CHAPTER 1

INTRODUCTION
In construction industry concrete is a material which is most widely used in the world. Concrete can also be called as man-made stone which is made after solidification of water, cement, aggregates (Badea, 2007) this solidification takes place, after mixing cement, water and aggregate and this chemical reaction is known as hydration.

Cement + Water + Aggregate = Concrete

1.1 Environmental Impact of Concrete

The main environmental concern in the production of cement and concrete is the energy consumption. The total production of cement in the world is 1.6 billion tons which produces 7% of the total carbon dioxide transferred to the atmosphere (Mehta P., 2001).

According to (NRMCA, 2012) during the process of manufacturing cement their are two processes during which CO$_2$ is produced

1) Use of fossil fuel in the process of burning.

2) Calcinations in which calcium oxide is produced during the heating process of calcium carbonate which releases CO$_2$.

90% of concrete is composed of water, sand and gravel by weight. Small amount of CO$_2$ is produced during mining process of gravel, crushing stone and transportation of concrete to the construction site. The major amount of CO$_2$ is due to the manufacturing of cement.

According to (Obla, 2009) 9 tons of CO$_2$ is emitted in the production of 1 ton of cement and about 10% of cement by weight is used in 1 cubic yard of concrete (weighs around 2 tons) for reducing this CO$_2$ emittance many studies have been made
for introducing supplementary cementations material such as Fly Ash, Rice husk ash and Bick dust.

1.2 Fly Ash (FA)

As we know that electricity is playing a major role in the development of the country. In India coal is mainly used for the production of electricity. In the production of electricity powdered coal is burnt which results in the production of fly ash.

According to (NTPC, 2007) In India 60 % of electricity is generated by burning coal as a fuel. Huge quantity of ash is generated from Indian coal as it has low calorific value of around 3000-3500 k and high ash content of around 30-35%. So as our present scenario power sector is growing and due to this at the end of year 2012 ash generation will reach 175 million tonne per annum, which will become a huge problem to dump it.

Previous studies shows that Fly ash can be utilize in concrete which was first investigated (Raymond E. Davis, 1937) and published a paper telling that fly ash shows excellent pozolanic properties. For ordinary construction 30% fly ash and for heavy construction 50% of fly ash can be replaced by cement. (Berry, 1986) told about the research which took place between 1976 to 1984 in the advancement and practical application of the use of fly ash based concrete.

After 1980 many studies has been done on the use of fly ash in concrete as a supplementary cementations material. Major fly ash producing countries has started using more fly ash in concrete also called High volume fly ash concrete. CANMET in 1985 developed High Volume Fly Ash concrete. It was a high performance
concrete which shows superior durability and excellent mechanical properties. (Malhotra) High Volume Fly Ash concrete (HVFA) helped to reduce the consumption of cement and water and increased the workability of the concrete due to the use of large proportion of Fly ash.

1.2.1 Production of Fly Ash

Fly ash is a residue which is obtained after the combustion of coal in the furnace of a thermal plant. Then this fly ash is collected by electrical or mechanical precipitations which is known as dry process or by wet process which is an old method.

1.3 Rice Husk Ash (RHA)

India is the second highest rice producing country in the world after China. Rice Husk is a by-product which comes from the rice mills. Around 120 million tons of rice paddy is produced in India in which 20% part is rice husk (Jivani, 2007). Disposal of such a big amount is hazardous for the rice producing nations. Rice Husk Ash (RHA) is generated by burning rice husk in boilers. For every thousand kilogram of paddy around 220kg of rice husk is produced and on burning this 220kg of rice husk around 55kg of rice husk ash is generated which is 25\% of rice husk (Koteswara Rao. D, 2011). So considering India which is the major producer of rice in the world, disposing this great amount of Rice Husk Ash is a big problem.

Research shows that Rice Husk Ash can be used as a pozzolon and can be used in concrete as a cement replacement (Pitt, 1976). Further several studies has been made on Rice husk ash showing that the concrete having RHA have good Compressive strength, splitting tensile strength and modulus of elasticity at various ages and chloride diffusion is reduced (A. A. Ramezanianpour, 2009). These studies
proves that if RHA is used as a substitute for a percentage of part and cement will not only become a means of disposal of this agricultural waste but also will lessen the cost of the construction.

**1.3.1 Effect of Temperature on Rice Husk Ash**

Rice Husk Ash shows different chemical composition at different burning temperature (Hwang, 1989). It has been also shown from several studies that rice husks when burnt in controlled conditions between temperatures of 500°C to 700°C and ground to particle sizes of less than 10 μm will perform acceptable pozzolanic properties to apply in cement and concrete industries (V.B COLUMN, 1974). Uncontrolled combustion results in poor quality of Rice Husk Ash as at lower than 500°C the ashes contain high carbon content and high amount of loss in ignition, and at temperatures greater than 700°C crystalline silica ash is formed (DEEPA, 2008).

**1.4 Brick Dust (BD)**

One of the oldest construction materials is brick, which was first used in Southern Turkey and around Jerico dating 7000 Bc (Brick Directory 2015). According to (Kidder, 2015) their are two major ingredients from which building bricks are made, one is clay and other is sand.

Brick dust is the waste product which comes from the field where bricks are made and from the demolition waste of the building. As Brick is composed of clay which contains sufficient amount of soluble silica and alumina finely grounded brick dust when combined with lime shows pozzolanic reaction (Rogers, 2011). As earliest said that Brick is the oldest and majorly used construction material so large amount of Brick dust is generated during manufacturing of Bricks and demolition of the
constructional structure so it is a major problem to dispose such a large amount of Brick Dust.

If Brick dust is used as a replacement for a percentage of cement then is will not only reduce the problem of disposing this waste, it will also reduce the environmental impact which is caused by the CO₂ emission from the manufacturing of the cement.

1.5 Potential Use of Brick Dust And Rice Husk Ash in Lucknow

Lucknow is known as city of Nawabs. According to (ICICI, 2011) present metropolitan area of Lucknow is 3091.40 sq km. Lucknow is surrounded by many district like Sitapur, Barabanki, Hardoi, Raebareli and Unnao. In past 17-18 years city has experienced lot of infrastructural development. Large number of private developers like Ansal, Sahara, Eldeco and DLF has entered in this infrastructural development. Lucknow metro Project has also started its construction in the year 2014. According to (CRISIL) Lucknow is one of the next top ten cities in India with enormous real estate potential.

1.5.1 Rice Husk Ash

In a Report (Dwivedi, 2011), Lucknow division which comprises of Lucknow, Unnao, Raebareli, Sitapur, Hardoi, Kheri, Shahu ji Maharaj Nager is major produces of rice. Total area in which rice production done is 792763000 hectare with a production of 1610409 mt of rice during the year 2010-2011 which is maximum as compared to other divisions in Uttar Pradesh. Rice mills in Lucknow division uses rice husk as a fuel to generate steam for parboiling process. In this experiment rice husk was burnt in an controlled combustion process for about 2 hrs with a burning
temperature ranging between 600-800 degrees. The ash obtained was grounded for 2 hours and the colour of the ash was light grey.

1.5.2 Brick Dust

Brick Dust is a waste product obtained from different brick kilns and tile factories. Now day’s construction work is on large scale so demand of brick also increases so due to this brick kiln industries all over the world also increased. There are numerous brick kiln which have grown over the decades in an unplanned way in different part of Lucknow. Tons of waste products like Brick Dust or broken pieces or flakes of bricks (brick bat) come out from these kilns and factories. So far, such materials have been used just for filling low lying areas or are dumped as waste material.

1.6 Research Objective

The objective of this research is to find the scope for the use of Brick Dust and Rice Husk Ash in Lucknow division to reduce the amount of cement in concrete for the construction work in Lucknow. This is done via material testing of concretes with various percentage of replacement of cement by Fly Ash from Reliance power plant in Rosa Shahjahanpur, Uttar Pradesh and Rice Husk Ash and Brick Dust collected from Lucknow division, Uttar Pradesh.

In present time fly ash is used in concrete as replacement of cement in a percentage for construction work. Fly ash used in the experiment was bought form Reliance power plant in Rosa, Uttar Pradesh. As there is no power plant near by Lucknow which produces good quality Fly Ash, so construction companies use to buy fly ash which cost around Rs1 per kg. Maximum cost includes transportation cost. So it is necessary to find out other waste material which is easily available in
Lucknow division so this cost can be reduced and the problem of disposing industrial waste material is minimized.

As we know that Lucknow is the highest producer of rice in Utter Pradesh and there is a large number of brick manufacturing companies in Lucknow so Rice Husk Ash and Brick Dust is generated as a waste in a large quantity which is also a threat to environment so this research is done for finding the possibility of using Rice Husk Ash and Brick Dust as a replacement for a percentage of cement rather than Fly Ash.

1.7 Outline of Thesis

Their are six chapters in this thesis which are:-

The first chapter explains the need of using waste material in concrete for reducing the cost of concrete and scope for using Rice Husk Ash and Brick Dust in Lucknow division instead of Fly Ash so that concrete can be more cheaper by using local waste material rather than Fly Ash which is not a local material.

Chapter 2 is literature review, which summarizes those work which has already been done in the field of Fly Ash concrete, Rice Husk Ash concrete, Brick Dust concrete.

Chapter 3 deals with Materials which describes about every material used along with their properties

Chapter – 4 Methodology-which describes the whole experimental program.

Chapter – 5 Results and Discussion - which give the results of the testing of the material, compressive strengths of the of Rice husk Ash concrete, Fly Ash
concrete, Brick Dust concrete and variations in the respective weights of the cubes with the changing proportions.

Chapter - 6 Conclusion and Future Scope- which evaluates the scope of use of Rice Husk Ash and Brick Dust as a replacement of a percentage of cement in concrete instead of Fly Ash which summarize the whole experiment, results and finding of this study as well as possibilities for future work.