CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Earth will be home to more than 9 billion people in 2050, a jump of 2.3 billion over four decades (Solidia Technologies, 2015). This global milestone will have a pronounced urban penchant. Two-thirds of the world population will reside in mega cities, urban centers with 10 million inhabitants. Rapid population growth and urbanization will have a dramatic effect on the increased demand for jobs, housing, energy, clean water, food, transportation infrastructure, and social services. The urbanization of the planet over the coming decades will exert intense pressure on the agility and responsiveness of industry to innovate. The building materials and construction industries must adapt new practices to meet the increased demand for materials to build the housing and transportation infrastructure.

Nowadays, due to limited availability of construction sites, developers take an effort to construct a building on a soft clay soil. Soil is a naturally occurring mixture of mineral and organic ingredients with a definite form, structure, and composition. It is composed primarily of minerals which are produced from parent material which is broken into small pieces by weathering. Larger pieces are stones, gravel, and other rock debris. Smaller particles are sand, silt, or clay. Clay particles are smaller than 0.002mm and cannot be seen
with the unaided eye. Because of the small particle size, clay soils can sometimes experience large amounts of expansion and contraction in volume with changes in moisture content. Soft clay soil can be categorized as and problematic soil due to its weakness which are low strength and high compressibility characteristics. Settlement can occur if the structure was constructed on a poor ground.

A soil shear failure can result in excessive building distortion and even collapse. Excessive settlements can result in structural damage to a building frame nuisance such as sticking doors and windows, cracks in tile and plaster, and excessive wear or equipment failure from misalignment resulting from foundation settlements. It is necessary to investigate both base shear resistance and settlements for any structure. The ground improvement is necessary to modify the soil properties. Ground improvement techniques are used to prepare the ground for new construction projects and to reduce the risk of liquefaction in areas of seismic activity. Various techniques had been used to improve the soft soil, for example lime treatment, acceleration of pre-consolidation using pre-fabricated vertical drains and the most popular method is vertical granular column.

Researchers had mixed clay with waste material to enhance its engineering quality. The selected waste material is bottom ash. It is a byproduct from electric power plant. These waste material is disposed and generally have no economic value. Bottom ash is physically course, porous, glassy, granular, greyish and incombustible materials that are collected from the bottom of furnaces that burned coil. It is found that it has pozzolonic properties which make it possible to replace cement in deep soil mixing.
1.2 PROBLEM STATEMENT

Soft clay is a problematic soil because of the soft clay weakness in strength characteristic and high compressibility. Due to this weakness, ground improvement need to be conducted in order to increase and improve the soft clay strength. Bottom ash column was not only increased the bearing capacity of soil, but also reduces the settlement of structure’s foundation. A characteristic of clay soil is that they swell in volume when they get wet and reduce in volume as they dry. The magnitude and direction of shrink and swell displacements are affected by a variety of factors. The displacements would cause serious impacts on some buildings and structures. It will be more dangerous if the structure built in a weak condition of the soil and at the same time it can cause failure to the structure. Bottom ash is formed in coal furnaces. It is made from agglomerated ash particles that are too large to be carried in the flue gases and fall through open grates to an ash hopper at the bottom of the furnace. Bottom ash is mainly comprised of fused courser ash particles. These particles are quite porous and look like volcanic lava. Bottom ash forms up to 25% of the total ash while the fly ash forms the remaining 75%. One of the most common uses for bottom ash is as structural fill. There is a strongly possibility of bottom ash being used as substitute of fine aggregate such as sand. Its use in concrete become more significant and important in view of the fact that sources of natural sand as fine aggregates are getting depleted gradually. The engineering and construction community has now taken up the challenge for the use of green and recycled byproduct in construction. One of those byproduct is the bottom ash from thermal power plant that faces an increasing production running into hundreds of thousand tonnes in Malaysia alone, and its method of disposal is relegated to landfills alone with no other commercial usage. An effective utilization of bottom ash in construction materials will significantly reduce the accumulation of the byproducts in landfills and thus reduce environmental pollution.