ISSN 2347-4289

# Analysis Of Life Cycle Environmental Impact For Residential Building In Bangladesh.

**Md. Shahrior Alam, Dr. Syed Ishtiaq Ahmad.**

M.Sc Engg student (Civil and Structure), BUET, Graduated from Military Institute Of Science & Technology (MIST)
Professor, Department of Civil Engineering, Bangladesh University Of Engineering And Technology (BUET)
E-mail: shahrioralam@yahoo.com, siahmed@ce.buet.ac.bd

**ABSTRACT:** This paper will show the environmental impact of a building from its construction phase to the end of its life i.e. demolition. Here mainly the emission of $CO_2$ is taken into consideration. As the global warming is most serious issue for environment, we are very much concern about the emission of $CO_2$ from different industries. However, emission from a building for its entire life cycle is seldom taken seriously. Since, there huge number of building in modem city like Dhaka, if possible any reduction in $CO_2$ emission will make a great contribution to reduce overall $CO_2$ emission and compare use of brick chips and stone chips. This thesis categorically estimates the $CO_2$ emission from various building plans for its entire life, which hopefully help us in guiding the reduction of $CO_2$ emission form a building. Two 6 storied residential building in Dhaka has been analyzed with stone and brick chips of same area of construction. The environmental impact for a 60 years life time has been calculated.

## 1. Introduction:

Carbon dioxide emission ($CO_2$) is important issue. The effect of all this extra carbon dioxide in the atmosphere is that the overall temperature of the planet is increasing (global warming).As a result, day-to-day level the climate is changing in unpredictable ways (from floods and hurricanes to heat waves and droughts). Global warming is the top most concern for environmental impact on our climate and geography of the world. $CO_2$ is responsible for increasing the temperature and a lot of research has done how we can reduce the effect of $CO_2$ on environment. Developing country like Bangladesh every year, every month, a huge number of concrete buildings is constructed produce 120 million MT concrete. We are concern but not understand about the impact of these buildings on environment. Because we have no data how much $CO_2$ is released from a building from its construction phase to the end of its life. In our country with a population of 160 million, is currently contributing 0.14 percent to the world's emission of carbon dioxide ($CO_2$).

## 2. Objective:

- Estimation of unit $CO_2$ emission for different types of building materials.
- Estimation of quantity of building materials required in 6 storey building, thereby calculating $CO_2$ emission and energy consumption.
- Estimation of $CO_2$ emisson construction, maintenance phase and operation phase.
- Estimation of energy consumption emission construction, maintenance phase and operation phase.
- Evaluate critical component of $CO_2$ emission for a building and suggest ways to reduce it.
- Comparison carbon emission and environmental impact between the buildings (stone chips & brick chips).
- Development of alternative source of energy to produce building material.

## 3. Methodology:

### 3.1 Data analysis:

Except sand and stone all the building materials are considered to be available locally. The analysis focused on Bangladeshi building materials. A life cycle analysis is only as valid as its data; therefore, it is crucial that data used for the completion of a life cycle analysis is accurate and current. When comparing different life cycle analyses with one another, it is crucial that equivalent data is available for both products and processes in question. If one product has a much higher availability of data, it cannot be justly compared to another product which has less detailed data. The validity of data should always be a concern with life cycle analyses. Since we are living in a global world and economy, new processes, manufacturing methods, and materials are introduced to various processes and products.

### 3.2 Data Selection and Validation:

The methodology followed four basic steps:

- Review of Bangladeshi industry.
- Review of available Bangladeshi data.
- Development of basic inventories from Bangladeshi data if sufficient, or from the best suited international inventories where Bangladeshi data was insufficient.
- Compare sustainability of data.

### 3.3 Review of Bangladeshi Industry:

The review of Bangladeshi industry includes a general description of the industry structure and the identification of:

- The major producer & their production rates.
- The types and grades of the product produced
- The process, feed stocks and energy sources used in Bangladesh.
- Quality of production Standard parameter.

### 3.4 Steps for collecting data:

**Step – 1: For Bricks:**
- Types of fuel used for burning (wood, gas, coal) ,amount of the fuel used for burning
- Amount of brick production, transport of raw materials to brick field, transport of brick to construction site

**Step – 2: For Cement:**
- Clinker domestic or imported from abroad
- Amount clinker required for production
- Amount gypsum required and cement production
- Working hour for production and electricity used for production

**Step – 3: For Sand:**
- Transportation cost to construction site
- Amount of fuel required for transportation and sieving.

**Step – 4: For Steel:**
- Electricity used for remolding
- Working hour for remolding

**Step – 5: For Glass:**
- Amount of silica required
- Amount of glass production
- Electricity used for production

**Step – 6: For Lime Coat:**
- Amount of calcium-hydroxide required for coating
- Amount of carbon dioxide required for coating.

**Step – 7: For stones:**
- Transportation cost to construction site
- Amount of fuel required for transportation and crushing stones.

There might be other factors (paint and water uses etc) to be considered but we consider the major factors of carbon emission and energy consumption.

## 4. Estimation of $CO_2$ Emission & Energy Consumption

### 4.1 Project description:

We have taken a project and calculated the total material required of 5400 Sft in Dhaka city try to specified the location and summarize all calculation that can be added into it.

**Table1:$CO_2$ Emission & Energy Consumption for 02 Residential Buildings at Dhaka, Bangladesh (construction phase only)**

| Sl. No. | Item Description | Project-1 | Project-2 | Standard Value Per Unit | | $CO_2$ Emission (Ton) | | Energy Consumption (GJ) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | CO2 Emission (Ton) | Energy Consumption (GJ) | Project-1 | Project-2 | Project-1 | Project-2 |
| | Construction Materials (construction phase) | | | | | | | | |
| | Cement(Bags) | 12440 | 7398 | 0.0194 | 0.0935 | 241.34 | 143.53 | 1163.2 | 691.71 |
| | Brick (Nos.) | - | 845222 | 0.00054 | 0.00575 | - | 456.8 | - | 4870.6 |
| | Stone (Cft) | 57258 | - | 0.00356 | 0.00483 | 203.8 | - | 2765.5 | - |
| | Sand (Cft) | 28580 | 18174 | 0.00138 | 0.02346 | 39.5 | 25 | 670.5 | 426.36 |
| | Rebar( Kg) | 133000 | 133000 | 0.0000624 | 0.001365 | 8.3 | 8.3 | 181.545 | 181.545 |
| | Glass (Kg) | 3500 | 3500 | 0.0013 | 0.0184 | 4.55 | 4.55 | 64.4 | 64.4 |
| | Lime(Ton) | 3 | 3 | 0.47 | 5.69 | 1.41 | 1.41 | 17.1 | 17.1 |
| | | | | | Total = | 498.9 | 639.59 | 4,862.25 | 6,251.72 |

# 6. Research findings:

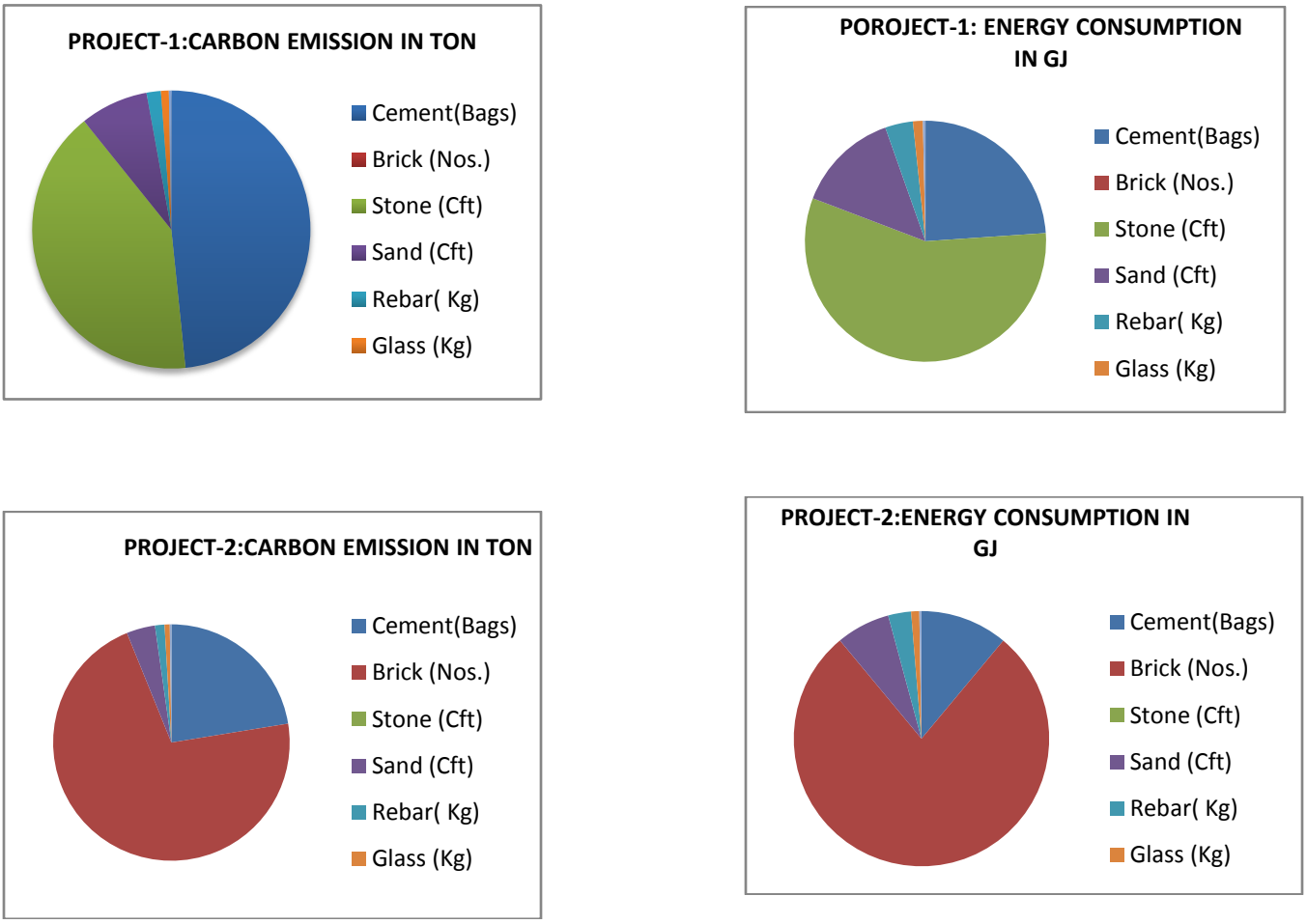


**Figure: Role of Construction Materials in $Co_2$ Emission and Energy Consumption**

The area of the project 1 and project 2 is same but the total $CO_2$ emission and total energy consumption is less in project 1 due to uses of stone instead of brick.
6 storey buildings has analyzed here. It shows:

**From project 1,** in construction phase stone produce 203.8 tons, cement produce 241.34 tons of $CO_2$. Total $CO_2$ emission per square feet in construction phase is **.0924tons/ft$^2$** and total energy consumption per square feet in construction phase is **0.90042GJ/ft$^2$**.

**From project 2**, in construction phase brick produce 455.8 tons, cement produce 143.53 tons of $CO_2$. Total $CO_2$ emission per square feet in construction phase is **0.118442tons/ft$^2$** and total energy consumption per square feet **1.1582GJ/ft$^2$**.

For using brick about 639.59 tons carbon-dioxide is emitted and energy consumption is about 6251.72 GJ from a six storied building in construction phase .On the hand for using stones instead of bricks we can reduces carbon-dioxide emission about **140.7Tons** (639.59-498.9) and reduction of energy consumption is about **1389.47GJ** (6251.72-4862.25) of same area of 5400sft . So using stone chips with the environmental point of view is beneficiary for the structures.

## 7. Conclusion:

We are so much concern about the impact of industry on environment. A huge number of concrete buildings are constructed in the world every year, every month. Impact of emission of carbon dioxide is threatened on environment. But we are not Concern. Because, we have no data how much $CO_2$ is released from a building from its construction phase to the end of its life. The use of 120 million MT concrete of which 10 million MT water and 20 million MT cement and 90 million MT aggregate is used in Bangladesh. The total aggregate used in the world is 9 billion tones. So it is important aspect in concrete production and its production and transportation will emit

carbon dioxide and consume fuel. So by using energy saving material, not sacrificing strength is important and locally available materials induce in concrete will help by the course. So, we can say brick and natural gas most of the $CO_2$ is produced and in construction phase brick production and in operation phase from electricity production most of energy is consumed .For reduction in $CO_2$ emission we have to work, to improve the brick production method and natural gas or used of stones instead of bricks. This analysis will encourage us to analysis more the environmental impact of building and will show the importance of reduction the emission of $CO_2$.

## 8. References:

[1]. JA Schell. 1996. The fate of the Earth. London: Chapman & Hall. 231p.

[2]. KT. Chung, SE Stevens and G Bultron. 1993. Degradation of azo dyes by environmental microorganism and helminthes. Environ. Toxicol. Chem., 12(2): 121-132.

[3]. R Wright, R Rosenfeld and BA Jacobs. 2003. Snitching and the code of the street. The British Journal of Criminology [online]. 43(2): 291-309. Available via: Ingenta. [Accessed 11 December 2011]

[4]. M Coyle. 1996. Attacking the cult-historicists. Renaissance Forum. [online]. Available at: http://www.hull.ac.uk/English/renforum/v1no1/coyle .htm [Accessed 18 November 2002].

[5]. C Chalaruk. 1988. Control of aquaculture wastes by bacterial decomposition. MSc thesis, Institute of Aquaculture, Stirling University. 91 pp.

[6]. D DEFOE. 1995. The fortunes and the misfortunes of the famous Moll Flanders. [Online]. Champaign, Illinois: Project Gutenberg. Available at: http://www.promo.net/cgipromo/pg/t9.cgi?entry=37 0&full [Accessed 18 November 2002].

[7]. Bangladesh Bureau of Statistics (BBS) (1991, 1996, 1999), “Statistical Year Book of Bangladesh.