

New Year's Stampede: Lan Kwai Fong 1993

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New Year's Stampede: Lan Kwai Fong 1993

Case Study Scenario: Hong Kong, January 2017

On a late January afternoon, Senior Officer Chan,¹ of the Security Bureau of Hong Kong, strolled through Victoria Park. [Chan is a fictional character, but all other people named in this case are real and depicted as accurately as possible.] As he walked through the gardens, observing the afternoon crowds, his thoughts drifted to the upcoming Lunar New Year festivities. Tens of thousands of Hong Kong residents and visitors would celebrate the Chinese New Year later that month, and their safety was the government's prime concern.

Before long, Chan had walked the distance across Victoria Park, past Hong Kong Park and Statue Square into to the Central district. He had entered the bustle of lunch-time shoppers and diners on busy D'Aguilar Street, the main road of Lan Kwai Fong area in Hong Kong's Central district. Lan Kwai Fong means "Orchid Laurel Square" in Cantonese. The area has transformed significantly since the 1980s. At that time, Lan Kwai Fong was home to warehouses, a number of small marriage match-making businesses, and a lone club, Disco Disco, located on D'Aguilar Street.² Today, the area is a lively center of commerce. The streets are lined with shops, restaurants and clubs. It is popular among tourists and locals alike. On New Year's Eve, Lan Kwai Fong is to Hong Kong what Trafalgar Square is to London, or Times Square to New York.

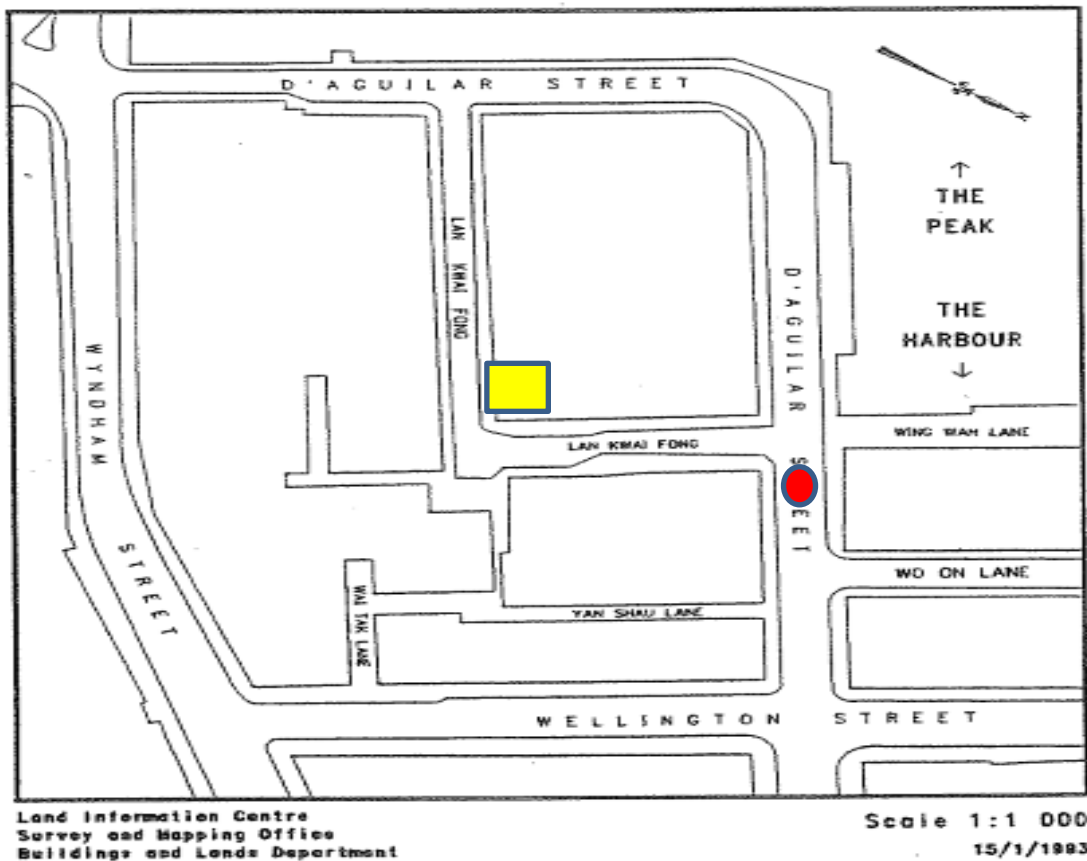
Officer Chan mingled with the crowds. The shops and restaurants were as packed as the clubs would be later that evening. Since Chan's appointment five years earlier, there had—thankfully—been no major incidents or accidents. But that had not always been the case. Despite past successes, Chan knew that careful planning was the key to preparedness at mass gatherings. The mood around him was jovial and everyone seemed happy and carefree—as they must have been, thought Chan, moments before the tragic events early on New Year's morning, 1993. Cognizant of the loss of lives and the suffering of the families directly affected by the tragedy in 1993, Chan was thankful for the thoughtful mitigation strategies that had since been implemented to avoid such tragedies in Hong Kong. Of the many corrective actions that the government had undertaken, Justice Kemal Bokhary's investigation and report had served as a particular source of calm, restitution, and action.

Part I: The Lan Kwai Fong Disaster: January 1, 1993

In the 1990s Hong Kong was still a colony of the United Kingdom, under the leadership of British Governor Christopher Francis Patten. Lan Kwai Fong was particularly busy during Western traditional days of public merry-making. The streets would be filled with revelers on St. Patrick's Day and on Halloween. On New Year's Eve, December 31, 1992, between 15,000 and 20,000 people had packed the streets of Lan Kwai Fong. Revelers lined D'Aguilar Street, the U-shaped main road of the Lan Kwai Fong area, as

well as the L-shaped road, also named Lan Kwai Fong that connected to D’Aguilar at both ends. In addition, two smaller roads Wing Wah Lane and Wo On Lane, fed into D’Aguilar; partygoers also filled them. The Hong Kong Commercial Broadcasting Company had organized a pop concert and set up a stage on the corner bend of Lan Kwai Fong [see Figure 1]. Over the course of the evening, multitudes came out to see the concert and assembled around this stage. The crowd density peaked at the time of the countdown to the New Year, when many more people joined the celebration for the dramatic last few moments. The roads had been closed to vehicular traffic and the merriment spilled into the streets. As midnight approached and corks popped, the streets—now choked with people—were also slippery with spilled champagne, beer, and aerosol spray streamers and foam. Anticipating large crowds, the police had set themselves the task of protecting the carousers by stationing 118 officers in the square mile covering Lan Kwai Fong.

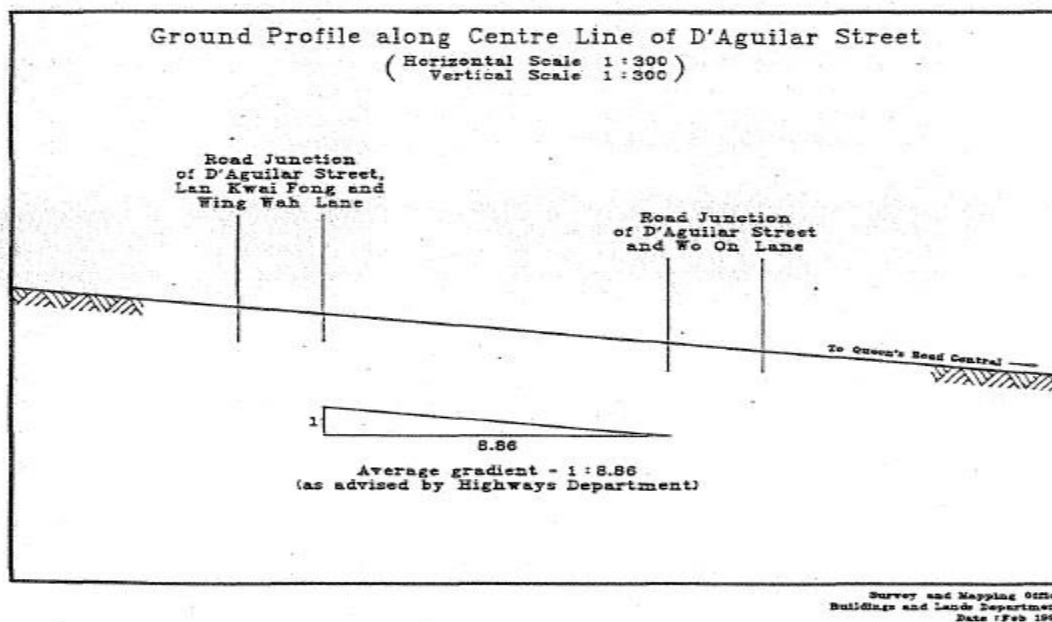
Figure 1: 1993 Map of Lan Kwai Fong



Note: The yellow rectangle represents the location of the stage, and the red oval is where the stampede occurred: FXB additions. Adapted from Kemal Bokhary, *The Lan Kwai Fong Disaster on January 1, 1993: Inquiry by the Honourable Mr. Justice Bokhary, Interim Report* (Hong Kong: Hong Kong, January 18, 1993), 4.

After the final countdown past midnight, on January 1, 1993, with the New Year ushered in, the crowd began to disperse from the stage area to move to their next destination for the night. Large crowds went down D'Aguiar Street, merging with those spilling out of Wing Wah Lane and Wo On Lane. D'Aguiar sloped steeply south toward Wellington where the crowds converged [see Figure 2]. Those that had celebrated midnight elsewhere were trying to enter D'Aguiar from Wellington Street to continue their party in Lan Kwai Fong.

Figure 2: Slope of D'Aguiar Street, Lan Kwai Fong, Hong Kong 1993



From Kemal Bokhary, *The Lan Kwai Fong Disaster on January 1, 1993: Inquiry by the Honourable Mr. Justice Bokhary, Final Report* (Hong Kong: Hong Kong, 1993), 13.

The density of the crowd rose rapidly to what became dangerous levels. Before long, with all the jostling, some people began to lose their footing on the slick street surface. Within minutes, a stampede ensued that turned a night of jubilation into a horror that Hong Kong had never before witnessed. Over 150 people seemed to be caught in a large human pile, crushed under each other's weight, unable to escape the crush of other bodies. Twenty people were determined to have died on the spot, and of the 67 people taken to nearby hospitals, one died and 45 were admitted for further care.³

Chief Inspector Clancy described the scene:⁴

I came up the eastern side of D'Aguiar Street and it just happened that the first person—I mean, I just saw this disaster in front me and the first person I saw was a large, European male, and I offered my hands to him as if to pull him out, which is what my intention was, my first reaction was to help, and because there was quite a bit of his body still

*visible, I pictured in my mind he wouldn't be too hard to pull out and away. But he said to me, no, don't. I am holding back five people. Then it occurred to me he was quite right because if he comes out you would create even more sudden pressure downward of more people collapsing if you create a gap. (From The Lan Kwai Fong Disaster Final Report, para 4.3, future quotations from the same source are noted in the text in parentheses.)*⁵

As dawn neared on January 1, the Hong Kong community mourned.

The Aftermath

The next morning, headlines around the world announced that twenty people were killed in a stampede in Hong Kong. All who died were between the ages of fifteen and thirty years, with the final toll being seven women and fourteen men. All but three were Hong Kong Chinese: Master Michael Frith, age fifteen, was British; Mr. Jody Fullerton, age eighteen, was Canadian; and Mr. Koji Niizeki, age twenty-seven, was Japanese.⁶ The local media blamed poor crowd control by local authorities, the steep slopes of the narrow lanes, and the slippery wet cobblestones.

As the last British Governor of Hong Kong, Patten knew that while it was terribly important to support communities throughout their grieving, there was little time for long reflection. The Chinese Lunar New Year—with all of its travel and massive crowds at train and bus stations—was only three weeks away. People needed answers and the Governor had to make sure that people remained safe. Not only were the pride and reputation of the colonial administration at stake, but any response to the tragedy would have to balance the safety of the crowds with respect for freedom of movement or assembly. In those fading years of the British imperial rule in Hong Kong, the residents of Hong Kong were already concerned about their freedoms under the rule of the mainland Chinese. The “Handover,” the transfer of sovereignty to the People’s Republic of China, was scheduled for July 1, 1997—a mere four years away.

Governor Patten commissioned Judge Kemal Bokhary to investigate the tragedy and issue a timely report on his findings. The need for an interim report was urgent, given that the Lunar New Year celebrations would occur all over Hong Kong on January 22, and appropriate measures had to be taken to secure the safety of those who would gather in celebration.

Part II: The Final Bokhary Report, February 23, 1993

Justice Kemal Bokhary, born in Hong Kong in 1947 to parents of Pakistani descent, received his early schooling in Hong Kong and his legal training in London. He was called to the Hong Kong Bar in 1971 and, in 1989, appointed a judge of the High Court. By the time of the Lan Kwai Fong disaster, Justice Bokhary was known to be hardworking, compassionate, savvy, and outspoken. His judgments were often

considered by scholars to be intellectually superior to his peers.⁷ These attributes secured the confidence of Governor Patten who picked Justice Bokhary for the challenging task that lay ahead.

Both men knew that the etiology of stampedes is often difficult to understand, because catastrophic consequences can result from seemingly small or benign triggers. Simple or nebulous reasons given for these lethal tragedies can be met with suspicions of investigative inertia or bureaucratic incompetence. In the 1990s, stampedes were not as well studied as they have since become in the ensuing decades. The Lan Kwai Fong tragedy occurred at a period in disaster history when professional and lay understandings of the causes of stampedes were rudimentary.

Officer Chan recollected that Justice Bokhary had delivered a preliminary report within close to two weeks, on January 18, 1993.⁸ The preliminary version was later incorporated in its entirety into the 131-page final report, completed and made public on February 23, 1993—only 50 days after it was commissioned. In an era when so little was known about stampedes, *how did Justice Bokhary go about making a meaningful post hoc analysis of what actually caused the disaster*, mused Officer Chan. Chan wondered whether the Justice's conclusions had stood the test of time. Since the 1990s, numerous studies have been conducted on crowd dynamics. Advanced crowd estimation techniques and computational models have allowed officials to predict, plan, and better prepare for mass gatherings. *How had the eminent Justice reached his conclusions without all these modern tools at his disposal?*

Justice Bokhary was charged with investigating what had happened, why it had happened, how rescue efforts were handled, and how to prevent another incident of its kind. The Justice assembled a team of thirteen people: an administrative officer and six others chosen by him; a law clerk of the Legal Aid Department; the Justice's own usual staff of four and himself. The team was assisted on a regular basis by Government Information Services, liaison officers from the fire services, the Hospital Authority, and the Hong Kong Police Force. They also received assistance from the media, other government services, and members of the general public. In the course of the investigation the team visited two hospitals, examined 64 written statements, recorded a further 556 statements from the fire and police services, reviewed 294 photographs and seven video tapes, and studied 21 post-mortem and 20 toxicology reports. They also conducted four site inspections of Lan Kwai Fong, among other activities. Justice Bokhary indicated from the outset that both the interim and final reports were to be made public upon completion. Determined to keep the process transparent, he noted:

Throughout, we have done things as openly as possible. And we have done whatever we could to keep the media and the public informed of our progress throughout. To that end, we have, through Government Information Services, provided the media with daily outlines of our progress during each weekday. (para.3.6)⁹

He explicitly stated that the purpose of the inquiry was not to apportion blame. He emphasized in the report's opening summary:

The Inquiry is concerned with what happened, why and how a recurrence is to be avoided. The attribution of blame is not an independent objection of the Inquiry. Recommendations do not of themselves imply criticism. The objective is to keep people safe—and at the same time free—in the future. (para. 30)

The Justice also stood ready to be held accountable for all that was included in the report:

This Report is the work of many. But the responsibility for its imperfection rests of course with me alone. (para.3.4)

Causal Factors Implicated in the Stampede

Dangerous Overcrowding

The large crowd at Lan Kwai Fong on that fatal night was not unanticipated: the police had estimated that between 15,000 and 20,000 might turn out in that area, given that a crowd of that size had had gathered there during the preceding Halloween celebrations (para. 4.19). The 118 police officers included 6 detectives and 112 uniformed officers instructed to “control crowds so as to prevent any outbreak of disorder” (para. 4.10). Yet, noted the Bokhary report, **no attempt was made to control the size of the crowd:**

The only persons whom they turned away were: someone in a wheelchair; and a couple pushing a baby in a pram. That was done by way of friendly advice, which mercifully was heeded. And, of course, it was done in the interests of the persons concerned by reason of their particular vulnerability, and had nothing to do with limiting the size of the crowd as a whole. (para.4.11)

Justice Bokhary opined that the unrestricted entry of people led to “dangerous over-crowding,” which he thus described:

In general, an area should be regarded as dangerously over-crowded unless police officers are able to patrol effectively among the people there... What must be avoided is a situation in which people are, at any time or anywhere, so densely packed that there is a real risk of a human pile-up. There is a range of danger. Nothing within that range, even if at the lower end of it, is acceptable. (para.7.57)

Justice Bokhary referred to (and drew lessons from) another stampede on New Year’s Eve, exactly ten years prior, in Trafalgar Square in London. He frequently cited the findings of the Greater London Council’s (GLC) study of the Trafalgar Square incident,

highlighting that also in this event, the Metropolitan Police made no attempt to limit the number of people allowed into the square that night. The stampede had resulted in two dead, and the Council recommended limiting crowd sizes in the future.

Justice Bokhary vividly describes how trivial events can trigger stampedes:

Because of the close-packed density of the crowd, people immediately behind could not avoid falling over anyone on the ground, in turn causing others to fall... Many of the people described the surprising manner in which some in front of them simply disappeared, and how they themselves, despite all efforts, could not avoid falling onto other people. (para. 7.70)

These studies, along with other observations made during the inquiry, convinced Justice Bokhary that independent of contributing factors, overcrowding was at the heart of the tragedy:

But without the over-crowding, the sort of pile-up which occurred would have been avoided. That pile-up was of a density which reflected the density of the crowd. Both were deadly. The density of the crowd was potentially so. And the density of the pile-up was actually so, as events have only too brutally demonstrated. (para. 5.3)

This analysis resulted in the recommendation that in future, crowd size should be controlled by restricting people into the area in the following manner:

As soon as officers on foot patrol among the crowd begin to experience difficulty in moving about reasonably freely, they should report the fact to those manning the control point or points. For that would be a sign of impending dangerous over-crowding and the need to start turning people away. (para. 7.56)

Chaotic Crowd Flow

For the countdown celebrations, a stage had been set up at the point of the L bend of Lan Kwai Fong Lane (see Figure 1), where the Hong Kong Commercial Broadcasting Co. Ltd. hosted a pop concert just before midnight. The concert drew large crowds and people pushed closer to the stage so that “those streets were certainly over-crowded in the extreme at the time of the countdown and shortly afterwards” (para. 4.19). It is noteworthy that in the written application for the stage license, the recorded anticipated attendance was 1,000.

Just after midnight, the tightly packed throng of people began moving down D'Aguilar Street, which slopes towards Wellington Street with an average gradient of 1 in 8.86; the eastern pavement was about 1.5 meters wide; the roadway was about 5.5 meters wide; and the western pavement (which was stepped and sunken below the level of the roadway itself) was about 1.4 meters wide. The Bokhary report noted that the crowd

began to swell even further where Lan Kwai Fong Lane and Wing Wah Lane join D'Aguilar Street, as people pressed forwards and downwards. Indeed, it was just below this point that the disaster occurred (see Figure 1).

Although not explicitly stated in his report, Justice Bokhary must have intuited that rapid changes in direction, or attempted multi-directional movements within a dense crowd, could be a risk for a human pile-up. He studied existing crowd-control measures taken at other places in Hong Kong, including plans at the Wong Tai Sin Temple (黃大仙祠) for the large crowds during Chinese and Taoist festivals. The investigation found that a "tidal flow" system had been in effective at Wong Tai Sin Temple since 1984, where the crowd was "allowed to enter the temple by phases only after a similar number of people have finished their worshipping and left the temple" (para. 7.17). Justice Bokhary's final recommendations included the use of a tidal system for crowd control at Lan Kwai Fong: a one-way system up D'Aguilar Street; or, at least separate entrances and exits to and from the area.

The report also recommended the banning of any stage during future large celebrations in Lan Kwai Fong. The Justice recognized that on the night of the disaster, it acted like a "magnet" to increase the density of a crowd that was already over capacity. He also noted that the attraction of seeing others in elaborate Halloween costumes just a few months before had created a similar effect on crowd flow, though he stopped short of recommending a ban on costumes, rather suggesting the consideration of a dress code:

It is likely that those costumes and that countdown were "magnets" drawing massive numbers over and above the usual Lan Kwai Fong crowd. Accordingly, doing whatever can be done to eliminate such magnets makes sound sense for an area the topography of which is unsuited to large crowds. But eliminating them is not necessarily always going to be easy. It is one thing to withhold public entertainment licenses and permits. Stopping people from wearing costumes is another. Perhaps the establishments in the area can enforce a dress code for admittance which might help. (para. 7.46)

Crowd Mood and Alcohol

The crowd was found to have been in "good humor," engaging in the usual antics of New Year's merry-making, "even if not everybody appreciated the extent to which people were spraying each other with champagne, beer, and aerosol streamers and foam" (para. 4.16). There were no reported incidents of violent behavior at Lan Kwai Fong that night, except for a few bottles being flung into the air on one occasion, though this was deemed to be out of inebriated celebration rather than malice, and did not cause any harm. It was clear, however, that the crowd had been consuming alcohol openly in the streets at the time of the disaster. Although this was no surprise, Justice Bokhary did make the disturbing discovery that the police were "unaware of any place in Hong Kong where there was as much under-age drinking as in Lan Kwai Fong" (para. 12.3). Justice Bokhary quoted from the paper that was presented to him by the Lan Kwai Fong Tenants' Association:

Aside from expressing fear about nights like New Year's Eve, the Association has long sought help in keeping teenagers from drinking and loitering in the streets on any night of the year... [M]any times, teenagers...lurch drunkenly across D'Aguilar Street in front of taxis and cars... In the vast majority of cases, these youngsters buy and consume alcoholic beverages away from Lan Kwai Fong—at supermarkets and convenience stores—and then come down to... loiter in front of the bars and restaurants. (para. 12.3)

The inquiry included toxicology reports of the disaster victims. Given the seemingly obvious association between alcohol and rowdy crowd behavior, the reports were considered surprising:

With one exception, it is clear that none of the 21 fatal victims were under the influence of alcohol. The exception (who was not under the age of 18 years) had a blood alcohol level of 134 milligrammes of alcohol in 100 millilitres of blood (which may be compared with the legal limit for driving in the United Kingdom of 80 milligrammes of alcohol in 100 millilitres of blood). (para. 4.63).

Nevertheless, Justice Bokhary observed that it need not be the intoxicated behavior of victims themselves that puts them at risk in a crowd situation but rather that of the entire crowd at large. The Bokhary report recommended tightening of Regulation 28 of the Liquor Laws, which prohibited the consumption of alcohol by any person under 18 years on any licensed premises. The law in Hong Kong at the time did not ban the sale of alcohol to minors. Justice Bokhary did not consider an immediate sale ban to be justified, but rather recommended a study into the pervasiveness of the problem. The report did, however, recommend banning the open consumption of alcohol in the streets of Lan Kwai Fong. While there was no specific mention of the finding of other intoxicants in the blood tests of the stampede victims, a recommendation for the further study of the prevalence of drug use in the context of crowd control was also made.

The Trigger for the Stampede

This factor is perhaps the most critical moment in the evolution of a stampede. What is the catalyst that triggers the transformation of a merry, good-natured crowd into a human pile-up measuring several bodies high and asphyxiating those crushed underneath? The terrain at the fateful spot in Lan Kwai Fong was made of interlocking concrete paving blocks, which seemed unremarkable when dry. On the night of the disaster, however, many reported the pavements had been slick with the spray of aerosol streamers, champagne, beer, and foam. Justice Bokhary went to the scene to understand the implications of this:

I was present at a test conducted by the Highways Department on January 8, 1993, when aerosol streamers and foam were sprayed on to the road surface where the victims fell. The resulting mixture was

described by the head of the Highways Department as "lethal". I tested it for myself by putting my foot on the mixture. It was certainly very slippery indeed. (para. 4.18)

In response to the findings of the slippery ground conditions when wet, Justice Bokhary recommended restoration of uneven and worn surfaces, the installation of guard rails, and the addition of steps to footpaths wherever appropriate as means of reducing the gradient.

Estimates as to when precisely the disaster occurred varied and Justice Bokhary estimated a time window between 12:01:02 a.m. and 12:08:04 a.m. Dwelling on the ambiguity surrounding the exact start of the stampede, Justice Bokhary writes:

No single witness has been able so far to provide a single clear account of precisely what happened. In the conditions which prevailed, that is not surprising... (para. 4.24)

A number of persons, more or less in a row and more or less at the same time, lost or were deprived of their footing and fell. Because the press from behind was overwhelming, more and more people started falling. People piled up those who had gone down before them, and were in turn piled upon by people who went down after them. The pile grew until it reached such a height that the people immediately behind it were propped up by it and pinned against it by the press of people behind and upslope of them. Thus came about what some witnesses have called a "human wall." (para. 4.25).

The official trigger for the stampede is then nebulous. After thousands of hours of collective investigation, the precise catalyst for this disaster remains elusive -- an accidental slip on wet sloping ground without room or opportunity to self-correct may be the likely cause. This anticlimactic conclusion seems almost trite. Nevertheless, it is within the simplicity of this conclusion that the kernel of Justice Bokhary's recommendations lies: the trigger for a deadly stampede can appear to be unclear and trivial, but the conditions allowing for such a simple event to become so lethal are identifiable and preventable.

In Justice Bokhary's own words:

The tragedy at Lan Kwai Fong on January 1, 1993, occurred not simply because people fell but because they were so densely packed that a massive, crushing human pile-up resulted when they fell. That dreadful result was due to extreme over-crowding. The other factors (such as the gradient, the slippery surface, the drunkenness, the spraying, the jostling, the pushing, the convergence at the cross-road and people coming upward) or any one or more of them might have caused many people to fall. (para. 5.3)

And finally:

If I had to convey in a single sentence how deadly a danger too large a crowd of revellers in the wrong place at the wrong time can be to itself, I would liken such a crowd to a clumsy, hard of hearing, shortsighted, intoxicated and schizophrenic giant lurching about in the dark on a slippery set of steps—whose safety may require more than just holding his hand, for that alone may not save him. (para. 18.2)

Part III: Sociopolitical Context of Hong Kong in 1993

The *South China Morning Post* (SCMP) is considered to be the most credible and reliable English daily newspaper in Hong Kong and has been in publication since 1903. The first comment on the Bokhary report in the SCMP appeared on January 20, and it was a lengthy one. Of the entire report, the comment zeroed in on the recommendation that "officers [should have] the right to control access in public places if safety was at risk."¹⁰ As the *South China Morning Post* reported:

Police welcomed the findings, noting they represented a change in the "philosophy of tolerance" employed at previous gatherings... "Hong Kong has to expect further action," Superintendent Lockyear said. "Our philosophy of tolerance has changed, the balance between the public's safety and freedoms has changed..." He noted [that] an officer of inspector rank or above [could] fully control or stop any public gathering, other than a religious assembly, if he "reasonably" believed it could cause a breach of peace.¹¹

The United Democrats of Hong Kong spokesman on security, Mr. James To Kun-sun, was most concerned, urging that:

...one had to distinguish between a large crowd gathering for a celebration and a protest march where police restrictions under the Public Order Ordinance could be criticized as an infringement of human rights. "If you take a protest outside the NCNA [New China News Agency], they are not using danger to public safety as a reason. They never even give a reason," he said.¹²

The significance and nervousness associated with Justice Bokhary's recommendation that the police should in future control crowd size and even restrict access in order to achieve safety if necessary must be placed in historical context. In 1993, the handover to China was only four years away. At that point, although technically under Chinese sovereignty, Hong Kong was to retain the status of a Special Administrative Region (SAR). The "Basic Law of the Hong Kong Special Administrative Region" would preserve the democratic and open market principles on which Hong Kong was founded: freedom of speech, freedom of the press, freedom of association and assembly, and freedom of procession, demonstration, communication and movement.¹³ In 1993, many

Hong Kong citizens feared that the government would institute crowd control measures in the wake of Lan Kwai Fong stampede that would infringe on these rights. Justice Bokhary addressed these concerns directly in his report:

One of the fears which has been expressed is that crowd control measures may be used to stifle political dissent. To those who have expressed that fear, I say two things. First, I would draw their attention to how I have framed—and continue to frame—my control recommendations in the context of festivals. Gatherings at festivals and political gatherings are different in ways which I will not attempt to define exhaustively. One difference is that the organizers of a political gathering will generally have in place arrangements for marshalling the people who participate in the march, meeting or other event which they organize.... Secondly I would commend those who have expressed the fear which I have just been addressing. (para. 6.9)

Officer Chan knew that these tensions between these freedoms and crowd control had not only persisted, but had only recently manifested as a crowd safety challenge for his own administration. The Umbrella Protests in 2014, where crowds often surpassed 100,000 people had routinely stressed the system. The logical need for restricting crowd size for crowd safety routinely competed with freedom of association and assembly. As of 2017, this tension between the freedom to assemble and governmental control persists in Hong Kong. In March 2017, after the election of Beijing-backed Chief Executive Carrie Lam, key activists who had been involved in the 2014 Umbrella Protests were arrested, and faced charges for public nuisance.¹⁴

Part IV: Current Understanding of Stampede Causes and Prevention

Preparedness plans of the Hong Kong Police are now imbued with the lessons of Lan Kwai Fong. The police and security forces have critical understanding of crowd behavior and crowd dynamics gleaned from observations and models of mass gatherings around the world. To date, human stampedes, along with heat-related illnesses, are the leading causes of mortality during mass gatherings.¹⁵ A total of 350 stampedes have been identified between 1980 and 2012, resulting in 10,243 deaths and 22,445 injuries.¹⁶ Since 2012, approximately 3,000 more have been killed and 2,000 more injured.¹⁷ Major religious events account for seven of the top ten deadliest stampedes on record. Stampedes have occurred at sports venues, music concerts, political demonstrations, celebrations, and other events.¹⁸ Death as a result of stampedes is most commonly due to traumatic asphyxia, internal crush injuries, and complications of rhabdomyolysis (the breakdown of muscle fibers, often resulting in kidney damage).¹⁹

Research on mass gatherings has shown that risk factors for stampedes include unplanned gatherings, warm weather, and crowd size.²⁰ Women make up the majority of fatal and non-fatal victims.²¹ Alcohol and drugs such as amphetamine (particularly 3,4-methylenedioxy-N-methylamphetamine, or Ecstasy) and other hallucinogens are

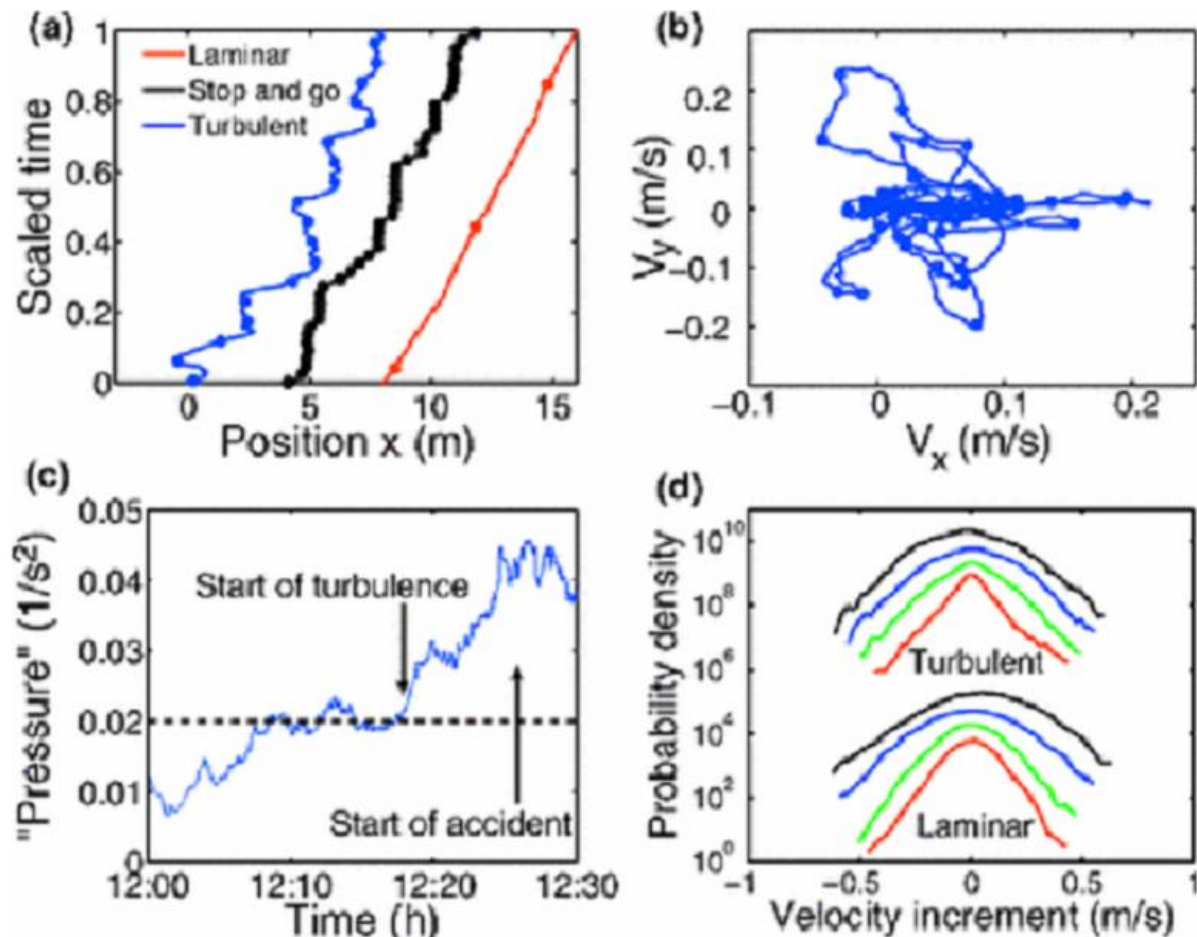
associated with crush injuries during rock and rave music concerts.²² In one study, nearly half the patients treated during a rock concert had admitted using alcohol or illicit drugs.²³ Intoxicants can act to influence crowd mood, the nature of which is independently associated with the likelihood of injuries at mass gatherings.²⁴ Crowd mood can be categorized as passive, active, or energetic according to the crowd's objective level of engagement in conversation, physical movements and contacts, and its level of cooperativeness.²⁵ Greater levels of activity are associated with greater demands for medical attention at these large crowd events.²⁶

In spite of these major advances in understanding of crowds and stampedes, Officer Chan knew that there was no room for complacency. In recent decades, stampedes have occurred at events where organizers have made huge investments in crowd management. The Hajj stampede in Mina in 2015, the railway bridge stampede at the Kumbha Mela in India in 2013, and the Love Parade stampede in Duisburg, Germany in 2010 were all fresh in Officer Chan's mind. Each of these locations had invested large sums of money, time and personnel while planning for the respective events.

Dirk Helbing, Anders Johansson, and Habib Zein Al-Abideen have studied the impact of crowd density on crowd flows. In their work on video recordings of the 2006 Hajj during which a stampede killed 380 people, Professor Helbing and his colleagues showed how, with increasing crowd density, crowd flow transitioned from "laminar" to "stop-and-go" to "turbulent."²⁷ Figure 3 depicts some of their research, showing the different kinds of flows and in Figure 3 (c), how on a time scale the accident swiftly followed the transition to turbulent flow. They found that in a crowd that is moving smoothly or in a laminar fashion, when average density of bodies in a localized area reaches six per square meter, flow decreases by a factor of three or more, so that the outflow drops significantly below the inflow.²⁸ At densities greater or equal to seven bodies per square meter, individual control of movement is partially lost as crowd motion becomes collective, causing forward and backward or "stop-and-go" compression waves as bodies are jostled against each other. These compression waves herald the start of unstable flow. As densities increase even further, at nine bodies per square meter, the crowd becomes like a fluid mass, dense enough to propagate shockwaves which turn the flow turbulent; people can be flung three meters or more, be lifted off their feet, have clothing torn off, and be thrown to the ground (see Figures 3b and c and Figure 4b for examples related to turbulent flow at the Hajj).²⁹ The likelihood of a stampede occurring increases dramatically when crowds reach ten bodies per square meter or greater.³⁰

From these data, two cofactors are now postulated to be generic features of stampedes: high crowd density and triggering events—factors also identified in the Bokhary report.³¹ Triggers can be real or rumored; substantial or minor; negative, or even positive.³² For example, in Iraq in 2005, a false rumor of a suicide bomber caused a panic-stricken rush that resulted in a stampede and 1,000 deaths.³³ The triggers at both the Mina

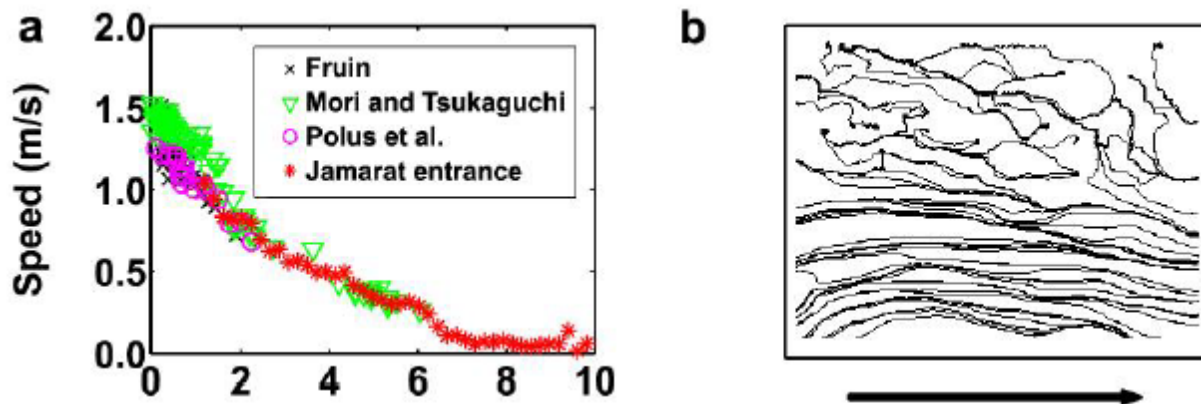
Figure 3: Crowd Dynamics at the 2006 Hajj Showing Crowd Flow Velocity and Movements during "Laminar," "Stop-and-Go," and "Turbulent" Flow



The first image (a) shows the different characteristics of the types of flow. The second image (b) shows the Hajj crowd in "turbulent" flow, moving in several different directions. The third image (c) shows the delay between the start of turbulent flow and the start of the Hajj accident, which occurs at the point of highest pressure. Reprinted with permission from Dirk Helbing, Anders Johansson, and Habib Zein Al-Abideen, "Dynamics of crowd disasters: An empirical study," *Phys. Rev. E* 75, 046109 April 2007, ©2007 American Physical Society, portion of Figure 3 (a-d), 4, <https://journals.aps.org/pre/abstract/10.1103/PhysRevE.75.046109>

stampede and the Kumbh Mela were likely small, yet they resulted in serious injury and deaths. In addition to these triggers, the promise of gratification (such as suddenly available prime seating before the start of a rock concert) can also cause crowds to rush toward each other.³⁴ For example, in 1989, 96 football fans were killed, and many more seriously wounded in a stampede in Hillsborough, in the UK. The stampede was triggered by the opening of a gate to two standing-only central pens near the field. When the gate opened, thousands of fans rushed into the pens, crushing people who were already in the area.³⁵

Figure 4: Crowd Density and Speed; “Turbulent Flow” at the Hajj in 2006



The first image (a) shows what happens to crowd speed as the crowd becomes denser: it slows down but does not stop: the names on the image relate the data on the crowd at Jamarat Bridge during the Hajj to findings of other studies. The second image (b) shows “turbulent” flow at the Hajj in 2006, with displacement of pedestrians in multiple directions of more than ten meters. From Dirk Helbing, Anders Johansson, and Habib Zein Al-Abideen, “Crowd Turbulence: The Physics of Crowd Disasters,” *Proceedings of the Fifth International Conference of Non-Linear Mechanics*, Shanghai 2007, portions of Figure 1, 968, <http://arxiv.org/pdf/0708.3339.pdf>. Used by permission of Professor Helbing.

Authorities around the world now have an arsenal of surveillance equipment at their disposal to monitor crowds in real time—cameras and drones are widely deployed around the world (the data used to create Figures 3 and 4 come from such equipment). Sophisticated computer algorithms have also made it possible to model crowds even prior to the event’s taking place. For example, Michael Batty and his co-authors³⁶ developed crowd simulation models to evaluate new parade routes at the Notting Hill Carnival in the United Kingdom. The models incorporated and adapted traffic models, pedestrian simulations, queuing theories, and other models that focused on density and crowd flows between entry points and destination points within the carnival area.³⁷ Additionally, they used “swarm intelligence” algorithms that captured how people initially move randomly around the event space in search of an attraction, and then once the attraction is located, they leave a “trail” for others to locate the same attraction more quickly.³⁸ Once the destination has been accessed, and the shortest route discovered, then that route will be used most and thus become most crowded. The Notting Hill simulations resulted in crowd flow optimization and change of the actual parade route for the carnival.

Part V: Discussion

The Bokhary Final Report elaborated on the findings first communicated in the Initial Report. Justice Bokhary himself wrote that his understanding of the events themselves did not evolve in any significant way between the Initial and Final Reports. However, he did come to a clearer understanding of the potential of his recommendations to prevent future tragedy. His recommendations are summarized below:

1. Plan events with as much advanced notice as possible to allow for all necessary precautions.
2. Conduct publicity campaigns in advance of the event that highlight rules and safety regulations.
3. “Pedestrianize” areas (exclude vehicular traffic from streets where revelers walk).
4. Establish observation points, specifically at Mass Transit Railway (MTR) stations.
5. Deploy a strong police presence including senior ranking officials.
6. Employ foot patrols who mix within the crowd, monitor the outskirts of the event area, can communicate up the chain and with each other, and can take quick action to control crowd behavior when necessary.
7. Modulate crowd concentrations through entrance and exit controls or other tidal flow systems, including a one-way traffic pattern.
8. Arrange for additional transportation options to accommodate crowds (e.g. extra trains and buses to bring people to and from the event).
9. Prohibit staging or other attractions that will draw huge numbers of people to one area.
10. Take particular caution with slopes, stairways, and other surfaces that may become slippery.
11. Coordinate with event organizers and develop contingency plans for impact of weather, transportation breakdown, fire, or other hazards which may arise.
12. Monitor the mood and nature of the crowd, especially when celebration involves alcohol.
13. Be aware of sudden crowd density changes.
14. Have means to communicate with a loud crowd who may not be aware of their surroundings due to inability to hear or see beyond their immediate environment.³⁹

What struck Chan as particularly remarkable about Justice Bokhary’s report is how prescient his findings were. Justice Bokhary’s observations have stood the test of time and been validated by the sophisticated crowd modeling techniques that have since been developed.

Officer Chan recognized that the tension between safety and freedom is one felt by administrators of mass gatherings everywhere. There are, for example, sound practices like queuing or disallowing alcohol consumption in public spaces that, while inconvenient, are generally accepted, and do not unreasonably impinge on individual liberties. But when do such crowd safety measures begin to compromise freedoms? The future of crowd control is sure to include new technologies like mobility mapping based on cell phone positions, or drone-assisted aerial surveillance. How, wondered Officer Chan, will rational restrictions on crowd safety be balanced with the need to respect the freedoms of movement, assembly, and speech—freedoms so coveted, yet constantly threatened, in our times.

Supplementary Readings

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Notes

¹ Senior Officer Chan is a fictional character, but all other people named in this case are real and depicted as accurately as possible.

² Andrea Lo, "The Complete History of Lan Kwai Fong," *South China Morning Post*, May 28, 2015, <http://www.scmp.com/magazines/hk-magazine/article/2037115/complete-history-lan-kwai-fong>.

³ Many of the details provided in this account are taken from Kemal Bokhary, *The Lan Kwai Fong Disaster on January 1, 1993: Inquiry by the Honourable Mr. Justice Bokhary, Final Report* (Hong Kong: Hong Kong Government, 1993).

⁴ Chief Inspector Clancy was among the many eyewitnesses that Bokhary and his team interviewed after the tragedy.

⁵ Bokhary, *Lan Kwai Fong Disaster: Final Report*, Para. 4.3; direct quotations from this document are indicated by paragraph numbers in parentheses following the quotations.

⁶ *Ibid.*, para.4.58-59.

⁷ "Kemal Bokhary," Wikipedia, accessed April 10, 2017, http://en.wikipedia.org/wiki/Kemal_Bokhary; Danny Gittings, "Hong Kong's Courts are Learning to Live with China," *Hong Kong Journal*, July 1, 2010, http://www.hkjournal.org/archive/2010_fall/2.htm.

⁸ Kemal Bokhary, *The Lan Kwai Fong Disaster on January 1, 1993: Inquiry by the Honourable Mr. Justice Bokhary, Interim Report* (Hong Kong: Hong Kong, January 18, 1993). Note that all of the material from the Interim Report was included in the Final Report,

⁹ Bokhary, *Lan Kwai Fong Disaster: 1993 Final Report*, 1-133; Note: All quoted and factual material cited on pages 4-11 in "Part II: The Final Bokhary Report, February 23, 1993," is from this Final Report.

¹⁰ Jonathan Braude, "Lan Kwai Fong proved things easily go wrong," *South China Morning Post*, January 20, 1993, <http://www.scmp.com/article/15923/lan-kwai-fong-proved-things-easily-go-wrong>.

¹¹ *Ibid.*

¹² *Ibid.*

¹³ "Chapter III: Fundamental Rights and Duties of the Residents," The Basic Law of the Hong Kong Special Administrative Region of the People's Republic of China, July 13, 2012, http://www.basiclaw.gov.hk/en/basiclawtext/chapter_3.html

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¹⁵ Robert Steffen, Abderrezak Bouchama, Anders Johansson, Iri Dvorak, Nicolas Isla, Catherine Smallwood, and Ziad A. Memish, "Non-Communicable Health Risks During Mass Gatherings," *Lancet Infectious Diseases* 12 (2012): 142-149.

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¹⁷ "List of human stampedes," *Wikipedia*, March 25, 2017, https://en.wikipedia.org/wiki/List_of_human_stampedes

¹⁸ Steffen et al., "Non-Communicable Health Risks During Mass Gatherings."

¹⁹ Edbert B. Hsu, "Human Stampede: An Unexamined Threat," *Emergency Physicians Monthly*, 2011, <http://epmonthly.com/article/human-stampede-an-unexamined-threat/>; Steffen et al., "Non-Communicable Health Risks During Mass Gatherings."

²⁰Frederik M. Burkle, Jr. and Edbert B. Hsu, "Ram Janki Temple: Understanding Human Stampedes," *Lancet* 377 (2011): 106-107; Hsieh et al., "Epidemiological Characteristics of Human Stampedes."

²¹ Hsu, "Human Stampede: An Unexamined Threat."

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- ³³ Ibid., 143.
- ³⁴ Burkle, Jr. and Hsu, "Ram Janki Temple: Understanding Human Stampedes."
- ³⁵ "1989: Football fans crushed at Hillsborough, *BBC On This Day*, n.d. http://news.bbc.co.uk/onthisday/hi/dates/stories/april/15/newsid_2491000/2491195.stm
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- ³⁷ Ibid., 1574.
- ³⁸ Ibid., 1576.
- ³⁹ FXB has summarized and made some clarifications to Bokhary's recommendations in the Final Report, Chapters 6-18, 38-102.



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