

CATMOCK DAILY CAPSULE

March 24, 2026

KAKURO

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SUDOKU

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Seismic Codes, Economic Constraints, and the Politics of Risk Calibration



Are the risks confronting structures in the Himalayan and northeastern regions of India being systematically underestimated, or are recent attempts at recalibration excessively alarmist? This question has assumed renewed salience following the withdrawal of updated seismic design standards that had sought to incorporate a decade's worth of scientific advances. The episode has triggered a broader debate among seismologists, structural engineers, policymakers and infrastructure planners regarding the appropriate balance between safety imperatives and economic feasibility in a resource-constrained environment.

The controversy originates in the Bureau of Indian Standards' (BIS) decision to retract a proposed revision to India's seismic code, which would have significantly altered hazard estimations for high-risk regions. The revised framework, grounded in probabilistic seismic hazard assessment, aimed to align Indian practices with international methodologies by integrating a wider array of geological, seismological and geotechnical variables. Unlike earlier approaches that relied heavily on historical seismicity, the proposed model attempted to estimate the forces that structures might encounter under the most severe plausible earthquake scenarios, thereby producing higher peak ground acceleration (PGA) values for vulnerable zones.

Scientific studies underpinning the revision suggest that existing codes may indeed underestimate the seismic risk in the Himalayan belt. The region, situated along an active tectonic boundary, has experienced significant earthquakes in the historical and geological record. Researchers argue that current zoning frameworks, which classify areas into broad categories based on past seismic events, fail to capture the cumulative stress build-up and the complex interplay of subsurface conditions that can amplify ground motion. In this context, the

proposed recalibration was intended to provide a more realistic representation of potential hazards.

However, translating these scientific insights into regulatory standards has proven contentious. Critics of the revised code contend that the heightened hazard parameters would lead to substantial increases in construction costs. Higher PGA values necessitate stronger structural designs, including more robust foundations, increased use of steel and reinforced concrete, and enhanced detailing to withstand lateral forces. For large-scale infrastructure projects—such as metro systems, bridges, dams and public buildings—these requirements could escalate budgets significantly, potentially delaying or even halting critical developments.

The tension between safety and affordability becomes particularly acute in the context of a rapidly developing economy. India's infrastructure ambitions, especially in seismically active regions, involve investments running into trillions of rupees over the coming decades. Policymakers must therefore grapple with the trade-off between investing in higher upfront safety measures and ensuring that projects remain financially viable. Government officials have argued that excessively stringent norms could strain public finances, reduce the number of projects that can be undertaken, and ultimately impede economic growth.

Yet, proponents of stricter standards emphasise that the costs of underestimating seismic risk may far exceed the savings achieved through leniency. Empirical evidence from past earthquakes indicates that a disproportionate number of fatalities occur in poorly designed or non-engineered structures. In this view, enhanced building codes are not merely technical prescriptions but instruments of risk mitigation that can prevent large-scale human and economic losses. The challenge, therefore, lies not in choosing between safety and cost, but in sequencing and calibrating policies in a manner that reconciles both objectives.

A further complication arises from the gap between regulatory frameworks and their implementation. Even under existing codes, compliance levels vary widely across regions. In many rural and peri-urban areas, construction practices remain informal, with limited adherence to prescribed standards. Strengthening codes without addressing enforcement mechanisms may yield limited benefits. Indeed, some experts argue that improving compliance with current regulations, particularly for low-cost housing, could have a more immediate impact on reducing vulnerability than introducing more sophisticated but less enforceable standards.

The proposed revision also highlights methodological debates within the scientific community. While probabilistic hazard assessment offers a more comprehensive framework, it involves uncertainties related to data quality, model assumptions and parameter estimation. Critics caution that over-reliance on such models, especially in data-sparse regions, could produce inflated risk estimates. Conversely, proponents maintain that uncertainty is an inherent feature of seismic science and that conservative estimates are preferable in safeguarding human life.

The withdrawal of the updated code, therefore, reflects not merely a technical disagreement but a broader institutional dilemma. It underscores the difficulty of integrating evolving scientific knowledge into policy frameworks that must account for economic constraints, administrative capacity and political considerations. The decision has also prompted calls for a more consultative approach, involving multiple stakeholders to arrive at a consensus on acceptable levels of risk.

Ultimately, the question is not whether seismic risks exist—they undeniably do—but how they are quantified, communicated and managed within a developmental context. Achieving an optimal balance requires a nuanced understanding of both the scientific and socio-economic dimensions of the problem. As India continues to urbanise and expand its infrastructure footprint, the stakes of this calibration will only grow, making it imperative that policy decisions are informed by both rigorous evidence and pragmatic judgment.

Beyond Language: Intentional Communication Across Species



Communication, in its most fundamental sense, is not an exclusively human faculty but a pervasive feature of the living world. From the waggle dances of honeybees that encode the location of nectar sources to the alarm calls of primates, organisms routinely transmit information to influence the behaviour of others. Yet human communication is often distinguished by its intentionality—the capacity to tailor signals in light of what one believes another individual knows, perceives or intends. This raises a critical question: is intentional communication a uniquely human trait, or does it find parallels in other species?

Intentional communication presupposes an audience toward whom a signal is directed. Consider a mundane human scenario: at a dining table, one might wish for a water bottle to be

passed. The process typically involves securing another's attention, gesturing toward the desired object, and, if necessary, modifying or repeating the gesture until comprehension is achieved. Crucially, the communicator adjusts their behaviour based on feedback, demonstrating an awareness—however implicit—of the recipient's mental state. This recursive sensitivity to another's knowledge has long been regarded as a hallmark of human cognition.

Empirical research, however, complicates this assumption. Studies of great apes indicate that they are capable of goal-directed communication that exhibits features of intentionality. In controlled experiments, apes use specific gestures to request food or assistance, persisting or elaborating their signals when initial attempts fail. Notably, they appear to differentiate between attentive and inattentive recipients, modifying their communicative strategies accordingly. Such behaviour suggests not merely the emission of fixed signals but a flexible system responsive to social context.

Orangutans in captivity provide particularly illustrative examples. When interacting with human handlers, they often employ distinct gestures to indicate desired outcomes, such as requesting food or objects. If presented with an incorrect item, they may abandon the initial gesture and adopt an alternative, implying an understanding that the previous signal failed to convey the intended meaning. This capacity to revise communicative acts in response to misunderstanding points toward a rudimentary form of perspective-taking.

The case of elephants further extends the discussion. Elephants are highly social mammals with complex cognitive abilities, including memory, empathy and cooperative behaviour. Observational and experimental studies suggest that they, too, engage in intentional communication. In one experimental paradigm, elephants were presented with two trays, one containing food and the other empty. When a human experimenter faced the animal, maintaining eye contact, elephants used their trunks to indicate the tray with food. When the experimenter turned away, thereby withdrawing visual attention, the elephants ceased gesturing, indicating sensitivity to the attentional state of the recipient.

Beyond such controlled settings, elephants display a rich repertoire of communicative behaviours in natural contexts. They use tactile signals, such as trunk touches, to coordinate movement and maintain social bonds. Visual gestures, including ear flapping and trunk positioning, often require the recipient's visual attention, reinforcing the notion that these signals are directed rather than indiscriminate. Vocalisations, too, play a role, with low-frequency rumbles conveying information over long distances within the herd.

The relationship between humans and domesticated or semi-domesticated elephants offers further insights. In regions where elephants have long been integrated into human activity, such as parts of South Asia, handlers (mahouts) develop nuanced systems of interaction involving touch, gesture and vocal cues. Over time, elephants appear to learn not only specific commands but also the intentions underlying them. Recent computational analyses of elephant

vocalisations suggest that calls directed at human handlers may differ systematically from those used in intra-species communication, indicating a degree of communicative adaptation.

Nevertheless, caution is warranted in interpreting these findings. While non-human animals exhibit behaviours consistent with intentional communication, the extent to which they possess a full-fledged theory of mind remains contested. Human communication is embedded within a highly generative linguistic system that enables the expression of abstract, hypothetical and recursive ideas. Non-human systems, by contrast, appear more constrained in scope and flexibility. The challenge lies in distinguishing between sophisticated associative learning and genuine attribution of mental states.

What emerges, however, is a continuum rather than a categorical divide. Intentionality in communication may not be an all-or-nothing property but one that varies in degree across species. The evidence from apes and elephants suggests that the cognitive prerequisites for intentional signalling such as attention monitoring, goal-directed behaviour and behavioural flexibility—are not uniquely human, even if they reach their most elaborate form in human language.

Reframing intentional communication in this way has broader implications for our understanding of cognition and evolution. It invites a reconsideration of the mechanisms that underlie social interaction and the evolutionary pathways that gave rise to complex communication systems. Rather than viewing human language as an isolated anomaly, it may be more productive to situate it within a broader biological continuum, where elements of intentionality are distributed, in varying forms, across the animal kingdom.

Thermal Instability and the Fire Risk in Electric Vehicle Batteries



The increasing adoption of electric vehicles (EVs) has intensified scrutiny over the safety of lithium-ion battery systems, particularly in light of sporadic but consequential fire incidents. While EVs are often regarded as safer than conventional internal combustion engine vehicles in several respects, their energy storage architecture introduces distinct thermal and chemical risks that warrant careful examination. The phenomenon of battery fires is neither ubiquitous nor inevitable; rather, it emerges from specific conditions under which thermal stability is compromised.

At the core of most EVs lies the lithium-ion battery, a technology characterised by high energy density and efficiency. These batteries consist of numerous cells packed together, each capable of storing and releasing electrical energy through electrochemical reactions. Under normal operating conditions, onboard battery management systems regulate temperature, voltage and current, ensuring that the system remains within safe thresholds. However, when these safeguards are breached, the system can enter a state known as thermal runaway—a self-reinforcing process in which rising temperatures accelerate chemical reactions, generating further heat.

Thermal runaway typically begins with the failure of a single cell. This failure may be triggered by mechanical damage, manufacturing defects, electrical overcharging or exposure to extreme environmental conditions. Once initiated, the heat generated in one cell can propagate to adjacent cells, leading to a cascading effect. During this process, the battery releases a mixture of flammable gases, including compounds such as hydrogen fluoride, which facilitate combustion. The resulting fire is often intense, difficult to extinguish, and capable of reigniting even after initial suppression.

A range of factors can precipitate such failures. Mechanical deformation, for instance, can compromise the integrity of the battery casing. Impacts to the undercarriage of a vehicle—such as collisions with road debris—may puncture or deform the battery pack, creating internal short circuits. Similarly, prolonged exposure to high temperatures, whether due to direct sunlight or immediate charging after extended use, can elevate internal stress levels. Charging practices also play a critical role; exceeding recommended voltage limits or using incompatible charging equipment can destabilise the electrochemical balance within cells.

External environmental conditions further modulate risk. In hot climates, the efficiency of cooling systems may be reduced, impairing the battery's ability to dissipate heat. Water exposure presents another hazard. Flooding can introduce conductive pathways within the battery, leading to short circuits and subsequent thermal events. Reports of EV fires following submersion in water highlight the latent risks associated with such exposure, particularly when contaminants are present.

Ageing and degradation add another layer of complexity. Over time, repeated charge-discharge cycles can lead to the formation of internal defects, such as dendrites—microscopic metallic structures that can bridge the gap between electrodes. These defects increase the likelihood of internal short circuits. Users who disregard warning signals, such as unusual heating, swelling or performance degradation, may inadvertently operate batteries in compromised states.

It is important, however, to contextualise these risks. EV fires are statistically less frequent than fires in conventional vehicles, which carry flammable fuels and operate at high temperatures. The distinction lies in the nature of the hazard: EV battery fires, once initiated, tend to be more intense and harder to control due to the continuous release of energy and oxygen from the battery itself.

Mitigation strategies are evolving at both the technological and user levels. Manufacturers have introduced structural reinforcements, thermal insulation layers and advanced battery management systems designed to detect anomalies and isolate failing cells. Research is underway to develop alternative chemistries, including solid-state batteries, which replace liquid electrolytes with more stable materials, thereby reducing the likelihood of thermal runaway.

From a user perspective, adherence to recommended practices is critical. Avoiding unauthorised charging equipment, refraining from overnight charging in unsuitable conditions, and ensuring that electrical infrastructure can handle high loads are essential precautions. Post-incident inspection is equally important; batteries subjected to impact or water exposure should be evaluated before further use.

Regulatory frameworks are also adapting. Updated safety standards now require rigorous testing of battery systems under various stress conditions, including thermal propagation and mechanical abuse. These measures aim to ensure that even in failure scenarios, the consequences are contained.

In sum, the fire risk associated with EV batteries is a function of complex interactions between design, usage and environment. While the underlying technology is robust when properly managed, deviations from optimal conditions can trigger severe outcomes. A combination of engineering innovation, regulatory oversight and informed user behaviour is therefore indispensable in ensuring that the transition to electric mobility does not compromise safety.

KAKURO & SUDOKU

SOLUTIONS:

KAKURO

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SUDOKU

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