STUDY OF SUBGRADE STRENGTH RELATED TO MOISTURE

A project submitted in partial fulfillment of the requirements for the degree of

Bachelor of technology

In

Civil engineering

By

Biswajeet Sahoo (10501029)

Devadatta Nayak (10501012)

DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY

ROURKELA-769008

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Under the profound guidance of

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CERTIFICATE

This is to certify that the thesis entitled, “STUDY OF SUBGRADE STRENGTH RELATED TO MOISTURE CONTENT” submitted by Mr Biswajeet Sahoo and Mr Devadatta Nayak in partial fulfillment for the requirements for the award of Bachelor of Technology Degree in Civil Engineering at National Institute of Technology, Rourkela(Deemed university) is an authentic workcarried out by them under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other university/Institute for the award of any Degree or Diploma.

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CONTENTS

1. BRIEF OVERVIEW OF THE PROJECT

The design of the pavement layers to be laid over subgrade soil starts off with the estimation of subgrade strength and the volume of traffic to be carried. Design of the various pavement layers are very much dependent on the strength of the subgrade soil over which they are going to be laid. Weaker subgrade demands thicker layers whereas stronger subgrade goes well along with thinner pavement layers. The Indian Road Congress encodes the exact design strategies of the pavement layers based upon the subgrade strength. Subgrade strength is mostly expressed in terms of CBR, the California Bearing Ratio. Hence, in all, the pavement and the subgrade together must sustain the traffic volume.

The subgrade strength owing to its inconsistency or variable nature poses a challenge for the engineer to come up with a perfect design of pavement. For example, the subgrade is always subjected to change in its moisture content due to precipitation, capillary action, flood or abrupt rise or subsidal of water table. Change in moisture content causes change in the subgrade strength. And it becomes quite essential for an engineer to understand the exact nature of dependence of subgrade strength on moisture content.

The project attempts in understanding the nature of variation of subgrade strength with water content. Thus, various soil samples are put to test for their strengths at different moisture contents by soaking them in waterbath for different days. Required inference can be drawn through the test results.

1. The Subgrade

As per MORD Specifications, subgrade can be defined as a compacted layer, generally of naturally occurring local soil, assumed to be 300 mm in thickness, just beneath the pavement crust, providing a suitable foundation for the pavement. The subgrade in embankment is compacted in two layers, usually to a higher standard than the lower part of the embankment. In cuttings, the cut formation, which serves as the subgrade, is treated similarly to provide a suitable foundation for the pavement.

Where the naturally occurring local subgrade soils have poor engineering properties and low strength in terms of CBR, for example in Black Cotton soil areas, improved subgrades are provided by way of lime/cement treatment or by mechanical stabilization and other similar techniques.

The subgrade, whether in cutting or in embankment, should be well compacted to utilize its full strength and to economize on the overall pavement thickness. The current MORD Specifications require that the subgrade should be compacted to 100% Maximum Dry Density achieved by the Modified Proctor Test(IS 2720-Part 7). The material used for subgrade construction should have a dry unit weight of not less than 16.5kN/m^3 .

2. Determining Subgrade strength for designing new roads:

For the pavement design of new roads the subgrade strength needs to be evaluated in terms of **CBR** value which can be estimated by any of the following methods:

- Based on soil classification tests and the table given in IRC:SP:72-2007 which gives typical presumptive design CBR values for soil samples compacted to proctor density at optimum moisture content and soaked under water for 4 days.

- Using a Nomograph based on wet sieve analysis data, for estimating 4-day soaked CBR values on samples compacted to proctor density.

- Using two sets of equations, based on classification test data, one for plastic soils and the other for non-plastic soils, for estimating soaked CBR values on samples compacted to proctor density.

- By conducting actual CBR tests in the laboratory.

The first, second and third method come in handy where adequate testing facilities are not available or the project is of such a size as to not to warrant elaborate testing procedures.

3.1 TYPICAL PRESUMTIVE DESIGN CBR VALUES(table 3.1)

Description of Subgrade soil	**IS Soil Classification**	**Typical Soaked CBR value(%)**
Highly plastic clays	CH, MH	2-3
Silty clays and sandy clays	ML, MI CL, CI	4-5
Clayey sands and Silty sands	SC, SM	6-10

3.3 QUICK ESTIMATION OF CBR

PLASTIC SOIL

CBR= 75/(1+0.728 WPI),

Where WPI= weighted plasticity index= $P_{0.075} \times PI$

PI= Plasticity index of soil in %

$P_{0.075}$= % Passing 0.075 mm sieve in decimal

NON- PLASTIC SOIL

CBR= $28.091(D_{60})^{0.3581}$

Where D_{60}= Diameter in mm of the grain size corresponding to 60% finer.

Soil classification can be used for preliminary report preparation.

SELECTION OF MOISTURE CONTENT FOR SUBGRADE STRENGTH EVALUATION(table 3.2)

Subgrade classification	Estimating Subgrade Mositure Content
Where the GWT is close enough to the ground surface to influence the subgrade moisture content .	1. The most direct method is to measure the moisture content in subgrades at the time of the yr when the GWT is at the highest level. 2. The subgrade moisture content for different soil types can be estimated by using the ratio subgrade moisture contents/ plastic limit which is about the same when GWT and climatic conditions are similar.
Subgrades with deep GWT but where seasonal rainfall brings about significant changes in moisture conditions under the road.	1. The design moisture content can be taken as optimum content obtained from Proctor Compaction Test corresponding to maximum dry density or from the nomograph, whichever is higher. 2. The possibility of local perched GWT and effects of seasonal flooding should, however , also be considered while deciding on GWT depth. Where such situations are encountered, the subgrade strength may be determined in terms of 4 day soaked CBR values.

3.4 CALIFORNIA BEARING RATIO (the actual laboratory method)

The CBR test was originally developed by O.J. Porter for the California Highway Department during the 1920s. It is a load-deformation test performed in the laboratory or the field, whose results are then used with an empirical design chart to determine the thickness of flexible pavement, base, and other layers for a given vehicle loading. Though the test originated in California, the California Department of Transportation and most other highway agencies have since abandoned the CBR method of pavement design. In the 1940s, the US Army Corps of Engineers (USACE) adopted the CBR method of design for flexible airfield pavements. The USACE and USAF design practice for surfaced and unsurfaced airfields is still based upon CBR today (US Army, 2001; US Army and USAF, 1994). The CBR determination may be performed either in the laboratory, typically with a recompacted sample, or in the field. Because of typical logistics and time constraints with the laboratory test, the field CBR is more typically used by the military for design of contingency roads and airfields.

The thickness of different elements comprising a pavement is determined by CBR values. The CBR test is a small scale penetration test in which a cylindrical plunger of 3 in^2 (5 cm in dia) cross-section is penetrated into a soil mass (i.e., sub-grade material) at the rate of 0.05 in. per minute (1.25 mm/minute). Observations are taken between the penetration resistance (called the test load) versus the penetration of plunger. The penetration resistance of the plunger into a standard sample of crushed stone for the corresponding penetration is called standard load. The California bearing ratio, abbreviated as CBR is defined as the ratio of the test load to the standard load , expressed as percentage for a given penetration of the plunger.

CBR = (Test load/Standard load)×100

The table gives the standard loads adopted for different penetrations for the standard material with a CBR value of 100%.

STANDARD LOAD USED IN CALIFORNIA BEARING RATIO TEST(Table 3.3)

Penetration of the plunger(inch)	Standard load (lb)	Penetration of plunger(mm)	Standard load (kg)
0.1	3000	2.5	1370
0.2	4500	5.0	2055
0.3	5700	7.5	2630
0.4	6900	10.0	3180
0.5	7800	12.5	3600

The CBR test is carried out on a compacted soil in a CBR mould 150 mm in diameter and 175 mm in height , provided with detachable collar of 50 mm and a detachable perforated base plate. A displacer disc, 50 mm deep to be kept in the mould during the specimen preparation, enables a specimen of 125 mm deep to be obtained. The moulding dry density and water content should be the same as would be maintained during field compaction. To simulate worst moisture condition of the field, the specimens are kept submerged in water for about 4 days before testing. Generally, CBR values of both soaked as well as unsoaked samples are determined. Both during soaking and penetration test, the specimen is covered with equal surcharge weights to simulate the effect of overlying pavement or the particular layer under construction. Each surcharge slotted weight , 147 mm in diameter with a central hole 53 mm in diameter and weighing 2.5 kg is considered approximately equivalent to 6.5 cm of construction. A minimum of two surcharge weights (i.e. 5kg surcharge load) is placed on the specimen. Load is applied on the penetration piston so that the penetration is approximately 1.25mm/min. The load readings are recorded at penetrations , 0 , 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 8, 9, 10, 11, 12, and 12.5mm. The maximum load and penetration is recorded if it occurs for a penetration of less than 12.5 mm.

The curve is mainly convex upwards although the initial portion of the curve may be concave upwards due to surface irregularities. A correction is then applied by drawing a tangent to the curve at the point of greatest slope. The corrected origin will be the point where the tangent meets the abscissa.

The CBR values are usually calculated for penetrations of 2.5 mm and 5mm. Generally the CBR values at 2.5mm penetration will be greater than 5mm penetration and in such a case the former is taken as the CBR value for design purposes. If the CBR value corresponding to a penetration of 5mm exceeds that for 2.5mm, the test is repeated. If identical results follow, the bearing ratio corresponding to 5mm penetration is taken for design.

4. Experimental work

Nine soil samples viz. A, B, C, D , E , F , G , H and I moulded at its optimum moisture content to its proctor density was tested for its CBR strength. Thus the process comprises of three parts.

1. Estimation of proctor density and optimum moisture content for each soil sample.

2. Moulding the soil sample into standard moulds keeping its moisture content and dry density exactly same as its optimum moisture content and proctor density respectively.

3. Determination of CBR strength of the respective soil samples in moulds using the CBR instrument.
   Each soil sample is tested for its CBR strength after being soaked in water for 1 day, 2 days, 3 days and 4 days. Unsoaked CBR is also determined for each sample.

4.1 PROCTOR DENSITY AND OPTIMUM MOISTURE CONTENT OF VARIOUS SOIL SAMPLES

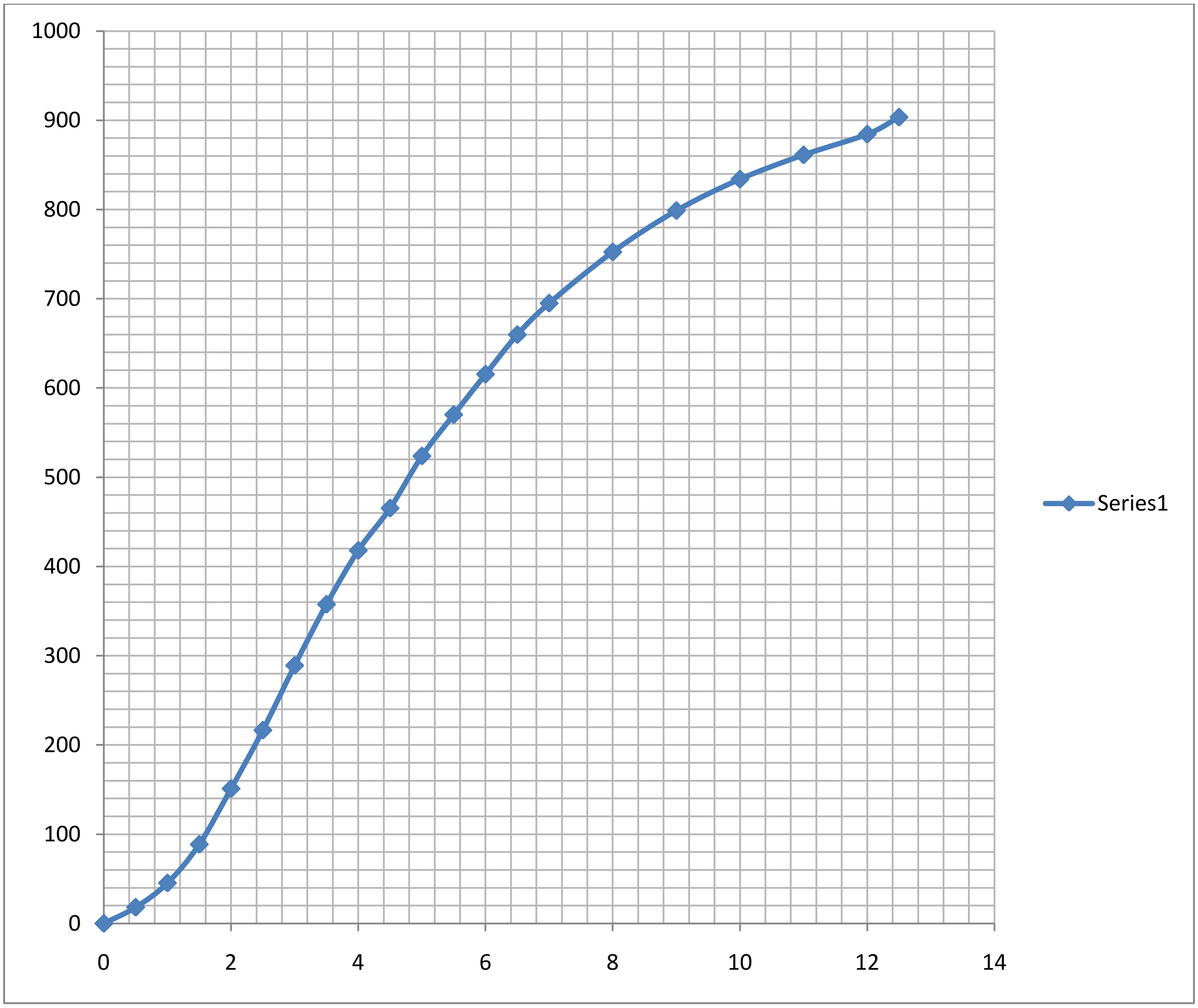
Sample	MDD(Kg/m^3)	OMC(%)
A	2270	6.7
B	2186	8
C	2354	7.4
D	2220	7
E	2232	8.2
F	2080	8.1
G	2272	9.1
H	1874	13.3
I	2168	7.8

(determined through modified proctor test)

4.2 DETERMINATION OF CBR

SAMPLE (A)

Un-soaked



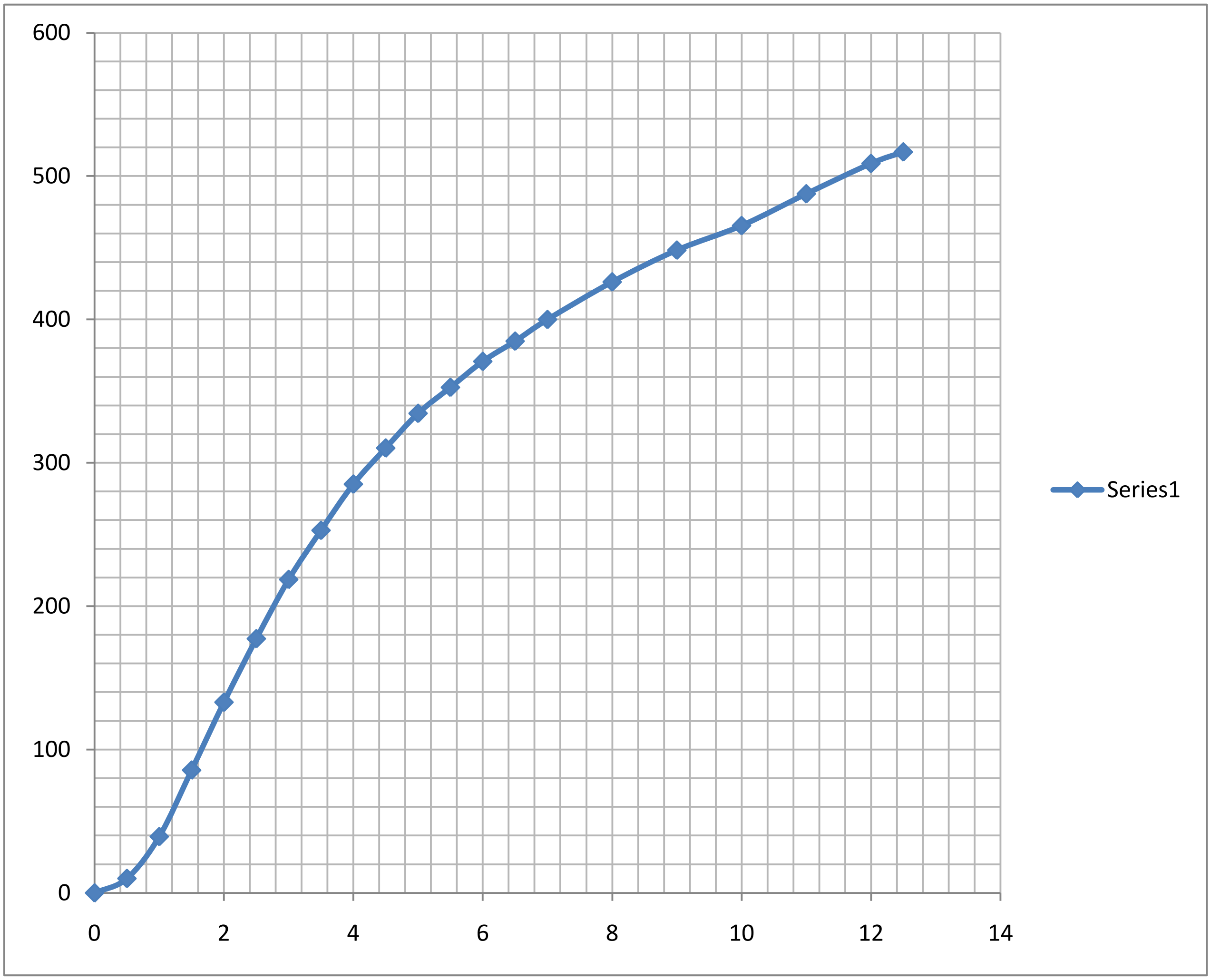
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(330/1370)*100%=24%

CBR_{5}=(600/2055)*100%=23.7%

1-day soaked



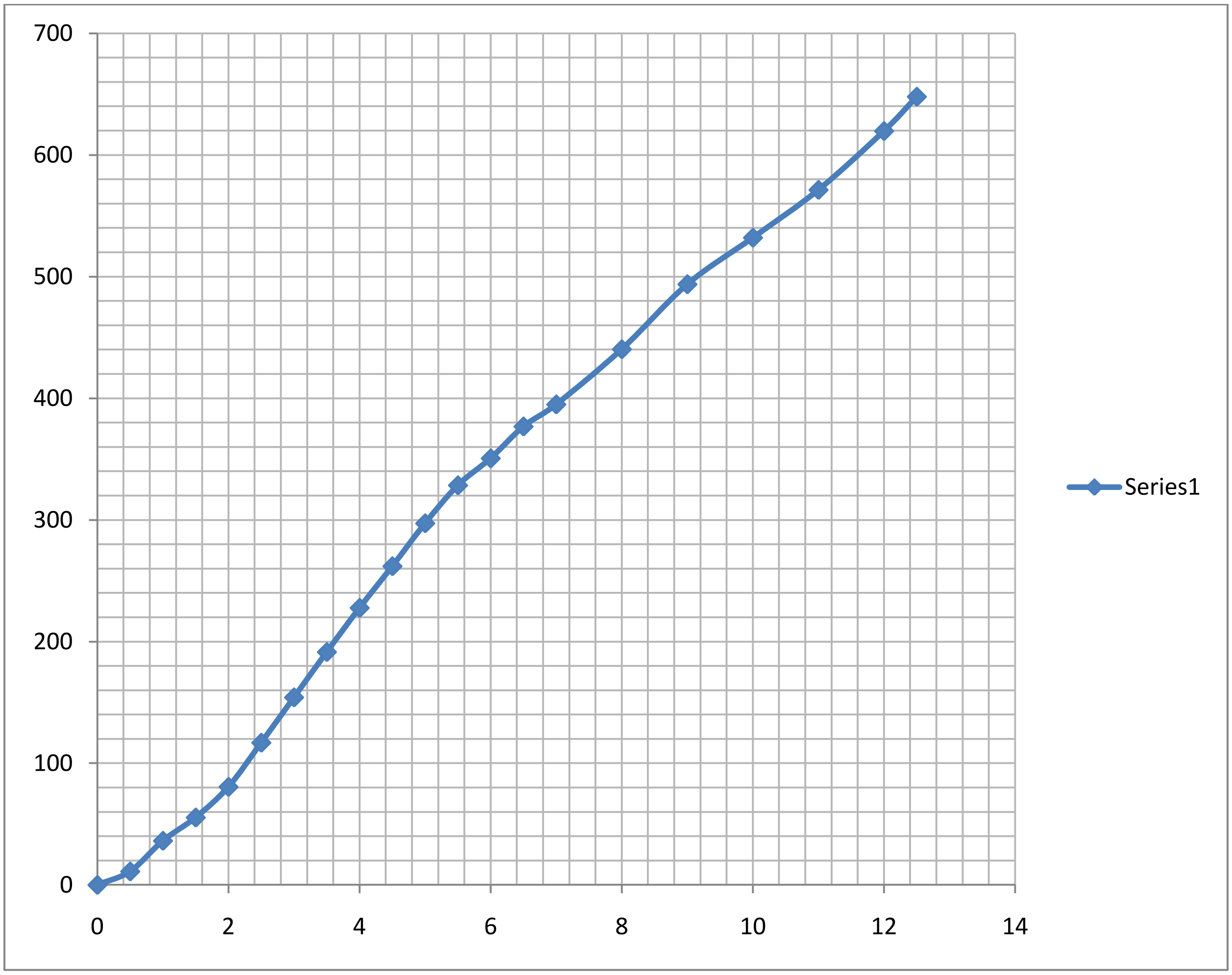
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(235/1370)*100%=17.4%

CBR_5=(350/2055)*100%=17%

2-days soaked



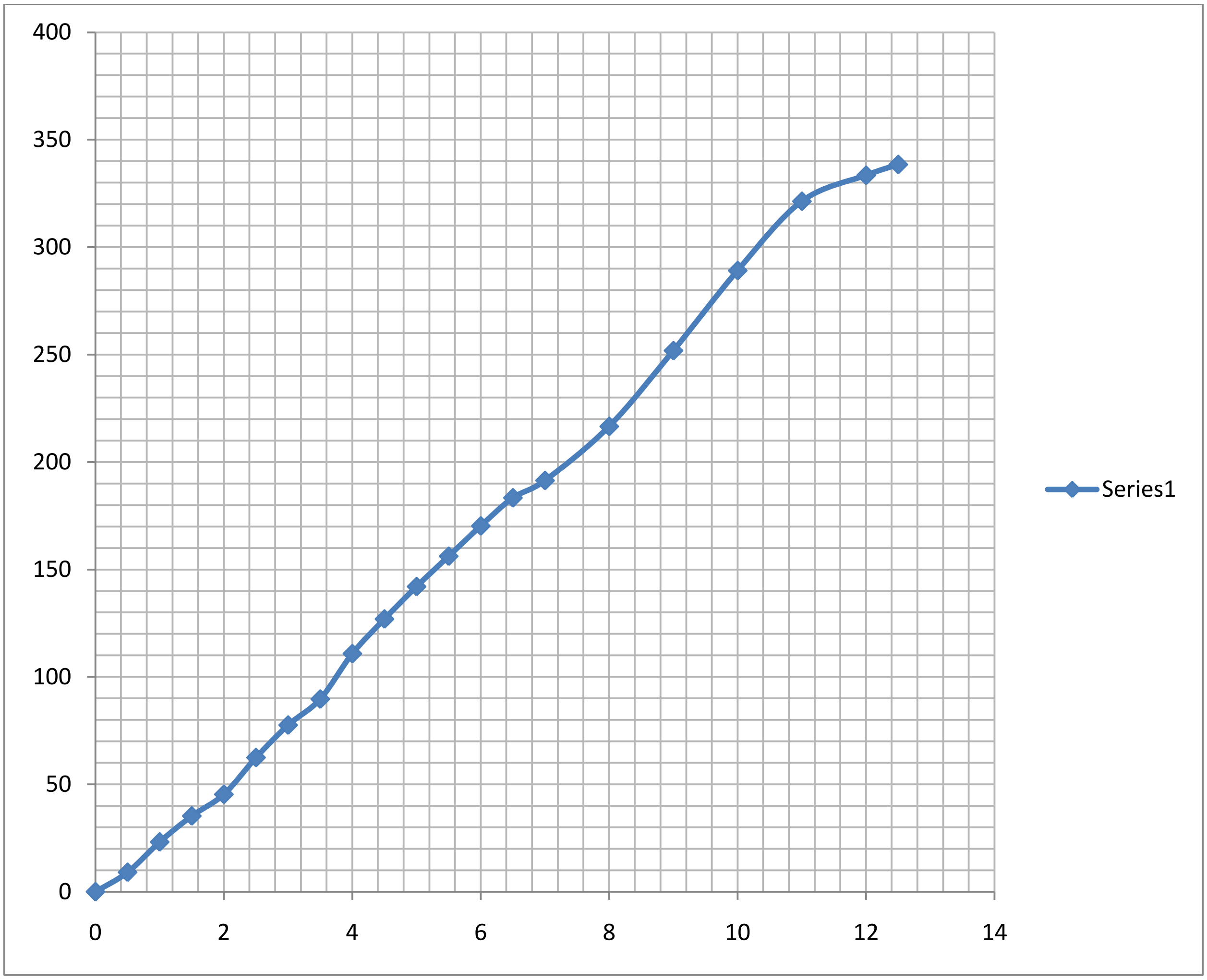
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(116.85/1370)*100%=8.5%

CBR_{5}=(297.16/2055)*100%=14.4%

3-days soaked



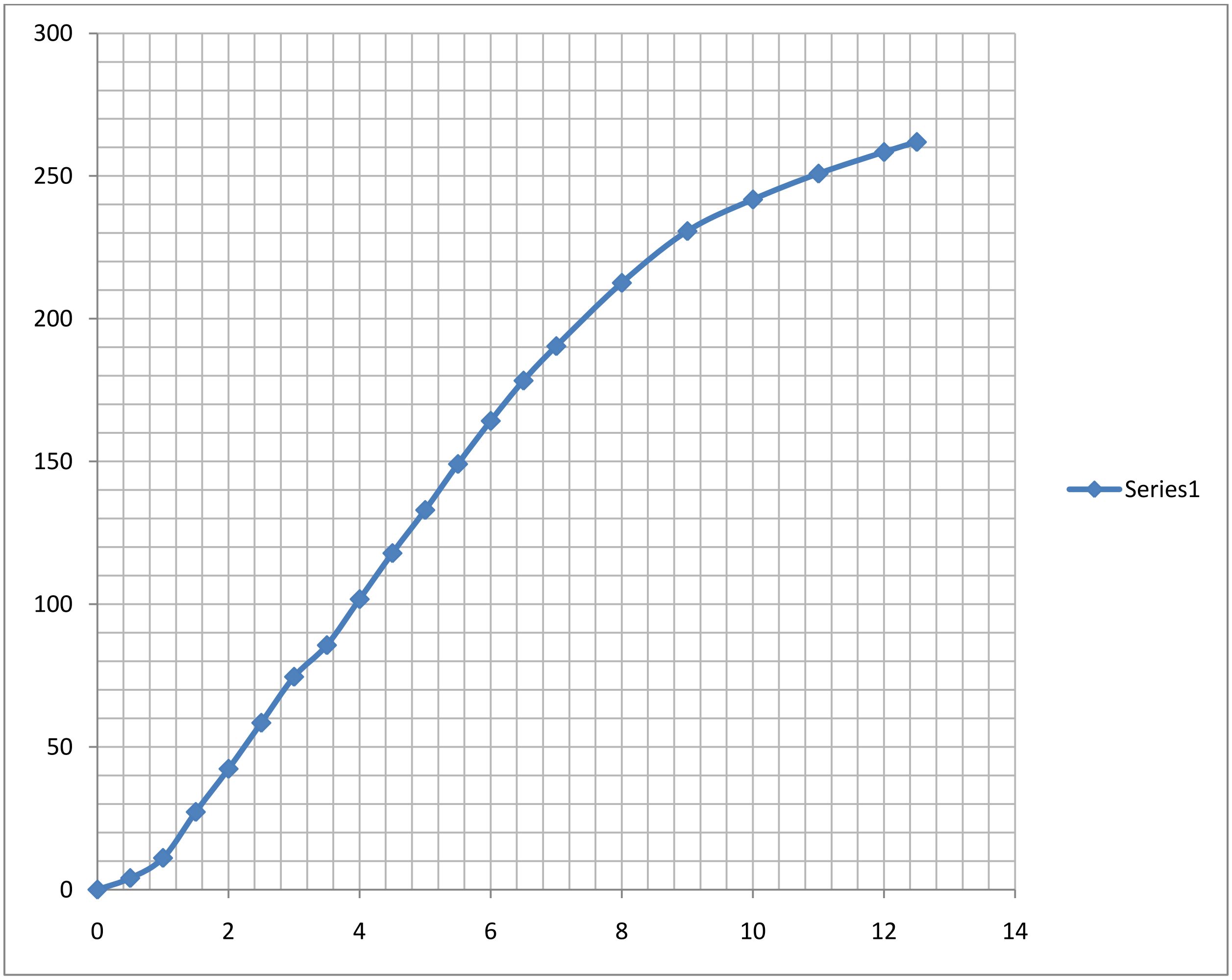
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(62.45/1370)*100%=4.6%

CBR_{5}=(142.03/2055)*100%=6.9%

4-days soaked



X : penetration(in mm)

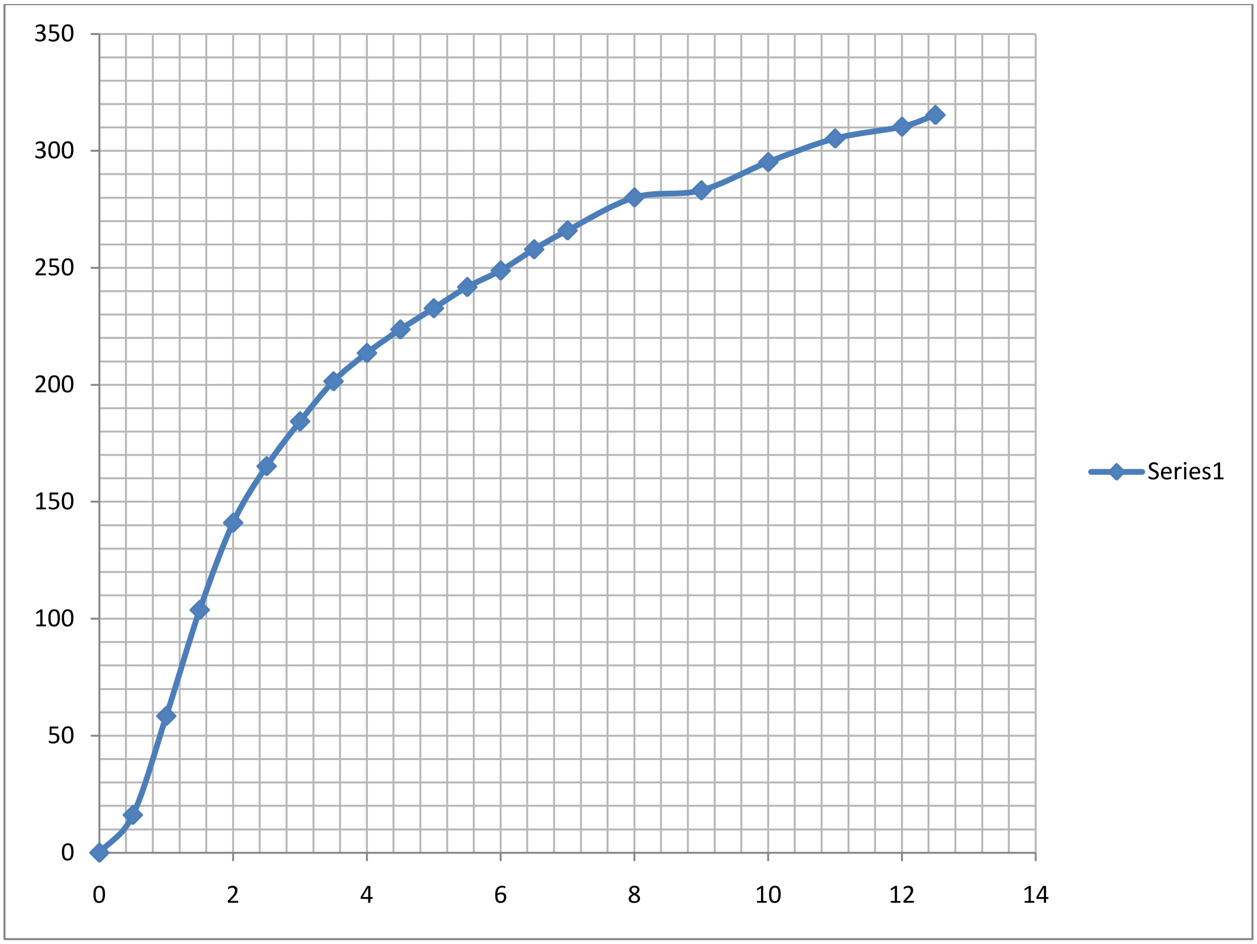
Y: loading(in kg)

$CBR_{2.5}$=(58.42572/1370)*100%=4.26%

CBR_{5}=(132.9689/2055)*100%=6.47%

SAMPLE (B)

Un-soaked



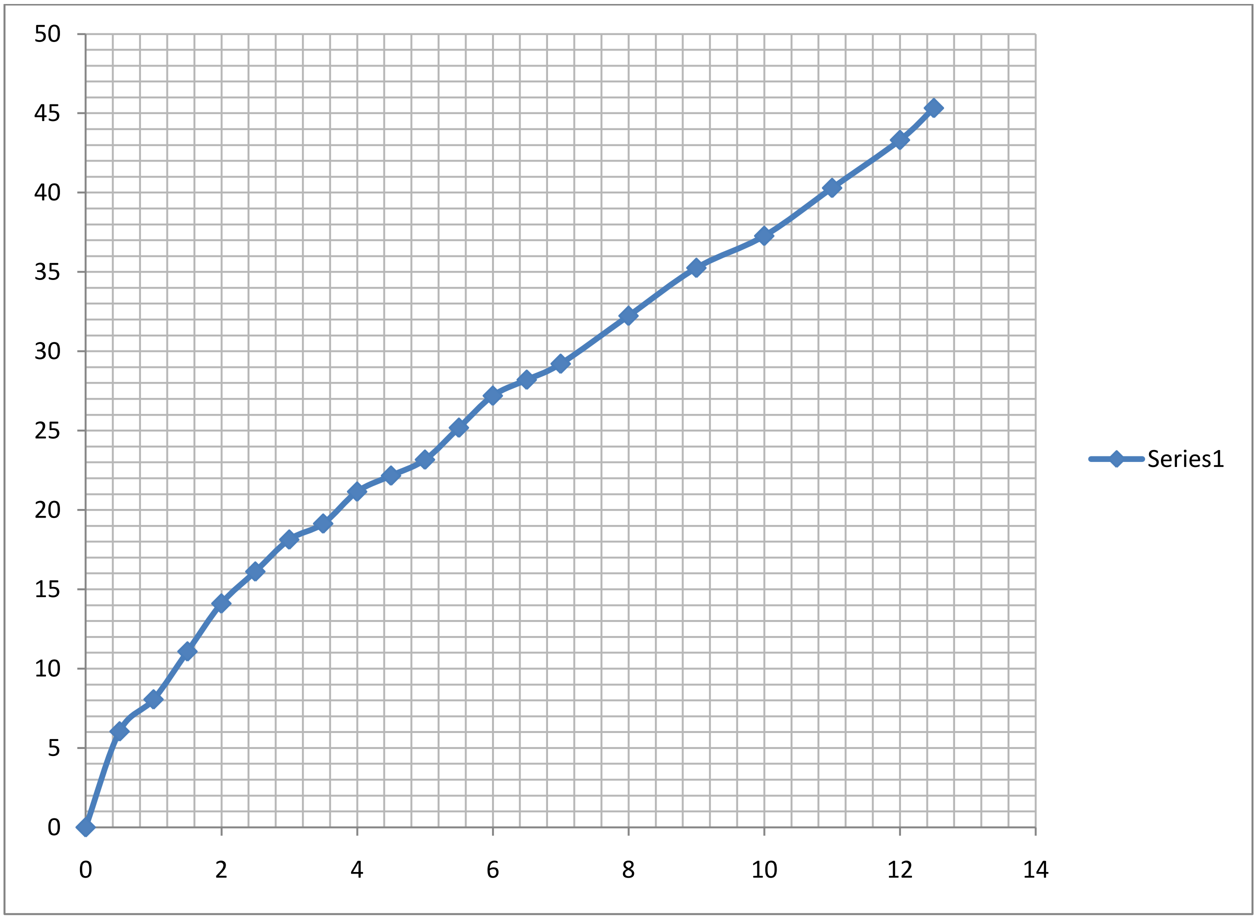
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(165.2/1370)*100%=12%

CBR_5=(232.69/2055)*100%=11.3%

1-day soaked



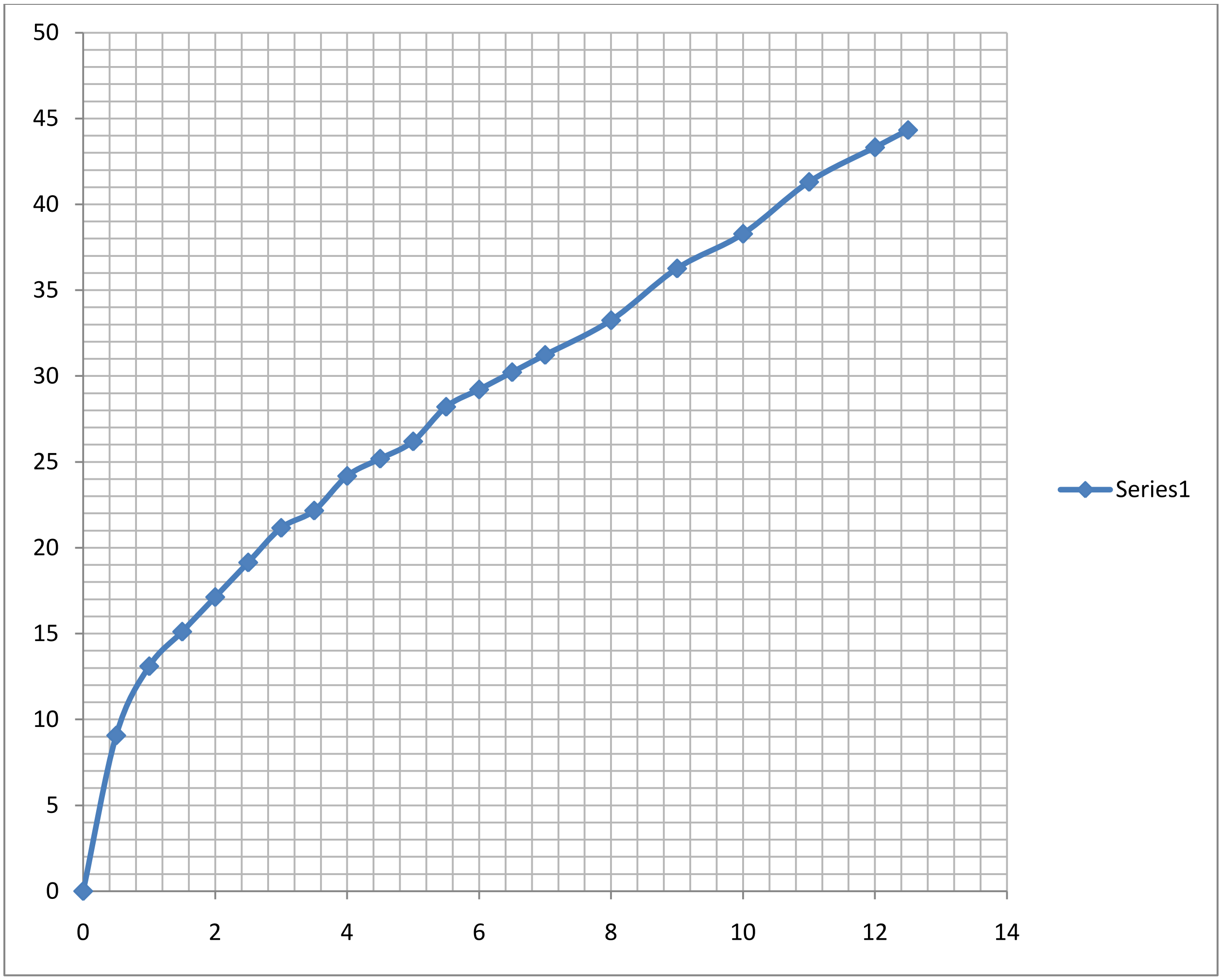
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(16.11/1370)*100%=1.2%

CBR_5=(23.16/2055)*100%=1.13%

2-days soaked



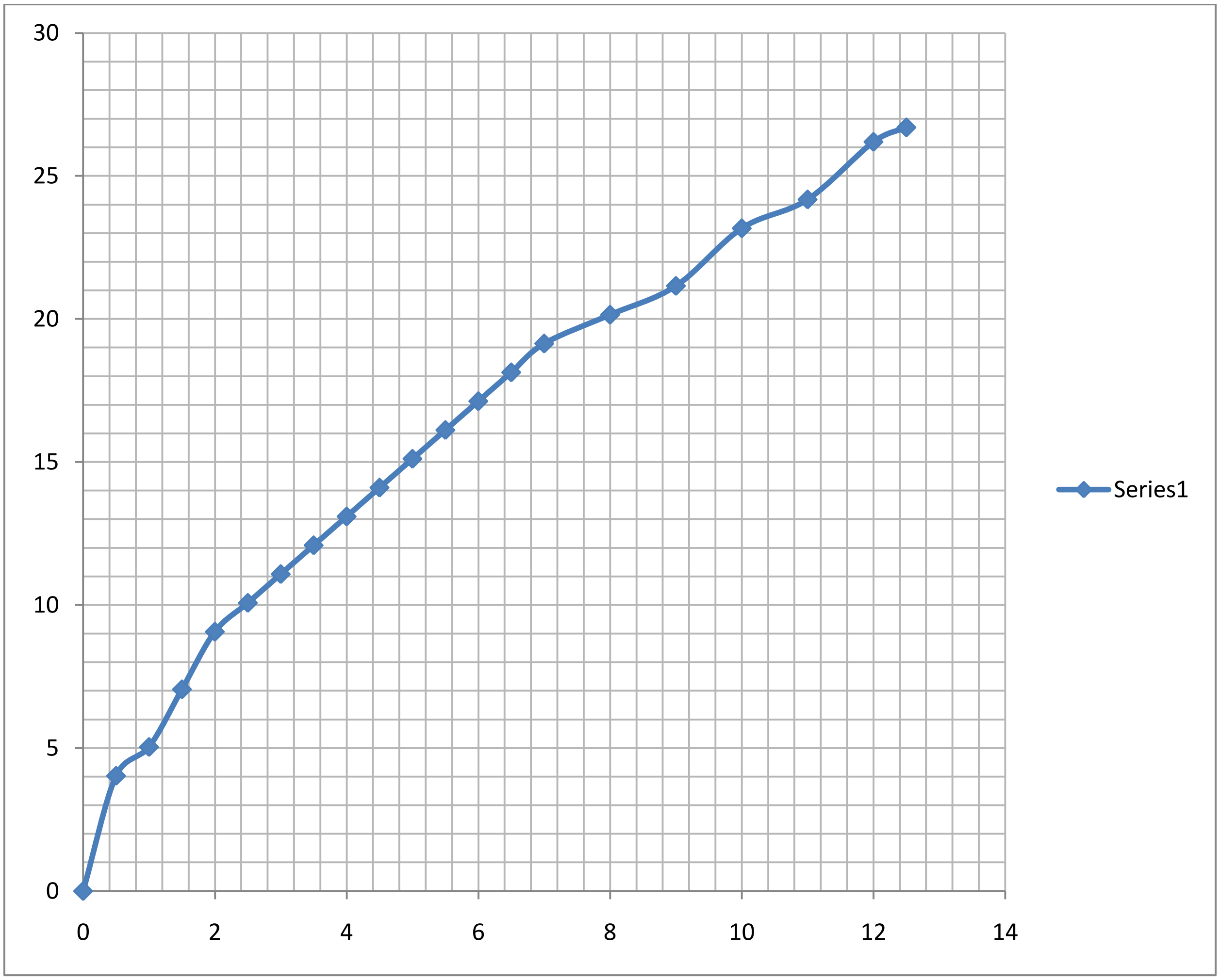
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(19.13/1370)*100%=1.3%

CBR_{5}=(26.19/2055)*100%=1.27%

3-days soaked



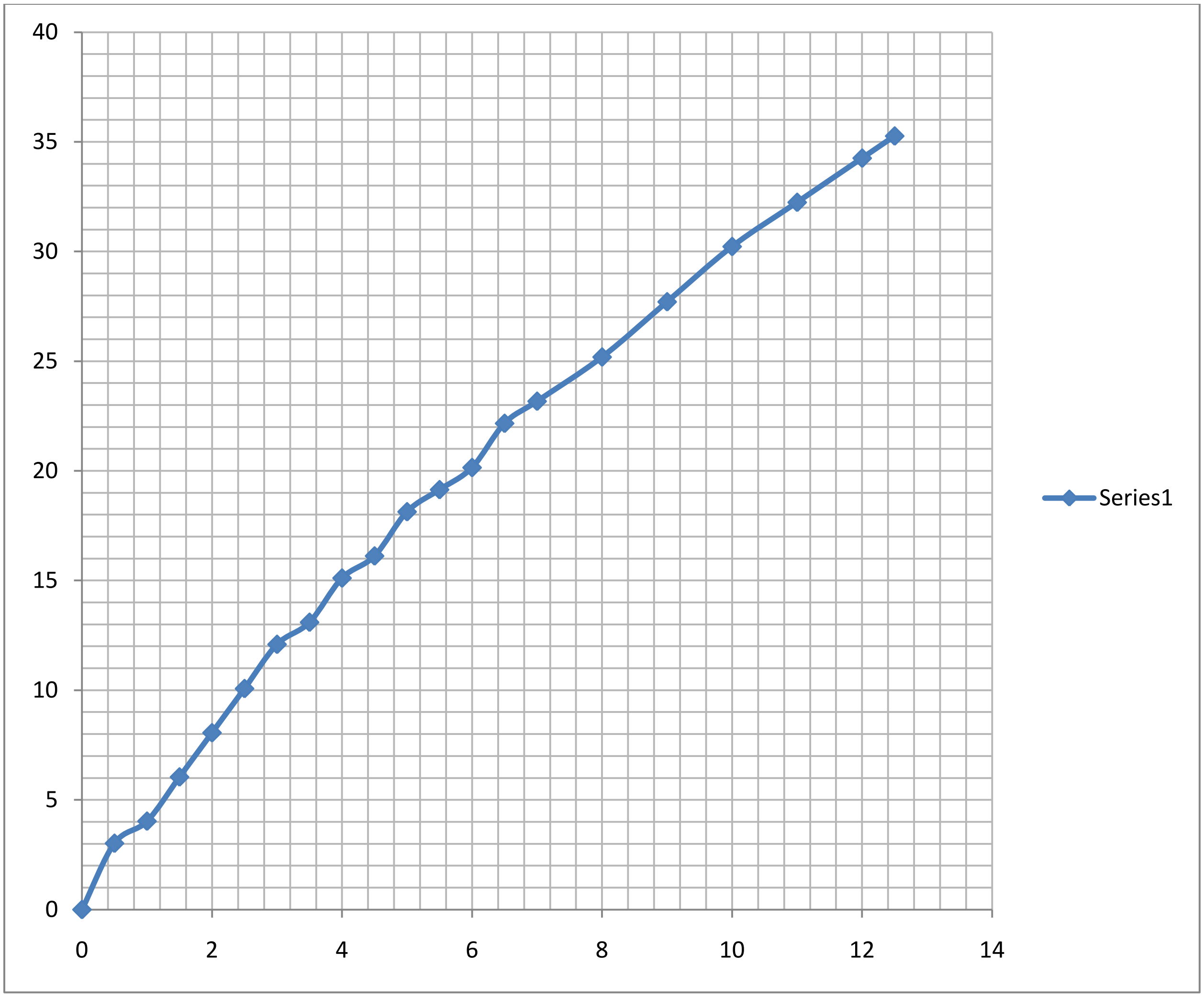
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(10.07/1370)*100%=.74%

CBR_{5}=(15.11/2055)*100%=.735%

4-days soaked



X : penetration(in mm)

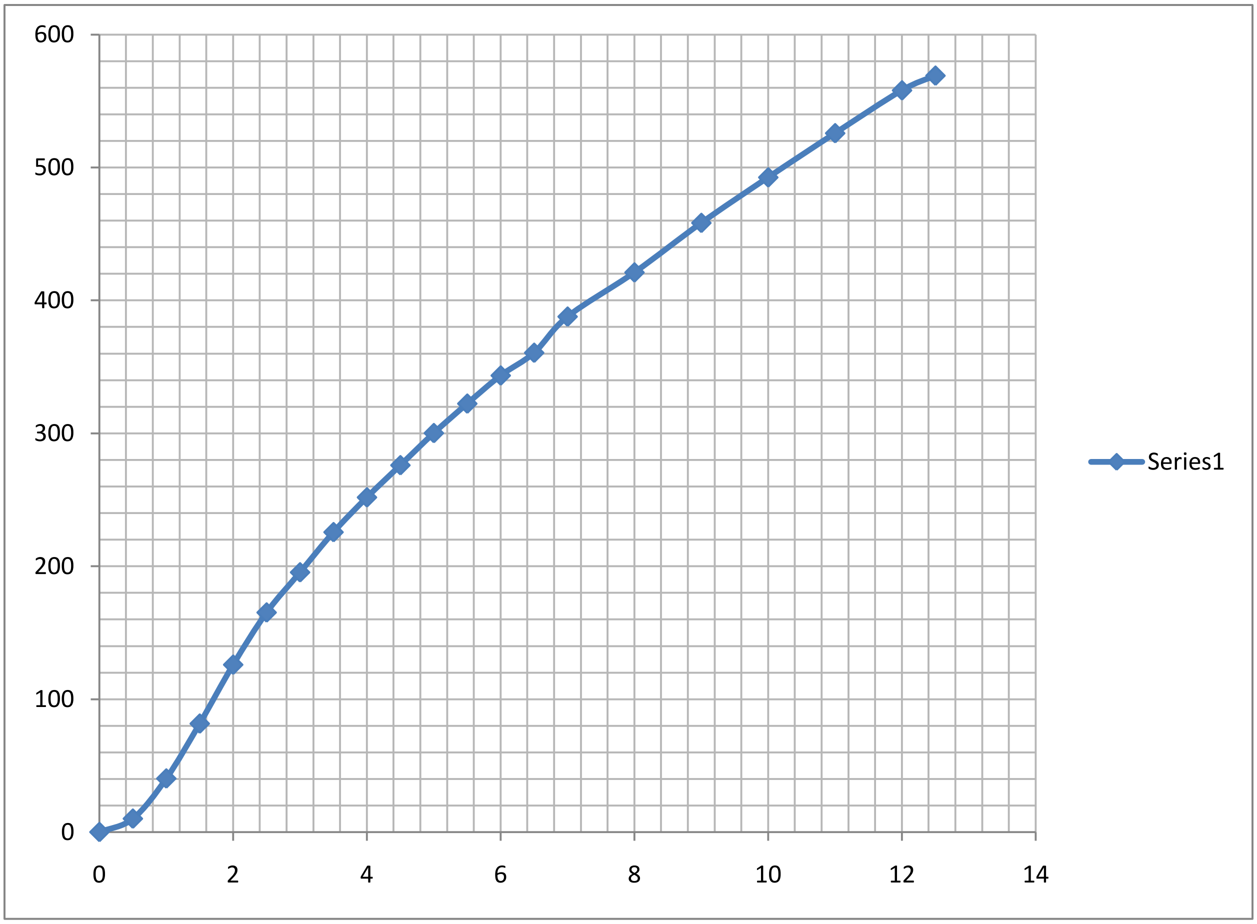
Y: loading(in kg)

$CBR_{2.5}$=(10.0734/1370)*100%=.735%

CBR_5=(18.13212/2055)*100%=.882%

SAMPLE (C)

Un-soaked



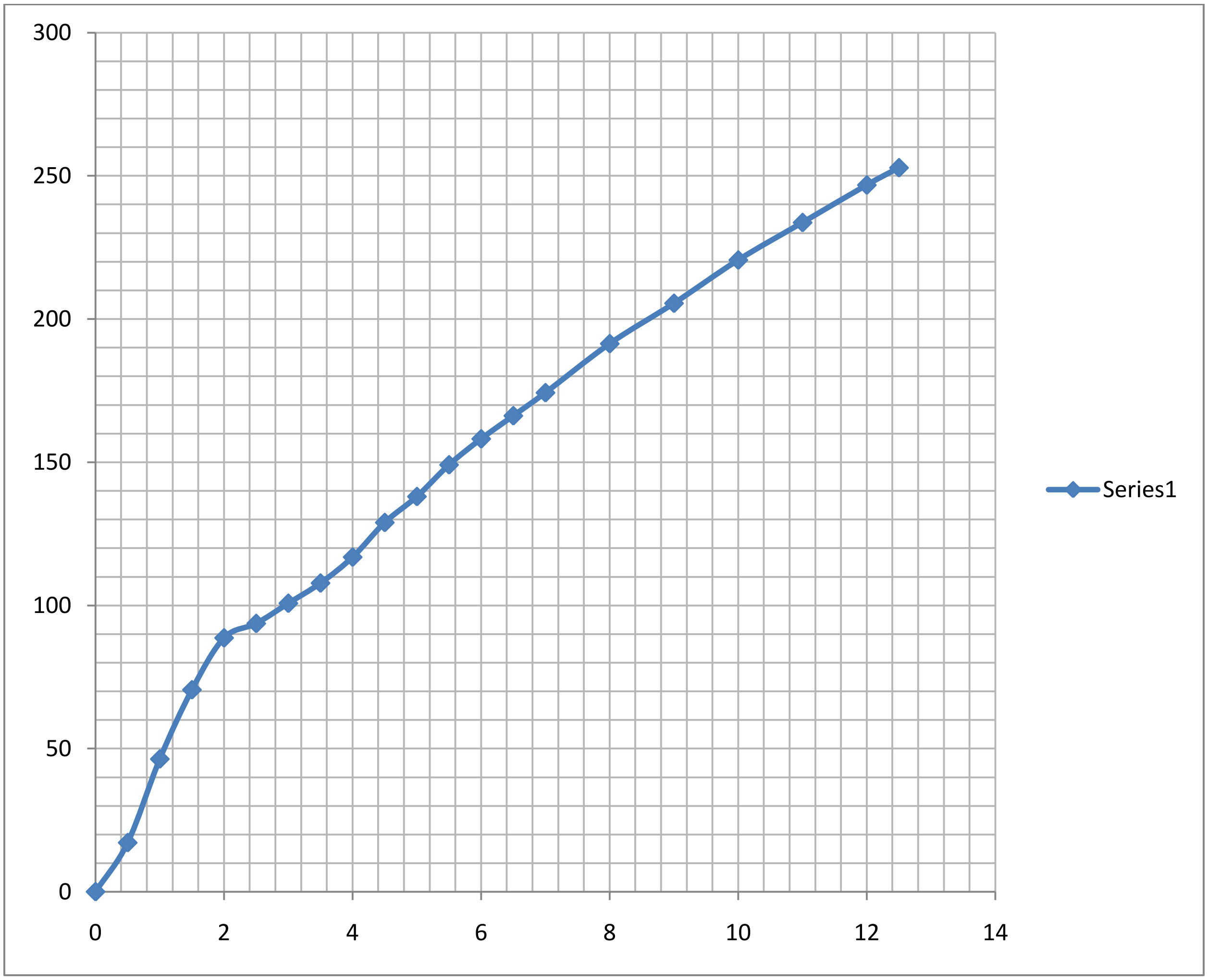
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(165.2038/1370)*100%=12.06%

CBR_5=(300.1873/2055)*100%=14.6%

1-day soaked



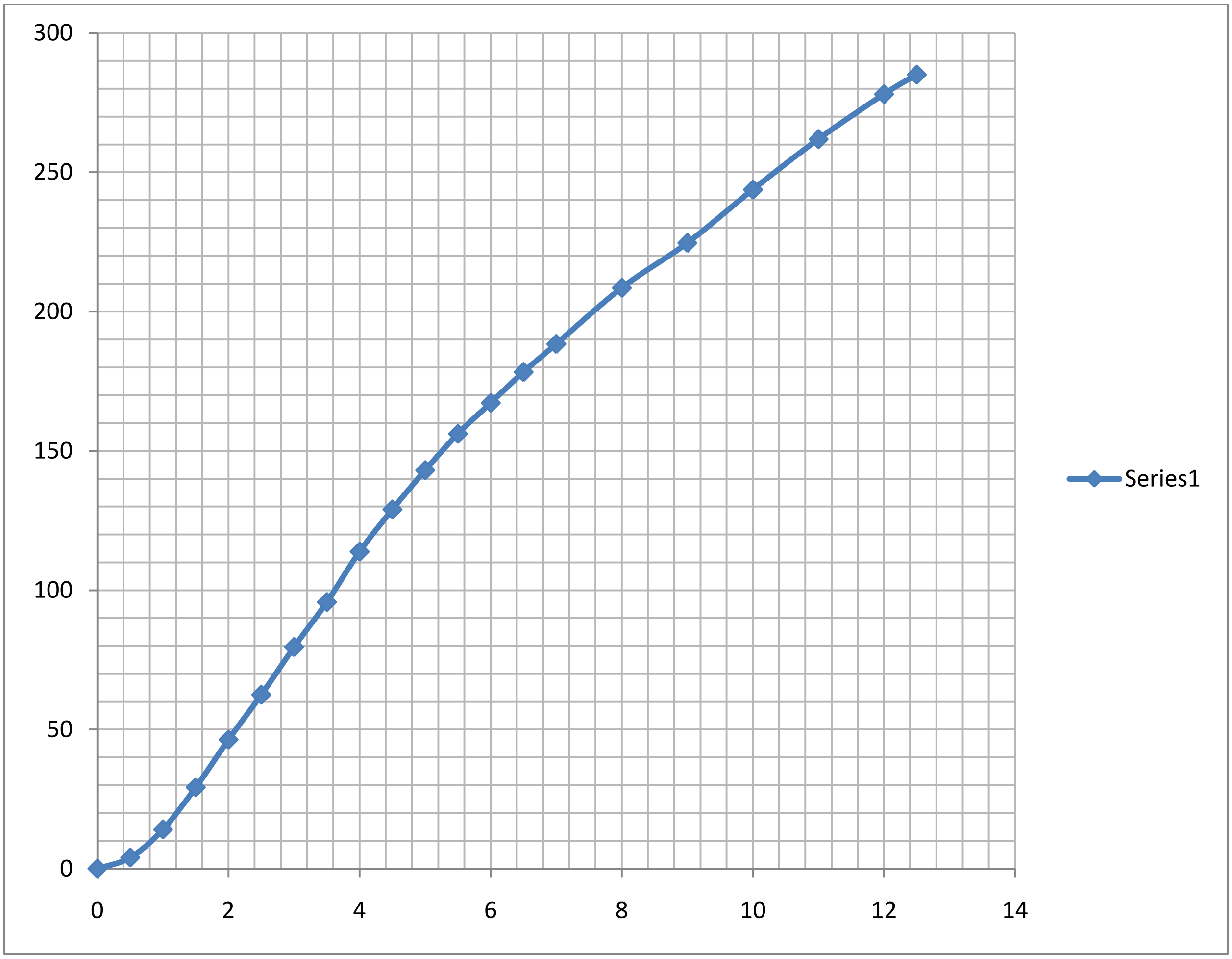
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(93.682/1370)*100%=6.8%

CBR_{5}=(138.0056/2055)*100%=6.715%

2-days soaked



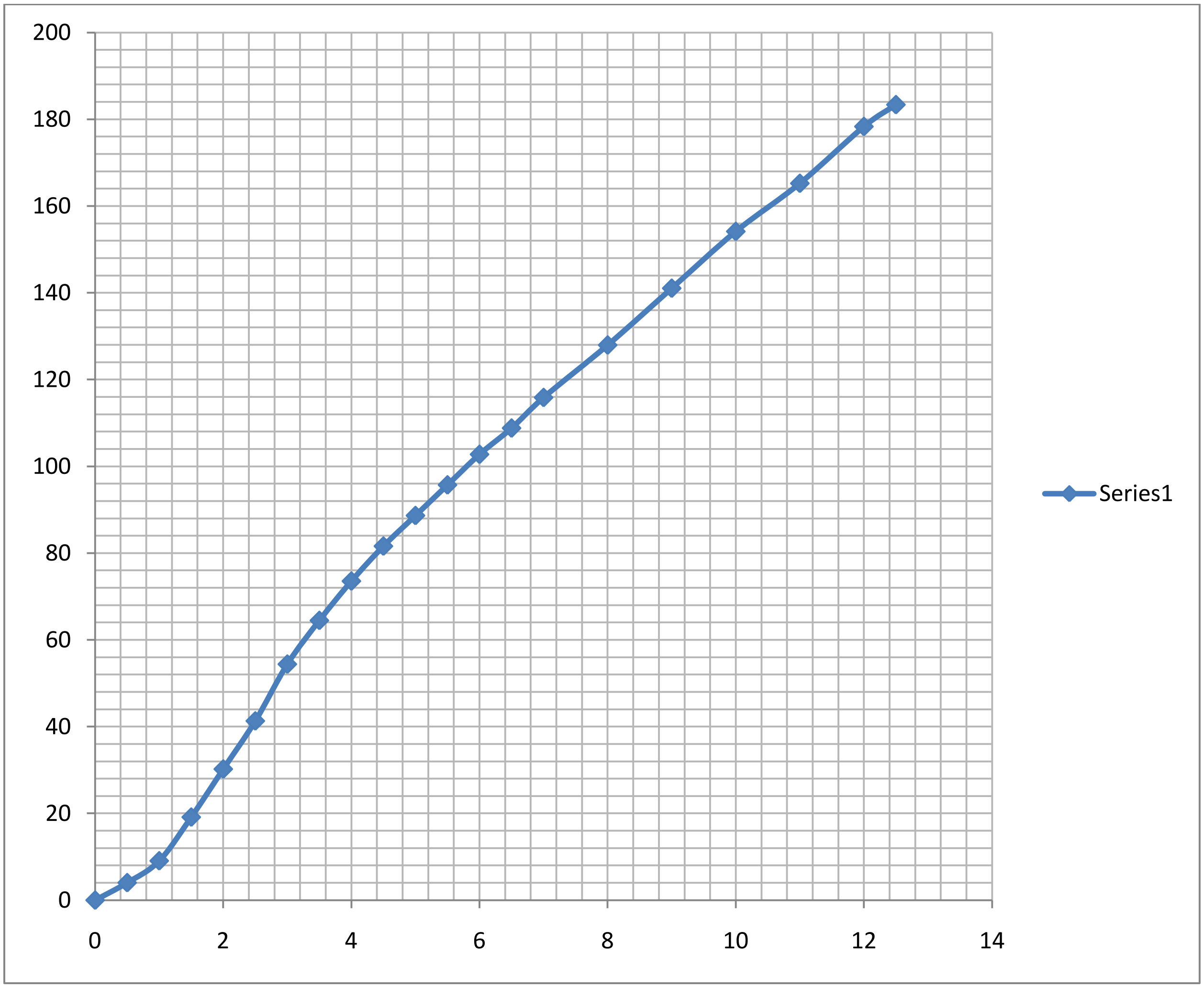
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(62.455/1370)*100%=4.56%

CBR_{5}=(143.042/2055)*100%=6.96%

3-days soaked



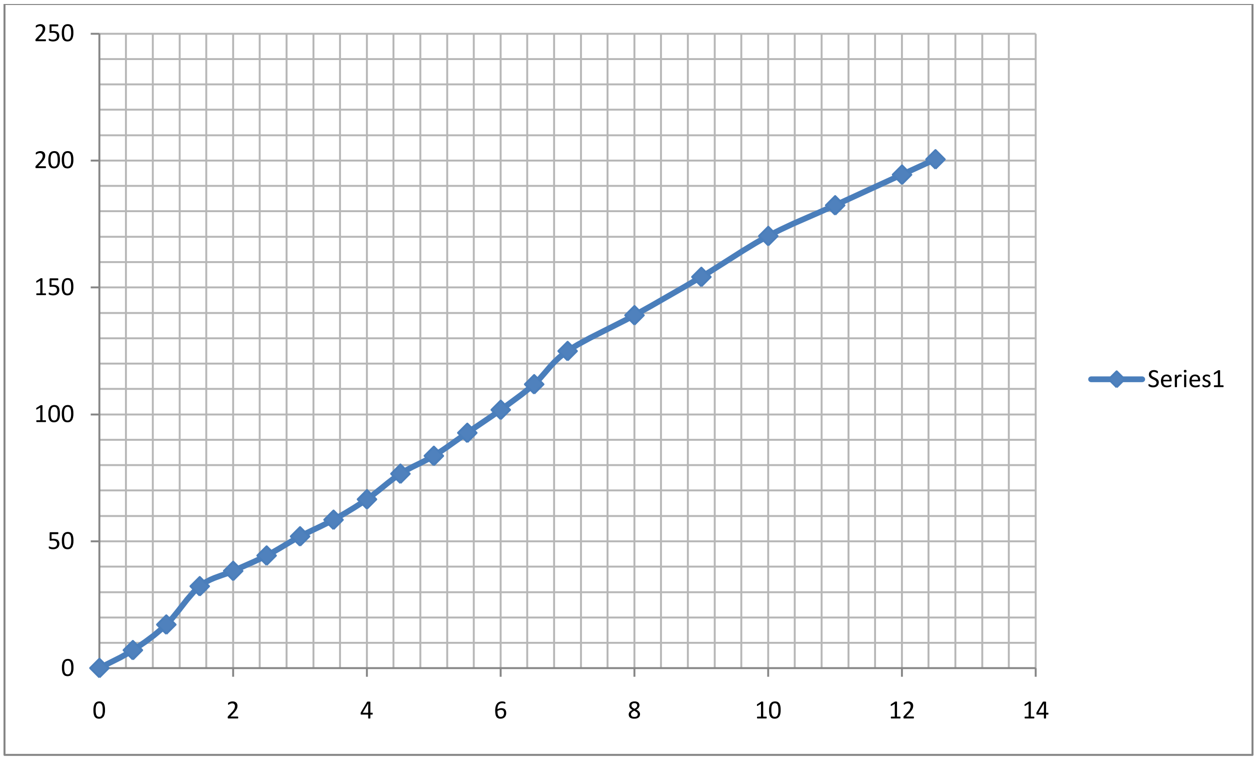
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(41.3/1370)*100%=3%

CBR_{5}=(88.645/2055)*100%=4.3%

4-days soaked



X : penetration(in mm)

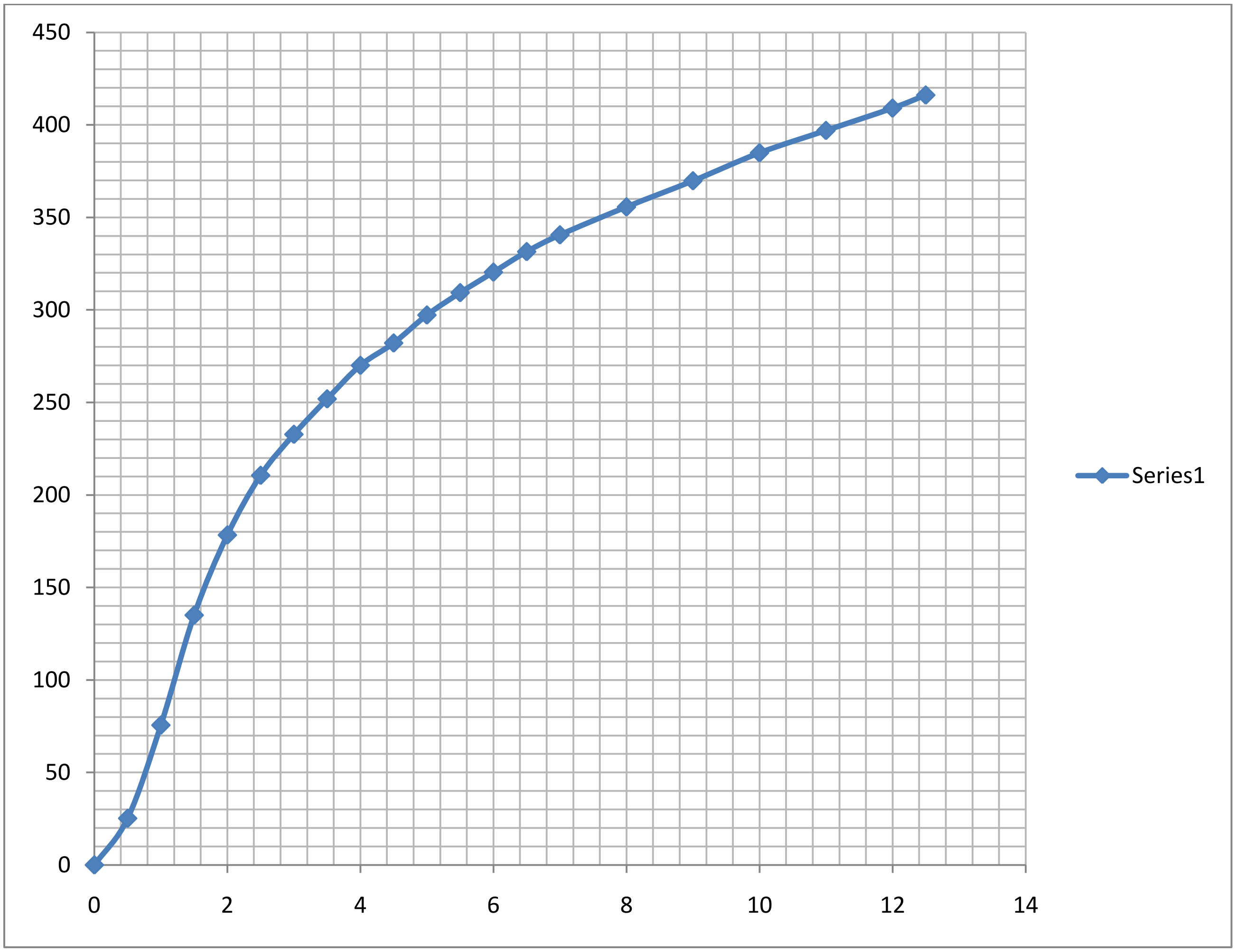
Y: loading(in kg)

$CBR_{2.5}$=(44.32296/1370)*100%=3.23%

CBR_5=(83.61/2055)*100%=4.07%

SAMPLE (D)

Un-soaked



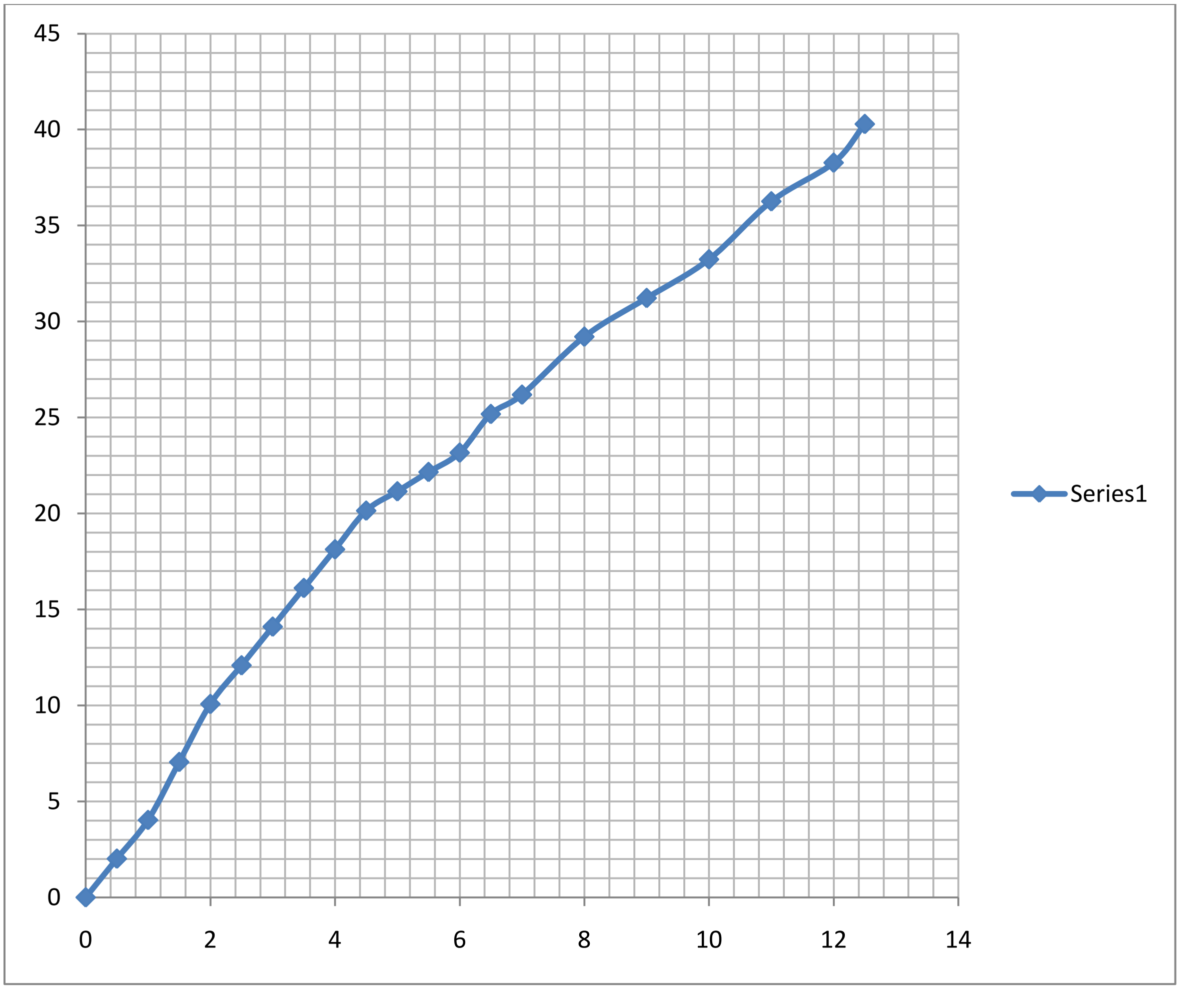
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(210.534/1370)*100%=15.4%

CBR_5=(297.165/2055)*100%=14.5%

1-day soaked



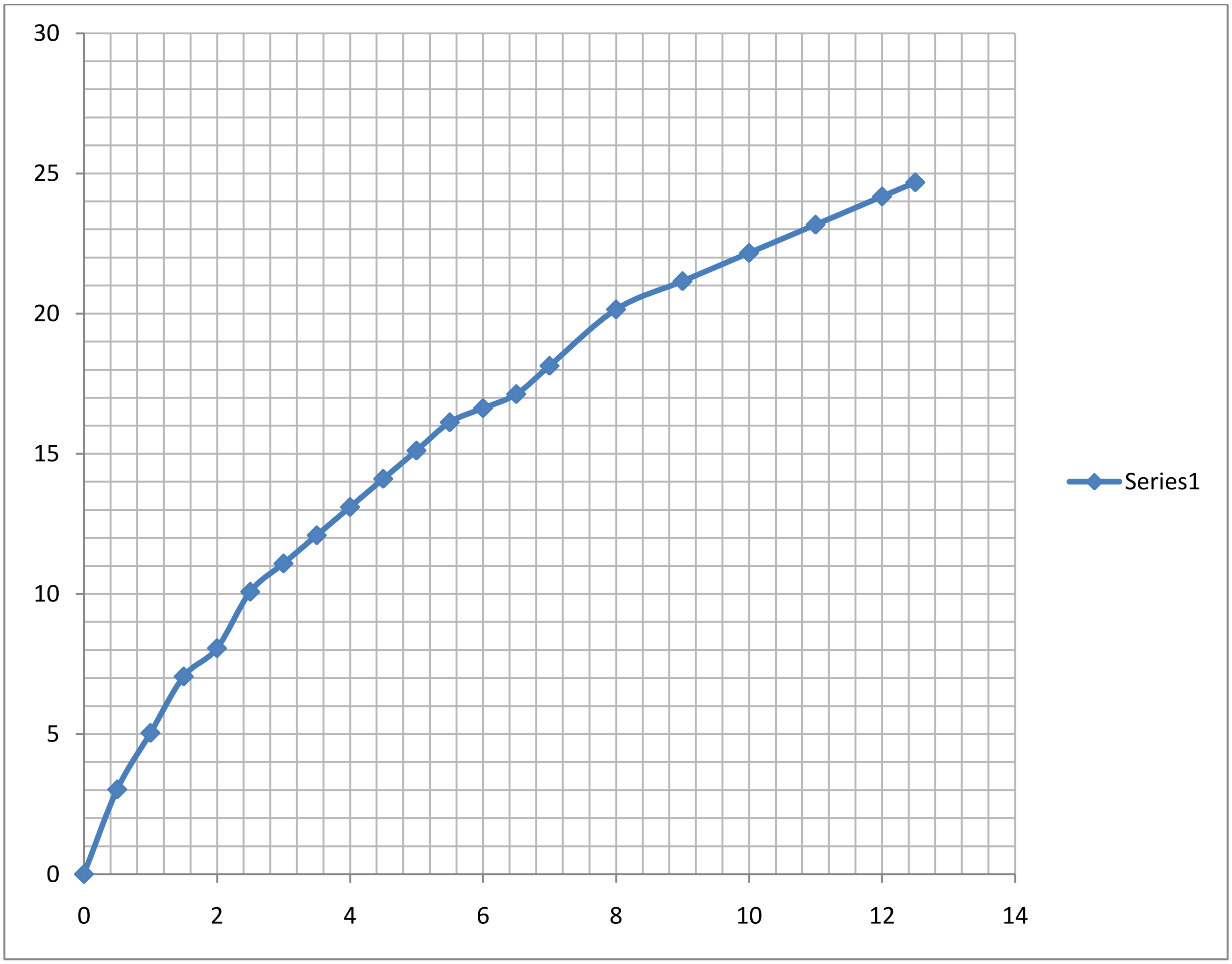
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(12.088/1370)*100%=.88%

CBR_5=(21.154/2055)*100%=1%

2-days soaked



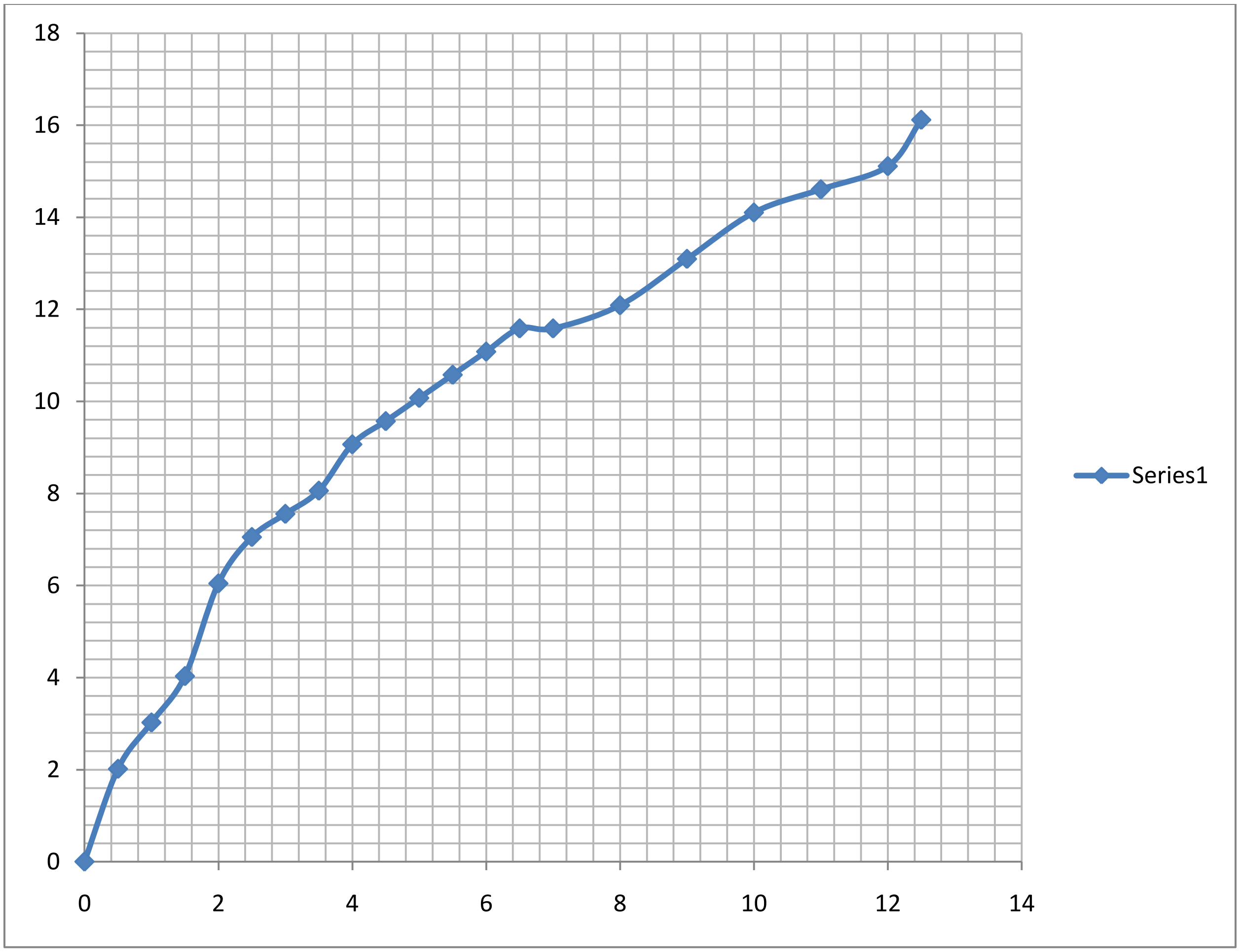
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(10.0734/1370)*100%=.74%

CBR_5=(15.11/2055)*100%=.735%

3-days soaked



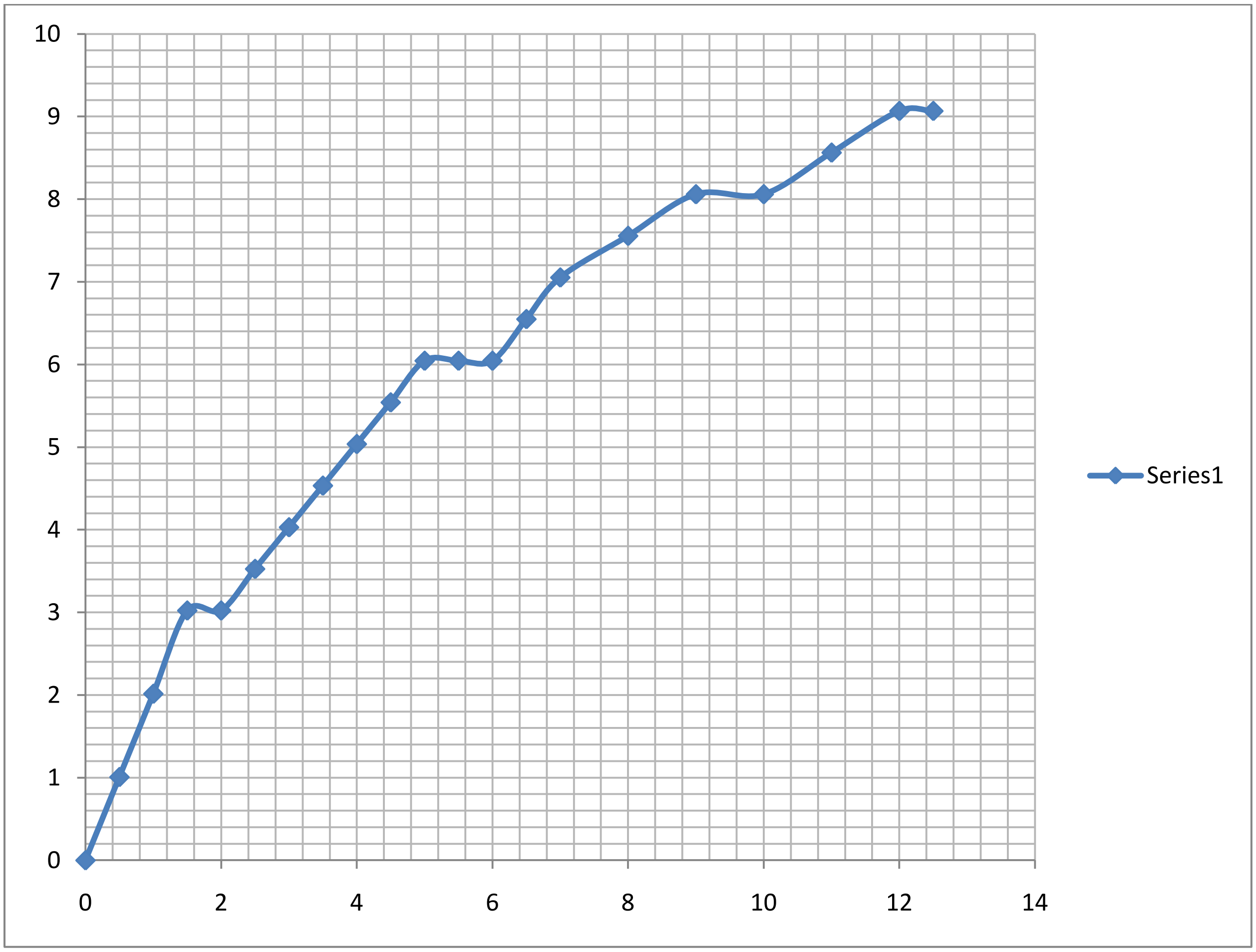
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(6.044/1370)*100%=.44%

CBR_5=(10.073/2055)*100%=.49%

4-days soaked



X : penetration(in mm)

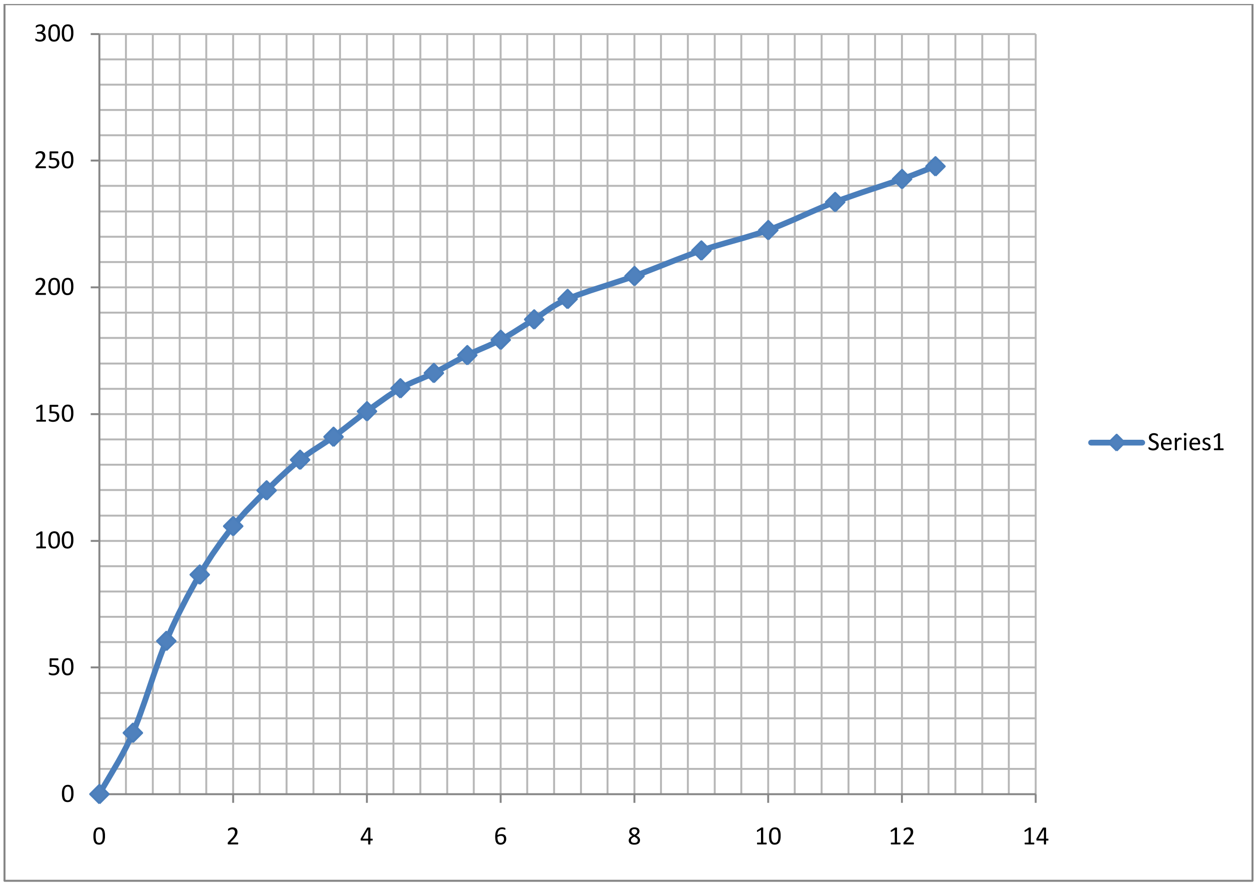
Y: loading(in kg)

$CBR_{2.5}$=(3.525/1370)*100%=.26%

CBR_{5}=(6.044/2055)*100%=.29%

SAMPLE (E)

Un-soaked



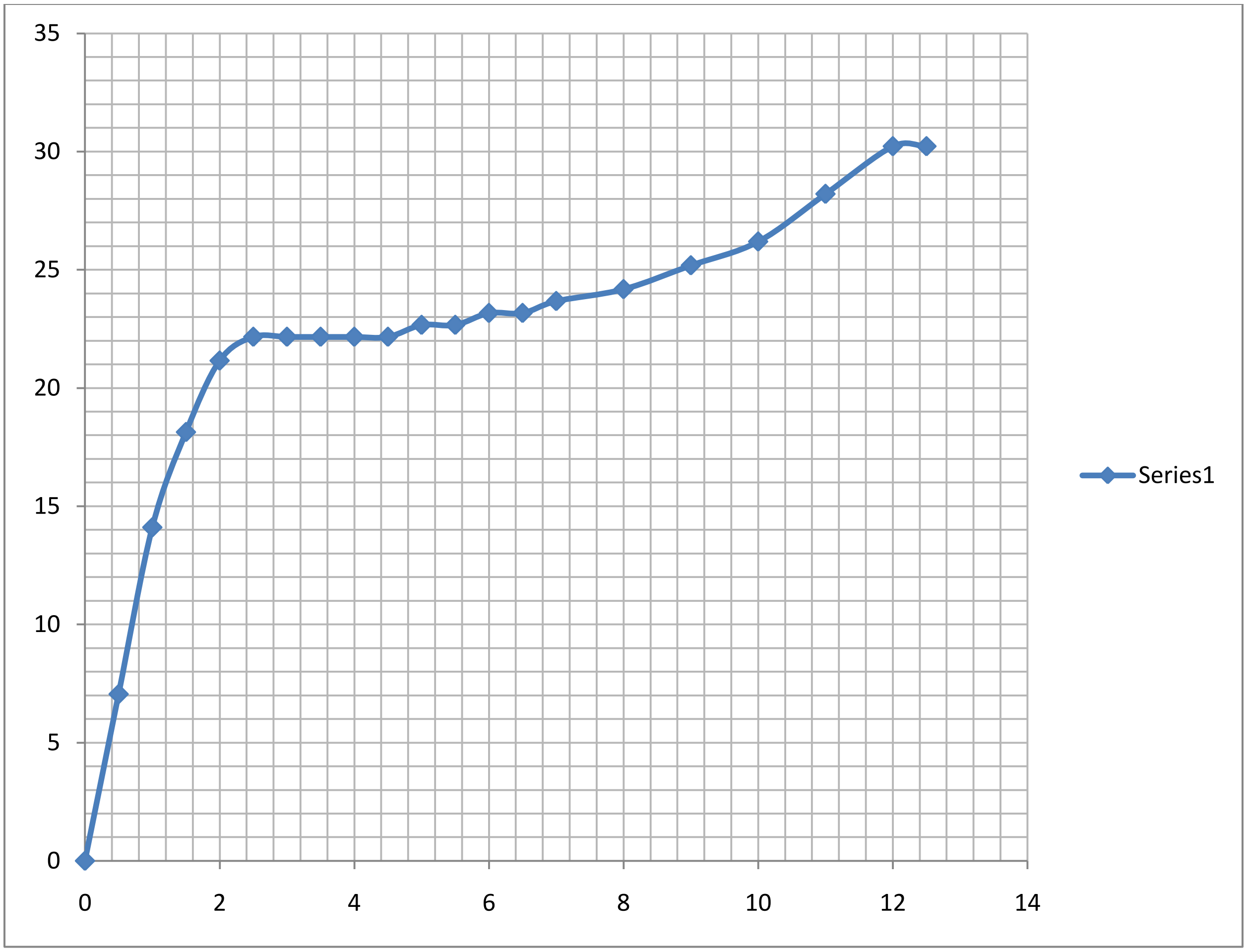
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(119.873/1370)*100%=8.75%

CBR_5=(166.211/2055)*100%=8.09%

1-day soaked



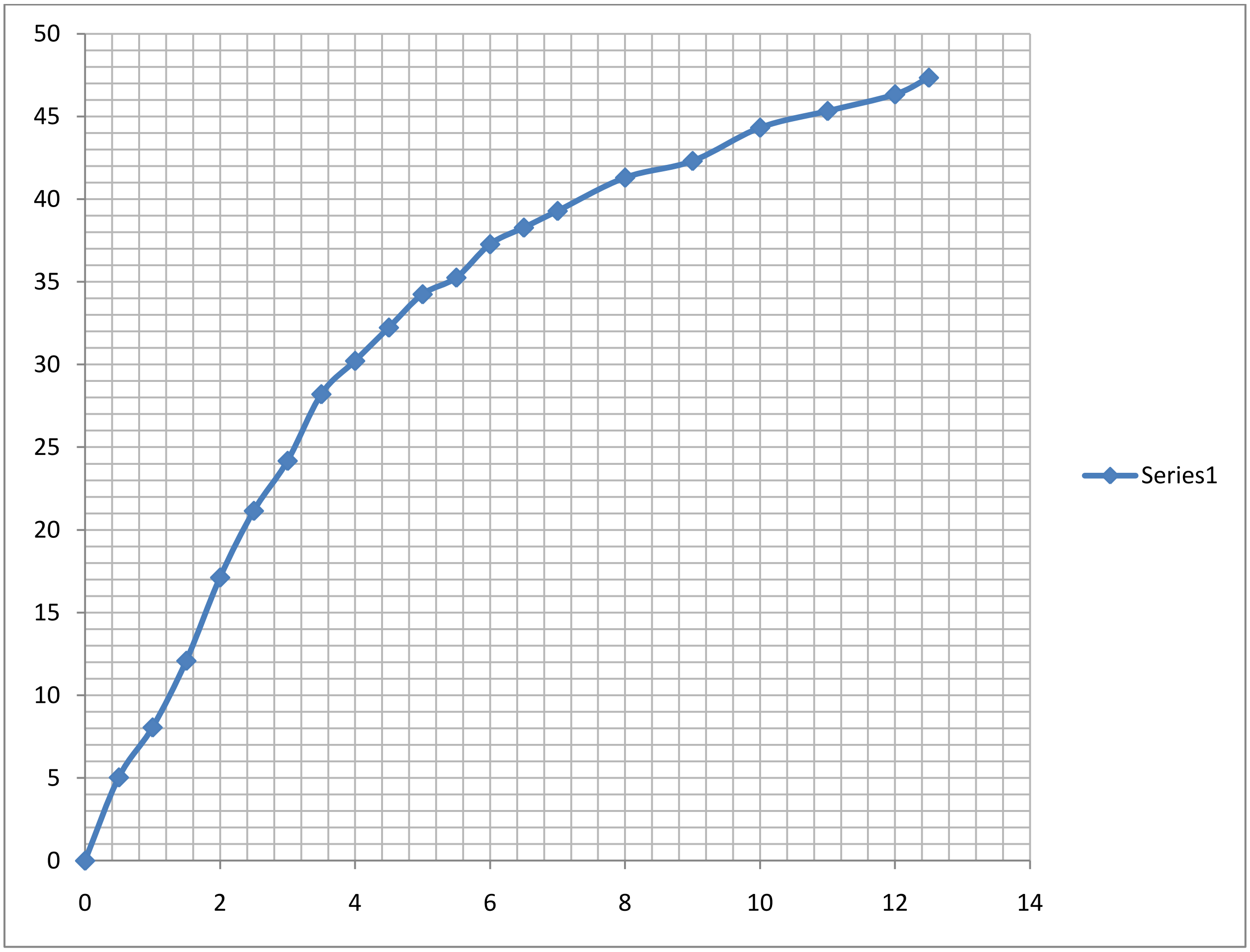
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(22.161/1370)*100%=1.62%

CBR_5=(22.665/2055)*100%=1.1%

2-days soaked



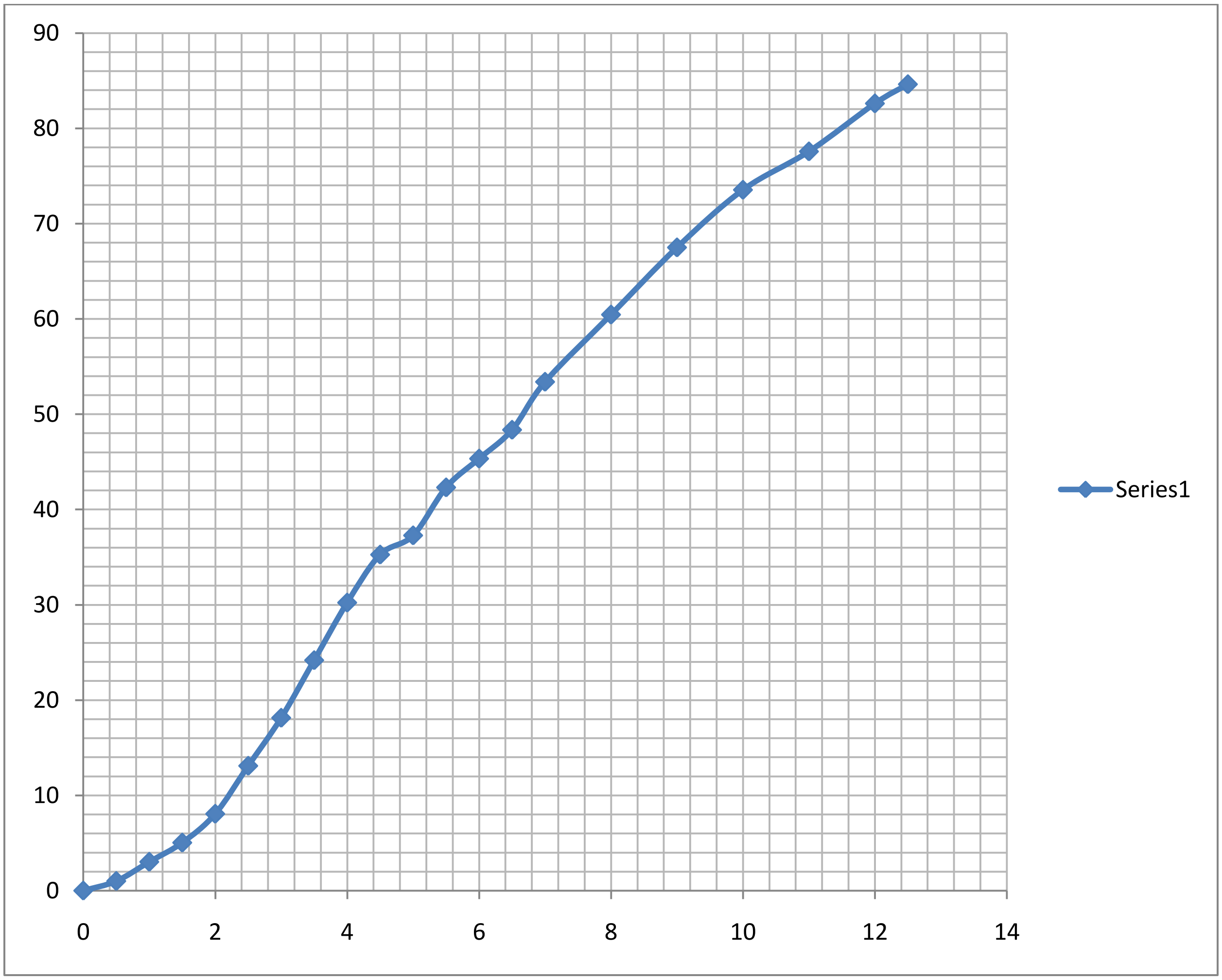
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(21.15/1370)*100%=1.54%

CBR_5=(34.242055)*100%=1.67%

3-days soaked



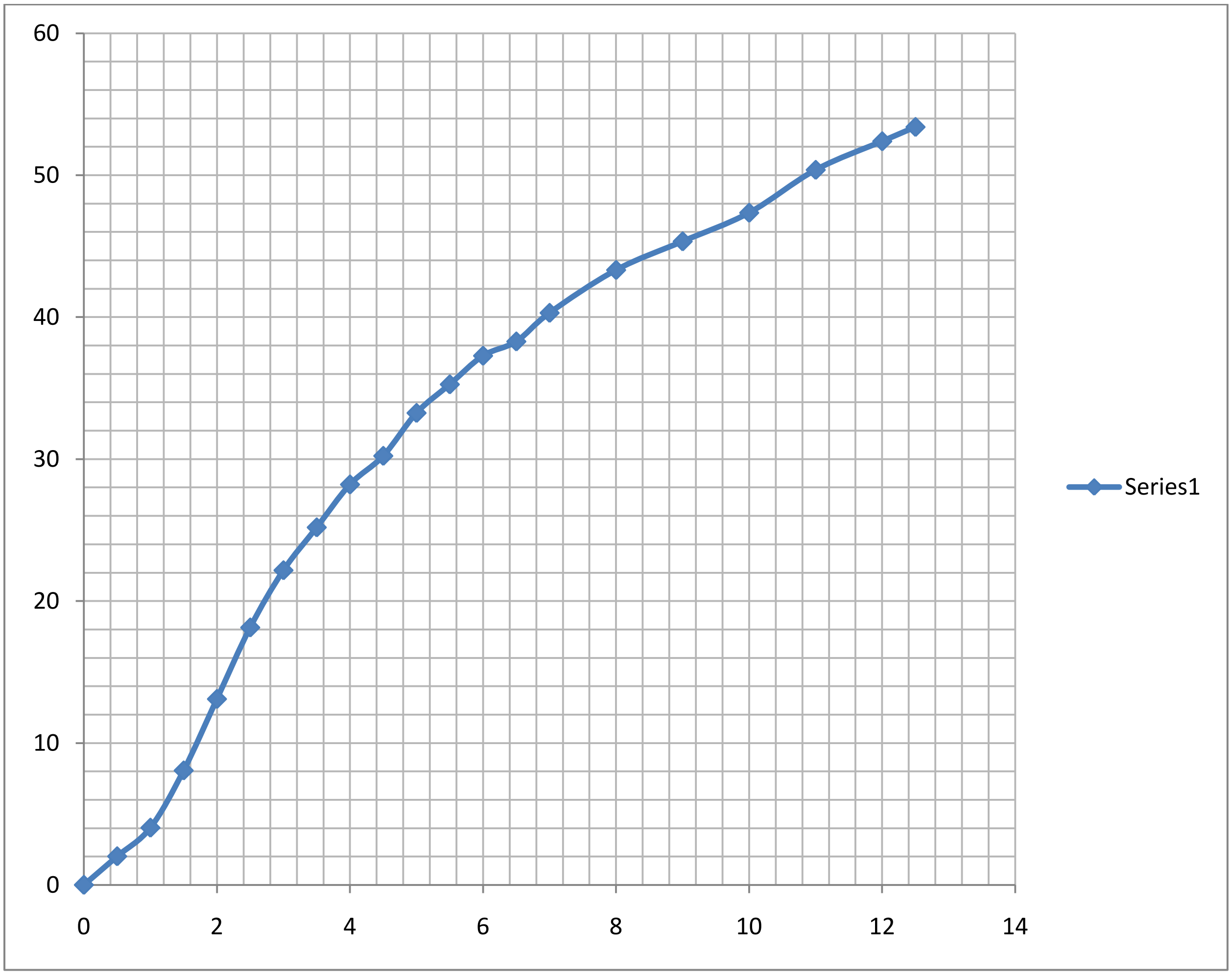
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(13.095/1370)*100%=.96%

CBR_5=(37.271/2055)*100%=1.65%

4-days soaked



X : penetration(in mm)

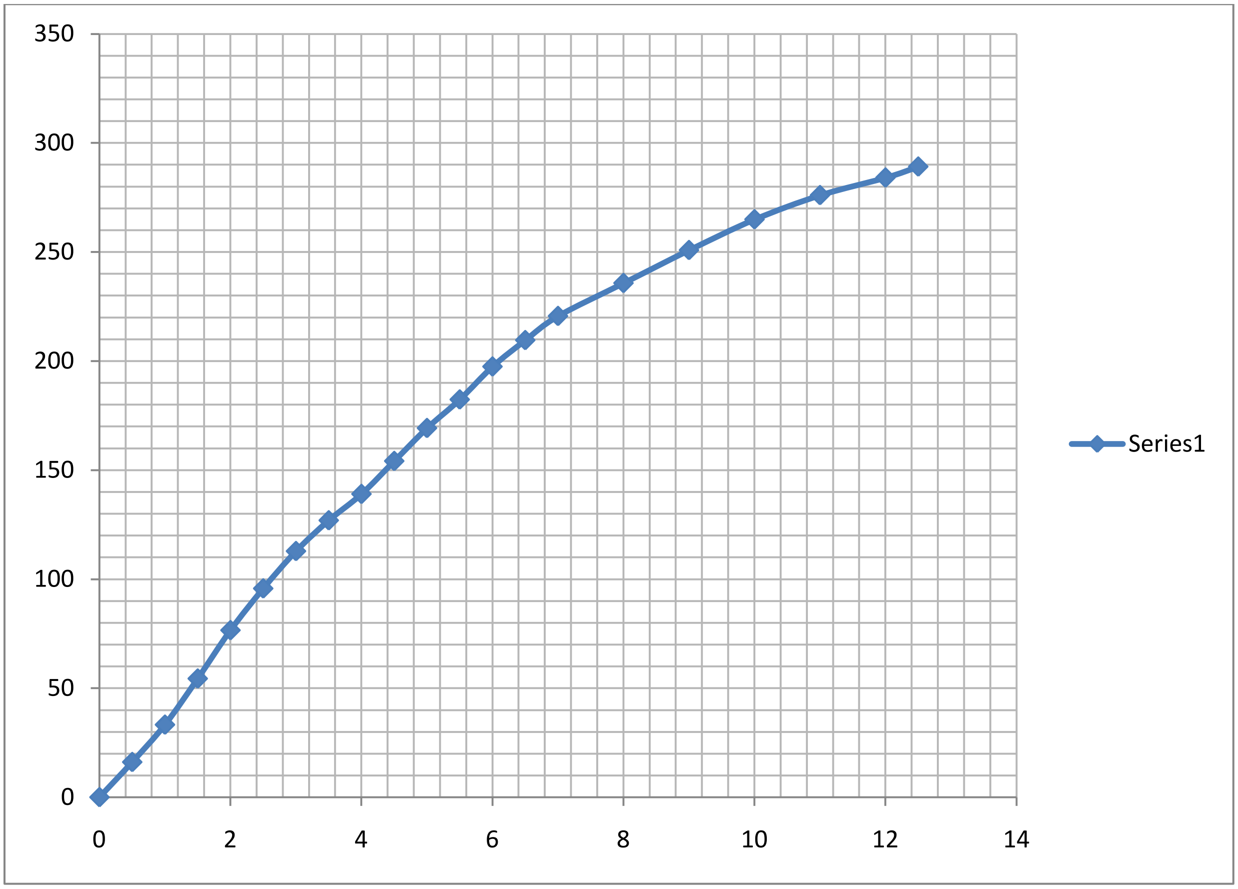
Y: loading(in kg)

$CBR_{2.5}$=(18.132/1370)*100%=1.32%

CBR_5=(33.24/2055)*100%=1.6%

SAMPLE (F)

Un-soaked



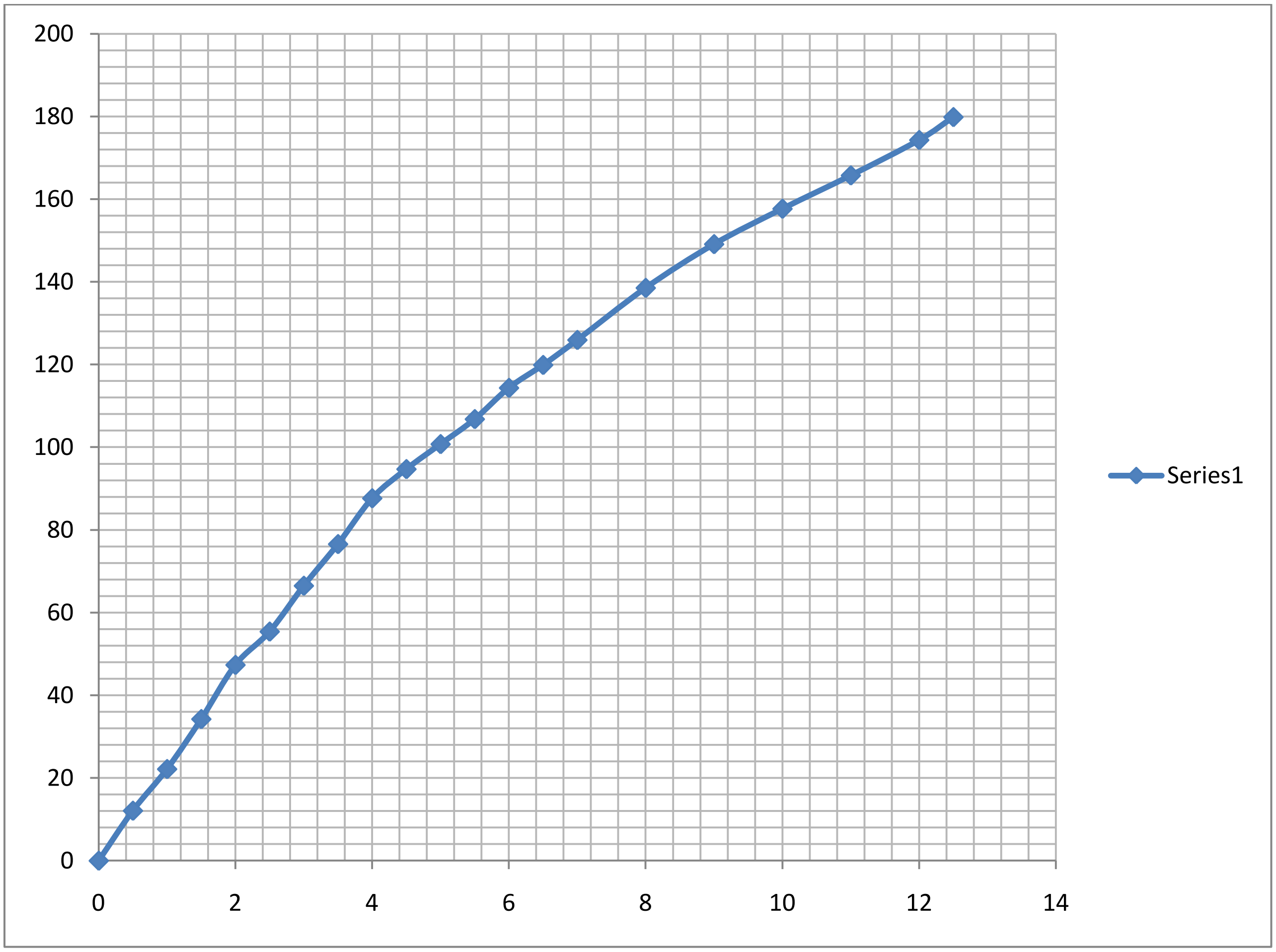
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(95.7/1370)*100%=6.98%

CBR_{5}=(169.23/2055)*100%=8.2%

1-day soaked



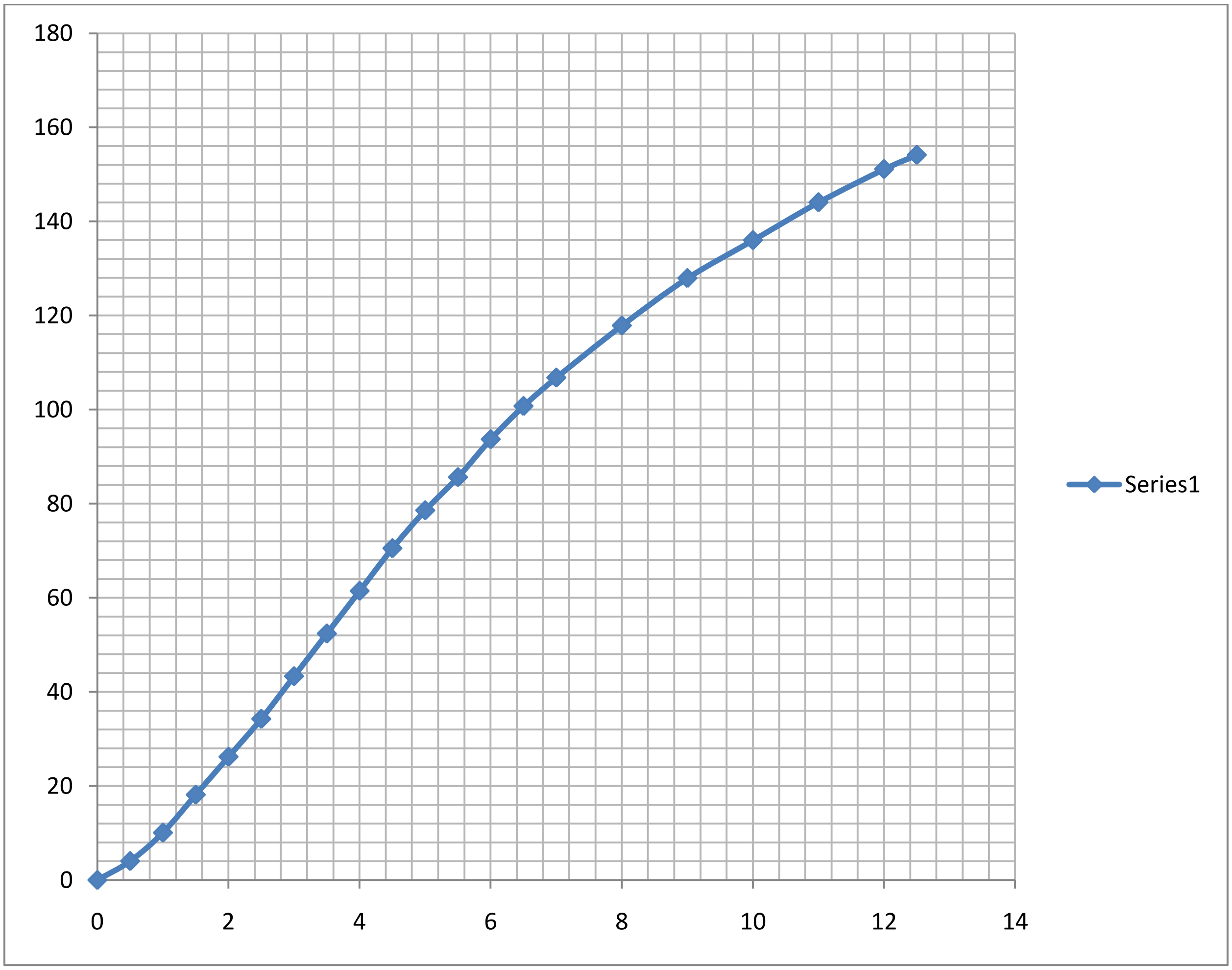
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(55.404/1370)*100%=4.04%

CBR_5=(100.734/2055)*100%=4.9%

2-days soaked



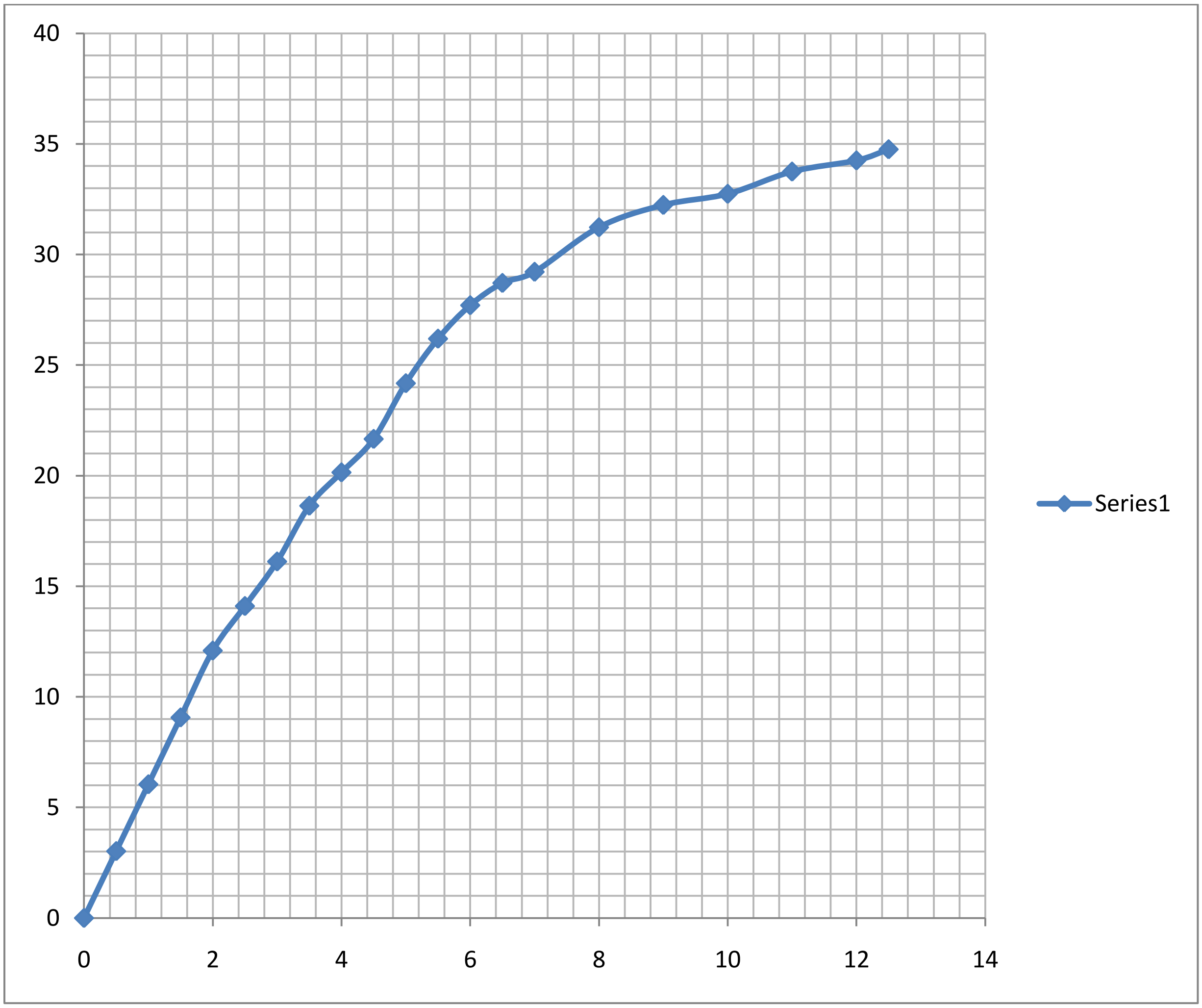
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(34.25/1370)*100%=2.5%

CBR_{5}=(78.572/2055)*100%=3.8%

3-days soaked



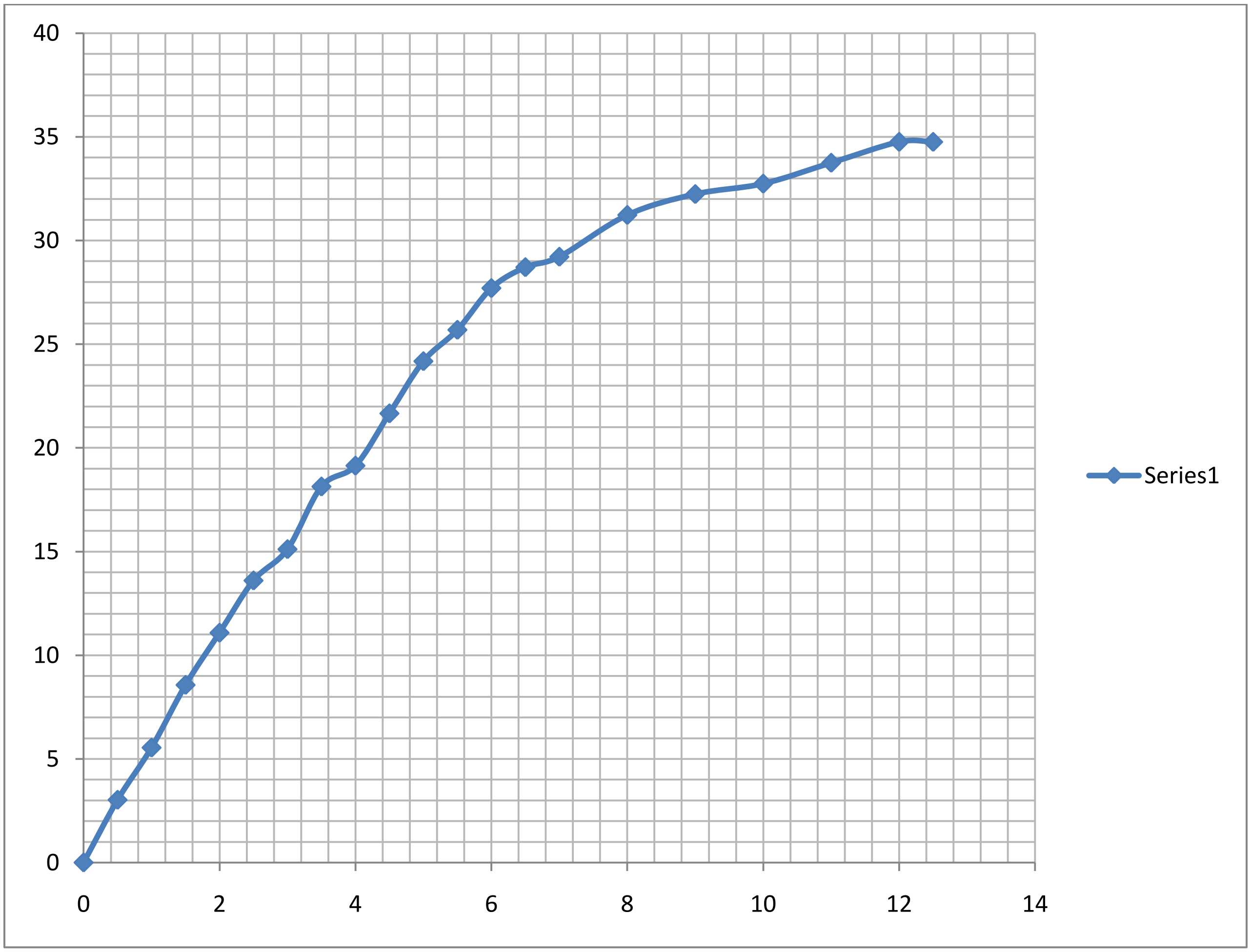
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(14.103/1370)*100%=1.03%

CBR_5=(24.176/2055)*100%=1.17%

4-days soaked



X : penetration(in mm)

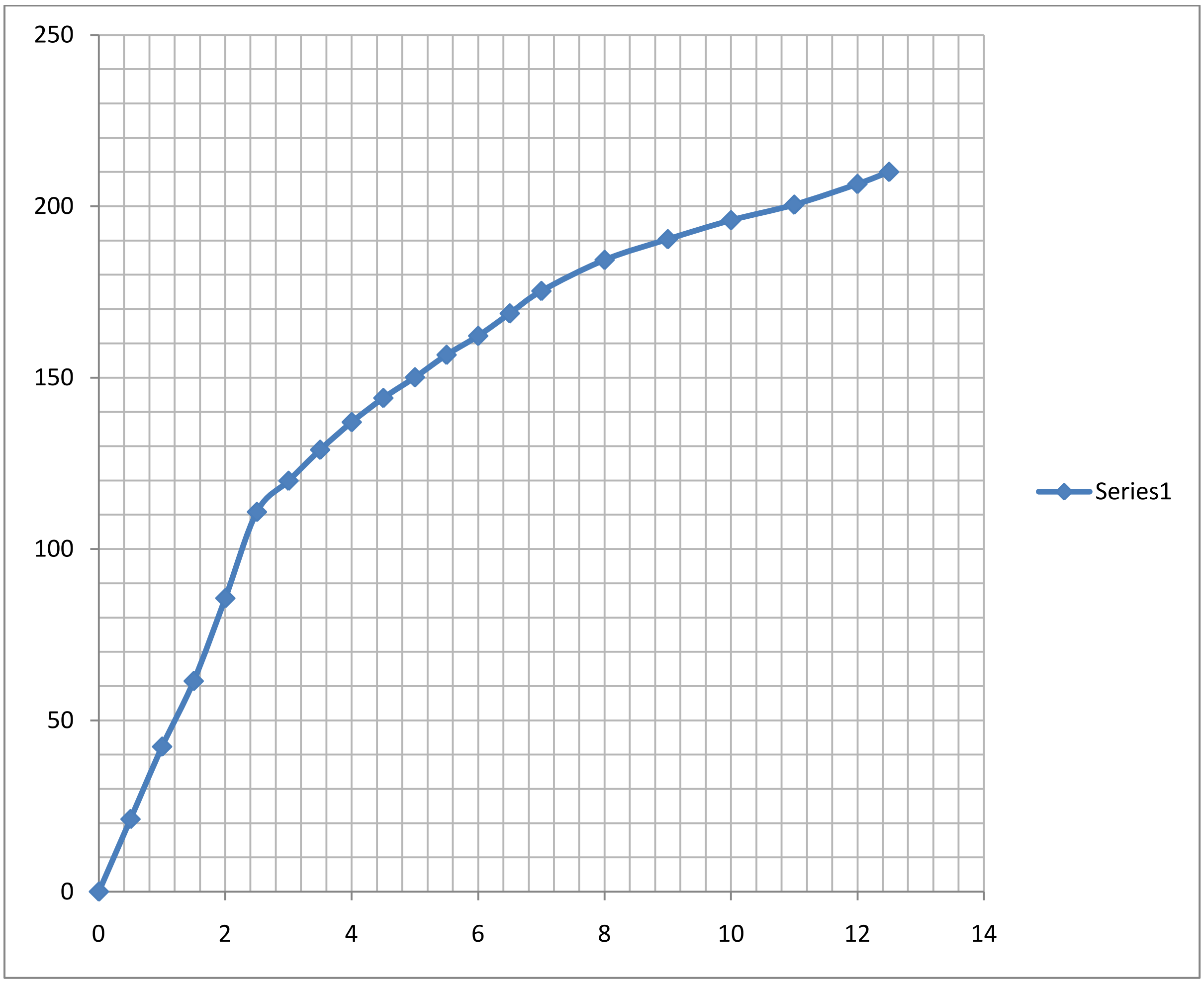
Y: loading(in kg)

$CBR_{2.5}$=(13.59909/1370)*100%=1%

CBR_{5}=(24.17616/2055)*100%=1.1%

SAMPLE (G)

Un-soaked



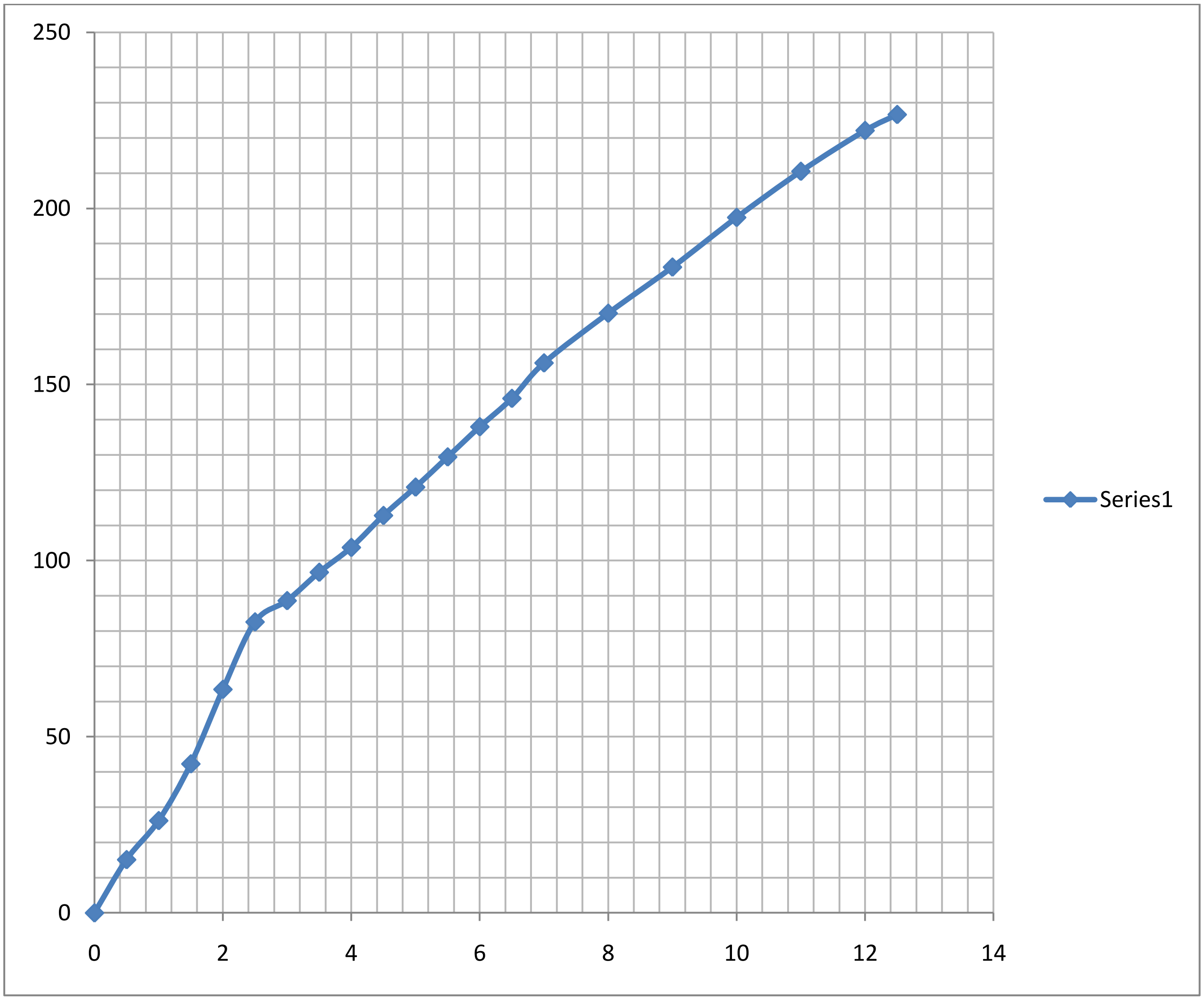
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(110.8074/1370)*100%=8.1%

CBR_5=(150.0937/2055)*100%=7.3%

1-day soaked



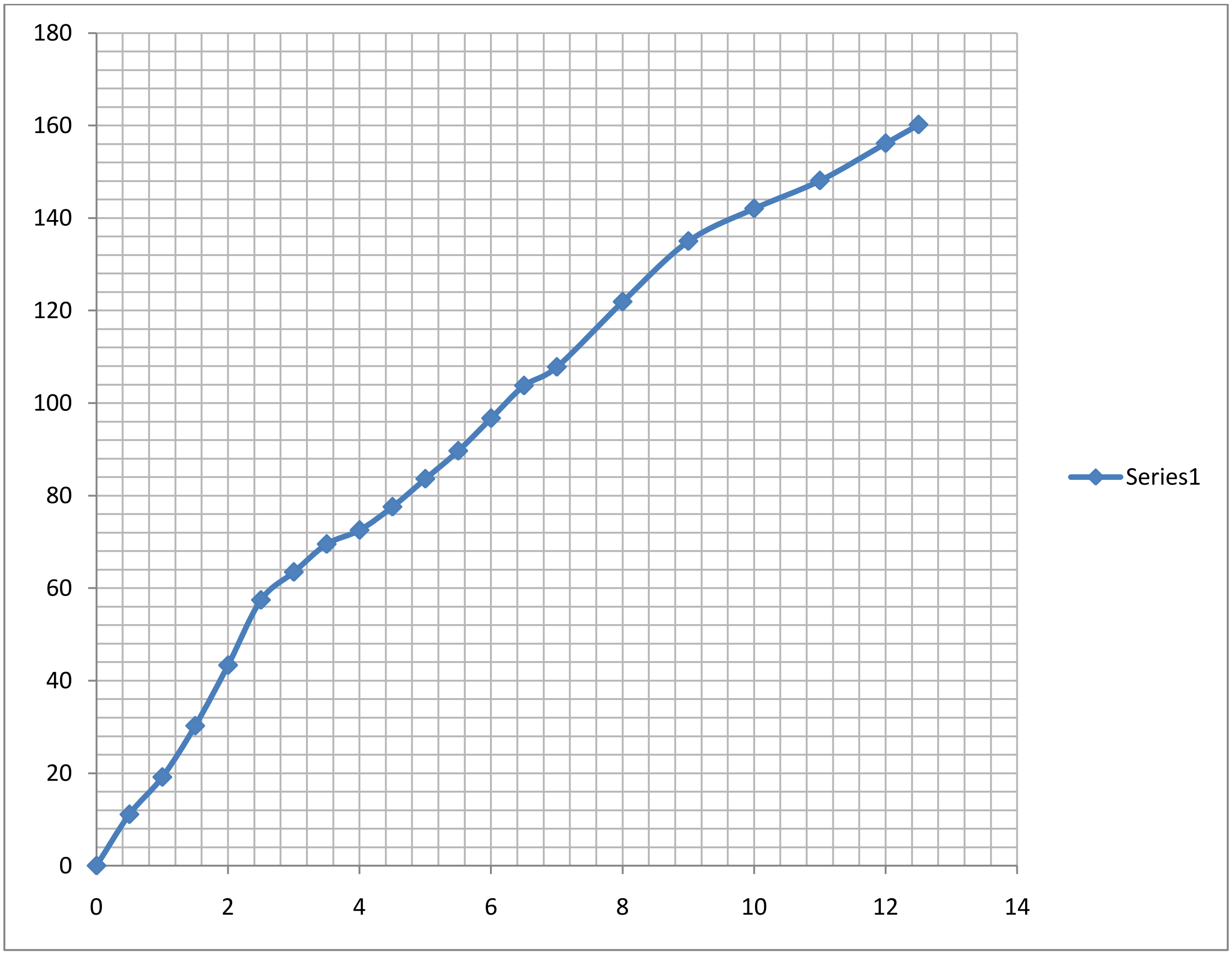
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(82.602/1370)*100%=6%

CBR_{5}=(150.0937/2055)*100%=7.3%

2-days soaked



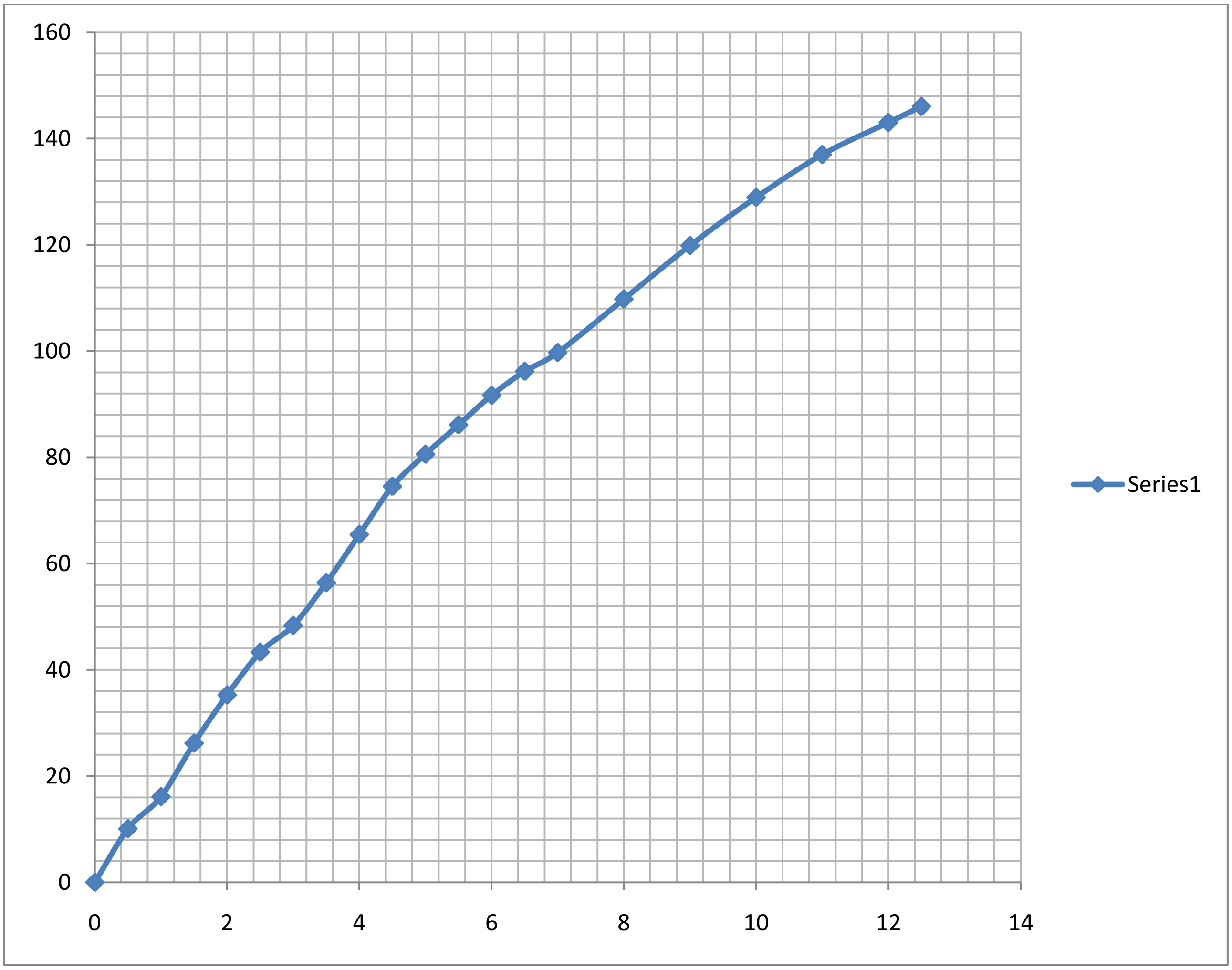
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(57.418/1370)*100%=4.2%

CBR_5=(83.609/2055)*100%=4.07%

3-days soaked



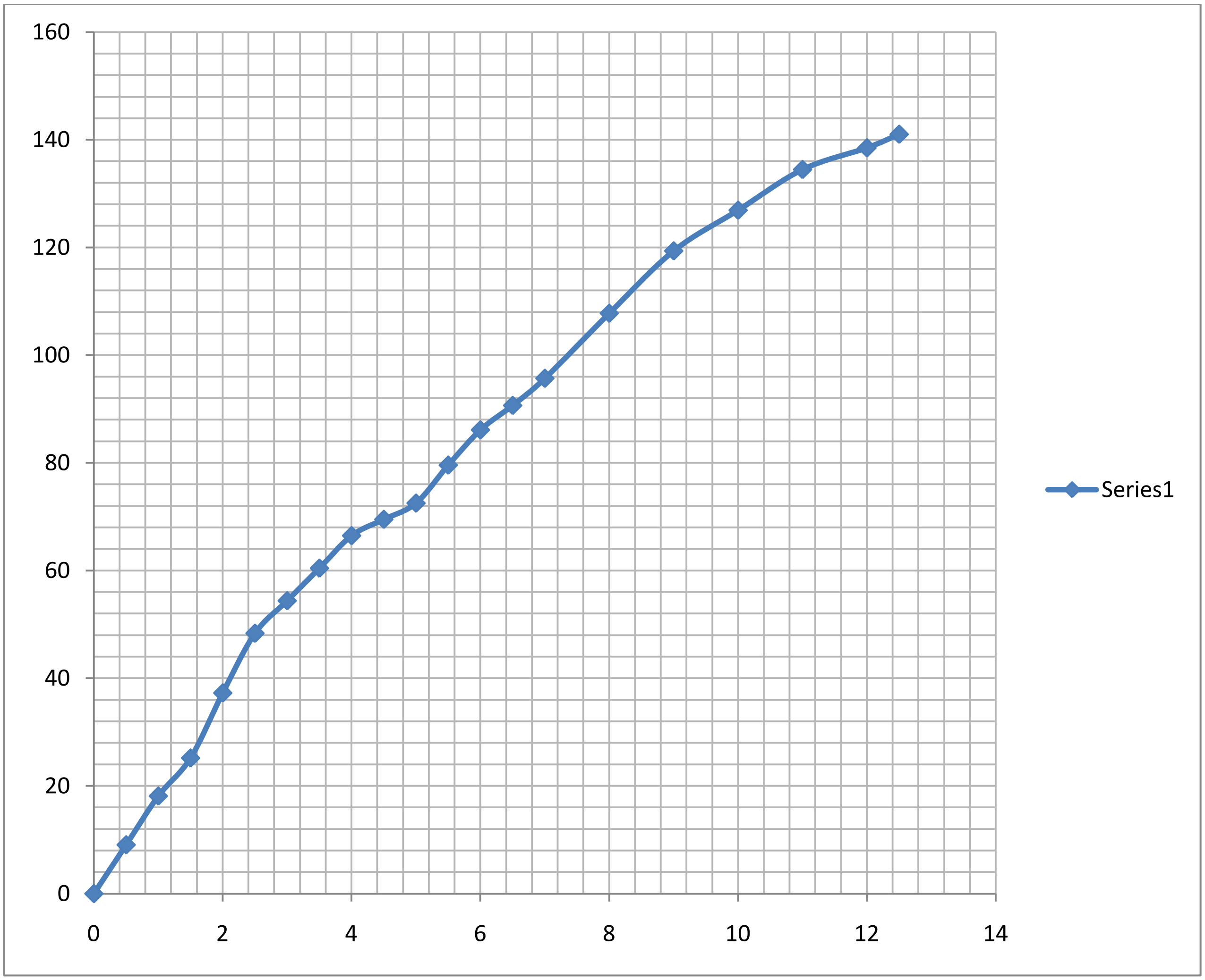
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(43.316/1370)*100%=3.16%

CBR_{5}=(80.5872/2055)*100%=3.9%

4-days soaked



X : penetration(in mm)

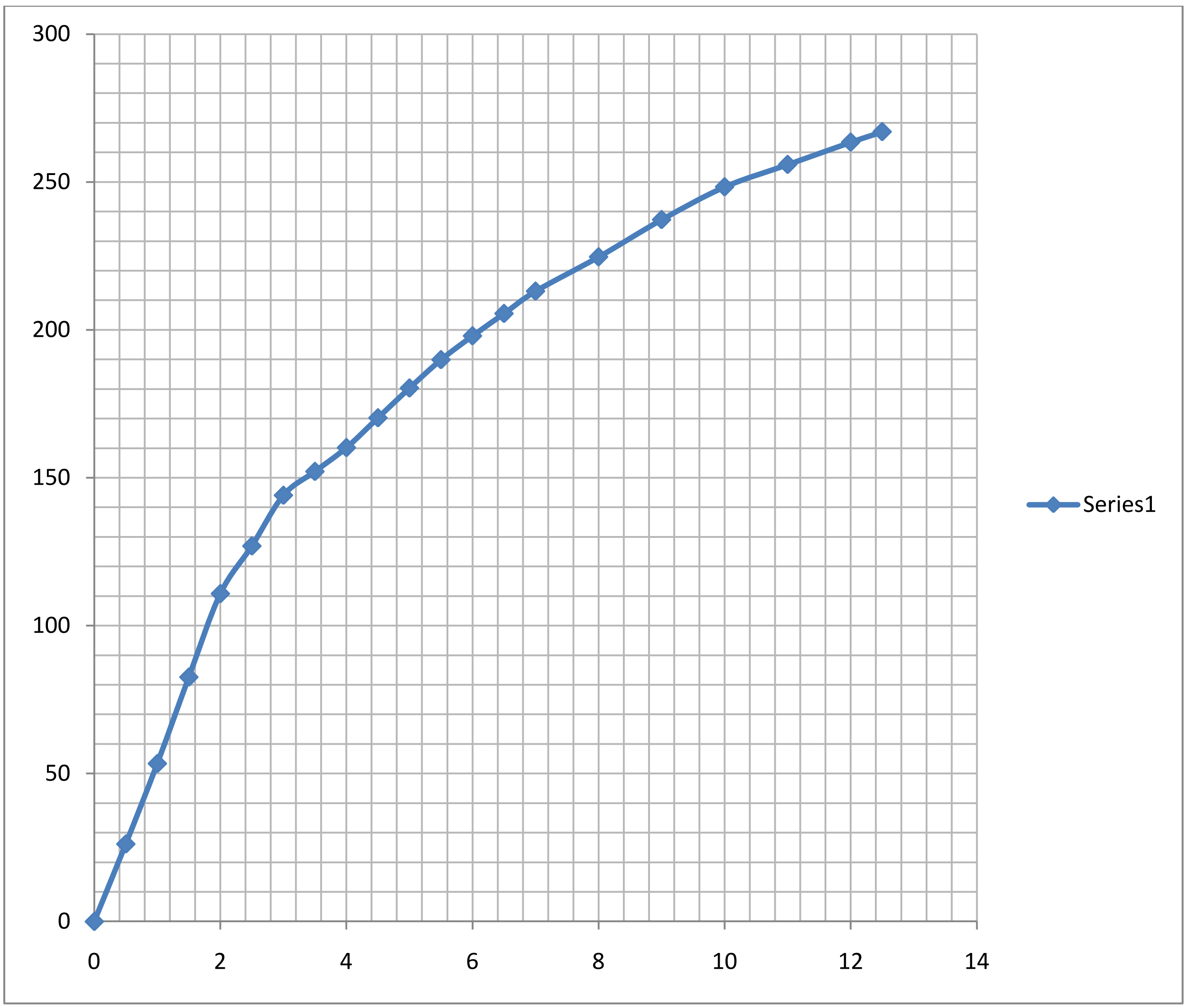
Y: loading(in kg)

$CBR_{2.5}$=(48.352/1370)*100%=3.5%

CBR_{5}=(72.528/2055)*100%=3.5%

SAMPLE (H)

Un-soaked



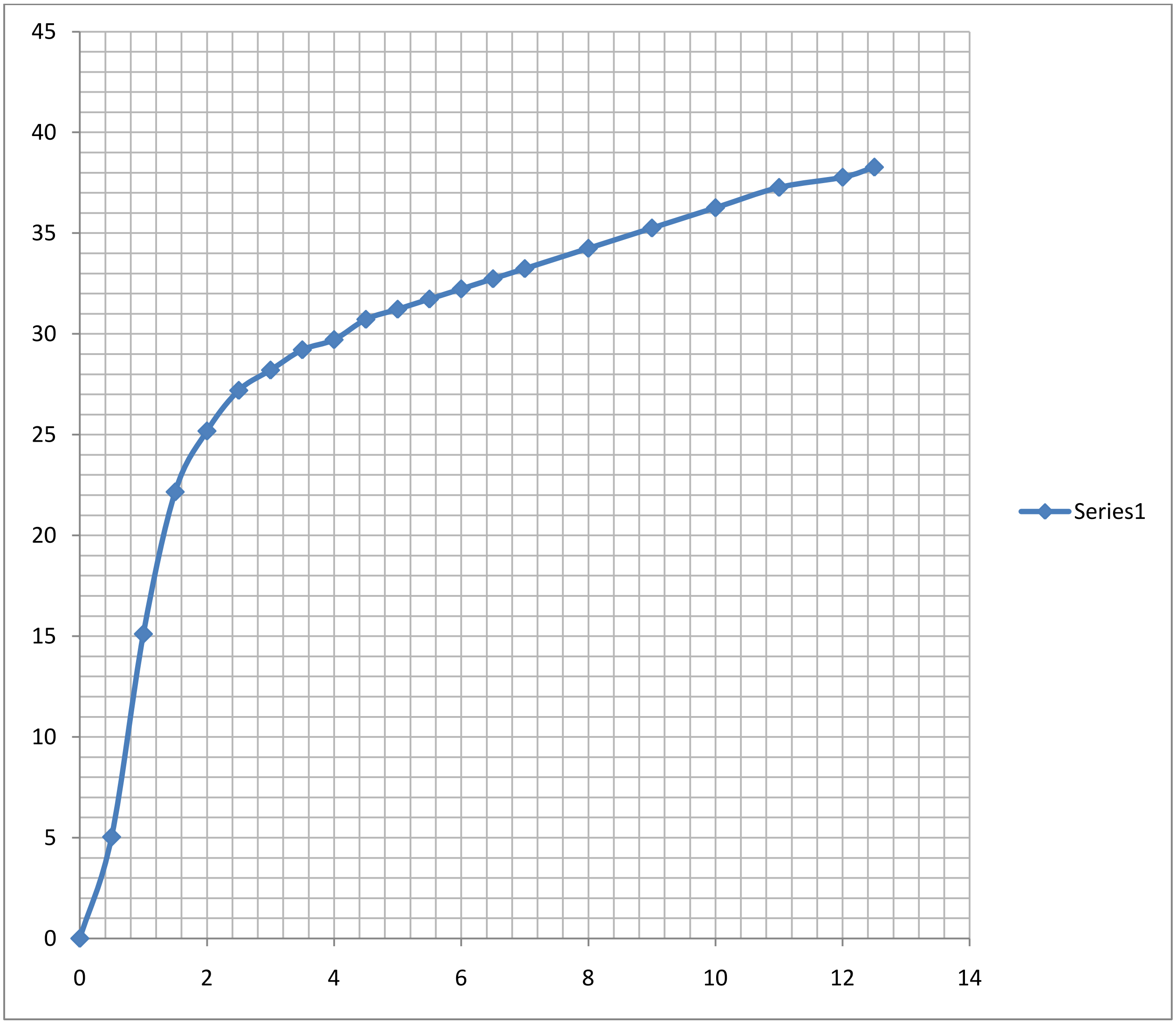
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(126.925/1370)*100%=9.26%

CBR_5=(180.314/2055)*100%=8.77%

1-day soaked



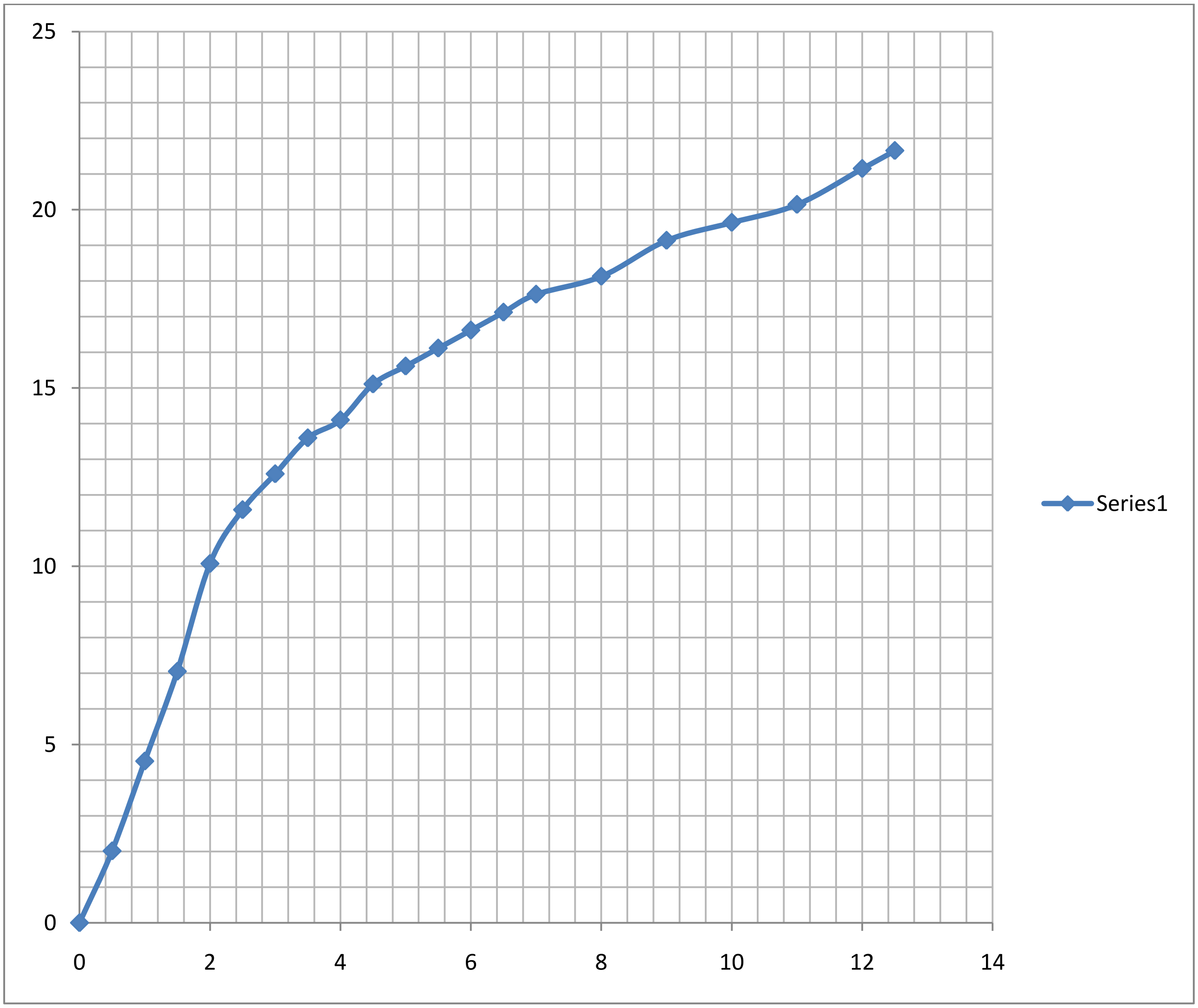
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(27.198/1370)*100%=2%

CBR_5=(31.227/2055)*100%=1.51%

2-days soaked



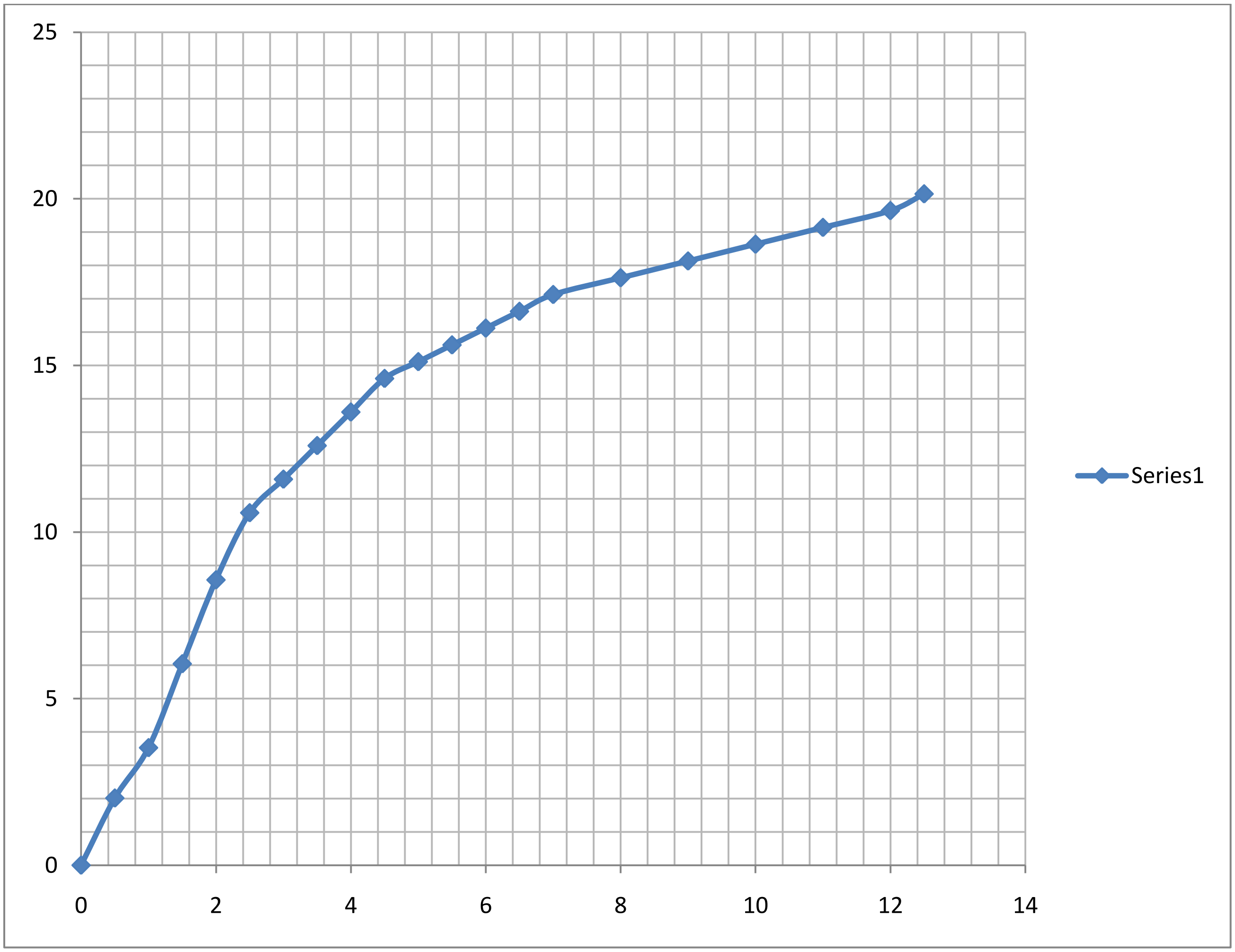
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(11.584/1370)*100%=.84%

CBR_{5}=(15.614/2055)*100%=.75%

3-days soaked



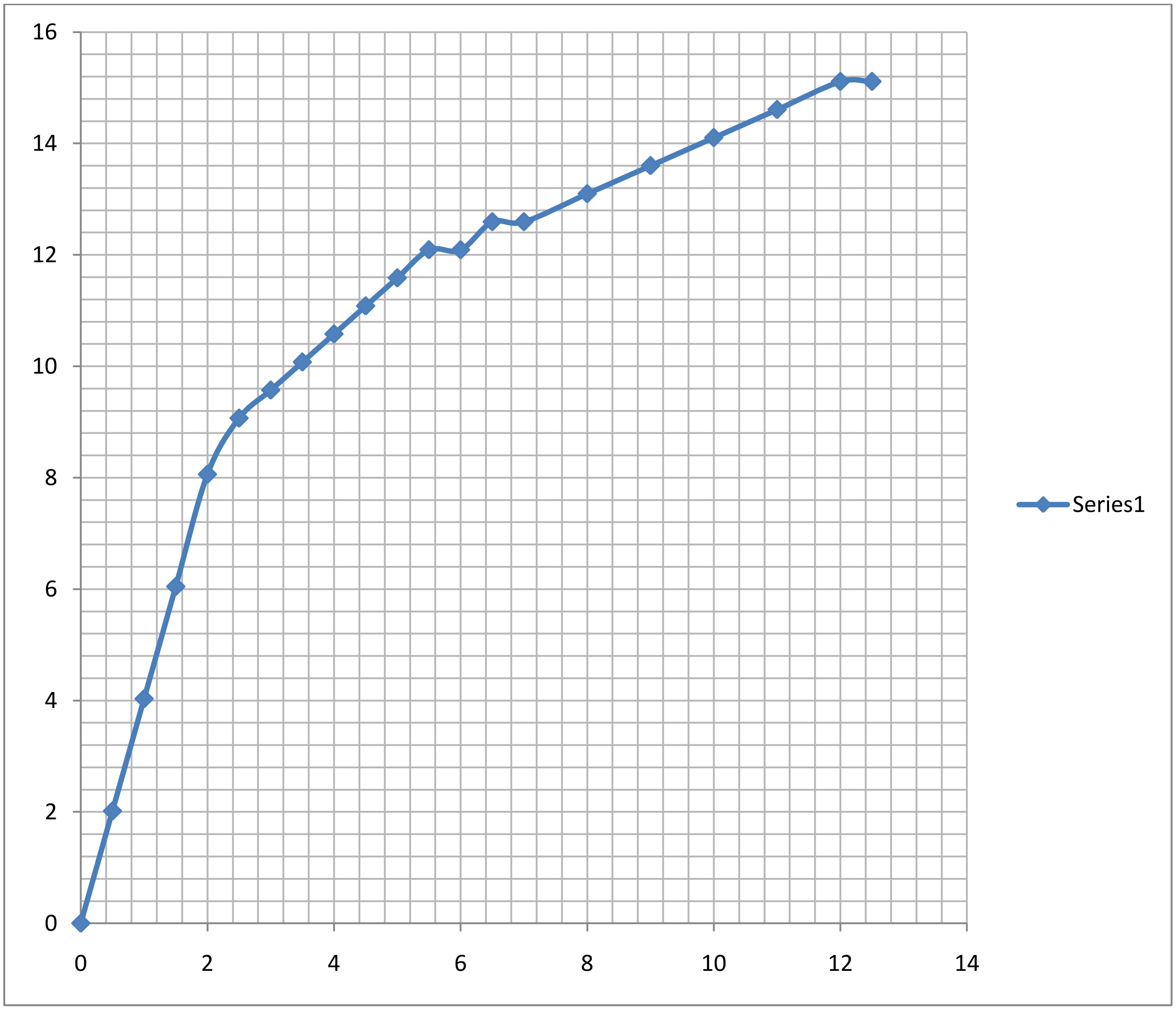
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(10.577/1370)*100%=.77%

CBR_{5}=(15.1101/2055)*100%=.735%

4-days soaked



X : penetration(in mm)

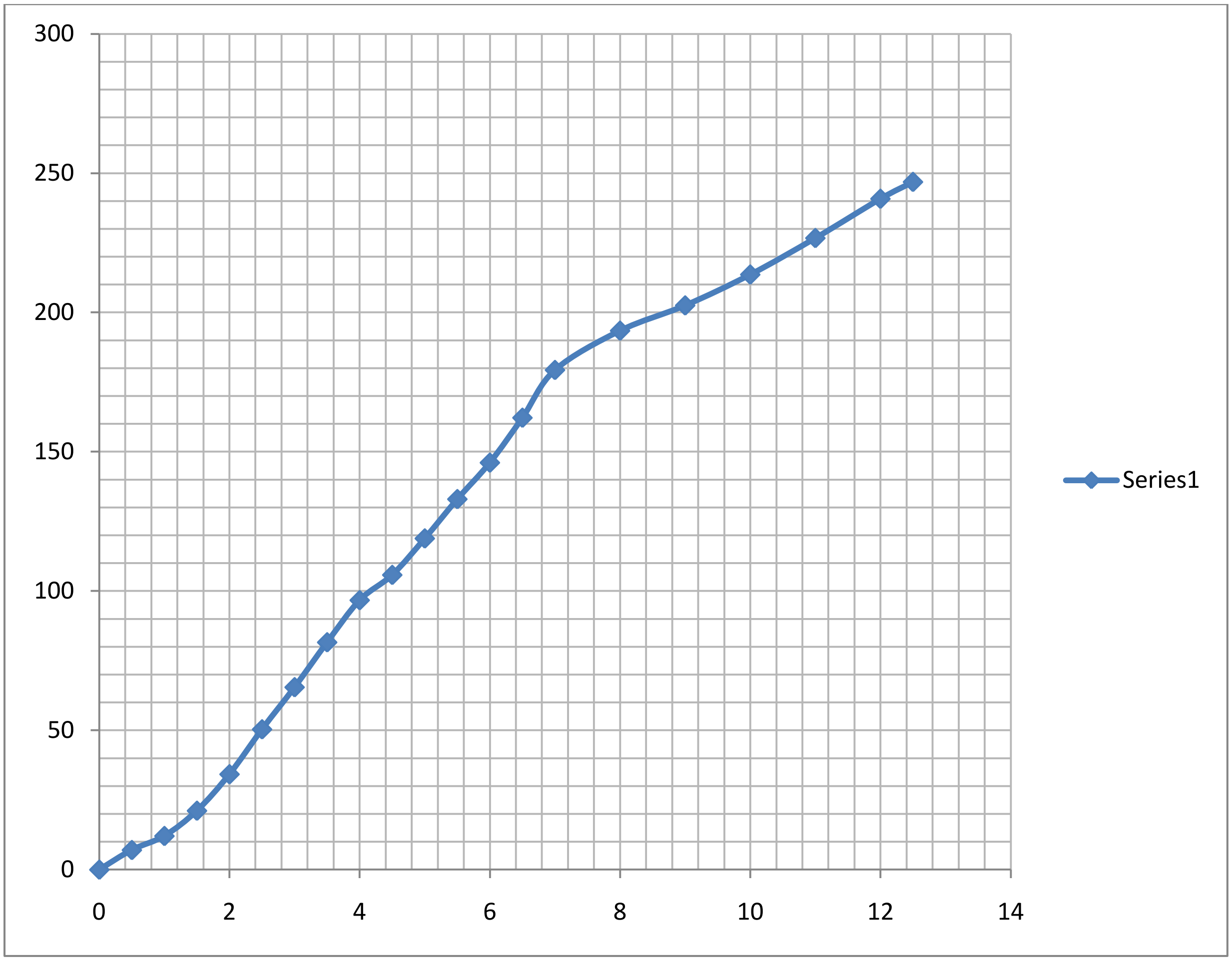
Y: loading(in kg)

$CBR_{2.5}$=(9.066/1370)*100%=.66%

CBR_5=(11.584/2055)*100%=.56%

SAMPLE (I)

Un-soaked



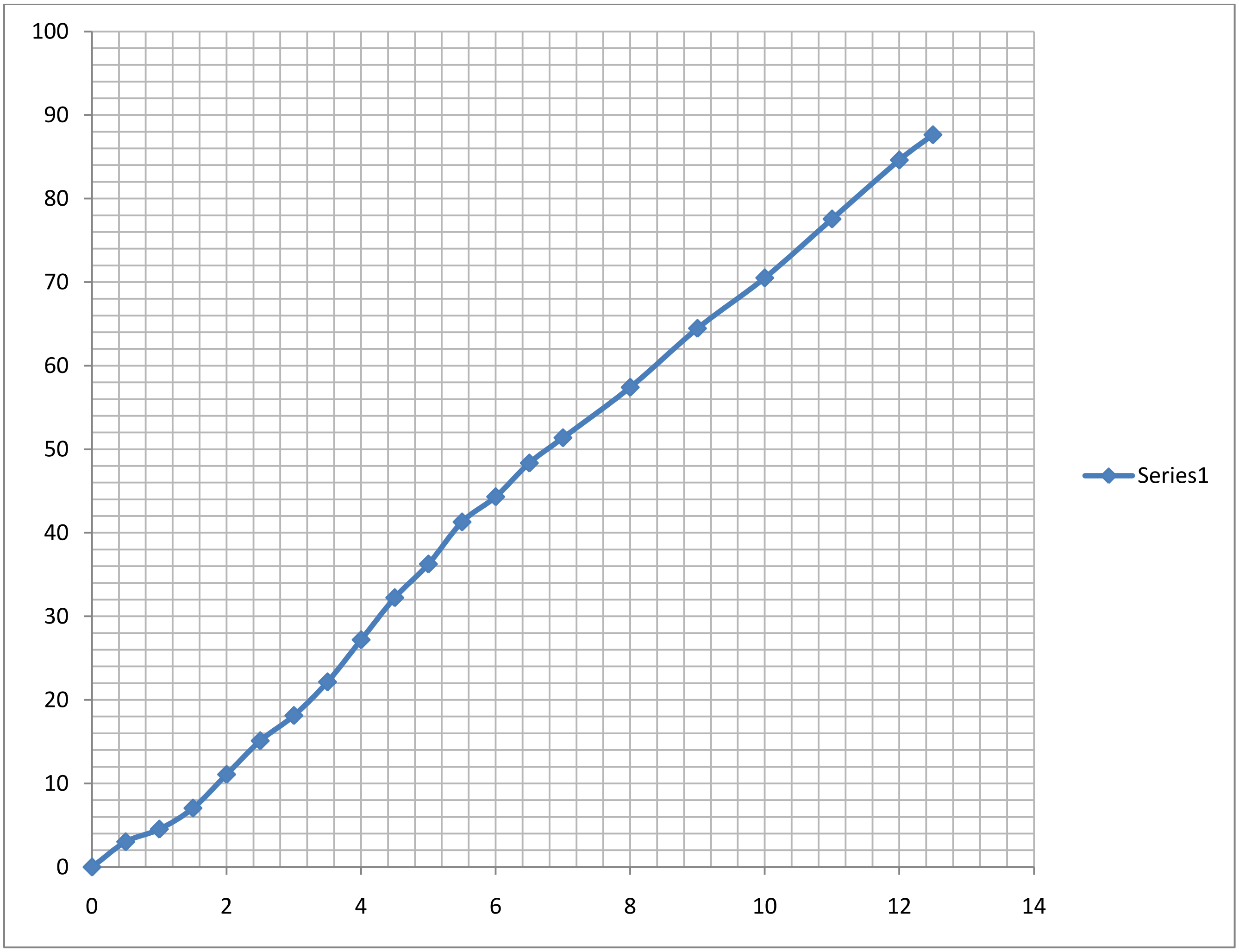
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(50.367/1370)*100%=3.6%

CBR_{5}=(118.866/2055)*100%=5.78%

1-day soaked



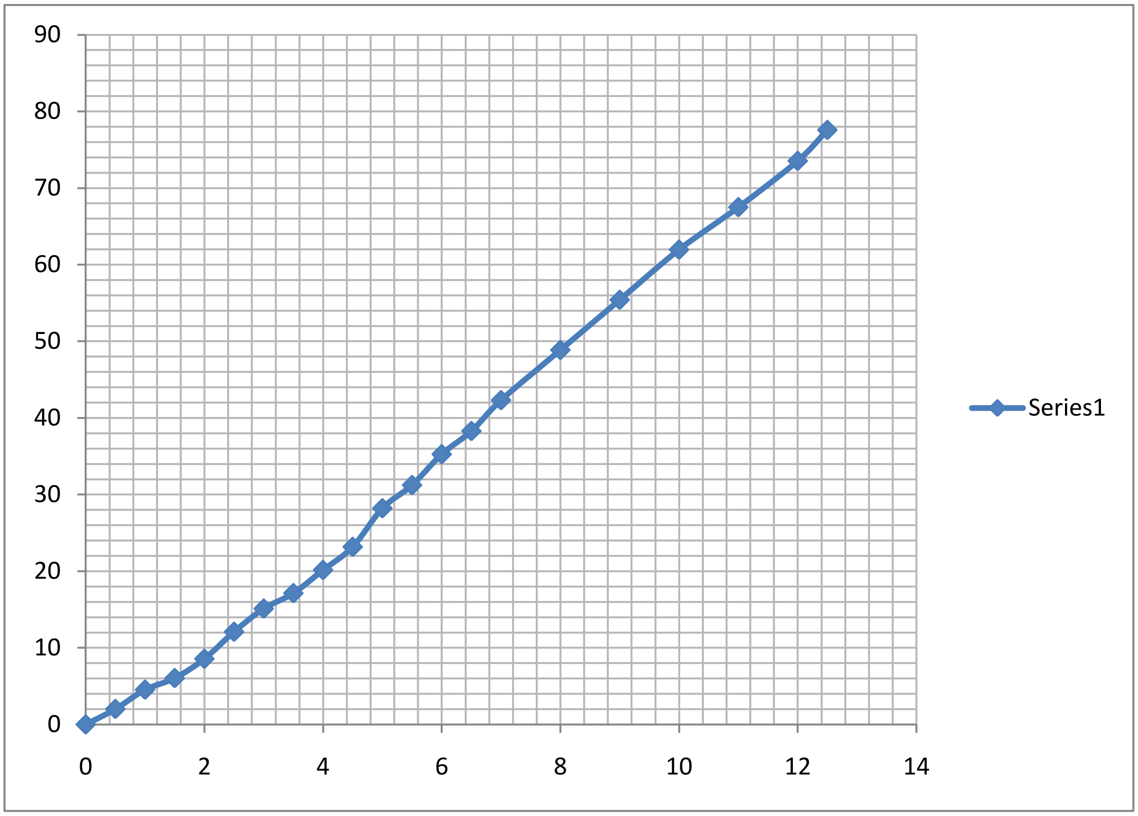
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(15.1101/1370)*100%=1.1%

CBR_{5}=(36.264/2055)*100%=1.76%

2-days soaked



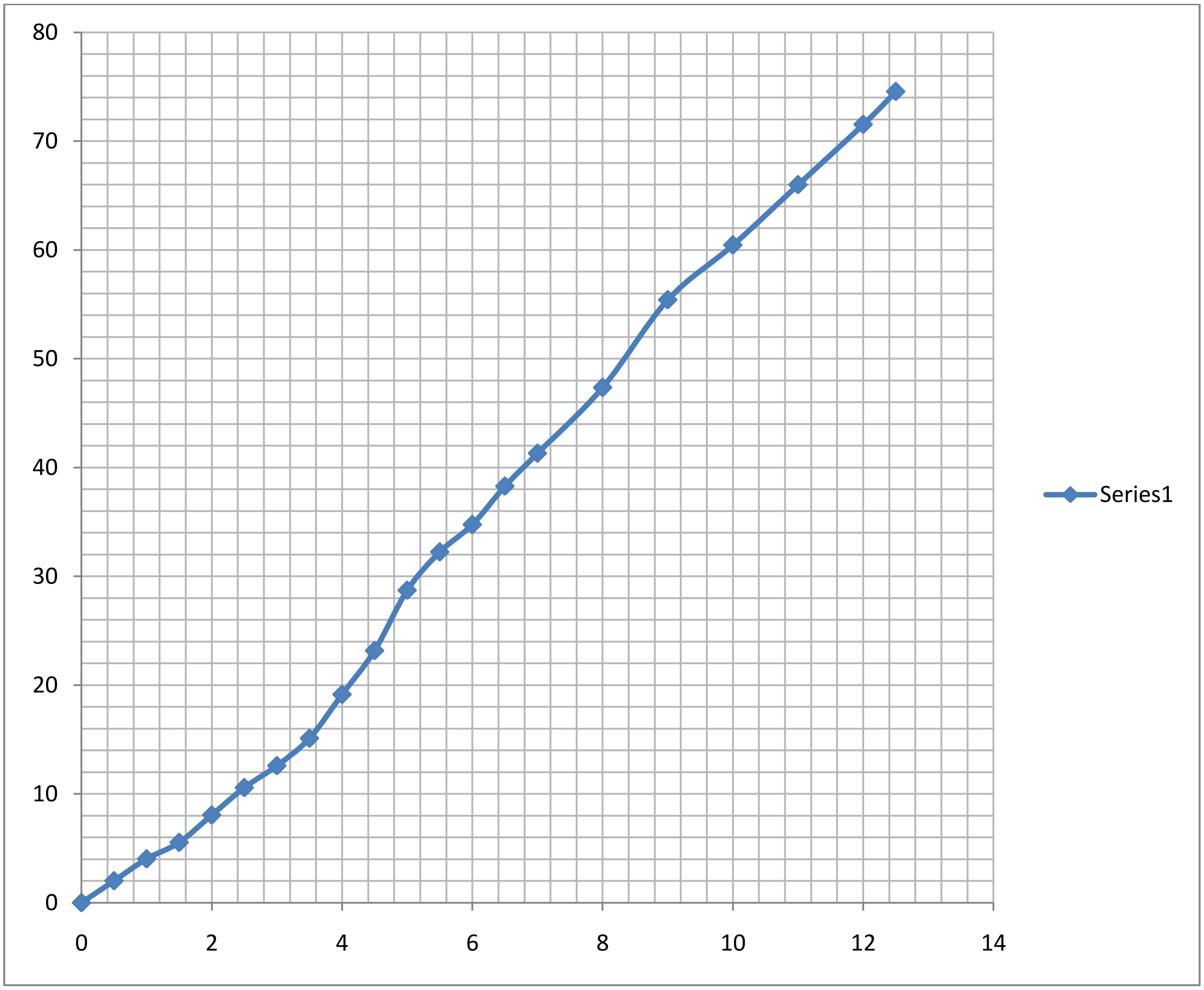
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(12.088/1370)*100%=.88%

CBR_5=(28.206/2055)*100%=1.37%

3-days soaked



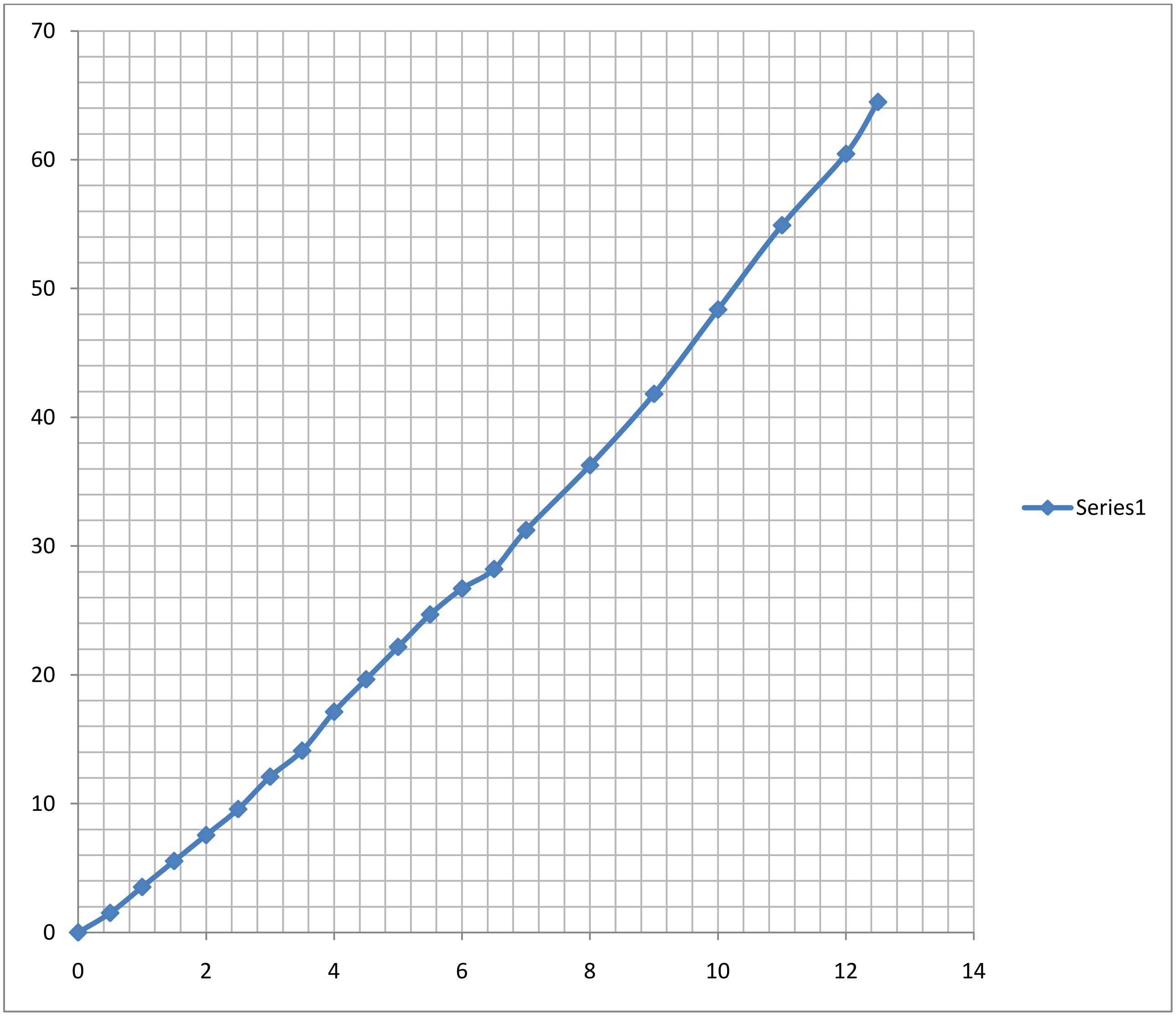
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(10.577/1370)*100%=.77%

CBR_5=(28.709/2055)*100%=1.39%

4-days soaked



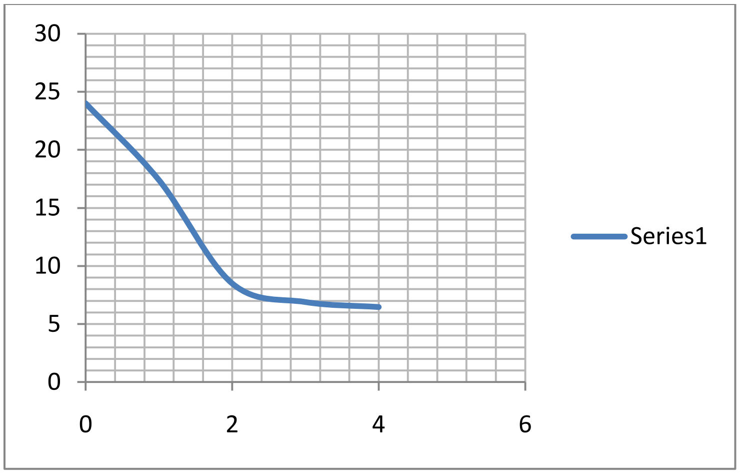
X : penetration(in mm)

Y: loading(in kg)

$CBR_{2.5}$=(9.57/1370)*100%=.7%

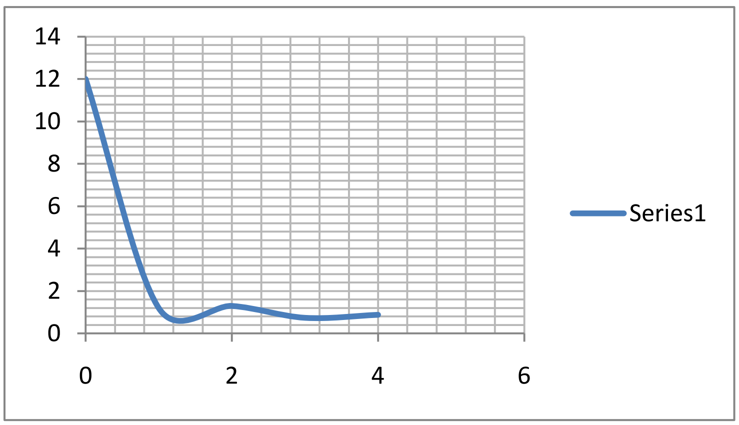
CBR_{5}=(22.161/2055)*100%=1%

4.3 VARIATION OF CBR WITH DAYS OF SOAKING.



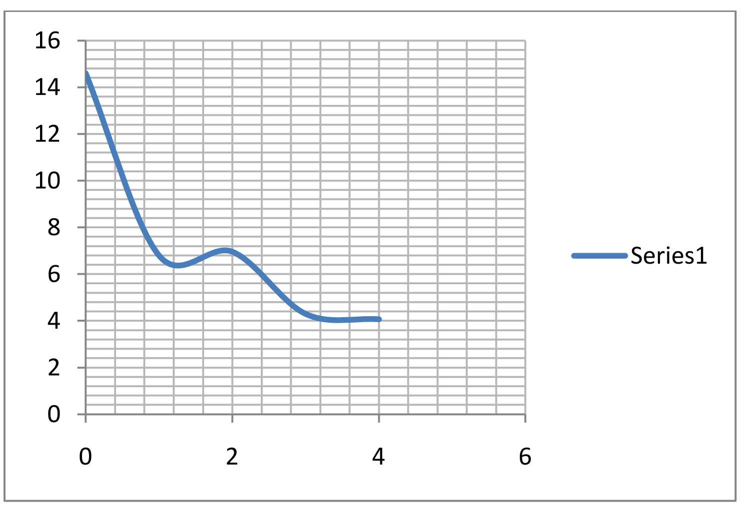
Bag A

Days(X)	CBR(Y)
0	24
1	17.4
2	8.5
3	6.9
4	6.47



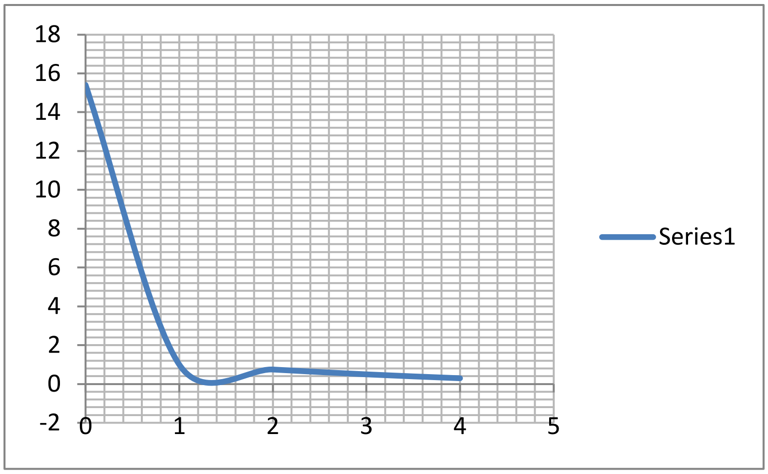
Bag B

Days(X)	CBR(Y)
0	12
1	1.2
2	1.3
3	0.74
4	0.882



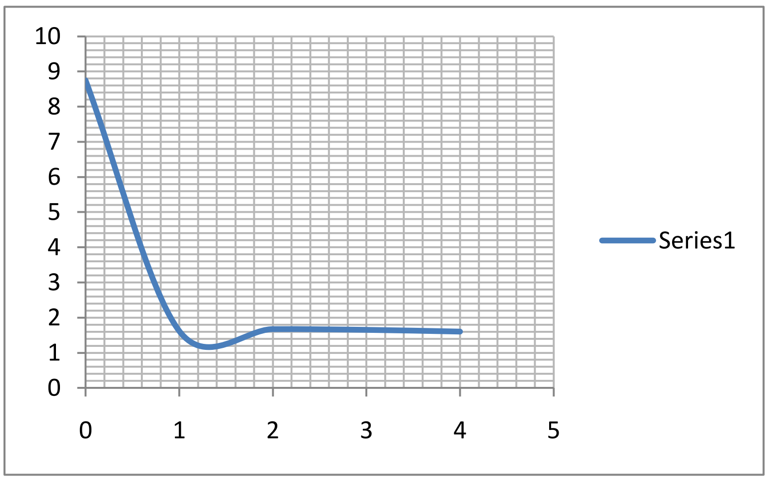
Bag C

Days(X)	CBR(Y)
0	14.6
1	6.8
2	6.96
3	4.3
4	4.07



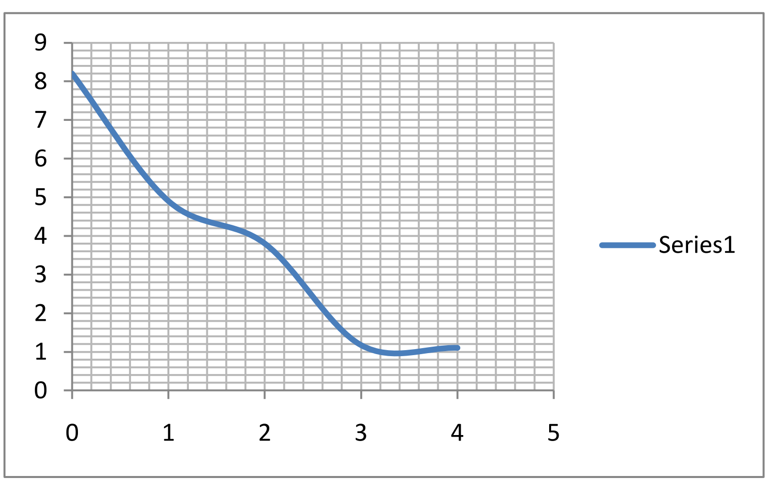
Bag D

Days(X)	CBR(Y)
0	15.4
1	1
2	0.74
3	0.49
4	0.29



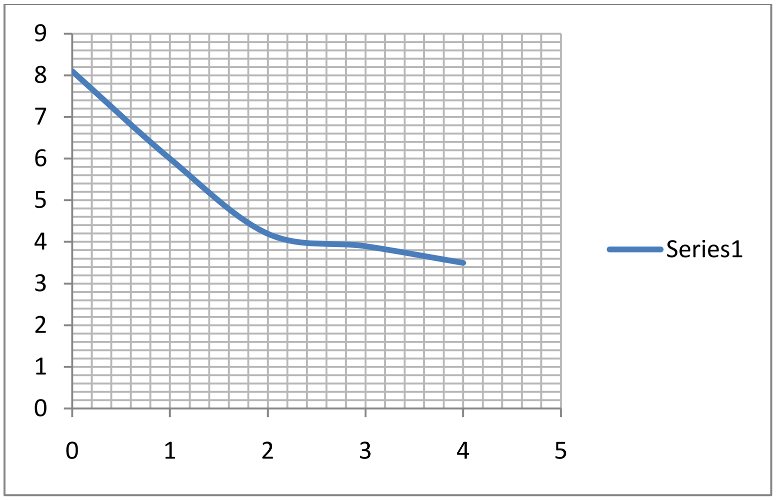
Bag E

Days(X)	CBR(Y)
0	8.75
1	1.62
2	1.67
3	1.65
4	1.6



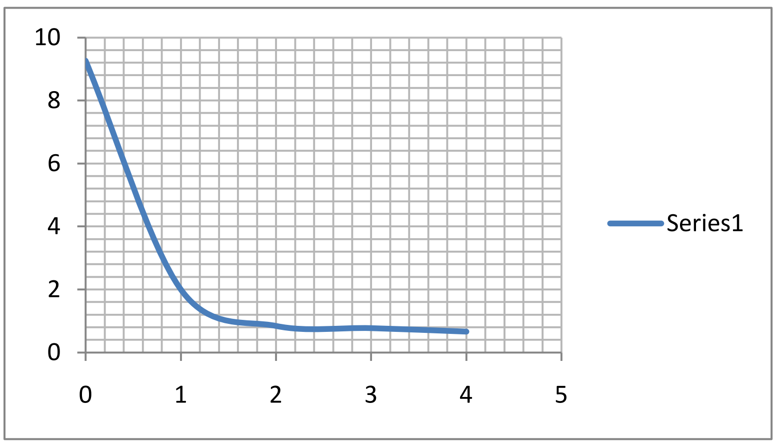
Bag F

Days(X)	CBR(Y)
0	8.2
1	4.9
2	3.8
3	1.17
4	1.1



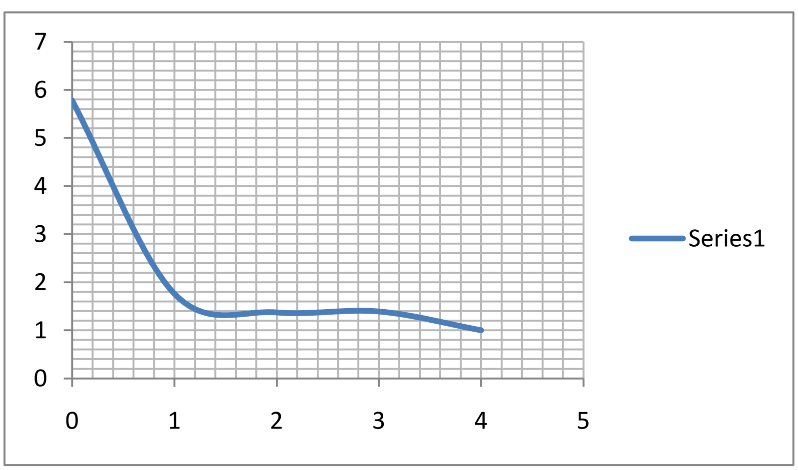
Bag G

Days(X)	CBR(Y)
0	8.1
1	6
2	4.2
3	3.9
4	3.5



Bag H

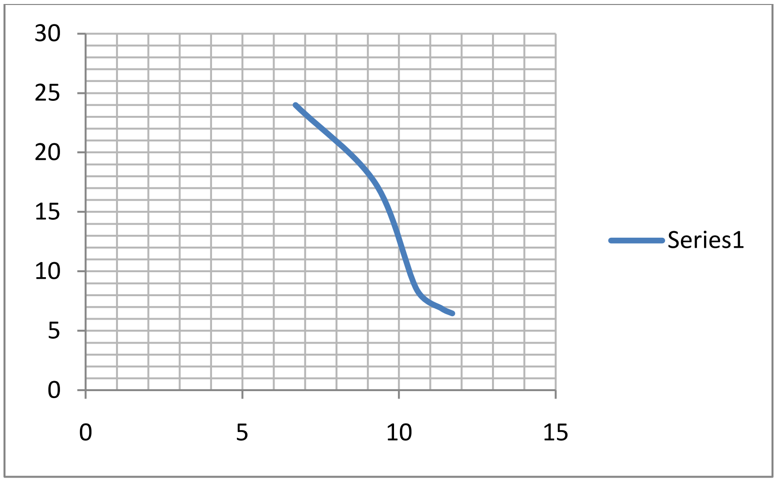
Days(X)	CBR(Y)
0	9.26
1	2
2	0.84
3	0.77
4	0.66



Bag I

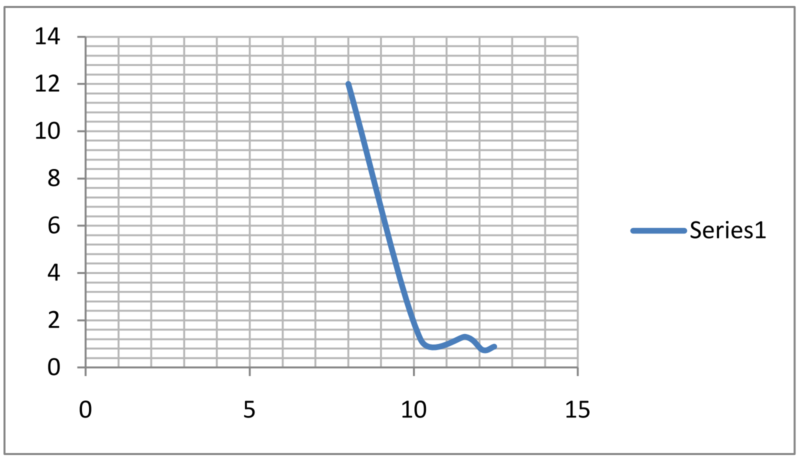
Days(X)	CBR(Y)
0	5.78
1	1.76
2	1.37
3	1.39
4	1

4.4 VARIATION OF CBR WITH MOISTURE CONTENT(AFTER EACH DAY OF SOAKING,UPTO 4 DAYS)



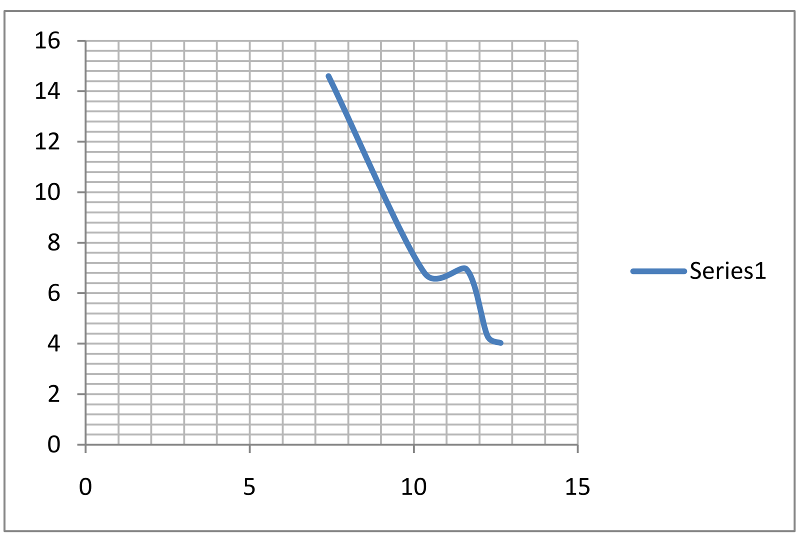
Bag A

Days	Moisture(%)(X)	CBR(Y)
0	6.7	24
1	9.25	17.4
2	10.56	8.5
3	11.35	6.9
4	11.7	6.47



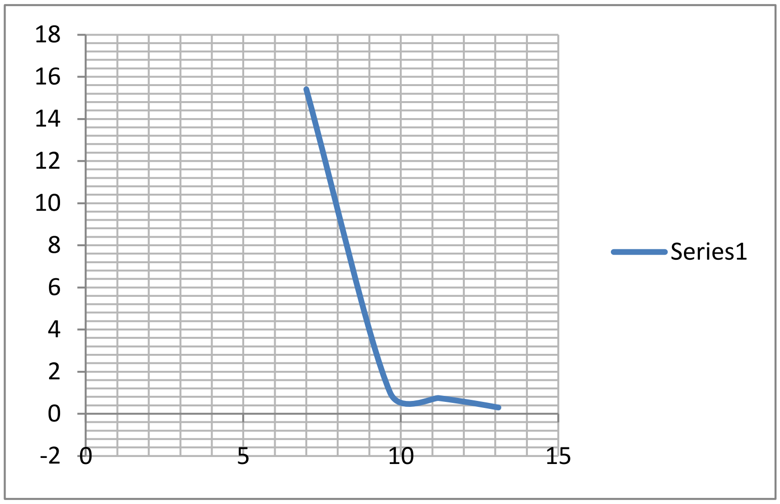
Bag B

Days	Moisture(%)(X)	CBR(Y)
0	8	12
1	10.2	1.2
2	11.56	1.3
3	12.1	0.74
4	12.45	0.882



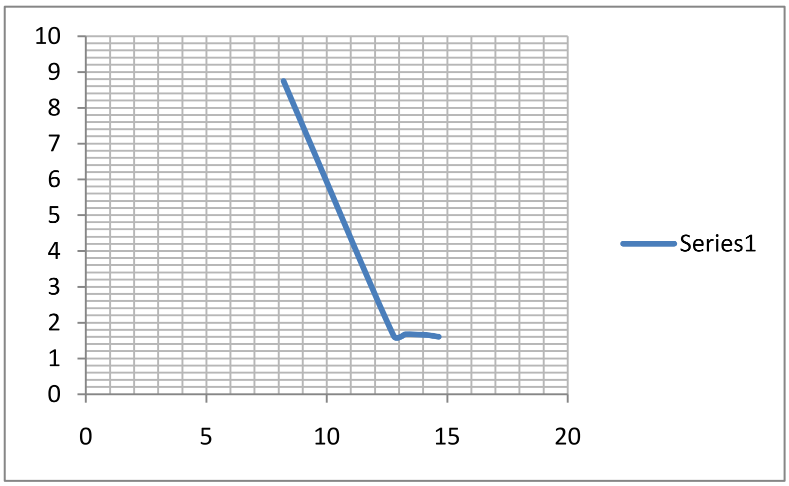
Bag C

Days	Moisture(%)(X)	CBR(Y)
0	7.4	14.6
1	10.33	6.8
2	11.6	6.96
3	12.25	4.3
4	12.65	4.03



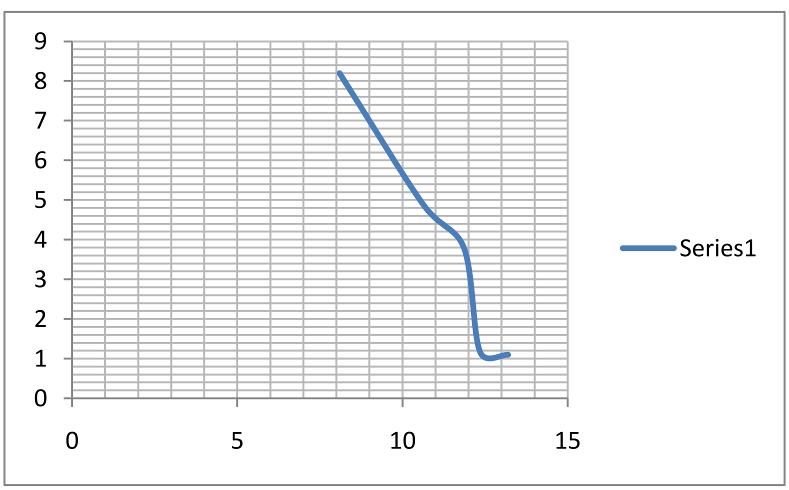
Bag D

Days	Moisture(%)(X)	CBR(Y)
0	7	15.4
1	9.66	1
2	11.2	0.74
3	12.34	0.49
4	13.1	0.29



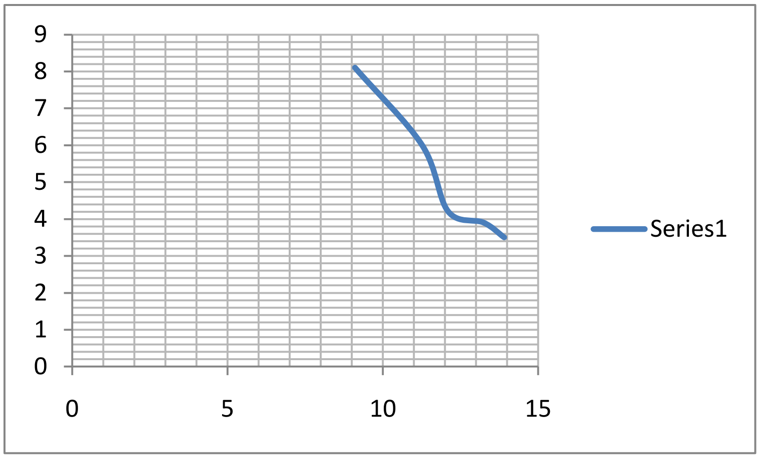
Bag E

Days	Moisture(%)(X)	CBR(Y)
0	8.2	8.75
1	12.78	1.62
2	13.25	1.67
3	14.12	1.65
4	14.65	1.6



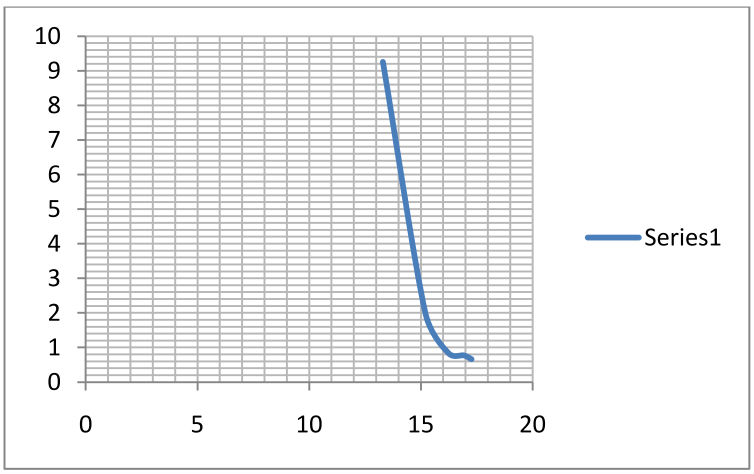
Bag F

Days	Moisture(%)(X)	CBR(Y)
0	8.1	8.2
1	10.62	4.9
2	11.86	3.8
3	12.35	1.17
4	13.2	1.1



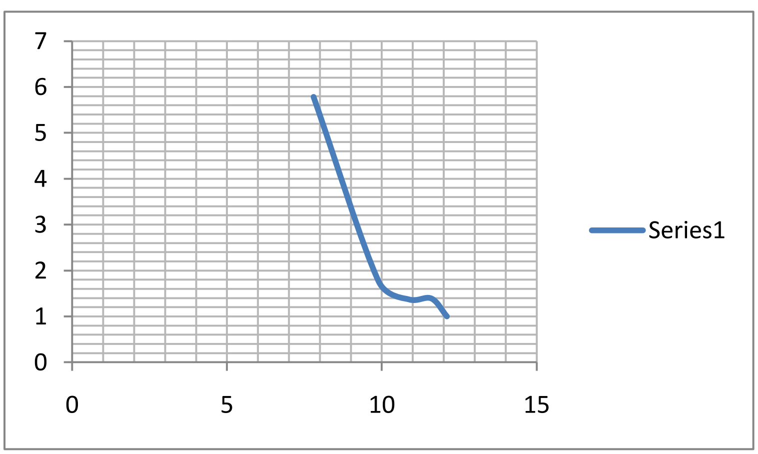
Bag G

Days	Moisture(%)(X)	CBR(Y)
0	9.1	8.1
1	11.26	6
2	12.1	4.2
3	13.24	3.9
4	13.9	3.5



Bag H

Days	Moisture(%)(X)	CBR(Y)
0	13.3	9.26
1	15.2	2
2	16.23	0.84
3	16.92	0.77
4	17.27	0.66



Bag I

Days	Moisture(%)(X)	CBR(Y)
0	7.8	5.78
1	9.9	1.76
2	10.88	1.37
3	11.6	1.39
4	12.1	1

5. Conclusion

On increasing the number of days of soaking, CBR decreases due to higher ingress of water. Dramatic loss of strength is observed when unsoaked soil is soaked for 1day under water and then tested for its CBR strength. On further increasing the number of days of soaking, gradual and not dramatic loss of strength is observed. Hence, the graph (CBR Vs soaking days) commences with a steep fall and then goes on with feeble falls.

Rate of ingress of water decreases with days of soaking because it closes in towards saturation. Most amount of water is soaked on the 1^{st} day and thus accounts for the highest drop in CBR strength of the soil sample.

Reference:

IRC-SP 37-2007