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RESOURCE OPTIMIZATION STRATEGY: C & D WASTE MANAGEMENT

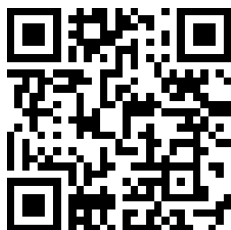
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Abstract: Population and urbanisation are unstoppable, which creates acute stress on present environmental conditions leading to sever problems of pollution. This pollution is contribution of an individual as well as industry. One such industry is construction industry. Civil engineering not only deals with construction of various structures but also works for their maintenance. Present era demands efficient and sustainable methods for any job. In this paper, the sources of construction and demolition waste are described especially at various phases of construction. Paper put forth the strategy to mitigate C&D waste, which are not only simple and basic but also applicable to India. Guidelines for handling the waste are proposed which will hold true and are practicable in nature. Paper proposes concept of 5 R for quality waste management which will surely meet the purpose of material management in various prospective. Measures suggested are strong enough and are focusing on planning strategy before and after actual work execution stamping an overall positive impact. Special yet simple approach is also briefed the best way possible guiding the stakeholders to mitigate and handle the waste management. This will certainly help to enhance the performance of various civil engineering projects where similar kind of need arises boosting the construction industry in India and uplifting the nation's economy.

Keywords: Structures, Sustainable, C & D, Material, Prospective, Planning



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INTRODUCTION

India is world's second largest growing economy and likely to become first in near future. Interestingly construction industry is also second largest industry after agriculture in Indian economy; this clarifies the quantum of construction and related works in regards of construction materials and enormous resources engaged in the job. Learning the statistical data regarding GDP of India share of construction in GDP on an average be up to 10 % according to the 12th Five Year plan [1]. At present India is planning to achieve the ambitious project of 100 smart cities that will surely incorporate huge amount of construction, which assures us that the construction and its role in nation's economy will continue to be unavoidable. Though this sector has so much of potential, management is not up to mark especially when it comes to resource management. India lacks in construction and waste management with respect to western nation.

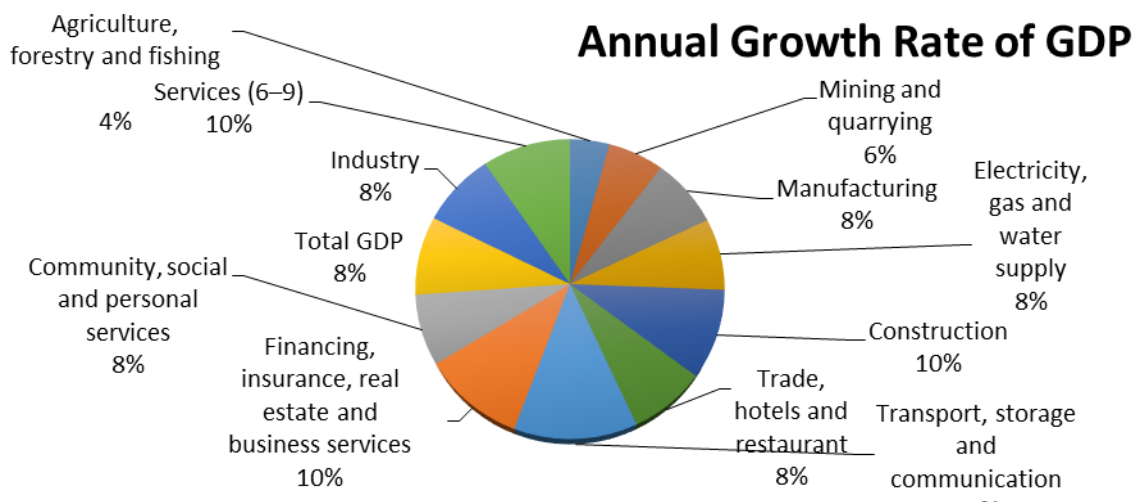


Fig.1: Annual Growth Rate of GDP

In India, there is lack of awareness regarding C&D waste management still today the waste is disposed of in the landfill. When compared with other nations one can settle down to the conclusion that in India the resources used in construction are not used to the fullest way possible which is highly done in other nation by the means of reduce , reuse and recycle. Natural resources are not only limited but also cost contribute high in construction cost making C&D waste management a matter to work on.

Table.1: Waste Generated In Million Tons Per Annum

Sr.no	Constituent	Quantity generated in million tons p.a
1.	Soil, sand and gravel	4.20-5.14
2.	Bricks and masonry	3.60-4.40
3.	Concrete	2.40-3.67
4.	Metals	0.60-0.73
5.	Bitumen	0.25-0.30
6.	Wood	0.25-0.30
7.	Others	0.10-0.15

Observing the data it assures that waste generated is very huge and the matter is needs systematic approach [2]. If seen globally humankind is running short of natural resource and on this platform, India should not waste in this fashion as all the constituents are natural and require thousands of year to formulate. Studying the data it clarifies the quantum and makes it mandatory to lower the wastage or at least reuse it further. The huge quantity of waste is not only waste of natural resources but also makes the disposal a matter to worry.

CHARACTERISTICS OF C&D WASTE

Construction and demolition waste can be defined as the waste generated at various stages of life of any structure where the waste is generally inert in nature. The waste generation starts from the excavation on the site, actual construction and ends finally on demolition. Main reasons responsible for waste generation can be summarised as follows

1 Waste Generated At Purchasing Of Materials

Material manager contractor and sub contractor are those who handle material purchasing. At this step, material purchased is to maintain inventory but it generally marks the starting of waste because each material bought has specific life, quality, and use. Keeping this in view the process of material calculation and work estimate should be flawless with this store keeper is expected to maintain the stock and record with care as soon as the material comes in his care which will lower this losses and wastes.

2 Waste Generated By Design and Specification

This waste is generally seen on site in order to meet the proper look of the room or any component of the structure

- i. Brickwork cutting of bricks and blocks to match up the dimensions
- ii. Flooring cuttings of floor tiles to fit carpet are
- iii. Ceiling cutting of tiles and fixing to fit room layout
- iv. Insulation cutting of insulating board to fit specific openings
- v. Paving cutting of pavers and paving tiles to fit the required layout

3 Waste Generated By Construction Activity

This type of waste can be termed as accidental in nature and are dynamic. Main reasons are as below

- i. Waste due to rework due to poor work
- ii. Surplus ordering
- iii. Waste due to error in material handling
- iv. Waste due to low quality of workers
- v. Inefficient coordination among the traders
- vi. Due to temporary works
- vii. Inefficient use of materials.

MANAGEMENT STRATEGY TO MITIGATE CONSTRUCTION WASTE

India generally focuses on reuse and recycles but to overcome this issue reduce should be the matter to focus as low waste will not only reduce material use but also reduce the money incurred in the later processes i.e. reuse and recycle. Generally, it is 10% of total material used, which is huge amount and cannot be omitted from consideration. Actually the real cost of waste material is not just the cost paid to subcontractor to remove the waste from the respective site but is as shown below.



Fig.2: Actual Cost of Waste Material

The basic step in reducing the waste and efficient management is to overcome the source of problem i.e. to low down the waste generation itself. Construction waste generation marks its generation as soon as the construction process heads to completion. It goes hand in hand with each phase of construction and the most vulnerable issue is that it cannot be detected at the tender stage, tis makes the need of that strategy which is sound and holds strong in overall. Simple yet best method is of 5 R i.e.

- I. Reduce
- II. Reuse
- III. Recycle
- IV. Recover
- V. Residue disposal

I Reduce:

For reducing the waste generation, it is the duty of Architects to design which will use less. In India, there is lack of awareness regarding C&D waste so the public, stakeholders should be made acquainted with the environmental ill effects caused by the waste so generated. While planning stage following consideration should be done:

- i. Is the design sustainable?
- ii. Does the design generates less waste
- iii. Is the design material oriented?
- iv. Does the design uses recycled material

- v. Does the construction process reduce the waste?
- vi. Does the product expected to use is easily recyclable
- vii. Does the material use is locally available

II Reuse:

Reuse is preferable over recycle because reuse is much simpler than recycle. Reuse implies use of respective material without processing i.e. with in its basic form. Many material can be reused especially the costly wooden doors, windows, fixtures can be easily reused further. In the same fashion high length timber, flooring products, paints, insulation pipes can be reused. Reuse of materials not only leads to complete use of purchased materials but also lowers the overall costing making the project cost effective. The basic approach is to keep supervision that has an approach to use the materials and store the leftover material properly for future use like the excavation done for footings can be used for refilling.

III Recycle:

Recycling is the diversion of material from waste to product that is economically and ecologically beneficial. Recycling is the process involving collection of waste material and processing it to get the desired product. However, the main problem is that it may lead to environmental hazards. Most of the residential construction material can be reused like cardboards, fitting materials, metals, paints, carpets, untreated timber. Practices that can be done using reuse and recycle jointly are stated below:

- i. Using excavated material for land filling
- ii. Using excavated rocks for street decoration
- iii. Green waste may be used for compost
- iv. Untreated timber can be used as mulch, biofuel, or pallets
- v. Waste concrete can be used as base fillers in road construction
- vi. Steel waste can be shipped to steel mills
- vii. Cardboards out of order may be shipped to paper mills.

IV Recovery:

Recovery is a wider phenomenon, which focuses on reuse waste material as fuel source. The purpose here is to end up the waste by using it finally as a fuel mostly done by incineration and so on. When the life of material is finished, it is exploited to generate energy in any way possible that would be used further.

V Residue Disposal:

In India disposal is directly done when waste is generated thus skipping all the other practices, which can be done. Generally, municipal solid waste contains up to 50% of the construction waste, even if this waste is mostly inert in nature but the quantum is very high becoming an issue of concern. For management of C&D waste disposal should be the final step to undertake as it has no return. Nevertheless, residue disposal should be done in the low-lying areas like mining zones that are abundantly found in India, but chemical test done will surely turn helpful. Though disposal sounds easy but it is not so, proper segregation of waste should be done and then it should be disposed respecting the dumping environment. Proper planning is expected here because transportation, material handling, sorting also incurs considerable amount of money.



Fig.3: Sequence of Activities

LIFE CYCLE OF WASTE MANAGEMENT:

As known earlier waste generation is continuous process and the cycle continues in the same way process of mitigating waste so generated can also be categorised in the below given way. Site engineer and the respective stakeholders should be keen to follow the process because skilful implementation will not only mitigate the wastage of valuable resources but also uplift the overall budget of the firm. Adaptation of such practises assures life long benefits and creates a sense of awareness regarding various related jobs.

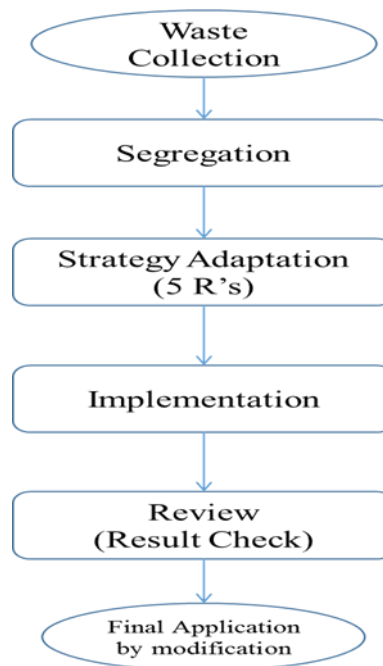


Fig.4: Life Cycle of Waste Management

SPECIAL APPROACH FOR C&D WASTE MANAGEMENT

In order to implement the knowledge to harness the most of the investment requires sound management. Dealing with C&D waste management requires high accuracy with no space for mistake in any way. Management in any project concludes with the management of 4 M's i.e. Man; Material; Money; and Machine. This management comprises of following managerial task.

- i. Design details should be handy.
- ii. Material requirement must be calculated beforehand.
- iii. Work sequence should be fair and known.

- iv. The team appointed should collect, store and segregate the waste generated on site.
- v. Client should plan for incentives for the least waste generated.
- vi. Heavy fines can be imposed when waste generation is seen.

CONCLUSION:

- i. Indian economy has potential to have rise in construction and thus the subsidiary waste from it making necessary to have special approach towards C&D waste. Awareness is to be made among the society for which government should provide necessary statistics in regards of waste generation.
- ii. Government should lay down some basic rules, bylaws to guide the local bodies to manage the waste generated. Steps should be taken e.g. heavy fines can be imposed who generate excessive waste on site or incentives in form of tax alteration or the firms can be ranked on the platform of waste generation.
- iii. All the stakeholders should work hand in hand with motive to design project that will generate minimum waste at each stage of project. Approach for the designers should be in favour of reducing waste generation. Planning should be emphasizing on those design, which will be sustainable.

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