

**Knowledge clip:** <https://www.youtube.com/watch?v=mgYz6Rwzma0>

**Essay:**

## **Research on safety standards and crowd behaviour during evacuations in the Netherlands**

Research has been conducted on the topic of safety standards and crowd behaviour during evacuations in the Netherlands. To ensure the most safety, guidelines have been created in different European countries, which give key figures to follow. Research suggests that there are differences between the key figures in between countries. The core challenge, therefore, is that LCB wants to understand which key figures are the most reliable and should be used when organizing an event. This project draws on desk research, a creative session, an experiment, and expert interviews.

Desk research has revealed the differences in safety key figures between the guidelines of the UK (Events Industry Forum, 2014), the Netherlands (Nederlands Handboek Evenementen Veiligheid, 2019), Germany (Ministeriums des Innern NRW, 2021), and Sweden (Swedish Civil Contingencies Agency, 2011), like the throughput of a door and stairs. A creative session with safety experts from various fields has uncovered that different key figures are being used among the experts. The input has been used to execute an experiment, analysing the throughput of a one-metre-wide door and one-metre-wide stairs. The experiment revealed key figures of an average of 110 people per minute per metre through a bottleneck and an average of 60 people per minute per metre using the stairs. Based on the experiment and expert interviews it is recommended to use the guidelines that show the lower key figure, due to the missing disrupting factors during the experiment. The guideline from the UK suggests a throughput of 82 people per minute per metre through a bottleneck. The guideline from the Netherlands suggests 45 people per minute per metre using the stairs. By following these key figures, the most safety is ensured during an event.

Furthermore, the desired behaviour of the crowd during an evacuation has been analysed using desk research and expert interviews. Models such as the leisure behaviour model of Knulst (Mulder, 2014) and the analysis model escape safety of Kobes and Oberijé (Kobes & Oberijé, 2010) give an insight into the influences on the behaviour of an individual. Experiments from Alexander Mintz in 1951 (Mintz, 1951) analysed the non-adaptive group behaviour and the results suggest that cooperative behaviour among the participants leads to success and “is rewarding to the individuals as long as everybody cooperates (Mintz, 1951).” However, if participants start to behave in an uncooperative way, it could lead to disaster, due to people blocking the exit and push each other out of the way to exit as quickly as possible. Other experiments of the research centre in Jülich (Adrian, Seyfried, & Sieben, 2020) analysed crowds in front of bottlenecks at entrances from the perspective of physics and social psychology. The results suggest that it is dependent on the corridor width leading to the bottleneck. A broad corridor leading to the bottleneck encourages people to behave competitively, due to the participants forming a semicircle around the bottleneck. By contrast, if the corridor to the bottleneck is smaller, people are already in a ‘queue-like’ formation. Therefore, only a few people compete to enter the bottleneck at the same time, which increases the speed of the evacuation people (Adrian, Seyfried, & Sieben, 2020).

Further research into this topic needs to be done, due to the numerous differences between the European countries. This project was aimed as a first trial, which helped in understanding the process of executing an experiment. In the near future, more experiments on this topic will be executed by LCB.

## References

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