Standard Test Method for Fresh and Hardened Concrete

Andres Sosa, Byron Reynolds, Vanesa Moreno

FAMU-FSU College of Engineering

December 5, 2014

Overview

Introduction

Concrete

- Components
  - Aggregates
  - Water
  - Cement
- Construction material
- Understanding strength characteristics

Purpose

- Problem statement
  - Strength characteristics
- Research objective
  - Compressive strength
  - Tensile strength
  - Flexural strength
  - Modulus of Elasticity

Background

- Origin
  - Ancient civilizations
  - Roman infrastructure
  - Revolutionary ideas
- Modern-day concrete
  - Portland cement & asphalt concretes
  - Aggregates
    - Inter-particle friction
    - Coarse and fine aggregates

Background

Formulas

- Elast Modulus equation:

$$E = \frac{S_2 - S_1}{\epsilon_2 - 0.000050} \tag{1}$$

- Poisson's Ratio can be found using the equation:

$$\mu = \frac{\epsilon_{t2} - \epsilon_{t1}}{\epsilon_2 - 0.000050} \tag{2}$$

- Strain can be calculated by:

$$\epsilon = \frac{\Delta L}{L} \tag{3}$$

Experimental Program

- Fresh Concrete
  - Mixing concrete
    - ASTM C 143
    - Dependency on ratio of components
  - Slump test
  - Air content testing

Testing Machine

Compressive Test

Testing Machine

Flexural Test

Background

Tensile Testing

Test Procedure

Mixing Concrete

- Mixing concrete
- Slump test
- Air content testing

Results

- Fresh Concrete

Table: Fresh Concrete properties

Batch	**Slump** [in]	**Air Content** [%]
A	2.00**	2.50
B	7.25	2.25
C	6.00	1.50

Background

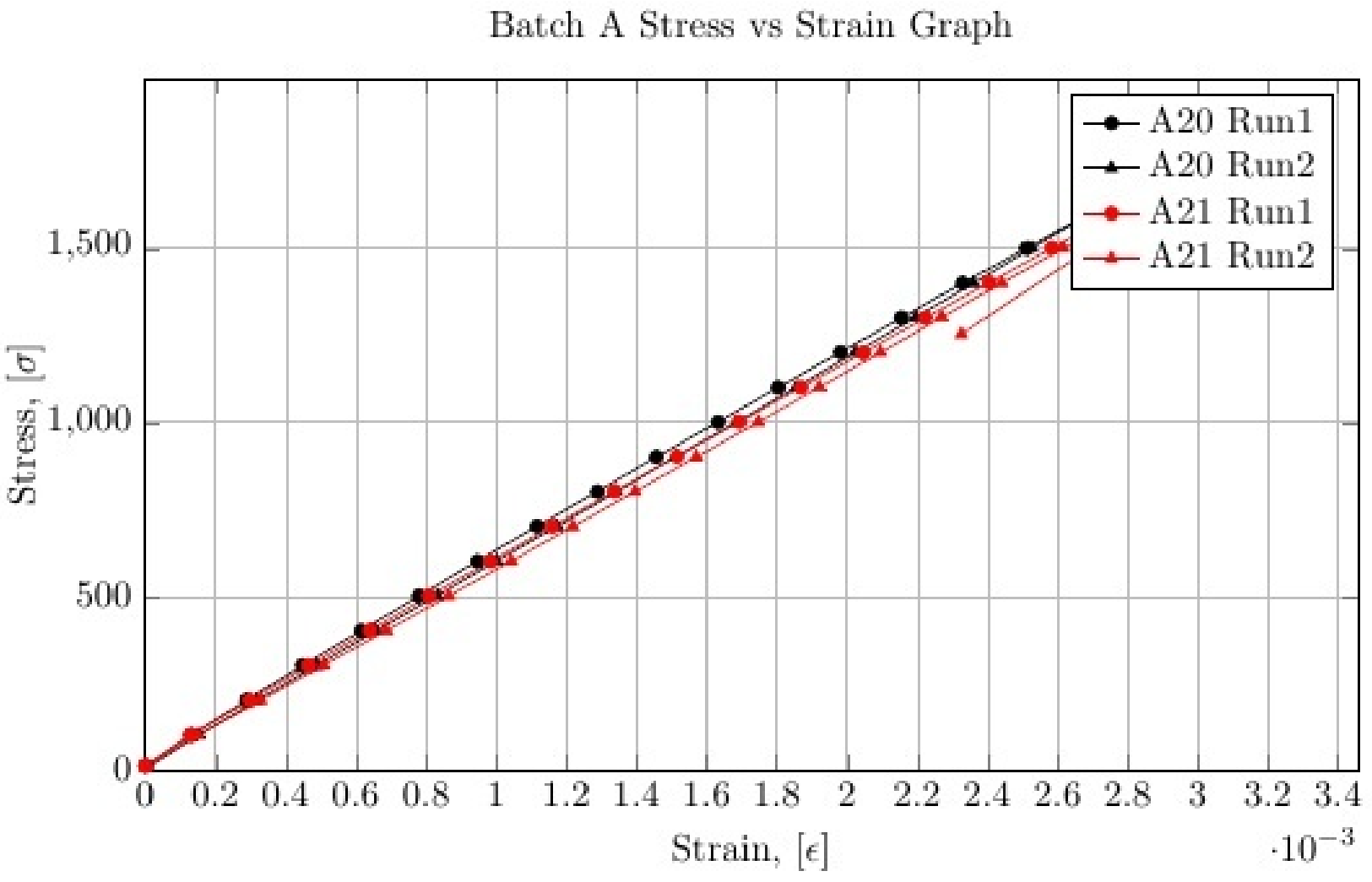
Tensile Testing

Table A.1: Test Results

		Average Failure Stress [psi]		
Age	**Batch**	**Compression**	**Tensile**	**Flexural**
7-Days	A	3162.7	361.9	50.1
	B	4058.1	413.8	675.2
	C	3355.0	432.1	714.8
28-Day	A	4668.4	728.1	752.1
	B	4775.7	831.0	725.0
	C	5040.9	523.2	242.5

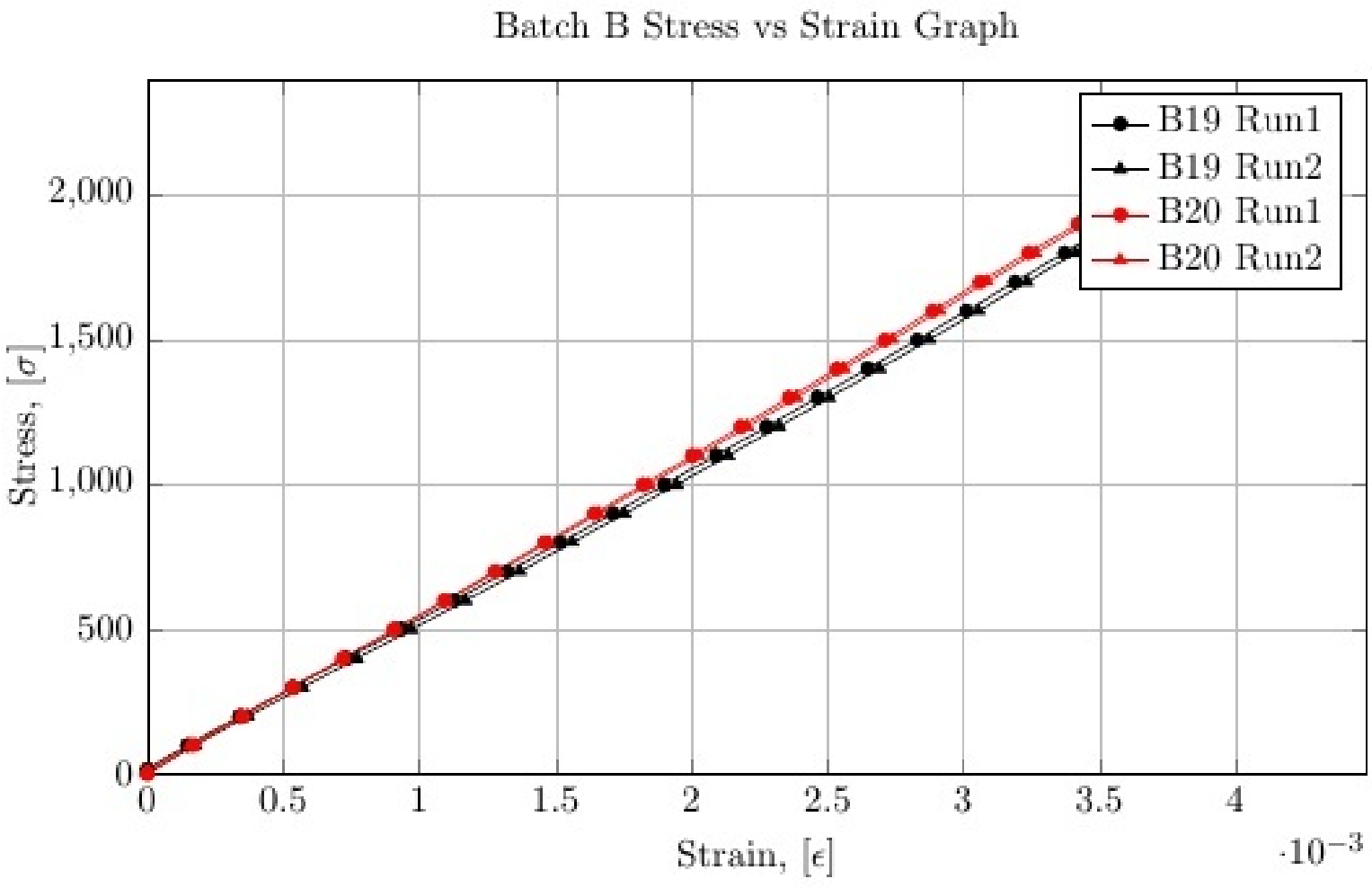
Results

Elastic Modulus



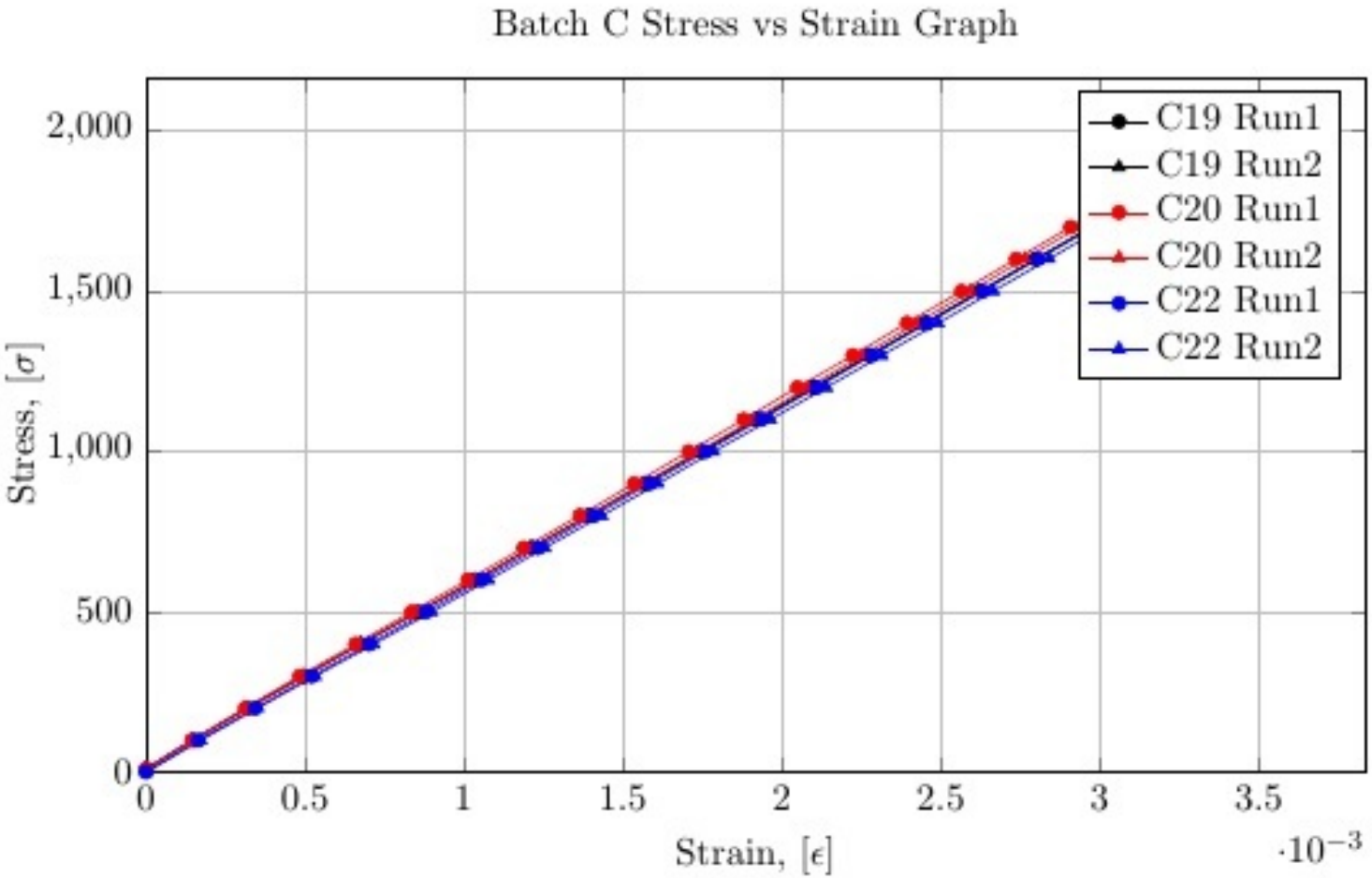
Results

Elastic Modulus



Results

Elastic Modulus

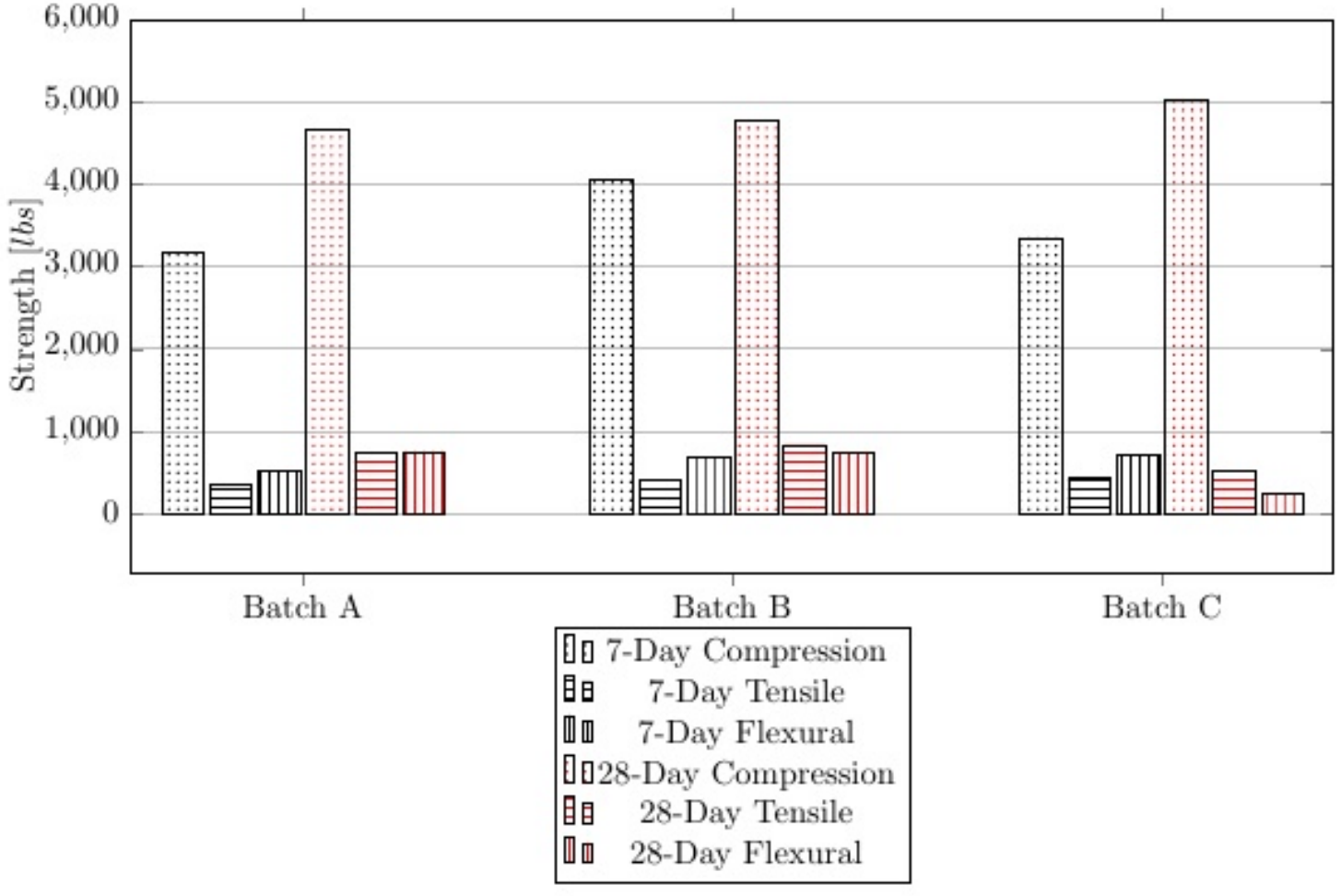


Results

Table: E-Modulus Values for Batch A, B, C

	E-modulus [*psi*] for Batch		
Specimen	**A**	**B**	**C**
19 Run 1	588763.8	534428.2	565639.7
19 Run 2	588428.4	533462.3	562300
20 Run 1	571031.2	552262.9	579381.6
20 Run 2	570385.4	551255.6	576764.5
22 Run 1			548790.8
22 Run 2			565785.5
Average	579652.2	542852.25	571021.45

Analysis


6,000
5,000
4,000
3,000
2,000
1,000
0
Strength [lbs]
Batch A
Batch B
Batch C
7-Day Compression
7-Day Tensile
7-Day Flexural
28-Day Compression
28-Day Tensile
28-Day Flexural

Analysis

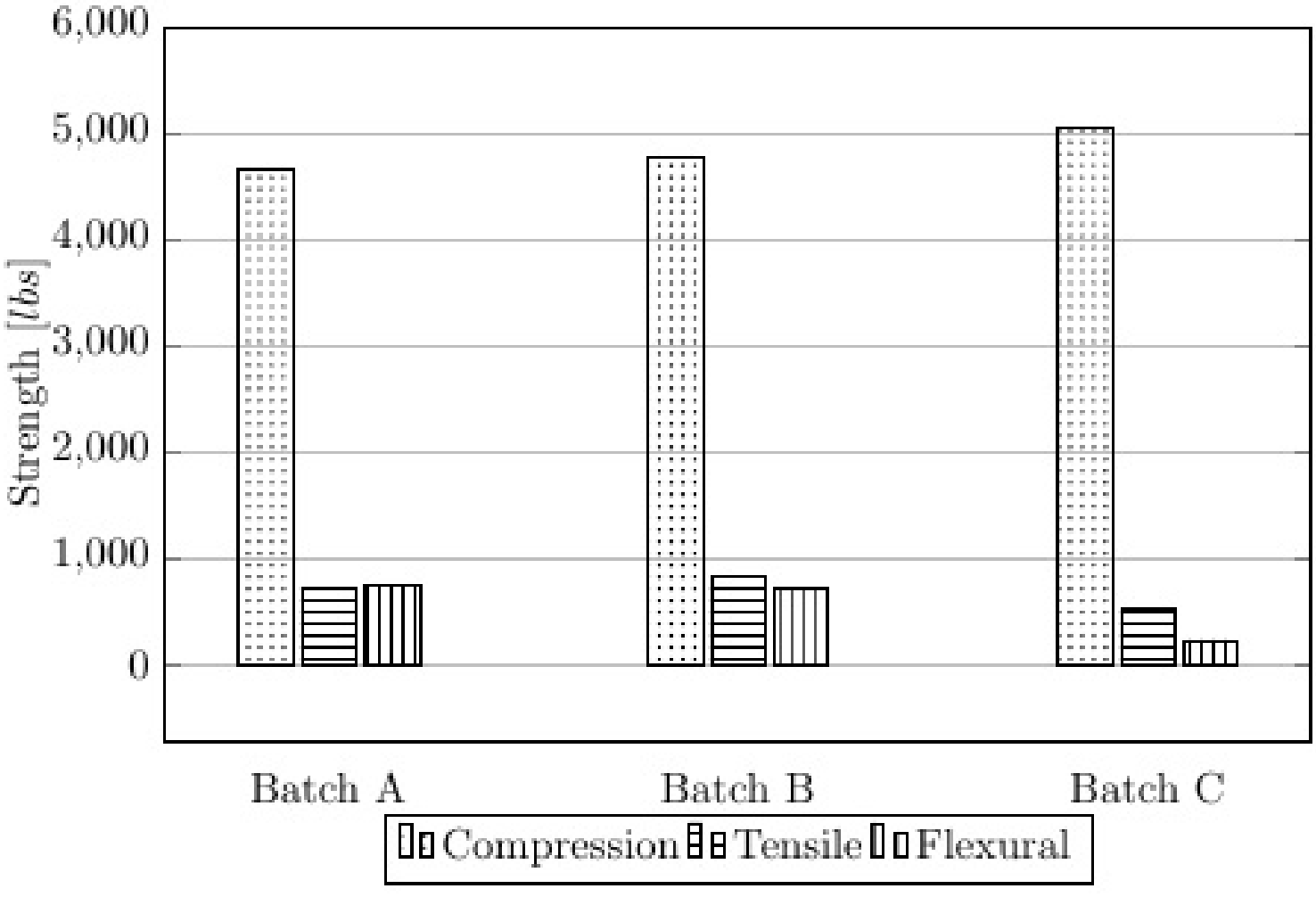


Figure 5.2: By batch comparison to show relationships of strength with water and air contents

Analysis

- Concrete strength over time
- Concrete strength by batch
- Concrete and water relationship
- Concrete and air relationship
- E-modulus

References

John Smith (2012)

Title of the publication

Journal Name 12(3), 45 – 678.

The End