Assessment & Repairs to Fire Damaged Concrete Foundations

A Historic & Devastating 2017 Fire in Santa Rosa, CA

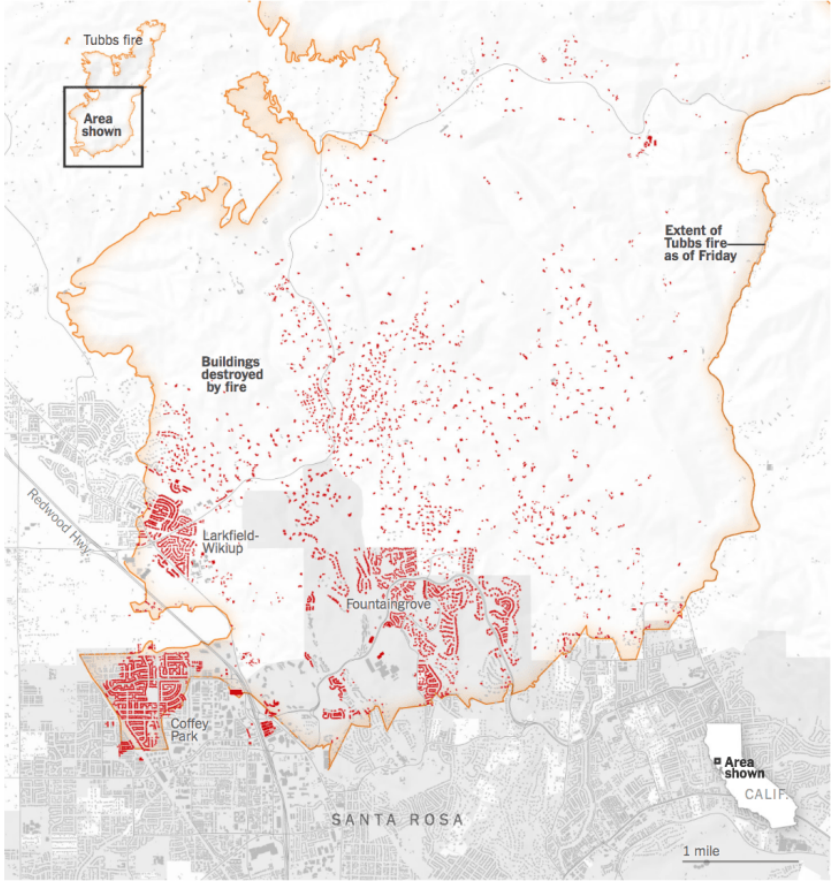
Ashok Kakade, P.E., Principal Engineer

Concrete Science, Inc.
Materials & Structural Engineers
1534 B Street, Hayward, CA 94541-3018
Tel. (510) 581-2342 Fax (510) 581-4178
www.concretescience.com, info@concretescience.com

Most Devastating Fire

- Week of October 8th, 2017
- Over 245,000 Acres
- Over 40 dead and hundreds hospitalized.
- More than 8,500 homes & businesses destroyed
- US $10 Billion +


CALIFORNIA
Pocket fire
101
Tubbs fire
Santa Rosa
Nuns fire
Atlas fire
Napa
101
Sacramento
80
5
San Francisco
510


Tubbs fire
Area shown
Extent of Tubbs fire as of Friday
Buildings destroyed by fire
Redwood Hwy.
Larkfield-Wikiup
Fountaingrove
Coffey Park
SANTA ROSA
Area shown
CALIF.
1 mile

Drone Video

Fire Resistance of Concrete

1. Excellent

a) Non-combustible
b) High resistance to heat transfer
c) No toxic fumes

Question:

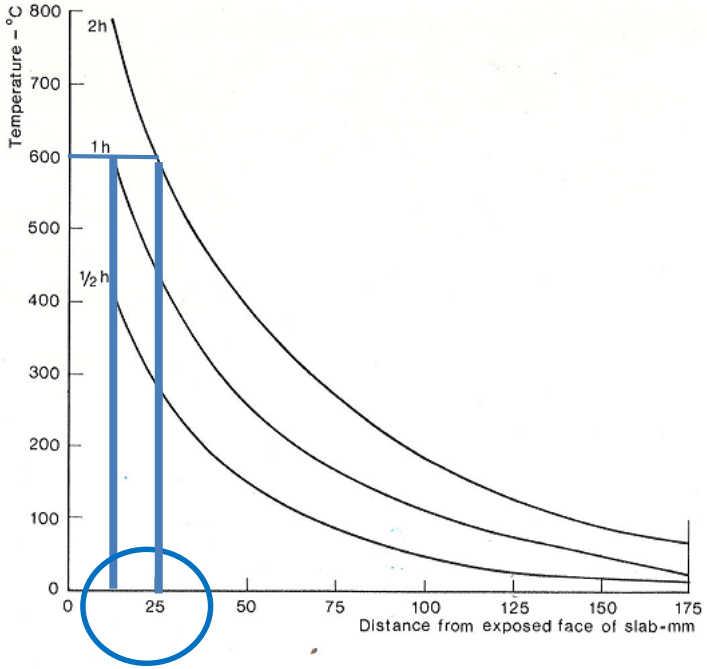
Can I save my Fire Exposed Concrete Structure?

Answer:

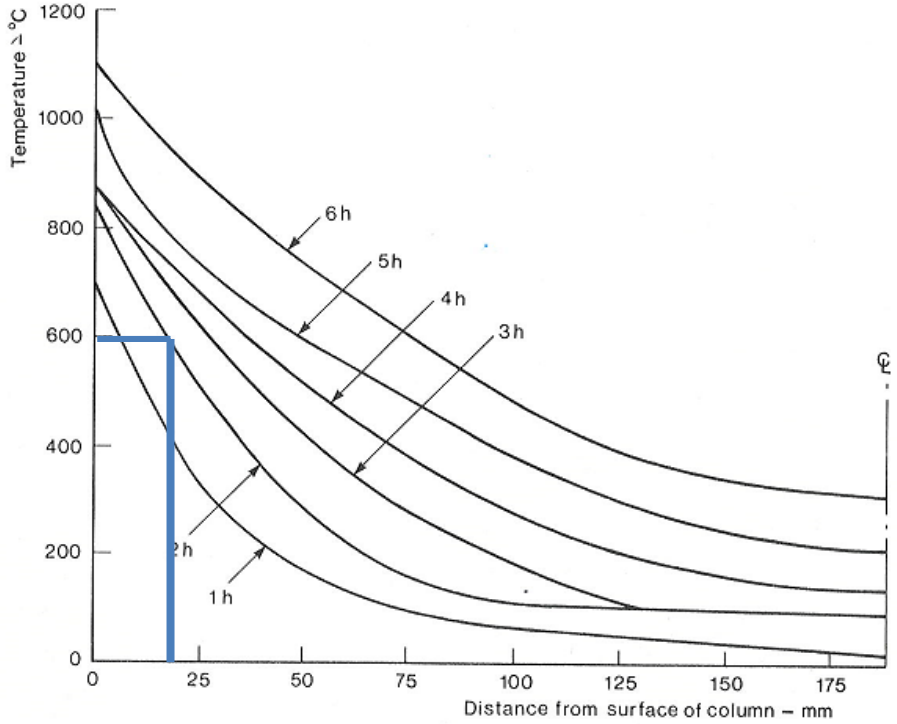
In majority of the cases: **YES**

Approx. Melting Points

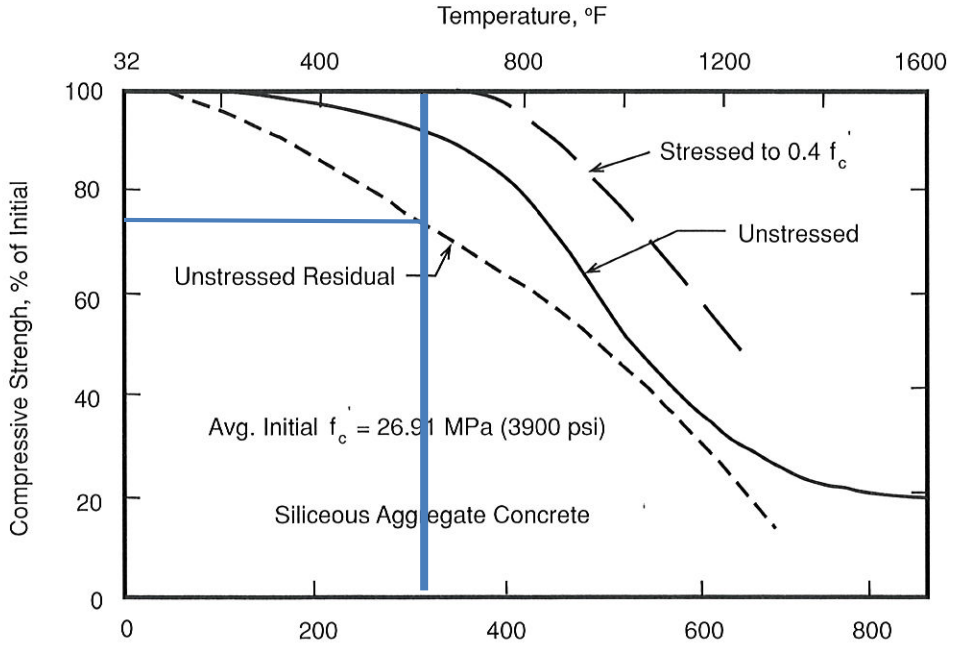
- Polyethylene: ~ 250 °F
- Lead ~ 620 °F
- Glass Softening: ~ 1,100 °F
- Aluminum: ~ 1,200 °F
- Silver: ~ 1,760 °F
- Copper: ~ 1,980 °F
- Cast Iron: ~ 2,100 °F
- **Steel**: ~ 2,550 °F



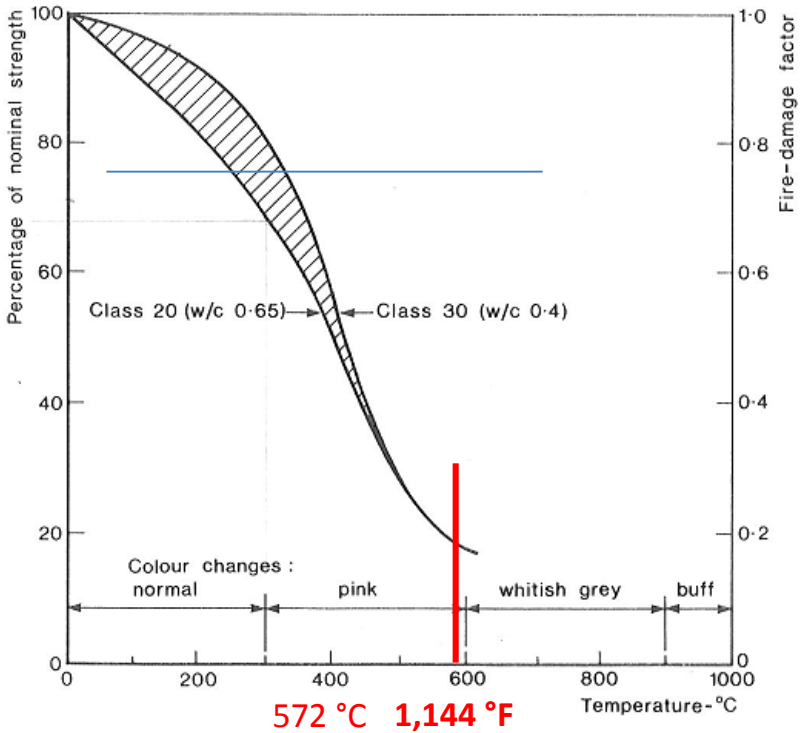
Concrete Slab Exposed to Fire



Concrete Stem Wall Exposed to Fire



Relative Compressive Strength After Fire



Compressive Strength of Concrete After Fire

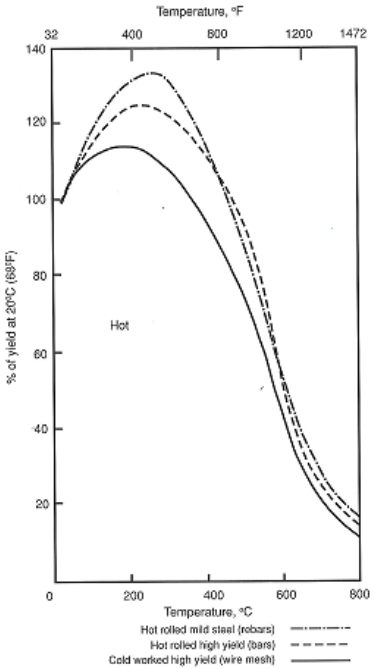


Fig. 4a. Yield strength of steel reinforcement while hot.

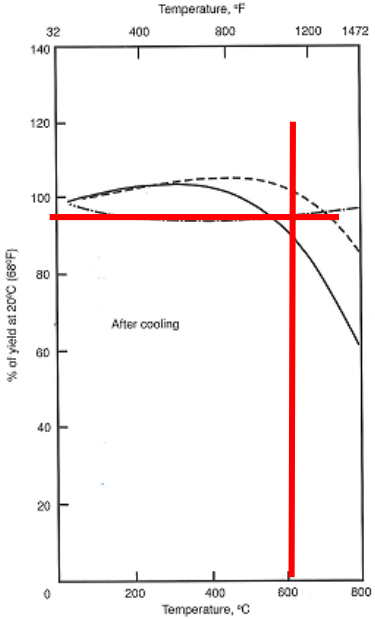
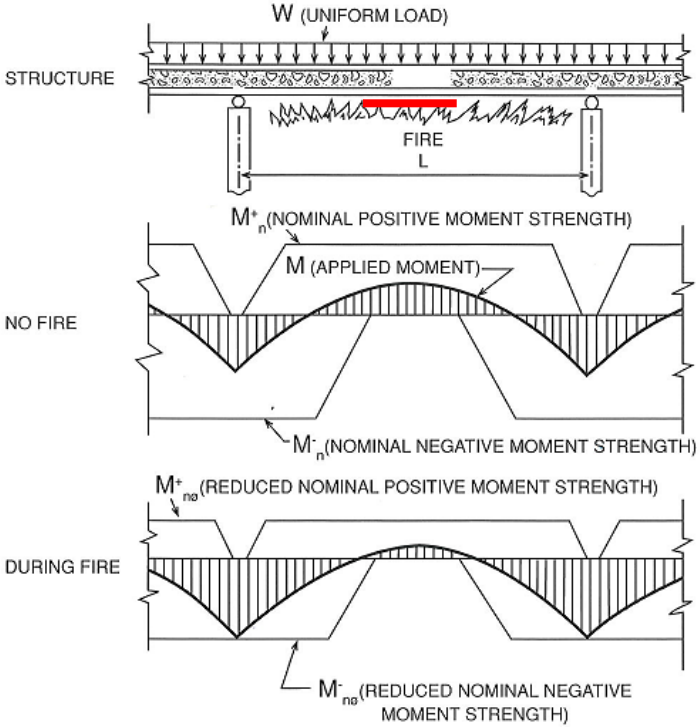


Fig. 4b. Yield strength of steel reinforcement after cooling.

Yield Strength of Steel After Fire



Deflection Diagram

Typical Fire Temperature & Duration

1,200 °F (~ 650 ° C)

- 2,000°F (~ 1,100 ° C)

30 MINUTES

Damage to Concrete

1. Reduction in **Compressive Strength** & Modulus of Elasticity
2. Micro-Cracking
3. Spalling
4. Color Change
5. **Loss of bond to steel**
6. Possible loss in steel strength & loss of tension in prestressing
7. Increase in deflection

Changes in Concrete Material

120 °C: Negligible Effect

250 °C: Localized crack, commencement of strength reduction

400 °C: Decomposition of Calcium Hydroxide begins

600 °C: Cracks in cement paste, color change to pink

900 °C: Color change to buff

1200 °C: More decomposition of paste

1400 °C: Complete decomposition