Iceman

The Physics of Drake's 405-Tonne Ice Block Installation

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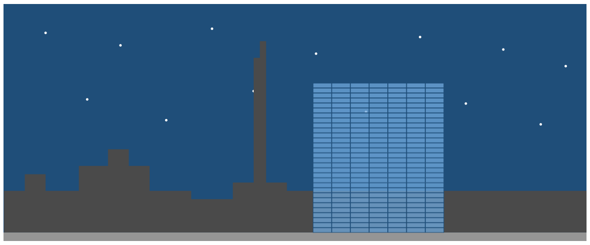
May 16, 2026



81 Bond Street, Toronto.

A physics paper, in honour of the triple-album drop.

Prologue

At midnight on May 15, 2026, Drake released his fifth studio album, *Iceman*, accompanied by two bonus albums called *Habibti* and *Maid of Honour*. The launch consisted of the coordinated release of the aforementioned albums and the installation of an ice sculpture in downtown Toronto called Iceman. The event took months of buildup with teasers on Instagram until the day when fans of the artist received an Instagram post directing them to GPS coordinates at the intersection of Bond and Dundas streets in downtown Toronto. These coordinates pointed to a pile of 3,500 blocks of Canadian ice created by Iceculture Inc. of Hensall, Ontario. Somewhere inside this ice sculpture, concealed in a certain ice block, there was a folder holding the release date of the albums.

What happened over the following days can be written as a physics paper.

Hundreds of fans turned up with picks, crowbars, and hammers to smash apart the ice sculpture, looking for the folder. One streamer, Kishka, found it on Tuesday afternoon. Police intervened on Monday night to slow down the pace of the destruction. Midweek, the Toronto Fire Department began directing fire hoses at the remaining portions of the sculpture, accelerating the destruction process to the dismay of the sculpture's designer.

The entire process can be understood as a three-part story about physics. Part I: Is it physically possible for the structure to exist in the first place? Part II: How much physical energy had been put into smashing apart the sculpture? Part III: How long should the sculpture have remained intact if it hadn't been destroyed by fire hoses, and by how much had those hoses shortened its lifespan?

This paper provides answers to each of the three questions.

Part I. Could It Stand?

The installation was made of 3,500 ice blocks, each sized 50 cm by 101 cm by 25 cm. At the density of pure water ice ($\rho_{\text{ice}} = 917\,\text{kg/m}^3$), the mass of each block is approximately

$$m_{\text{block}} = \rho_{\text{ice}} \cdot V_{\text{block}} = 917 \times (0.50 \times 1.01 \times 0.25) \approx 116\,\text{kg}. \tag{1}$$

According to press coverage, the weight of each block was approximately 300 lb (136 kg), slightly larger than the value derived from the dimensions; the discrepancy might stem from rounding up the dimensions. We will use the dimensional values for calculations throughout the paper. Therefore, the total ice mass is approximately

$$M_{\text{total}} = N \cdot m_{\text{block}} = 3500 \times 116 \approx 405\,\text{tonnes}. \tag{2}$$

Standing 7.62 m high (25 feet), the structure consisted of 3,500 ice blocks of approximate size $0.126\,\text{m}^3$, making the total ice volume equal to $442\,\text{m}^3$. The area covered by the stack is therefore approximately $58\,\text{m}^2$, or 7.6 m on each side, which matches the published description of the artwork as nine metres wide.

The question to address here is whether a pile of ice blocks of this size approaches its physical limit.

Base load of the structure

If the blocks are stacked with their 25 cm faces on top, the total contact area of each bottom block would be

$$A = 0.50\,\mathrm{m} \times 1.01\,\mathrm{m} = 0.505\,\mathrm{m}^2. \tag{3}$$

Dividing the total height by the block height gives approximately $n \approx 30$ layers of blocks, meaning that every block in the bottom layer supports the weight of the 29 blocks above it. The base pressure is therefore

$$P_{\mathrm{base}} = \frac{(n-1) \cdot m_{\mathrm{block}} \cdot g}{A} = \frac{29 \times 116 \times 9.81}{0.505} \approx 66\,\mathrm{kPa}. \tag{4}$$

This load is approximately two-thirds of one atmosphere; it is relatively low.

Uniaxial compressive strength of ice

The important material parameter here is the uniaxial compressive strength of ice at temperatures close to the melting point and at moderate strain rates, ranging between $\sigma_c = 5\,\mathrm{MPa}$ and $25\,\mathrm{MPa}$ depending on temperature and grain size; we will assume it to be about $\sigma_c \approx 10\,\mathrm{MPa}$ (which is in the middle of the range). Therefore, this number is

$$\frac{\sigma_c}{P_{\mathrm{base}}} = \frac{10 \times 10^6}{66 \times 10^3} \approx 151 \tag{5}$$

times higher than the base pressure. The base blocks of the sculpture were carrying less than 1% of their ultimate crushing load.

How tall could the pile be?

Equating the base pressure to the compressive strength yields an estimate of approximately

$$n_{\max} = \frac{\sigma_c \cdot A}{m_{\mathrm{block}} \cdot g} + 1 \approx 4{,}448 \text{ layers} \tag{6}$$

in the pile. At 25 cm per layer, this corresponds to a maximum stack height of

$$H_{\max} \approx 4448 \times 0.25\,\mathrm{m} \approx 1112\,\mathrm{m}, \tag{7}$$

or approximately one kilometre.

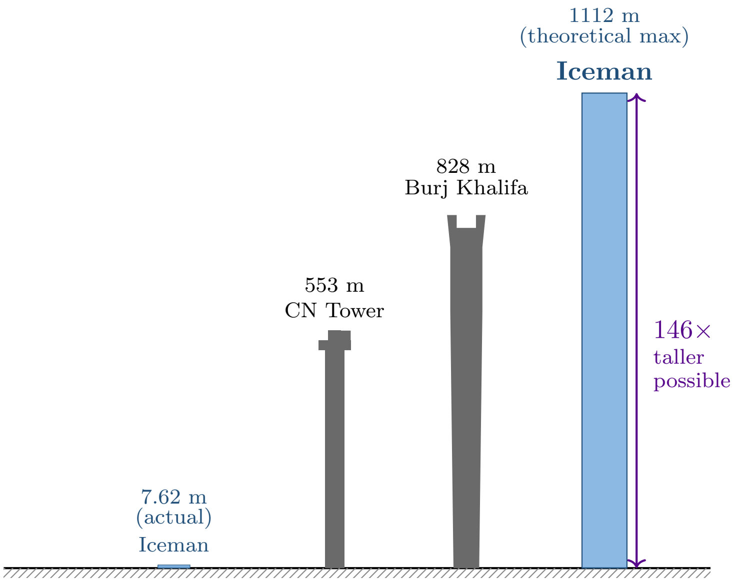


Figure 1: The actual Iceman sculpture stands 7.62 m (left of the figure); the theoretical maximum is approximately 1112 m, or almost two CN Towers tall (right of the figure). Height comparison with the CN Tower (553 m) and Burj Khalifa (828 m) shown for reference.

Of course, asking this question in isolation makes little sense, since the compressive strength of ice is only one out of several possible failure modes for a pile of this height. Well before reaching this level of height, the ice sculpture would have succumbed to various failure mechanisms: ice creep, buckling of the stack as a slender column, lateral instability caused by the smallest symmetry perturbation, and degradation of interblock contact interfaces due to bottom blocks warming and melting. Any real ice structure approaching 50 m in height would be impossible to construct and to keep standing.

The correct conclusion is narrower than the claim that Drake could have constructed a kilometre-high ice structure. It is this: the structure Drake designed was nowhere near the material's compressive limit. The limitations on the pile's height were due to logistics, permits, and the city of Toronto's tolerance for art installations in intersections.

Part II. Could You Crack It?

Part two of our story began once the ice structure was erected. As announced in the Instagram post, the album's release date was hidden in one of the blocks of the pile, meaning fans would have to destroy it to find the folder physically. Hundreds of people arrived at the spot with picks, hammers, and crowbars, and one streamer, Kishka, uncovered the folder with a May 15 date in it by Tuesday afternoon. On Monday night, when it appeared that fans were getting too unruly, the police intervened to disperse the crowd.

The physics question to address here is: how much energy was required to smash the ice blocks?

Fracture mechanics of ice

While the energy required for propagating a crack through a brittle material is a function of the material's fracture toughness K_{IC}, which for ice at temperatures near the melting point is equal to about

$$K_{IC} \approx 100\,\mathrm{kPa}\cdot\mathrm{m}^{1/2}, \tag{8}$$

yielding the critical strain energy release rate of

$$G_c = \frac{K_{IC}^2}{E_{\mathrm{ice}}} = \frac{(10^5)^2}{9\times 10^9} \approx 1.1\,\mathrm{J/m^2} \tag{9}$$

assuming a Young's modulus $E_{\mathrm{ice}} \approx 9\,\mathrm{GPa}$, this thermodynamically calculated value seriously understates the energy requirements. A real hammer blow produces damage zones and comminuted ice rather than producing a single cleavage crack. The fracture energy requirement increases with increasing strain rate and impact force; measured in a comminution test, the effective specific fracture work is about

$$G_c^{\mathrm{eff}} \approx 3000\,\mathrm{J/m^2}. \tag{10}$$

This will be the fracture work we will use in further calculations.

Energy expenditure per broken block

Splitting open a block by propagating a cleaving crack through the 25 cm thickness over a 50 cm width of the structure yields a new crack surface area of

$$A_{\mathrm{crack}} = 0.50\,\mathrm{m}\times 0.25\,\mathrm{m} = 0.125\,\mathrm{m^2}. \tag{11}$$

The energy required for breaking one block would then be about

$$E_{\mathrm{block}} = G_c^{\mathrm{eff}}\cdot A_{\mathrm{crack}} = 3000\times 0.125 \approx 375\,\mathrm{J}. \tag{12}$$

Hammer energy budget

A standard sledgehammer head usually has a mass of $m_h = 4\,\mathrm{kg}$ and a typical velocity of about $v_h \approx 6\,\mathrm{m/s}$ at the impact point. The kinetic energy imparted in each blow is approximately

$$E_{\mathrm{swing}} = \tfrac{1}{2} m_h v_h^2 = \tfrac{1}{2}\times 4\times 36 \approx 72\,\mathrm{J}. \tag{13}$$

However, most of this energy dissipates as elastic rebound of the hammer head, vibration in the handle, and noise. Assuming that approximately

$$\eta \approx 0.10 \tag{14}$$

of the kinetic energy is effectively transferred into fracturing the ice, this results in a useful energy of about 7.2 J per hammer blow. To break a single ice block, one would need

$$N_{\mathrm{swings/block}} = \frac{E_{\mathrm{block}}}{\eta E_{\mathrm{swing}}} \approx \frac{375}{7.2} \approx 52 \tag{15}$$

hammer blows.

Total energy expenditure

Since there are 3,500 blocks of ice in the pile, the total number of blows required is

$$N_{\text{total}} = N_{\text{blocks}} \times N_{\text{swings/block}} = 3500 \times 52 \approx 182{,}000 \text{ blows.} \tag{16}$$

If hammer blows are executed steadily, one per second, it would take about two days of continuous swinging (assuming a constant fatigue threshold of a human operator) to break the entire pile of ice. Of course, searching for the folder did not require destroying all 3,500 blocks: assuming a uniform distribution over the blocks, the expected number of broken blocks before finding the folder is $N/2 = 1750$; therefore, the number of required swings is around 91,000.

In other words, the mechanical energy required to destroy Drake's ice pile completely is approximately

$$E_{\text{total}} = N_{\text{blocks}} \times E_{\text{block}} \approx 1.3\,\text{MJ}, \tag{17}$$

comparable to the kinetic energy of a fast-moving small vehicle: a 1500 kg sedan moving at 100 km/h has a kinetic energy of about 0.58 MJ. The whole pile of 3,500 ice blocks, smashed to pieces by human effort, has the mechanical energy of roughly two and a half cars on a freeway.

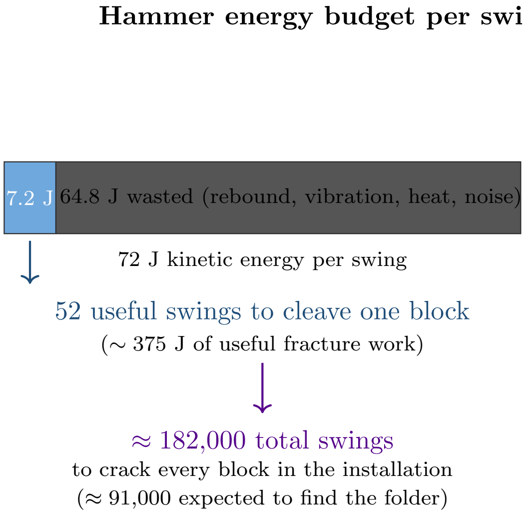


Figure 2: Energy expenditure per hammer blow. The kinetic energy imparted by a blow is approximately 72 J; only 10% of it (about 7.2 J) is used for breaking the ice, while the rest is wasted in rebound, vibration, and noise. Cracking a single block requires about 52 useful swings, and cracking the whole 3,500-block installation requires on the order of 182,000 swings.

Another point worth making is that the energy budget for destruction presented in the previous paragraphs assumes a single, isolated person striking the ice blocks with a hammer at a steady pace. In reality, the operation at the corner of Bond and Dundas Street involved dozens of people working in parallel, each with a tool in hand. Therefore, the rate of ice breaking increased proportionally with the number of people participating in the operation. At the same time, the rate was severely limited by the complexity of coordination and, of course, the police intervention, which happened well before the folder was found.

Part III. How Fast Should It Have Deteriorated?

Midweek, when the folder had already been revealed and the album's release date was known, the sculpture's purpose was served; the Fire Department took over with the intent of dismantling the remaining ice. The structure's designer's complaint about its being dismantled was essentially that it should have lasted much longer on its own. The question to be addressed is how much energy is required to melt all the ice in the sculpture, and how long that process would have taken if the pile had been left untouched.

Total energy expenditure required for melting the ice

The latent heat of fusion of pure ice is

$$L_f = 334\,\mathrm{kJ/kg}. \tag{18}$$

Using this value, melting the entire pile, initially at 0 °C, requires about

$$E_{\mathrm{melt}} = M_{\mathrm{total}} \cdot L_f = 405{,}000 \times 334{,}000 \approx 135\,\mathrm{GJ}. \tag{19}$$

In terms of electricity consumed, this is about 38 MWh, approximately the daily energy consumption of 1,300 Toronto homes.

Natural melt model

Given that the average temperature of mid-May 2026 in Toronto was around 10 °C, with highs ranging from 50 °F to 64 °F across May 11 through 15, the pile of ice was exposed to three major sources of energy.

Solar absorption. Mid-May solar insolation in Toronto is approximately $5\,\mathrm{kWh/m^2/day}$, or $18\,\mathrm{MJ/m^2/day}$. Given the blue tint of the ice, which raises the albedo somewhat, we take the absorption coefficient to be $1 - \alpha = 0.70$. Therefore, with the pile's exposed surface area of approximately $290\,\mathrm{m^2}$ and an effective solar-facing area of roughly half that, the solar contribution is

$$Q_{\mathrm{solar}} \approx 1.8\,\mathrm{GJ/day}. \tag{20}$$

Convective transfer from warm air. Assuming a natural convective heat exchange coefficient of $h \approx 15\,\mathrm{W/m^2K}$ and a temperature difference of $\Delta T = 10\,\mathrm{K}$, the contribution is

$$Q_{\mathrm{conv}} = h \cdot A \cdot \Delta T \approx 15 \times 290 \times 10 \approx 43.5\,\mathrm{kW} \approx 3.7\,\mathrm{GJ/day}. \tag{21}$$

Net longwave radiation. The radiative heat transfer between the pile (with emissivity $\varepsilon_{\mathrm{ice}} = 0.97$) at 273 K and the environment at 283 K is

$$Q_{\mathrm{rad}} = \varepsilon\sigma_{SB}(T_a^4 - T_i^4) \cdot A \approx 1.2\,\mathrm{GJ/day}. \tag{22}$$

Altogether, the three energy sources contribute approximately

$$Q_{\mathrm{natural}} \approx 1.8 + 3.7 + 1.2 = 6.7\,\mathrm{GJ/day}, \tag{23}$$

meaning that, left on its own, the sculpture would have lasted

$$t_{\text{natural}} = \frac{E_{\text{melt}}}{Q_{\text{natural}}} = \frac{135}{6.7} \approx 20 \text{ days} \tag{24}$$

before melting completely.

Effect of applying fire hoses

A fire hose provides approximately 1500 L/min of 10 °C water onto the structure. Two of them continually yield

$$\dot{m}_{\text{water}} = 2 \times \frac{1500}{60} = 50\,\text{kg/s} \tag{25}$$

of water. Each of those kilograms releases approximately

$$\Delta H_{\text{water}} = c_p \cdot \Delta T = 4186 \times 10 \approx 42\,\text{kJ/kg} \tag{26}$$

as it cools to 0 °C, yielding a heat flux of

$$Q_{\text{hose}} = \dot{m}_{\text{water}} \cdot \Delta H_{\text{water}} = 50 \times 42{,}000 \approx 2.1\,\text{MW}, \tag{27}$$

or 181 GJ/day. Together with the natural energy sources, this amounts to

$$Q_{\text{hose total}} \approx 6.7 + 181 \approx 188\,\text{GJ/day}, \tag{28}$$

resulting in a total melt time of

$$t_{\text{hose}} = \frac{E_{\text{melt}}}{Q_{\text{hose total}}} \approx 0.72 \text{ days} \approx 17 \text{ hours}. \tag{29}$$

Acceleration of melting by the firefighters

The use of fire hoses accelerated the destruction of the ice pile by a factor of

$$\frac{t_{\text{natural}}}{t_{\text{hose}}} \approx \frac{20}{0.72} \approx 28, \tag{30}$$

reducing its lifespan by approximately

$$\Delta t = t_{\text{natural}} - t_{\text{hose}} \approx 19 \text{ days}. \tag{31}$$

Therefore, Iceculture's complaint, stated in physical terms, is that the city melted a structure that was supposed to survive at least 19 days in approximately 17 hours.

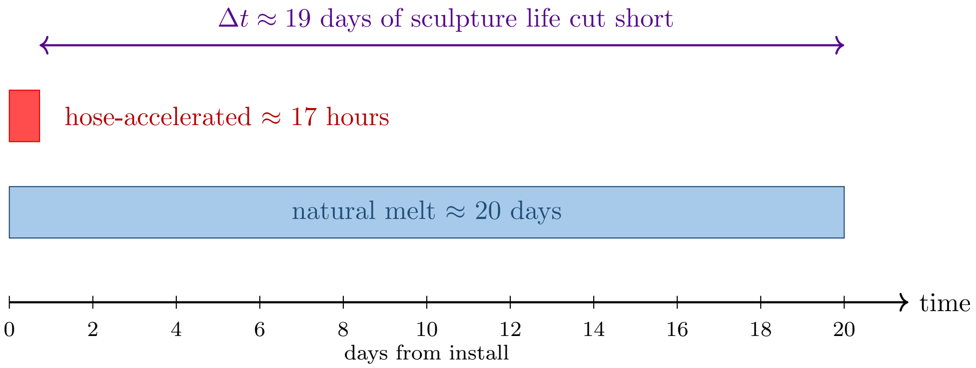


Figure 3: Comparison of natural and hose-accelerated melt times of the Iceman structure. Left alone in Toronto's mid-May weather, the sculpture would last about 20 days due to solar insolation (1.8 GJ/day), convective heating from warm air (3.7 GJ/day), and longwave radiation (1.2 GJ/day). With two fire-hose lines constantly applied, the warm municipal water supply alone provides approximately 181 GJ/day, collapsing the sculpture in about 17 hours. The acceleration factor is about 28×, and the calendar lifetime reduction is 19 days.

Conclusion

The three parts of the story add up to a complete picture of what happened at 81 Bond Street.

The ice sculpture installed by Drake had ample margin against structural failure. It bore less than 1% of its compressive limit; theoretically, it would support more than 4,000 layers of blocks, or 1,112 metres in height, before the bottom blocks crushed under their weight. The limiting factor on the pile height was the surrounding urban environment: permits, sightline considerations, traffic in the intersection, and the logistical issues associated with installing an artwork there.

The crowd that gathered to destroy the sculpture worked within a fracture energy budget of roughly 1.3 megajoules, distributed across 3,500 individual blocks. An isolated person with a hammer would require two days of steady swinging to do the job, but, considering the crowd dynamics and police intervention, as well as the fact that the folder was hidden in only a small fraction of the blocks, the actual rate of destruction was substantially slower. Nevertheless, a crowd of people working simultaneously with tools must have performed a lot of physical work; this is indicative of the success of the album rollout.

After the folder was found and the albums were prepared for release, the sculpture ceased to perform its purpose. Its natural melt time was about 20 days; the city had other plans. The use of two fire hoses reduced the melt time to 17 hours, accelerating the destruction by approximately 28-fold and shortening the sculpture's lifespan by about 19 days.

Each part of our story has one dominating number: 151 is the safety factor on the bottom blocks (that is, the pile was overengineered and could not have failed from compressive stresses); 52 is the number of swings required to break a block (the cost of admission to the album rollout); 28 is the acceleration factor of fire hoses over the weather. Each of these numbers characterizes a part of our story.

As far as the complaint by the sculpture's designer goes, it is debatable whether the destruction was justified: if you believe the pile should have been left intact for 20 days, the complaint was justified. If not, it was not.

Iceman dropped at midnight on May 15, 2026.
The ice was gone well before the weekend.
The album is here to stay.

Acknowledgements

Dimensions of individual blocks, their number, and the height of the stack are reported by Iceculture Inc. as quoted by CBC News, the Globe and Mail, and Rolling Stone. May 2026 Toronto weather is sourced from the local weather forecasts available at the time. All information regarding the physical properties of ice is obtained from standard glaciological literature. Drake, Iceculture, and Lucasfilm Ltd. do not sponsor this research.

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Written May 16, 2026, the day after Iceman *dropped. Christopher Gilmartin.*