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# Concrete Compressive Strength, Flexural Strength, Tensile Strength Concrete Grades 25MPa, 30MPa, 35MPa and 40Mpa

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**Abstract**

This paper is studying the value of compressive strength, flexural strength test, tensile strength test, according to the standard 25MPa (ratio cement1:sand1:stone2), 30MPa (ratio cement1: sand1.5:stone1.5), 35MPa (ratio cement1: sand0.75:stone1), and 40MPa (ratio cement1: sand0.25:stone0.75), and by using materials in the central part of the country, especially the province, where the materials used: cement, manufactured from the SAVANNAKHET cement factory , sand and river rocks and the building, (1). For testing the value of compressive strength concrete), size15cmx30 there are 12 samples here: (Concrete Grade 25MPa contains 3 examples, 30MPa concrete with 3 samples, 35MPa concrete with 3 samples, 40MPa concrete with 3 samples 28 days old. (2). For testing the value of tensile strength concrete), size15cmx15cmx15cm there are 12 samples here: (Concrete Grade 25MPa contains 3 examples, 30MPa concrete with 3 samples, 35MPa concrete with 3 samples, 40MPa concrete with 3 samples 28 days old. (3). For testing the value of flexural strength concrete), Size 15cmx15cmx60cm contains 12 samples here: (Concrete Grade 25MPa contains 3 samples, 30MPa concrete with 3 samples, 35MPa concrete with 3 samples, 40MPa concrete with 3 samples 28 days old, for testing the value of tensile strength concrete) given to a Standard AASHTO(American Association of State Highways and Transportation Officials Test), ASTM (American Society for Testing and Materials)... with the age of 28 days respectively, it is then tested with a mechanical machine to find the unit value to analyze the value of compressive strength, flexural strength test, tensile strength test.

**Keywords:** *Compressive strength, flexural strength, tensile strength, Modulus*

## 1. Introduction

The purpose of this research is to study and test the properties of materials before they become concrete by mixing cement, sand, stones, and water to use in the analysis to determine the value: compressive strength, flexural strength, tensile strength, thermal expansion, shrinkage of concrete to know the characteristics and properties of concrete to be used in various construction engineering works and find ways to improve when there are structural problems in construction engineering, which details are as follows;

**Properties of the sand:** The sand used is the sand obtained from the MEKONG river, which is

the located in the NAKAE village, Kaisonphomvihan capital, Savannakhet province, which will test the properties of the sand according to international standards. SIEVE ANALYSIS TEST (SAND) AASHTO T 27 (American Association of State Highways and Transportation Officials Test 27) it will test for fine size or fine grain, coarseness of sand grain and fine modulus of sand grain (Fine modulus) by testing the grain resolution percentage through and through the number 9.5mm, 4.75mm, 1.18mm, 0.30mm, 0.15mm respectively in order to calculate the fine modulus value of sand. The formula is:

$$\text{FM (Fine modulus)} = \frac{\%Retainned\ sieve}{100}$$

(AASHTO T27, 2012)

**Properties of the stone:** The stone used is natural stone with a size smaller than or equal to 5cm according to the standard of the international unit IS (international system) SIEVE ANALYSIS TEST COARSE AGGREGATE (Combine) AASHTO T27 is the MEKONG river stone, located in the NAKAE village, in the KAISONPHOMVIHAN city, Savannakhet province. Which will test the size of the percentage of grains through and through the number 37.5mm, 25.0mm, 19mm, 12.5mm, 9.5mm, 4.75mm and calculate the modulus value of the stone. The formula is:

$$\text{FM (Fine modulus)} = \frac{\%Retainned\ sieve}{100}$$

(AASHTO T27, 2012)

**Characteristics of cement:** Cement is cement produced in Savannakhet Province, cement from Lao Cement Factory, Savannakhet. Portland cement is used for structure. Viscosity index is at PI 52.5 (Plastic Index). (laocement.com, 1999)

**Characteristics of water:** tap water can be used in households by filtering from the Mekong River of the Savannakhet Water city Company, located in NAKAE Village, Kaisonphovihan city, Savannakhet Province (Kownarumit, 2014).

**For the design of concrete mixture** is done according to ACI 211.1 method (American Concrete Institute, 1991)

## 2. Materials and Methods

This test method is used to determine the compressive strength, flexural strength, tensile strength, cylindrical, rectangular, and square concrete blocks.

### 2.1 Data analysis tools

Cement, sand, stone, water, aggregate, Sieve sand and stone, steel hammer, concrete collapse tester, weighing scale, measuring stick, notebook, computer, block-shaped concrete casting, rectangular concrete casting, rectangular concrete casting, Unit Test Machine, flexural Testing Machine, tensile Testing Machine.

### 2.2 Data analysis methods

Slump test: American Society of Testing Materials (ASTM C 143/C 143M) slump test the formula used to calculate: SLUMP) = 30 – H, When H = the height of the tested concrete after lifting the model in centimeters (American Society of Testing Materials, Standard Test Method for Slump of Hydraulic-Cement Concrete1, 2003)

#### 2.2.1 Concrete mix ACI 211.1 (ACI: American Concrete Institute)

The compressive strength of concrete is an important property of hardened concrete which, if not specified otherwise, will be considered the compressive strength test result of concrete at 28 days as the standard test by casting a sample according to the standard: cylinder shape, American standard ASTM C 192 (American Society of Testing Materials, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory1, 2007), the size used is diameter 15cm, high 30 cm. The formula used to calculate (Bayan & Al-Nu'man, 2015)

$$\text{Compressive strength } (f_c') = \frac{Compressive\ read\ (P)}{Area\ (A)}$$

$$(Kgf/cm^2)$$

The tensile strength of concrete is an important property of hardened concrete which, unless otherwise specified, is assumed to be the compressive strength test result of 28 days as a criterion, test by casting a sample according to the standard: rectangular shape, American standard ASTM C 78 (P. J. F. Wright, 2015), the size used is: 15cmx15cmx15cm. The formula used to calculate (Damrongsorn, 2015):

$$\text{Tensile strength } (f_c') = \frac{compressive\ read\ (P)}{width\ x\ depth\ of\ 2\ (bxd^2)} \ (Kgf/cm^2)$$

The flexural strength of concrete is an important property of hardened concrete which, unless otherwise specified, is assumed to be the flexural strength test result of 28 days as a criterion, test by casting a sample according to the standard: beam, American standard ASTM C78 (Wright, 2015), the size used is: 15cmx15cm x60cm. The formula used to calculate (The American Association of State Highway and Transportation Officials. Standard Specification for Highway Materials and Method of Sampling and Testing Part II AASHTO DESIGNATION : T 97, 1997):

$$\text{The module is broken (R)} = \frac{compressive\ read\ x\ length\ \ (Pxl)}{(width\ x\ depth\ of\ 2(bxd^2)} \ (Kgf/cm^2$$

### 2.2.2 Test methods

Material testing

Fine aggregate test: Take a sample of 1,312.6g of sand and grind it through sieves number 9.50mm, 4.75mm, 1.18mm, 0.30mm, 0.15mm and record the value of sieve and sieve respectively to find the percentage of sieve and the percentage of sieve with the following formula: 100% - percent retained (American Association of State Highway and Transportation officials, 2008).

Coarse aggregate test: take 7,195.0 g of stone samples and grind them through sieves number 37.5mm, 25mm, 19mm, 12.5mm, 9.5mm, 4.75mm and record the value of sieve and sieve respectively to find sieve percentage and sieve percentage with the formula: percentage retained= 100%-percentage retained (American Associatio of State Highway and Transportation Officials, 2022).

Coarse aggregate 9.5mm test: bring 2,126.0 g of stone samples to pass through sieves number 37.5mm, 25mm, 19mm, 12.5mm, 9.5mm, 4.75mm and then record the values through the sieve and the sieve respectively to find the sieve percentage and the sieve percentage with the following formula: percentage retained= 100% - percentage retained (American Association of State Highway and Transportatio Officials, 2010).

Coarse aggregate19 mm test: 3,945.6 g of rock sample was passed through sieves number 37.5 mm, 25 mm, 19 mm, 12.5 mm, 9.5 mm, 4.75 mm and then recorded. The sieve and sieve pass values respectively to find the percentage of sieve. and percentage grating with the formula: percentage retained= 100% - percentage retained (Amican Association of State Highway Officials, 2011-2012).

Testing the specific gravity and absorption of fine aggregate according to the standard Specific gravity and absorption of fine aggregate (sand) AASHTO T 84-00 (American Association of State Highway and Transportation Officials, 1984).

Specific gravity and absorption test of coarse aggregate (aggregate) AASHTO T 85-91 (American Concrete Institute, 1991).

Unit weight and voids in fine aggregate test AASHTO T 19 (AASHTO T 19M/T19, 2014).

Unit weight and voids in coarse aggregate test AASHTO T 19 (American Association of State Highway and Transportation officials, CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATE, 2000).

Unit weight and voids in aggregate test (Size 9.5 mm) AASHTO T 19.

Unit weight and voids in aggregate test (Size 19 mm) AASHTO T 19.

### 2.2.3 Concrete testing

Concrete slump test is to mix cement, sand, stone and water with the ratio of concrete grade 25MPa, 30MPa, 35MPa, and 40MPa value as shown in table1, then put it on a concrete mold size 15cmx30cm, 15cmx1 5cmx 15cm and 15cmx15cmx60cm respectively. After casting the concrete, use a hammer to make 35 strokes (The American Association of State Highway and Transportation Officials. Standard Specification for Highway Materials and Method of Sampling and Testing Part II AASHTO DESIGNATION : T 97, 1997).

Concrete compressive strength test casting concrete sample size 15cmx30cm, 12 samples are: 3 samples of concrete grade 25MPa, 3 samples of concrete grade 30MPa, 3 samples of concrete grade 35MPa, and 3 samples of concrete grade 40MPa. Measure the size of the 12 samples and bring them to the test with a Unit Weight Machine with a scale to record the readable values to calculate the concrete compressive strength (AASHTO T22, 2017) and modulus (Tran Van Quana, 2023).

Concrete Tensile Test Casting Concrete Sample Size 15cmx15cmx15cm, 12 samples are: 3 samples of concrete grade 25MPa, 3 samples of concrete grade 30MPa, and 3 samples of concrete grade 35MP, and 3 samples of concrete grade 40MPa. Measure the size of the 12 samples and bring them to the test with a Unit Weight Machine with a scale to record the readable values to calculate the concrete compressive strength (AASHTO T22, 2017).

Concrete flexural strength test Cast concrete samples, size 15cmx15cmx60cm, 12 samples are: 3 samples of concrete grade 25MPa, 3 samples of concrete grade 30MPa, and 3 samples of concrete grade 35MPa, and 3 samples of concrete grade 40MPa. Measure the size of the 12 samples and bring them to the test with a Unit Weight Machine with a scale to record the readable values to calculate the concrete compressive strength (AASHTO T 97, 2018).

## 3. Result

Fine aggregate testing Percentage of passing by number of points: 9.50 mm = 100%, 4.75 mm = 98.8%, 1.18 mm = 92.8%, 0.30 mm = 16.3%, 0.15 mm = 1.6%, which Target standards are 9.50 mm = 100%, 4.75 mm = 95-100%, 1.18 mm = 45 -80%, 0.30 mm = 10-30%, 0.15 mm = 2-10%. , Calculated modulus: FM = 1.90.

Coarse aggregate testing of percentage passing numbers: 37.5 mm = 100%, 25 mm = 100%, 19 mm = 98%, 12.5 mm = 98%, 9.5 mm = 40.3%, 4.75 mm = 1% which standard set is 37.5 mm = 100%, 25 mm = 100%, 19 mm = 95 -100%, 12.5 mm = 95-100%, 9.5 mm = 20-55%, 4.75 mm = 0-15%, calculated module: FM = 1.63.

Coarse aggregate Testing (size 9.5 mm) through sieve according to sieve number: 37.5 mm = 100%, 25 mm = 100%, 19 mm = 100%, 12.5 mm = 99.8%, 9.5 mm = 40%, 4.75 mm = 1.1%, where the specified standards are 37.5 mm = 100%, 25 mm = 100%, 19 mm = 95-100%, 12.5 mm = 95-100%, 9.5 mm = 20-55%, 4.75 mm = 0-15%, Calculated module: FM=1.

Coarse aggregate Testing (size 19 mm) according to the number: 37.5 mm = 100%, 25 mm = 100%, 19 mm = 96%, 12.5 mm = 96%, 9.5 mm = 1.9%, 4.75 mm = 0.3% which is standard 37.5 mm = 100%, 25 mm = 100%, 19 mm = 95-100%, 12.5 mm = 95-100%, 9.5 mm = 20-55%, 4.75 mm = 0-15%, calculated state module: FM = 2.06

The specific gravity and adsorption test of fine aggregate was: specific gravity 2.60g/cm3 and percentage adsorption of fine aggregate 1.05%.

The specific gravity and coarse aggregate adsorption test was: specific gravity 2.70g/cm3, coarse aggregate adsorption 0.47%.

The unit weight and voids in fine aggregate test gap are: Unit weight 1.47 g/cm3 and fine aggregate test gap 1.34 g/cm3.

The unit weight and voids in coarse aggregate test: Unit weight 1.59g/cm3 and coarse aggregate test gap 1.45g/cm3.

The unit weight and voids in coarse aggregate test (size 9.5mm) are: Unit weight 1.49g/cm3 and coarse aggregate test area 1.44g/cm3.

The unit weight and voids in coarse aggregate test (size 19mm) are: Unit weight 1.51g/cm3 and coarse aggregate test area 1.45g/cm3.

Compressive strength of concrete grade 25Mpa, sample 1: 28.93Mpa, sample 2: 28.70Mpa and sample 3: 29.78Mpa, concrete grade 30Mpa. Sample 1: 40.48Mpa, sample 2: 40.70Mpa and sample 3: 40.87Mpa, concrete grade 35Mpa. Sample 1: 46.71Mpa, Sample 2: 47.65Mpa and Sample 3: 46.54Mpa, concrete grade 40Mpa. Sample 1: 53.24Mpa, Sample 2: 52.05Mpa and Sample 3: 52.11Mpa.

Tensile strength of concrete grade 25Mpa, sample 1: 32.19Mpa, sample 2: 32.97Mpa and sample 3: 32.10Mpa, concrete grade 30Mpa. Sample 1: 43.08Mpa, sample 2: 42.99Mpa and sample 3: 42.99Mpa, concrete grade 35Mpa. Sample 1: 48. 24Mpa, Sample 2: 48.02Mpa and Sample 3: 48.11Mpa, concrete grade 40Mpa. Sample 1: 54. 37Mpa, Sample 2: 54.24Mpa and Sample 3: 54.20Mpa

Flexural strength of concrete grade 25Mpa, sample 1: 3.53Mpa, sample 2: 3.51Mpa and sample 3: 3.56Mpa, concrete grade 30Mpa sample 1: 4.03Mpa, sample 2: 4.13Mpa and sample 3: 4.20Mpa, grade sample 35Mpa concrete 1: 4.52Mpa, sample 2: 4.59Mpa and sample 3: 4.67Mpa, and grade sample 40Mpa concrete 1: 5.06Mpa, sample 2: 5.14Mpa and sample 3: 5.20Mpa

## 4. Discussion

The highlight of this research is the compressive strength, tensile strength, tensile strength and modulus of 28-day concrete using Lao red bull cement, rock and sand from Mekong River in the concrete mix proportions of (1: 1:2), (1:0.75:1.5), (1:0.5:1) and (1:0.25:0.75) as follows:

For the analysis and calculation results of the compressive strength that occurred according to the mixing ratio of 296.99 kg/cm$^2$, 414.72 kg/cm$^2$, 478.79 kg/cm$^2$ and 542.70 kg/cm$^2$, respectively, it can be seen that there is no value. It is considered to be within the criteria when compared to the standard (Specifications for Construction and Acceptance of Portland Cement Concrete Pavement for Highway, TCCS 39-2022: Tieu Chuan Co So 39-year 2022 page 11) that specifies that the compressive strength of concrete at 28 days must be greater than or equal to 101.94kg/cm$^2$($R_{28\ days}^{compressive} \geq 101.94 kg/cm2$ ) (TCCS 39, 2022)It is considered to pass the criteria or give a value higher than the standard, which is considered to be used and it can be seen that it is consistent when compared to research journals. “Study of properties, compressive strength and flexural strength of concrete mixed with ceramic waste”, the research results showed that the concrete compressive strength was 210 kg/cm$^2$, 240 kg/cm$^2$, 280 kg/cm$^2$ (Amnuaypornlert, 2017).

For the analysis and calculation results of the modulus at the ratios of 260, 255.55 kg.cm$^2$, 307, 540.57 kg.cm$^2$, 330, 443.83 kg.cm$^2$, and 351, 808.66kg.cm$^2$ respectively, the obtained values did not decrease or change much. It is considered consistent when compared with the research journal “Evaluation of factors affecting the compressive strength and elastic modulus of rubber aggregate concrete using machine learning models” (Tran Van Quana, 2023).

For the analysis and calculation of the flexural strength according to the mixing ratio of 35.98kg/cm$^2$, 41.99kg/cm$^2$, 46.78kg/cm$^2$, and 52.29kg/cm$^2$ respectively, it is considered that the

value does not decrease and does not increase much. It is within the criteria when compared with the standard (Specifications for the Construction and Acceptance of Portland Cement Concrete Pavements for Highways TCCS 39-2022: Tieu Chuan Co So 39, 2022, page 11). It states that the flexural strength of concrete aged 28 days must be greater than or equal to 25.48kg/cm$^2$ ($(f_{28\,days}^{flexural} \geq 25.48kg/cm2)$ (TCCS 39, 2022). It is considered to pass the criteria or give a value higher than the standard, it is considered to be used and it is considered consistent when compared with the research journal "Behavior and Methods for Calculating the Flexural Strength of Fiber-Reinforced Concrete Beams" (Lecturer, 2007)

For the analysis and calculation of the tensile strength according to the ratio of the mixture 3 2 7 . 0 7 kg/cm$^2$ , 4 3 8 . 5 5 kg/cm$^2$ , 490.5kg/cm2 and 553.2kg/cm$^2$ respectively can be seen That the value does not decrease and does not decrease or change a lot is considered to be within the criteria (Specifications for Construction and Acceptance of Portland Cement Concrete Pavement for Highway, TCCS 39-2022: Tieu Chuan Co So 39-year 2022 page 11) that specifies that the compressive strength of concrete at 28 days must be greater than or equal to 101.94kg/cm$^2$($R_{28\,days}^{compressive} \geq 101.94kg/cm2$) (TCCS 39, 2022)It is considered to pass the criteria or give a value higher than the standard, which is considered to be used and it can be seen that it is consistent when compared to research journals. “Study of properties, compressive strength and flexural strength of concrete mixed with ceramic waste”, the research results showed that the concrete compressive strength was 210 kg./cm$^2$, 240 kg/cm$^2$, 280 kg/cm$^2$ (Amnuaypornlert, 2017).

## 5. Conclusion

From the experimental results, the following conclusions can be that:

The average compressive strength of the samples (1-3) is 29.10, (4-6) is: 40.70, (7-9) is: 47.00, (10-12) is: 53.24 mega pascal, and modulus value of the samples (1-3) is 25,531.07, (4-6) is 30,169.73 , (7-9) is 32,416.54 , and (10-12) is 34,512.43 mega pascal respectively as show in table1.

The average tensile strength of the samples (1-3) is: 32.10, (4-6) is: 43.00, (7-9) is: 48.10a, and (10-12) is: 54.30 mega pascal, respectively as show in table2

The average flexural strength of the samples (1-3) is: 3.53, (4-6) is 4.12, (7-9) is 4.59, and (10-12) is 5.13mega pascal respectively as show in table3.

## 6. Conflict of Interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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Table1. Concrete compressive strength and modulus test AASHTO T22

| COMPRESSIVE STRENGTH AND MODULUS CONCRETE TEST AASHTO T22 CONCRETE CLASS 25, 30, 35, 40Mpa | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Age | Concrete class | Size,cm | | Weight | Load | | Resistance | | Modulus | Average | | Modulus |
| No. | day | | D | H | g | KN | Kgf | Kgf/cm2 | Mpa | Mpa | Kgf/cm2 | Mpa | Mpa |
| 1 | 28 | 25Mpa | 15 | 30 | 12,214.00 | 511.00 | 52,107.74 | 294.88 | 28.93 | 25,440.07 | 296.99 | 29.1 | 25,531.07 |
| 2 | 28 | | 15 | 30 | 12,243.00 | 507.00 | 51,699.85 | 292.57 | 28.70 | 25,340.23 | | | |
| 3 | 28 | | 15 | 30 | 12,278.00 | 526.00 | 53,637.32 | 303.53 | 29.78 | 25,810.50 | | | |
| 4 | 28 | 30Mpa | 15 | 30 | 12,214.00 | 715.00 | 72,910.05 | 412.60 | 40.48 | 30,092.64 | 414.72 | 40.7 | 30,169.73 |
| 5 | 28 | | 15 | 30 | 12,243.00 | 719.00 | 73,317.94 | 414.91 | 40.70 | 30,176.76 | | | |
| 6 | 28 | | 15 | 30 | 12,278.00 | 722.00 | 73,623.86 | 416.64 | 40.87 | 30,239.61 | | | |
| 7 | 28 | 35Mpa | 15 | 30 | 12,339.00 | 825.20 | 84,147.38 | 476.19 | 46.71 | 32,328.52 | 478.79 | 47.0 | 32,416.54 |
| 8 | 28 | | 15 | 30 | 12,305.00 | 841.70 | 85,829.92 | 485.71 | 47.65 | 32,650.07 | | | |
| 9 | 28 | | 15 | 30 | 12,340.00 | 822.20 | 83,841.46 | 474.46 | 46.54 | 32,269.74 | | | |
| 10 | 28 | 40Mpa | 15 | 30 | 13,434 | 940.00 | 95,853.77 | 542.70 | 53.24 | 34,512.43 | 542.70 | 53.24 | 34,512.43 |
| 11 | 28 | | 15 | 30 | 13,176 | 919.00 | 93,712.36 | 530.57 | 52.05 | 34,124.55 | | | |
| 12 | 28 | | 15 | 30 | 13,260 | 920.00 | 93,814.33 | 531.15 | 52.11 | 34,143.20 | | | |

Table2. Concrete compressive tensile strength test AASHT T22

| CONCRETE COMPRESSIVE TENSILE STRENGTH TEST AASHTO T22 CONCRETE CLASS 25, 30, 35, 40 Mpa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Age | Concrete class | Size,cm | | | Weight | Load | | Resistance | Average | |
| No. | day | | L | W | H | g | KN | Kgf | Kgf/cm2 | Kgf/cm2 | Mpa |
| 1 | 28 | 25Mpa | 15 | 15 | 15 | 8,480.00 | 724.00 | 73,827.80 | 328.12 | 327.07 | 32.1 |
| 2 | 28 | | 15 | 15 | 15 | 8,500.00 | 719.00 | 73,317.94 | 325.86 | | |
| 3 | 28 | | 15 | 15 | 15 | 8,510.00 | 722.00 | 73,623.86 | 327.22 | | |
| 4 | 28 | 30Mpa | 15 | 15 | 15 | 8,350.00 | 969.00 | 98,810.96 | 439.16 | 438.55 | 43.0 |
| 5 | 28 | | 15 | 15 | 15 | 8,250.00 | 967.00 | 98,607.02 | 438.25 | | |
| 6 | 28 | | 15 | 15 | 15 | 8,200.00 | 967.00 | 98,607.02 | 438.25 | | |
| 7 | 28 | 35Mpa | 15 | 15 | 15 | 8,130.00 | 1,085.00 | 110,639.73 | 491.73 | 490.5 | 48.1 |
| 8 | 28 | | 15 | 15 | 15 | 8,160.00 | 1,080.00 | 110,129.87 | 489.47 | | |
| 9 | 28 | | 15 | 15 | 15 | 8,000.00 | 1,082.00 | 110,333.81 | 490.37 | | |
| 10 | 28 | 40Mpa | 15 | 15 | 15 | 8,587.00 | 1,223.00 | 124,711.88 | 554.28 | 553.2 | 54.3 |
| 11 | 28 | | 15 | 15 | 15 | 8,409.00 | 1,220.00 | 124,405.96 | 552.92 | | |
| 12 | 28 | | 15 | 15 | 15 | 8,569.00 | 1,219.00 | 124,303.99 | 552.46 | | |

Table 3. Concrete compressive flexural strength test AASHT T97

| CONCRETE FLEXURAL TEST AASHTO T97 ASTM C78-84, CONCRETE CLASS 25, 30, 35, 40 Mpa | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Age | Concrete class | Size, cm | | | | Weight | Load | | Resitanc | Average | |
| No. | day | | L0 | L | b | d | g | KN | Kgf | Kgf/cm2 | Kgf/cm2 | Mpa |
| 1 | 28 | 25Mpa | 60 | 45 | 15 | 15 | 32,044.50 | 26.50 | 2,702.26 | 36.03 | 36.03 | 3.53 |
| 2 | 28 | | 60 | 45 | 15 | 15 | 32,043.10 | 26.30 | 2,681.87 | 35.76 | | |
| 3 | 28 | | 60 | 45 | 15 | 15 | 32,046.00 | 26.70 | 2,722.66 | 36.30 | | |
| 4 | 28 | 30Mpa | 60 | 45 | 15 | 15 | 32,024.30 | 30.20 | 3,079.56 | 41.06 | 42.01 | 4.12 |
| 5 | 28 | | 60 | 45 | 15 | 15 | 32,024.60 | 31.00 | 3,161.14 | 42.15 | | |
| 6 | 28 | | 60 | 45 | 15 | 15 | 32,023.90 | 31.50 | 3,212.12 | 42.83 | | |
| 7 | 28 | 35Mpa | 60 | 45 | 15 | 15 | 32,003.10 | 33.90 | 3,456.85 | 46.09 | 46.82 | 4.59 |
| 8 | 28 | | 60 | 45 | 15 | 15 | 32,002.30 | 34.40 | 3,507.84 | 46.77 | | |
| 9 | 28 | | 60 | 45 | 15 | 15 | 32,001.90 | 35.00 | 3,569.02 | 47.59 | | |
| 10 | 28 | 40Mpa | 60 | 45 | 15 | 15 | 32,206.00 | 45.50 | 4,639.73 | 51.55 | 52.31 | 5.13 |
| 11 | 28 | | 60 | 45 | 15 | 15 | 32,281.00 | 46.20 | 4,711.11 | 52.35 | | |
| 12 | 28 | | 60 | 45 | 15 | 15 | 32,239.00 | 46.80 | 4,772.29 | 53.03 | | |