

## The Occurrence Mechanism of Shanghai New Year's Eve stampede

Fan Wang<sup>1, a</sup>, Sishi Liu<sup>2, b</sup>

<sup>1</sup> School of Management, Wuhan Donghu University, Wuhan 430212, China.

<sup>2</sup> School of Management, Hubei University of Education, Wuhan 430205, China.

<sup>a</sup>342162102@qq.com, <sup>b</sup> sunshine5455@163.com

### Abstract

People could gather together more easily in the contemporary society due to the continuous growth of population, the rapid development of economy and the acceleration of urbanization process, resulting in a higher risk in human stampede. It is of great significance to analyze the occurrence mechanism of the human stampede and prevent the stampede event. According to study the course of the Shanghai New Year's Eve stampede on December 31 in the year of 2014, this paper builds up a four-stage model of human stampede which contains incubation period, the development period, the deterioration period and the outbreak period. Based on describing the features of different periods, this paper summarizes the different performance of the stampede during different periods. As is shown in the result, the main factors leading to human stampede are organization, management, objective and subjective factors.

### Keywords

Human stampede, the occurrence mechanism, case study, four stages modal.

### 1. Introduction

Population growth, the convergence of interests could lead to people gathering and further to human crowd (1). Human stampedes are the most dangerous catastrophe in large-scale crowd agglomeration events, and are defined to have the following characteristics: coming from crowded crowds, being able to cause great harm or even death to humans and can cause mass loss. It tends to undermine normal activity (or movement) order, threatening people's personal safety (2).

M.V. Ramesh (3) argued that crowded crowds are the main cause of stampede. Hsieh (4) summarized the characteristics of stampede by studying the stampede events occurred between 1980 and 2007, and their research shows that stampede has a higher death rate in the Middle East and the developing countries, and stampede related to sports, religion, music, politics, or stampede caused by activities without relevant organizational mechanisms, has a higher death rate. Frederick M Burkle Jr (5) summarized several characteristics of such stampede events caused by religious activities by studying the cases in India: high population densities, frenzy of religious celebration, emergence of scarce resources, failure of government departments early warning mechanism, lack of security equipment. Based on studying the stampede events in public places, Ren (6) thought that stampede had the following characteristics: the occurrence of time and space uncertainty, the cause of many, sudden and difficult to control, group death, great harm.

Faisel T (2) summarized the causes of stampede, mainly in the following areas: the emergence of the crowd; special events; natural or man-made disaster, such as rainstorm, fire disaster, landslides; rumors; get something or go to a place competitively; temporarily changed notice; the end of the event or the end of the performance. Wang (8) analyzed the factors of campus stampede through his investigation and analysis, and he thought that these factors could mainly be divided into four aspects: human factors, material factors, environmental factors and management factors. Factors include the crowd out of control, population density, flow speed, safety management, time constraints, building safety facilities, capacity of the key parts, lighting defects, and natural weather. Tong (9) concluded that the triggering factors that led to stampede include three aspects: the proportion of vulnerable people, the attractiveness of exports and the degree of patience of the crowd. Liu (10) thought that the

peak average distribution, platform area, the proportion of imports and exports, the proportion of instructors and so on will affect stampede accident risk during his study of the subway station.

Based on these studies, this paper analyzes the occurrence mechanism of Shanghai New Year's Eve stampede, and summarizes the occurrence mechanism of stampede event, so as to provide suggestions and guidance to reduce the risk of stampede.

## 2. Reduction Of Shanghai New Year's Eve Stampede

December 23, 2014 23:35, many pedestrians gathered in the Shanghai Bund, while the entering flow and the exiting flow had a hedge in Chen Yi Plaza, causing someone to fall. Then it took place to human stampede. According to statistics, the injured were mostly women and students. At 16:00 on January 2, 2015, the stampede had resulted in 36 deaths and 49 injured in a short period of 21 minutes, averaging 1.7 deaths per minute.

### 2.1 Fuse of the Event

From the occurrence of Shanghai New Year's Eve stampede, the fuse was that there was someone falling on the stairs. At 23:35 on December 31, a stalemate was formed by large number of people in the middle of the staircase, resulting in somebody's unbalanced fall at the bottom of the ladder, and then led to more people fall and stack, causing crowded stampede occurred. In essence, the reason for the stampede was that the concentration of crowds was much greater than the tolerance of the site, and the lack of the government capacity in public risk early warning management and crisis management.

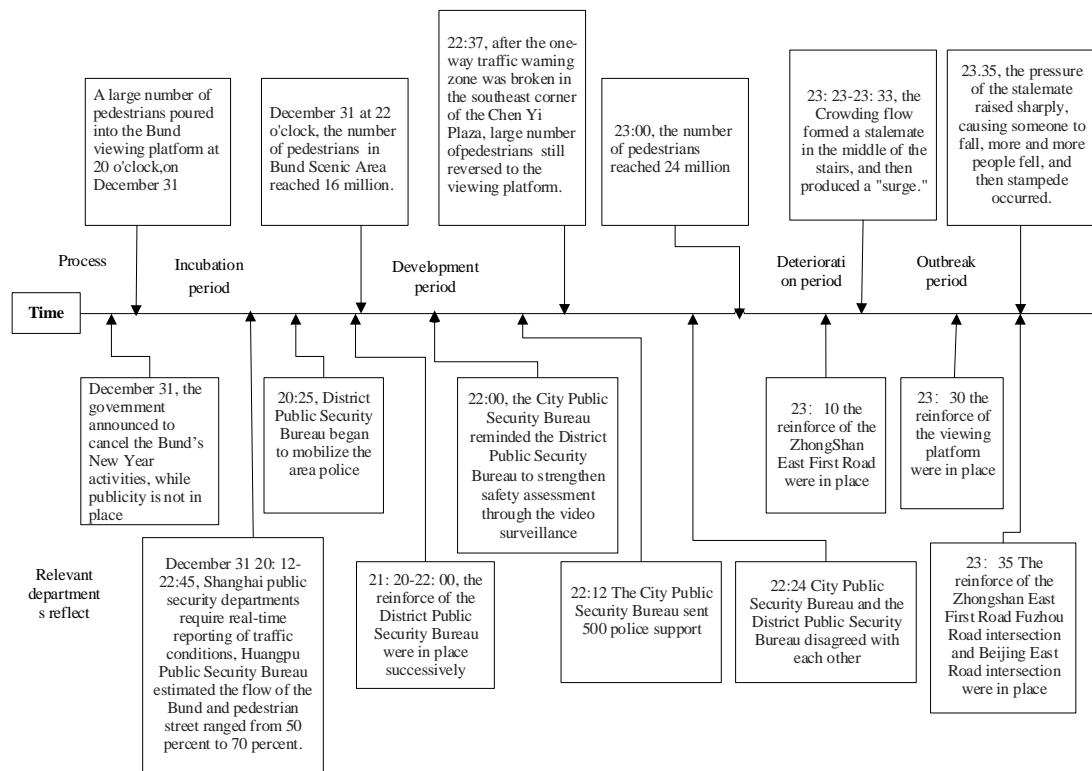


Fig. 1 The Process of the Stampede

#### 2.1.1 Sub-section Headings

The section headings are in boldface capital and lowercase letters. Second level headings are typed as part of the succeeding paragraph (like the subsection heading of this paragraph). All manuscripts must be in English, also the table and figure texts, otherwise we cannot publish your paper. Please keep a second copy of your manuscript in your office. When receiving the paper, we assume that the corresponding authors grant us the copyright to use the paper for the book or journal in question. When receiving the paper, we assume that the corresponding authors grant us the copyright to use the

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## **2.2 Evolution of Events.**

This paper analyzes the evolution process of Shanghai New Year's Eve stampede by referring to the theory of enterprise life cycle, and divides it into four stages: latency period, development period, deterioration period, outbreak period.

### **2.2.1 Latency Period**

Since 2011, the Huangpu District Government, the Shanghai Municipal Tourism Bureau and the Shanghai Radio and Television Station had held New Year Countdown activities for three consecutive years in the Bund Scenic Area, causing great social repercussions. Taking public safety and other factors into account, this year, activities in the Bund Scenic Area were temporarily canceled. December 9, 2014 the 95th executive meeting of the Huangpu District Government decided that the 2015 New Year countdown event would be held at the Bund source, specifically hosted by the Huangpu District Tourism Bureau. However, there are several reasons for the existence of stampede risk:

First of all, the publicity of the activity is poor. The notice of activities' cancellation was not in place; some people still think that the Bund would hold same activities like those in previous years.

Second, many people confused the Bund and the Bund source. The New Year countdown event was held in the Bund Scenic Area in the past few years, and in 2014 the place was changed to the Bund Source, some people confused the two places, leading to confusion while changing their location. The people who had arrived in the Bund Scenic Area had to go to the Bund source, exacerbating the flow of people surging.

Third, the government underestimated the security risks of the crowd. From Figure 1, the public security department's estimation and the argument of whether to take temporary control at the roads along the bund or not shows that the government underestimated the number of people gathered together.

### **2.2.2 Development Period**

December 31, 2014 20:00 to 21:00, many people went to the Bund Scenic Area like what they did in previous years. Before 22:00, most people reached the Bund Scenic Area. According to Baidu big data survey, at 21 o'clock, the number of people in Bund Scenic Area reached its peak.

20:12, Huangpu Public Security Bureau began to pay close attention to the Bund Scenic Area and Nanjing Road pedestrian street with police mobilizing at the same time. 21 o'clock, police force was in place successively. During this period, there were several problems: first, the crowd density and its change were not accurately grasped, and data were not reported timely; second, the called police force was much smaller than the required police force.

### **2.2.3 Deterioration Period**

December 31, 2014, around 22 o'clock, the flow began to gather in a large scale, while the direction of the flow began to change. According to Baidu big data, after 21 o'clock, a large number of people flowed from Chen Yi Square to the Bund Source along the ZhongShan East road, where the light show located. It can be seen from the Baidu search keyword analysis that, at 23:20, "whether the light show is canceled or not", "light show tickets" and other keywords began to increase sharply in the number of searches. As is shown in Figure 1, 22:37, after the one-way traffic warning zone was broken in the southeast corner of the Chen Yi Plaza, although the on-site duty police tried to maintain order, large number of people still reversed to the viewing platform.

22:00, the leaders of Shanghai Municipal Public Security Bureau noticed the huge risk from the video surveillance. 22:12, the Shanghai Municipal Public Security Bureau sent 500 police support, as shown in Figure 1, these police force were in place successively. 22:24, the Shanghai Municipal Public Security Bureau and the Huangpu District Public Security Bureau disagreed with each other

on whether to divert the Zhongshan First Road's traffic flow or not. Ultimately, fearing of people's mistakenly thought of large-scale activities, they did not take traffic control.

In the meantime, the risk was further exacerbated. On the one hand, some people retrograded into the viewing platform, which has 17 steps and people could fall easily; On the other hand, although the public security were in place successively, part of the police were still not in place even when the stampede occurred. At the same time, the treatment of emergency between the upper and lower departments was not uniform.

#### **2.2.4 Outbreak Period**

December 31, 2014 23:30, the police found that many people stranded in a channel of Chen Yi Plaza from the monitoring probe, so duty police was immediately mobilized to rush to the scene. The police were blocked by large crowded crowds, so they took a forced cut, which was a waste of 5 to 8 minutes.

23:35, the flow of Chen Yi Plaza and QinShui platform hedged at the slope, resulting in someone to fell. People in high places were aware of the danger, waving their arms to let others back. The people on the stairs and the police rushed to the rescue began to shout to let the crowd on the staircase back, but the voice was too small and did not play much role. More and more people were overwhelmed, so the situation began to get out of control.

23:40, seeing the people below in danger, several young people leaning against the wall began to call everyone to shout, "Back! Back!" People on the stairs aware of the danger below, the trend of people flow began to decrease, finally stopped. Ten minutes after, the crowd began to retreat, but the repressed people had become weak, when the crowd finally spread, dozens of people collapsed on the stairs, rescue workers began shouting and cardiopulmonary resuscitation immediately.

23:50, more and more police arrived, they tried to pull the pressed people out from the people flow, but that did not work.

23:55, all the survivors stand up. Crying screams and the ambulance sound mixed into a group, the medical staff and the nearby enthusiastic public came to those fell to the ground and began to shout and cardiopulmonary resuscitation, trying to rescue. Some people had died.

### **3. The Occurrence Mechanism of Sahnghai New Year's Eve Stampede**

According to trace back to the Shanghai New Year's Eve stampede on December31,2014, this paper analyzes the risks of the human stampede. The in depth analysis in different stages was shown in the paper. Therefore, the possible reasons are as follows.

#### **3.1 The Factors of Organization.**

In every year before 2014, the New Year celebration activities were held in the Bund of Shanghai in China, but changes had taken place in the year of 2014. As the cancel of the New Year celebration activity, the government security reduced to a lower rank (from municipal to district). For one thing, it was the major factor that the negligence of risk early warning and the undervaluation of the number of people. For another, the change of the celebration activity led to the change of the crowding paths. Such factors would directly affect the crowding which triggered the human stampede.

#### **3.2 The Factors of Management of the Government**

The factors of management of the government were as follows: First, it was poor for the local government to evaluate the risk. Shanghai was not only the largest city in China but also a famous tourist city. And the Bund was a must for visitors to Shanghai. There were much more people coming to the Bund specially in new year's eve. However, it was out of control for the unexpected overcrowding. As shown in Figure2, the numbers of people at different moments are more than estimated ones. Data sources are from "The report on Shanghai New Year's Eve stampede".

Second, the weakest thing is the emergency management. They were lack of a procedure adopted to address an emergency. When it took place in emergency, the poor communication would cause a lot of complication. Furthermore, the emergency response capacity was slower in the deterioration

period. For example, when it took place to the human stampedes, part of the 500 policemen who Shanghai public security bureau adjusted to the Bund from other places haven't arrived.

### 3.3 The Objective Factor.

It took place in a dark night although there were some lamps. At the stairs, the pedestrians were much more than it could bear. Under these conditions, it was easier for the pedestrians to fall down to the stairs.

### 3.4 The Subjective Factor.

It was the main factor that the pedestrians were so blind that they were crowding to the viewing platform on the night in question. To get to the ideal places, some of pedestrians gone up the stairs and others came down the staircase which led to collisions. That also was the reason for that the policemen couldn't get in the crowding for emergency rescue.

Besides, the panic psychology of the pedestrians was another reason. When it happened to overcrowding, it was easier to fall down if they were panic. Once one of the pedestrians fell down, others would trip over.

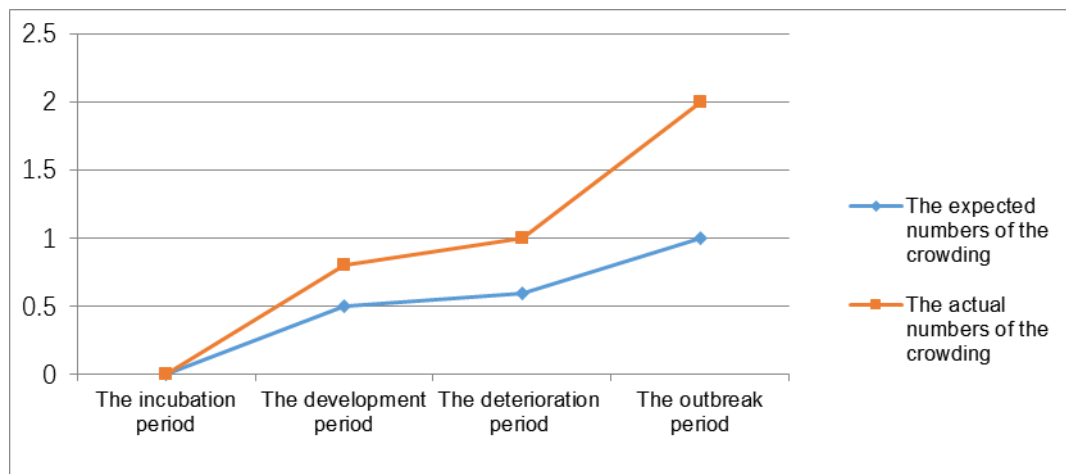


Fig. 2 The comparative map of crowding in question

## 4. Conclusion

According to recall and analyze the Shanghai New Year's Eve stampede on December 31 in the year of 2014, this paper summarized its occurrence mechanism. All in all, the Shanghai New Year's Eve stampede resulted from a combination of things—the factors of organization—the absence of propaganda, the factors of management of the government, the objective factor and the subjective factors. Therefore, it is necessary to take active action to prevent from human stampede risks. The suggestions on risk-prevention are as follows.

First, it is important for the government to improve risk warning ability. Assort with the relative departments to the risk of warn, evaluation and keep away. The early warning system about prevention from human stampede is of the first magnitude.

Second, the emergency management counts heavily. Once the crowding is out of control, it is more likely to take place the human stampede. Where there was a dense crowd, it is essential to attach importance to safety management.

Third, the pedestrians should be rational when they are in the crowding. When it happens to serious crowding or human stampede, the pedestrians must clam down and take effective steps.

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