INVESTIGATION OF ABUNDANT TREATED SEA SAND WITH DIFFERENT PERCENTAGES IN CONCRETE BRICK MAKING RATIO 1:6

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ABSTRACT

These studies present the result of flexural strength and shrinkage for evaluating the abundant sea sand brick. Flexural strength and shrinkage of abundant sea sand brick according the requirement British Standard 6073- 1 1981. The optimum mix proportion by percentage of the abundant sea sand which is 5%, 10%, 15%, 20%. Result of the test indicated that the proportion abundant sea sand and mix design were the two key factors the quality of brick. Increasing the percentage sea sand in brick significantly reduce the strength the concrete brick. The rate of strength gain of the continuously cured the sample beyond 28 days was also found to be significantly. A weakness in abundant sea sand brick was shown during the flexural experiment. This paper presents the role of different percentage in the cement brick that came as a result of our survey to their effect. The material used are cheap and it consider and waste material. For this purpose 200 brick sample include abundant sea sand brick were design for a particular strength and application building works. The trial mix and abundant sea sand was used are 1:6 for sand cement ratio. The water cement ratio use for this experiment was 0.4. The mould sizes were used 205mm x 150mm x 65mm. The flexural strength and shrinkage was tested at 7, and 28 days of water curing. Based on the result obtained, conclusion can made which is the appropriate percentage of abundant sea sand brick for producing quality cement brick was in the range 5% to 15%.

ABSTRAK

Kajian ini menunjukkan hasil kekuatan lentur dan penyusutan untuk menilai limpahan pasir pantai. Kekuatan lentur dan susut bata simen limpahan pasir pantai mengikut keperluan British Standard 6073-1 1981. Nisbah optimum campuran dengan peratusan limpahan pasir pantai adalah 5%, 10%, 15%, 20%. Keputusan uji menunjukkan bahawa reka bentuk perkadaran limpahan pasir pantai dan campuran adalah dua faktor utama dalam kualiti bata simen. Peningkatan peratusan bata pasir pantai secara mendadak dapat mengurangkan kekuatan bata konkrit. Untuk meningkat lagi kekuatan sampel ianya hendaklah terus dengan rawatan air selama 28. Kelemahan dalam batu bata limpahan pasir pantai yang juga dipaparkan selama tempoh eksperimen. Ini dapat menunjukkan peranan peratusan yang berbeza dalam bata simen sebagai hasil dari eksperimen. Bahan yang digunakan adalah murah dan diklasifikasi sebagai bahan buangan. Untuk sampel eksperimen ini merangkumi 200 tujuan bata bata limpahan pasir pantai adalah rekaan untuk sebuah kekuatan tertentu dan bekerja aplikasi bangunan. Untuk sampel kawalan iaitu pasir biasa dan limpahan pasir pantai digunakan adalah 1:6 untuk perbandingan pasir semen. Perbandingan air simen digunakan untuk percubaan ini adalah 0.4. Saiz acuan kayu yang digunakan adalah 205mm x 150mm x 65mm. Kekuatan lentur dan penyusutan diuji pada 7, dan 28 bersamaan rawatan air. Berdasarkan keputusan yang diperolehi, kesimpulan boleh dibuat yang merupakan peratusan yang sesuai dari batu bata limpahan pasir pantai yang untuk menghasilkan bata simen berkualiti berada di antara 5% hingga 15%.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Brick is very important material for building construction. Brick is very unique and its' only man made building materials and testify to their use since the early human civilization. It can be attractive appearances and superior properties, such as compressive strength and durability. Brick are widely use for building, civil engineering work and landscape design.

The functional and decorative qualities of brick is being extensively used many types of building in this world, from work cottages to mass housing as well as the construction. Brick is one of the oldest building materials and it is lot of story behind the making of bricks. It has two types of brick which is clay brick and concrete brick.

Both of this brick have different material, and their quality depends the manufacturing. The river sand material for brick products is first confined to prestigious civil works such as fortified wall and gatehouse and major domestic work such as castle, partition and manors.

Although bricks are all regularized to conform to coordinating dimensions that allow proper bonding arrangements, some bricks are very regular and consistent in size and other relatively distorted and vary within prescribed tolerances. Brickwork is primarily a structural material but it is often use as cladding where it is not called upon to carry any imposed dead load.

Research and consideration making sea sand adding in the brick is one of major in civil engineering study. Sea sand will use in brick and it must be checked the chloride level. This is because sea sand content high level chloride ions. Furthermore sea sand needs to reduce chloride ion for suitable material in civil engineering works.

Sea sand have a coarse grain characteristic and gradation which is vary as well salt contain (Cl) and sulphate (SO4), in addition sea sand have a high density and has good resistance to wear and tear due the influence of climate and mechanical factors (Mangerongkonda, 2007).

This research has a lot of benefit benefits to be done as with the data getting from this research such as compression strength of the brick, percentages of water absorption, flexural testing and shrinkage. It might be contributed to the new finding of replacing concrete brick nowadays.

1.2 Problem Statement

Now a days waste material is the best alternative for avoiding not only from waste abundance but it also in directly decreasing the cost of construction which increasing rapidly. Also the increasing of sand transportation and mobilization to the construction sites make the contractor have a problem during the payment. Using sea sand might be the best substitutes for brick material. Besides, the river sand is unpredictable sources during the monsoon season which the sand pumping will stop for a while because the water table river increases at that time, and the cost of sand will increase during monsoon season. The sea sand is the best alternative for monsoon season. River sand is an essential raw material in construction industry and introducing an alternate material has not been yet successful due to many reasons.

While in coastal sand beaches have a problem at the edge of the road side and this cause affection of environments in terms of scenery and sight of visitor. Therefore abundant sea sand beaches could overcome this problem and might helping the contractor to resolve the problems construction material.

1.3 Objectives of Study

The objectives of this study are:

I. To measure the shrinkage of bricks ratio 1.6 with different percentage of sea sand replacement.

II. To measure value of flexural strength brick when mixing sea sand properties.

1.4 Scope Area of Study

Scope of this project is to identify the strength and cement brick mixing with abundant sea sand. By laboratory work for determination of properties of cement brick mixing abundant sea sand will be done according to the percentage of replacing of the river sand in range 5%, 10%, 15%, and 20%.

In this study the sea sand sample is taken from east peninsular of Malaysia which is Dungun, Terengganu front of UiTM Dungun. The sample was taken on the road or the sea shore and not involving the sea sand that close to the water.

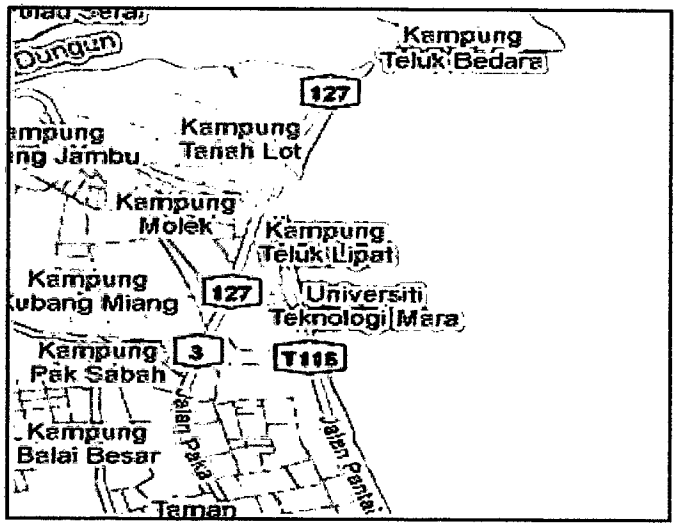

Figure 1.1: Location of the samples
Source: Anonymous 2010a

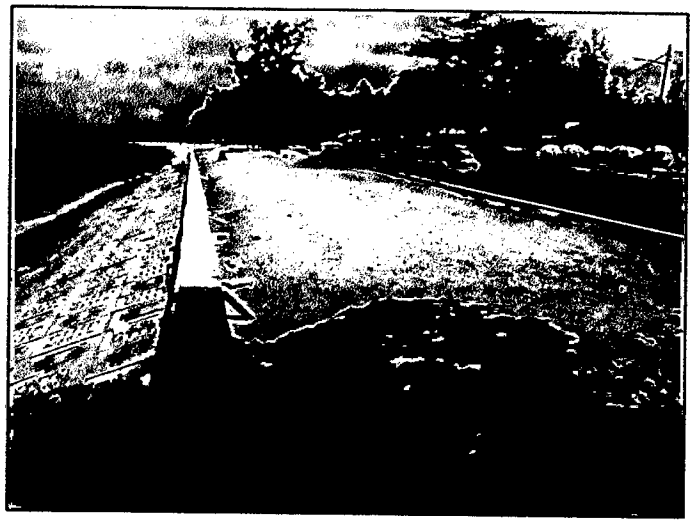

Figure 1.2: Location of the sample
Source: Anonymous 2010a

A physical and mechanical property is involved for sea sand study field. For the physical properties, the laboratory test which is:-

I. Standard Test Method for Sieve Analysis of Fine, ASTM 136.

II. Chloride Content, Mercuric Thiocyanate Method, BS 8113.

For the mechanical properties the laboratory test which is:-

I. Standard Test Method Flexural Strength, ASTM C293-02.

II. Shrinkage Test Method, ASTM C157.

Table 1.1 shows that the number of brick needs to be testing for the flexural testing. The value of its dry and wet weight is been recorded before the flexural testing proceed.

Table 1.1: The Number of Bricks Needed for The Flexural Testing.

SHRINKAGE TESTING		
Percentage	Days	
	7	28
0%	5	5
5%	5	5
10%	5	5
15%	5	5
20%	5	5
Total	25	25

Table 1.2 The Detailing Number for Shrinkage Samples.

FLEXURAL TESTING		
Percentage	Days	
	7	28
0%	5	5
5%	5	5
10%	5	5
15%	5	5
20%	5	5
Total	25	25

1.5 Significant of Study

This study will serve the good application in reducing the using of ordinary sea sand in brick production. Using the wastage material for construction has a big impact for civil engineering industry and it could help the contractors to use another material for river sand substitutes. Thus, abundant sea sand seems to have potential to use in construction for building works. For this study and preliminary work show that the sea sand products replacement is an uncommon research since sea sand are unusual uses in civil engineering product especially for construction material. The important of this study will show the development of material using sea sand for good application and might be the solution in reducing the river sand material for brick products.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The definition of word sea sand can define as the small particle which is similar with the river sand. It has many grade and size. The properties sand have benefit for civil work and building work for today. For origin sea sand at the ice age, the sea water level stood some 120m lower than today, fringing the edge of the continental shelf. There were beaches, dunes and so on. The sand locked up in these is radio-carbon dated to about 9,000 years old, which we will refer to as modern or Holocene sand. As the ice age ended some 6000 years ago, and the sea level rose, the beaches and dunes moved with it. By the action of waves, nearly all the sea sand within a certain size range was swept towards the land. By about 4000 years ago, the process had ended, and the beaches and dunes were essentially where they are found today (*Anonymous 2010b*).

A sand sample can be described in terms of grain size, color, composition, morphology (angularity and shape) and surface texture. Grain size is a result of several factors, including composition, durability, severity of weathering conditions, transport distance from its site of origin, and physical sorting by wind and/or water currents. For the sea sand origin, part of the mixture of clay and sand that gathered in the sea beds during the last several 10's of million years ago. All sand in the Malaysia is made of calcium carbonate (CaCO3), but it comes from a number of different sources. Sand collected from different beaches has different chemical properties (*Anonymous, 2010b*).

The sea sand is obtained from sea shores. It has fine rounded grains and light brown color. Sea sand contains salts which attract moisture from atmosphere. Such absorption causes dampness and disintegration of work. Sea sand also retards setting action of cement. Due to these reasons, sea sand is generally avoided for engineering purposes. It is used only as a local material for nonstructural purposes. The sea sand used in this method should be of good quality to be adequate for the construction criteria.

2.2 Cement Bricks

Brick masonry units may be solid, hollow, or architectural terra cotta. All types can serve a structural function, a decorative function, or a combination of both. The various types differ in their formation and composition. The cement bricks are similar to a clay stock (plaster) brick but are more often used in regions where clay might be in short supply. There is usually not a big price difference between cement and clay plaster bricks and cement brick is mostly used as a substitute. When ordering cement bricks make sure that they are properly cured and dry before using them. (*Anonymous, 2010c*)

2.3 Strength of Brick Masonry

The main factors governing the strength of a brick structure include brick strength, mortar strength and elasticity, bricklayer workmanship, brick uniformity, and the method used to lay brick. The strength of a single brick masonry unit varies widely, depending on its ingredients and manufacturing method. Brick can have an ultimate compressive strength as low as 1,600 psi. On the other hand, some well-burned brick has compressive strength exceeding 15,000 psi. (Olsen *et al*, 2001)

2.4 Brick Classification

A finished brick structure contains face brick (brick placed on the exposed face of the structure) and backup brick (brick placed behind the face brick). The face brick is often of higher quality than the backup brick and however, the entire wall may be built of common brick. Figure 2.1 show the diagram of brick (Olsen *et al*, 2001).

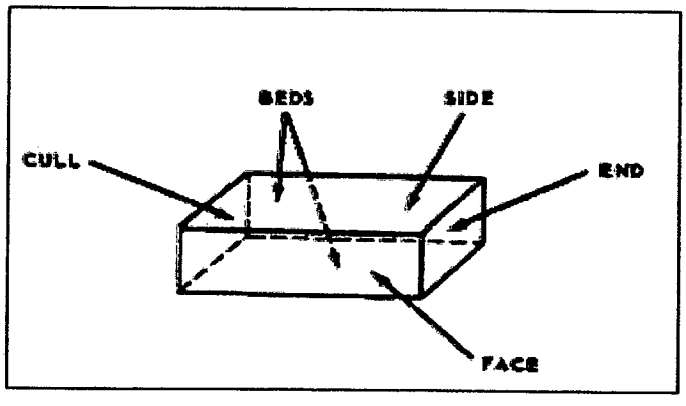

Figure 2.1: Brick surface
Source: Olsen *et al*, (2001)

2.5 Brick Dimension

The work size of a standard brick is 65mm high x 215mm long x 102mm wide. Some bricks are made with different work sizes. For example brick heights of 119mm and 162mm to match 1.5 and 2 standard size brick heights, including mortar joint, respectively. 50mm and 90mm high bricks, 90mm wide bricks and 290mm long bricks are made for different structural and aesthetic effect. Larger bricks are often used for more economical laying and as a design feature either on their own or combined with smaller bricks.

2.6 Material for Concrete Brick

Currently, the use brick has remained steady in construction industry, it is important choose the good raw material. In this study the important material concrete brick is a threaten sea sand, river sand, and cement. The choosing material concrete brick is according British Standard and journal study.

2.6.1 Sea Sand

Sea sand is a major material in making brick. According to Gunasageran Mawtha (2003), the sea sand have been use for construction at Sri Lanka offshore and project housing at Modarawila, Panadura which is recommended by National Building Organisation and Civil Engineering Department of the Morutuwa University. The particle size of sea sand which has been used was a 2mm. He also stated that the advantage of using sea sand would cost less than river sand. Stock of

sand is located in a convenient place, especially for those engaged in construction industry in Colombo and Gampaha district. According to Dias (2008), although offshore sand is reportedly used in many countries such as the UK, Continental Europe, India, Seychelles and Singapore, most of the documentation regarding its use was found mainly regarding UK practice, and to a lesser extent regarding European practice.

2.6.2 River Sand

River sand of medium or fine grade can be used for block/brick making but choose sand that is evenly graded from fine dust up to 3 or 4mm in size. River sands are not as cohesive as crusher run sands and natural mined sands. Sand should comply British Standard 1200:1976 sand for masonry. It should be free from clay and other contaminants and choosing the correct grading is important. Very fine sand is not suitable for brickwork as it cannot bond with cement paste.

2.6.3 Cement

The cements described here are Portland cement which most widely used in making concrete brick. Cement is the most costly material and by do mixing trials with different aggregates it will be able to minimize the cement content which it might cut the construction cost. Cement should always be stored in dry place, off the floor and should be use within three months of the date of manufacture. Based on British Standard 4627:1970, cement are hydraulic and it depend upon water rather than air for strength development.

2.6.4 Water

Only clean clear potable water should be used in the manufacture of the blocks and bricks. Any organic material in water will prevent the cement from setting. Chemicals and impurities could also affect the strength of the end product. (BS3148 1980).

2.7 Curing of Concrete Brick

The process of maintaining the moisture in the brick is called curing. The use of water in curing concrete brick is intended to penetrate the brick. Therefore, the part that expose to the environment should be cured to ensure the brick surface is not in too dry condition to prevent water loss in capillary concrete brick and to increase the strength. According to American Concrete society, Curing has a strong influence on the properties of hardened concrete such as durability, strength, water tightness, abrasion resistance, volume stability, and resistance to freezing and thawing and deicer salts. Surface strength development can be reduced significantly when curing is defective. The curing period may depend on the properties required of the concrete brick, the purpose for which it is to be used, the ambient conditions, and the temperature and relative humidity of the surrounding atmosphere. Figure 2.2 shows the effect of different periods of water curing on the permeability of cement paste. As may be seen, extending the period of curing reduces the permeability.

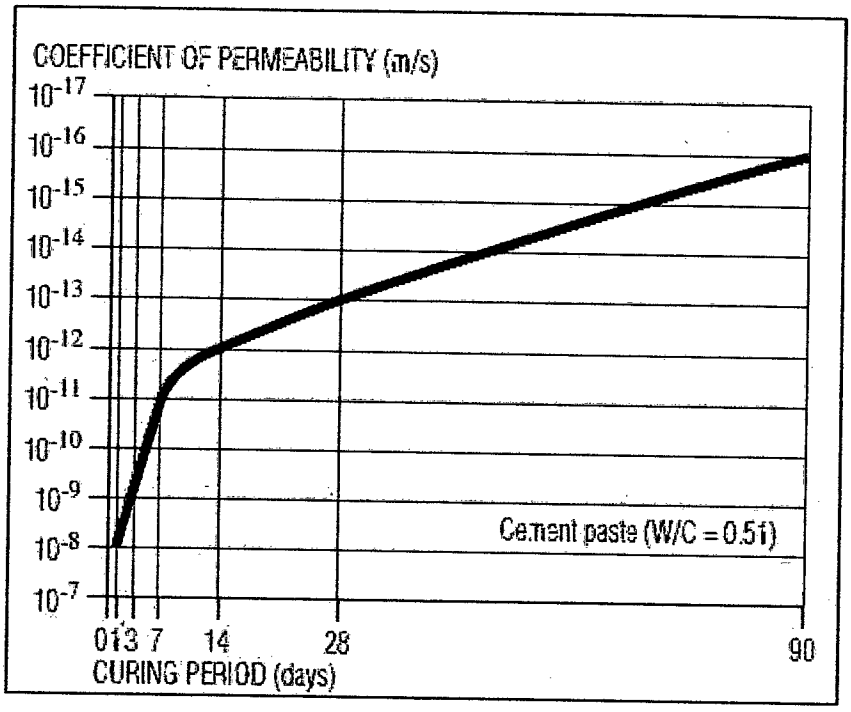

Figure 2.2: Effect of Duration of Water Curing on the Permeability of Cement Paste. **Source:** Cement and Aggregate Australia.

2.8 Efflorescence

Efflorescence is effects which it can be refer as one staining type. . Efflorescence staining is a white crystalline deposit that forms on or near the surface of concrete, masonry, and cement based materials. It is the most common post installation defect in direct adhered exterior ceramic tile, stone, and brick wall systems. Efflorescence starts as a salt which is dissolved by water; the salt solution is then transported by gravity or by capillary action to a surface exposed to air, where the solution evaporates and leaves behind the crystalline deposit. Efflorescence can also occur beneath the surface or within ceramic tile, stone, or thin brick units. The efflorescence will be effect as:-

I. Presence of soluble salts.

II. Presence of water (for extended period).

III. Transporting force (gravity, capillary action, hydrostatic pressure, evaporation).

Based on Masonry Institute America, for removing efflorescence, sandblasting should be used with caution and afterwards the masonry should be sealed with a waterproofing material. An alternative to sandblasting, which has shown good success when done properly is the use of special chemical cleaners. Cleaning efflorescence from masonry walls does not cure the problem, it only removes the symptoms. After cleaning, the efflorescence will reappear unless the natural efflorescent chain is broken. Due to the added water used when pre-soaking and post-flushing the walls when using chemical or acid cleaners, the efflorescence will sometimes reappear which it often stronger than before.

After final sandblasting or acid cleaning of the efflorescence from the masonry, the wall should be sealed. The efflorescence already indicates that soluble alkali sulfates may exist in the wall and that the sulfates have migratory paths to the surface. All we can prevent now is the moisture from entering the masonry and rendering the sulfates into solution.

2.9 Flexural Testing for Concrete Brick

Flexural strength deserves special attention since adequate knowledge on strength parameters can allow structural design engineers to check the adequacy with suitable design methods. According to Bristish Standard 6073-1 1981 state that the average flexural strength of the sample, to the nearest 0.05 N/mm2. Swaminathan Dhanapdia(1965), has conducted a thesis on marble sawing powder waste as brick