

Corrosion Assessment of Rebar - A Case study

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1.0 Introduction

In this case study a RCC hospital building at Cuttack, Orissa was taken for corrosion assessment and methods adopted for repairing. The assessment was divided into two parts:

- Visual inspection
- Detailed investigation by NDT method

A systematic visual inspection was conducted to get a fair idea about the deterioration and distress of the existing RCC buildings. Visual inspection and extensive photography of the building were taken to decide the extent of investigation and selection of tests. It was observed that columns and stair case beam of the building were cracked. Water soaking marks were present. Plaster and some concretes were worn-out from the column and stair case beam. Reinforcement bars were exposed. Fig. 1 shows the visual inspection showing rebar corrosion and spalling of concrete.



Fig. 1: Corrosion of rebar

Visual investigation was the obvious limitation that only visible surface can be investigated. Internal defects go unnoticed and no quantitative information could be obtained about the reinforcement. For these reasons, a visual inspection was supplemented by detailed investigation. Rebar corrosion was investigated by digital covermeter and corrosion analyzer.

2.0 Digital Covermeter (Profometer)

A covermeter or profometer was used for measuring concrete cover. By means of this test it was able to detect rebar size, direction and position. Measurements were based on the damping of a parallel resonant circuit. After preparation of surface the instrument was made ready for testing. The search head touched to the point of testing and was moved slowly. An electromagnetic field was generated by the search head (probe). When a reinforcing bar or other metal object lied within this field, the line of forces were distorted. The disturbance caused by the presence of the metal in turn produced a local change in field strength detected by the search head (probe) and indicated by the meter reading. It was therefore possible to locate the reinforcing bars and determine their orientation. Cover to bar was also determined by a suitable calibration for the particular size of the bar and the material under investigation. For the above purpose the profometer-5 (rebar locator) was used. Fig. 2 shows testing with cover meter.

Table 1 shows the data obtained from rebar locator. It was found from the above calibrations that average cover thickness was 32 mm and the average bars were 15 nos. in X-axis in 1.5 m and 3 nos. in Y-axis in 0.5 m.

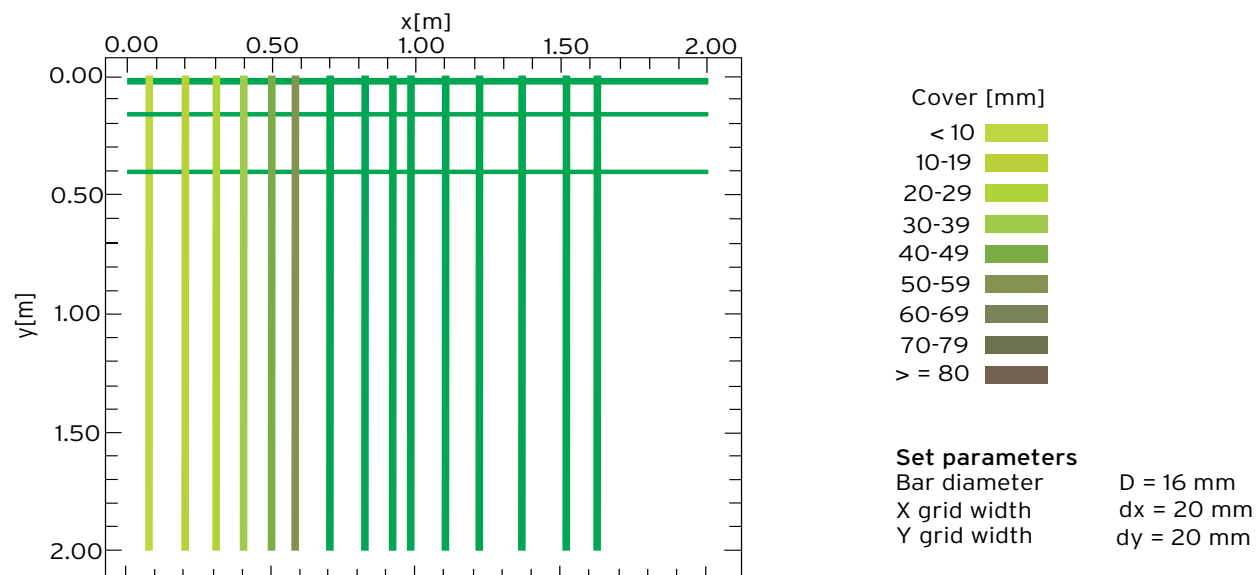


Fig. 2: Data obtained from rebar locator

Table 1: Statistical data from rebar locator

Measured covers			
x [m]	Cover [mm]	y [m]	Cover [mm]
0.08	34	0.02	36
0.20	35	0.16	46
0.30	35	0.40	40
0.40	32		
0.50	30		
0.58	27		
0.70	28		
0.82	33		
0.92	29		
0.98	28		
1.10	29		
1.22	32		
1.36	34		
1.52	26		
1.62	69		

Statistic

- i Number of measured bars
- ii Average measured cover
- iii Standard deviation
- iv Maximum of measured covers
- v Minimum of measured covers
- vi Span

	X	Y
i N	= 15	3
ii m	= 33.4	40.7 mm
iii sa	= 10.3	5.0 mm
iv Max	= 69	46 mm
v Min	= 26	36 mm
vi R	= 43	10 mm

3.0 Corrosion Analysing Instruments

The potential of a corroding rebar differs from that of a non-corroding rebar by about several 100mv. The fact was utilized in the potential measurement to provide information about the condition of the reinforcement. After surface preparation the instrument was made ready for the testing. The following were the requirements for testing.

- Connection to the reinforcement (non-corroding).
- Reference electrode (copper or copper sulphate electrode was recommended).
- Voltmeter (possibly with memory and possibility of printing option).

Fig. 3 shows different points of testing by corrosion analyser and the pictures obtained from the analyser. From the calibration it was found that the green shaded portion whose potential was highest was more corroded (65.5% to 99.3%).

4.0 Conclusions

Reinforcement concrete structures have the potential to be very durable and capable of withstanding a variety of adverse conditions. However, failures in the structures do still occur as a result of premature reinforcement corrosion. Corrosion of reinforcing steel which was main cause of the deterioration was easily identified visually by characteristic cracking pattern parallel to the reinforcement, spalling of the concrete cover. From detailed NDT investigation by cover meter/ rebar locator it was found that average cover thickness was 32 mm and at some places cover was less than 25 mm which required some additional cover. From corrosion analyzer the area could be marked exactly where potential was higher to carry out the repair and rehabilitation.

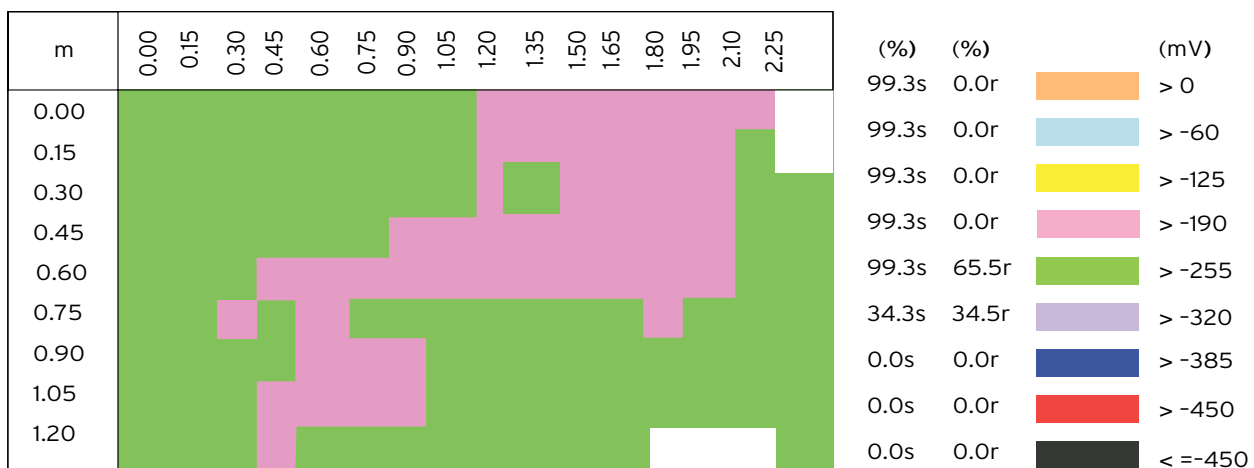


Fig. 3: Pictures from corrosion analyser