iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** IX **Month of publication:** September 2020

DOI: https://doi.org/10.22214/ijraset.2020.31334

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IX Sep 2020- Available at www.ijraset.com

Conditional Evaluation of 90 Meter High Old Reinforced Concrete Chimney and its Repair and Rehabilitation Methodology

Sachin Mutkure[1], Dr. Rashmi Bharatey[2], Dr. Dilip Mase[3], Chinmay Mutkure[4]
[1]*Student M-tech in Structural Engineering, G.H. Raisoni College of Engineering, Nagpur, Maharashtra, India.*
[2]*Assistant Professor, G.H. Raisoni College of Engineering, Nagpur, Maharashtra, India*
[3]*Director, P.T. Mase & Associates. Nagpur, Maharashtra, India*
[4]*Student BE in Civil Engineering, G.H. Raisoni college of Engineering, Nagpur, Maharashtra, India*

Abstract: ***Reinforced concrete (RC) chimney is a special structure, which is a symbol of industries. A chimney is tall slender structure, mainly two types of chimney are widely constructed in India. Steel stack and RC chimney. Both structures required inspection and maintenance. if not properly maintained chances of failures is high.to avoid the failure of structure adoption of effective as well as proper maintenance technique, conditional evaluation is necessary to identify the Effect of atmosphere on tall RC industrial structure, it is evaluated and studied. In this research, RC chimneys are evaluated by the NDT test and failure mode of a structure is analyzed, and the defective zone in structure for repair is found out. And method adapted for repair and rehabilitation and material suitable for repair as per structural requirement is discussed.***
Keywords: Conditional evaluation, NDT test, Repair and rehabilitation, Reinforce concrete chimney, Structural assessment, Selection of material, Maintenance technique.

I. INTRODUCTION

Reinforce concrete (RC) Chimney is the main structure in industries, maximum RC Chimney is constructed in the late 20th century. So it is important to inspect its condition and evaluate as per its present condition. NDT test help in examining the structure without distorting or semi-destructive type. Evaluate RC chimney is presently located in orient cement plant dist. Telangana, India. Structural consideration is single flume, 90metrs height. RC chimney. Some non-distractive test which is performed on concert surface areas. Ultrasonic pulse velocity (UPV), rebound hammer test (RH), pH & carbonation test. And visual inspection, this test helps to inspect the structure and suggest repair methodology for damage section. Repair and rehabilitation are the jobs of an expert person from the beginning of time and it should be performed in a systematically planned way. It is a better alternative compare to demolition, at the present condition there should not be specified guidelines related to repair or rehabilitation process. In this article, we disused about repair of the reinforced concrete section. In India, the various old structure is waiting for repair but lack of knowledge about repair technique and material available for repair. Lake of this knowledge many structures goes to wrong practices in strengthening or repair. This article helps to a selection of material for their suitable used.

II. CONDITIONAL ASSESSMENT

A. To carry out visual inspection of RC Chimney shell and collect details of structure in term of damage/distress observed.
B. Mark the location for NDT tests
1) Ultrasonic pulse velocity test.
2) Rebound hammer test.
3) Cover meter/rebar cover test.
4) pH & carbonation test
C. Prepare the surface for non-distractive/partial-destructive test
D. Carry out the above test on the prepare surface.
E. Repeat the step 1 to 4 in all direction of rc chimney concrete shell.
F. Carry out chemical test in lab.
G. To suggest appropriate repair scheme for rc chimney structure base on conclusion arrived from ndt test

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IX Sep 2020- Available at www.ijraset.com

III. NDT TEST METHOD

A. Ultrasonic pulse velocity (UPV).

The instrument used for UPV test is Ultrasonic concrete testing (Model No. -102) (Canopus) machine, assembly of the machine is transmitter and receiver it attaches with a display unit, generally, three types are used to performed UPV test. Direct method indirect method & semi-direct method. The direct method is most accurate but in some cases it not suitable, rather than the direct method used indirect method or semi-direct, as per suitable condition on site. The detail process of testing is incorporated in IS 516(part-5/sec1):2018.as per IS specification add 0.5km/s in semi-direct & indirect method of test. UPV test performs for assessing the quality of the material. As well as Homogeneity of the concrete structure.

Pulse velocity (km/sec)	Concrete quality
Above 4.5	Excellent
3.5 to 4.5	Good
3 to 3.5	Medium
Below 3	Doubtful

Table-1 Quality of concrete as per IS 516 part-2/section-1:2018

Sr.no	Particulars	Time	Path	Velocity	Remark
	Grid-1 North Side At 1.0Mtr Level				
1	Indirect	62.5	200	3.2	Doubtful
	Indirect	59.5	200	3.36	Doubtful
	Indirect	78.9	200	2.55	poor
	Indirect	62.9	200	3.18	Doubtful
	Indirect	66.3	200	3.02	Doubtful
	Indirect	73.8	200	2.71	poor
	Indirect	76.1	200	2.63	poor

Table-2 NDT Test result value

B. Schmidt Hammer Tests. (RH)

The reference for rebound hammer test is I.S. 13311 Part-2 1992 this test perform for surface hardness of RC chimney shell. The instrument show the reading in the form of Rebound number, six reading of rebound indices are adopted and average of this after deleting outliner as per I.S 8900:19798 become the rebound index for observed point.

Quality of concrete	Average rebound
Excellent	>40
Good	30-40
Fair	20-30
Doubtful	20<

Table -3 Rebound criteria for quality of concrete grading

Sr.no	Rebound number	After Eliminating out liner	Average	Probable comparative strength
	Grid-1 North Side At 1.0Mtr Level			
1	36,38,40,42,42,40,46,36,36	36,36,38,42,40,36	38	41
	38,32,32,38,36,36,36,32,34	32,36,32,34,38,32	34	34
	32,30,34,36,40,38,34,30,38	32,34,36,38,34,30	34	34

Table-4 Rebound hammer test result.

IV. SAMPLE OF VISUAL INSPECTION






©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IX Sep 2020- Available at www.ijraset.com

V. SELECTION OF MATERIAL

Selection of material in important concept it involving an understanding of the requirement of the repair while selecting material for repair some point should be considered. Grade of concrete or material, the grade of material used for repair, which type of repair need for structure, Capacity of repair structure, age of the structure, geographical and environmental condition of the region, the requirement of owner Economical factor.

A. Factors have to be consider for repair

1) Physical properties.
2) Mechanical properties.
3) Durability related properties.
4) Chemical properties related to other repair material.
5) Function of repair material.

Physical and mechanical properties like, dimensional stability, coefficient of thermal expansion, strength, Poisson ratio, stuffiness elastic modulus etc. durability related properties like water absorption, weathering resistance. Etc.

VI. MATERIAL IS USED FOR REPAIR AND METHODOLOGY FOR APPLYING

Material
Rust remover
Migrating multifunctional corrosion inhibitor
E- Glass Fibre 700GSM
Epoxy resin based concrete bonding
Epoxy resin based injection grout
Polymer modified mortar.
Micro concrete.

Table-5 Material is used for repair

Analyze and understand all the provided review comments thoroughly. Now make the required amendments in your paper. If you are not confident about any review comment, then don't forget to get clarity about that comment. And in some cases there could be chances where your paper receives number of critical remarks. In that cases don't get disheartened and try to improvise the maximum.

A. Structure surface should be check for loss material, void, honeycombing etc.
B. Damage surface sound hollow, and area marked suitable geometrical shape.
C. Exposed honeycombed area, crack expose corroded element
D. Surface preparation.
E. Used rust remover to exposed reinforcement.
F. Used additional reinforcement for missing or rusted elements.
G. Coated exposed reinforcement or additional reinforcement to inhibiting primer.
H. Entire repair surface is protected to low viscosity resin.
I. Used injection grouting for honeycombed area.
J. Used MFC grout at specified pressure
K. Used epoxy putty to fix nozzle.
L. And allow every function to dry for 24 hours minimum.
M. For damaged area where thickness of repair is more than 50 mm, Ready to use micro concrete should be done using ply formwork instead of Polymer modified mortar.
N. E Glass fiber sheet (700 GSM) should be cut, fixed and rolled on the fresh applied base coat.
O. Top coat of Epoxy Saturant should be applied on the fiber wrapped surface.
P. Finally provide 3 coat Solvent containing hybrid aliphatic PU coating to the entire surface from outside.

©IJRASET: All Rights are Reserved

VII. RESULT FOR NDT TES

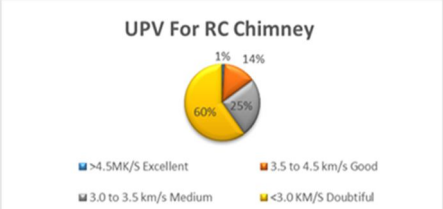


Figure- 1 Graphical representation of UPV test of complete structure

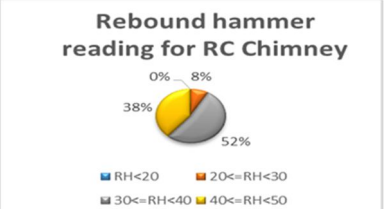


Figure- 2 Graphical representation of UPV test of complete structure

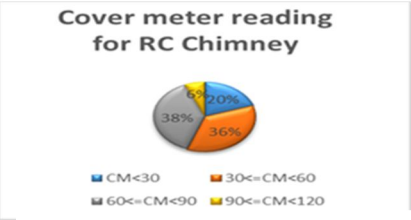


Figure- 3 Graphical representation of Cover meter test of complete

Ultrasonic pulse velocity result for chimney is indicates that 1% of concrete quality is excellent, 14% is good, and 25% is medium. 52% of rebound numbers are between 40 and 50. And 8% of RH number is below 20 and 30% rebound number in between 40 to 50. Cover meter readings 6% of the cover is between 90mm to 120mm.38% of the cover is between 60mm to 90mm.36% of the cover is between 30mm to 60mm.and 20% of cover in between 30mm. From the above result of UPV& RH test, the quality of concrete in RC Chimney is medium. Reinforced concrete chimney required repairing

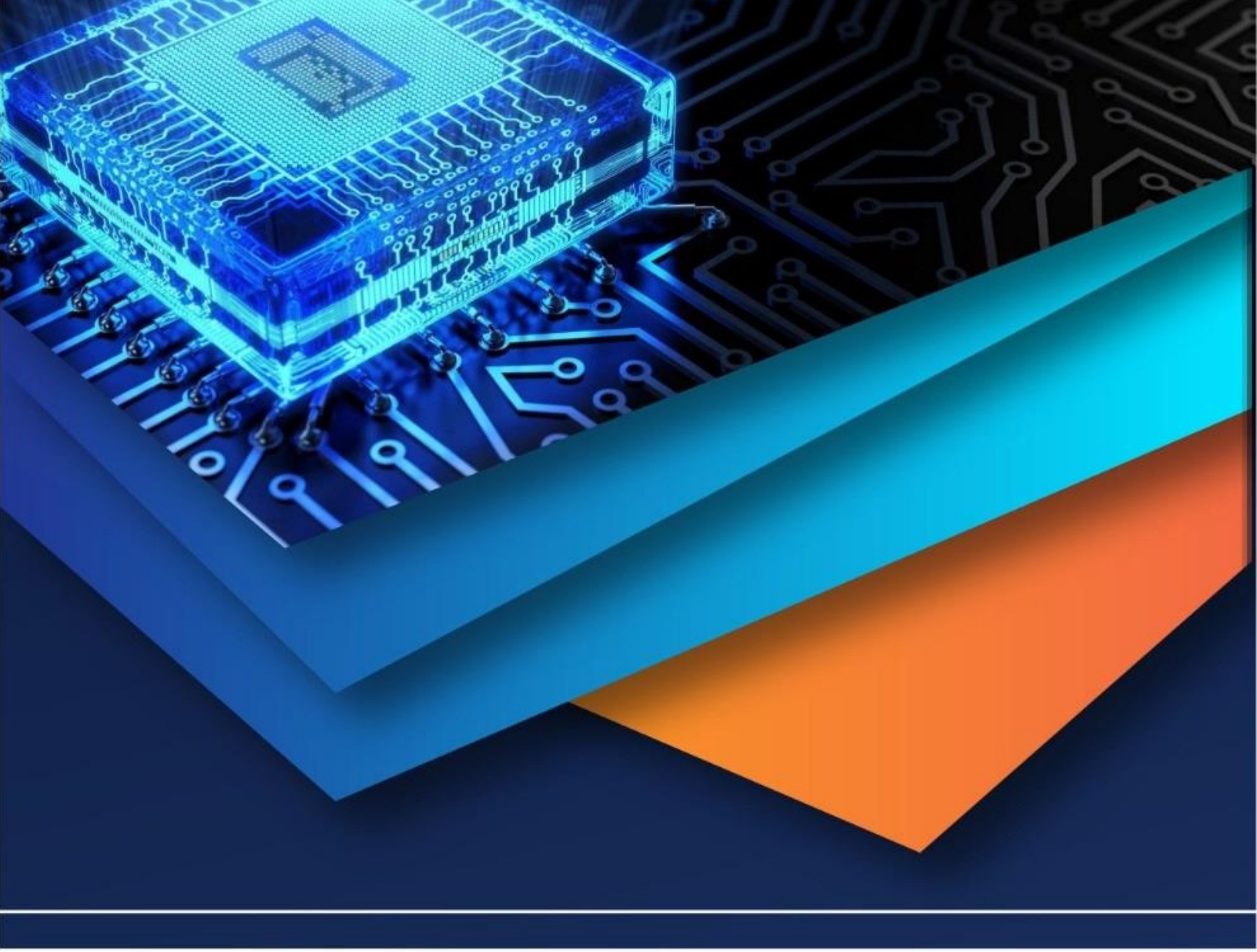
VIII. CONCLUSION

After successful implantation of repair and rehabilitation scheme quality of concrete is improved. And structure achieves its probable strength. The repair material performs adequately only when if they are only prepared, applied and cured as per the specified procured for it and which may necessary the used for proper tools and skill. The cost of material is generally high after success fully implementation of prescribed material health of structure is improve by 25% to 30%

REFERENCES

[1] P.Kulkarini, K. Engineer, “CONDITIONAL EVALUATION OF RCC SILIO USING VARIOUS NDT TESTING”, RESEARCH GATE 2017.
[2] A.Khombe, V. Jahagirdar,” A CRITICAL REVIEW ON MODELLING OF INDISTRIAL CHIMNEY”, IJRASET, volume 4 MARCH 2016.
[3] R. Sarkar, S.Goyal,”SEISMIC ANALYSIS OF A 275 M TALL RCC MULTI-FLUE CHIMNEY: A COMPARISON OF IS CODE PROVISIONS AND NUMERICAL APPROACHES”, www.researchgate.net.2015.
[4] S.Kacm, G. Gursoy,” STRUCTURAL RETROFITTING OF A REINFORCED CONCRETE CHIMNEY” IJAERS volume 4 2017
[5] S.Naik, H.Bhuva,” A REVIEW ON PARAMETRIC STUDY OF RCC CHIMNEY FOR DIFFERENT LOADING CONDITION”, IJAERD volume 4, 2017
[6] M.maj, A. Ubysz.”CRACKED REINFORCED CONCRETE WALLS OF CHIMNEYS, SILOS AND COOLING TOWERS AS RESULT OF USING FORMWORKS”,MATECH web of conferences 2018
[7] IS 13311(Part-1):1992 Non-destructive testing of concrete method of test.
[8] IS 516(part5/sec1):2018 Non-destructive testing of concrete method of test.
[9] S.Bhaskar, P.shrinivasn, A.chellapan;”Conditional assessment of 30 year old overhead RCC reservoir’’NDE-2006,pp 83-89 December 2006.
[10] Sachin Mutkure, Dr. Rashmi Bharatey, Dr. Dilip Mase, & “A Reviews on Behaviour of Industrial Chimneys International Journal of Scientific Research in Science and Technology (IJSRST),Online ISSN : 2395-602X, Print ISSN : 2395-6011,Volume 7 Issue 3,pp.118120,MayJune2020.Availableat doi: https://doi.org/10.32628/IJSRST207329
Journal URL : http://ijsrst.com/IJSRST207329

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)