# Determination of Loss in Strength of Steel Due To Stacking on Construction Site

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***Abstract-*** ***Use of corroded steel for reinforcement work is frequently carried out construction activity of human beings. The construction technology has advanced since the beginning of primitive construction technology to the present a concept of modern house buildings. The present construction methodology for buildings brought for the best aesthetic look, high quality & fast construction, cost effective & innovative appearance. But use of corroded and deteriorated steel is directly hampering the strength of the structures. Around 40% of structure failure occur due to deterioration of steel reinforcement. Due to fluctuation in cost of steel material used in construction industry, people prefer to buy the material in bulk quantity when the cost is low. But the steel starts gradually deteriorating due to prolonged stacking time. Such deteriorated steel used in reinforcement work leads to reduction in life span and strength of the building. This also involves the strength reduction along with increase in the stacking period. The study involves comparative analysis of newly manufactured steel bars and corroded steel bars. It also covers inspection of materials used on site for reinforcement activities***

***Index Terms-*** ***Strength loss, Corrosion, Tensile strength,***

## I. INTRODUCTION

The steel available on construction site looks different from the newly manufactured steel, this is due to the steel on construction site comes in contact with oxygen and moisture leading to slow oxidation process causes corrosion generally known as rusting of iron.

CHEMICAL REACTION:

$$4Fe + 3O2 \longrightarrow 2Fe_2O_3$$

$$Fe_2O_3 \xrightarrow{H_2O} Fe_2O_2.xH_2O$$

(*Rust*)

Handling and storing steel on construction site leads to deterioration and corrosion. This leads to reduction in strength of steel material further leading to failure of structure. Hence Exposure to water and air has an adverse effect on steel leading to corrosion. As a result the structure will become less durable with increase in severity of corrosion. As factor of safety of 1.5 is considered for steel according to load criteria, there is no consideration of factor of safety for use corroded or deteriorated steel for reinforcement work.

To find out the actual loss in strength of the steel after rusting we carried out few investigations and tests and calculated the strength difference between newly manufactured steel and corroded steel.

## I. RESEARCH METHODOLOGY

Various construction sites were visited to inspect the reinforcement steel used for construction activities. We found that deteriorated steel which was stored for long time span from one month to three years was also used for reinforcement of slabs, beams, columns etc.

Collected deteriorated steel bars of different stacking period from construction sites was done to carry out tests to find out strength difference between newly manufactured steel bars and deteriorated steel bars. All the specimen collected were of 12mm diameter.

The collected samples were tested on UTM by conducting tensile test. During first test newly manufactured bars and one month old stacked bars were tested. During second test, bars of longer time span on stacking were tested. Comparison of these test results along with new bars test results were done in order to study the strength variation and difference of the bars after getting deteriorated. Firstly the gauge length on all the 66cm long bars was marked by applying the formula 5Φ. The bars were further clamped in the UTM, tensile load was applied

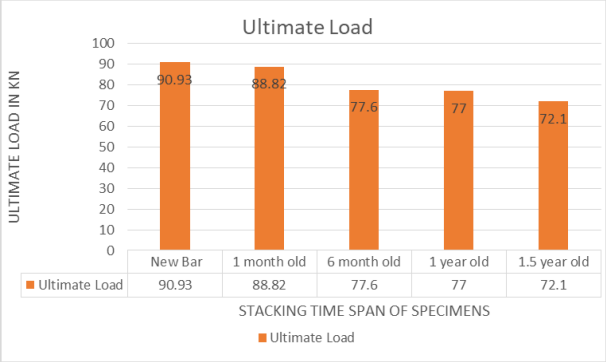
gradually on the clamped specimen by means of control knob. Gradual deformation of the specimen was displayed on the screen in the graphical format. Similar procedure was applied for all the specimens. Hence further analysis of the test results was done.

## II. ANALYSIS

Tensile test conducted on six samples of 66cm long 12mm diameter TMT bars of grade fe500. Three bars were new and three bars were one month old.

Second tensile test conducted on three samples of 66cm long 12mm diameter TMT bars of grade fe500. Three bars were of different life span i.e. 6 months, 1 year, 1.5 years (approximately). Following graphical representations shows the test results

Results indicates that stacking period of steel is directly proportional to decrease in strength of steel.




The deteriorated steel bars when compared with newly manufactured steel bars, one month old bar's strength is found to be decrease by 3%. Similarly for 6 month, 1 year, and 1.5year old bar's strength is decreased by 14.65%, 15.32% and 20.71% respectively when compared with newly manufactured steel bars.

Fig 3(a) Failure of newly manufactured steel bars

Fig 3(b) Failure of Deteriorated steel bars

## VI. CONCLUSION

From analysis and results we can conclude that strength reduction of steel on site is directly proportional to time period of stacking of steel material. Awareness to the community and construction industry can be created to reduce economical losses and structure failure. Deteriorated steel should not be used for reinforcement work during construction activity. Bonding strength of steel in concrete decreases due to formation of layer of rust on surface of steel bars. In coastal areas or in case of long storage, apply protective coating of primer to prevent scaling.

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[3] Indian standard code of practice for corrosion protection of steel reinforcement in RB and RCC construction. (Clause 5.3) Protective coating on concrete cover and reinforcement and APPENDIX B (Clause 5.3.3) procedure of application of protective coating.