

Twenty-Eight Days in Winter Is Not Twenty-Eight Days in Summer

— Measured in maturity, **28** days at **5°C** is only **0.5000** of **28** days at **20**, and catching up takes **56.00** days —
at **35** it takes **18.67** — the same span of days differs by **3.0000** — [Paper 450]

Yuuki YAMAGISHI (山岸 勇輝)

Yamagishi Complexity Torus Lab, Japan

September 2026

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Abstract

Curing is specified in days. This paper shows that the same span of days carries maturity differing by a factor of **3**—so “28 days” is not a quantity until the temperature is stated. No new theorem or law is claimed. First, 28 days at **20°C** is 20160 degree-hours (Section 2). Second, 28 days at **5°C** is only **0.5000** of that (Section 2). Third, this is the core of the paper. Reaching the same maturity takes **56.00** days at **5°C** and **18.67** at **35**, a ratio of **3.0000** (Section 3). Fourth, that factor of **3** agrees between two independent computations (Section 3). Fifth, equal maturity nevertheless does not give equal final strength (Section 4). Sixth, the separator is whether days or maturity is the quantity (Section 4). **Keywords:** concrete, maturity, Nurse-Saul function, strength development, curing.

Scope of this paper (scope note): No new theorem or law is claimed—the maturity method (Nurse-Saul) and the temperature dependence of strength development are all standard. No mix is designed—water-cement ratio, admixtures and cement type are not the subject. No absolute strength is asserted—how many N/mm² result is not treated; only the days needed for equal maturity. One datum temperature is fixed—**10°C** is used, and that choice itself has latitude. Freezing is excluded—early-age frost damage is a different phenomenon and lies outside the maturity method. No code is discussed—which standard prescribes how many days is not the subject. Relation to earlier papers: Paper 449 showed that power, not the gear, sets the speed—there too, the visible specification was not the real quantity. Paper 300 showed that common root and distinct root can be decided—“days” and “maturity” are distinct roots by that criterion. Paper 403 showed that the order of temperatures is not the order of hotness—there too, one word for temperature hid two quantities. What is added is giving maturity at three temperatures, giving the catch-up as 56.00 and 18.67 days, showing that the ratio 3.0000 agrees between two independent computations, placing the crossover effect as the boundary, and placing the separator at days versus maturity.

1. Notation and the Question

Setting: For d days of curing at T [$^{\circ}\text{C}$], define the maturity relative to a datum T_0 by

$$M = (T - T_0) \times 24 d$$

in degree-hours. The claim of the maturity method is that strength develops according to M , not to d . Below, $T_0 = -10$.

Observation 1.1

Curing is specified in days. “28-day strength” is the settled phrase—a quantity counted on a calendar.

Observation 1.2

But chemistry follows temperature. The same 28 days advances the reaction by different amounts in winter and summer—days are not the quantity itself.

Question: By how much do they differ.

2. The Same Twenty-Eight Days Differs by a Factor of Two

Computation 2.1: Take the maturity of 28 days at two temperatures.

Curing temperature	Maturity of 28 days [degree-hours]
20°C	20160.0
5°C	10080.0

Observation 2.2

The ratio is exactly 0.5000. 28 days at 5°C is 14 days at 20—half the progress.

Observation 2.3

The datum of -10°C is doing the work. The ratio is $20 - (-10) = 30$ against $5 - (-10) = 15$ —a factor of 2, not the 4 that 20 against 5 would give.

Observation 2.4

So “a quarter of the Celsius reading means a quarter of the progress” is wrong. Where the datum sits changes the ratio—it is neither absolute zero nor the freezing point, but -10°C chosen empirically.

3. Catching Up Takes 56.00 Days, or 18.67

Computation 3.1: Take the days needed at other temperatures to reach the maturity of 28 days at 20.

Curing temperature	Days needed	Relative to 28
5°C	56.0000	2.0000
20°C	28.0000	1.0000
35°C	18.6667	0.6667

Observation 3.2

Twice in winter, two-thirds in summer. 56 days against 18.67—a factor of **3.0000** in the days to the same strength.

Observation 3.3

That 3.0000 agrees between two independent computations. The direct ratio $(35 + 10)/(5 + 10)$ and the inverse ratio $56.0000/18.6667$ —they land on the same value.

Observation 3.4

So “cure for 28 days” is not a quantity until the temperature is stated. Winter’s 28 days and summer’s are different things—one phrase naming two.

Observation 3.5

Extending the curing period for cold-weather concreting closes exactly this gap. What is already known as practice has only been rewritten in numbers—nothing new is being said.

4. The Separator

The separator: is the quantity days, or maturity.

Observation 4.1

If it is days, a calendar suffices. Wait the same number of days anywhere—that is how it is run.

Observation 4.2

If it is maturity, nothing can be managed without measuring temperature. The same days do not guarantee the same result—measurement is required.

Observation 4.3

These are distinct roots by the criterion of Paper 300. Both are called “curing period”—one an amount of time, one a product of time and temperature.

Observation 4.4

The same shape as Paper 449. There, the visible specification—the gear—did not set the speed—here the visible specification—the days—does not set the strength. In both, specification and quantity have come apart.

Observation 4.5

This stands where Paper 403 said the order of temperatures is not the order of hotness. One word for temperature serves both a state and a rate—here only the rate is at work.

Observation 4.6

There is, however, a boundary. Equal maturity does not give equal final strength—curing hot raises early strength and lowers long-term strength. It is called the crossover effect.

Observation 4.7

To be honest—so the maturity method serves “when may the formwork come off” but not “how strong will it finally be”. Without stating how far it predicts, this tool commits the same error—one more device for making two quantities look like one.

5. Roll Call and Closing

1. **28 days at 20 is 20160 degree-hours** (Computation 2.1): **the reference.**
2. **At 5 it is 10080** (Computation 2.1): **exactly half.**
3. **Not the Celsius ratio** (Observation 2.3): **the datum of -10 works.**
4. **56.0000 days at 5** (Computation 3.1): **twice.**
5. **18.6667 days at 35** (Computation 3.1): **two-thirds.**
6. **A span of 3.0000** (Observation 3.2): **the core.**
7. **Two independent computations agree** (Observation 3.3): **direct and inverse.**
8. **“28 days” is no quantity alone** (Observation 3.4): **one phrase, two things.**

9. The separator is days or maturity (Observation 4.3): **distinct roots by Paper 300.**

10. Equal maturity, unequal final strength (Observation 4.6): **the crossover effect.**

Closing: Curing is specified in days—“28-day strength” is the settled phrase, a quantity counted on a calendar. But chemistry follows temperature, and the same 28 days advances the reaction by different amounts in winter and summer. The difference is a factor of two—28 days at 20°C is 20160 degree-hours and at 5 it is **10080**, a ratio of exactly 0.5000: 28 days in the cold is 14 days in the warm. And it is not the Celsius ratio—the datum of −10°C makes it 30 against 15, a factor of 2 rather than the 4 that 20 against 5 would give. So “a quarter of the Celsius reading means a quarter of the progress” is wrong: where the datum sits changes the ratio, and it is neither absolute zero nor the freezing point but −10°C chosen empirically. In days-to-catch-up the span becomes a factor of three—**56.0000** days at 5°C against **18.6667** at 35, a ratio of **3.0000**. And that 3.0000 agrees between two independent computations, the direct ratio $(35 + 10)/(5 + 10)$ and the inverse ratio $56.0000/18.6667$. So “cure for 28 days” is not a quantity until the temperature is stated: winter’s 28 days and summer’s are different things, one phrase naming two. Extending the curing period for cold-weather concreting closes exactly this gap—what is already known as practice has only been rewritten in numbers. One thing separates them—is the quantity days, or maturity. If it is days, a calendar suffices and one waits the same number anywhere. If it is maturity, nothing can be managed without measuring temperature, because the same days do not guarantee the same result. They are distinct roots by the criterion of Paper 300, one an amount of time and one a product of time and temperature. It is the same shape as Paper 449, where the gear did not set the speed: in both, specification and quantity have come apart. And it stands where Paper 403 said the order of temperatures is not the order of hotness—one word serving both a state and a rate, with only the rate at work here. There is, however, a boundary—equal maturity does not give equal final strength. Curing hot raises early strength and lowers long-term strength, in what is called the crossover effect. To be honest—so the maturity method serves “when may the formwork come off” but not “how strong will it finally be”. Without stating how far it predicts, this tool commits the same error: one more device for making two quantities look like one.

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