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Portland Cement, Structural Steel & AT Math: From Observation to Theory

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ABSTRACT: *In this paper, we calculate the variables for regular concrete that have been observed but not put on a mathematical basis. Concrete is widely used and is a n important building material. Understanding concrete better is important considering that a lot of infrastructure repair work in the US will be done in the short term- work that has been neglected for far too many years. Concrete repair is a large part of that work.*

KEYWORDS: Portland cement; concrete; AT Math.

INTRODUCTION

Civil Engineers study concrete in detail. But to my knowledge, the theory undergirding the measured variables for concrete such as 28-day strength, or the water to cement ration has never been done before. Using the new Physics, uncovered again from ancient times, by this author, we calculate the parameters that are essential to understand concrete fully. We begin with the chemical equations for cement.

Tricalcium silicate + Water--->Calcium silicate hydrate+Calcium hydroxide + heat
2 Ca_3SiO_5 + 7 H_2O ---> 3 $CaO \cdot 2SiO_2 \cdot 4H_2O$ + 3 $Ca(OH)_2$ + 173.6kJ
Dicalcium silicate + Water--->Calcium silicate hydrate + Calcium hydroxide +heat
2 Ca_2SiO_4 + 5 H_2O---> 3 $CaO \cdot 2SiO_2 \cdot 4H_2O$ + $Ca(OH)_2$ + 58.6 kJ
Source: [1]

METHOD

A desktop investigation of known variables such as 28 day strength, water to cement ratio, the air entrainment in Mortar, heat of hydration, and the manufacture of cement in a clinker was undertaken. Then AT Math was applied to the physics and chemistry of Portland cement. Astrotheology has formulas and known parameters that were used to compare against those observed for concrete.

Molecular Mass

$2Ca_3=20\times2\times3=120$
$2Si=14x2=28$
$2O5=16\ x10=160$
$14H=1\ x14=14$
$7O=16\ x7=112$

$\Sigma=434\ x\ 6.023=2614$

$M=Ln\ t$
$2613.9=Ln\ t$
$t=13.65$

$E=1/t=0.732+173.6=2.472$

$e^{2.472}=118.461=1/0.844158$

Poisson's Ratio

$0.844(M_L/M_{A)}=0.26$

$M_L/M_A=0.308$

$0.308/4=1/12.98{\sim}1/13=1/E$

$E=13$
$E^2+E-2=t$
$13^2+13-2=t=180=\pi$

$0.26(8/3)=0.693=Ln\ 2$
$t=2$
$t^2-t-1=E=1$
$t=-1;2$

$0.69333(8/3)=1.443$
$e^{1.443}=1.15523=1/\sin 60°=E$

$s=E\times t=|E||t|\ \sin\theta$

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s=t

E=1/sin θ

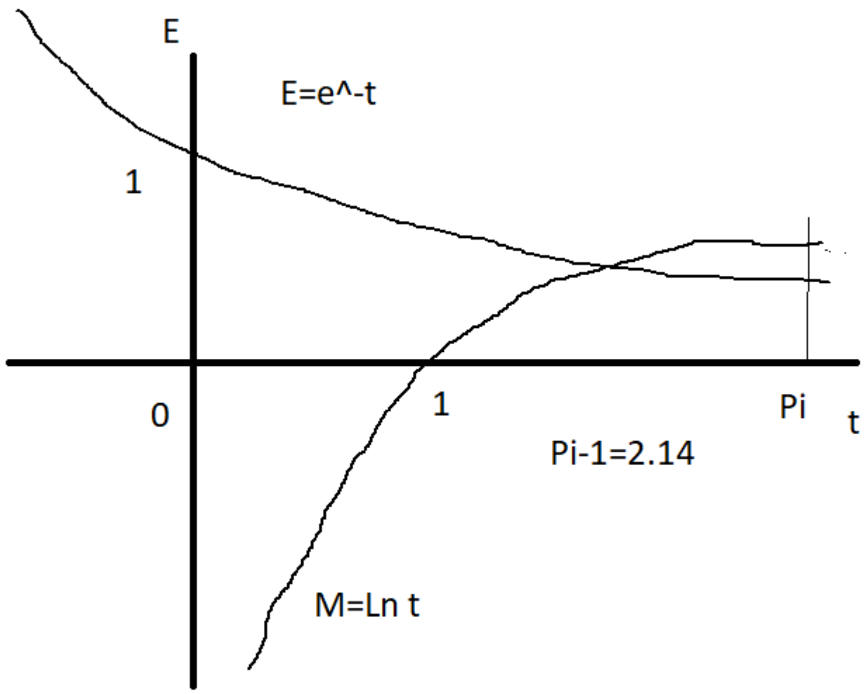

Figure1 Plot of ln function and exponential function

Strength of Concrete

M=Ln t

E=1/t=1/F

F=t

M=Ln F
=Ln 20.0MPa

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$=2.9957 \approx 3 \Rightarrow y=y'$

$t^2-t-1=2t-1$

$t=3$; $E=5$

Concrete Test specimen

Test Cylinder dia150mm x height 300 mm

$SA=2\pi(0.150)^2 \times 0.300+(\pi)(0.150^2)$
$=0.2828+0.7068$
$=0.9898 \approx 1$

$0.9898+0.7068=16.96 \approx 17$

Concrete is said to have 75% of its 28 day strength at 7 days. We can use the log strength formula to verify this.

75%=3/4=1/s @ 7 days

$M=1/81=0.012345679$

$(1/7 \times 7)+2=3=t$

$M=\text{Ln } t$

$dM/dt=1/t=2$

$t=1/2=t_{min} \Rightarrow$GMP

$dM/dt=1+2=3$

$t=1/3=33.3\%$

33.3% x 28 days=9.24 days

$\text{Ln } t=\text{Ln } 9.24=2.22$

22.2/20MPa=111=1/9=$1/c^2$=M

4(1/√2)=0.2828=Mv=$\overline{P}$

Ln (π-1)=76.154

76.15+22.2=0.9835=98.4% Strength @t=π

ΔH=173.6 kJ≈√3

t^2-t-1=E
$(\sqrt{3})^2-\sqrt{3}-1$=2.67=Sf=1/E=t

F=t=2.67

ΔF=Δt

Aside:

t=KE=1/2Mv^2=1/2(4)(9)=18

Δt=2.67 x (1/18)
=148.333

148.333 x 24 Hrs /day=0.356

$e^{-0.356}$=7.004≈7 days

M=0.012345679=1/81

M=(1/7)(7)+2=3=t

Now

Δt=π-1=2.14159

2.14159 x 1/18=118.977

118.977/24=0.4957≈5=E ⇒y=y'

ΔH_1=173.6 C
ΔH_2=58.6 C

ΔH_T=231.9

Ln 23.18=3.1433≈π

15 minutes +2 Hrs+12Hrs+20Hrs=34.25 hrs

M=Ln t
=Ln 34.25=1/2.8299=1/28.3=1/(4√2)

PV=nRT
PV/[nR]=T

20 ×V/8.31=23.18

V=96.3129

Cylinder Area Exposed=$\pi R^2=\pi(0.150)^2$ x0.300
=2.120

2.120/96.3129=2.20=1/454=Ln 9.24 days

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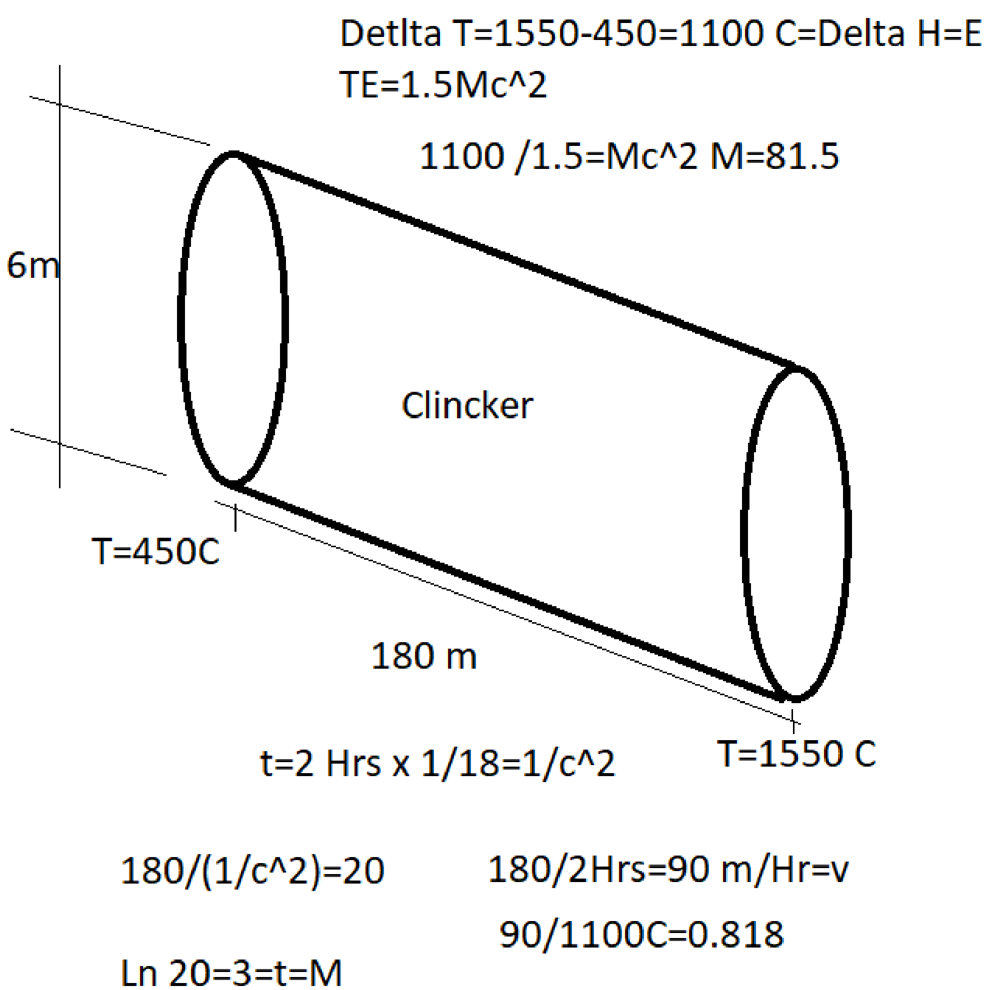

Figure 2 The typical Clinker and the making of cement.
water/cement ratio

H_2O=18 g/mol x 6.023=108.414 g

108.414/81.6=1.3286~4/3=s

1/s=75.26%

w/c=0.42

108.414/c=0.42
c=264.4=1/378=E

Mortar & Porosity tpo combat rejointing.

$pH=Log [H^+]=12$

M=Ln t
$[H^+]=t$

t=162.7

1.6275/1.0074=1.6155≈1.618

OH^- =17 g/mol ×6.023=102.4295

Ca^{2+}=20 g/mol ×6.023=120.46

Σ=222.8895=Ln 9.24 days=M

Stage V=36 Hours=1.5 days

36 Hr x 1/18=2=t

$t^2-t-1=E=1$

t=-1;2

Heat of Hydration

15 min (0.25 Hrs) +2 Hrs+12Hrs+20 Hrs=34.25

1/34.25 x 1/18=1622≈1.618=t

dE/dt=2t-1
2t=1622

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t=0.811≈81

E=1/t=1/81=0.12345679=M

$(0.81)^2$-(0.81)-1=1.1539=1/0.866=1/sin 60°

s=t

s=|E||t|sin 60

E=1/sin 60°

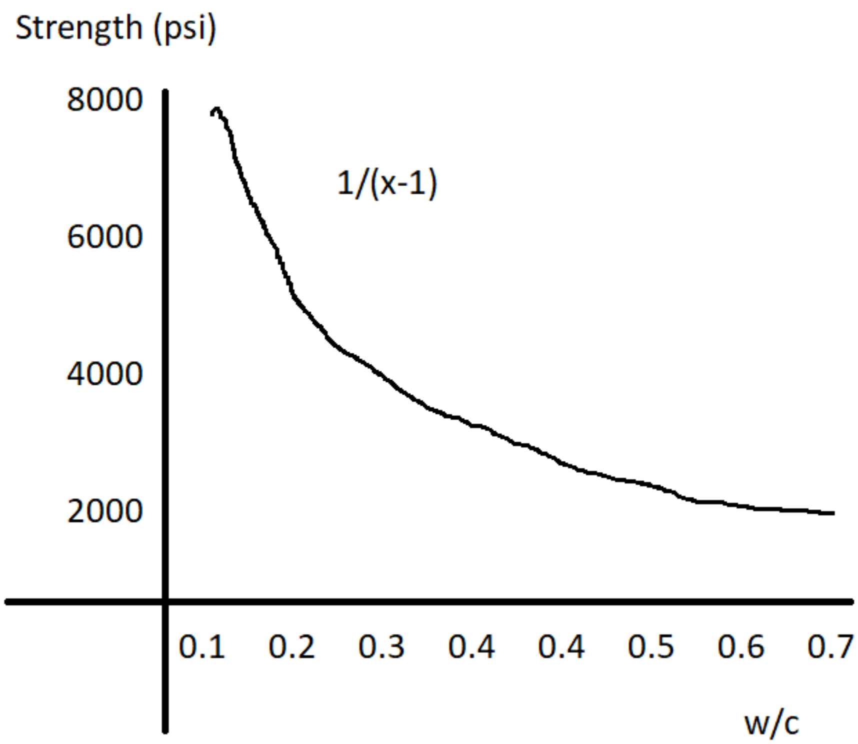

Figure 3 The water to cement ratio plot against strength.
108.414/c=e^{-t}=e^{-3}

c=2.177=1/0.459

2.177/6.023=0.361

$(0.361)^2$-(0.361)-1=1.2308≈1/81

Now T=1550 C

PV=nRT

T=PV/R
1550=20(V)/8.31
V=644.025

Vol=Area x Height=π0.150$)^2$ (0.300)
=3.5197

3.5197/644.025=0.54651

$(0.5465)^2$-0.546516-1=E=-.12478~-1.25=E_{min}

c=M=Ln t=35197

$e^{0.35197}$=1.4218=1/0.7033

1.4218=1+w/c≈√2

w/c=0.4218≈(π-e^1)=Young's modulus

c=E

M=c=Ln t=1
t=2.718

t_f-t_0=π-e=0.4233

Water
H_2=2 x1=2

O=1 x16 =16

Σ 18

5% Air
N_2=14 x 2=28
H_2=1 x 2=2
O_2=16 x 2=32

Σ=62

Air /Water=
62/18=3.44=1/0.2903

3.444 x 0.4218=343.2

$(0.3432)^2$-0.3432-1=1/0.816≈1/81

343.2 x 2.5%Air=0.858=1-142

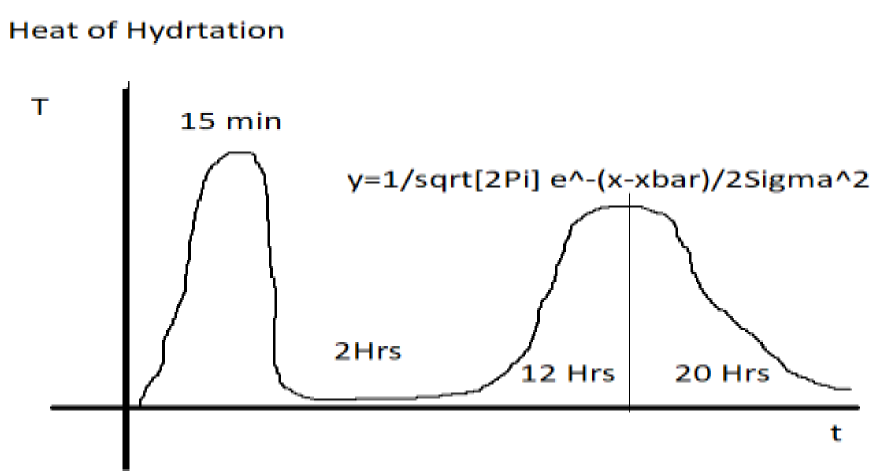

Figure 4 The Plot of Heat of Hydration over time

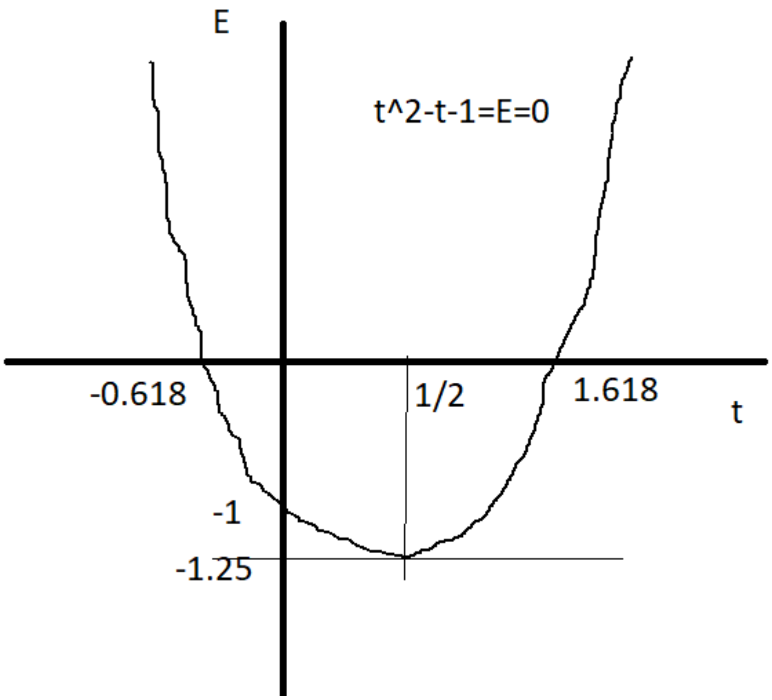

Figure 5 The golden Mean Parabola.

Refer to Figure 4
$y=1/\sqrt{2\pi}\cdot e^{(x-\bar{x})^2/2\sigma^2}$

$\Delta H=1/\sqrt{2\pi}\cdot e^{(\{32+12\}/2)^2/2(17)}$
=0.40058
=1/2.5
=1/Air

Refer to Figure 5

$t^2-t-1=E$
$(0.4)^2-0.4)-1=-1.24\approx-1.25$

Refer to Figure 1

M=Ln t
-1.24=Ln t
t=0.28938

E=1/3.46

Refer to Figure 3.
y=1/(x-1)
=1/0.28938
=1.40722
≈1.41=√2

For Structural Steel:
E=1/t=1/F

F=t

$PE=Mc^2$

$36\ psi=M(3)^2$
M=4

$H_2=2 \times 1=2$
$O_2=2 \times 16=32$
Σ=34

34x 6.023=2.047

$e^{2.04}=0.1300=E$

$E^2+E-2=t$
$13^2+13-2=18=t$

Carbon Equivalent Value

CEV=C+Mn/6+ [Cr+Mo+V]/5+[Ni+Cu]/15

C=0.135 for 36 psi Steel

CEV=0.42 =w/c

Refer to Figure 3.

36=1/(n-1)
36(n-1)=1
36n-36=1

36n=1+36
36n=37
n=1.02777
=w/c ratio

C=12 x 6.023x2.777%=2.007

M=Ln t=Ln 20.07=2.999≈3=t ⇒GMP y=y’

M=t

Conclusion

We see how AT Math can be used to put Concrete from Portland Cement on a theoretical footing. There are rounding errors in the calculations that could be improved upon by more careful analysis.

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