International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 11, November-2014

An Experimental Study on Behaviour of RC Column with PVC Cover

Gobinath G
PG Student
Nandha Engineering College
Erode, India

Selvi k
Assistant Professor
Nandha Engineering College
Erode, India

,

***Abstract* -In this paper an experimental study is presented to investigate the effectiveness of PVC tube for confinement of concrete columns. PVC is Stay-in-place (SIP) formwork has been used as an alternative to the conventional formwork system. The systems are mainly assembled on site, hence simplifying the construction process and reducing the construction time as the removal procedure has been eliminated. PVC tubes having 180 mm, 250 mm and 300mm external diameters, 600 mm height pipe were will use to confine the concrete column. The concrete mix design has been designed using IS code 10262-1982). The column specimens were tested for axial loading in the loading frame machine of capacity 1000kN. The Conventional columns 180 mm without PVC confinement are fail by local buckling. The calculate capacities of the PVC encased specimens and corrosion prevention.**

Keywords – M30, Strength, PVC , Corrosion

INTRODUCTION

Cement plays the vital role in construction cement act as a binding material in all concrete structural. RC bridges under aggressive environment conditions. the resistance of the structural members may deteriorate with time. Corrosion of ttmbrdded rein forcing steel is one of the main causes for the resistance deterioration which may have a significant effect on the bridge behaviour. The reinforcing steel corrosion is mostly due to chloride ion contamination of the concrete and the use of de-icing salts during winter in cold regions is major source of chloride ions. The effect of the structural member resistance degradation on its safety level or reliability level has been investigated recently. And also the major problem in concrete column is corrosion of reinforcement bars due to water penetration from water logged concrete structure and wet zone in seashore area. The correction are formed due to water containing chemical, chloride, sulphate salts. Mainly correction form due to reaction of salty water and due to improper mix design the penetration of water to structure to corrode the reinforcement bars. Decrease in cement content in using of concrete mix will leads to formation of correction. The problem may be overcome by using the increase cement content and providing extra PVC as cover to the concrete column structure. PVC cover also act as permanent formwork The formwork system must be capable of carrying its own weight, the weight developed by fresh concrete, and the live loads associated with the construction process and equipment. Stay-in-place (SIP) formwork has been lately used as an alternative to the conventional formwork system. Stay-in-place formwork systems are mainly assembled on site, hence simplifying the construction process and reducing the construction time as the removal procedure is eliminated. As well, most of the stay-in-place formwork systems are made of lightweight and prefabricated materials. Mostly PVC and FRP are prefers for Stay-in-place (SIP) formwork . it should be good strength, durable, handling, etc.**,**

AIM AND SCOPE OF INVESTIGATION

AIM

- In world as consists of more than 70% cover by oceans, river etc., with salty content
- Bridge is only way to travel, exchange a goods by land.
- Bridge structure is structural element which are constructed by means of concrete ingredients in salty water which can easily corrosion in bridge column
- Which result is reducing strength due to corrosion of reinforcement in column
- To prevent & overcome the damage by using PVC (polyvinyl chloride) cover which over the concrete surface to prevent the corrosion of the reinforcement
- Additionally it can be used for fixed formwork in column
- The strength, durability, and compressive strength of column structure element are studied and

performed in this project

MATERIALS

INTRODUCTION

Material investigation is done to test the various materials that are used in making concrete cubes. According to these test results obtained we designed the mix ratios for the materials and prepared the concrete cubes, beams and cylinders. The information are given below,

CEMENT

OPC of 43 grades in one lot was procured and stored in air tight container. The cement used was fresh i.e. used within three months of manufacture. It should satisfy the requirement of IS12262. The properties of cement are determined as per IS4031:1968 & results are tabulated.

FINE AGGREGATE

A fine aggregate obtained from the river is used for experimental purpose. The less amount of clay and silt (<3% by weight). The hire from silt, clay, salt and organic material and it was clean and dry. It is of size retained in 1.19 micron sieve.

Chemical Composition of Manufactured Sand and Natural Sand

Constituents	Natural Sand(%)	Test method
SiO_2	80.78	IS: 4032-1968
Al_2O_3	10.52	
Fe_2O_3	1.75	
CaO	3.21	
MgO	0.77	
Na_2O	1.37	
K_2O	1.23	
TiO_2	Nil	
Loss of ignition	0.37	

BULKING OF FINE AGGREGATE

- Table the representative of sample of sand, from the available lot at sight.
- Fill the graduated jar with sand up to certain weight compacting.
- Level the sand surface by gentle motion and note down this height.
- Now pour the water into the graduated jar containing sand till the sample is submerged.
- Cover the jar with the disk and give some motion.
- The tamping rod should be moved through out into sample in the jar, so as to ensure to removed of entrapped air completely.

Bulking of Fine Aggregate

S.no	Initial height of sand	Height of sand after adding water	Bulking factor
1.	600	550	9.09
2.	650	590	10.17
3.	700	650	7.14
Percentage Of Bulking			8.8

Coarse Aggregate

The coarse aggregate is strongest and porous component of concrete. Presence of coarse aggregate reduces the drying shrinkage and other dimensional changes occurring on account of movement of moisture. The coarse aggregate used passes in 19 mm and retained in 11.4mm sieve. It is well graded (should of different particle size and maximum dry packing density and minimum voids) and cubical in shape.

WATER

Ordinary drinking water available in the construction laboratory was used for casting all specimens of this investigation. Water helps in dispersing the cement even, so that every particle of the aggregate is coated with it and brought into ultimate contact with the ingredients.

It reacts chemically with cement and brings about setting and hardening of cement. It lubricates the mix and compact property. Potable water, free from impurities such as oil, alkalis, acids, salts, sugar and organic materials were used. The quality of water was found to satisfy the requirement if IS456-2000.

Properties of Natural Sand

S.no	Properties	Values
1	Size	Passing through 4.75mm sieve
2	Fineness modulus	2.54
3	Specific gravity	2.78
4	Water absorption	1.0%

MIX DESIGN

GENERAL

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible. The main objective is to stipulate the minimum strength and durability. It also reveals the relation between aggregate and paste. The other conditions being equal, for workable mixes the strength of concrete varies as an inverse function of the water/cement ratio. Since the quantity of water depend upon the amount of paste, it is important that as little paste as possible should be used and hence the importance of grading.

1:1:2.18

PVC (POLYVINYL CHLORIDE)

Poly(vinyl chloride), commonly abbreviated PVC, is the third-most widely produced polymer, after polyethylene and polypropylene.

Density [g/cm^3]	1.3–1.45	1.1–1.35
Thermal conductivity [W/(m·K)]	0.14–0.28	0.14–0.17
Yield strength [psi]	4500–8700	1450–3600
Young's modulus [psi]	490,000	
Flexural strength (yield) [psi]	10,500	
Compression strength [psi]	9500	
Coefficient of thermal expansion (linear) [mm/(mm °C)]	5×10^{-5}	
Vicat B [°C]	65–100	Not recommended
Thermal conductivity [W/(m·K)][l]	0.14–0.28	0.14–0.17
Yield strength [psi][l]	4500–8700	1450–3600
Resistivity [Ω m]	10	10^{12}–10^{15}
Surface resistivity [Ω]	10	10^{11}–10^{12}

Mechanical properties

PVC has high hardness and mechanical properties. The mechanical properties enhance with the molecular weight increasing but decrease with the temperature increasing. The mechanical properties of rigid PVC (uPVC) are very good; the elastic modulus can reach 1500-3,000 MPa. The soft PVC (flexible PVC) elastic is 1.5-15 MPa. However, elongation at break is up to 200-450%. PVC friction is ordinary; the static friction factor is 0.4-0.5, and the dynamic friction factor is 0.23.

Thermal and fire properties

The heat stability of raw PVC is very poor, so the addition of a heat stabilizer during the process is necessary in order to ensure the product's properties. PVC starts to decompose when the temperature reaches 140 °C, with melting temperature starting around 160 °C. The linear expansion coefficient of rigid PVC is small and has good flame retardancy, the Limiting oxygen index (LOI) being up to 45 or more. The LOI is the minimum concentration of oxygen, expressed as a percentage, that will support combustion of a polymer and noting that air has 20% content of oxygen.

Electrical properties

PVC is a polymer with good insulation properties, but because of its higher polar nature the electrical insulating property is inferior to non polar polymers such as polyethylene and polypropylene.

Since the dielectric constant, dielectric loss tangent value, and volume resistivity are high, the corona resistance is not very good, and it is generally suitable for

medium or low voltage and low frequency insulation materials.

CASTING AND CURING

INTRODUCTION

The mould specification, preparation of mould the method of casting and curing are discussed in following.

CASTING MOULD PREPARATION

The PVC mould dia 180mm, 600 mm height was placed in position on an even surface. All the interior faces and sides were coated with mud oil to prevent the sticking of concrete to the mould.

MIXING

The concrete using grade M30 (1:1.:2.18) with water cement ratio 0.37 were used. Concrete is mixed in roller type of mixing machine.

Fig 1:Concrete mixing

PLACING

Concrete is properly placed beneath and along the sides of the mould with help of trowel.

COMPACTION

Hand compaction was done for all the cubes used in the test. The damping mild steel rods having point ends were used to poke the concrete and it is placed in vibrating table to make compaction complete.

Fig 2 : casting of column

CURING

Fig 3 : Curing of column

The specimen is striped after 24 hours. The test cubes were cured for duration of 28 days in a curing tank. With chloride content

TEST OF SPECIMEN AND RESULT ANALYSIS

INTRODUCTION

Testing of concrete plays an important role in controlling and confirming the quality of cement concrete. Conventional column are tested for its strength characteristics.

TESTING OF SPECIMEN

COMPRESSION TEST

The cubes of size 150x150x150mm are placed in the machine such that load is applied on the opposite side of the cubes as casted. Align carefully and load is applied, till the specimen breaks. The formula used for calculation
Compressive Strength= Total Failure Load / Area of the Cube

Fig 4 :Compression Test

SPLIT TENSILE TEST

The test is carried out by placing cylinder specimen of dimension 150mm diameter and 300mm length, horizontally between the loading surface of compression testing machine and the load is applied until failure of the cylinder along the vertical diameter. The failure load of the specimen is noted.

The failure load of tensile strength of cylinder is calculated by using the formula
Tensile strength = 2P / 3.14 DL6.2.2

Where,
P - Failure of the specimen
D - Diameter of the specimen
L - Length of the specimen

Fig 5 :Split Tensile Test

FLEXURAL TEST:

The test is carried out to find the flexural strength of the prism of dimension 100 x 100 x 500 mm. The prism is then placed in the machine in such manner that the load is applied to the uppermost surface as cast in the mould. Two points loading adopted on an effective span of 400 mm while testing the prism .The load is applied until the failure of the prism. By using the failure load of prism

Flexural strength = Pl/bd^2

, P - Failure load of the prism
l - Length of the prism
b - Breadth of the prism
d - Depth of the prism

Fig 6 :Flexural Test

TEST RESULTS

S.NO	SPECIMAN	COMPRESSIVE STRENGTH N/mm^2	
	CUBE	7 DAYS	28 DAYS
1	1	16.82	28.9
	2	17.01	29.07
	CYLINDER	SPLIT TENSILE N/mm^2	
2	1	0.98	2.40
	2	0.89	2.36
	PRISM	FLEXURAL TEST N/mm^2	
3	1	4.13	6.40
	2	4.09	6.17

TEST SETUP

Column has been tested in loading frame with proper procedure.The axial load is applied gradually and the strain readings were taken at regular intervals of loading. The loading is continued up to the ultimate load level and the failure pattern has been studied

APPARATUS:

RC column,
Loading frame,
Load Po=σccAg+(σSCσCC)ASC

RESULT

Fig,No.7 Testing of column

COLUMN RESULLT	
INITIAL CRACK	182 KN
MAXIMUM LOAD	209 KN
NO OF CYCLE(S)	355

CONCLUSION

- The non use of concrete proves to be more effective penetration in concrete column.
- May use of PVC confinement column to achieve good axial compressive strength, penetration control and corrosion
- Compressive strength is decreased due to curing in salty solution
- Total ultimate load carrying capacity of the specimen is devastatingly low. Since the load carried is about 240kN whereas the ordinary is about only 109kN

SUGGESTION FOR FUTURE WORK

- Use PVC confinement column with different dia of column specimen with various loading
- Investigation of production of PVC column with different curing 28 days, 54 days, and 84 days
- Experimental Investigation of water permeability test after testing of column

REFERENCES:

- IS: 456-2000 "Code of Practice for Plain a of Indian Standards, New Delhi.
- Jianhui Sun : Probablllstlc Analysis Of Reinforced Concrete Bridge Girders Under Corrosion August, 1999
- Amr Abdel Havez :Behaviour of PVC Encased Reinforced Concrete Walls Under Eccentric Axial Loading Canada, 2014
- Saraswati Setia :Mr International Journal of Engineering And Technology, Vol. 5, No. 1, June, 2013
- Hadi M. N. And Zhao H. : (2011). Experimental Study of High-strength Concrete Columns Confined With Different Types Of Mesh Under Eccentric And Concentric Loads. Journal Of Materials In Civil Engineering, 23 (6), 823-832.
- Gupta: Confinement of Concrete Columns With Un plasticized Poly-vinyl Chloride Tubes International Journal of Advanced Structural Engineering 2013, 5:19