1.1 Research context

Planet earth has been continuously changing in terms of physical due to many reasons. The earth’s crust is actually quite thin compared with the diameter of the earth. At the depth below the crust is molten rock in which it is flowing all the time. One of the most important aspects of the crust is that it comprises several plates interconnected. It should be noted that the continuous movement of the molten rock has been called convection. The flowing of the molten rock is one of the causes for volcano activities along the boundary between plates. In addition, it also continuously drives the plates thereby causing them to move either against each other or away from other plates. This movement is one of the causes triggering major earthquakes. Note that each year around 10,000 people die from the earthquake (Elnashai and Sarno, 2008). Unfortunately, even with current technology and knowledge, we still unable to precisely predict an earthquake incident with respect to where, when, and magnitude.

Even though Thailand is not located along the ring of fire in which major earthquakes frequently occur, it does not mean the country is completely safe from earthquakes and tsunamis. As evident in the 26 December 2004 earthquake that causes huge damage to the western coastline, particularly the loss of lives of both foreigners and Thais. The way of life for some Thais is to reside very close to the tsunami-prone beaches because of their careers and close biding with original land. Furthermore, beautiful beaches are the attraction for both foreign and Thai tourists. Another example recently observes was the 5 May 2014 earthquake in Chiang Rai at which huge damage was created. In addition, the loss of some lives was invaluable.
In facts, every year almost same numbers of earthquake occur. In the past, however, Thailand had no seismic stations to observe and record the incidents. Thus, there have not been records and reports with respect to the earthquake incidents. It should be noted that the earthquake-prone areas in Thailand are mostly located in the North and West. Some parts in the South are also prone to minor earthquakes. Thus, civil engineering design in such areas must take into account for the vibration generated by an earthquake. Otherwise, damage experienced in Chiang Rai would come back to haunt us.

Thailand is increasing facing the environmental problem concerning the accumulated numbers of discarded tyres. For example, disposing huge amount of used tyres in open areas is prone to fire, whether by accidents or by intensions. When this happens, it would be very difficult to cease the fire because they are very good for burning. Then, there would be consequences such as the groundwater may be contaminated when the burnt tyres are brought into underground. The contaminated groundwater then needs over hundreds of years to become clean again. It is therefore essential for Thailand to sensibly consider this problem. For instance, solutions must be sustainable, i.e., they must not create consequent and associated problems, cheap to operate, and conserve the environment.

Therefore, in the future Thailand should have some kinds of regulation or law concerning the management for those industrial wastes in order to prevent probably environmental problems might be created. It should be noted herein that the United States of America and Europe have been imposing the laws concerning these wastes for some times. For example, since 2003 disposing of whole used tyres in the EU have been prohibited. In case of tyres required to be thrown away, they must be undergone some processes first, e.g., be shredded to have smaller size. Nonetheless, this process must be carried out by authorised privates (Khalid and Artamendix, 2004). Note that in the UK in the past discarded tyres were frequently burnt to obtain the heat for producing electricity. This operation of course created the air pollution. Therefore, burning used tyres were completely prohibited.

As population is increasing the wastes generated is also growing. In Thailand, the common practice for municipal waste is just simply dumping and covering. This practice has led to several consequent problems, especially the environmental ones. The
obvious one is that ground water located nearby a waste site is very likely to be contaminated. Recently, land for dumping the waste is quite scarce. As a result, there have been attempts to build incinerators. In southern Thailand, there are three of them, located in Phangan, Phuket, and Hatyai. It should be emphasised that the left over from burning wastes is ashes, call incinerator ashes, comprising fly- and bottom- ashes. These ashes, however, still need to be properly managed in order to not generate further associated problems.

This research wanted to utilise discarded tyres and incinerator bottom ashes regarded as solid waste. It could be achieved by first mixing them; and, then employed as earthquake buffer. These mixtures were employed as foundation soil (material) located both underneath and surrounding structures in order to absorb the vibration generated by earthquakes. This would somewhat reduce the vibration transmitted to superstructure thereby softening the damage created. The benefits of the research are that both wastes can be utilised instead of just throwing away. In addition, overall construction would be decreased as the wastes can be obtained with no cost.

1.2 Research objectives

The following objectives were set to achieve the aims of this research project:

1) Investigate the properties of recycled tyre chips.
2) Investigate the properties of incinerator bottom ashes.
3) Investigate and experiment the mixtures of recycled tyre chips and incinerator bottom ashes.
4) Investigate the efficiency of compound tyre chips-incinerator bottom ashes in terms of vibration reduction.
5) Propose a mixture between the tyre chips and incinerator bottom ashes that could mostly reduce the vibration generated by earthquakes.

1.3 Research methods

To achieve the aims of the research the first task was to obtain as much information related to this project as possible, especially a technique for simulating an earthquake. The methods for this research project were divided into steps as following:
1) Study and search the literature related to this project for the purpose of gathering information as much as possible. For example, a technique for generating a simulated earthquake. In addition, methods for reducing the vibration caused by earthquake are also studied.

2) Prepare and purchase all materials required, including accelerometers and their associated instruments for measuring and recording the vibration during testing.

3) Design and build a chamber for housing model soil layer as well as model houses. Note that the chamber must be strong enough to withstand the vibration.

4) Perform underground explosion to obtain appropriate vibration levels similar to those generated by earthquakes.

5) Perform seismic tests on the model housed having been installed with accelerometers. The houses are constructed over the mixtures between tyre chips and incinerator bottom ashes.

6) Analyse the data obtained from the experiments; compare the results with other earthquake buffer materials.

7) Prepare a final research report.

1.4 Expected outcome

This research project wished to obtain the basic and mechanical properties in terms of vibration resistance of the mixtures between recycled tyre chips and incinerator bottom ashes. Then, propose appropriate mixtures in order to be used as earthquake buffer that is very cheap to obtain.

1.5 Layout of report

This report begins with chapter 1 that provides some introductory remarks with respect to the importance for conducting this research project, especially basic earthquake engineering. It also includes the brief methods employed to carry out the experiment and objectives of the research. All of the essential work and research related to this research were reviewed and summarised in our own understanding in chapter 2. This chapter also paves ways for conducting the experiments in terms of providing the methods that other investigators had done.

Chapter 3 simply provides readers concerning materials, methods, and test programmes to be carried out. The main aim of this chapter is to provide the
information as accurate as possible so that others would be able to follow suite. After all of the test programmes done, their results are summarised in chapter 4. Also included in the chapter is discussion at which is one of the most important aspect of conducting research. This is because it would provide some insight knowledge why something happens. Then, it would be further enhanced by others to form a group of new knowledge. Chapter 5 traditionally concludes what this project has done and got. Also, some recommendations are also included so that one might be interested in doing similar work.