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The Influence of Addition of Plastiment-VZ to Concrete Characteristics in Riau Province

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Abstract: Riau Province has an area of 8,702,000 ha consisting of 7,121,344,00 ha of forest and 3,867,000 ha in the form of peatlands. Peat structures are soft and have pores that make it easy to hold water. Peat water has a high color intensity, low pH, high organic content and has an acidic properties. So it does not qualify as a mixture of concrete. To meet the needs of water in the concrete mix then water should be obtained from another place but it will require a greater cost and time. To resolve the issue, the advancement of concrete technology has resulted in admixture that can help in maintaining the quality of concrete. Plastiment-VZ is a plasticizer material that can increase workability of concrete without adding water. However, for the use in the field, the selection of admixture must be adjusted to the planned concrete situation and condition. Excessive use of admixture will also result in uneconomical concrete.

The design of the job mix using the Department of Environment (DOE) method with compressive strength concrete plan $f_c' = 25$ MPa. The percentage of Plastiment-VZ addition is 0%, 0.05%; 0.10%; 0.15% and 0.20% to the weight of cement. The reduction of the amount of water in this study is 10% of the total amount of water. Specimens in each variation were made using cylinder mold with 15 cm in diameter and 30 cm high. After specimens are created and maintained, testing of compressive strength concrete held in 28 days. The test results show that the trend of average compressive strength has increased along with the addition of Plastiment-VZ percentage. The equation resulting from the average compressive strength is $y = -362.7x^2 + 133.3x + 28.10$ with value $R^2 = 0.969$. The highest average compressive strength value was obtained in the addition of 0.20% Plastiment-VZ at 40.76 MPa. Statistical testing with Analysis of Variance - ANOVA states that there is a very real interaction or treatment between the compressive strength of the concrete with the addition of Plastiment-VZ. So it can be concluded that the reduction of the amount of water with the addition of Plastiment-VZ has an effect on the increasing of concrete compressive strength characteristics.

Keywords: Anova, Concrete, Compressive Strength, Influence, Plastiment-VZ.

1. Introduction
Peatland is a wetland ecosystem formed from the accumulation of organic matter in forest land from vegetation debris over a long period of time. Peat structures are soft and have pores causing it easy to hold water. Peat water has a high color intensity, low pH, high organic content and acid properties.

T. Mulyono (2004), the water required in the manufacture of concrete to trigger a chemical process cement, aggregate wetting and provide convenience in concrete work. Water containing harmful compounds, contaminated with salt, oil, sugar or other chemicals will degrade the quality of concrete and even change the properties of the concrete produced.
Based on these conditions, the condition of peat water does not meet the requirements for use as a mixture of concrete. To meet the water requirement in concrete mix then water must be obtained from other place but it will require cost and bigger time.

To overcome these problems, the advancement of concrete technology has resulted additives which can help in maintaining the quality of concrete. One product output from PT. Sika Indonesia is Plastiment-VZ. Plastiment-VZ is a plasticizer material that can improve the workability of concrete without adding water.

However, for use in the field, the selection of admixture or must be adjusted to the planned concrete situation and condition. Excessive use of additives will also result in uneconomical concrete, given the expensive price of additives.

These conditions, complicate the community both service providers and users of construction services, especially in Riau Province, because it is not yet known clearly the dosage that is suitable with the condition of both cement and aggregate materials available in Riau Province. So to get maximum results that can be applied widely by the community both service providers and users of construction services in Riau Province, research will be needed to analyze the effect of the addition of Plastiment-VZ on the characteristics of concrete in Riau Province.

2. Literary Review

2.1 Water Peat

Peat is an accumulation of organic materials composed of the remains of plants and decaying plant tissue. The peat deposition process generally occurs in the basin area and ultimately forms the deposition of peat water.

Kusnaedi, (2006), Peat water is a surface water that is commonly found in tidal, swampy and lowland areas, with the following characteristics:

a. High color intensity with brownish red
b. Low pH
c. The organic content is very high
d. Turbidity and low suspended particle content
e. Low cation content

2.2 Additive

P. Nugraha dan Antoni, (2007), additive is a material other than water, aggregate and hydraulic cement mixed in concrete or mortar added before or during stirring.

The addition of added ingredients in a concrete or mortar mix does not change the large composition of the other ingredients, Because the use of this added material tends to be a substitute or substitution of the concrete mixture. Because the goal is to improve or change certain properties and characteristics of the resulting concrete or mortar, then the tendency to change the composition in volume weight is not felt directly compared with the initial composition of concrete without added ingredients.

In general, the added materials used in the concrete can be divided into two, namely chemical admixture and mineral additive. S. Aprilianti and Nadia (2012), o produce concrete with low fas but still easy to work then needed added materials. One of them is using the superplasticizer admixture. With the ability to reduce high water use, concrete mixes with added materials are capable of producing higher compressive strength of concrete.

2.3 Plastiment-VZ

According to Technical Data PT. Sika Indonesia (2011), Plastiment-VZ is a concrete plasticizer material and water reducer in large quantities, in accordance with ASTM with accelerated hardening effect, in accordance with ASTM C 494-92 type D.

Plastiment-VZ is used as an additive for various concrete uses where the condition of casting requires high quality concrete. The advantages of Plastiment-VZ will produce the following properties:

a. Accelerate hardening time in hot weather
b. Accelerate hardening after setting
c. Improve workability without adding water
d. Reduces water without loss of workability
e. Improve the quality of concrete
f. Reduce shrinkage
g. Slump loss control lasts longer
h. Better surface finish
i. Chloride free, so as not to damage reinforcement
j. The dosage of Plastiment-VZ is 0.15 – 0.40 to the weight of the cement. The effective dose of Plastiment-VZ depends on cement type and aggregate quality with a general dose of 0.15% - 0.25% for low absorbent concrete to fine aggregate. This dose can be increased up to 0.60% to overcome difficulties in terms of cement or aggregate quality, high temperature and difficult casting conditions. Plastiment-VZ must be mixed first directly into the water mixture after it is aggregated. Characteristics of Plastiment-VZ can be seen in table 1.

| Table 1. Plastiment-VZ characteristics |
|----------------------------------------|
| Technical Data                         |
| Form                                   | Polyhydroxy Carbon Salts |
| Colour                                 | yellow                  |
| Specific gravity                       | 1.17 – 1.19 kg/ltr      |
| Age and Storage                        | Minimum of 1 year if kept in |
| Storage                                | original unopened packaging in a |
2.4 Analysis of Variance

S. Yitnosumarto, (1991), Analysis of Variance (ANOVA) is one hypothesis test on parametric statistics, to test the interaction between two factors in an experiment by comparing the mean of more than two samples. ANOVA was developed by Ronald Fisher (1918) to analyze the diversity of a response and divide it into sections dealing with a known source of diversity and is associated with random error. The known sources of diversity will be associated with the independent variables of the tried (treatment) factors.

Procedure of variance analysis Using single numerical variables measured from a number of samples to test the null hypothesis of a population that (estimated) has the same mean. The variable should be a quantitative variable. This variable is sometimes referred to as a dependent variable.

In the ANOVA test, sample evidence is taken from each population under study. The data obtained from the sample is used to calculate sample statistics. The sampling distribution used to make statistical decisions, ie rejecting or accepting the null hypothesis (H0), is the F Distribution.

In this test it is assumed that all populations under study have the same variant, regardless of whether the populations have the same or different mean count.

3. Data Analysis

3.1 Materials Research

The material used is :

a. Type I Cement (Ordinary Portland Cement - OPC), production of PT. Semen Padang
b. Coarse aggregate or crushed stone from Pangkalan area
c. Fine aggregates from the Teratak Buhu area
d. Water at Batching Plant Laboratory PT. Mekar Abadi Mandiri Jalan Lintas Pekanbaru - Duri Km.62
e. The additives Plastiment-VZ production PT. Sika Indonesia

3.2 The Design of The Test Object

Concrete design using Department of Environment (DOE), with cylinder molds of 150 mm x 300 mm. The compressive strength of the plan is \( f_c = 25 \text{ MPa} \).

The admixture used are Plastiment-VZ. Percentage of Plastiment-VZ addition that is 0%, 0.05%, 0.10%, 0.15% and 0.20% to the weight of cement. The reduction of the amount of water in this study as much as 10% of the composition of the mix design.

Initial research begins by conducting preliminary testing on the material, manufacture of specimens, slump test, stages of concrete treatment for 28 days and compression concrete testing.

3.3 Analysis of Concrete Compressive Strength

Calculation of compressive strength value can be used formula :

\[
\gamma_c = \frac{P_{\text{max}}}{A_c}
\]

where :

\( \gamma_c \) = Concrete Compressive Strength (MPa)

\( P_{\text{max}} \) = Maximum load (N)

\( A_c \) = Surface area (mm\(^2\))

3.4 Data Analysis Method

Analysis of variance would be a valid statistical technique to be applied using the following assumptions:

a. The studied population has a normal distribution.
b. Sampling is done randomly and each sample is independent or not bound by another sample.
c. The populations in which the sample values are obtained have the same population variance values.

| Table 2. Distribution treatment |
|-------------------------------|
| No.  | % Plastiment-VZ | Specimen | 1  | 2  | 3  | Total |
|------|-----------------|----------|----|----|----|-------|
| 1.   | 0               | Y1\(_1\)  | Y1\(_2\) | Y1\(_3\) | Σ \(_{j=3}^{3} Y_j\) |       |
| 2.   | 0.05            | Y2\(_1\)  | Y2\(_2\) | Y2\(_3\) | Σ \(_{j=3}^{3} Y_j\) |       |
3. \(0.10 \quad Y_3_1 \quad Y_3_2 \quad Y_3_3 \quad \sum_{j=1}^{p} Y_j\)

4. \(0.15 \quad Y_4_1 \quad Y_4_2 \quad Y_4_3 \quad \sum_{j=1}^{p} Y_j\)

5. \(0.20 \quad Y_5_1 \quad Y_5_2 \quad Y_5_3 \quad \sum_{j=1}^{p} Y_j\)

\[F_{count} = \frac{KT_{treatment}}{KT_{experiment}}\]  \hspace{1cm} (2)

Where:

- \(KT_{treatment}\) = Middle square treatment
- \(KT_{experiment}\) = Middle square experiment

Distribute \(F\) at a significant level, \(F_{critical} a = 0.05 \) or \(0.01\). If \(F_{count} > F_{table}\), then there is a very real treatment. With note if \(a = 0.05\) called different or significant effect, and if \(a = 0.01\) called different or very significant effect. Data analysis of \(F\) test result can be seen in table 3.

Table 3. Data analysis of \(F\) test result

| SK  | Db | JK | KT | \(F_{ltung}\) |
|-----|----|----|----|-------------|
| Treatment | \((p-1)\) | \(n\sum_{j=1}^{p} (Y_j - Y)^2 = JK_p\) | \(KT_p\) | \(KT_p / KT_G\) |
| Experiment error | \((pn-1)\) | \(\sum_{i=1}^{n} \sum_{j=1}^{p} (Y_{ij} - Y_{i..})^2 = JK_{i..}\) | \(KT_{i..}\) | - |
| Total | \((pn-1)\) | \(\sum_{i=1}^{n} \sum_{j=1}^{p} (Y_{ij} - Y_{i..})^2 = JK_{i..}\) | - | - |

(Source : S. Yitnosumarto, 1991)

4. Results and Discussion

4.1 The compressive strength of the concrete

After testing the specimens with the addition of Plastiment-VZ, then the test result of the compressive strength can be seen in table 4. In Figure 1 shows the value of compressive strength of concrete on each specimen with variation of Plastiment-VZ, while In Figure 2 pada gambar 2 menunjukkan nilai kuat shows the average compressive strength value with the addition variation of Plastiment-VZ.

Table 4. The compressive strength of the concrete

| % Plastiment-VZ | Specimen | Weight (g) | Area (cm²) | Load (kN) | Compressive Strength (MPa) | Average Compressive Strength (MPa) |
|----------------|----------|------------|------------|-----------|---------------------------|----------------------------------|
| 0 | I | 12680 | 176.79 | 520 | 29.99 | 27.49 |
| | II | 12810 | 176.79 | 460 | 26.53 |
| | III | 12860 | 176.79 | 480 | 25.96 |
| 0.05 | I | 12910 | 176.79 | 590 | 34.03 | 35.18 |
| | II | 12980 | 176.79 | 620 | 35.76 |
| | III | 12980 | 176.79 | 620 | 35.76 |
| 0.1 | I | 12840 | 176.79 | 660 | 38.07 | 37.49 |
| | II | 12890 | 176.79 | 670 | 38.65 |
| 0.15 | I | 12950 | 176.79 | 700 | 40.38 | 39.03 |
| | II | 12980 | 176.79 | 660 | 38.07 |
| | III | 12980 | 176.79 | 670 | 38.07 |
| 0.2 | I | 12850 | 176.79 | 720 | 41.53 | 40.76 |
| | II | 12665 | 176.79 | 680 | 39.22 |
| | III | 12750 | 176.79 | 720 | 41.53 |
4.2 Analysis of Variance – ANOVA

Treatment design with mathematical notation can be seen in table 5, while the analysis of variance can be seen in table 6.

From Table F it can be seen that $F_{0.05}^{\text{Table}} = 3.48$ and $F_{0.01}^{\text{Table}} = 5.99$, while $F_{\text{count}} = 35.55$. Because $F_{\text{count}} > F_{\text{Table}}$, there is a very real interaction or treatment on compressive strength of concrete with the addition of Plastiment-VZ.

4.3 Discussion

From the test result on all specimens, the compressive strength of the concrete is higher than the compressive strength of the plan is 25 MPa. The test results show that the trend of average compressive strength of concrete has increased along with the addition of Plastiment-VZ. The equation resulting from the average compressive strength of the concrete is $y = -362.7x^2 + 133.3x + 28.10$ with $R^2 = 0.969$. The highest average compressive strength of the concrete was obtained in the addition of 0.20% Plastiment-VZ at 40.76 MPa.

Statistical testing with Analysis of Variance - ANOVA states that there is a very real interaction or treatment between the compressive strength of the concrete with the addition of Plastiment-VZ. So it can be concluded that the addition of Plastiment-VZ influences the increase of concrete compressive strength characteristics.

### Table 5. Mathematical Notation

| No | % Plastiment-VZ | Sampel 1 | Sampel 2 | Sampel 3 | Sum   |
|----|----------------|----------|----------|----------|-------|
| 1  | 0              | 29.99    | 26.53    | 25.96    | $\sum_{j=1}^{3} Y_{1j} = 82.48$ |
| 2  | 0.05           | 34.03    | 35.76    | 35.76    | $\sum_{j=1}^{3} Y_{2j} = 105.55$ |
Table 6. F Test Results Using Compressive Strength of Concrete

|   | SK  | DB     | JK    | KT    | F_{count} |
|---|-----|--------|-------|-------|-----------|
| Treatment | 4   | 321.36 | 80.34 |
| Experiment error | 10  | 22.63  | 2.26  |
| Total       | 14  | 343.98 | 82.60 |

5. Conclusion

The conclusions are:

a. Statistical testing with Analysis of Variance - ANOVA states that there is a very real interaction or treatment between the compressive strength of the concrete with the addition of Plastiment-VZ.

b. The addition of Plastiment-VZ influences the increase of concrete compressive strength characteristics.

c. The test results show that the trend of average compressive strength of concrete has increased along with the addition of Plastiment-VZ.

d. The equation resulting from the average compressive strength of the concrete is $y = -362.7x^2 + 133.3x + 28.10$ with $R^2 = 0.969$.

e. The highest average compressive strength of the concrete was obtained in the addition of 0.20% Plastiment-VZ at 40.76 MPa.

6. References

[1] T. Mulyono. 2004. Teknologi Beton, Edisi II. Yogyakarta: Andi Offset.

[2] Kusnaedi. 2006. Mengolah Air Gambut dan Kotor Untuk Air Minum. Jakarta: Penebar Swadaya.

[3] P. Nugraha and Antoni. 2007. Teknologi Beton. Yogyakarta: Andi Offset.

[4] S. Aprilianti and Nadia. 2012. “Analisis Pengaruh Beton dengan Bahan Admixture Naphtalene dan Polycarboxilate Terhadap Kuat Tekan Beton Normal”, Jurnal Konstruksi. Vol. 3, No. 2, April 2012. pp. 33 – 40.

[5] PT. Sika Indonesia. 2011. Data Teknis Know-How From Site To Shelf.

[6] S. Yitnosumarto. 1991. Percobaan Perancangan, Analisis Dan Interprestasinya. Jakarta: PT. Gramedia Pustaka Utama.