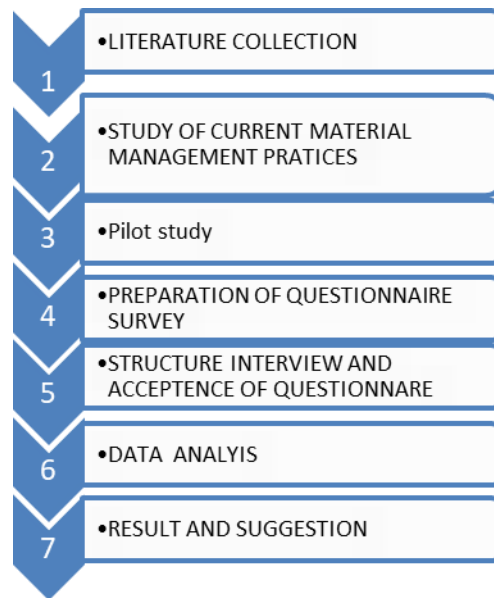
#### METHODOLOGY

The research methodology, which is a combination of both standard and quantitative approaches, was adopted in this study. This research has the advantage of finding solid research formats and achieving legitimate and reliable findings. The study initially collected items such as book reviews and recent published papers related to asset management, in many book reviews ABC analysis, S curve analysis is often used for asset management, in many cases ABC analysis is very important.

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**Figure 1 Step by step process of methodology**

## DATA COLLECTION

In the current construction environment there are many changes taking place in various techniques that begin the daily life of construction. Data collected from six residential projects stored in Saravanapatti, Coimbatore.

As a growing capital, infrastructure is also developing rapidly. The apartment building has 4

floors and each apartment has 2 houses. According to the contractor it will take 1.5 years to complete the whole project with a budget of 1.5crore rupees. The main problems identified in the area are the lack of assets due to the excess material requirements of other contractors' activities and due to site conditions the storage of assets is also a major problem for them.

**Table 1: Total quantity of materials**

No of floors	Cement bags	Sand In tons	Aggregate in Tons	Bricks
Ground floor	1110	76	98	26000
First floor	1500	78	100	29000
Second floor	1500	78	100	29000
Third floor	1500	78	100	29000
Fourth floor	1500	78	100	29000
Total	71100	388	498	142000

## ANALYSIS AND FINDINGS

### S-curve analysis

S-curve analysis is an important project management tool. This analysis was performed to compare between fixed and actual material costs. S-curve provides an overview of project performance in terms of cost and time. S-curves analysis allows the project management team to obtain an essay to identify project growth,

smoothness, and problems that could adversely affect the project if no remedial action is taken.

The cost variance is calculated as the difference between the actual costs of the work performed (BCWP) and the actual cost of the work performed (ACWP). Cost performance is calculated as estimates of the budget expenditures of work performed on actual costs of work performed.

## PLANNED COST FOR THE G+6 RESIDENT

### Building

(S curve) Calculation of cement, sand, aggregate and estimating the cost for ground floor

#### Cement calculation: Grade of concrete

- M60 Mix proportions
- 1:1.36:1.74 (1=Cement, 1.36= Sand, 1.74= Aggregate)
- Ground floor concrete work=145(cum)...
- 1 CUM of cement =551(kgs) approximately 12 bags of cement
- Required cement for ground floor (kgs) =area of ground floor×1cum of cement =145×551=79895 (kgs)
- Cement bags required for ground floor = 79895/50 = 1598 bags for 145(cum).
- Cost of cement bag (50 kg) =370.00/-
- Total Cost of the cement bags for 145(cum) =1598×370=591223.00/

#### Sand calculation

- Sand (kgs) = cement (kgs) ×1.36 = 48750×1.36=76050.8kgs
- Tons of sand = 76050/1000 = 76.05tons
- 1 ton sand cost=1400.00/-
- 1 cum sand = 1600kgs
- Required sand for ground floor= 49.68cum
- Calculating the cost of sand=76.06×1400=106484.00/-

#### Aggregate calculation

- Aggregate (kgs) = (cement (kgs) ×1.74) = 56336.79×1.74 = 98026.7kgs
- Tons of aggregate = 98026.7/1000 = 98.28tons
- 1 ton aggregate cost=500.00/-
- 1cum aggregate=1450kgs
- How many cum of aggregate=98.2
- How many cum of aggregate= 98.28/1.45 = 67.78 cum
- Calculation the cost of aggregate=67.78×500=33900.00/-

#### Calculation of bricks

- First class bricks 19×9×9 cm
- Bricks used for 1 cum=500 Ground floor=52 cum

- Calculation of bricks=52×500= 26000
- 1 brick cost=6.00/- Total no of bricks=26000×6=156000.00/-
- Quantity of bricks required for ground floor: 26000.00/-

#### ABC analysis

The ABC analysis is employed to identifying material items that features a high impact on overall inventory cost. During this method materials divided into three Groups. A class, B class & C class. a category materials which require the best consideration, B Class materials which require medium consideration, and C Class materials which require the smallest amount consideration such the control mechanism be focused on selective Material quantity in percentage = [Each material cost/ Total cost of material]\*100

#### Percentage of materials for ABC analysis

- Material quantity in percentage= (each materials cost /total cost of materials)\*100.
- Total four material cost =5659155.00/-
- Percentage of cement = [3201536/5619155] × 100 = 56.57%
- Percentage of sand= [58200/15619155] ×100 = 19.14%
- Percentage of aggregate = [279619/5659155] × 100 = 6.91%
- Percentage of bricks = [999400/5659155] × 100 = 17.38%
- “A” class -5% to 10% of the items represent 60% to 70% money value.
- “B” class -15% to 20% of the items represent 15% to 20% money value.
- “C” class -60% to 70% of the items represents 5% to 10% money value.
- “A” class material is cement
- “B” class material is sand
- “C” class materials are aggregate and brick

## RESULT AND DISCUSSION

Below tables shows the price and quantity of cement, sand, aggregate and bricks and also measured the full cost and quantity of materials for G+6 building in each floor. In calculation to find

out the overall cost and quantity and also measure the materials cost materials and figure 2, 3 and 4

shows the S curve for materials cement, sand and bricks.

**Table 2 Cement cost and quantity**

No of floors	cum	Quantity in kgs	Calculation of bags	Bags	Rate	Amount
Ground floor	145	79895	$79895/50 = 1598.9$	1600	370.00/-	592000.00/-
First floor	160	88160	$88160/50=1763.2$	1763	370.00/	652384.00/-
Second floor	160	88160	$88160/50=1763.2$	1763	370.00/	652384.00/
Third floor	160	88160	$88160/50=1763.2$	1763	370.00/	652384.00/
Fourth floor	160	88160	$88160/50=1763.2$	1763	370.00/	652384.00/
Total						3201536.00/-

**Table 3 Sand quantity and cost**

No of floors	Quantity cum	Tons	Rate	Amount
Ground floor	$76050/1600= 47.53$	76	1500.00/-	114000.00/-
First floor	49	78	1500.00/-	117000.00/
Second floor	49	78	1500.00/-	117000.00/
Third floor	49	78	1500.00/-	117000.00/
Fourth floor	49	78	1500.00/-	117000.00/
Total				582000.00/-

**Table 4 Aggregate quantity and cost**

No of floors	Quantity cum	Tons	Rate	Amount
Ground floor	$98026/1450=67.78$	98	550.00/-	55931.00/-
First floor	68.95	100	550.00/-	57922.00/-
Second floor	68.95	100	550.00/-	57922.00/
Third floor	68.95	100	550.00/-	57922.00/
Fourth floor	68.95	100	550.00/-	57922.00/
Total				279619.00/-

**Table 5 Bricks quality and cost**

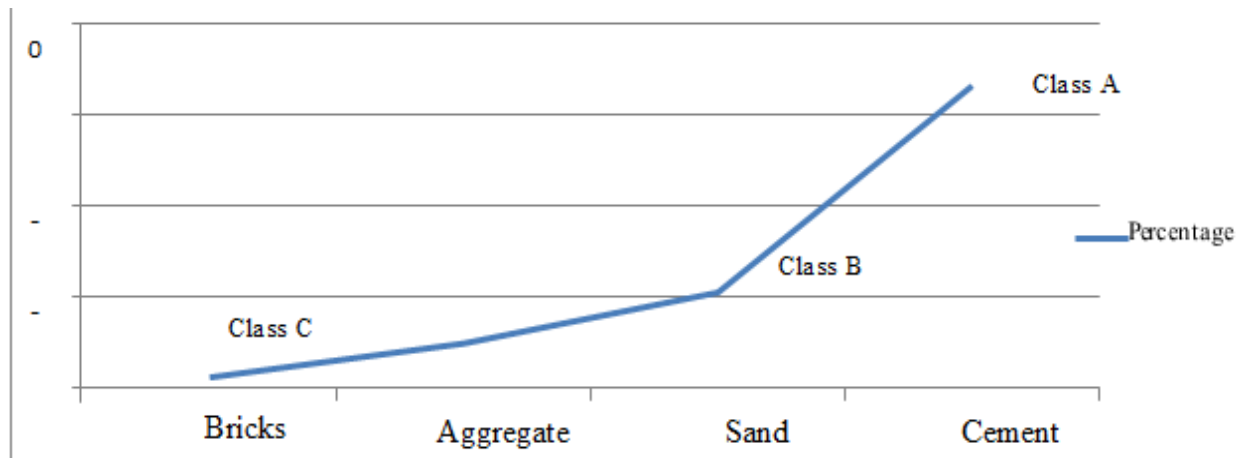
No of floors	Cum	In 1cum	No of bricks	Rate	Amount
Ground floor	52	500	26000	7.00/-	182000.00/-
First floor	58	500	29000	7.00/-	203000.00/-
Second floor	58	500	29000	7.00/-	203000.00/
Third floor	58	500	29000	7.00/-	203000.00/
Fourth floor	58	500	29000	7.00/-	203000.00/
Total					994000.00/-

**Table 6 material cost and quantity**

S. no	Material	Cost	Unit	Quantity
1	Cement	3201536.00	Bags	86532
2	Sand	582000.00/-	Tons	388
3	Aggregate	279619.00/-	Tons	498
4	Bricks	994000.00/-	No. of bricks	55500
	Total	5057155.00/-		

The table no 6 shows material used and its quantity, cost. The total cost of four materials like cement, sand, aggregate, bricks are Rs5057155.00/-

This material cost detail is very important concern for application of ABC analysis. The cost of cement and sand is highest among all material.

**Figure 5 ABC analysis graph**

By implementation of ABC analysis, we've calculated the materials cost and quantity of the materials and located the whole cost of the materials. Proper Utilization of specific materials per the schedule and timely procurement of fabric for every individual activity is feasible by using this system. We are able to preplan the materials from the initial stage of construction and depending upon the periodic requirement and their cost, procurements of materials are going to be purchased. By using this method we will estimate material quantity to greater accuracy.

The S curve technique provides the difference in the planned cost and actual cost of the project. Thanks to some reasons like climatic conditions, natural calamities, improper procurement of materials and material fluctuation in market increases the development cost and budget. Difference between plans and drawings thanks to

late delivery of fabric in time as per the schedule data will increase the price of the project. The explanations of cost variation of the project thanks to the time delay, in time material delay it should show the value difference. We are able to reduce the price and time by proper planning and scheduling. Thanks to improper scheduling and controlling to delaying the project it'll increase the time and value. Due to errors in RCC design drawings, it causes problems to the contractor and it causes time and price overrun, if the deviation occurs in materials or items, it shows a control on material procurement and it shows the effect on total project cost. Sometimes, material fluctuations may give profit or loss to contractor or client. Economic order quantity analysis for cement, which is 506 Bags repetition of requesting 15days which has succeeded the issues of Stock out successfully over the particular Site stock records.

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