

**REGIONAL LABORATORY**  
**R.W.D, MUZAFFARPUR**

**GRADATION TEST OF** GSB Gr.I

Name of works:- Constn of Road from Bhasar to Madaripur Road  
(Nathuni Mehta House) to Nadaf Tola under  
M.M.G.SY in Bajpatti Block

Name of Division:- R.W.D, Works Division Pupri Date of Collection 01.07.2020

Name of Agency :- Ram Vishwas Ray Date of Test 03.07.2020

Agreement No :- 18/SBD/2019-20 Package No:- M.M.G.SY

Ref:- (PIU) A.E, R.W.D, Works Sub Div. Bajpatti LT. No:- 276/Enc./Dt.26.06.2020

| SL. No. | Sieve No. mm | Weight Retained (KG) | % Wt. of Retained                 | Cumulative % Retained | % of passing | Required Limit % | Remarks     |
|---------|--------------|----------------------|-----------------------------------|-----------------------|--------------|------------------|-------------|
| 1       | 2            | 3                    | 4                                 | 5                     | 6            | 7                | 8           |
|         |              |                      | <u>CH. 225 M.</u>                 |                       |              |                  |             |
|         |              |                      | <u>Wt. of Sample - 24.208 Kg.</u> |                       |              |                  |             |
|         | 75           | NIL                  | NIL                               | NIL                   | 100          | 100              |             |
|         | 26.5         | 8.207                | 33.90                             | 33.90                 | 66.10        | 55-75            |             |
|         | 4.75         | 8.432                | 34.83                             | 68.73                 | 31.27        | 10-30            |             |
|         | 0.075        | 7.309                | 30.19                             | 98.92                 | 1.08         | < 10             | Permissible |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |
|         |              |                      |                                   |                       |              |                  |             |

Memo No:- 838 Date:- 03/7/20

Copy forwarded to – Executive Engineer  
R.W.D, Works Division Pupri

2146/12  
2.7.20  
L.A

03/07/20  
A.E

2146/12  
3.7.20  
E.E

R.W.D  
REGIONAL LABORATORY  
MUZAFFARPUR

**REPORT ON**  
**CONCRETE MIX DESIGN (M-30)**  
**FOR THE PROPOSED**  
**Construction of Road from " Bhasar Madaripur Raod (Nathuni**  
**Mehta House) to Nadaf Tola " Under MMGSY**  
**BLOCK- BAJPATTI, DISTRICT- SITAMARHI, STATE- BIHAR**

**SUBMITTED TO:**  
**ASSISTANT ENGINEER**  
**RWD WORKS SUB DIVISION BAJPATTI**

**Agency:**  
Ram Vishwas Ray  
Add- Kumhra Vishanpur, Ward No-16,  
Dumra, Sitamarhi



**TESTING DONE BY**  
**OM SAI CONSULTANTS**

**(AN ISO 9001:2015 & ISO/IEC 17025: 2017 CERTIFIED, NABL ACCREDITED LAB)**  
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# NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2 The additions such as fly ash or ground granulated blast furnace slag may be taken in the concrete composition with respect to the cement and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part-1) and IS 455 respectively. 2 Minimum grade for plain concrete under mild exposure condition is not specified.

Therefore Required cement content = 373.81 kg (greater than above three) per  $\text{m}^3$  of fresh concrete.

## 7 Determination of coarse and fine aggregate

$$V = \left[ W + \frac{C}{S_c} + \frac{1}{p} \cdot \frac{f_a}{S_{sa}} \right] \times \frac{1}{1000} \quad \text{and}$$

$$V = \left[ W + \frac{C}{S_c} + \frac{1}{1-p} \cdot \frac{c_a}{S_{sa}} \right] \times \frac{1}{1000}$$

where

V = absolute volume of fresh concrete, which is equal to gross volume ( $\text{m}^3$ ) minus the volume of entrapped air.

W = mass of water (kg) per  $\text{m}^3$  of concrete.

C = mass of cement (kg) per  $\text{m}^3$  of concrete.

$S_c$  = specific gravity of cement.

p = ratio of fine aggregate to total aggregate by absolute volume.

$f_a, c_a$  = total masses of fine aggregate and coarse aggregate (kg) per  $\text{m}^3$  of concrete respectively, and

$S_{sa}, S_{sc}$  = specific gravities of saturated surface dry fine aggregate and coarse aggregate respectively.

i. Coarse aggregate

Here, V = 0.98 C = 373.81  $S_c$  = 3.14 p = 0.297  
 $S_{sa}$  = 2.75  $S_{sc}$  = 2.6

$$0.98 = [153.264 + 373.81/3.14 + (1/0.703) \times (ca/2.75)] \times 1/1000$$

$$ca = 1368.14 \text{ kg/m}^3$$

ii. Fine aggregate

$$0.98 = [153.264 + 373.81/3.14 + (1/0.297) \times (fa/2.6)] \times 1/1000$$

$$fa = 546.48 \text{ kg/m}^3$$

Quantities per  $\text{m}^3$

| Water (kg) | Cement (kg) | Coarse aggregate (kg) | Fine aggregate (kg) |
|------------|-------------|-----------------------|---------------------|
| 153.26     | 373.81      | 1368.14               | 546.48              |
| 0.410      | 1.0         | 3.66                  | 1.46                |

FOR ONE BAG OF CEMENT

|                         |       |          |
|-------------------------|-------|----------|
| Water -                 | 20.5  | kg       |
| Coarse aggregate -      | 183.0 | kg       |
| 20 mm size (60%) =      | 109.8 | kg       |
| 10 mm size (40%) =      | 73.2  | kg       |
| sand [fine aggregate] = | 73.1  | kg (dry) |

Adjustment in water for water absorption

$$\text{Total Wt. of water} = 20.5 + 183 \times 0.55\% + 73.1 \times 1.16\% = 22.4 \text{ kg}$$

Considering 2% free water in sand

$$\text{So net water} = 22.35 - 73.1 \times 2\% = 20.9 \text{ kg}$$

Or 20.9 litre

So for one bag of cement

Coarse aggregate - 183.0 kg

Sand = 73.1 kg (dry)

Water = 20.9 litre



## 5 Selection of water and sand content

From table - 4, of IS 10262, for 20 mm nominal size chips water is  
sand percentage for Zone II sand = 35 %

186 kg/m<sup>3</sup> and

For change in values in water cement ratio compacting factor and sand Zone III,  
the following adjustment as required.

| Change in Condition                                                        | Water content                       |
|----------------------------------------------------------------------------|-------------------------------------|
| (a) For decrease in w.c. ratio by<br>(0.6 - 0.41) that is 0.19             | 0 3.8                               |
| (b) For sand zone conforming<br>to sand Zone III of<br>Table - 4 of IS 383 | 0 1.5                               |
| (c) For increase in compacting factor<br>by (0.9-0.8) that is 0.1          | $\frac{3}{3\%} \quad \frac{0}{5.3}$ |
| Therefore required sand content =                                          | 35-5.3 = 29.7                       |
| water content = 186 kg + 3 %                                               | 191.58 kg                           |

## 6 Determination of Cement Content

|             |           |
|-------------|-----------|
| W/C ratio = | 0.41      |
| Water =     | 191.58 kg |
| Cement =    | 467.27 kg |

Superplasticizer used here is **CONPLAST SP430BH** of Fosroc Chemicals  
(India) Pvt. Ltd., H.O. Vishnu Chittam, No. 10, 2<sup>nd</sup> Floor, Sirur Park B Street,  
Seshadripuram, Bangalore 560020 (website: www.fosroc.com). Water content  
is to be reduced up to 25% as per the brochure of **CONPLAST SP430BH** of  
Fosroc Chemicals (India) Pvt. Ltd.

As per IS: 9103 - 1999 for the reduction of water content up to 20 %  
after application of the superplasticizer/admixtrue by 0.6% by weight of cement one gets.  
Reduced water content = 153.264 litre/m<sup>3</sup> of fresh concrete.

### Determination of cement content

|          |                                      |
|----------|--------------------------------------|
| w/c =    | 0.410                                |
| w =      | 153.26 litre/m <sup>3</sup>          |
| Cement = | 373.81 kg per cum of fresh concrete. |

As Per IS 456 : 2000 Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum  
Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum

(Clauses 6.1.2, 8.2.4.1 and 9.1.2)

| Sl<br>No. | Exposure    | Plain Concrete                                    |                                        |                                 | Reinforced Concrete                               |                                        |                                 |
|-----------|-------------|---------------------------------------------------|----------------------------------------|---------------------------------|---------------------------------------------------|----------------------------------------|---------------------------------|
|           |             | Minimum<br>Cement<br>Content<br>kg/m <sup>3</sup> | Maximum<br>Free Water-<br>Cement Ratio | Maximum<br>Grade of<br>Concrete | Minimum<br>Cement<br>Content<br>kg/m <sup>3</sup> | Maximum<br>Free Water-<br>Cement Ratio | Minimum<br>Grade of<br>Concrete |
| (1)       | (2)         | (3)                                               | (4)                                    | (5)                             | (6)                                               | (7)                                    | (8)                             |
| i)        | Mild        | 220                                               | 0.60                                   | -                               | 300                                               | 0.55                                   | M 30                            |
| ii)       | Moderate    | 240                                               | 0.60                                   | M 15                            | 300                                               | 0.50                                   | M 35                            |
| iii)      | Severe      | 250                                               | 0.50                                   | M 20                            | 320                                               | 0.45                                   | M 30                            |
| iv)       | Very severe | 280                                               | 0.45                                   | M 20                            | 340                                               | 0.45                                   | M 35                            |
| v)        | Extreme     | 280                                               | 0.40                                   | M 25                            | 360                                               | 0.40                                   | M 40                            |



**Table 2 ( Single-Sized Aggregate of Nominal size 10 mm)**

| 10 mm wt. 10.00 kg |                   | Total                        |            | 10000 gm  |                           |
|--------------------|-------------------|------------------------------|------------|-----------|---------------------------|
| Sieve (mm)         | Wt. Retained (gm) | Cumulative wt. Retained (gm) | Retained % | % passing | As per IS-383 (% passing) |
| 20                 | 0                 | 0                            | 0          | 100       | 100                       |
| 12.5               | 0                 | 0                            | 0          | 100       | 100                       |
| 10                 | 480               | 480                          | 4.8        | 95.2      | 85-100                    |
| 4.75               | 7948              | 8428                         | 84.28      | 15.72     | 0-20                      |
| 2.36               | 1295              | 9723                         | 97.23      | 2.77      | 0-5                       |
| Pan                | 277               | 10000                        | 100        | -         | -                         |

**Table 3 ( Graded Aggregate of Nominal size 20 mm)**

( After mixing 20 mm single- Sized (60%) and 10 mm single- sized (40%) Aggregate

|            |                   | Total                        |            | 10000 gm  |                           |
|------------|-------------------|------------------------------|------------|-----------|---------------------------|
| Sieve (mm) | Wt. Retained (gm) | Cumulative wt. Retained (gm) | Retained % | % passing | As per IS-383 (% passing) |
| 40         | 0                 | 0                            | 0          | 100       | 100                       |
| 20         | 373               | 373                          | 3.73       | 96.27     | 95-100                    |
| 10         | 4863              | 5236                         | 52.36      | 47.64     | 25-55                     |
| 4.75       | 3987              | 9223                         | 92.23      | 7.77      | 0-10                      |
| Pan        | 777               | 10000                        | 100.00     | -         | -                         |

Conforms to IS 383 for 20 mm graded chips.

(vii)

Sieve analysis of sand **Koilwar****Table 4 SAND TAKEN 2000 gm**

| Sieve (mm) | Wt. Retained (gm) | Cumulative wt. Retained (gm) | Retained % | % passing | As per IS-383 % passing for |             |              |             |
|------------|-------------------|------------------------------|------------|-----------|-----------------------------|-------------|--------------|-------------|
|            |                   |                              |            |           | Gr. Zone I                  | Gr. Zone II | Gr. Zone III | Gr. Zone IV |
| 10         | 0                 | 0                            | 0          | 100       | 100                         | 100         | 100          | 100         |
| 4.75       | 82                | 82                           | 4.10       | 95.9      | 90 - 100                    | 90 - 100    | 90-100       | 95 - 100    |
| 2.36       | 182               | 264                          | 13.20      | 86.8      | 80 - 95                     | 75 - 100    | 85-100       | 95 - 100    |
| 1.18       | 192               | 456                          | 22.80      | 77.2      | 30 - 70                     | 55 - 90     | 75-100       | 90 - 100    |
| 0.5        | 312               | 768                          | 38.40      | 61.6      | 15 - 34                     | 35 - 59     | 60-79        | 80 - 100    |
| 0.3        | 670               | 1438                         | 71.90      | 28.1      | 5 - 20                      | 8 - 30      | 12-40        | 15 - 50     |
| 0.15       | 518               | 1956                         | 97.80      | 2.2       | 0 - 10                      | 0 - 10      | 0-10         | 0 - 15      |
| Pan        | 44                | 2000                         | 100.0      | 0         | -                           | -           | -            | -           |

Fineness Modulus of Sand = 2.48

Hence conforms to zone III of IS - 383

**3 Target mean strength concrete :**

For quality control and M - concrete

Standard Deviation as per table - 1 of IS-10262 - 2009 =

5

So for M -

Target mean strength  $f_{ck}$ 

=

$$f_{ck} + 1.65 \times S$$

=

$$30 + 1.65 \times 5$$

$$\text{Say } 38 \text{ N / mm}^2$$

$$38.25 \text{ N / mm}^2$$

**4 Selection of Water Cement Ratio**

From fig. 1 of IS 10262

For target mean strength of 38 N/mm<sup>2</sup>

IS 456 Maximum Water Cement Ratio

Water cement ratio =

0.45

0.410





## Mix Design of M - 30

(With Super Plasticizer)

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GEOTECHNICAL, MATERIALS TESTINGS, SURVEY, DPR, ERT & NDT  
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—CONCRETE MIX DESIGN—

|                                                                                              |                                                  |
|----------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>Report No:</b> OSC/MIX/151219/03                                                          | <b>Date of Receiving:</b> 13.11.2019             |
| <b>Job Description:</b> Concrete Mix Design M-30<br>with O.P Cement 43 Grade and Plasticizer | <b>Date of Testing:</b> 13.11.2019 to 15.12.2019 |
| <b>Letter No:</b> 0/Camp-Bajpatti                                                            | <b>Date of Reporting:</b> 15.12.2019             |

### 1. PROTOCOL IS: 10262:2009 & SP-23 GUIDELINE & MORTH

The method of concrete mix design consists of selection of optimum proportion of water, cement, fine/coarse aggregate & admixture to produce concrete of specified properties most economically. The proportion of concrete mix is obtained experimentally evolved relationship between the factors in the choice of mix design.

It provides reasonably accurate guide to arrive at an optimum proportion of ingredients. The final mix proportion is obtained on the basis of trial mix. The mix design has been carried out as per IS:10262 guideline keeping in the view. The recommended mix design deviation and targeted mean strength. The recommended mix proportion should be tested at site their workability and strength.

|    |                                                       |                         |
|----|-------------------------------------------------------|-------------------------|
| 1  | Grade of Concrete                                     | M-30                    |
| 2  | Characteristic Strength At 28 Days, N/mm <sup>2</sup> | 30.0 N/mm <sup>2</sup>  |
| 3  | Targeted Strength At 28 Days, N/mm <sup>2</sup>       | 38.25 N/mm <sup>2</sup> |
| 4  | Degree of Quality Control                             | Good                    |
| 5  | Exposure Condition                                    | Severe                  |
| 6  | Degree of workability                                 | 0.9 Compacting Factor   |
| 7  | Slump Required                                        | (75-85) mm              |
| 8  | Nominal Size of Aggregate                             | 20 mm                   |
| 9  | Type of Cement                                        | O.P.C - 43 grade        |
| 10 | Minimum Cement Content                                | 320 kg/m <sup>3</sup>   |
| 11 | Admixture Type                                        | Plasticizer             |

### 2. Test data of materials

|       |                                                |        |
|-------|------------------------------------------------|--------|
| (i)   | Cement used OPC (43 Grade)                     |        |
| (a)   | Specific gravity of cement                     | 3.14   |
| (ii)  | Specific gravity of coarse aggregate           | 2.75   |
| (iii) | Specific gravity of sand                       | 2.60   |
| (iv)  | Water absorption of coarse aggregate           | 0.55 % |
| (v)   | Water absorption of sand                       | 1.16 % |
| (vi)  | Sieve analysis of coarse aggregate Mirzachauki |        |

Table 1 (Single-Sized Aggregate of Nominal size 20 mm)

Wt - 10.00 kg Total 10000 gm

| Sieve (mm) | Wt. Retained (gm) | Cumulative wt. Retained (gm) | Retained % | % passing | As per IS-383 (% passing) |
|------------|-------------------|------------------------------|------------|-----------|---------------------------|
| 40         | 0                 | 0                            | 0          | 100       | 100                       |
| 20         | 622               | 622                          | 6.22       | 93.78     | 85-100                    |
| 10         | 7785              | 8407                         | 84.07      | 15.93     | 0-20                      |
| 4.75       | 1346              | 9753                         | 97.53      | 2.47      | 0-5                       |
| Pan        | 247               | 10000                        | 100        | -         | -                         |







... LABORATORY

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Doc. No.: OSC/7.8/F-01

## TEST REPORT

Mix Design of M - 30  
(With Super Plasticizer)

Dated &gt; 15.12.2019

To,  
Assistant Engineer  
RWD Works Sub Division, Bajpatti

Project Name :- Construction of Road from "Bhasar Madaripur Raod (Nathuni Mehta House)  
to Nadaf Tola " Under MGSY R.W.D Works Division Pupri in Block Bajpatti District  
Sitamarhi.

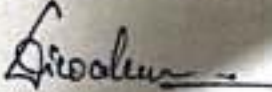
Agreement No :- 11/SBD/2019-20, Dated > 07.11.2019

| Quantities per m <sup>3</sup> |             |                       |                     |
|-------------------------------|-------------|-----------------------|---------------------|
| Water (kg)                    | Cement (kg) | Coarse aggregate (kg) | Fine aggregate (kg) |
| 153.26                        | 373.81      | 1368.14               | 546.48              |
| 0.410                         | 1.0         | 3.66                  | 1.46                |

Size no. of Cubes were Casted on 17.11.2019 (7 days & 28 Days) Compressive Strength are tabulated below.

| Sample no. | 7 days Comp.Strength (N/mm <sup>2</sup> ) | 7 days Av. Comp.Strength (N/mm <sup>2</sup> ) | Sample no. | 28 days Comp.Strength (N/mm <sup>2</sup> ) | 28 days Av. Comp.Strength (N/mm <sup>2</sup> ) |
|------------|-------------------------------------------|-----------------------------------------------|------------|--------------------------------------------|------------------------------------------------|
| 1          | 27.3                                      | 27.1                                          | 4          | 39.0                                       | 39.2                                           |
| 2          | 26.9                                      |                                               | 5          | 39.5                                       |                                                |
| 3          | 27.2                                      |                                               | 6          | 39.2                                       |                                                |

Conclusion :7 days compressive strength is higher than 70% of target mean strength , 28 Days compressive strength is higher than target mean strength hence the above mix design may be adopted.

  
Checked By:-



1. The result listed refers only to the tested samples and applicable parameters endorsement of product is neither inferred nor implied.
2. Total liability of our Lab. is limited to the invoiced amount.
3. Samples will be destroyed after 90 days from the date of issue of test report.
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