ABSTRACT

Waste management is a fundamental component to any manufacturing or production enterprise. It is estimated that there are million tons of quarrying waste are produced in each year. The excessive wastage of materials, improper management on site and low awareness of the need for waste reduction are common in the local construction sites in India. With the urge for development and to satisfy the needs and wants, working and growth of Construction Industry is unavoidable. Over the last two decades material management , the world over has gained recognition as a science to be studied extensively and applied systematically to ensure efficiency and viability of any industry. This thesis discusses the various waste material management methods/techniques for effective waste material management for minimization of project cost and better material management through a case study of construction. Construction waste is generated throughout the construction process such as during site clearance, material use, material damage, material non-use, excess procurement and human error. The exact quantity and composition of construction waste generated throughout the projects are difficult to be identified as they are keep on changing due to the dynamic nature of the construction activities. Different stages of construction generates different types and composition of waste. Therefore the trend of waste generated throughout the construction stages need to be identified.

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CHAPTER - 1

INTRODUCTION

1.1 GENERAL:-

Construction waste has caused serious environmental problems in many large cities . Enormous amounts of infrastructure and building work have be built, so numbers of demolished structures are also increasing in construction work .As increasing demands of dumping areas for never-ended construction waste are thrown away, there is a shortage of landfills. Therefore, reducing waste generation becomes a pressing issue around the world

Waste arising from the total or partial construction of building and/civil infrastructure These materials may be soil, gravel, construction materials of water flow system pieces of concrete, ceramics, coats, bricks, overlay plates, tiles, plaster, sand, stones, pieces of sanitary are ,etc. The materials of construction waste are generally heterogenic which yield the largest portion of waste from building and other relevant activities. The composition of these materials depends on the local geological characteristics and the type of constructions or civil works

Road planning and associated materials arising from road maintenance activities. These materials may be asphalt and all pavement materials, such as sand, gravel, metal and materials coming from road dismantling and renovation. They may be also generated during underground hydraulic and electrical installation work in cities as well as from repairing activities.

Waste minimization is any techniques, process or activities which avoids, eliminates or reduces waste at its source or allows reuse or recycling waste for benign purposes. There are many possibilities for disposing waste from construction and demolition activities, from recycling to incineration and land filling. Prior to considering various options that could be utilized, a hierarchy of disposal options needs to be captured into six levels, from low to high impacts, namely, reduce, reuse, recycle, compost, incinerate and landfill. Three main waste minimization strategies identified are reusing and reducing construction materials,

collectively and these are presented in the order of preference, representing a hierarchy of environmental benefits and potentials for economic saving

1.2 WHAT IS WASTE PROBLEM:-

- To answer the question of why waste is a problem, it is important to the human environment relationship. According to the academic field of environmental economics, the environment provides our human society with raw materials, which transfers into consumer goods and services for consumption; while as a by-product of the production and consumption processes, the raw materials and energy return to the environment as waste products. The environmental is also a waste sink which has the assimilative capacity to absorb waste. However, waste destroys environmental quality when it is produced at a rate exceeding the assimilative capacity provided by the environment. The environment could no longer provide us with the life-supporting services and raw materials we need to survive.
- In the early history of human civilization, waste was not treated purposely as waste was not a problem to humans. They relied solely on the assimilative capacity of the environment to naturally breakdown the waste. In our old society or in some rural areas, waste is still simply dumped in backyards, on streets, on open land or in the sea. It would then be ignited and burned occasionally when methane gas accumulates.
- The effort and money dedicated to treating our waste problem has dramatically increased. Many parties involved in the waste generation process from the design and the production stages to the consumption and disposal stages are motivated to rethink and make changes to their practices to reduce waste.

1.3 WHAT IS CONSTRUCTION WASTE

- Waste is often legally defined to include specific items by law or under an Ordinance. Waste is further classified usually in three different categories: by forms, sources or by its associated impacts to humans or to the environment. The waste definition and classification system affects the corresponding handling, treatment and disposal
- Specifications and requirements as well as the trading of materials across the border Construction waste is one of the categories of waste defined by source. It is similar but slightly different across administrative entities. The Environmental Guidelines:

Assessment, Classification & Management of Liquid & Non-Liquid Waste issued by the Department of Environment and Conservation provides a comprehensive and representative definition of construction waste that it is an generally defined as "bring materials resulting from the demolition, erection, construction, refurbishment or alteration of buildings or from the construction, repair or alteration of infrastructure-type development such as roads, bridges, dams, tunnels, railways and airports, and which is not mixed with any other type of waste, and does not contain asbestos waste"

1.4 WHAT IS PROBLEM WITH CONSTRUCTION WASTE

- Construction waste takes up a significant portion, ranging from one-third to one-fourth, of the total waste produced in many countries. Most of it buried in landfills due to its non-combustible nature. Moreover, the problem of stockpiling inert materials recovered from construction waste has become more common and serious. Insufficient earth-filling projects used to absorb the high quantity of inert materials have led to it being stockpiled. It is also difficult and economically inefficient to sort inert materials to meet project specifications for the use of filling materials.
- Despite knowing the problem, many countries still lag behind in reducing and Recovering construction waste due to the limitations of local resources to manage waste, waste management knowledge and recycling capacity as well as the lack of awareness by stakeholders and government's will to reduce waste. Large quantities of construction waste which can be recycled and has high value, is being dumped or used in low-value applications. To understand the barriers that make reduction and recovery of construction waste.

1.5 WHAT IS CONSTRUCTION WASTE MANAGEMENT:-

- The evolution of the mindset and the overall approach in waste management has affected the management of construction waste too. In the past, construction waste was simply dumped in open dumps or the sea as end treatment. Some of them were used in earth filling works but without much effort on waste separation. Mixed construction waste with high-value recyclables were buried at the same time. The reuse and recycling of construction materials was once high because of material shortages during the war and post-war periods, especially when the cost of virgin materials remained high. However, the incentive to reuse

and recycle construction materials has dropped since the supply of raw materials has become more stable and sufficient Waste The relatively low price of virgin materials has made reuse and recycling a less economically efficient option. In recent years, a holistic, integrated and life-cycle approach and the waste hierarchy have also been applied to construction waste management. A number of measures targeting the construction process itself from the design and planning stage, demolition and construction operation stage as well as other measures which do not particularly target the construction process itself have been proposed and adopted commonly across the world to reduce and manage construction waste. summarizes these measures for managing construction waste by stages

1.2 NEED FOR THE STUDY:-

- It reduces the demand up on new resources.
- Cuts down the cost and effort of transport and production.
- Use waste which would otherwise be lost to landfill sites.

1.3 OBJECTIVES:-

- Construction waste management are reduce the generation of construction waste.
- Maximize reduce and recycling.
- To reduce the intake of mixed construction waste at landfills.
- Reduce the construction cost of site.
- Cut down the cost and effort of transport and production.
- Use the waste which would otherwise be lost to landfill site.

1.4 CAUSES OF WASTAGE:-

- Lack of materials management system.
- Poor house keeping.
- Poor storage condition.
- Poor quality control.
- Contractors negligence.
- Unconcerned supervisory staff.
- Untrained labour.

- Non-use of left over material.
- Thefts Improper handling.

1.5 SCOPE:-

- Construction waste management using for the reduction of construction cost.
- It is an eco-friendly concept of construction.
- Using a waste materials in place of fresh materials so cost reduce.
- Applicable to construction projects for material planning and control, receiving & inspection of material.
- It is also used in store keeping, inventory control, scrap control.

1.7 BENEFIT FROM THE STUDY:-

Through this study, construction industry would come to know how the effective material management helps in Project Cost Saving from material saving and also reducing the wastages.

CHAPTER – 2

LITERATURE REVIEW

1. **Mansi jain,(Oct, 2012), "Economic aspect of construction waste material in terms of cost saving" journal of scientific and research publication, vol 2, issue 10 pp 1-7**

   Due to least priority given to appropriate site waste minimization and management systems in Indian construction industry leads to generation of huge quantities of material waste every year. This problem is not only detrimental at environmental level as most of the waste is disposed off in landfills but also in economic terms as waste materials have their specific economic values before getting mishandled

   Proper site waste management reveal that it is economically viable to do significant cost savings from the whole process. In which total benefits exceeds totals cost by incorporating appropriate methods. And widespread adoption can significantly save huge amount of money which otherwise goes into landfills in form of waste materials.

2. **Abhinandan Gupta (July 2012), "Sustainable Construction Management Practice- Site Waste Management" International Journal of Scientific and Research Publications, Volume 2, Issue 7 pp1-3.**

   The study for this research work highlights many aspects which are lacking for developing sustainable construction planning. Over here the approach for overcoming such waste mitigation strategy can only be successful by joint efforts of governing regulatory bodies as well as individual concern with it. Application of such sustainable waste management planning may increase the potential to reduce, reuse and recycle construction waste generation. Public - private awareness and participation on such alerting agendas will help to secure and sustain future generation to come.

3. **Oyeshola Femi Kofoworola, Shabbir H. Gheewala (9 july 2008), "Estimation of construction waste generation and management in Thailand," Elsevier pp 1-8**.

Thailand's construction industry generated an average of 1.1 million tons of construction waste per year during 2002–2005. Most of these wastes were dumped illegally and others were land filled. This is a loss of valuable economic resources. To develop a sustainable construction industry in Thailand, the Integrated National Waste Management plan must be fully implemented together with measures that encourage the recovery and recycling

4. **Vivian W.Y. Tam(2011), "Rate of Reusable and Recyclable Waste in Construction" The Open Waste Management Journal, volume 4, pp 28-32**

As environmental protection has been pressing hard around the world, high energy utilization and pollution generation from construction activities seems cannot be controlled. Reusing, recycling and reducing construction materials have been encouraged and suggested for the practices in construction activities. This paper investigated the rates of reusable and recyclable waste for plastic, paper, timber, metal, glass and concrete from five case studies. It was found that "metal" has the highest rate as the high profit making on recycling while "plastic" has the lowest rates Recommendations on reusing, recycling and reducing construction materials were also discussed.

CHAPTER - 3

METHODOLOGY

- This dissertation adopts a qualitative approach in studying the possible roles of the government in construction waste management. To understand these roles,an evolution model will be developed to capture the changing government roles and the involvement of the private sector in construction waste management by three stages of construction waste industry development. Drawn from overseas experiences, the three development stages of construction waste industry are: the old days of construction waste management while the construction waste industry has not yet existed, thee arly stage of construction waste industry development and the mature stage of construction waste industry development. The overseas review will focus on the experiences of Australia, the United States, the United Kingdom and Singapore. In these developed countries, waste has become their primary concern. Construction waste has grabbed the attention of their governments and proactive actions have been taken to manage their construction waste since the last two decades, with some good performances already achieved.

- After understanding the possible roles of government in construction waste management at different stages of construction waste industry development and the current roles of the Government in managing construction waste. In addition to the current practices and barriers in managing construction waste and the final part of this dissertation will make suggestions on the possible roles that the Government can play in managing construction waste as well as specific actions the government can take in solving the construction waste problem. The policy recommendations in the final part of this dissertation will be based on both the review of overseas experiences from desktop research on government's publications, journal articles, magazines, articles on governments' websites, related companies' websites and other literatures and the review of some local experiences from both desktop research on literatures as well as

the findings from the interviews with local stakeholders for their knowledge, experiences and perspectives

- To limit the scope of this dissertation to the overall management of construction waste with primary focus on waste reduction, the construction waste studied for the dissertation will not cover the discussion of chemical and hazardous waste which could be contained in construction waste

CHAPTER -4

CASE STUDY

4.1 BACKGROUND INFORMATION ABOUT THE PROJECTS

- **Name Of the projects :**

  Project: Construction Of Site GOVERNMENT MODEL SCHOOL, SAMI, DIST. - PATAN

  Project details:

  - **Location Of Project :** Sami, Dist.- Patan
  - **Contractor :** Vikasbhai J. Patel
  - **Consultant :** Jayshree Testing Laboratory, Patan
  - **Project Cost :** 4.61 Crore
  - **Completion Time :** 12 months
  - **Date Of Starting :** 2/3/2013
  - **Distance from Patan**: 46km.

TABLE 4.1 MONTHLY CEMENT CONSUMPTION

Months	Cement consumption	
	In bags (nos.)	In kg
March	2279	113950
April	0909	45450
May	1026	51300
June	0726	36300
July	2834	141700
August	0736	36300
September	2876	143800
October	0621	31050
November	1548	77400
December	0401	20050
January	0267	13350
February	0134	6700
Total	**11997**	**599850**

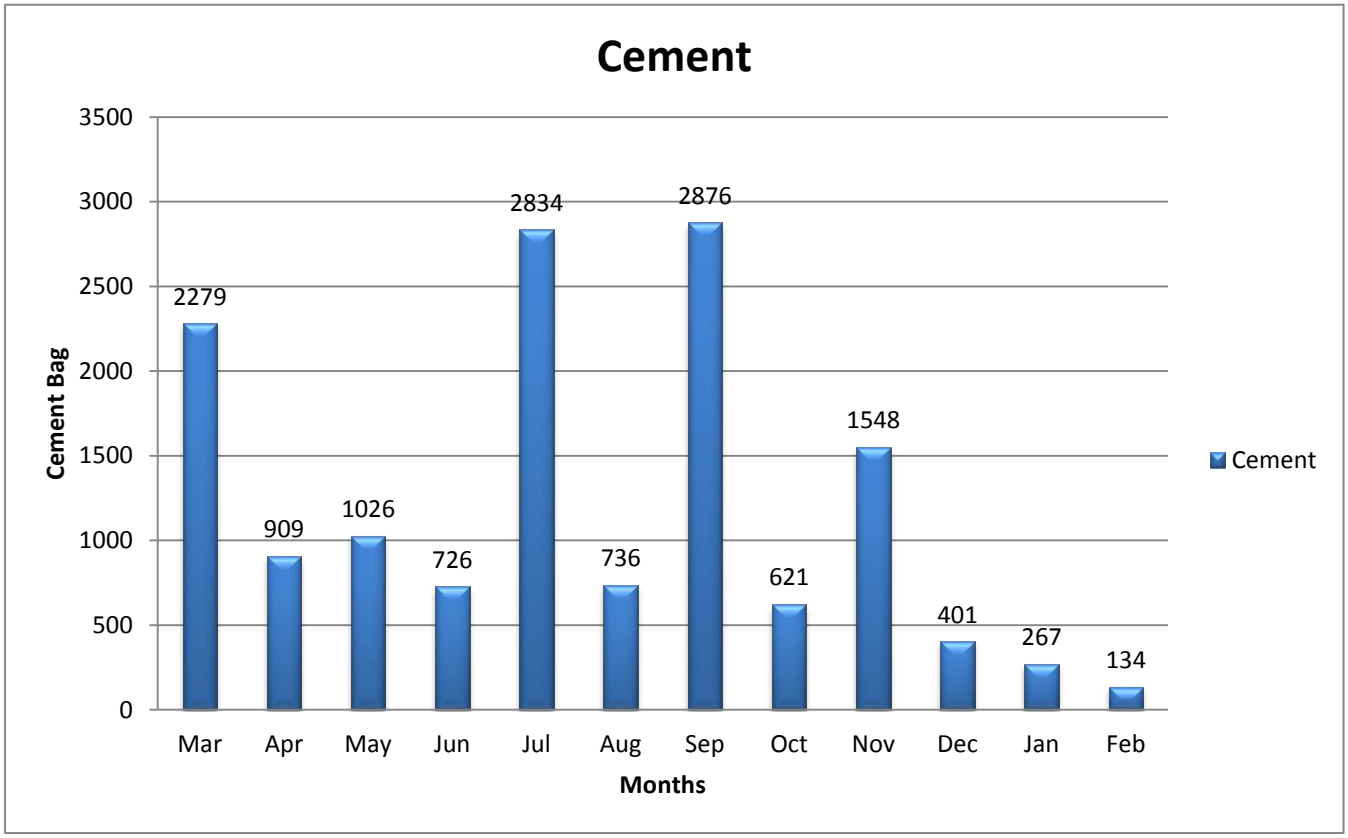


TABLE 4.2 MONTHLY STEEL CONSUMPTION

Months	Steel consumption In (kg)
MARCH	11000
APRIL	26000
MAY	32000
JUNE	38000
JULY	44000
AUGUST	34000
SEPTEMBER	43000
OCTOBER	28000
NOVEMBER	15000
DECEMBER	21000
JANUARY	12000
FEBRUARY	10000
Total(kg)	314000

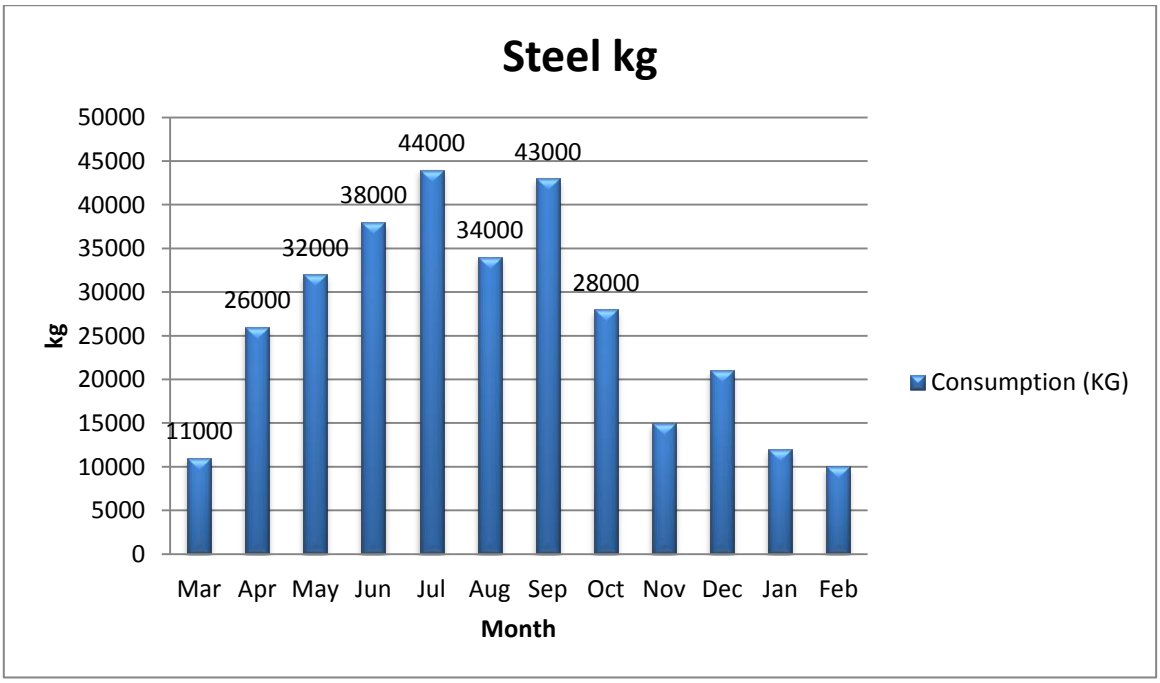


TABLE 4.3 MONTHLY AGGREGATE CONSUMPTION

Months	Aggregate consumption In (Tons)
MARCH	11
APRIL	26
MAY	32
JUNE	38
JULY	44
AUGUST	34
SEPTEMBER	43
OCTOBER	25
NOVEMBER	37
DECEMBER	10
JANUARY	7
FEBRUARY	5
Total(Tons)	312

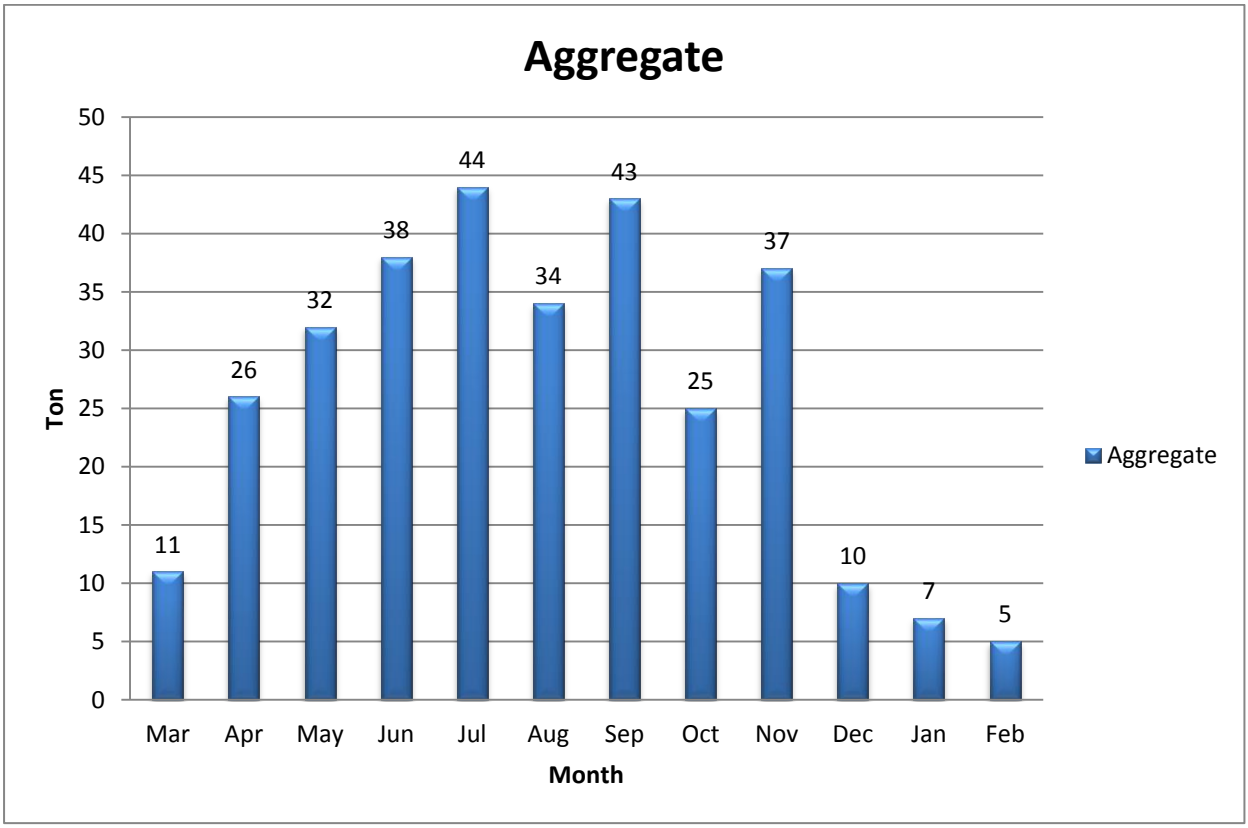


Table 4.4 MONTHLY SAND CONSUMPTION

Months	Sand consumption In (Ton).
MARCH	173
APRIL	87
MAY	98
JUNE	70
JULY	272
AUGUST	71
SEPTEMBER	276
COCTOBER	124
NOVEMBER	109
DECEMBER	78
JANUARY	62
FEBRUARY	59
Total(Tons)	**1478**

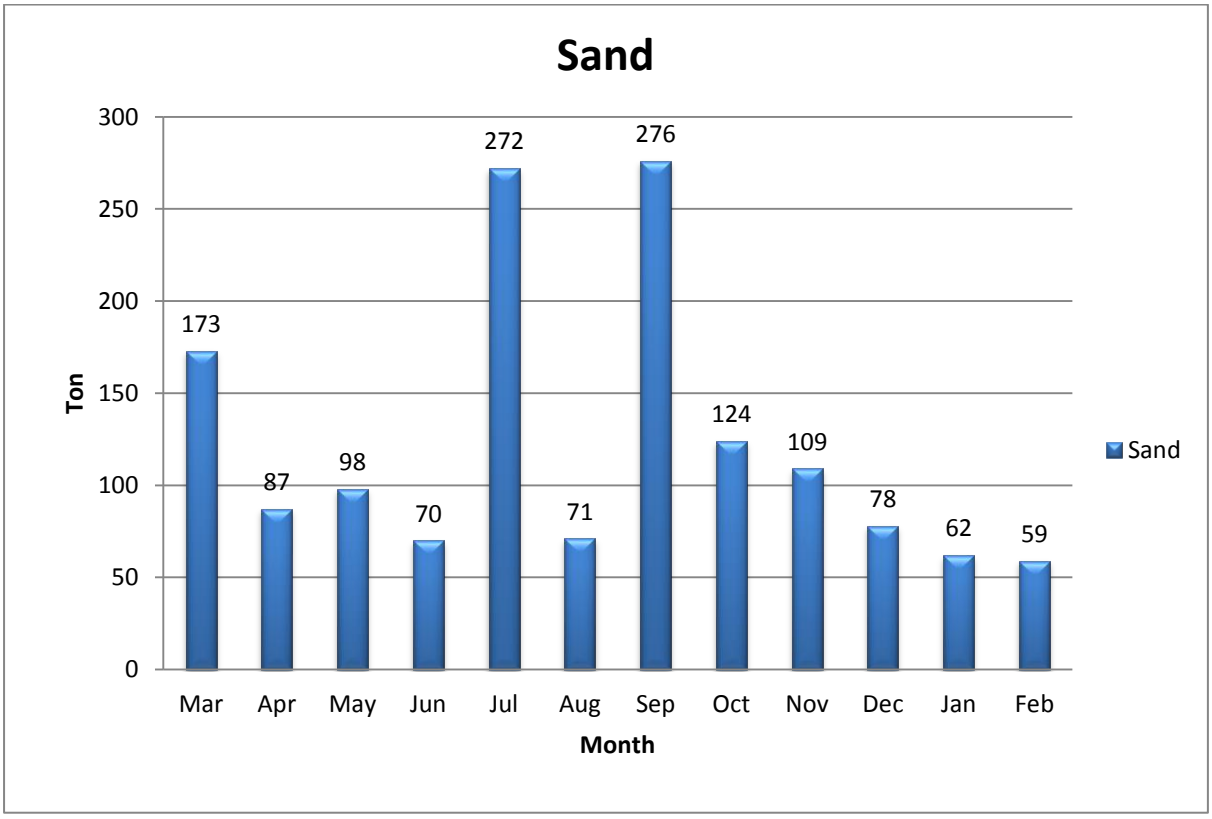
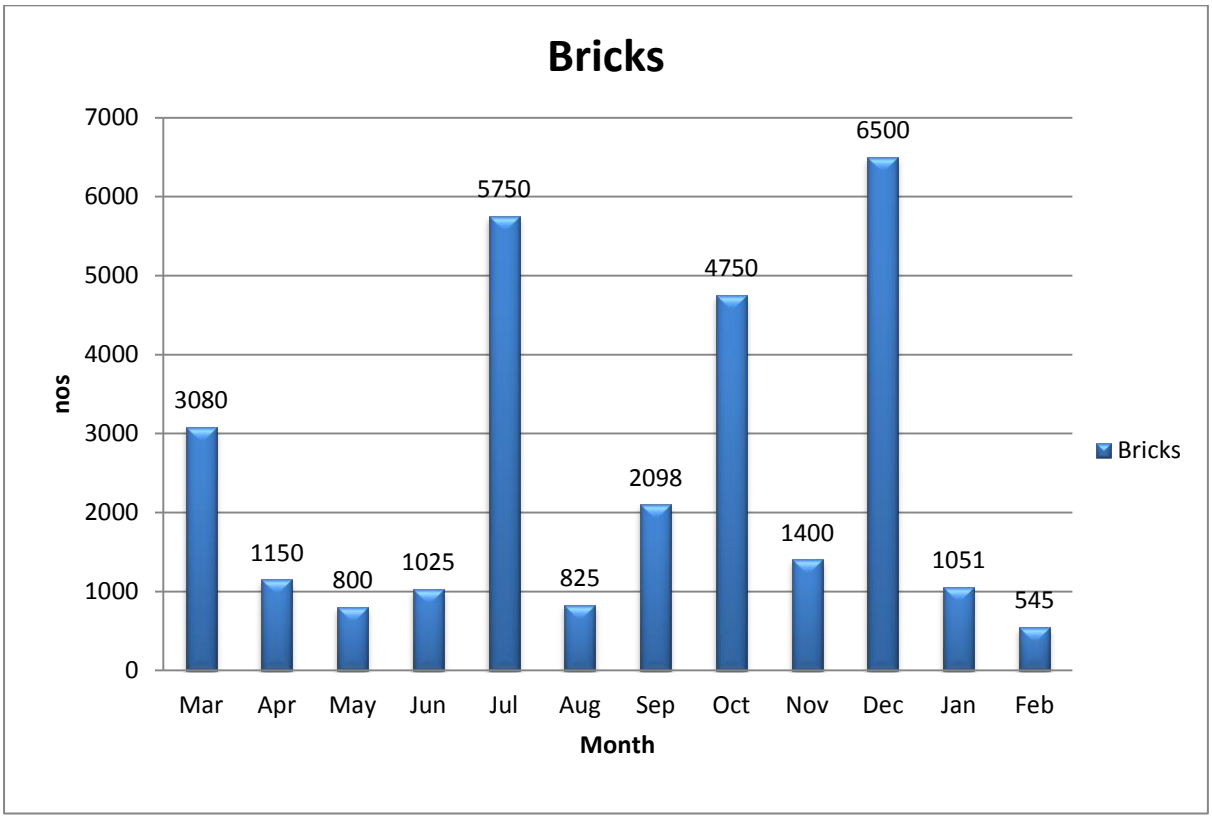


Table 4.5 MONTHLY BRICKS CONSUMPTION

Months	Bricks consumption In (nos).
MARCH	3080
APRIL	1150
MAY	800
JUNE	1025
JULY	5750
AUGUST	825
SEPTEMBER	2098
COCTOBER	4750
NOVEMBER	1400
DECEMBER	6500
JANUARY	1051
FEBRUARY	545
Total(Tons)	**28974**



CHAPTER - 5

WASTE MANAGEMENT OF MATERIALS – AN OVERVIEW

5.1 DEFINATION:-

- The function responsible for the coordination of planning, sourcing, purchasing moving, storing and controlling materials in an optimum manner so as to provide a pre-decided service to the customer at the minimum cost.
- Material Management is the concept requiring an organized structure which unifies into one functional responsibility the systematic planning and control of all materials from identification of the need to delivery to the customers.

5.2 IMPORTANCE OF WASTE MATERIAL MANAGEMENT:-

- The importance of material management lies in the fact that any significant contribution made by the material manager in reducing materials cost will go a long way in improving the profitability ands the rate of return on investment.
- Material management deals with managing of materials along with costs.
- Construction materials and components contribute around 50-60% of the total value of construction.
- It is estimated that about 10% of all materials delivered to the site either end up as waste or illegally removed during the construction phase.
- Furthermore, it has been noticed that large quantities of building materials are allowed to be buried or burnt each year due to inadequate controls on project sites.
- Hence, proper material management is imperative for effective construction management.

5.3 FUNCTIONS OF WASTE MATERIAL MANAGEMENT:-

To achieve best results, it would be worthwhile to place all the functions related to materials under a single department known as material management department.

- **Planning** : Estimating the type of material, their actual quantities, and the time at which it is required.
- To develop new sources of supply for purchases to remain competitive in the market.
- Development of ancillary units.
- Cost control of materials using various cost reductions methods.
- To develop coordination between various departments.
- Arranging transportation in the most economical way for the incoming and outgoing materials.
- Providing proper storage and distribution systems so as to reduce wastage, pilferage, deterioration, etc.
- Disposal of excess stocks, surplus, scrap items and also salvage of materials.
- To from research and development with respect to material cell.

5.4 COMPLEXITIES OF WASTE MATERIAL MANAGEMENT IN CONSTRUCION SECTOR :-

- Each job has its own requirement of materials, stores and spares.
- In many cases the raw materials like soil, bricks, stones and aggregates are manufactured at the site itself, hence, these materials have their own problems.
- Each job has its own design, specifications and other materials. Each job has its own mechanization, electrical and construction equipment.
- The type of work that is carried out by this equipment is not similar or same. Equipment may work in soft soil in some cases and hard soil in another type but may not work in solid blasted rock the next time.
- The organizational set up for material management at each site may be different.
- The problems of weather conditions, idle and more working periods may be different in different jobs. This will affect the inventory control, storage and production.

The above problems have been mentioned to make one understand the important necessity, which is required adopting integrated material management system on construction project.

5.5 MANAGERIAL SKILLS REQUIRED FOR WASTE

MATERIAL MANAGEMENT:-

Followings are some of the managerial skills required for the waste material management.

1) Technical Expertise:-

- It is essential to know everything about all the materials proposed to be used in the construction.
- Updating such information and documentation of the same, form an asset in management.

2) Understanding an Experience:-

- Through understanding of all the phases and sequences helps in timely procurement and economic purchases of the materials .
- While experience increases one's ability to envisage problems in early stage and adopt corrective measures to achieve the final goal.

3) Commercial Skills:-

- Ability to negotiate.
- Competence in analyzing comparative statements and selecting proper suppliers.
- Experting in framing and interpreting contract conditions and other documents.
- Experience in cost estimation and analysis.

5.6 ADVANTAGES OF INTEGRATED WASTE MATERIAL MANAGEMENT:-

1) Better Accountability:-

- Through centralization of authority and responsibility for all aspects of materials function, a clear accountability is established.
- Various user departments can direct their problems with regard to materials to one central point so that action can be taken immediately. This helps in evaluating the performance of material management in an objective manner.

2) Better Coordination:-

- When a central authority is responsible for all the functions, the departments under the authority create an identity, which is common. This results in better support and better coordination in the accomplishment of the materials functions.
- The user department also finds that they have to approach one department for discussing and solving their materials problems. This creates an atmosphere of trust and better relations between the user departments and the material management department.

3) Better Performance:-

- As all the inter-related functions are integrated organizationally, greater speed and accuracy results in communication.
- Need of material is promptly brought to notice by material planning.
- Purchase department is fed with stock levels and order status by stores and inventory control department.
- All this calls for judicious decisions leading to lower costs, better inventory turnover, reduced stock-outs, reduced lead times and a general reduction in paper work.

4) Adaptability to EDP:-

- The centralization of the materials functions has made it possible to design data processing systems.
- All information with regard to materials functions is centralized under the integrated material management functions.

- This has facilitated the collection, collation and analysis of data, leading to better decisions.
- Advanced and efficient electronic data processing systems can be economically introduced under an integrated set-up.

5) Miscellaneous Advantages:-

- Under an integrated material management system, a team spirit is inculcated.
- Results in better morale and cooperation.
- The opportunities for growth and development are better in an integrated set-up.

TABLE 5.1 BUILDING CONSTRUCTION CONCEPTUALISING COSTS BREAKDOWN

Sr. No.	Description of Material	Building up to 2 story's with brick walls & RCC upper floors & Roof
1	Bricks	14.0%
2	Sand	3.0%
3	Cement	9.0%
4	Aggregate	3.0%
5	Timber	16.5%
6	Steel	11.0%
7	Sheet glass 3 mm thick	1.0%
8	Paints	1.5%
9	CI pipes (water supply) and fittings	3.0%
10	Electrical wiring including conduit	6.0%
11	CI soil, waste & went pipes	4.0%
12	Sanitary fitting	2.5%

TABLE 5.2 CONSTRUCTION MATERIAL WASTAGE PLANNING NORMS

Sr. No.	Type of Materials	Planned Wastage
1	Cement	2%
2	Sand	10%
3	Aggregate	5%
4	Concrete Structural	2%
5	Concrete binding (lean)	10%
6	Reinforcement steel bars	3%
7	Reinforcement steel mesh	10%
8	PVC sheeting	15%
9	Steel for windows	7%
10	Timbering in trenches	5%
11	Stone masonry	5%
12	Marble lining	20%
13	Wood for door frames	5-7.5%
14	Wood for shutters	5-10%
15	Sheet roofing	2.5%
16	Tile roofing	5%
17	Floor tiling	2-5%
18	Wall tiling	3%
19	Pigments (for colors other than natural gray)	5%
20	Paints	5%

5.7 METHOD FOR INSPECTION:-

Materials can be inspected by

1) Visual.

2) Tactile.

3) Statistical.

- This method depends upon then type of materials, the quality and the suitability of each.
- This should be carried out the before the materials are unloaded.
- If, after unloading, and unacceptable number of defective items are discovered it will be difficult to claim for any form of compensation from the supplier.
- Forms of compensation could be anyone of the following:

- Substitution of all materials by another batch.
- Credit note for the value of the defective items.
- Reduction in the unit price of the defective items.
- Replacement of the defective goods.

1) Visual Inspection:-

- This is generally possible for those items which are not packed and where the quality can be seen at a glance, e.g. Sand, grit etc.
- Checks should be carried out prior to and during unloading, with a final check on the method of protection.
- The vast majority of quality control checks are visual and defective material is generally easily recognized. For example, visual check for bricks.
- In case of unloading of bricks following checks are made by the responsible person, which can easily detected by visual inspection like.
  1) From colour of the brick one can easily justify that whether brick are over burnt or under burnt from source.
  2) Whether unplugged lime seems on the surface of the brick.
  3) Effect of efflorescence is shown on brick or not.
  4) size of the brick is nor regular.
- In case of unloading of cement following checks are made by the responsible person, which can easily detected by visual inspection like
  1) cement particle fill like very fine.
  2) no lumps create on cement bags.
- In case of unloading of aggregates following checks are made by the responsible person, which can easily detected by visual inspection like
  1) selected aggregate size in bulking of all aggregates.
  2) selected aggregates roughness is same in all aggregates.

2) Tactile Inspection:-

- From the appearance of a material defectiveness or poor quality may be visualized but by touching it this can be confirmed.
- This method of inspection has only a limited application and is usually confined to materials such as sand, cement.
- For example, checks made on cement after opening the bag of cement like.
  1) Is the colour of cement is gray or greenish?
  2) Is it gives cool feeling when hand is inserted into the bag?
  3) When handful cement is thrown on water, is it flow on surface for some time?
  4) Is there any lump of cement shown on the beg

3) Statistical Sampling:-

- By using statistical techniques on samples from bulk deliveries the state of the whole delivery can be fairly accurately forecast.
- The inspection of materials may be required to carry out specified technical inspection on the whole or a given sample from a batch of materials delivered to the organizations.
- An inspection report would then be prepared giving the results of the inspection. For example, in case of test made for materials like cement, sand, aggregates etc. the sample taken for the test should be taken as per the IS specifications and methodology should be as per specification given in IS code for particular test.

CHAPTER-6

WASTE AVOIDANCE

6.1 DEFINATION:-

Waste avoidance refers to activities that focus on ensuring that waste is not created to begin with. It is by far the most economical approach to dealing with waste compared to minimisation and disposal. Increasingly, international debate is beginning to question the whole notion of waste.

One such debate is the perception that waste is a man made creation that does not have to exist. It is a creation that has for long been accepted to be a cost of development. Research by resource efficiency protagonists such as Young reveals that consumption and production have over the years, resulted in increased quantities of generated waste. It then follows that human action has the ability to eliminate waste and transcend to waste avoidance if there is awareness, commitment, accountability and liability.

6.2 WASTE PREVENTION:-

Waste prevention concentrates on site practice that can determine whether or not waste will be created prior to or during construction site activity. As the saying goes, the best way to manage waste is not to create it at all. The biggest opportunity to impact on waste generation through prevention principles is at:

- ✓ **Design -** through design for waste reduction i.e. doing more with less, and design with consideration for reuse and recycling at the end of life of a structure.
- ✓ **Operations** - through clear communication of designs to the project team to avoid unnecessary waste through errors.
- ✓ **Procurement** .-through the engagement of suppliers to encourage a reduction in packaging.

6.3 DEMAND MANAGEMENT:-

Waste demand management concentrates on site practices that rely on the human element. Many jobsite waste problems are a result of avoidable practices. Some of the key human interfaces that can avoid waste generation include:

- ✓ **Material delivery** - care when loading, transporting and off loading materials.
- ✓ **Material storage** - safe storage, covered storage where necessary and storage away from jobsite activities.
- ✓ **Material use** -doing more with less, material storage for reuse elsewhere.
- ✓ **Project team** -communication, commitment from staff, training and reduced human error.
- ✓ **Buying recycled** -reduced demand of virgin material production, redirection of waste to extended use applications.

6.4 WASTE REDUCTION:-

Waste reduction concentrates on site practices that determine the amount of generated waste that will ultimately be disposed by landfill. This is best achieved through source control as the waste is being generated on site. This requires 100% contribution from the generators. Source control is achieved through:

- ✓ **Separation at source**-. selective and separate disposal of generated waste for reuse, recycling and garbage disposal.
- ✓ **On-site reuse** - closure of materials flow loop internally on site instead of externally in the waste stream.

CHAPTER-7

WASTE MANAGEMENT PLAN

7.1 DEFINATION:-

A waste management plan can be described as a construction project related plan that gives provisions for the prevention, separation, salvage, reuse, recycling and disposal of construction waste. The ultimate goal of a waste management plan is to reduce the amount of construction waste destined for landfill to an absolute minimum. A waste management plan encourages resource efficiency and helps internalise the environmental externalities related to building construction. A waste management plan presents an opportunity for a building owner and his team to demonstrate responsibility toward the environment by using a green approach to construction. Furthermore, the plan helps the building contractor identify opportunities from waste rather than to have to deal with it as a daily problem on site. Most importantly, a waste management plan encourages the client team to demand, help develop and comply with waste reduction targets for the project and also serves as a guideline for the contractor's waste management activities on site.

7.2 ELEMENTS OF A WASTE MANAGEMENT PLAN:-

Project planning is very important because it allows the opportunity to define a problem, assess possible solutions, proceed to implement the final option and make provision for evaluation at the end. It is unthinkable to commence a construction project without going through this process. For the same reason, waste management on construction sites should be planned before construction activities begin (in order to avoid dealing with waste as a problem).

A waste management plan does not have to be complicated, in fact it need not even be a long document. It simply needs to be concise, comprehensive and practical for easy interpretation and implementation on site. A good waste management plan will contain the following components:

- ✓ Goals
- ✓ Waste audit
- ✓ Waste disposal options

- ✓ Waste handling requirements
- ✓ Transportation requirements
- ✓ Economic assessment

7.2.1 Setting goals:-

Before conducting any detailed planning for waste management on site, the client team should make a commitment to waste prevention and waste redirection from landfill to reuse and recycling applications. This should be followed by realistic quantitative targets for waste reduction[4]. Realistic targets can be based on previous projects of similar nature, targets set by environmental rating systems that reward waste reduction with credit points and financial considerations (advised by market conditions).

7.2.2 Waste Audit:-

For the contractor to be able to determine the best approach to deal with jobsite waste, he needs to collect information relating to the waste that will be generated on site. This information will be useful for waste planning. Such information is generally required before the waste is actually generated on site although on site waste audits can also be conducted to capture useful information for future projects and to update waste estimates for the current project.

A waste audit can basically be divided into two activities viz. a waste analysis and a waste assessment.

- **Waste analysis**:-

A waste stream analysis will determine the types and quantities of waste that will be generated in the project. The analysis will also determine the stages of construction where specific wastes will be generated. There are two methods of conducting a waste stream analysis . The first involves collecting actual data from project sites to determine the types of materials being discarded. The second uses information from previous projects. Both methods characterise wastes that are generated on the jobsite, and can help identify suitable waste reduction options.

Collecting data from the jobsite during construction can take several forms. Information can be extracted from purchase records, waste bin inspections and detailed waste analyses of selected sample waste bins. Secondary analysis from previous experience on the other

hand includes extracting waste generation rates, using purchase records and using waste disposal records for similar projects. In cases where information is not readily available, other sources that can be used for quantity estimates include engineering estimates, and typical waste composition figures for construction sites.

- **Waste assessment**:-

A waste assessment will use the information collected in the waste analysis to determine the site-specific waste characteristics. The assessment will help characterise waste by type, amount, method of generation and time of generation. It will also identify the construction activities that generate large quantities of waste. This information will inform the contractor on which waste reduction options he needs to focus his efforts.

Waste analysis and assessment information can be captured in a simple spreadsheet. It can be arranged in a manner that will easily show the types of envisaged waste materials, the expected quantities, recyclability, activity and time of generation, and a possible recycling option.

7.2.3 Waste disposal options:-

Having assessed all the waste that will be generated on site, it is now possible to explore the various end-scenarios. It is useful to have knowledge of the types of materials that are reusable and recyclable, the conditions of acceptance in the respective markets, secondary market conditions in your area and the location and types of waste disposal sites.

- **Reusable materials:-**

✓ Some materials can be accepted for reuse applications if they satisfy certain criteria. e.g. dimensions, level of contamination and quality.

✓ Typical places to approach with reusable materials include suppliers, secondary material outlets and renovators.

✓ If available, obtain a published list of locally accepted reusable materials.

✓ Reusable waste can be sold at a site sale or auction.

✓ Useful waste material can also be donated to charity organisation.

- **Unwanted waste**:-

✓ Accept that site activity will inevitably still generate a certain amount of unusable and unwanted waste that is good only for disposal by landfill.

✓ Find out what types of waste disposal sites are there, i.e. municipal waste sites, C&D waste sites, garden and construction waste sites etc.

✓ Determine the requirements for acceptance e.g. commingled or clean separated waste.

✓ Determine the location and distance to these sites.

✓ Determine the tipping fees charged by each.

- **Hazardous waste:-**

✓ Find out about all the relevant local regulations relating to the handling and disposal of hazardous waste.

✓ Find local hazardous waste removal contractors.

✓ Determine the location and distance to the designated hazardous waste disposal sites.

✓ Determine the tipping fees charged by each.

7.2.4 Waste handling requirements:-

In order to have efficient waste management on the jobsite, consideration should be given to how the waste will be handled to maximise recovery. Since the most effective waste reduction strategy is source control, 100% participation from the construction crew is important. Before the crew can participate, it is important that they are made aware of the waste plan, they need to be trained on waste handling methods and they need to be involved in the process. The project team needs to appoint an individual that will be responsible for the overall waste management activity. This can be the general contractor or a waste management specialist. This individual can appoint and train one or two waste management leaders that will be responsible for the day-to-day running of jobsite waste activities and feedback to the waste manager.

Some of the actions the waste team will have to take include the following:

✓ Decide on whether to implement a .time based. waste recycling system at the job face or dedicate .a recycling centre. on site.

✓ In case of the former, plan the system and determine container sizes, number and location and coordinate details of container collection.

✓ In case of the latter, design and layout the recycling centre on site.

- ✓ Determine security, staff and facility requirements for the recycling centre.
- ✓ Clearly mark all items in the recycling centre to avoid confusion, contamination and abuse.
- ✓ Plan for the collection of waste from the job face to the recycling centre.
- ✓ Ensure adequate and sufficient containers to allow for effective waste separation, storage, collection and transport to the recycling centre and to the final destination.
- ✓ Train the labour crew to distinguish between reusable and recyclable materials, how to avoid contamination and where to store reusable and unwanted waste.
- ✓ Co-ordinate waste collection to avoid the collection of half-empty or overflowing containers.

7.2.5 Transportation requirements:-

Consider options available to collect and transport reusable, recyclable and unwanted waste away from the construction site. There are four basic methods that can be used, namely...

✓ **Commercial hauling** - This method involves contracting with waste or recycling service providers to place collection containers on-site, collect and transport the full containers to waste or recycling facilities. This strategy works well on projects where large quantities of materials are generated, such as on demolition sites, big housing projects and on commercial projects. Some recyclers offer smaller waste containers or containers with several compartments for small-scale projects such as home improvements.

✓ **Self-hauling** - This method is often preferred for residential construction and remodelling. Recyclable materials are collected on-site in piles or temporary containers and taken to recycling facilities using the contractor's own vehicles. This method is effective for materials generated in small quantities.

✓ **Cleanup services** - A construction clean-up service that offers waste removal and recycling services all in one. The clean-up crew comes on-site and picks up recyclables and garbage that are collected in piles or containers. taken to the most appropriate recycling or disposal facility. Such services can offer job-site recycling consultations as well.

✓ **Commingled recycling** - The last option in the order of preference, commingled recycling programs collect containers of mixed recyclables or mixed garbage and recyclables, and separate them at material recovery facilities. This option is convenient for cramped sites, but the cost saving is limited (high pre-recycling costs) and recycling rates may be lower than

for other options. When assessing the above options, contact the service providers in your area and request details on the sizes of their containers, and their rental and collection cost estimates.

7.2.6 Economic considerations:-

The information will help in deciding which of the waste materials are economical to reuse and recycle and which are not. The main criteria that are used to decide between extended use applications and landfill disposal are the cost implications of each option and the anticipated returns. Landfill disposal generally depends on local tipping fees and the associated transport costs while extended use applications depend on recycling costs and market conditions.

The cost analysis can be conducted in a simple spreadsheet. For all the identified reusable and recyclable materials, use the estimated quantities (from the waste audit), container sizes and rental estimates (transportation requirements) and tipping fees/rebates (disposal options) to calculate the total cost of each possible option. Calculate the estimated disposal cost for all other unwanted wastes. For all the reusable and recyclable options, calculate the cost of land filling the same amount of waste and compare with the above totals to determine the savings or additional costs.

CHAPTER - 8

SCHEDULING

8.1 Introduction:-

- Scheduling is process of preparing the work plan to a time frame indicating the start and completion of each activity. It is also shows sequential relationship among various activities.
- Schedules are also prepared for construction resources such as labour, material machinery and money required at various stage of the work .
- The actual progress of each activity can be monitored with reference to the planned programme . if there are any delay suitable corrective actions can be taken to speed up the work.
- The construction schedule is a tool that a contractor uses to manage time and execute activities in a proper sequence. To proper a construction schedule . the project is divided into different activities or operations.
- The sequence of the operation can be decided after knowing their inter-relationship as per construction method adopted.

Purpose:-

- Making available a time-table showing the schedule and sequence of each activity.
- Providing a schedule for monitoring the progress of work and taking corrective measures if required.
- Providing a means for establishing and maintaining time goals and prioritizing.

Scheduling of resources:-

- For many given work the resources are materials manpower, machinery (plant/equipment)and money.

- These resources have to be utilized in a planned and efficient manner in order to derive the maximum benefits.
- Further, there may be many uncertainties in the availability of resources the right type of labour or equipment may not be available at the required time due to labour unrest or breakdown of machinery.
- Thus, the execute the construction work in an efficient manner and without wastage of any inputs. The schedules various project resources need to be prepared.

Types of schedule:-

1) Material schedule
2) Labour schedule
3) Machinery schedule

8.1.1 Material schedule:-

- The material schedule showing weekly requirements of commodities are prepared from the construction programme.
- A material schedules enables storage space to be adequately planned and necessary arrangement to be made for timely delivery of materials. The disruption of work due to shortage of materials can be avoided by using a material schedule.
- The typical material schedule may be prepared either months wise or week wise depending on the extent of the project and shortage space.
- A typical material schedule prepared week wise for the construction of a temporary shed.

8.1.2 Labour schedule:-

- The labour schedule shows the manpower requirement of the project in a tabular from for various stage
- The labor schedule serves the various purpose during the construction stage are as follows.

1. It provide the site incharge ample warning of his future labour requirement
2. By noting the actual work force regularly on the chart, a direct measure of labour expenditure on the site can be obtained.
3. If the man power shortage is likely in a particular section of the project.
4. It helps efficient and optimum deployment of the labour force in various section of the project**.**

8.1.3 Equipment Schedule:-

- An equipment schedule is prepared for all plant required to be deployed on the project. From this schedule, the delay in the work that may occur either due to non availability or break down of equipment can be known.
- Such a schedule enables the efficient and optimal utilization of plant and equipment on a project.
- Using this schedule timely arrangement can be made for renting or deploying for particular equipment at a particular time.

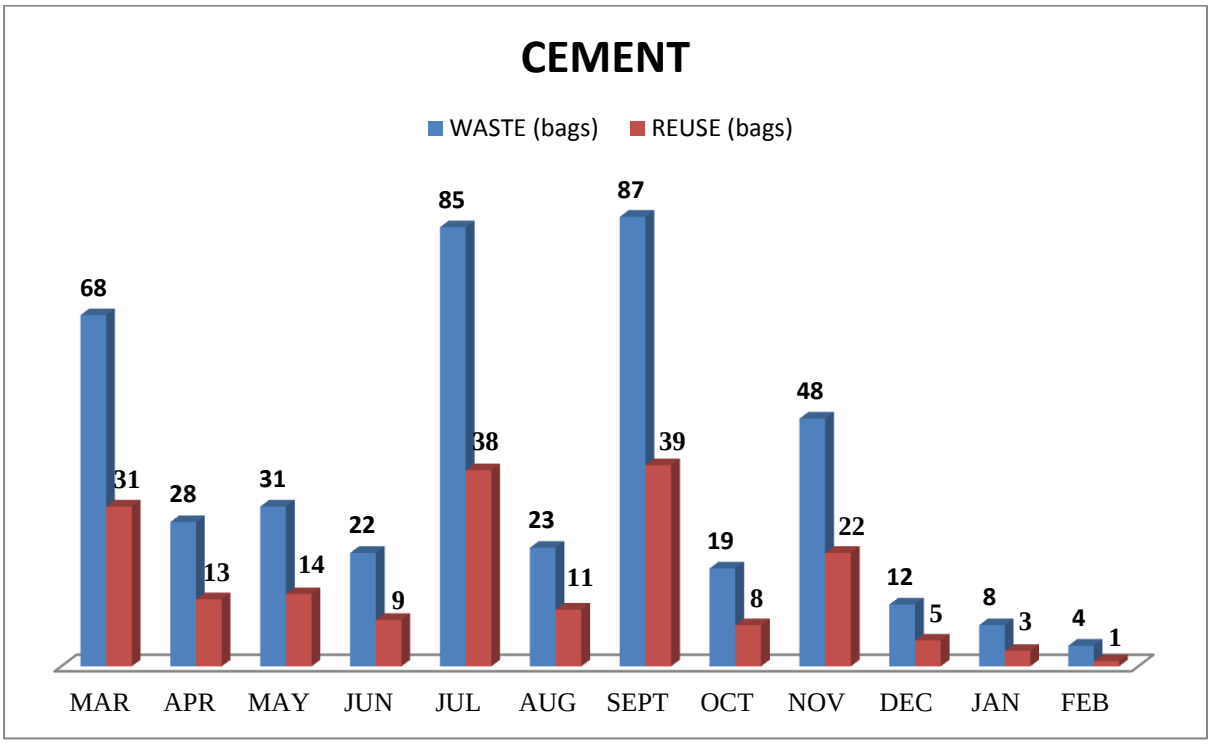
CHAPTER - 9

WASTE CALCULATION

CEMENT

TABLE 9.1 MONTHLY CEMENT WASTE AND REUSE

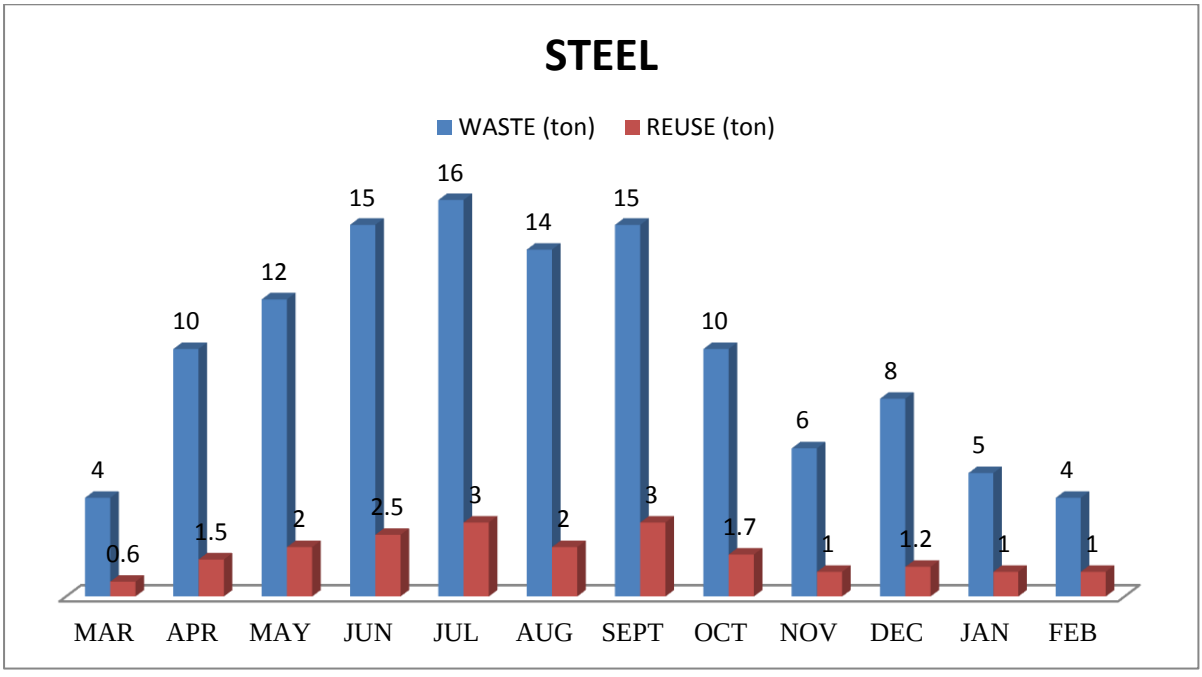
MONTH	CONSUMPTION	WASTE	REUSE
MAR	2279	68	31
APR	909	28	13
MAY	1026	31	14
JUN	726	22	9
JUL	2834	85	38
AUG	736	23	11
SEPT	2876	87	39
OCT	621	19	8
NOV	1548	48	22
DEC	401	12	5
JAN	267	8	3
FEB	134	4	1
TOTAL		**435**	**194**



STEEL

TABLE 9.2 MONTHLY STEEL WASTE AND REUSE

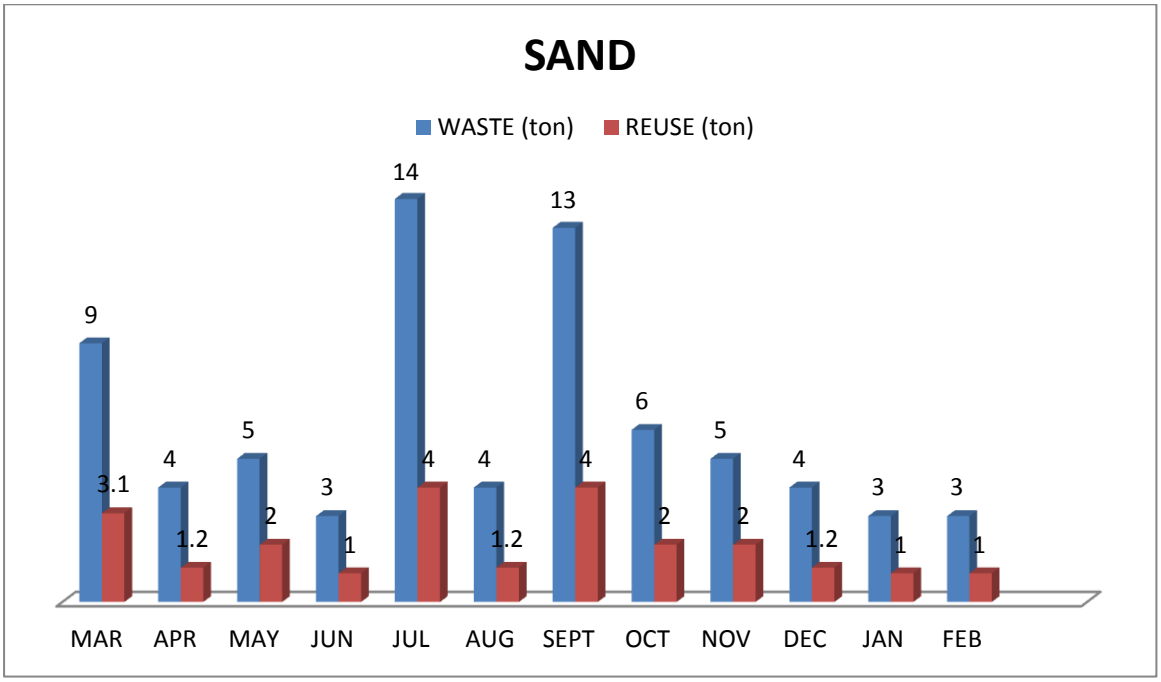
MONTH	*CONSUMPTION (kg)*	*WASTE (tons)*	*REUSE(tons)*
MAR	11000	3	0.6
APR	26000	10	1.5
MAY	32000	12	2
JUN	38000	15	2.5
JUL	44000	16	3
AUG	34000	14	2
SEPT	43000	15	3
OCT	28000	10	1.7
NOV	15000	6	1
DEC	21000	8	1.2
JAN	12000	5	1
FEB	10000	4	1
TOTAL		**118**	**20.5**



SAND

TABLE 9.3 MONTHLY SAND WASTE AND REUSE

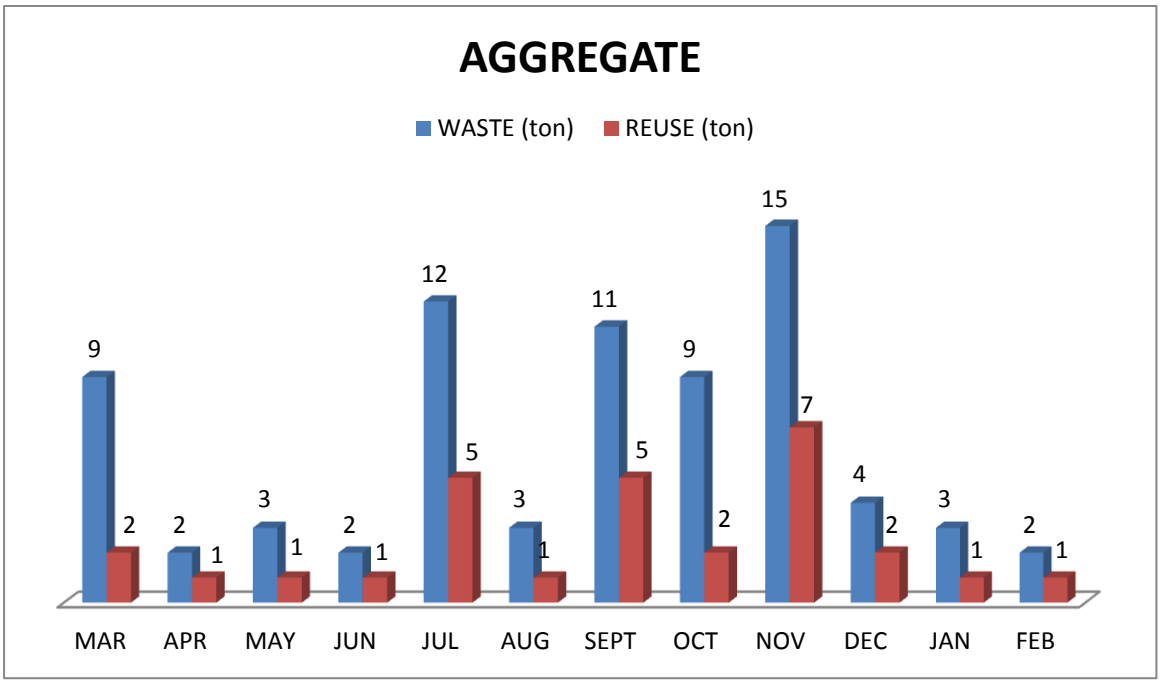
MONTH	*CONSUMPTION (tons)*	*WASTE (tons)*	*REUSE (tons)*
MAR	173	9	3.1
APR	87	4	1.2
MAY	98	5	2
JUN	70	3	1
JUL	272	14	4
AUG	71	4	1.2
SEP	276	13	4
OCT	124	6	2
NOV	109	5	2
DEC	78	4	1.2
JAN	62	3	1
FEB	59	3	1
TOTAL		72	23



AGGREGATE

TABLE 9.4 MONTHLY AGGREGATE WASTE AND REUSE

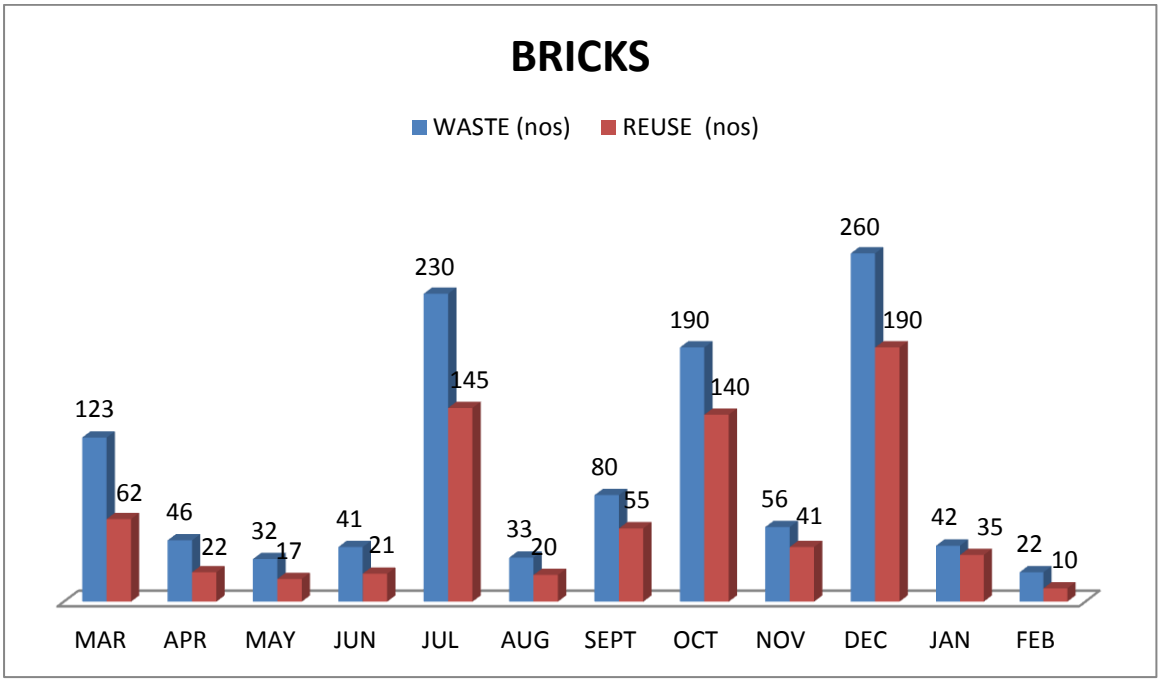
MONTH	*CONSUMPTION (tons)*	*WASTE (tons)*	*REUSE (tons)*
MAR	11	9	2
APR	26	2	1
MAY	32	3	1
JUN	38	2	1
JUL	44	12	5
AUG	34	3	1
SEP	43	11	5
OCT	25	9	2
NOV	37	15	7
DEC	10	4	2
JAN	7	3	1
FEB	5	2	1
TOTAL		**75**	**30**

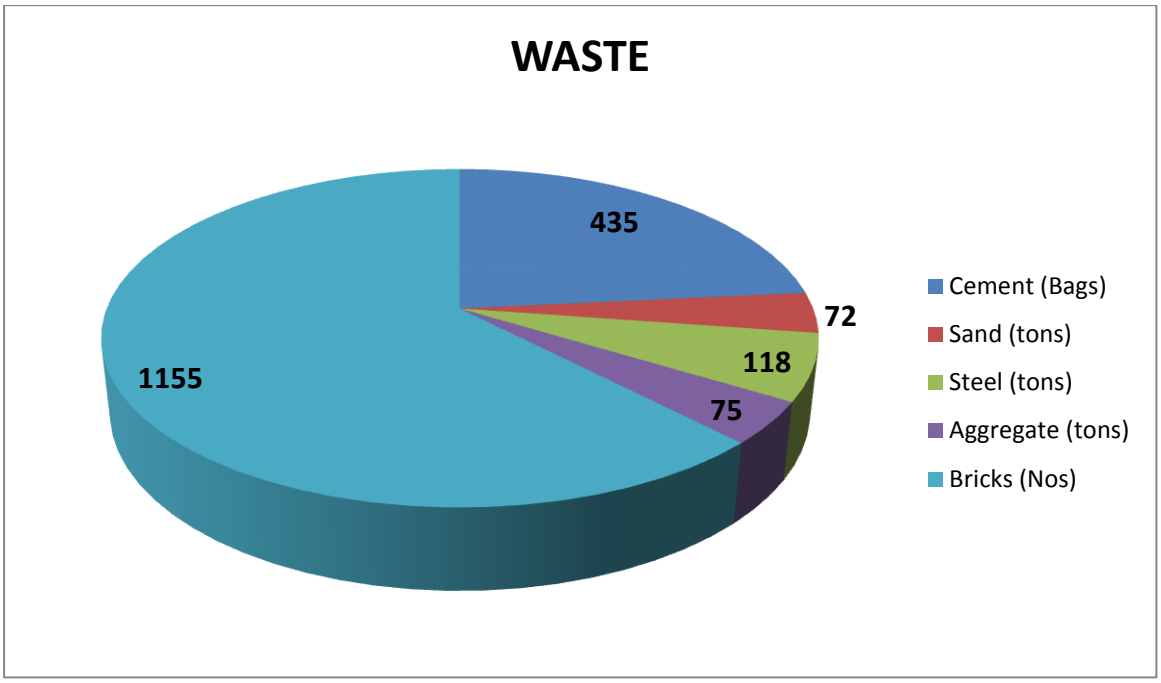


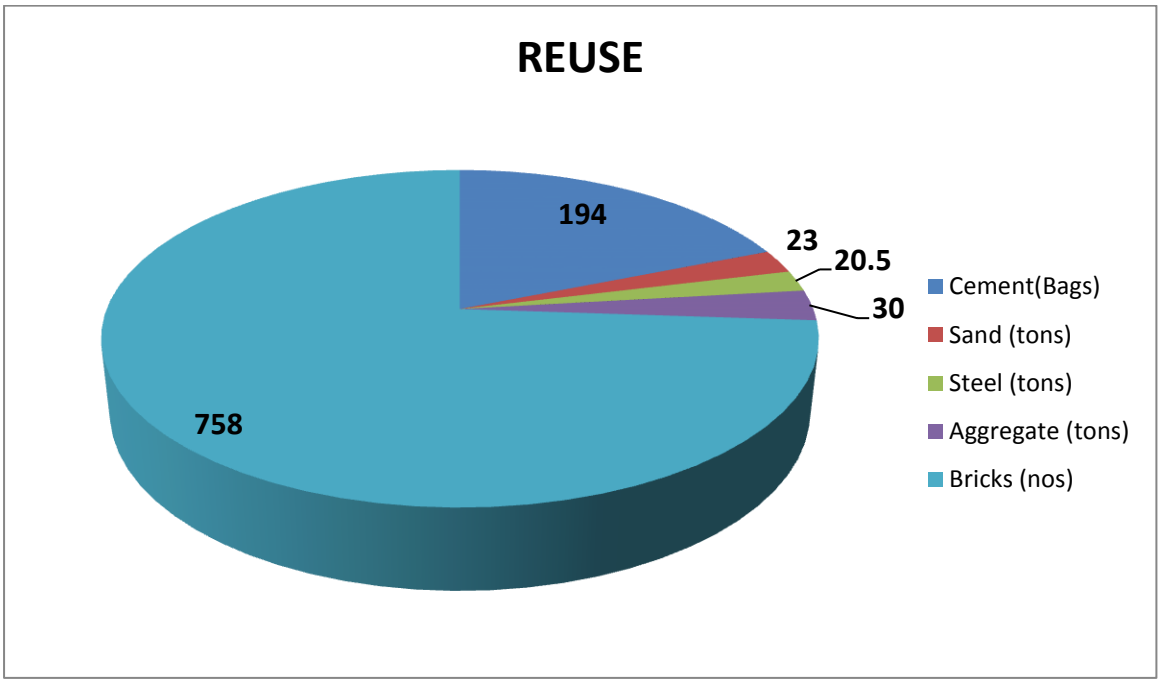
BRICKS

TABLE 9.5 MONTHLY BRICKS WASTE AND REUSE

MONTH	*CONSUMPTION (Nos)*	*WASTE (nos)*	*REUSE (nos)*
MAR	3080	123	62
APR	1150	46	22
MAY	800	32	17
JUN	1025	41	21
JUL	5750	230	145
AUG	825	33	20
SEP	2098	80	55
OCT	4750	190	140
NOV	1400	56	41
DEC	6500	260	190
JAN	1051	42	35
FEB	545	22	10
TOTAL		**1155**	**758**




WASTE
435
72
118
75
1155
Cement (Bags)
Sand (tons)
Steel (tons)
Aggregate (tons)
Bricks (Nos)


REUSE
194
23
20.5
30
758
Cement(Bags)
Sand (tons)
Steel (tons)
Aggregate (tons)
Bricks (nos)

CHAPTER - 10

REMEDIAL MEASURE

Remedial measures for Cement

- Waste cement can be used in plaster work.
- It can be used in concrete work.

It is said that using of 10 kg cement mortar appx. 0.5 kg of mortar is wasted in plaster work. Density of mortar is 2200 kg/cum.
Volume of plaster is 0.01m3. so that 22kg cement is used for 1cum.

Remedial measures for Steel

- Used in RCC of compound wall.
- Used in RCC for gate column.
- Used in curtailment in slab.
- Used in stirrups for small size diameter steel.

Remedial measures for Bricks

- Used in Brick Bat Cement Concrete.
- Used in Compound wall construction.
- Used in partition wall.
- Used in road pavement.

Volume of single brick= (19cm*9cm*9cm) = 1539 cm3
Volume of broken or wastage brick is appx. around 720 cm3
Volume Landfilling is 720 cm3 2 758 Nos = 545760 cm3

Remedial measures for Aggregate

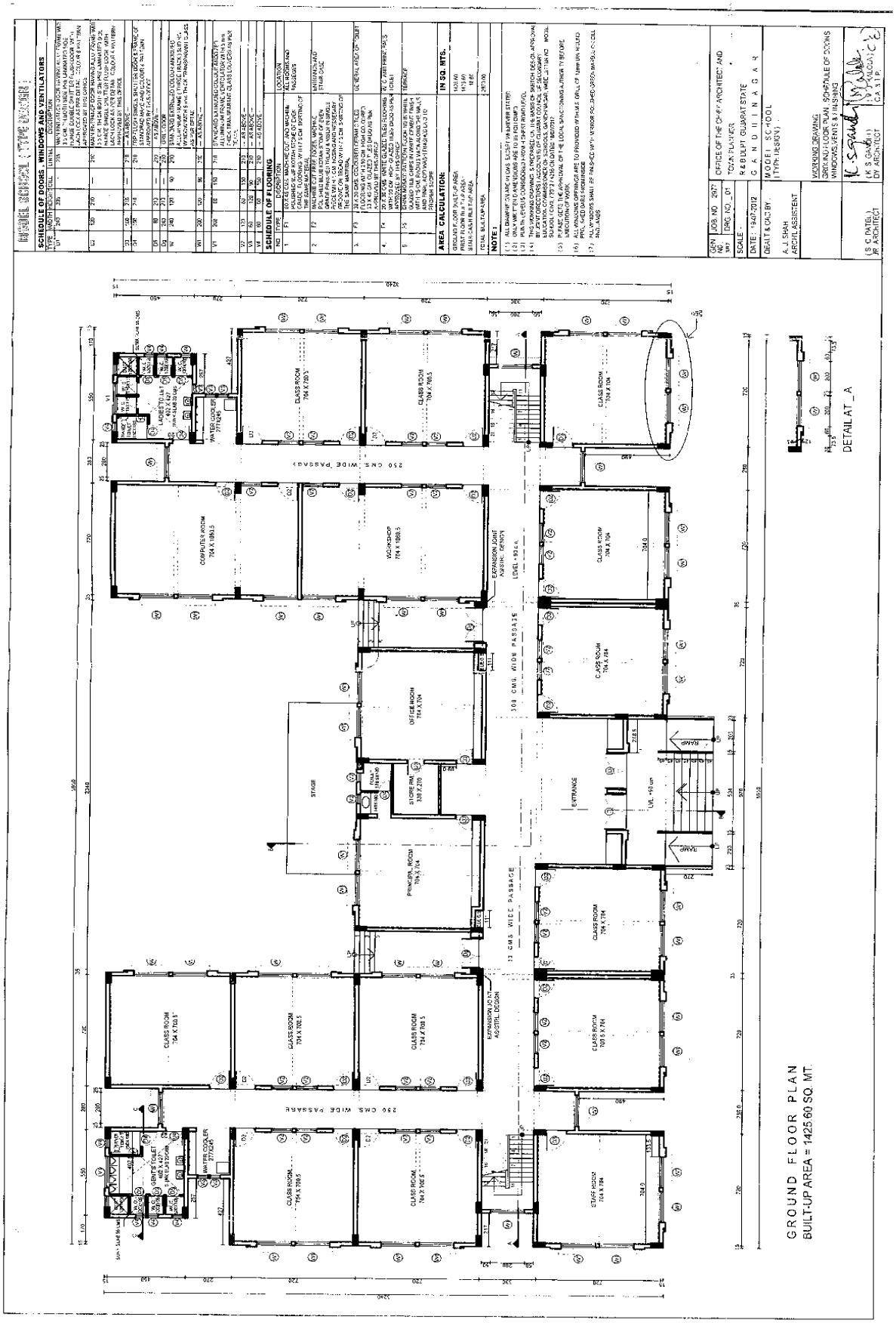
- Used in RCC work for beam.
- Used in RCC work for slab.

Remedial measures for Sand

- Used in cement mortar.
- Used in sand filling.

Density dry sand 1780kg/m3
Wet sand 1920kg/m3
Compacted 2080kg/m3

Reuse of sand is 23 tons so that it can be utilized for 13 m3(1800 kg/m3)



FIRST FLOOR PLAN

SCHEDULE OF REINFORCEMENT FOR COLUMNS (BLOCK-B)

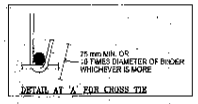
SCHEDULE OF COLUMNS
FROM FOOTING TO PLINTH BEAM LEVEL, PLINTH BEAM LEVEL TO FIRST FLOOR LEVEL, FIRST FLOOR LEVEL TO SECOND FLOOR (PRESENT TERRACE) LEVEL, SECOND FLOOR (PRESENT TERRACE) LEVEL TO FINAL TERRACE LEVEL (BLOCK-B)

DRG. No.:- GEN-2/MS/IV 6/14 DATE 7/08/

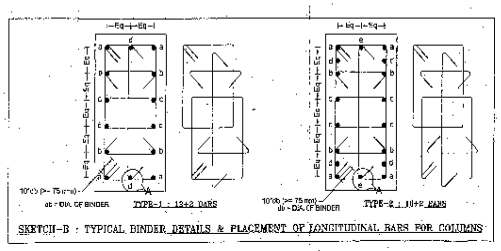
SR.NO.	COLUMN NOS.	COLUMN SIZE (mm x mm)	FROM FOOTING TO PLINTH BEAM LEVEL: COND. GRADE	VERTICAL BARS NOS.&DIA.#	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/3	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/1	ARRANGEMENT OF BINDERS	LO IN MM	REMARKS	FROM PLINTH BEAM LEVEL TO FIRST FLOOR LEVEL: COND. GRADE	VERTICAL BARS NOS.&DIA.#	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/3	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/1	ARRANGEMENT OF BINDERS	LO IN MM	REMARKS	FROM FIRST FLOOR LEVEL TO SECOND FLOOR (PRESENT TERRACE) LEVEL: COND. GRADE	VERTICAL BARS NOS.&DIA.#	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/3	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/1	ARRANGEMENT OF BINDERS	LO IN MM	REMARKS	FROM SECOND FLOOR (PRESENT TERRACE) LEVEL TO FINAL TERRACE LEVEL: COND. GRADE	VERTICAL BARS NOS.&DIA.#	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/3	TRANSVERSE REINFORCEMENT (BINDERS) WITHIN L/1	ARRANGEMENT OF BINDERS	LO IN MM	REMARKS
1	CB1, CB4,	350X700	M25	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-20ϕ (b) +4-16ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
2	CB2, CB5	350X700	M25	4-32ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-20ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-28ϕ (a) +4-20ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-20ϕ (a) +4-20ϕ (b) +4-16ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
3	CB3, CB6	350X900	M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +4-32ϕ (d) +2-16ϕ (e)	10ϕ-75C/C	8ϕ-150C/C	TYPE-2	900		M20	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +4-32ϕ (d) +2-16ϕ (e)	10ϕ-75C/C	8ϕ-150C/C	TYPE-2	900		M20	4-32ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +4-25ϕ (d) +2-12ϕ (e)	10ϕ-75C/C	8ϕ-150C/C	TYPE-2	900		M20	4-25ϕ (a) +4-20ϕ (b) +4-25ϕ (c) +4-25ϕ (d) +2-12ϕ (e)	10ϕ-75C/C	8ϕ-150C/C	TYPE-2	900	
4	CB7, CB10	350X900	M25	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	900		M20	4-32ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	900		M20	4-28ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	900		M20	4-25ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	900	
5	CB8, CB9	350X700	M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-25ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-25ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-20ϕ (a) +4-20ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
6	CB11, CB16	350X700	M25	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-25ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-25ϕ (a) +1-20ϕ (b) +4-20ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-20ϕ (a) +4-20ϕ (b) +4-16ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
7	CB12, CB15	350X700	M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +1-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-25ϕ (a) +4-20ϕ (b) +1-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
8	CB13, CB14, CB18	350X700	M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	10ϕ-75C/C	TYPE-1	700		M20	4-32ϕ (c) +4-25ϕ (c) +1-25ϕ (c) +2-12ϕ (a)	10ϕ-75C/C	10ϕ-75C/C	TYPE-1	700		M20	4-32ϕ (c) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	10ϕ-75C/C	TYPE-1	700	
9	CB17, CB20	350X700	M25	4-32ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +4-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	10ϕ-75C/C	TYPE-1	700		M20	4-25ϕ (c) +1-25ϕ (c) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-25ϕ (c) +4-25ϕ (c) +4-25ϕ (b) +2-12ϕ (c)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	
10	CB19	350X700	M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M25	4-32ϕ (a) +4-32ϕ (b) +4-32ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (a) +1-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700		M20	4-32ϕ (c) +1-25ϕ (b) +4-25ϕ (c) +2-12ϕ (d)	10ϕ-75C/C	8ϕ-150C/C	TYPE-1	700	

GENERAL NOTES :-

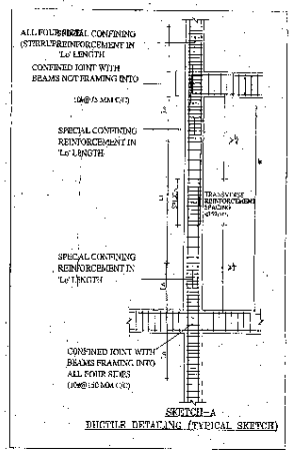
1. FOR GENERAL NOTES & TYPICAL DUCTILE DETAILING OF STRUCTURAL MEMBERS, PLEASE REFER TO THIS OFFICE DRAWING No. SBDC - G1 "GENERAL NOTES AND TYPICAL DUCTILE DETAILING FOR MOMENT RESISTING R.C.C. FRAME BUILDING STRUCTURES", DATED 01-05-2009 (REVISION - 1 DATED 01-08-2010). REBENDING, STUDDYING & FOLLOWING ALL THE DETAILS & INSTRUCTIONS OF THE ABOVE SAID DRAWING IS VERY IMPORTANT, SINCE ALL SUBSEQUENT NOTES ARE GIVING SPECIFIC & ARE COMPLIMENTARY TO THE NOTES GIVEN IN THE ABOVE SAID DRAWING SBDC-G1. THIS OFFICE DRAWING SBDC-G1 SHALL BE REFERRED TO WITH ALL SUBSEQUENT DRAWINGS FOR THIS PROJECT.
2. FOR R.C.C. LAYOUT OF COLUMNS & OTHER GENERAL NOTES, PLEASE REFER TO THIS OFFICE FOOTINGS DRAWING NO.------
3. GRADE OF CONCRETE FOR COLUMNS SHALL BE AS MENTIONED IN SCHEDULE OF COLUMNS.
4. FOR REINFORCEMENT DETAILS.
   4.1 ϕ INDICATES HYSD STEEL BARS Fe415 GRADE CONFORMING TO IS: 1786 : 2008.
5. CLEAR COVER OF 50 MM TO THE LONGITUDINAL BARS SHALL BE PROVIDED FOR COLUMNS.
6. FOR BINDER DETAILS & PLACEMENT OF LONGITUDINAL BARS FOR COLUMNS AND DISTANCE L0 AND L1, PLEASE REFER TO SKETCH-A AND SKETCH-B.
7. WHILE CONCRETING THE PORTION AT THE JUNCTION OF THE BEAM WITH THE COLUMN, IT SHOULD BE ENSURED THAT ONLY THE MIX OF HIGHER GRADE SHALL BE USED.
8. TOP OF THE PLINTH BEAMS SHALL BE KEPT 150MM BELOW FINAL GROUND LEVEL.
9. LAP SPLICES IN THE COLUMN REINFORCEMENT SHALL BE PROVIDED IN THE CENTRAL HALF OF THE MEMBER LENGTH. NOT MORE THAN 50% OF THE BARS SHALL BE SPLICED AT ONE SECTION.
10. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
11. THIS OFFICE SHALL NOT BE RESPONSIBLE FOR MISINTERPRETATION OF ALL DRAWINGS, ANY CHANGE/DEVIATIONS MADE IN THE DESIGNS SUPPLIED BY THIS OFFICE AND ANY INADEQUACY IN QUALITY AND WORKMANSHIP OF THE WORK AS A WHOLE.
12. DISCREPANCY AND/OR AMBIGUITY, IF ANY, SHALL BE GOT RECTIFIED WELL BEFORE EXECUTION.
13. TOP OF THE PLINTH BEAMS SHALL BE KEPT 150MM BELOW FINAL GROUND LEVEL.



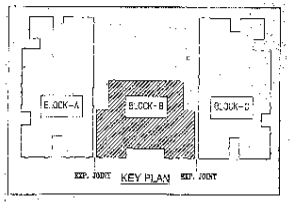
DETAIL AT 'A' FOR CROSS TIE



SKETCH-B : TYPICAL BINDER DETAILS & PLACEMENT OF LONGITUDINAL BARS FOR COLUMNS



DUCTILE DETAILING (TYPICAL SKETCH)



KEY PLAN

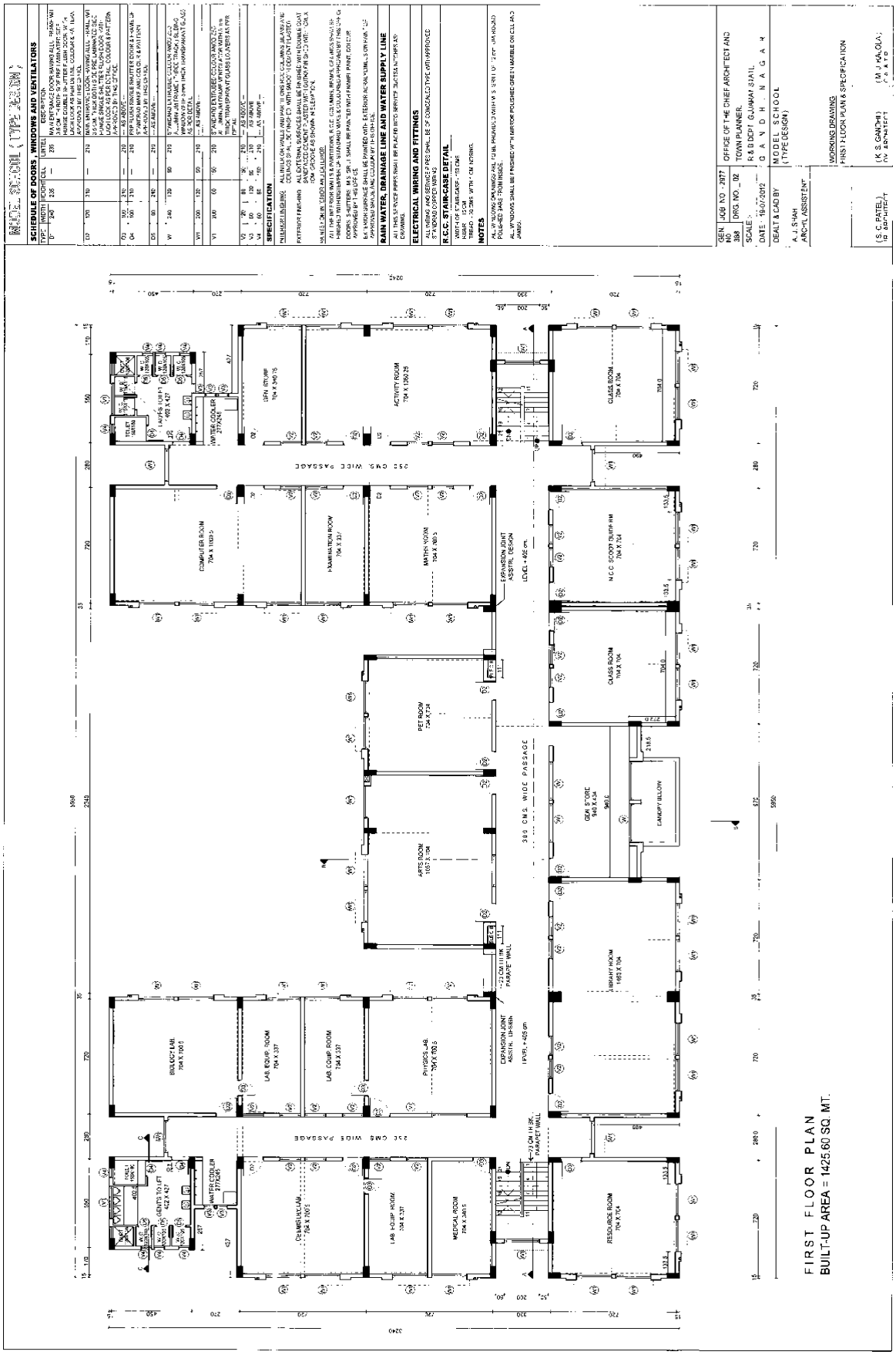
GOVERNMENT OF GUJARAT
ROADS AND BUILDINGS DEPARTMENT

DRG. No.:- GEN-2/MS/IV 6/14 DATE :- 7/08/

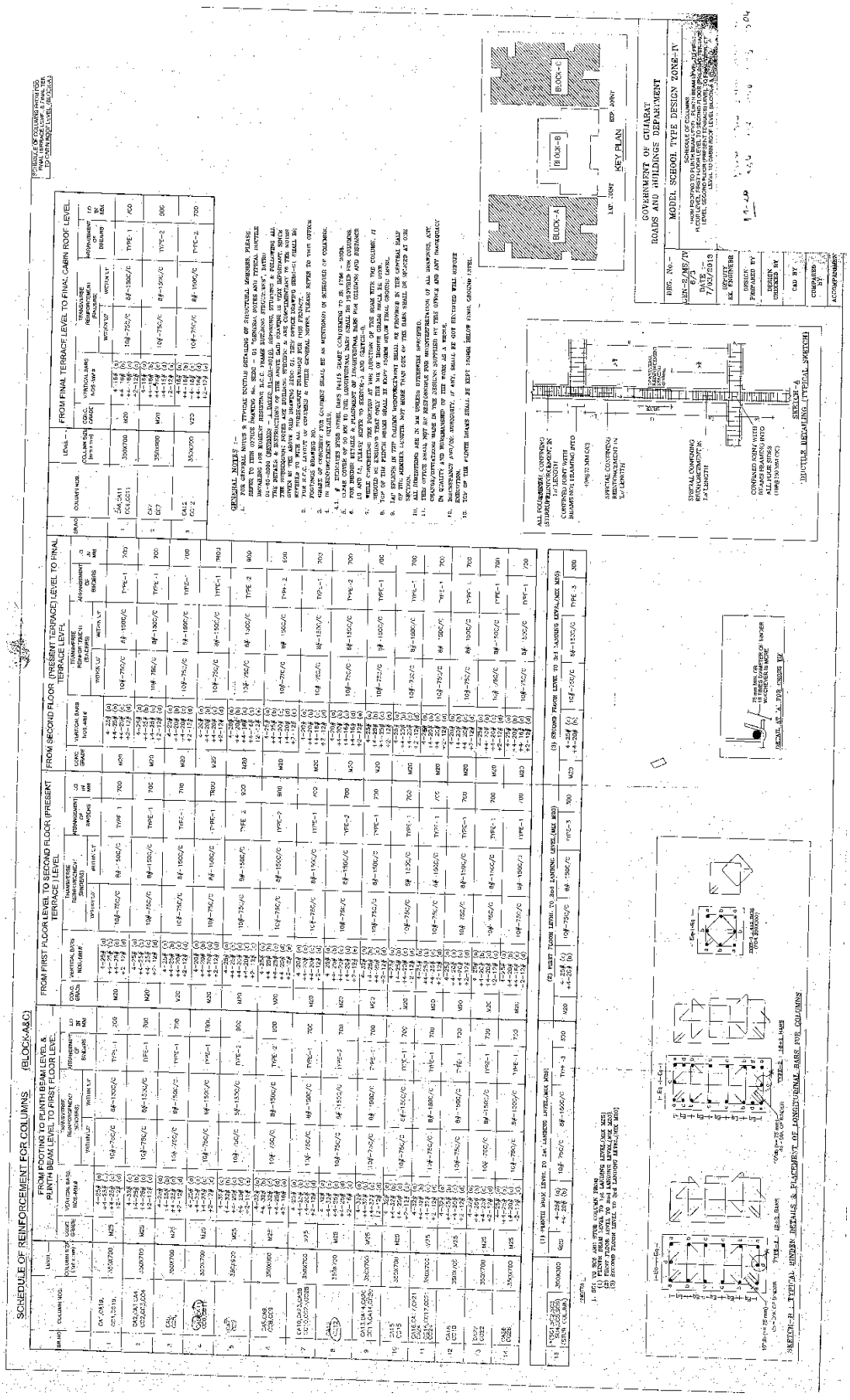
MODEL SCHOOL TYPE DESIGN ZONE-IV

SCHEDULE OF COLUMNS
FROM FOOTING TO PLINTH BEAM LEVEL, PLINTH BEAM LEVEL TO FIRST FLOOR LEVEL, FIRST FLOOR LEVEL TO SECOND FLOOR (PRESENT TERRACE) LEVEL, SECOND FLOOR (PRESENT TERRACE) LEVEL TO FINAL TERRACE LEVEL (BLOCK-B)

DEPU EL. ENG
DESIG PREPARE
DESIG CHECKE
CAD :
COMPA BY :
ACCOMPA



FIRST FLOOR PLAN



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2) Vilas, N., & Guilberto, B. (2007). Construction and Demolition Waste Management : Current Practices in Asia. International Conference on Sustainable Solid waste Management, (pp. 97-104). Chennai, India.

3) P. Agamuthu, "Challenges in sustainable management of construction and demolition waste", Waste Manag. Res., vol. 26 no. 6, pp. 491-492, 2008.

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5) J. Solis-Guzman, M. Marrero, M.V. Montes-Delgado, and A. Ramirez-de-Arellano, "A Spanish model for quantification and management of construction waste", Waste Manag., vol. 29, pp. 2542-2548, 2009.

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9) N. Kollikkathara, H. Feng, and D. Yu, "A system dynamic modelling

approach for evaluating municipal solid waste generation, landfill capacity and related cost management issues," Waste Management, vol. 30, no. 11, pp. 2194–2203, 2010.

10) H. Yuan, A. R. Chini, Y. Lu, and L. Shen, "A dynamic model for assessing the effects of management strategies on the reduction of construction and demolition waste," Waste Management, vol. 32, no. 3 pp. 521-531, 2012.

11) C. Llatas, "A model for quantifying construction waste in projects according to the European waste list," Waste Management, vol. 31, no.6, pp. 1261-1276, 2011.

12) H. Yuan and L. Shen, "Trend of the research on construction and demolition waste management," Waste Management, vol. 31, no. 4, pp. 670-679, 2011.

STEEL WASTE

BRICKS WASTE

SAND WASTE

AGGREGATE WASTE

DRAWING

TABLE 1 MONTHLY CEMENT CONSUMPTION

Months	Cement consumption	
	In bags (nos.)	In kg
MARCH	2279	113950
APRIL	0909	45450
MAY	1026	51300
JUNE	0726	36300
JULY	2834	141700
AUGUST	0736	36300
SEPTEMBER	2876	143800
OCTOBER	0621	31050
NOVEMBER	1548	77400
DECEMBER	0401	20050
JANUARY	0267	13350
FEBRUARY	0134	6700
Total	**11997**	**599850**

CHART-1 CEMENT CONSUMPTION (BAGS)

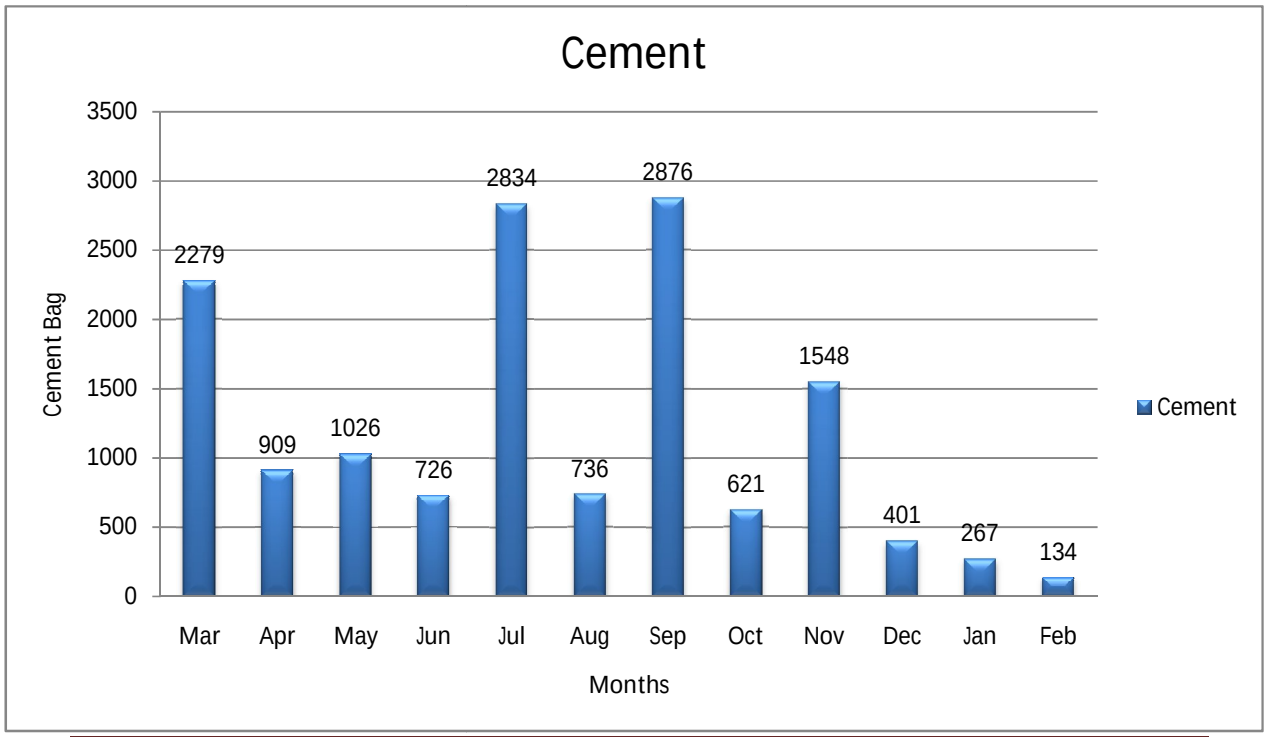


TABLE 2 MONTHLY STEEL CONSUMPTION

Months	Steel consumption In (kg)
MARCH	11000
APRIL	26000
MAY	32000
JUNE	38000
JULY	44000
AUGUST	34000
SEPTEMBER	43000
OCTOBER	28000
NOVEMBER	15000
DECEMBER	21000
JANUARY	12000
FEBRUARY	10000
Total(kg)	314000

CHART-2 STEEL CONSUMPTION (TONS)

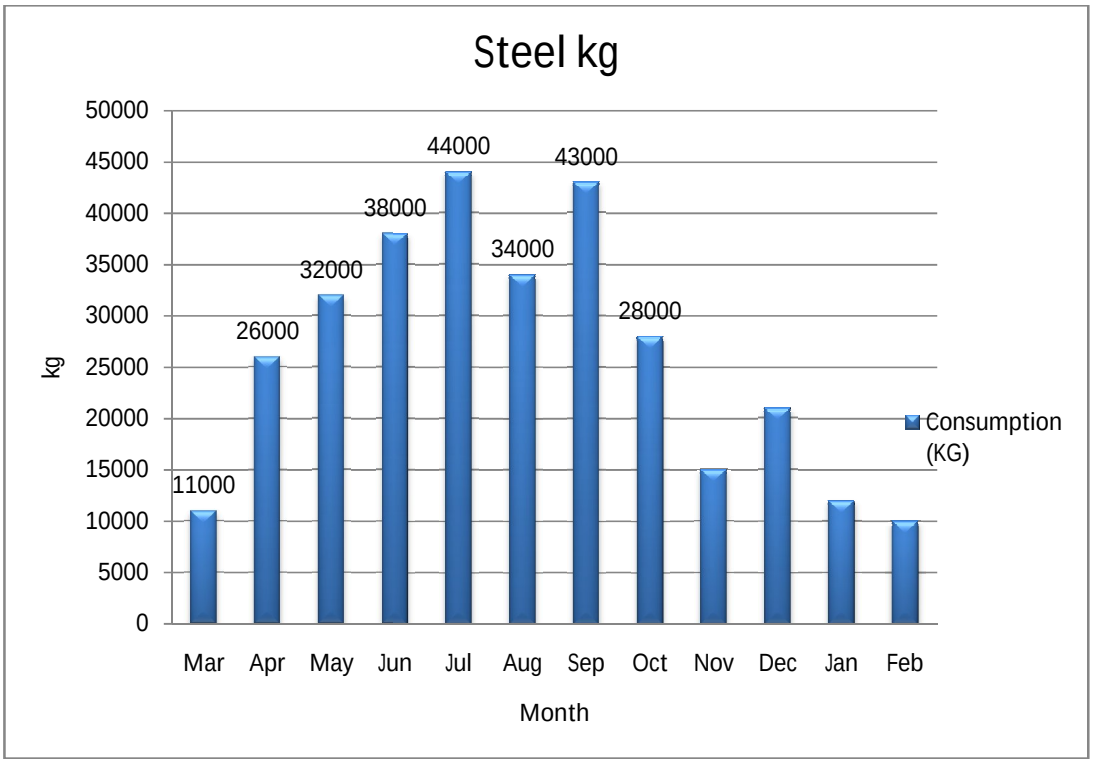


TABLE-3 MONTHLY AGGREGATE CONSUMPTION

Months	Aggregate consumption In (Tons)
MARCH	11
APRIL	26
MAY	32
JUNE	38
JULY	44
AUGUST	34
SEPTEMBER	43
OCTOBER	25
NOVEMBER	37
DECEMBER	10
JANUARY	7
FEBRUARY	5
Total(Tons)	312

CHART-3 AGGREGATE CONSUMPTION (TONS)

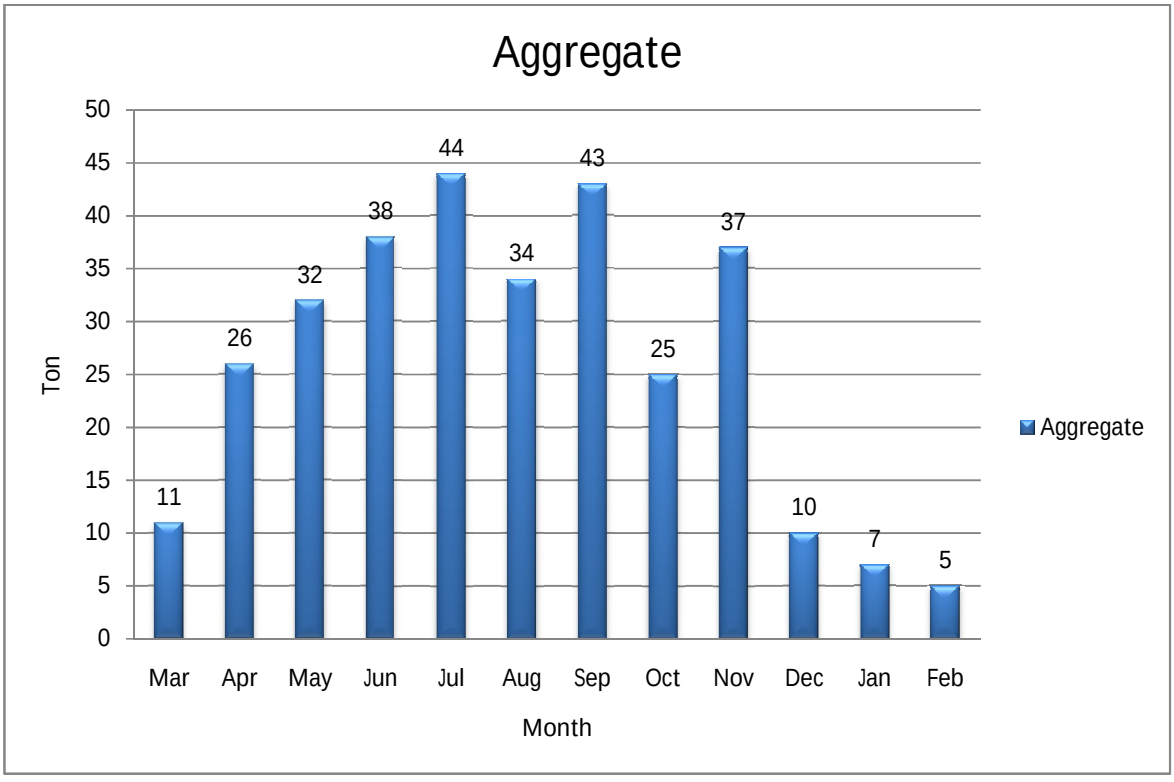


Table 4 MONTHLY SAND CONSUMPTION

Months	Sand consumption In (Ton).
MARCH	173
APRIL	87
MAY	98
JUNE	70
JULY	272
AUGUST	71
SEPTEMBER	276
COCTOBER	124
NOVEMBER	109
DECEMBER	78
JANUARY	62
FEBRUARY	59
Total(Tons)	**1478**

CHART-4 SAND CONSUMPTION (TONS)

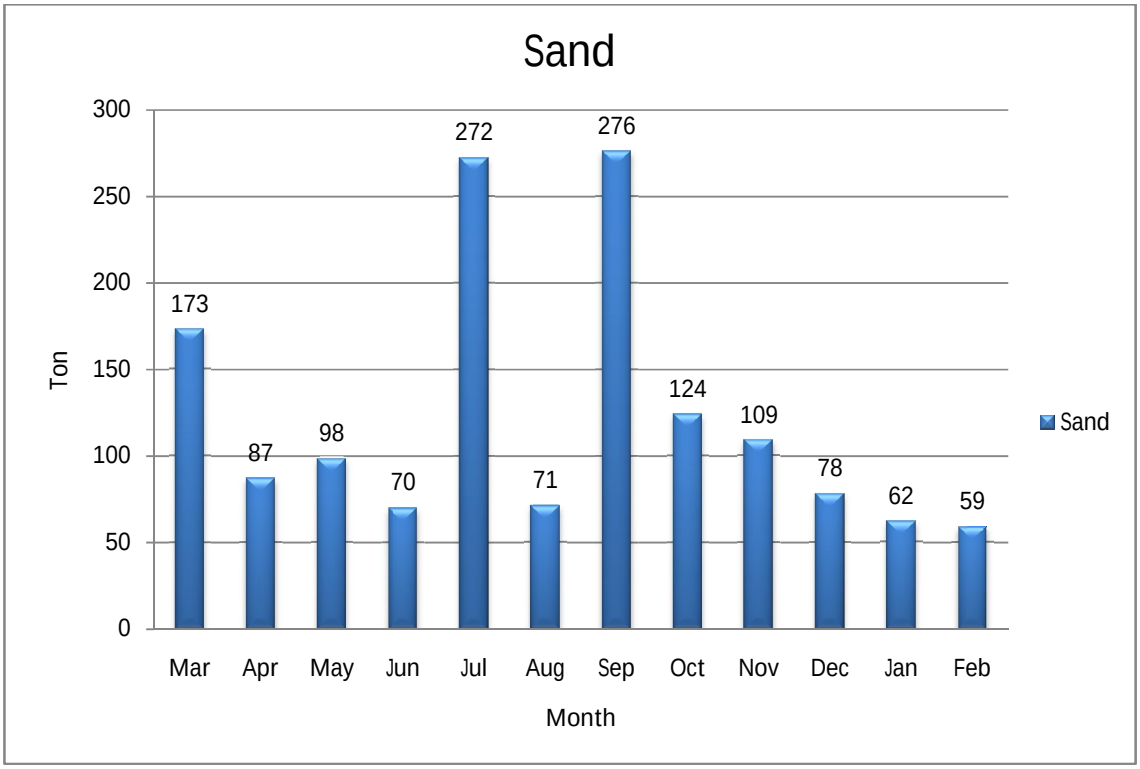


Table-5 MONTHLY BRICKS CONSUMPTION

Months	Bricks consumption In (nos).
MARCH	3080
APRIL	1150
MAY	800
JUNE	1025
JULY	5750
AUGUST	825
SEPTEMBER	2098
COCTOBER	4750
NOVEMBER	1400
DECEMBER	6500
JANUARY	1051
FEBRUARY	545
Total(Tons)	**28974**

CHART-5 BRICKS CONSUMPTION (NOS)

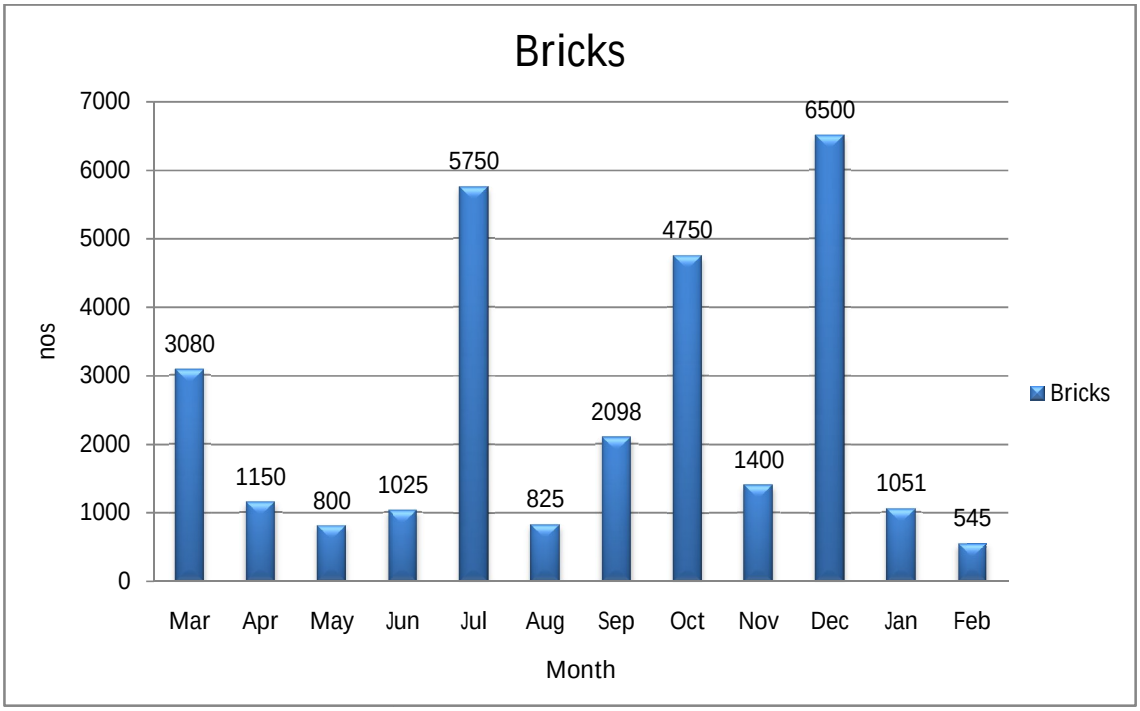


TABLE-6 MONTHLY CEMENT WASTE AND REUSE

MONTH	CONSUMPTION	WASTE	REUSE
MAR	2279	68	31
APR	909	28	13
MAY	1026	31	14
JUN	726	22	9
JUL	2834	85	38
AUG	736	23	11
SEPT	2876	87	39
OCT	621	19	8
NOV	1548	48	22
DEC	401	12	5
JAN	267	8	3
FEB	134	4	1
TOTAL		**435**	**194**

CHART-6 CEMENT WASTE & REUSE (TONS)

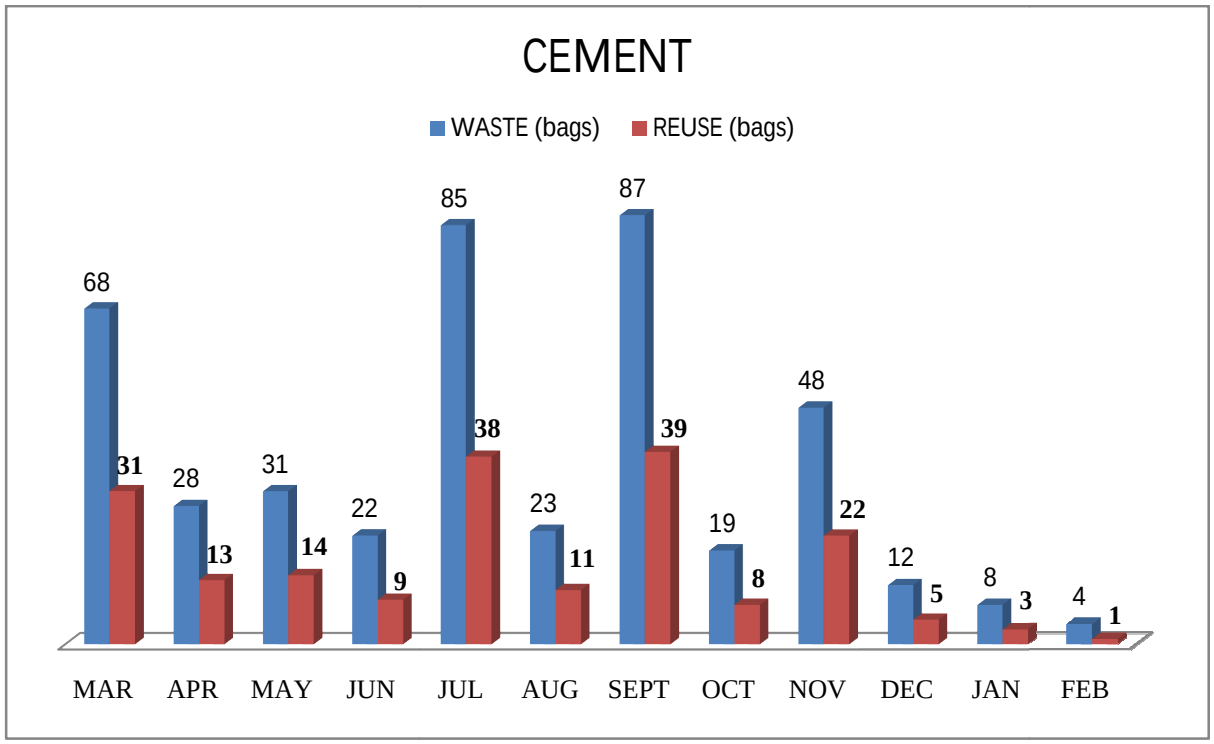


TABLE-7 MONTHLY STEEL WASTE AND REUSE

MONTH	*CONSUMPTION (kg)*	*WASTE (tons)*	*REUSE(tons)*
MAR	11000	3	0.6
APR	26000	10	1.5
MAY	32000	12	2
JUN	38000	15	2.5
JUL	44000	16	3
AUG	34000	14	2
SEPT	43000	15	3
OCT	28000	10	1.7
NOV	15000	6	1
DEC	21000	8	1.2
JAN	12000	5	1
FEB	10000	4	1
TOTAL		**118**	**20.5**

CHART-7 STEEL WASTE & REUSE (TONS)

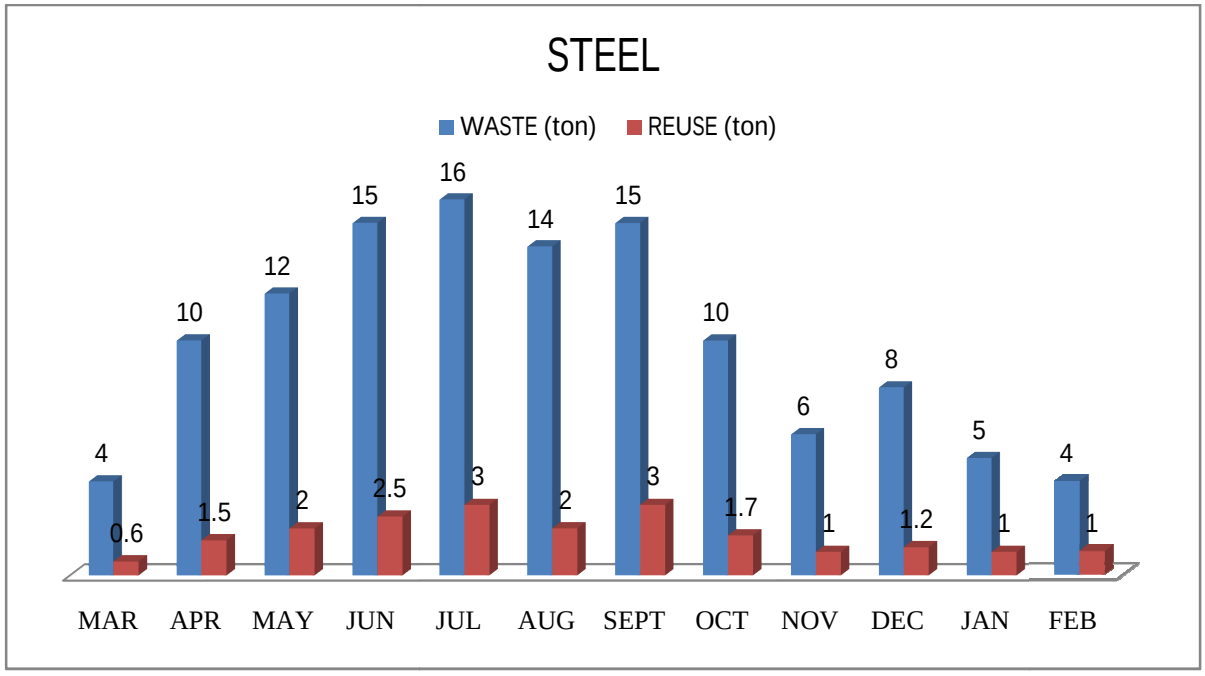


TABLE-8 MONTHLY SAND WASTE AND REUSE

MONTH	*CONSUMPTION (tons)*	*WASTE (tons)*	*REUSE (tons)*
MAR	173	9	3.1
APR	87	4	1.2
MAY	98	5	2
JUN	70	3	1
JUL	272	14	4
AUG	71	4	1.2
SEP	276	13	4
OCT	124	6	2
NOV	109	5	2
DEC	78	4	1.2
JAN	62	3	1
FEB	59	3	1
TOTAL		72	23

CHART-8 CEMENT WASTE & REUSE (TONS)

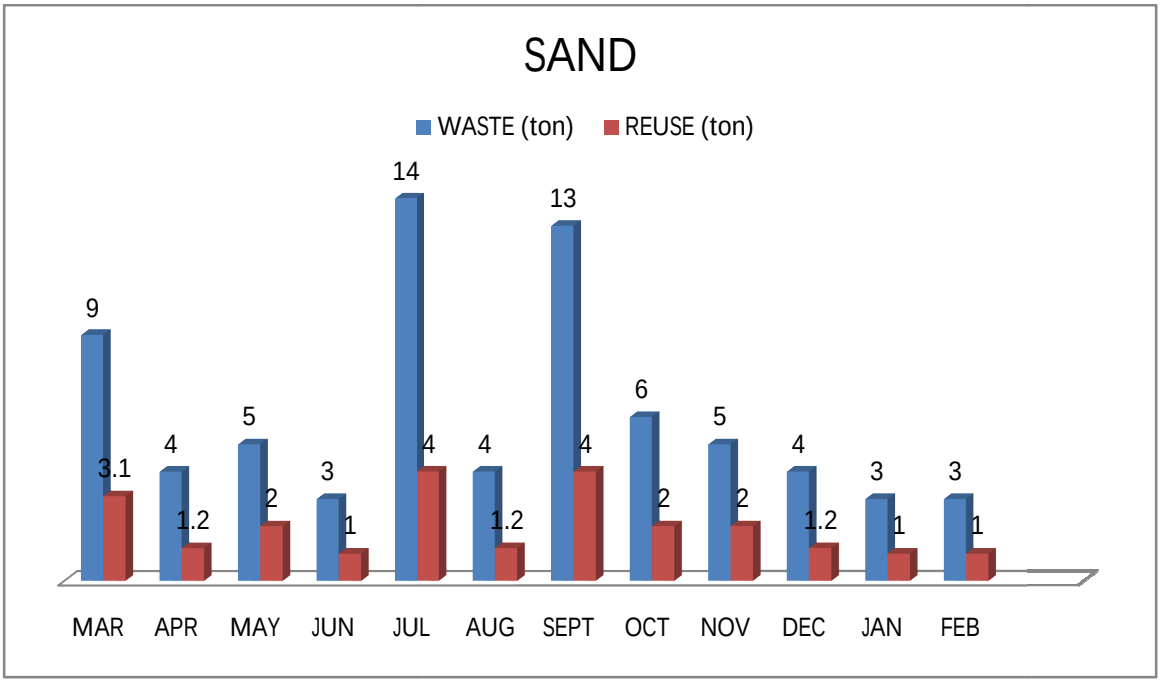


TABLE-9 MONTHLY AGGREGATE WASTE AND REUSE

MONTH	*CONSUMPTION (tons)*	*WASTE (tons)*	*REUSE (tons)*
MAR	11	9	2
APR	26	2	1
MAY	32	3	1
JUN	38	2	1
JUL	44	12	5
AUG	34	3	1
SEP	43	11	5
OCT	25	9	2
NOV	37	15	7
DEC	10	4	2
JAN	7	3	1
FEB	5	2	1
TOTAL		**75**	**30**

CHART-9 AGGREGATE WASTE & REUSE (TONS)

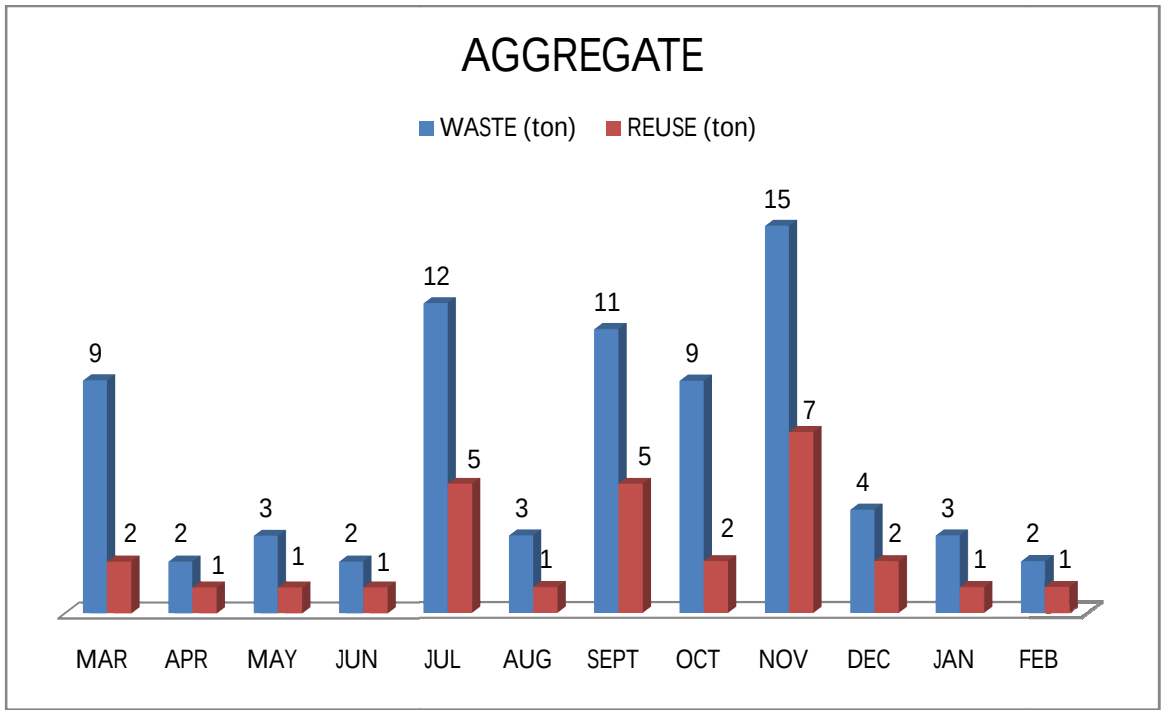
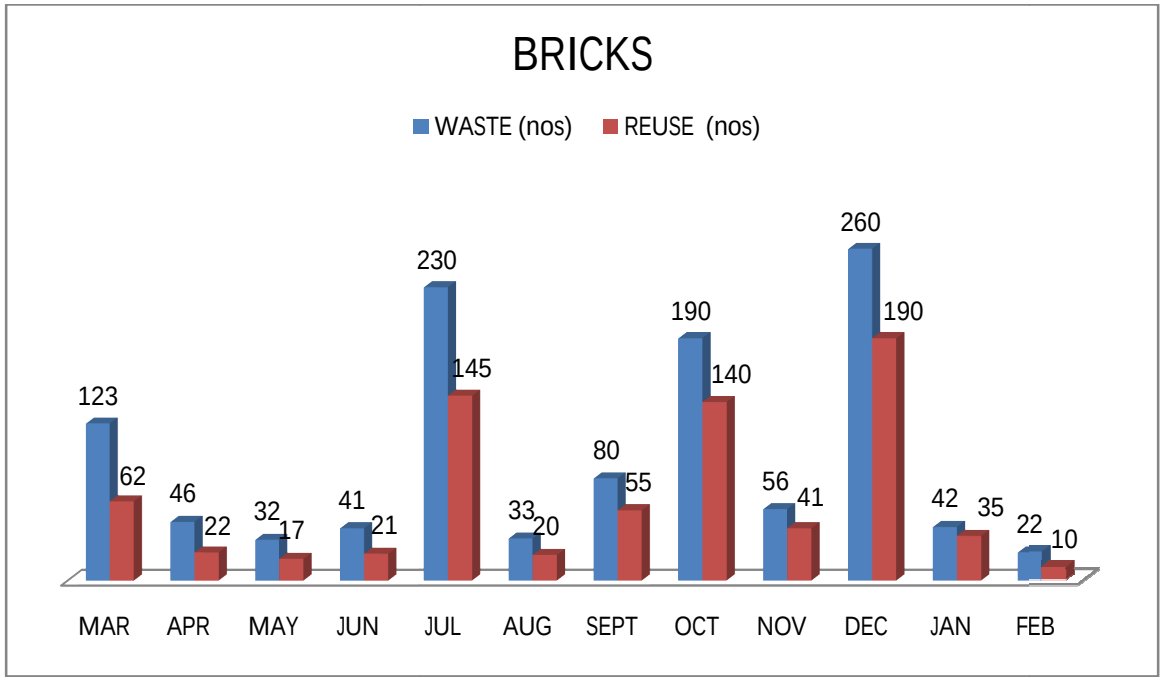


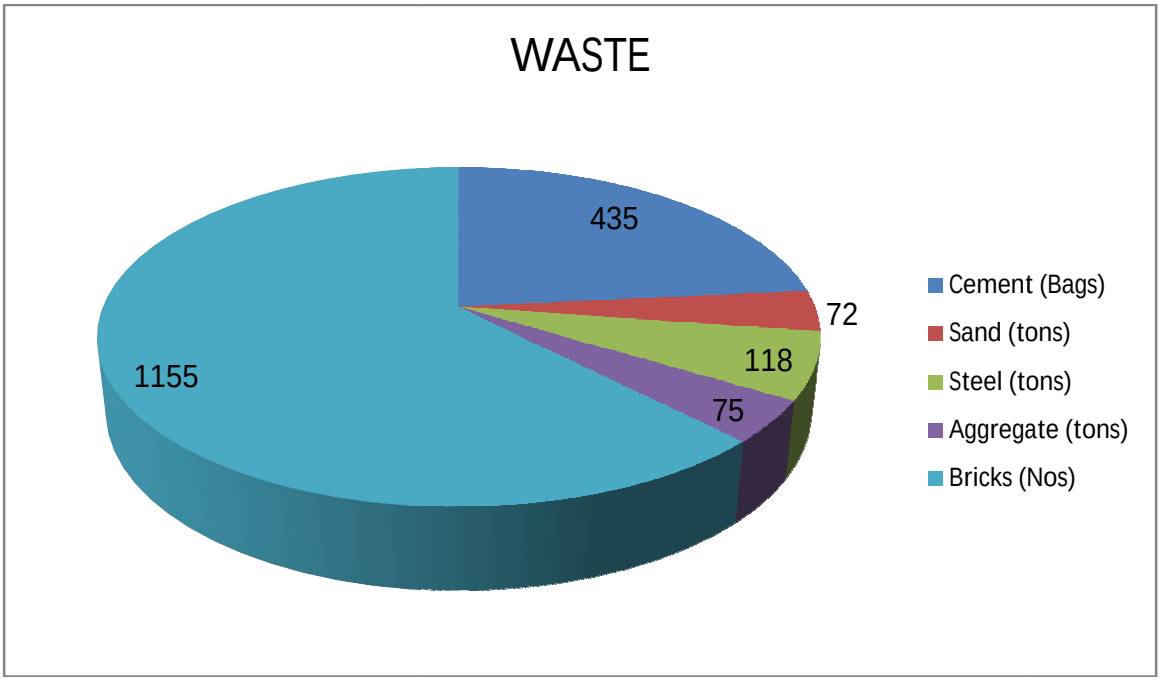
TABLE-11 MONTHLY BRICKS WASTE AND REUSE

MONTH	*CONSUMPTION (Nos)*	*WASTE (nos)*	*REUSE (nos)*
MAR	3080	123	62
APR	1150	46	22
MAY	800	32	17
JUN	1025	41	21
JUL	5750	230	145
AUG	825	33	20
SEP	2098	80	55
OCT	4750	190	140
NOV	1400	56	41
DEC	6500	260	190
JAN	1051	42	35
FEB	545	22	10
TOTAL		**1155**	**758**

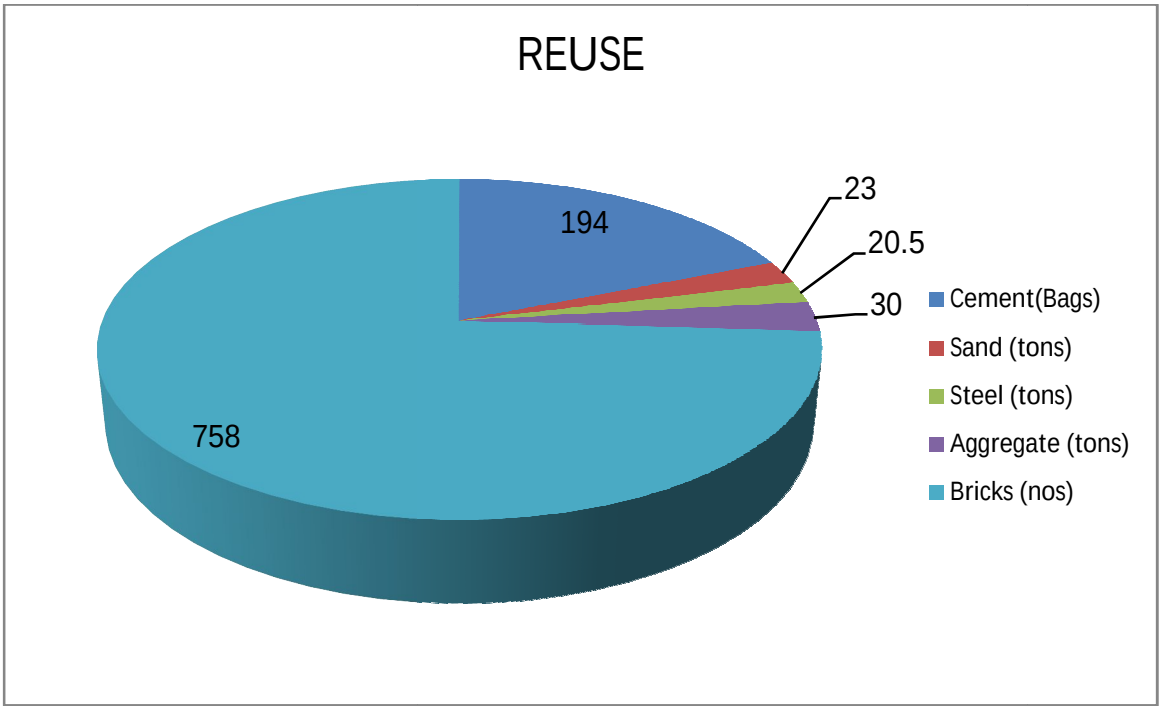
CHART-10 BRICKS WASTE & REUSE (NOS)



WASTE CHART



REUSE CHART



FORM 1 THE PATENTS ACT 1970 (39 OF 1970) & The Patent Rules, 2003 APPLICATION FOR GRANT OF PATENT (See Section 7,54 & 135 And Rule 20 (1))	**(FOR OFFICE USE ONLY)** Application No: Filing Date: Amount of Fee Paid CBR No: Signature:

1. APPLICANT (S)

Name	Nationality	Address
PATEL VARUN MANILAL	INDIAN	31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA – 384265
PATEL PRIYANKKUMAR BIPINBHAI	INDIAN	13, AYODHYAPURI SOCIETY, NEAR CHHINDIYA GATE, PATAN, GUJARAT, INDIA - 384265
PATEL MEET PARSOTTAMDAS	INDIAN	1, SHAKTI NAGAR, NEAR GUNGDI ROAD, PATAN, GUJARAT, INDIA – 384265
SALVI SARVANG SUNILBHAI	INDIAN	TRISHERIYU, SALVIWADO, PATAN, GUJARAT, INDIA - 384265

2. INVENTOR (S)

Name	Nationality	Address
PATEL VARUN MANILAL	INDIAN	31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA – 384265
PATEL PRIYANKKUMAR BIPINBHAI	INDIAN	13, AYODHYAPURI SOCIETY, NEAR CHHINDIYA GATE, PATAN, GUJARAT, INDIA - 384265
PATEL MEET PARSOTTAMDAS	INDIAN	1, SHAKTI NAGAR, NEAR GUNGDI ROAD, PATAN, GUJARAT, INDIA – 384265
SALVI SARVANG SUNILBHAI	INDIAN	TRISHERIYU, SALVIWADO, PATAN, GUJARAT, INDIA - 384265

3. TITLE OF THE INVENTION

“CONSTRUCTION WASTE MANAGEMENT”

4. **ADDRESS FOR CORRESPONDENCE OF APPLICANT IN INDIA**

PATEL VARUN MANILAL

31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA

MOBILE NO: **09724810510**
E-MAIL: varunpatel9037@gmail.com

5. PRIORITY PARTICULARS OF THE APPLICATION (S) FILED IN CONVENTION COUNTRY Not Applicable

Country	Application Number	Filing Date	Name of the applicant	Title of the Invention

6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICANT Not Applicable

International application Number	International filing date as allotted by the receiving office

7. PARTICULARS FOR FILING DIVISIONAL APLICATION Not Applicable

Original (first) application number	Date of filing of original (first) application

8. PARTICULARS FOR FILING PATENT OF ADDITION Not Applicable

Main application /patent Number	Date of filing of main application

9. DECLARATION:

(i) We the above named inventors are the true and first inventors for this invention and declare that the applicants herein are our assignee or legal representative.

(a) Date
(b) Signature
(c) Names: PATEL VARUN MANILAL

(a) Date
(b) Signature
(c) Names: PATEL PRIYANKKUMAR BIPINBHAI

(a) Date
(b) Signature
(c) Names: PATEL MEET PARSOTTAMDAS

(a) Date
(b) Signature
(c) Names: SALVI SARVANG SUNILBHAI

(ii) Declaration by the applicant (s) in the convention country

We the applicants(s) in the convention country declare that the applicant (s) herein are our assignee or legal representative

(a) Date

(b) Signature (s)

(c) Name (s) of the signatory

(**iii) Declaration by the applicant(s):**
I/we the applicant(s) hereby declare(s) that: -

- ❑ I am/we are in possession of the above mentioned invention
- ❑ The provisional /complete specification relating to the invention is filed with this application
- ❑ The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us
- ❑ There is no lawful ground of objection to the grant of the patent to me/us.
- ❑ I am/we are the assignee or legal representative of true and first inventors
- ❑ The application or each of the applications, particular of which are given in para-5 was the first application in convention country/countries in respect of my/our invention
- ❑ I/we claim the priority from the above mentioned application (s) filed in convention country/countries and state that no application for protection in respect of the invention had been made in a convention country before that date by me/use or by any person from which I/we derive the title
- ❑ My/our application in India is based on international application under patent cooperation treaty (PCT) as mentioned in Para-6
- ❑ The application is divided out of my/our application particulars of which are given in para7 and pray that this application may be treated as deemed to have been filed on under sec 16 of the act
- ❑ The said invention is an improvement in or modification of the invention particulars of which are given in Para- 8

10. **Following are the attachments with the application :**

(a) Provisional specification/complete specification
(b) Complete specification (in conformation with the international application)/ as amended before the international preliminary examination authority (IPEA) as applicable (2copies), no of pages no of claims
(c) Drawing (in conformation) with the international application/as amended before the International preliminary examination (IPEA) as applicable (2copies), no of sheets
(d) Priority documents
(e) Translation priority document/specification/international search report
(f) Statement and undertaking on form 3
(g) Power of authority
(h) Declaration of inventor ship on form 5
(i) Sequence listing in electronic form
(j) ……

Fee Rs…**1000/- (One thousand only)**…in Bank Draft bearing no **760801**
Date **10/12/2012** on **State Bank Of India, mavdi road, Rajkot** bank.
I/we hereby declare that to the best if my/our knowledge, information and belief the fact and matters stated herein are correct and I/we request that a patent may be granted to me /us for the said invention.

Dated this 6th day of April, 2013.

Signature: -

Name: - VARUN M. PATEL, PRIYANK B. PATEL, MEET P. PATEL, SARVANG S. SALVI

To:
The Controller of Patents
The Patent Office, At Mumbai

FORM 2

THE PATENTS ACT, 1970

(39 OF 1970)

&

THE PATENTS RULE, 2003

COMPLETE SPECIFICATION

(See Section 10, Rule 13)

""CONSTRUCTION WASTE MANAGEMENT""

VARUN MANILAL PATEL

31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA – 384265.

PRIYANKKUMAR BIPINBHAI PATEL

13, AYODHYANAGAR SOCIETY, NEAR CHHINDIYA GATE, PATAN, GUJARAT, INDIA-384265.

PATEL MEET PARSOTTAMDAS

1, SHAKTINAGAR, NEAR GUNGDI ROAD, PATAN GUJARAT, INDIA – 384265

SARVANG SUNILBHAI SALVI

TRISHERIYU, SALVIWADO,PATAN, GUJARAT, INDIA-384265

The following specification particularly describes the invention and the manner in which it is to be performed.

Field of the Invention

This invention is related to construction and also keep down its waste and reuse of waste material in construction.

The evolution of the mindset and the overall approach in waste management has affected the management of construction waste too. In the past, construction waste was simply dumped in open dumps or the sea as end treatment. Some of them were used in earth filling works but without much effort on waste separation. Mixed construction waste with high-value recyclables were buried at the same time. The reuse and recycling of construction materials was once high because of material shortages during the war and post-war periods, especially when the cost of virgin materials remained high. However, the incentive to reuse and recycle construction materials has dropped since the supply of raw materials has become more stable and sufficient waste. The relatively low price of virgin materials has made reuse and recycling a less economically efficient option. In recent years, a holistic, integrated and life-cycle approach and the waste hierarchy have also been applied to construction waste management. A number of measures targeting the construction process itself from the design and planning stage, demolition and construction operation stage as well as other measures which do not particularly target the construction process itself have been proposed and adopted commonly across the world to reduce and manage construction waste. Summarizes these measures for managing construction waste by stages

Background / Prior Art

Construction waste has caused serious environmental problems in many large cities. Enormous amounts of infrastructure and building work have be built, so numbers of demolished structures are also increasing in construction work .As increasing demands of dumping areas for never-ended construction waste are thrown away, there is a shortage of landfills. Therefore, reducing waste generation becomes a pressing issue around the world. Waste arising from the total or partial construction of building and/civil infrastructure These materials may be soil, gravel, construction materials of water flow system pieces of concrete, ceramics, coats, bricks, overlay plates, tiles, plaster, sand, stones, pieces of sanitary are ,etc. The materials of construction waste are generally heterogenic which yield the largest portion of waste from building and other relevant activities. The composition of these

materials depends on the local geological characteristics and the type of constructions or civil works. Waste minimization is any techniques, process or activities which avoids, eliminates or reduces waste at its source or allows reuse or recycling waste for benign purposes. There are many possibilities for disposing waste from construction and demolition activities, from recycling to incineration and land filling. Prior to considering various options that could be utilized, a hierarchy of disposal options needs to be captured into six levels, from low to high impacts, namely, reduce, reuse, recycle, compost, incinerate and landfill. Three main waste minimization strategies identified are reusing and reducing construction materials, collectively and these are presented in the order of preference, representing a hierarchy of environmental benefits and potentials for economic saving.

Objective of the invention

This study has been planned with following objectives

- Construction waste management are reduce the generation of construction waste.
- Maximize reduce and recycling.
- To reduce the intake of mixed construction waste at landfills.
- Reduce the construction cost of site.
- Cut down the cost and effort of transport and production.
- Use the waste which would otherwise be lost to landfill site.

Detailed Description

The importance of material management lies in the fact that any significant contribution made by the material manager in reducing materials cost will go a long way in improving the profitability and the rate of return on investment. Material management deals with managing of materials along with costs. Construction materials and components contribute around 50-60% of the total value of construction. It is estimated that about 10% of all materials delivered to the site either end up as waste or illegally removed during the construction phase. Furthermore, it has been noticed that large quantities of building materials are allowed to be buried or burnt each year due to inadequate controls on project sites.

Hence, proper material management is imperative for effective construction management. To achieve best results, it would be worthwhile to place all the functions related to materials under a single department known as material management department. In

Planning, estimating the type of material, their actual quantities, and the time at which it is required. To develop new sources of supply for purchases to remain competitive in the market. Development of ancillary units. Cost control of materials using various cost reductions methods. To develop coordination between various departments. Arranging transportation in the most economical way for the incoming and outgoing materials. Providing proper storage and distribution systems so as to reduce wastage, pilferage, deterioration, etc. Disposal of excess stocks, surplus, scrap items and also salvage of materials.

Claims

- There should be a centralized material management team co-ordination between the site and the organization.
- Proper control, tracking and monitoring of the system required.
- Awareness and accountability should be created within the organization.
- Firms employing proper material management system are seen to have increased their overall efficiency by 35%. Planning of construction material should be done on long term basis as emergency buying may prove to be costly.
- Purchase of class A material should be frequent and inventory should be optimum to reduce investment and interest cost.

If the planning of the project is updated from time to time which depicts the actual progress of the project .then the material requirement sheet can also be modified and this will result in showing the actual consumption at site. The supplier selection is done systematically by the company but the vendors list should be updated from time to time to have an efficient system for purchasing. Indian construction industry is suffering from labour absent sum during major festival like Holi & Dipawali.

ABSTRACT

Title:- "CONSTRUCTION WASTE MANAGEMENT"

Waste management is a fundamental component to any manufacturing or production enterprise. It is estimated that there are million tons of quarrying waste are produced in each year. The excessive wastage of materials, improper management on site and low awareness of the need for waste reduction are common in the local construction sites in India. With the urge for development and to satisfy the needs and wants, working and growth of Construction Industry is unavoidable. Over the last two decades material management ,the world over has gained recognition as a science to be studied extensively and applied systematically to ensure efficiency and viability of any industry. This thesis discusses the various waste material management methods/techniques for effective waste material management for minimization of project cost and better material management through a case study of construction. Construction waste is generated throughout the construction process such as during site clearance, material use, material damage, material non-use, excess procurement and human error. The exact quantity and composition of construction waste generated throughout the projects are difficult to be identified as they are keep on changing due to the dynamic nature of the construction activities. Different stages of construction generates different types and composition of waste. Therefore the trend of waste generated throughout the construction stages need to be identified.

In this study we find the wastage of material and its reuse in construction.

Dated this 6th day of April, 2013

Signature:-

Name:- VARUN M. PATEL, PRIYANK B. PATEL, MEET P. PATEL, SARVANG S. SALVI

FORM-3

THE PATENTS ACT, 1970

(39 of 1970)

&

THE PATENTS RULES, 2003

STATEMENT AND UNDERTAKING UNDER SECTION 8

(See Section 8, rule 12)

We, **1) VARUN MANILAL PATEL** an Indian National residing 31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA– 384265 and **2) PRIYANK BIPINBHAI PATEL** an Indian National residing at 13, AYODHYAPURI SOCIETY, NEAR CHHINDIYA GATE, PATAN, GUJARAT, INDIA– 384265 and **3) MEET PARSOTTAMDAS PATEL** an Indian National residing at 1, SHAKTI NAGAR, NEAR GUNGDI ROAD, PATAN, GUJARAT, INDIA– 384265and **4) SARVANG SUNILBHAI SALVI** At TRISHERIYU, SALVIWADO, PATAN, GUJARAT, INDIA– 384265 hereby declare:

(i) that We have not made any of this application for the same/substantially the same invention outside India. **NIL** "OR"

(ii) that we who have made this application No. _____dated_____alone/jointly with_____, made for the same/substantially same invention application(s) for patent in the other countries, the particulars of which are given below :

Name of the Country	Date of Appln.	Application. No.	Status of Appln.	Date of Publication	Date of grant
NIL					

(iii) that the rights in the application(s) has/have been assigned to **NIL**

that We undertake that upto the date of acceptance of the complete specification by the Controller, We would keep him informed in writing the details regarding corresponding applications for patents filed outside India within three months from the date of filing of such application.

Dated this 3rd day of April, 2013

Signature: _____

VARUN M.PATEL, PRIYANK B. PATEL, MEET P. PATEL, SARVANG S. SALVI

To

The Controller of Patents

The Patent Office at Mumbai

FORM 5

THE PATENTS ACT, 1970
(39 of 1970)
&
The Patents Rules, 2003
DECLARATION AS TO INVENTORSHIP
[See section 10(6) and rule 13(6)]

1. We VARUN MANILAL PATEL, PRIYANK BIPINBHAI PATEL, MEET P. PATEL AND SARVANG S. SALVI

hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of my / our application numbered _____ dated _____ is/are

2. INVENTOR(S)

Name	Nationality	Address
VARUN MANILAL PATEL	INDIAN	31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA – 384265
PRIYANK BIPINBHAI PATEL	INDIAN	13, AYODHYAPURI SOCIETY, NEAR CHHINDIYA GATE, PATAN, GUJARAT, INDIA - 384265
MEET PARSOTTAMDAS PATEL	INDIAN	1, SHAKTI NAGAR, NEAR GUNGDI ROAD, PATAN, GUJARAT, INDIA – 384265
SARVANG SUNILBHAI SALVI	INDIAN	TRISHERIYU, SALVIWADO, PATAN, GUJARAT, INDIA - 384265

Dated this 6th day of April, 2013.

Signature:

Name of the signatory: - VARUN M. PATEL, PRIYANK B. PATEL, MEET P. PATEL, SARVANG S. SALVI

3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY: -

in India is by way of assignment from the true and first inventor(s).

Dated this 6th day of April, 2013.

Signature: -

Name of the signatory:- VARUN M. PATEL, PRIYANK B. PATEL, MEET P. PATEL, SARVANG S. SALVI

4. STATEMENT

(to be signed by the additional inventor(s) not mentioned in the application form)

I/We assent to the invention referred to in the above declaration, being included in the complete specification filed in pursuance of the stated application.

Dated this ……..day of ……..20…….

Signature of the additional inventor(s): -

Name: -

To, The Controller of Patents

The Patent Office, at Mumbai

Note:-

***Repeat boxes in case of more than one entry.**

***To be signed by the applicant(s) or by authorized registered patent agent otherwise mentioned.**

***Name of the inventor and applicant should be given in full, family name in the beginning.**

***Complete address of the inventor should be given stating the postal index no./code, state and country.**

***Strike out the column(s) which is/are not applicable.**

GTU Innovation Council

Patent Drafting Exercise (PDE)

GIC Patent Drafting Exercise Project Team: 4895

FORM 1 **THE PATENTS ACT 1970** **(39 OF 1970)** **&** **THE PATENTS RULES, 2003** **APPLICATION FOR GRANT OF PATENT**	**(FOR OFFICE USE ONLY)** **Application No:** 12037 **Filing Date:** **Amount of Fee paid:** **CBR No:**

1. APPLICANT(S)

ID	Name	Nationality		Mobile No.	Email Address
1	Varun Patel	Indian		9724810510	varunpatel9037@gmail.com
2	Meet Patel	Indian		8866512893	meet.patel.3001@gmail.com
3	Priyank Patel	Indian		9428384022	priyank.3842@gmail.com
4	Sarvang Salvi	Indian		9033695327	sarvangsalvi@gmail.com

2. INVENTOR(S)

ID	Name	Nationality		Mobile No.	Email Address
1	varun patel	Indian		9724810510	varunpatel9037@gmail.com
2	Meet Patel	Indian		8866512893	meet.patel.3001@gmail.com
3	Priyank Patel	Indian		9428384022	priyank.3842@gmail.com
4	Sarvang Salvi	Indian		9033695327	sarvangsalvi@gmail.com

3. TITLE OF INVENTION / PROJECT

Construction Waste Management

4. ADDRESS FOR CORRESPONDENCE OF APPLICANT/AUTHORIZED PATENT AGENT IN INDIA

Name: Varun Patel
Address: 31, MAHAVIRNAGAR SOCIETY, B/H ADARSH VIDHYALAY, PATAN, GUJARAT, INDIA – 384265.
Mobile: 9724810510
Email ID: varunpatel9037@gmail.com

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5. PRIORITY PARTICULARS OF THE APPLICATION(S) FIELD IN CONVENTION COUNTRY

Country	Application No.	Filing Date	Name of the Applicant	Title of the Invention
N/A	*N/A*	*N/A*	*N/A*	*N/A*

6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICATION

International application number	International filing date as alloted by the receiving office
N/A	*N/A*

7. PARTICULARS FOR FILING DIVISIONAL APPLICATION

Original(First) Application Number	Date of filing of Original (first) application
N/A	*N/A*

8. PARTICULARS FOR FILING PATENT OF ADDITION

Main Application / Patent Number	Date of filing of main application
N/A	*N/A*

9. DECLARATIONS:

(i) Declaration by the inventor(s)

I/We, the above named inventor(s) is/are true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

Date: 03-May-2014

Name	Sign & Date
1 varun patel	_____
2 Meet Patel	_____
3 Priyank Patel	_____
4 Sarvang Salvi	_____

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant (s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

Not Applicable

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(iii) Declaration by the applicant(s)

I/We, the applicant(s) hereby declare(s) that:-

- ☑ I am/We are in possession of the above mentioned invention.
- ☑ The provisional specification relating to the invention is filed with this application.
- ☒ The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.
- ☑ There is no lawful ground of objection to the grant of the patent to me/us.
- ☑ I am/we are the assignee or the legal representative of true & first inventors.
- ☒ The application or each of the application,particulars of each are given in the para 5 was the first application in the convention country/countries in respect of my/our invention.
- ☒ I/we claim the priority from the above mentioned applications(s) filed in the convention country/countries & state that no application for protection in respect of invention had been made in a convention country before that date by me/us or by any person from which I/we derived the title.
- ☒ My/Our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in para 6.
- ☒ The application is divided out of my/our application(s) particulars of which are given in para 7 and pray that this application may be treated as deemed to have been filed on _____under section 16 of the Act.
- ☒ The said invention is an improvement in or modification of the invention particulars of which are given in para 8.

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10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

- [✓] (a) Provisional specification/Complete specification
- [✘] (b) Complete specification(In confirmation with the international application) / as amended before the international.Preliminary Examination Authority(IPEA),as applicable(2 copies),No.of pages.....No.of claims.....
- [✓] (c) Drawings(In confirmation with the international application)/as amended before the international Preliminary Examination Authority(IPEA),as applicable(2 copies),No.of sheets.....
- [✘] (d) Priority documents
- [✘] (e) Translations of priority documents/specification/international search reports
- [✓] (f) Statement and undertaking on Form 3
- [✘] (g) Power of Authority
- [✘] (h) Declaration of inventorship on Form 5
- [✘] (i) Sequence listing in electronic Form

(j) .....

Fees Rs.XXX in Cash/Cheque/Bank Draft bearing No.XXX Date: XXX on XXX Bank.

I/We hereby declare that to the best of my /our knowledge, information and belief the fact and mtters stated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this ..... day of ..... 20.....

	Name	**Sign & Date**
1	Varun Patel	_____
2	Meet Patel	_____
3	Priyank Patel	_____
4	Sarvang Salvi	_____

To
The Controller of Patent
The Patent Office, at Mumbai.

NOTE: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

FORM 2
THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003
PROVISIONAL SPECIFICATION

1. TITLE OF INVENTION / PROJECT

Construction Waste Management

2. APPLICANT(S)

Varun Patel (Indian)

Meet Patel (Indian)

Priyank Patel (Indian)

Sarvang Salvi (Indian)

3. PREAMBLE TO THE DESCRIPTION

The following specification describes the invention.

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4. DESCRIPTION

a. Field of Application / Project / Invention

This invention is related to construction and also keep down its waste and reuse of

b. Prior Art / Background of the Invention / References

Construction waste has caused serious environmental problems in many large cities. Enormous amounts of infrastructure and building work have be built, so numbers of demolished structures are also increasing in construction work .As increasing demands of dumping areas for never-ended construction waste are thrown away, there is a shortage of landfills. Therefore, reducing waste generation becomes a pressing issue around the world.The materials of construction waste are generally heterogeneity which yield the largest portion of waste from building and other relevant activities.

c. Summary of the Invention/Project

This thesis discusses the various waste material management methods/techniques for effective waste material management for minimization of project cost and better material management through a case study of construction. Construction waste is generated throughout the construction process such as during site clearance, material use, material damage, material non-use, excess procurement and human error. The exact quantity and composition of construction waste generated throughout the projects are difficult to be identified as they are keep on changing due to the dynamic nature of the construction activities. Different stages of construction generates different types and composition of waste. Therefore the trend of waste generated throughout the construction stages need to be identified.
In this study we find the wastage of material and its reuse in construction.

d. Objects of the Invention/Project

1. Construction waste management are reduce the generation of construction waste.
2. Maximize reduce and recycling.
3. To reduce the intake of mixed construction waste at landfills.
Reduce the construction cost of site.
4. Cut down the cost and effort of transport and production.
5. Use the waste which would otherwise be lost to landfill site.

e. Drawing(s)

f. Description of the Invention

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The importance of material management lies in the fact that any significant contribution made by the material manager in reducing materials cost will go a long way in improving the profitability and the rate of return on investment. Material management deals with managing of materials along with costs. Construction materials and components contribute around 50-60% of the total value of construction. It is estimated that about 10% of all materials delivered to the site either end up as waste or illegally removed during the construction phase. Furthermore, it has been noticed that large quantities of building materials are allowed to be buried or burnt each year due to inadequate controls on project sites. In Planning, estimating the type of material, their actual quantities, and the time at which it is required. To develop new sources of supply for purchases to remain competitive in the market. Development of ancillary units. Cost control of materials using various cost reductions methods. To develop coordination between various departments. Arranging transportation in the most economical way for the incoming and outgoing materials. Providing proper storage and distribution systems so as to reduce wastage, pilferage, deterioration, etc. Disposal of excess stocks, surplus, scrap items and also salvage of materials.

g. Examples

h. Unique Features of the Project

1. There should be a centralized material management team co-ordination between the site and the organization.
2. Proper control, tracking and monitoring of the system required.
3. Awareness and accountability should be created within the organization.
4. Firms employing proper material management system are seen to have increased their overall efficiency by 35%. Planning of construction material should be done on long term basis as emergency buying may prove to be costly.

5. DATE & SIGNATURE

Date: 03-May-2014

	Name	Sign & Date
1	Varun Patel	_____
2	Meet Patel	_____
3	Priyank Patel	_____
4	Sarvang Salvi	_____

NOTE: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

6. ABSTRACT OF THE INVENTION

Waste management is a fundamental component to any manufacturing or production enterprise. It is estimated that there are million tons of quarrying waste are produced in each year. The excessive wastage of materials, improper management on site and low awareness of the need for waste reduction are common in the local construction sites in India. With the urge for development and to satisfy the needs and wants, working and growth of Construction Industry is unavoidable
. Over the last two decades material management ,the world over has
gained recognition as a science to be studied extensively and applied systematically to ensure efficiency and viability of any industry.

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