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The Absorbent Capabilities of Soil in Structural Works Are Related to the Quality of the Concrete

Biatma Syanjayanta

Department of Architecture, Musamus University, Merauke, South Papua, Indonesia ORCID: 0009-0007-2308-6635

ABSTRACT: In implementing building construction from low level to middle level, if the implementation is not using the services of a supervisory consultant, the implementers sometimes do not pay attention to the rules in the implementation. Especially in the implementation of casting the lower structure, namely concrete foundations and foot plates. Often workers do not use work floors or bases under the location where the casting will be used, to prevent water absorption caused by the soil, which can affect the strength of the lower structure. This research aims to examine the absorption capacity of soil in substructure work on the quality of concrete in the process of casting concrete foundations. Planning the substructure with concrete construction must be based on several aspects, one of which is paying attention to the type and texture of the soil. Soil type, apart from being related to strength and bearing capacity, is also related to the permeability of the soil. Permeability is the ability of the soil to allow water seepage through voids or pores in the soil. Due to the condition of this type of soil with very high water absorption capacity, it is necessary to pay attention to the implementation of concrete work that is in direct contact with the ground when carrying out the work, for example by using a plastic base or work floor, even at the level of simple work, in order to maintain the workability (thinness) of the concrete mixture. by taking into account the water cement factor (FAS) to maintain the quality of the concrete.

KEYWORDS: Soil characteristics, concrete foundation, Merauke, South Papua.

1. INTRODUCTION

Much development is carried out in all sectors of life, especially building and housing construction. Many new buildings were built, including offices, shops and hotels, as well as many housing complexes and other public facility buildings. In real conditions in the field, building construction generally uses concrete as the substructure of the building, especially for the construction of the foundation structure.

In implementing building construction from low level to middle level, if the implementation is not using the services of a supervisory consultant, the implementers sometimes do not pay attention to the rules in the implementation. Especially in the implementation of casting the lower structure, namely concrete foundations and foot plates. Often workers do not use work floors or bases under the location where the casting will be used, to prevent water absorption caused by the soil, so it can affect the strength of the lower structure, namely by reducing the water cement factor (FAS) which automatically reduces the quality of the concrete. planned. With this situation, plus workers' ignorance of the characteristics of the soil at the work site, it is certain that this will reduce the required strength of the concrete [1].

2. CONDITIONS OF THE RESEARCH LOCATION

2.1. Geographical Conditions

The research location is in the city of Merauke district, located in South Papua province, geographically located between 1370 - 1410 East Longitude and 50 - 90 South Latitude. With an area reaching up to 45,013.33 km2.[3] The topography in Merauke district is generally flat and swampy along the coast with a slope of 0-3% and towards the north, starting from Tanah Miring, Jagebob, Elikobel, Muting and Ulilin districts, the topography is wavy with a slope of 0 - 8%. The geographical conditions of Merauke Regency, which are relatively unspoiled, are a challenge and development opportunity for Merauke Regency, which still holds a lot of economic potential to support development [2].

2.2. Soil Conditions

Most of the research location areas are plain areas at an altitude of between 0 - 60m above sea level, in general they are downstream areas of rivers with great potential. The types of soil found at the research location consist of organosol, alluvial and gray hydromorphic soil found in swamp and brackish areas. This type of soil is formed from artificial sedimentary parent material which is spread across the Okaba, Merauke and Kimaam districts (Wikipedia, general description of Merauke district). Soil in swamp land can be alluvial or peat. Alluvial soil is sediment formed from a mixture of materials such as mud, humus and sand with different levels [2].

The condition of the soil in the research area is the result of alluvium deposits (achidan and sudana, 1992). This produces a type of alluvial soil or entisol soil according to the soil taxonomy classification (soil survey staff, 1990), namely

entisol soil located on tidal flats with an aquic soil moisture regime. . The types of soil in the study area (classified as Alluvial Gray and Alluvial Brown. Alluvial Soil or Entisols according to Soil Taxonomy (Soil Survey Staff, 1990) come from new deposits, in layers, the amount of organic material changes irregularly with depth [3].

Soil permeability shows the soil's ability to pass water (Klute and Dirksen, 1986), whereas according to Hakim et al., (1986), permeability is for the transfer of water or air. Quantitatively, soil permeability/hydraulic conductivity is the speed of movement of a fluid in a porous medium, or is defined as the speed of water passing through the soil in a certain time period expressed in centimeters per hour (Baver, 1959; Foth, 1984) [1].

Not much is known about the variation in soil permeability levels due to various types of land use on alluvial soils. Therefore, it is very important to study the soil's ability to conduct water (soil permeability) as a result of various land use patterns.

2.3. Alluvial Soil

Soil has characteristics based on its formation (organic or inorganic) and color. These characteristics include the following. This soil formation involves organic material that has decomposed. Organic soil has a black color and forms peat land. Because the formation process is through mud deposits carried by rivers, alluvial soil has a relatively high water content, so it is able to store water well [4].

Alluvial soil is a type of soil formed due to mud deposits, usually carried by river flows. This type of soil is usually found downstream, because it comes from upstream areas of rivers that experience sedimentation. The typical characteristics of alluvial soil are generally brown to gray in color, according to the mineral content and mud deposits that form it (Soil Taxonomy, Soil Survey Staff, 1990) [3].

2.4. Peat Soil

Soil in swamp land can be alluvial or peat. Alluvial soil is sediment formed from a mixture of materials such as mud, humus and sand with different levels. Peat is the result of the weathering of organic materials such as leaves, wood twigs and shrubs in a water-saturated state and over a very long period of time (thousands of years). In nature, peat is often mixed with clay. Soil is called peat soil if it meets one of the following requirements (Soil Survey Staff, 1996) [3].

Peat soil is naturally found in the top layer. Underneath there is a layer of alluvial soil at varying depths. Land with a peat soil thickness of less than 50cm is referred to as peat land or soil. It is called peat land if the peat thickness is more than 50cm. Thus, peat land is swamp land with a peat thickness of more than 50 cm. Based on their depth, peatlands are divided into four types, namely [4]:

1. Shallow peat land, namely land with a peat thickness of 50-100 cm;
2. Medium peat land, namely land with a peat thickness of 100-200 cm;
3. Deep peat land, namely land with a peat thickness of 200-300 cm;
4. Very deep peat land, namely land with a peat thickness of more than 300 cm.

2.5. Foundation/substructure

The foundation is part of a substructure system that supports its own weight and all force loads from the upper structure, then transmits them to the layers of soil and rock beneath it. The following is the meaning and definition of foundation from several book sources [5]:

1. According to Sardjono (1988), the foundation is one of the building constructions that is located at the bottom of a construction, the foundation has an important role in a building, where the foundation bears all the burden of the upper construction to the soil layer at the bottom.
2. According to Gunawan (1991), the foundation is a part of building construction whose task is to place the building and transmit the load of the upper structure (upper structure/super structure) to the ground base which is strong enough to support it.
3. According to Hardiyatmo (2002), the foundation is the lowest structural component of a building which transmits the building load to the soil or rock beneath it.

2.6 Concrete

Concrete has long been known as a material with adequate compressive strength, easy to form, easy to produce locally, relatively stiff and economical. In order to produce concrete that is suitable for its use and accurate selection of the type of material, influencing factors and processing methods. The quality or grade of concrete depends on these three things. The strength, durability and other properties of concrete are influenced by the properties of the basic materials that form it, the mixture ratio, the mixing method, the work method during concrete casting, the compaction method and maintenance during the hardening process [6].

According to SK-SNI-T15-1991-03, concrete is made by mixing Portland cement (PC), water and aggregate, with or without admixture in certain proportions. Making concrete is not just about mixing the basic ingredients that form it, but to get concrete of good quality, which meets strict requirements, because of higher demands, it must be calculated or carried out carefully according to SNI 03-2834-1993, Procedures Making a Normal Concrete Mix Plan and SNI 03-3976-1995, Procedures for Mixing Concrete Castings [7].

2.7. Cement Water Factor (fas)

Water has an influence in making paste, the stability of cement reactions and in curing concrete. On the quality of concrete, the influence of water can be seen from how much or how little water is used, known as the cement water factor. The cement water factor required to achieve the targeted average compressive strength is based on the relationship between compressive strength f'cr and fas obtained from research. If research data is not available, then use graph 1 or

table 2 and graph 2 (both cylindrical specimens or cube) for special environments, the maximum fas must comply with SNI 03-1915-1992 concerning Sulfate Resistant Concrete and SNI 03-2914-1994 concerning Specifications for Watertight Reinforced Concrete [7].

The lower the FAS value, the higher the compressive strength value of the concrete. However, in reality, if the FAS value is less in mixing the concrete is difficult to compact. Thus, there is a certain FAS value that can produce maximum concrete compressive strength. The density of the concrete mix greatly influences the compressive strength of the concrete after it hardens. Having 5 percent air pores reduces the compressive strength of concrete by up to 35 percent, and 10 percent pores reduce the compressive strength of concrete by up to 60 percent [8].

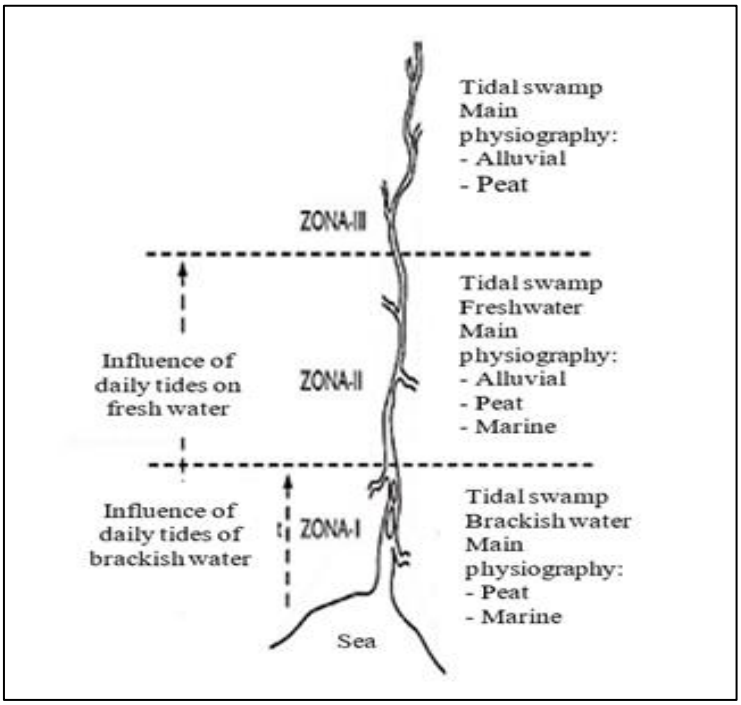
The ratio of the weights of water and cement for a concrete mix is called the water cement ratio (WCR) or water cement factor (FAS). In order for a perfect hydration process to occur in the concrete mix, a FAS value of 0.4 – 0.6 is generally used depending on the quality of concrete you want to achieve [9].

3. DISCUSSION

The author takes as an example the case of concrete casting work on the lower structure, namely the footplate foundation. Foundation planning must cover all aspects to ensure safety in accordance with applicable requirements, for example determining the dimensions of the foundation which include length, width and thickness, then the number and distance of reinforcement that must be installed in the foundation. The regulations for planning palm foundations are listed in SNI 03-2847-2002 [7].

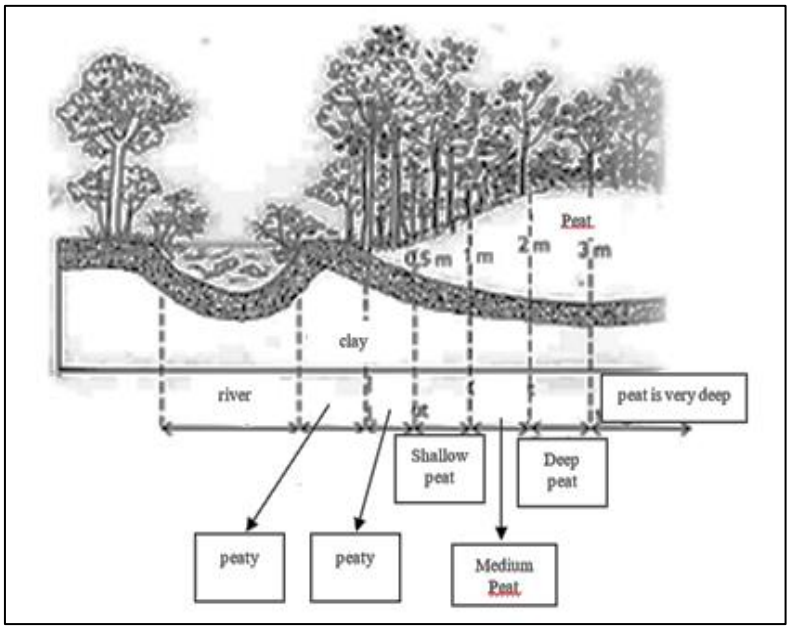
In implementing building construction from low level to middle level, if the implementation is not using the services of a supervisory consultant, the implementers sometimes do not pay attention to the rules in the implementation [10]. Especially in the implementation of casting the lower structure, namely concrete foundations and foot plates. Often workers do not use the work floor or base below the location where the casting will be used as shown in Figure 1.

Fig. 1. Implementation of casting without a work floor



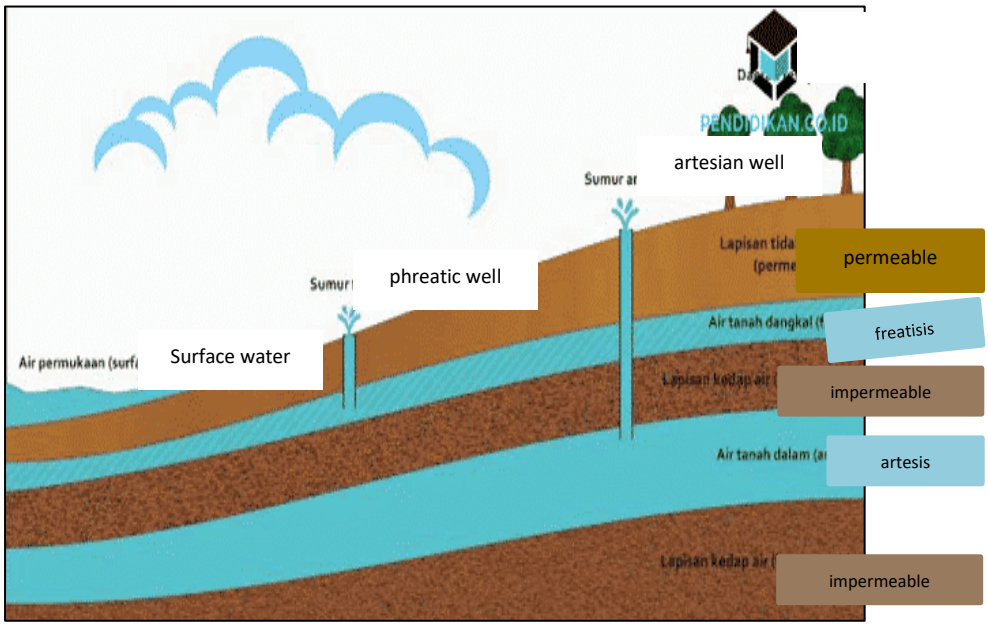
Source: Soil Survey Staff, 1990

Fig. A.



Source: Soil Survey Staff, 1990

Fig. B.



Source: Pendidikan.co.id

Fig. C.

Fig. 2. A, B, C. Soil type zones and elevations

Soil permeability is the ability of the soil to allow water seepage through voids or pores in the soil within a certain time until the soil is saturated. The research location is in zone I with a fairly large soil pore level and a high level of permeability as shown in Figure 2.

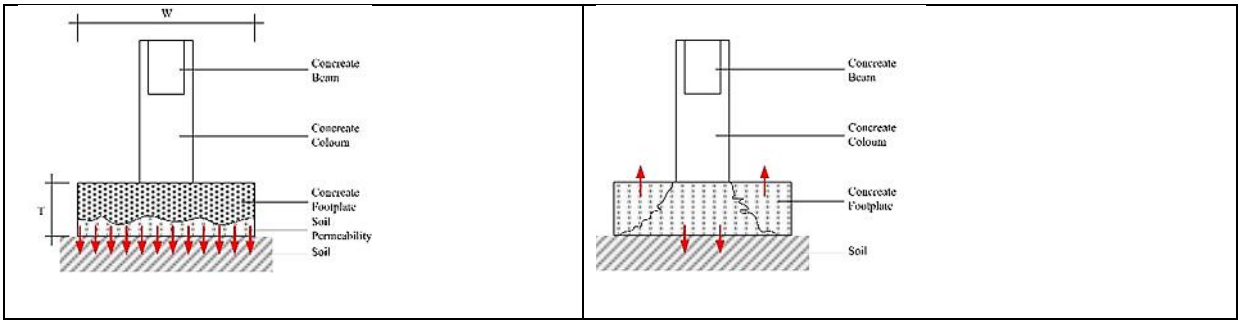


Figure 3. Direction of FAS absorption into the soil

Foundation damage in the form of cracks is caused by shear forces, this usually occurs if the ratio of the concrete mixture means that the quality of the concrete used is also poor, thereby reducing the concrete's ability to withstand compressive loads. The quality of the concrete is also influenced during the implementation period, namely by the reduction in the Cement Water Factor which is caused by the loss of cement paste due to the soil's fairly high water absorption capacity. This loss of cement paste is caused by soil texture which affects the water absorption capacity of the cement. The water absorption capacity of cement is shown in Figure 3. Figure 3 shows the direction of absorption from a foundation plate with a thickness of T. If there is a reduction in the FAS value due to cement paste seeping into the ground, the strength of the plate previously supported with a thickness of T will decrease. This will reduce the planned concrete strength due to reduced FAS. By reducing FAS, it is certain to reduce the strength of the concrete and can cause cracks in the concrete structure itself. Figure 4 shows the possibility of structural cracks. If cracks occur in the concrete, it is certain that there will be a collapse of the foundation structure and a complete collapse of the building.

4. CONCLUSION

Substructure planning with concrete construction must be based on several aspects, one of which is paying attention to the type and texture of the soil. Soil type, apart from being related to strength and bearing capacity, is also related to the permeability of the soil. Permeability is the ability of the soil to allow water seepage through voids or pores in the soil

Due to the condition of this type of soil with very high water absorption capacity, it is necessary to pay attention to the implementation of concrete work that is in direct contact with the ground when carrying out the work, for example by using a plastic base or work floor, even in simple work stages, in order to maintain the workability (thinness) of the concrete mixture. by taking into account the water cement factor (FAS) to maintain the quality of the concrete.

Not much is known about the variation in soil permeability levels due to various types of land use on alluvial soils. Therefore, it is very important to study the ability of soil to conduct water (soil permeability) as a result of various land use patterns, especially in building planning.

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