

## A Sustainable Approach of Demolition, Reconstruction, Reuses and Recycling Construction Materials in Bangladesh

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**Abstract:** Demolition, Reconstruction, Reuses and Recycling (DRRR) construction materials process has become a popular research area in the worldwide. Construction activities are increasing with time and lack of awareness we could not utilize demolished materials in appropriate way. Environmental impact can be minimised by making use of demolished materials in a sustainable manner. There have starting late many reviews and interests in made and making countries about possible approach of beating and reusing existing materials from those progress works out. Finally, reused mean from security strong, dim tops, pieces are more saving than from the change and obliteration junk. The paper provides some sustainable approach of the method of demolition, reconstruction, recycling and reuses construction materials and some strategies of design for adaptability, disassembly and reuse. Fashioners, change get-together can have movement and obliteration materials from exchanges by sharpening source diminishment, securing, changing and reusing. Finally, it can be concluded that the DRRR construction materials can be used in the manufacturing of buildings subfloors, panels, blocks, refractory bricks and for concrete strength applications.

**Keywords:** *Demolition; Reconstruction material; Reuses; Recycling; Sustainability*

**Introduction:** The use of demolished construction materials through recycling and reuses process for reconstruction has not gained popularity in the construction industry [1]. Foreign countries are developing day by day because they are conscious about demolition, reconstruction materials, reuse and recycling of construction activities. For example, two billion tons of aggregate are produced in each year in the United States [2]. Production is expected to increase to more than 2.5 billion tons per year by the year 2020 [3]. On the other hand, Bangladeshi people are not concern in this field. As a result, they are missing a lot of potentiality in economic sector. Besides, course of action for a couple catalysts to customers of the reused things respects to be essential to propel the usage [4]. For that reason, the benefit of construction and demolition (C & D) is the main study of this paper. Reusing is the procedure is the way toward changing over waste materials into new materials and protest [5].

There are various kinds of construction waste materials which are the result of demolition. The demolished waste materials mainly indicate brick, concrete, tiles, plastic, aluminum, timber,

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steel, glass, plastic etc [2]. Concrete is the primary composition of cement, coarse aggregates, fine aggregates and water [15]. So we get coarse aggregates from recycling concrete aggregates which are obtained from demolition waste [3]. Bricks are important building materials which considered as waste when broken [4]. Reusing bricks can be used for partition walls, for lands capping or any other artistic creation [18]. Recycling bricks can be used as coarse aggregate [10]. A tile is a produced bit of hard-wearing material, for example, earthenware, stone, metal, or even glass, by and large utilized for covering rooftops, floors, dividers, showers, or different protests, for example, tabletops [16]. Broken tiles can be used as aggregate after crushing and also for artistic activities [5, 17]. The waste timber used as animal bedding which are reuses able and also used to make sustainable power source which are not reuseable [2]. Steel and aluminum are the premier construction materials across the world and the most widely used in all types of civil engineering works. Steel squander happens amid the development and repair of structures and when they are eventually wrecked and the material ends up noticeably accessible for reusing [9].

Although number of researches have been conducted on the *DRRR* in the worldwide; however there are no specific guideline and work on the *DRRR* in context of Bangladesh. Following those potentialities in this field of *DRRR*, this paper describes the simple procedure and precautions of demolition, clarify the recycling and reusing potentiality of various constructions and demolished materials and an overview of *DRRR* methods. The main objective is to encourage the people of Bangladesh to use these ‘seemingly’ *DRRR* materials for the construction industry for producing structural concrete.

**Methodology:** The approach of demolition, reconstruction, recycling and reuses construction materials is not rich in our country. To fulfill the objectives of this work, the following steps should be performed:

**Data Collection & Analysis:** Both primary and secondary data were collected in doing this research. Primary data, such as the opinion from contractors, waste collectors, recyclable waste dealers and construction workers through in depth interview. Secondary data, such as statistics data and reports from past study reports, books, journals and newspaper. The important data were noted from observations and interviews.

**Procedure and Precautions:** In BNBC-1993, the technique, precautionary measures and wellbeing arrangements in obliteration and destroying of a wide range of structures and structures are portrayed in short.

Point by point overview and investigation of the structures to be decimated and its environment must be done.

- I. Anticipating decimation and security of abutting structures: Neighbors and Public should be well ahead advised through daily paper or other media

- II. Insurance of Adjoining Properties: Written Notice should be served to the potential influenced assembling/structures
- III. Precautionary measures Prior to Demolition: Protection of open, walkway shed and overhangs
- IV. General precautionary measures amid annihilation: security against all harms or death toll and property, steady supervision, sufficient lighting and ventilation at site
- V. Arrangement of devastation operation: the operation might continue in plummeting request i.e. story by story, or rooftop trusses/steel structures, divider, floor, segments and so forth
- VI. No materials might be dropped or tossed on the ground or outside the outside dividers
- VII. Every one of the works ought to be done on endorsement and under the supervision of 'Building Official' or by an architect having knowledge in decimation of comparable size.

It can demolish building materials through conventional techniques and deliberate controlled collapse. Demolition by conventional techniques includes [14]:

- i. Hand demolition
- ii. Demolition by collapse
- iii. Demolition by pusher arm

Below the figure 2(a) indicates the method of hand demolition and figure 2(b) indicates the method of demolition by collapse. \* Figures are collected from online.



**Fig. 2(a):** Hand demolation



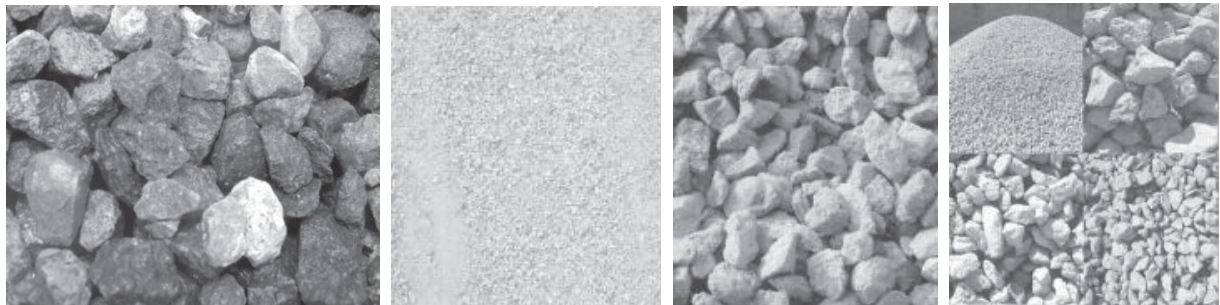
**Fig. 2(b):** Demolition by collapse

**Results and Discussion:** After the demolition of building, we got a lot of building waste materials. Among themselves concrete, brick, timber, steel, tiles are most valuable. We got coarse aggregates from concrete which are used as light weight concrete or road base [6]. We

also got smaller size aggregates or brick chips (coarse aggregates) which are used for partition wall or pavement [1]. We got new particleboard, animal bedding from reuses timber and got energy from which are not reuses. A partial replacement of gravel and artistic activities are done by tiles which are from demolished building. We found steel furniture from reuses steel. Below the table 3.1[output and application of DRRR] which indicate the benefit of demolition, recycling, reuses and reconstruction materials in construction industry. Here the figure 3(a) which indicates the recycling aggregates from concrete after crushing.\*Table 1 and 2 have prepared according to the opinion from contractors, waste collectors, recyclable waste dealers and construction workers through in depth interview.

**Table 1.** Output and application of DRRR

Material	Output	Application
Concrete	Aggregates	Light weight concrete, road base
Brick	Smaller size aggregates or brick chips	Pavement, partition wall
Timber	Reuse or Recycling	New particleboard, animal bedding
Steel	Reuse or Recycling	Steel furniture
Tiles	Reuse or Recycling	A partial replacement of gravel



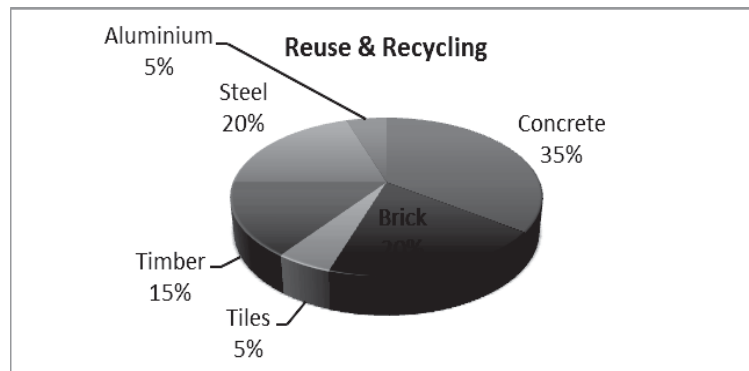
**Fig. 3(a):** Recycled aggregates

We have discussed with contractors about the percentage of reuse and recycling materials from construction activities. Then we got some statistical data from them and it was oral. Below the table 2 [materials VS Reuse & Recycling] and figure 3(b) which indicate the statistical and graphical representation of percentage of reuse and recycling materials.

**Table 2.** Reuse & recycling materials

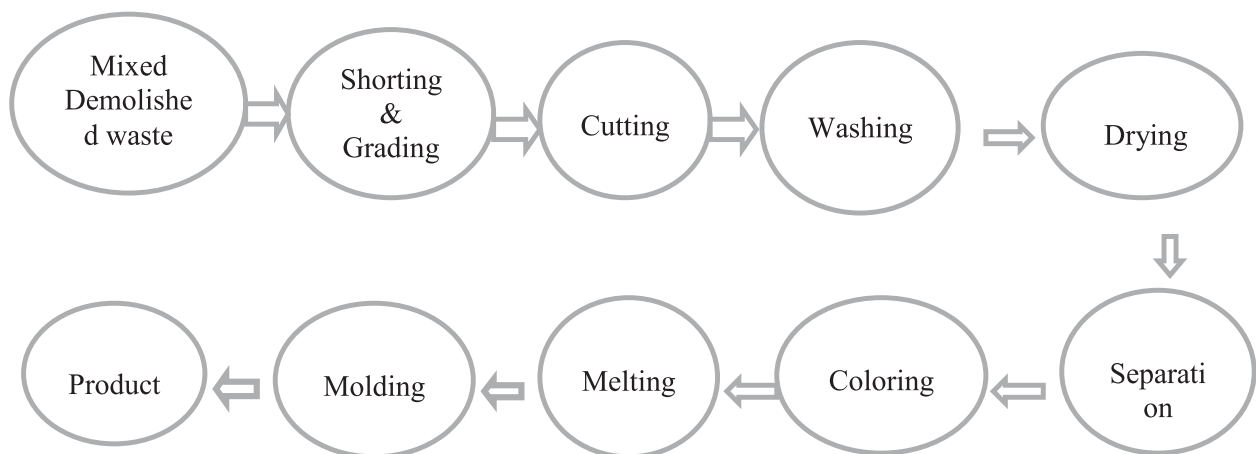
Materials	Reuse & Recycling
Concrete	35
Brick	20
Tiles	5
Timber	15
Steel	20
Aluminum	5
Total	100





**Fig. 3(b):** Reuse & recycling materials

Those materials are not reuse able; they are used to recycle for new products. Here figure 3(c) source: Moniruzzaman et. al. [11] indicates the typical flow diagram of construction waste recycling industry. The demolition wastes collected from the construction site and residential area. After collecting those materials workers shorten and grading those mixed materials. Then they cut the materials in suitable size. After cutting, workers washed and dried them in proper way. Then separated them according to size and colored them. Then those materials were put on the machine for melting. After melting workers got mold from them to prepare products. Here is the flow diagram which indicates how useless materials turn into useful products.



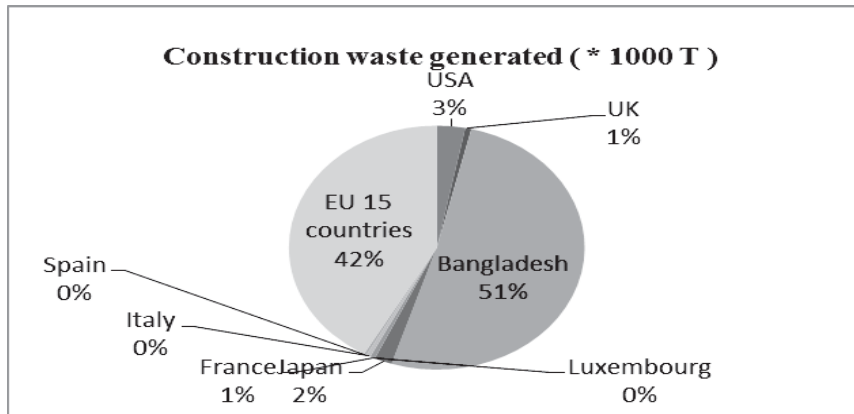
**Fig. 3(c):** Typical flow diagram of construction waste recycling industry

From the Table 3 we have known that  $13.5 \times 10^6$ T construction wastes generated from United State of America per year. On the other hand about  $224 \times 10^6$ T construction waste generated from Bangladesh. So, the statistics show that about 16.59 time more waste generated from Bangladesh than USA. In the Table 3 and the figure 3(d) source: Bansal and Singh [5] indicate the global scenario of handling construction and demolition waste. Here we can know that there is a huge

potential to reuse and recycle of construction and demolition waste from the construction activities. But lacking of knowledge and interest it cannot use them properly. As a result we are missing a lot of economic potential.

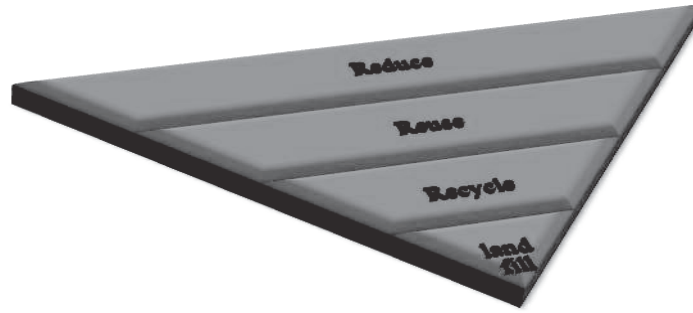
**Table 3.** Global scenario of handling C & D waste

Country	Construction waste generated ( * 1000 T )
USA	13500
UK	3000
Bangladesh	224000
Japan	8500
Luxembourg	0
France	2400
Italy	2000
Spain	1300
EU 15 countries	183000



**Fig. 3(d):** Global scenario of handling C & D waste

The idea of 3R which alludes to reduce, reuse and also recycling especially with regards to creation and utilization is notable today. It is something like utilizing recyclable materials is more than real practice, reusing of crude materials if conceivable and decreasing utilization of assets and vitality [6]. These can be connected to the whole life cycles of items and administrations – beginning from outline and extraction of crude materials to transports, produce, utilize, destroying and transfer can be communicated as figure 3(e) which indicates the sustainable waste management hierarchy [18]. \*This figure has prepared according to the opinion from contractors, waste collectors, recyclable waste dealers and construction workers through in depth interview.



**Fig. 3(e): Sustainable Waste Management Hierarchy**

**Conclusions:** The paper has been discussed procedure and precautions for demolition of a building according to BNBC -1993. Demolition is a scientific, albeit risky operation. So the construction workers should follow the procedure, precautions and safety provisions in demolition and dismantling of all types of buildings and structures. So it needs talented labor and compelling association, requires exceptional strategies and satisfactory enactment, and comprehensive distributions. It is along these lines basic to outline a code of practice for obliteration covering method, readiness, system, and enactment on security and significant issues. Bangladesh is a huge waste generated country. So, it has a huge potential to reuse, recycle for reconstruction. In Bangladesh, all the debris and demolition squanders (brick, steel, etc.) have for long been utilized as a part of development works and foundation advancement, for example, auxiliary/tertiary street developments and so on. In any case, at present there is no specialist to investigate the matter, nor any commitments for checking the quality and nature of those materials before their reuse. If the result is satisfactory after test the consistency, permeability, strength, financial analysis of reuses and recycling materials by specialists, people should follow this approach in their construction activities.

**Future directions:**

- To inspect construction and quality program management.
- To identify the sustainable process of construction equipment management.
- Financial analysis of recycled waste concrete should be done.
- To investigate the applicability of recycled waste concrete.
- To observe the permeability of waste concrete.
- To measure the strength property of concrete manufactured with recycled concrete aggregate

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