EDUCATIONAL ASSIGNMENT for JOSEPH JOHN WUNDERLICH for 11th grade

This assignment covers the following Educational Objectives (Subjects marked with a "■" are the main subject, and those marked with an "□" are secondary subjects):

- ■ PHYSICS
- □ Related MATHEMATICS
- □ READING
- □ WRITING

ASSIGNMENT*: *Write a paper titled "Understanding the Physics of Reinforced Concrete" in single-spaced, 10-point-font, and citing sources in either APA, MLA, or Chicago style (pick just one).

The paper must have the following section titles and content:

I. Early Personal Experience with Reinforced Concrete

Include photos and narrative of your earliest memories with reinforced concrete and why you think we needed it

II. Fundamental Physics of Reinforced Concrete

Include definitions of:

Compression Strength
Tensile Strength
Stress
Strain
Stress vs Strain (include graphs)
Ductile Material
Brittle Material
Structural properties of Concrete
Structural Properties of Steel
Structural Properties of Reinforced Concrete

III. Structural Problems and Solutions for Frank Lloyd Wright's Fallingwater

Understanding the Physics of Reinforced Concrete

Joseph J. Wunderlich
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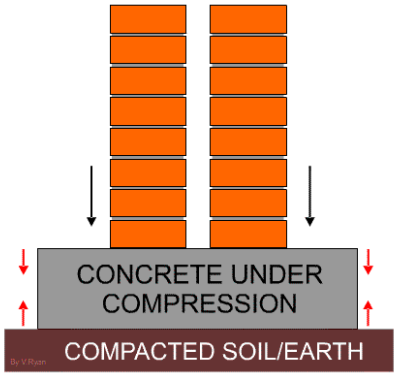
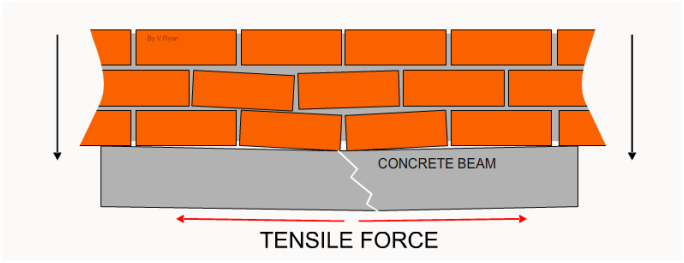
I. Early Personal Experience with Reinforced Concrete

While my father and I were working on the foundation for our house's new renovation about 10 years ago, He and I were lining up a steel rebar foundation in the trench we dug around where we would pour the cement for the foundation. There are several reasons why I imagine we would do this. For one, during the winter I know that the water in the ground freezes which causes the dirt to expand slightly. This expansion can cause the cement underground to crack if not supported by a metal frame to hold the stone together. A second reason would be to keep the cement from collapsing due to air bubbles that form in the poured slab. Concrete has a strong compression strength but pockets of air could comprimise sections of the foundation, so having metal reinforcement would keep the pocket from becoming any larger. This is my hypothosis.

II. Fundamental Physics of Reinforced Concrete

Reinforced concrete has a strong compression strength, and has an increased tensile strength as well when steel rebar is added. This makes for an excellent foundation material that is slightly ductile and will hold together well under load.





- Compression strength: The strength of materials under load that normally reduce size. This is concrete's well known strength.
- Tensile strength: The strenth to withstand being pulled apart in opposite directions. Steel cables that support the Golden Gate Bridge require this.
- Ductilility: A solid material's ability to deform under tensile stress. Wrought Iron, the primary building material in the Effel tower, is a well known ductile material.
- Brittleness: A property of a material to be unable to deform (under strain) and break when under stress. Cast Iron is a good example of a brittle material.
- Stress: Internal force associate with a strain.
- Strain: A relative change in a material's strength due to outside (external) forces.

III. Structural Problems and Solutions for FLW's Falling Water

When I visited Frank Lloyd Wright's famous house Falling Water, I was struck by how perfect the building's style was balanced. The colors and materials all complimented one another as well as the natural landscape. This building is a feat in architectual design. But as for the building's structure, there are some fatal flaws that could compremise the building's future. The first observable problem was the first floor overhanging balcony on a slight decline. In fact most of the overhanging building, including the second floor balcony and first floor windows were all equally askew. So much so that I could feel the slope just slightly when standing inside.

A quick solution to this sagging problem would simply to place some colums in the water to support the overhang, but this would take away from the well known look of the building, so a less obtrusive approach would be required. Perhaps long struts painted black and shoved underneith the building would work as well without being too noticeable.

Bibliography

In order of appearance on this page:

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2. Ryan, Technologystudent.com, "COMPOSITE MATERIALS - REINFORCED CONCRETE", Last modified 2010, http://www.technologystudent.com/joints/reinforc1.html

3. Mel Marshall, P. Eng., NPCA, Precast.org, "Why Rebar Spacing is Crucial", Last Modified October 31, 2012, http://precast.org/2012/10/why-rebar-spacing-is-crucial/

4. Wikipedia, "Properties of Concrete", Last Modified 30 March 2015, at 02:19, http://en.wikipedia.org/wiki/Properties_of_concrete\

5. Bowling Green State University, Physics 201 – College Physics I, Hooke's Law and Simple Harmonic Motion, "Definition of Stress and Strain", Last modified 2003, http://physics.bgsu.edu/~stoner/p201/shm/sld002.htm

6. Tyler Meek, Failures Wiki, "Fallingwater: Restoration and Structural Reinforcement" https://failures.wikispaces.com/Fallingwater