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Study on Buildup the Properties of R.C.C. Structures against Fire

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ABSTRACT

Fire remains one of the serious potential risks to most buildings and structures. Since concrete is widely used in construction, research on fire resistance of concrete becomes more and more important. Many researchers all over the world have done some researches on this subject. The mechanical properties of all common building materials decrease with elevation of temperature. The behavior of a reinforced concrete structure in fire conditions is governed by the properties of the constituent materials, concrete, and steel, at high temperature. Both concrete and steel undergo considerable change in their strength, physical properties, and stiffness by the effects of heating, and some of these changes are not recoverable after subsequent cooling.

The mechanical properties of steel deteriorate by heat during fires, and the yield strength of conventional steel at 600°C is less than 1/3 of the specified yield strength at room temperature. Therefore, conventional steels normally require fire-resistant coating to be applied. The temperature increase in the steel member is governed by the principles of heat transfer. Consequently, it must be recognized that the temperature of the steel member(s) will not usually be the same as the fire temperature in a compartment or in the exterior flame plume. Protected steel will experience a much slower temperature rise during a fire exposure than unprotected steel. Also, fire effect on steel member is influenced with its distance from the center of the fire, and if more ventilation occurs near the steel in a fuel-controlled condition, wherein the ventilation helps to cool the steel by dissipating heat to the surrounding environment. Even once a protracted amount, the interior temperature of concrete remains comparatively low; this allows it to retain structural capability and hearth shielding properties as a separating part.

INTRODUCTION

The emperature increase of steel and concrete in composite steel-concrete elements leads to a decrease of mechanical properties such as yield stress, Young's modulus, and ultimate compressive strength of concrete. Thus, load bearing of steel decreases when steel or composite structure is subjected to a fire action. If the duration and the intensity of the fire are large enough, the load bearing resistance can fall to the level of the applied load resulting in the collapse of the structure. However, the failure of the World Trade Centre on 11th September 2001 and, in particular, of building WTC7 alerted the engineering profession to the possibility of connection failure under fire conditions. In this study, S220 and S420 ribbed concrete steel rebars were subjected to 7 different temperatures to determine the high temperature behavior of reinforcement steels.

We are all responsive to the harm that fireplace will cause in terms of loss of life, homes and livelihoods. A study of sixteen industrial nations in Europe and the USA, North American country and Japan) found that, during a typical year, the quantity of individuals killed by fires was one to two per 100,000 inhabitants and therefore the total price of fireside harm amounted to 0.2% to 0.3% of GNP. Within the USA specifically, statistics collected by the National hearth Protection Association (USA) for the year 2000 showed that quite 4,000 deaths, over 100,000 injuries and quite $10bn of property harm were caused by hearth.

***CLASSES OF DAMAGE*:**

Class of Damage	Repair classification	Repair Requirements
Class 1	Superficial	For repair, use cement mortar trowelling using cement slurry bonding
Class 2	General	Non-structural or minor structural repairs like restoring cover to reinforcement using cement polymer slurry as bonding layer and nominal light fabric reinforcement or using epoxy mortar over the primary coat of epoxy primer.
Class 3	Principal Repair	Where concrete strength is significantly reduced, strengthening to be carried out with shotcreting in case of slabs and beams and jacking in case of columns. For less damaged columns shotcreting is also proposed
Class 4	Major repair	Repair method is demolition

LITERATURE REVIEW

Fire remains one in every of the intense potential risks to most buildings and structures. The intensive use of concrete as a structural material has semiconductor diode to the necessity to completely perceive the impact of fireplace on concrete. Typically concrete is assumed to own smart fireplace resistance. The behavior of ferroconcrete columns below extreme temperature is especially tormented by the strength of the concrete, the changes of fabric property and explosive spalling.

The hardened concrete is dense, homogenized and has a minimum of a similar engineering properties and sturdiness as ancient vibrated concrete. However, high temperatures have an effect on the strength of the concrete by explosive spalling then have an effect on the integrity of the concrete structure.

EXPERIMENTAL WORK

***INTRODUCTION*:** The specimens for testing were TMT bar of 16mm diameter. 50 bars were move 40cm size. 5 Specimens were tested for the mechanical properties victimisation UTM before heating at traditional temp and also the properties were tabulated. 12 specimens every were heated within the electrical chamber at 150°, 350°, 650° associate degreed 950°C for an hour with none disturbance once heating, out of 12 specimens for every temperature 6 samples were quenched in water for speedy cooling and also the different 6 were unbroken aside for traditional cooling at atmospherical temperature. These specimens later were tested for mechanical properties with UTM and microstructure study victimisation SEM.

EQUIPEMENT:

i.) Universal Testing Machine
ii.) Scanning Electron Microscope
iii.) Electrical Furnace

RESULTS FROM AUTOMATIC UTM:

Table1: Properties for rapid cooling conditions

S. NO	Temp in ° C	Ultimate load (kN)	Ultimate stress (kN/mm^2)	Yield stress (kN/mm^2)	Max. Extension (mm)	Elongation (%)	.2% proof stress
1	2	67.1	0.583	0.446	1.64	27.6	0.454
2	1	66.4	0.589	0.489	1.76	35	0.464
3	3	66.8	0.611	0.459	1.521	27.	0.456
4	6	69.7	0.632	0.467	0.956	27.5	0.472
5	9	81.2	0.711	0.476	0.224	13.8	0.554

Table2: Properties for ordinary cooling conditions

S.NO	Temp in ° C	Ultimate load (kN)	Ultimate stress (kN/mm2)	Yield stress (kN/mm^2)	Max. Extension (mm)	Elongation (%)	.2%proof stress (kN/mm2)
1	27	67.1	0.583	0.446	1.64	27.6	0.454
2	150	66.7	0.578	0.462	1.154	34.2	0.456
3	350	64.9	0.580	0.443	1.131	29.5	0.436
4	650	66.5	0.583	0.491	0.865	28.41	0.453
5	950	68.7	0.596	0.472	0.720	28.5	0.448

***For RAPID cooling conditions*:**

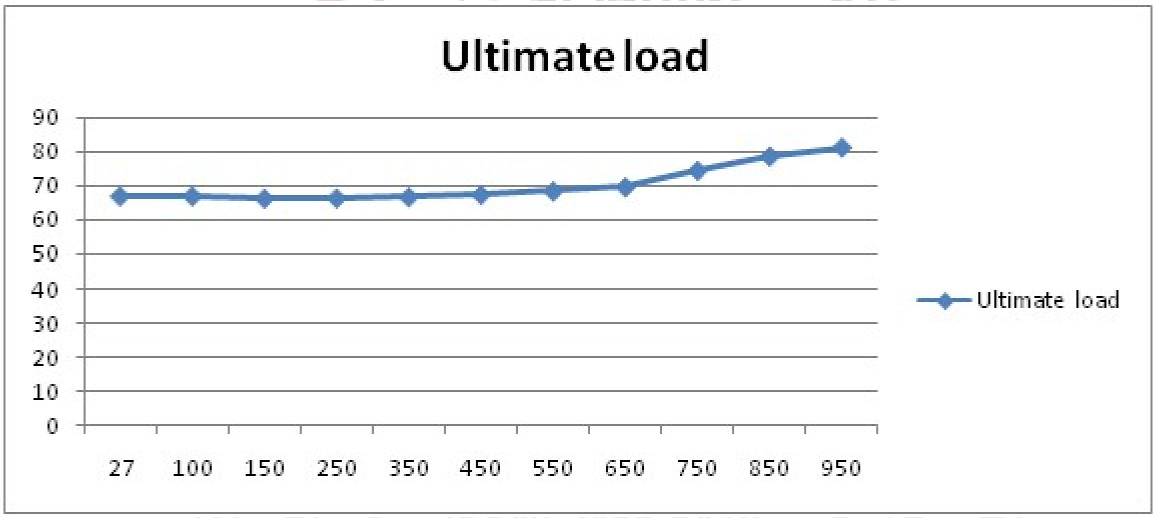

Fig : Temperature vs ultimate load

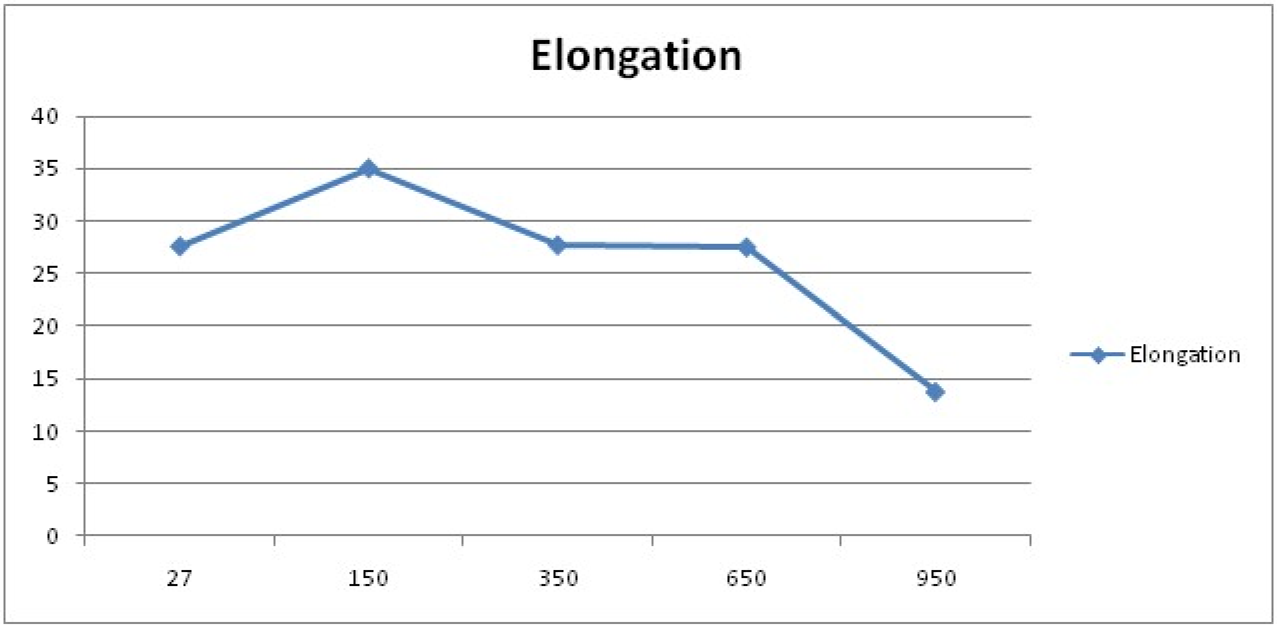

Fig : Temperature vs % Elongation

From the above Fig. it can be observed that ultimate stress initially decreases and then gradually increases, with increase in temperature, this happens due to the microstructure of the bar. For high temperatures the grain size decreases.

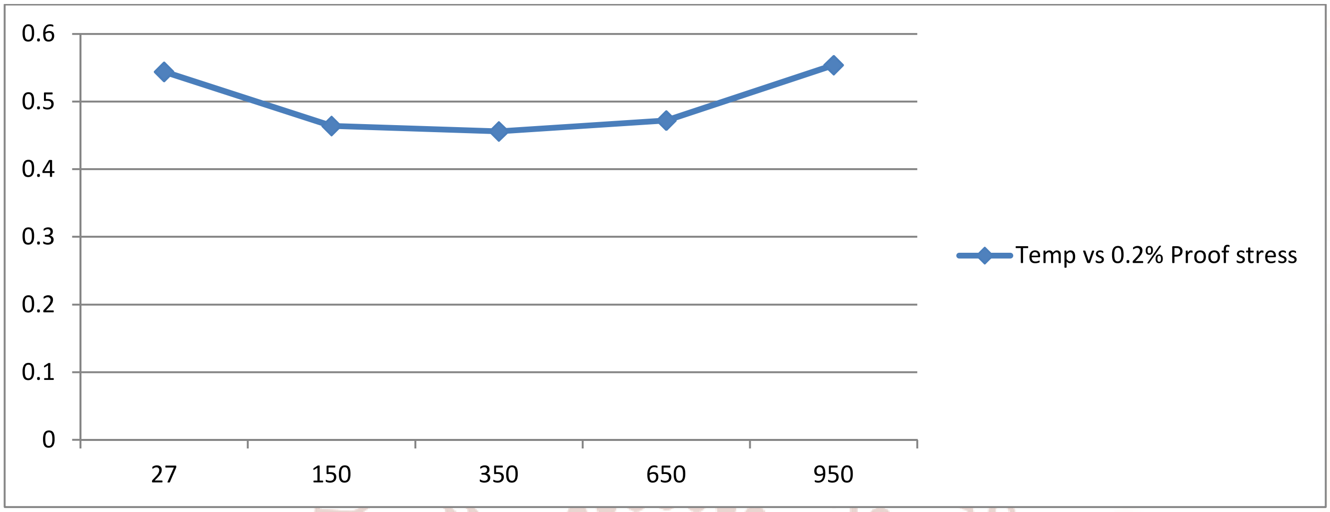

Fig: 0.2%Proff stress vs temperature

From the above Fig. it can be observed that the proof stress initially constant then decreases and then gradually increases, while we increases the temperature.

***For ORDINARY cooling conditions*:**

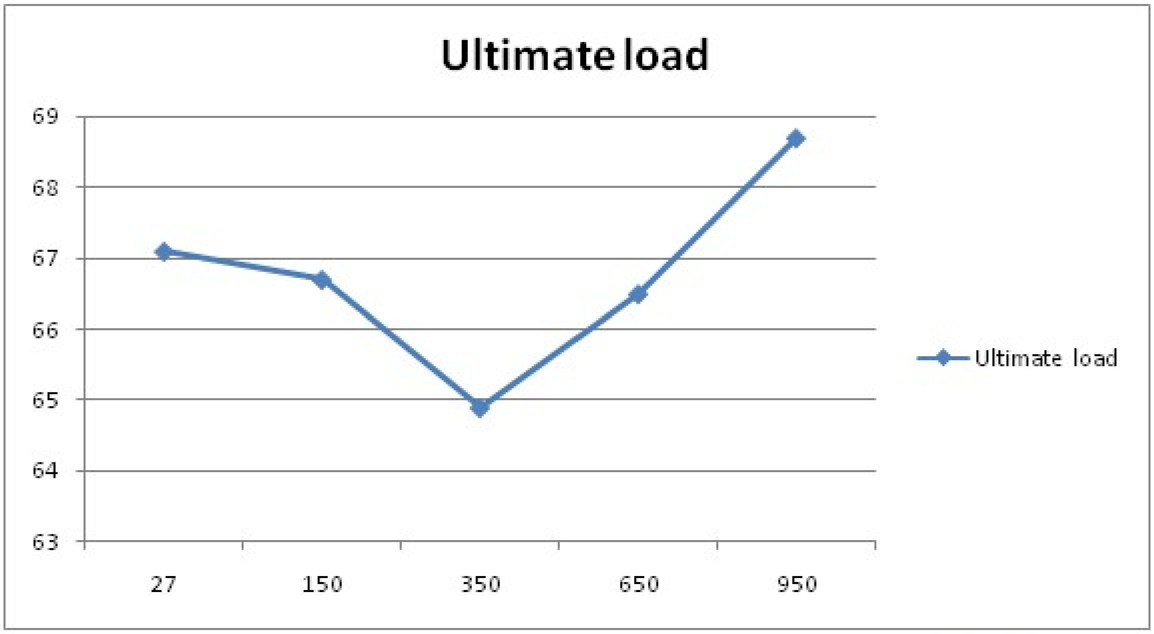

Fig : Temperature vs ultimate load

From the above Fig, the ultimate load carrying capacity of the specimen was reduced in the specimen before heating.

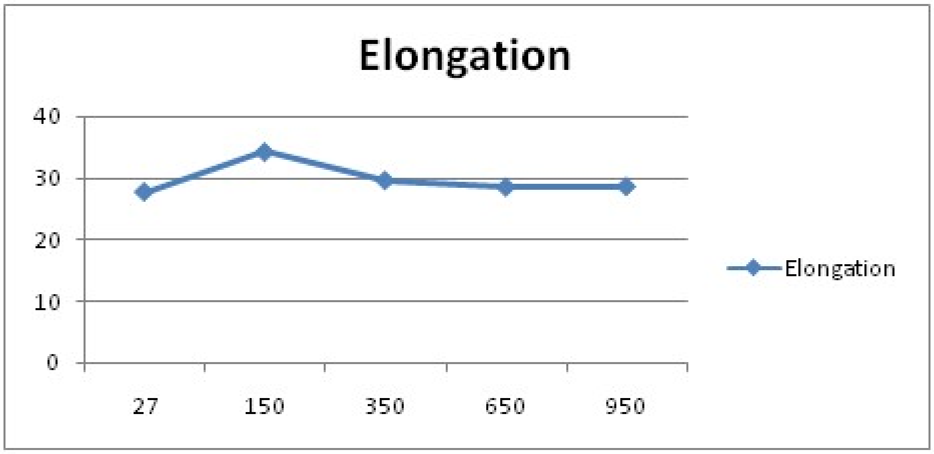

Fig: Temperature vs Elongation

From the above Fig. it can be observed that the % Elongation initially increases upto a point and then gradually decreases. For high temperatures the grain size decreases.

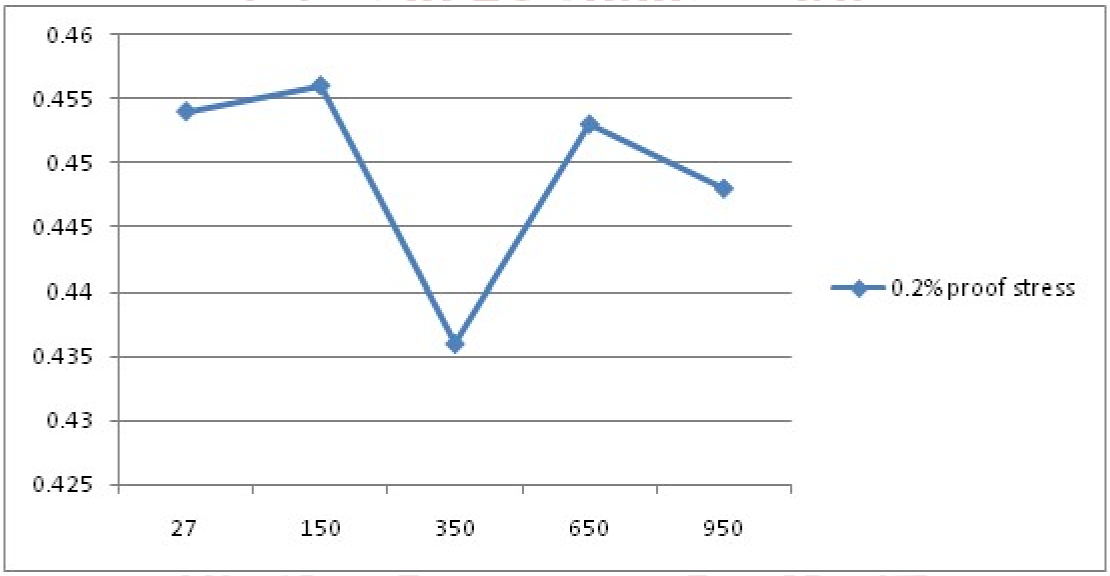

Fig: Temperature vs .2% Proof stress

In above fig it shows the variation between temperature and proof stress in which the proof stress first decreases then suddenly increases up to certain limit after which again start decreasing.

CONCLUSION

i.) The impact of fireside on the reinforcement bars heated at numerous temp of 150° C 350° C, 650°C, 950° C, cooled quickly by termination in water and usually cooled within the atmospherical temp were studied and it's ascertained that the plasticity of quickly cooled bars once heating to extreme temperature to 950 ° C.

ii.) Finding out the characteristic changes in the mechanical properties of the bars by enduringness testing victimisation U T M shows that the rise in final load and reduce in proportion elongation of the specimen that mean that there's important decrease in plasticity of the specimen..

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