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EVALUATION OF CORROSION RATE IN STEEL REINFORCEMENT OF RCC

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Abstract - *In present condition an attempt has been made to calculate rate of mild steel corrosion in different water cement ratio as a 0.4, 0.45, 0.5, 0.55. Each W/C ratio four specimen have been prepared. The factor related to create corrosion and its effect has been studied preciously.*

Key Words: Water cement ratio, Reinforcement bar, Accelerated corrosion technique, Corrosion rate

1. INTRODUCTION

This article guides a stepwise walkthrough by Experts for writing a successful the use of accelerated corrosion test equipment for calculate rate of steel corrosion has been widely accepted as a destructive state of the art technique which is useful for reinforcement corrosion in concrete with different W/C ratio. With increase in W/C ratio concrete is more workable and the rate of steel corrosion has been calculated. Occurrence of corrosion is a slow speed process due to the presence of concrete for the protection of steel. It take long time with two processes like initiation stage and progress of reinforcement corrosion for the severe corrosion exposure condition.

In this paper an attempt has been made to firstly describe the accelerated corrosion test which is used to calculate short term reinforcement corrosion which is available in local market. The rate of corrosion is calculated by the equation and the weight loss also calculated in the paper.

1.1 MEASURE THE RATE OF STEEL CORROSION

1. ACCELERATED CORROSION TEST (ASTM-F2832)
2. SALT SPRAY METHOD (ASTM-B117)
3. HALF CELL POTENTIAL (ASTM-B876)
4. COPPER ACCELERATED SALT SPRAY (ASTM-B368)
5. WEIGHT LOSS METHOD

ACCELERATED CORROSION TEST (ASTM-F2832)

A potential difference between the reinforcement bar in each specimen and a power was supplied, which provide a constant 60 DC voltage. After that the cathode was generated in to the reinforcement bar which promoted the moving of chloride ions from the solution to the area adjacent to the metal. This test was conducted 6 hrs and each time four specimen were installed in this test water is filled with salt or sea water can be also used but recently I used salt with water and after specific time period over. The specimen was removed from water and then it was removed with breaking concrete and reinforcement is cleaned with natural water and then again cleaned with chemical namely sulphuric acid and after that weight of the steel bar noted.

Fig -1: Accelerated corrosion of steel bar

1.2 RAPID CHLORIDE PERMEABILITY TEST

Chlorides penetrate crack-free concrete by a variety of mechanisms: capillary absorption, hydrostatic pressure, diffusion, and evaporative transport of these, diffusions predominant. Diffusion occurs when the concentration of chloride on the outside of the concrete member is greater than on the inside.

This results in chloride ions moving through the concrete to the level of the rebar. When this occurs in combination with wetting and drying cycles and in the presence of oxygen, conditions are right for reinforcement corrosion. The various standard methods are:

- ASTM C 1202 or AASHTO T 277 (American standard)
- FHWA /RD-81 (Federal highway administration)
- CSA S413-94(Canadian standard)

Fig -2: Rapid chloride permeability test

Table -1: RCPT criteria

Charge passed (C)	Chloride ion penetrability
> 4000	High
2000 – 4000	Moderate
1000 – 2000	Low
100 – 1000	Very low
<100	Negligible

1.3 WEIGHT LOSS AND CORROSION RATE

In this method initial and finale weight is measured before and after the specimen removed from concrete. And using the weight loss equation the rate of corrosion calculated.

Table -2: Corrosion rate criteria as per NACE

Corrosion Rate (mm/year)	Corrosively
<0.025	Low
0.025 to 0.12	Moderate
0.13 to 0.25	High
>0.25	Severe

1.4 MATERIAL AND METHODOLOGY

This experiment was executed using combination of the accelerated corrosion test and weight loss of steel bar. Which consist of a partial immersion of the concrete specimen, which containing steel bar of 20 mm diameter and almost 170 to 180 mm length with specimen having 100 mm diameter and 200 mm length. With water cement ratio 0.4, 0.45, 0.5, 0.55 each W/C ratio four specimen were prepared.

Surface area is A is L2πr cm2

Density of steel bar is 7.78 gm/cm3

Time to exposure is 6 hours

1.5 TEST RESULT

1.5.1 ACCELERATED CORROSION AND WEIGHT LOSS RESULT

0.40 W/C Ratio				
Length	200	175	180	175
Wt loss (G)	0.686	0.73	0.69	0.726
A=87.6*W	60.0936	63.948	60.444	63.5976
B=DAT	2813.87	2462.1366	2532.48336	2462.1366
Weight loss(A/B)	0.0214	0.0260	0.0239	0.0258
Average rate of corrosin (mm/year)	0.0243			LOW CORROSION

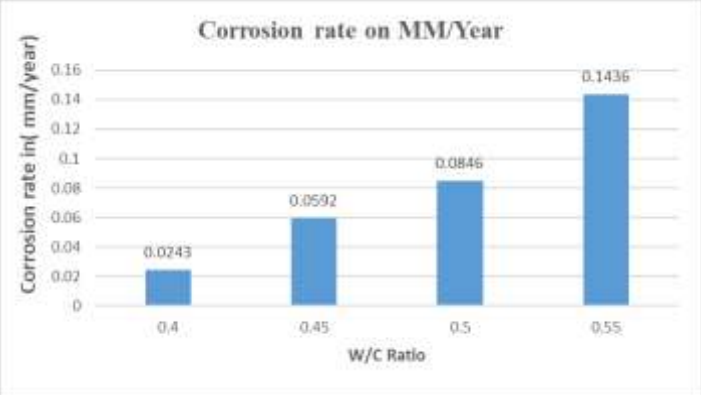
0.45 W/C Ratio				
Length	190	185	195	200
Wt loss Gram	1.838	1.782	1.798	1.903
A=87.6*W	161.0088	156.1032	157.5048	166.7028
B=DAT	2673.177	2602.83	2743.524	2813.87
Weight loss	0.0602	0.0600	0.0574	0.0592
Average rate of corrosin (mm/year)	0.0592			MODERATE CORROSION

LOSS RESULT

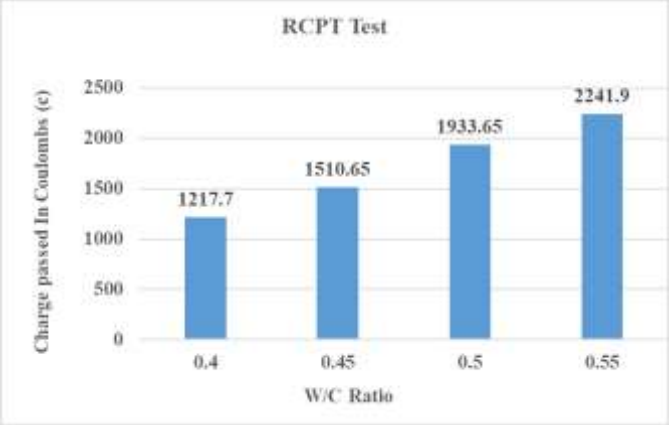
0.5 W/C Ratio				
Length	200	190	175	200
Wt loss Gram	2.6	2.567	2.605	2.585
A=87.6*W	227.76	224.8692	228.198	226.446
B=DAT	2813.87	2673.17688	2462.1366	2813.8704
Weight loss	0.0809	0.0841	0.0927	0.0805
Average rate of corrosion (mm/year)	0.0846			MODERATE CORROSION

0.55 W/C Ratio				
Length	195	200	180	175
Wt loss Gram	4.395	4.229	4.288	4.333
A=87.6*W	385.002	370.4604	375.6288	379.5708
B=DAT	2743.524	2813.87	2532.483	2462.137
Weight loss	0.1403	0.1317	0.1483	0.1542
Average rate of corrosion (mm/year)	0.1436			HIGH CORROSION

1.5.2 RCPT RESULT



Sr. No.	Name of sample	Grade of concrete	Charge passed In Coulombs (c)	Charge passed In Coulombs (c)	Average Charge passed In Coulombs (c)	Chloride permeability
1	0.40	M25	1192.5	1242.9	1217.7	Low
2	0.45	M25	1507.5	15138	1510.65	Low
3	0.5	M25	1926	1941.3	1933.65	Low
4	0.55	M25	2243.7	2240.1	2241.9	Moderate



3. CONCLUSIONS

DURABILITY

- It is observed that with increase W/C ratio Increase water capillary.
- It is observed that Chloride permeability is increase with W/C Ratio increase from low to moderate.

RATE OF STEEL CORROSION

- The corrosion rate is found to be increasing with increasing Water content in the concrete.
- The corrosion rate is low for 0.4 W/C and its value is 0.0243 mm/year and it will be increases up to 0.1436 for a 0.55 W/C ratio.
- The corrosion rate is low to moderate and moderate to high in present cylindrical case.

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BIOGRAPHIES

My self Sondagar Nikunj N. recently I am doing Master of Civil Structure Engineering in Noble Group of Institute Junagadh.