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A Car Drive Through Water: A Reflection on Rain, Risk, and the Fragility of Urban Life

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ABSTRACT

On 12 December 2025, a short journey to pick up my daughter from school turned into a lived experiment in driving under intense tropical rainfall and sudden flash flooding in Kuala Lumpur. What began as dark clouds above Wisma Methodist at Jalan Hang Jebat developed into a heavy downpour that followed us from the school gate to the entrance of the MEX highway via Jalan Sungai Besi. In this reflection, I weave together my embodied experience of reduced visibility, flooded junctions and the anxious task of protecting a child in the passenger seat with empirical findings from recent research on rain, traffic flow, waterlogging, and vehicle stability. Studies from transportation engineering and flood-risk science show how rainfall intensity, ponding depth, and driver decision-making interact to slow traffic, destabilise vehicles and increase accident severity in urban settings. At the same time, climate-driven increases in intense rainfall expose the limits of drainage and road infrastructure and force cities to rethink how they monitor, design and manage roads under water. My simple question on that evening—"Which lane will still be passable for this old car?"—connects directly to deeper scientific and ethical questions about urban resilience, equity and the everyday vulnerability of families moving through a flooded city.

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Watching the Sky Darken: From Ordinary School Run to Urban Hazard

At 3.51 p.m., I stood by the roadside near my daughter's school at Jalan Hang Jebat. The rain had not yet started, but the sky over Wisma Methodist was already heavy with dark clouds, a quiet warning that the atmosphere was close to tipping (Figure 1, left). Within minutes, at 3.54 p.m., the downpour arrived in full force, a grey curtain that blurred the contours of buildings and wires (Figure 1, right). As I waited for school dismissal, I was not yet thinking about hydrodynamic instability or depth, and velocity thresholds. My concerns were simpler and more intimate: my daughter's safety, the reliability of my old car, and the possibility of flash floods on the familiar route home.

Figure 1: Transition from darkening sky to heavy rainfall at Jalan Hang Jebat. The photographs show the rapid shift in weather conditions while waiting outside the school at Jalan Hang Jebat on 12 December 2025. The left image, taken at 3.51 PM, captures the still-dry surroundings under an increasingly dark sky that signalled an approaching storm. The right image, taken minutes later at 3.54 PM, shows the sudden onset of an intense downpour that reduced visibility and marked the beginning of continuous heavy rainfall for the rest of the afternoon.

Transportation research reminds us that these personal worries are grounded in real physical changes on the road. Even moderate rainfall reduces visibility and pavement friction, forcing drivers to slow down, increase headway and rely on headlights and wipers to compensate for the loss of visual cues [1,2]. At higher intensities, rain triggers waterlogging when drainage capacity is exceeded, creating shallow pools and deeper ponds that alter the effective geometry and roughness of the road surface [3, 4]. In that moment, however, the theory condensed into a very ordinary scene: parents with umbrellas, children running to cars, and a sky that no longer looked like late afternoon but like early evening.

On the Highway in a Moving Grey Tunnel

By 5.00 p.m., with my daughter safely belted in the passenger seat, I steered the car from the school area toward Jalan Sungai Besi, heading for the MEX highway. Visibility dropped sharply. The windscreen wipers worked at maximum speed, yet the world outside remained a moving grey tunnel. Buildings that I usually used as landmarks became faint silhouettes, much like the blurred structures captured in Figure 2 (left).

Empirical studies show that such conditions do not simply "slow traffic"; they reshape the entire flow regime. Experiments and simulations combining rainfall and induced waterlogging demonstrate that free-flow speed, capacity and maximum traffic flow all decline as rainfall intensity and water depth increase, particularly on multi-lane urban roads similar to Jalan Sungai Besi [5]. Fluctuations in speed and headway become more pronounced in space and time, producing unstable stop-and-go patterns that propagate along the road network. Advanced modelling, such as the application of car-following models and physics-informed graph neural networks, further confirms that rain and flooding introduce higher uncertainty into traffic prediction and require more sophisticated tools to anticipate congestion and risk [6].

Inside the car, I experienced these dynamics not as equations but as sensations: the need to focus intensely on the faint red of brake lights ahead; the decision to keep a larger distance from vehicles in front; the tension in my fingers on the steering wheel as spray from lorries temporarily erased the lane markings. The road was still technically open, but it felt narrower, more fragile, and less forgiving.

Meeting the Water: Decision-Making at a Flooded Exit

The most unsettling moment came at the familiar corner where I usually exit towards the MEX highway. That junction was no longer a simple curve of asphalt but a temporary shallow lake, with stagnant brown water estimated at 1 to 1.5 metres deep, reaching well above the wheel arches of some vehicles attempting to pass (Figure 2, right). A motorcycle hesitated, then pushed through the water; a car appeared half-submerged under the flyover. I chose to continue straight and use a further exit where the water level looked lower. My old car still had to cross flooded sections, but at depths that felt survivable, and, to my relief, the engine did not stall.

Figure 2: Heavy rainfall and flash flooding along Jalan Sungai Besi en route to the MEX Highway. The images document the driving conditions encountered at Jalan Sungai Besi around 5.00 PM on the same day. The left photograph illustrates the severely reduced visibility caused by the ongoing downpour as vehicles approached the MEX Highway. The right photograph shows a flash-flooded corner beneath the flyover, where rising water levels reached approximately one to one and a half metres, forcing several vehicles and motorcyclists to avoid the usual exit route.

Research on driver behaviour in floodwater suggests that this kind of decision is far from trivial. show that motorists often rely on prior experience, “I crossed here before”, and social cues such as watching other vehicles, rather than on hydrodynamic thresholds, when deciding whether to enter floodwater. Many underestimate the risk of being swept away or of engine failure, especially when there is social or time pressure to reach a destination [7]. Simulator experiments indicate that drivers adopt more conservative strategies, namely lower speeds, larger gaps, avoidance of certain lanes, when heavy rain and waterlogging are combined, but risky decisions still occur, particularly when signage or enforcement is weak.

Hydrodynamic studies add another layer of seriousness. Numerical modelling of vehicles moving through floodwaters has identified critical combinations of depth and flow velocity at which buoyancy and drag forces can cause sliding, loss of traction or even floating of passenger cars [8]. Entropic methods applied to urban flooding further refine the instability criteria and show how small increases in depth can abruptly shift a vehicle from stable to unstable states [9]. These thresholds are often much lower than what drivers intuitively expect. My instinctive avoidance of the deepest section at the first exit was therefore not just emotional caution; it was aligned, unknowingly, with the safety recommendations emerging from this growing body of work.

At the same time, accident statistics from Seoul and other cities demonstrate that rain-related factors are associated with higher severity of crashes, particularly for smaller vehicles and less experienced drivers [10]. Knowing this from the literature after the fact intensifies the retrospective weight of that five-minute decision. As a parent, I was simply trying to choose the “safer” lane. As an ecotoxicologist reading transport studies, I now see that moment as an intersection of hydrology, engineering and human psychology.

Flooded Roads as a Symptom of Climate and Infrastructure Fragility

The floodwater at the Sungai Besi exit did not appear out of nowhere. It was the visible surface of deeper structural issues in drainage, land use and climate. Reviews of urban infrastructure emphasise that intense rainfall events, amplified by climate warming, are increasingly pushing drainage systems and asphalt pavements beyond their design assumptions, shortening service life and compromising safety. As cities become more paved and less permeable, storm runoff accumulates rapidly on road surfaces, especially at low points, underpasses and poorly drained junctions, creating exactly the kind of localised ponding that blocked my usual route to the highway.

Risk assessments of transport infrastructure show that disruptions from extreme rainfall can propagate far beyond the immediate flooded segment, causing cascading delays, economic losses and inequitable impacts on different communities [11]. Simulation models of urban traffic under extreme weather, such as those developed for Thessaloniki, highlight how even short episodes of heavy rain can significantly reduce network performance and require adaptive traffic management strategies [12]. In Beijing, quantitative analyses of urban waterlogging and road safety reveal that high-risk segments often coincide with areas of low drainage capacity, complex intersections and steep gradients, all of which interact with rainfall patterns and traffic demand [13].

My experience on Jalan Sungai Besi fits within this broader pattern. The flooded corner was not simply an unlucky puddle; it was likely a known low-lying point where runoff converges and where drainage struggles during peak storms. Emerging work on optimally locating rain gauges and monitoring systems along transport corridors further argues that real-time rainfall data, linked to flash-flood risk maps, can support earlier warnings and pre-emptive closures of dangerous segments [14]. In other words, the decision I made on the spot—“skip this exit, try the next one”—is a micro version of the decisions that transport authorities must systematise at the network scale as extreme rainfall becomes more frequent.

For families, especially those driving older vehicles or living in areas with limited alternative routes, these infrastructural vulnerabilities translate into daily uncertainty. A routine school pick-up can suddenly carry non-trivial physical risk. The incident made me think about households who must drive through similar conditions not occasionally but repeatedly, without the privilege of changing schedule or route. Urban flooding is therefore not only a problem of engineering but an issue of social justice and planetary health, because those with fewer resources often face the highest exposure to climate-intensified hazards.

Learning from One Drive: Towards Safer and Kinder Cities

By the time we finally joined the MEX highway, the floodwater was behind us, but the emotional residue remained. My daughter quickly returned to her usual chatter, while my mind replayed the images of submerged lanes and hesitant motorcycles. Writing this reflection allows me to transform that anxiety into learning. At the personal level, the drive reinforced simple but important practices: respecting speed reductions in heavy rain, avoiding deep water even when other vehicles attempt it, and being willing to choose a longer route rather than insisting on the "usual" one. These may sound obvious, yet the literature on flash-flood fatalities shows how often people underestimate the power of shallow water and overestimate their vehicle's abilities.

At the professional level, the experience connects my work in environmental science with the interdisciplinary efforts of traffic engineers, hydrologists and urban planners. Studies on rainfall-induced traffic flow changes, urban waterlogging and predictive modelling show that cities can design better systems when they integrate meteorological data, hydrodynamic simulations and human behaviour into a unified framework. Infrastructure that drains quickly, communicates risk clearly and protects vulnerable road users is as essential to urban planetary health as clean air or safe drinking water.

Finally, at the ethical level, the drive reminds me that every urban journey involves unseen labour: the engineers who design culverts and pavements, the meteorologists who issue warnings, the emergency responders who rescue stranded motorists, and the researchers whose models we hope will keep our roads open and safe. When I look again at Figures 1 and 2, I no longer see only a personal memory of a stressful evening. I see a small window into a global challenge: how to move people safely through cities that are becoming wetter, more congested and more fragile under climate change.

Conclusion

A short, storm-soaked journey from a school gate to a highway on-ramp is easy to dismiss as a minor inconvenience, especially when no accident occurs and the car engine survives. Yet, when placed alongside contemporary research on rain, waterlogging and transport systems, that journey becomes a rich case study of how individual experience intersects with complex urban processes. The heavy rain over Jalan Hang Jebat and Jalan Sungai Besi, the flooded exit to the MEX highway, my decision to avoid the deepest water, and my quiet relief at reaching home safely all correspond to measurable changes in visibility, traffic flow, hydrodynamic forces and infrastructure performance described in the literature.

As climate warming increases the frequency of intense rainfall in many cities, more parents, children and commuters will find themselves driving through similar moving grey tunnels. Reflecting on this one drive reminds me that resilience is not only about robust pavements and drainage; it is also about informed drivers, compassionate public communication and equitable planning that protects those who cannot simply "wait out the storm." My hope is that combining lived narrative with empirical evidence, as I have attempted here, can contribute in a small way to conversations on safer, kinder and more climate-aware urban mobility.

Declaration on the Use of Artificial Intelligence

The author declares that generative artificial intelligence tools were used in a supportive capacity during the preparation of this manuscript. These tools assisted with language refinement, structural organisation, and stylistic clarity of the text. All ideas, interpretations, reflections, and conclusions presented in this paper are the author's own and are grounded in personal experience and scholarly judgment. The author retains full responsibility for the content, accuracy, originality, and integrity of the manuscript.

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