Coding Built Enviornment's Effect on Incidents of Mass Shootings in Schools Using Public Records

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Soft Target Engineering to Neutralize the Threat Reality

SENTRY

Scope

The research contributes to RD.1 Architectural Design Research, specifically to the area of Designing Security in the Public Realm. This research will generate new knowledge on the role of the built environment in the vulnerability and resilience of soft targets and develop a framework for the design of smart sites and buildings that reduce or eliminate vulnerabilities, to make more strategic use of security technology in support of human intelligence.

One of the main goals of this research is to enhance the security of soft targets, specifically schools, against mass shootings. To establish a clear definition of mass school shooting incidents, the Congressional Research Service (CRS) definition was utilized [1].

A multiple homicide incident in which four or more victims are murdered with firearms—not including the offender(s)—within one event, and at least some of the murders occurred in a public location or locations in close geographical proximity and the murders are not attributable to any other underlying criminal activity or commonplace circumstance.

The outcomes of this study will contribute significantly to the advancement of the knowledge base in the field of Architectural Design Research and will have practical implications for the design of secure built environments.

Overarching Code List

A systematic review of publicly available reports of past incidents of mass shootings identified potential contributions of the physical environment to the vulnerability or resilience of venues and communities to attacks. We developed a list of codes to tag passages of the publicly available reports that identified a built environment attributes. During the coding process, this list developed into a comprehensive of 96 sub-codes, within the 13 parent codes shown in Table 1, enabling a finer-grain understanding of the patterns and trends emerging from the incident reports.

Table 1: Code Groups
1. Arrangement of Space and Elements
2. Arrangement or organization
3. Building Components
4. Building Systems
5. Circulation
6. Climate and Weather
7. Materials
8. Physical Restrictions
9. Placemaking
10. Security Technology
11. Site
12. Mapping
13. Surveillance

Methodology

During the process of compiling a list of mass school shooting occurrences, The Violent Project's publicly-accessible database of mass shooting incidents was utilized [2]. Our methodology involved filtering events that had occurred in the past 25 years and aligning them with the definition of mass shooting established by the Congressional Research Service (CRS). From the aforementioned database we gathered events that took place from 1989 to 2022, and of these events, a total of 11 satisfied the CRS criteria for mass shooting incidents. Subsequently, we conducted an exhaustive search of public records to ascertain the availability of reports, resulting in a refined list of six incidents. Following this, an examination of the available data led us to discard a certain number of events due to data quality concerns (depicted in gray in Figure 1). Ultimately, this study focused on six select events (indicated in black in Figure 1) as a consequence of these efforts.
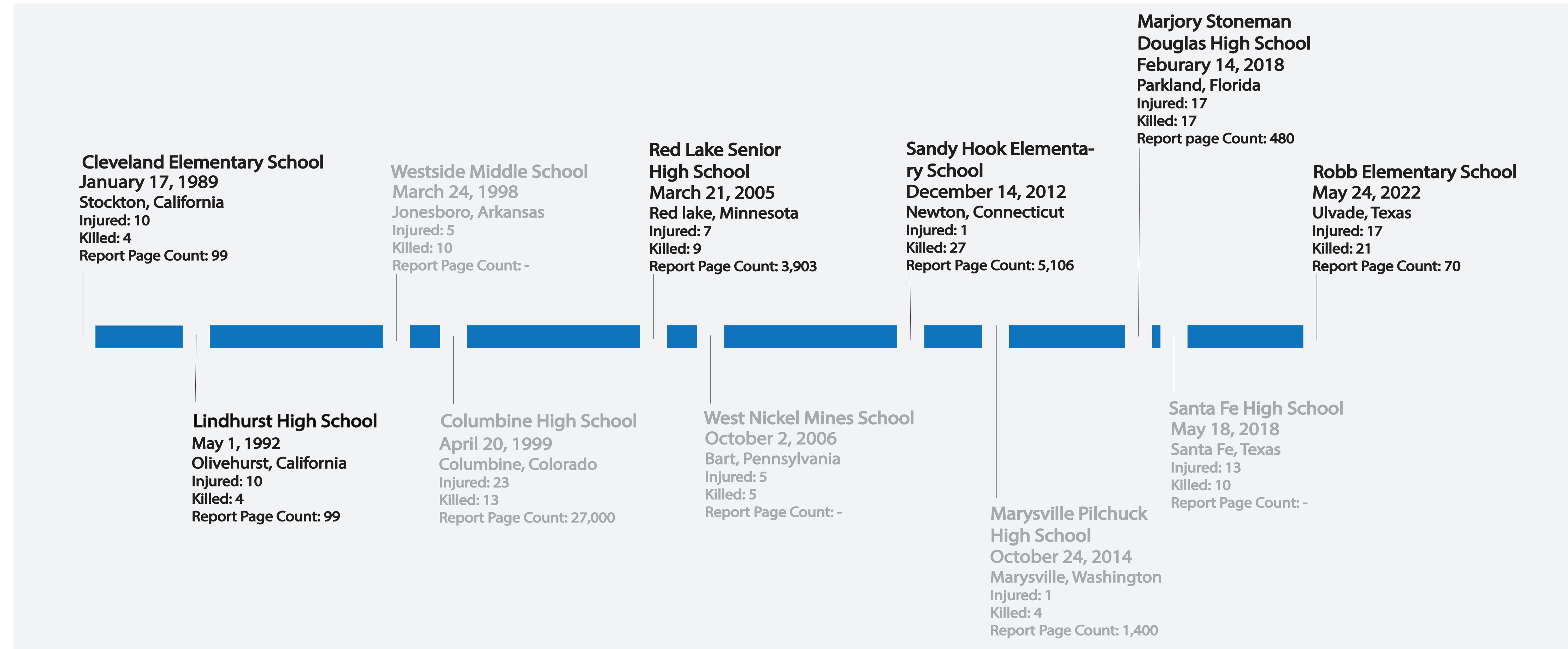

Cleveland Elementary School January 17, 1989, Stockton, California, Injured: 10, Killed: 4, Report Page Count: 99

Westside Middle School March 24, 1998, Jonesboro, Arkansas, Injured: 5, Killed: 10, Report Page Count: -

Red Lake Senior High School March 21, 2005, Red lake, Minnesota, Injured: 7, Killed: 9, Report Page Count: 3,903

Sandy Hook Elementary School December 14, 2012, Newton, Connecticut, Injured: 1, Killed: 27, Report Page Count: 5,106

Marjory Stoneman Douglas High School Feburary 14, 2018, Parkland, Florida, Injured: 17, Killed: 17, Report page Count: 480

Robb Elementary School May 24, 2022, Ulvade, Texas, Injured: 17, Killed: 21, Report Page Count: 70

Lindhurst High School May 1, 1992, Olivehurst, California, Injured: 10, Killed: 4, Report Page Count: 99

Columbine High School April 20, 1999, Columbine, Colorado, Injured: 23, Killed: 13, Report Page Count: 27,000

West Nickel Mines School October 2, 2006, Bart, Pennsylvania, Injured: 5, Killed: 5, Report Page Count: -

Marysville Pilchuck High School October 24, 2014, Marysville, Washington, Injured: 1, Killed: 4, Report Page Count: 1,400

Santa Fe High School May 18, 2018, Santa Fe, Texas, Injured: 13, Killed: 10, Report Page Count: -

Figure 1: Timeline of Mass School Shootings Examined for This Study

Analysis

The sparkline diagram on the left shows the frequency that each of the 96 sub-codes were identified in each individual school incident, labeled bythe code groups 1-13 (Table 1, note that the code group number is followed by a decimal that refers to a subcode within the parent code) . The diagram on the right shows the aggregate frequency of each code group for all of the reports. Notably, the Security Technology code group was significantly more frequent among the six reports analyzed. All of the reports frequently focus on specific building components with functions of access control (doors, locks) and circulation in the school buildings. The more recent reports show an expanded scope of focus, in the increased attention to site factors in the perimeter of the building. This reinforces the need for the next steps of this research to model layered security architectural approaches.
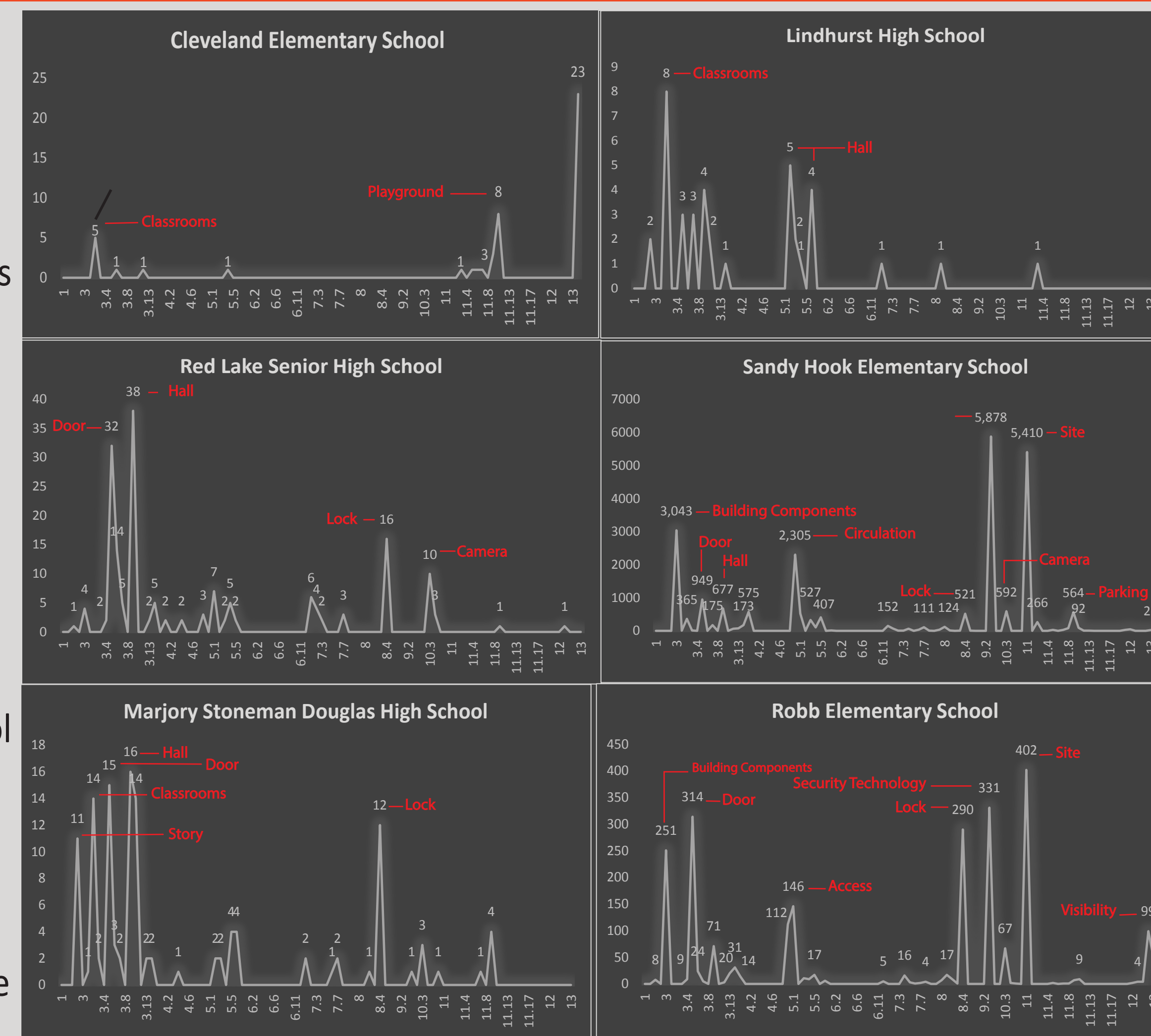

Figure 2: Number of instances (y-axis) that sub-codes in each of the major code groups 1-13 in Table 1 (x-axis) were identified in each incident report. Labeled peaks indicate highest frequency subcodes.
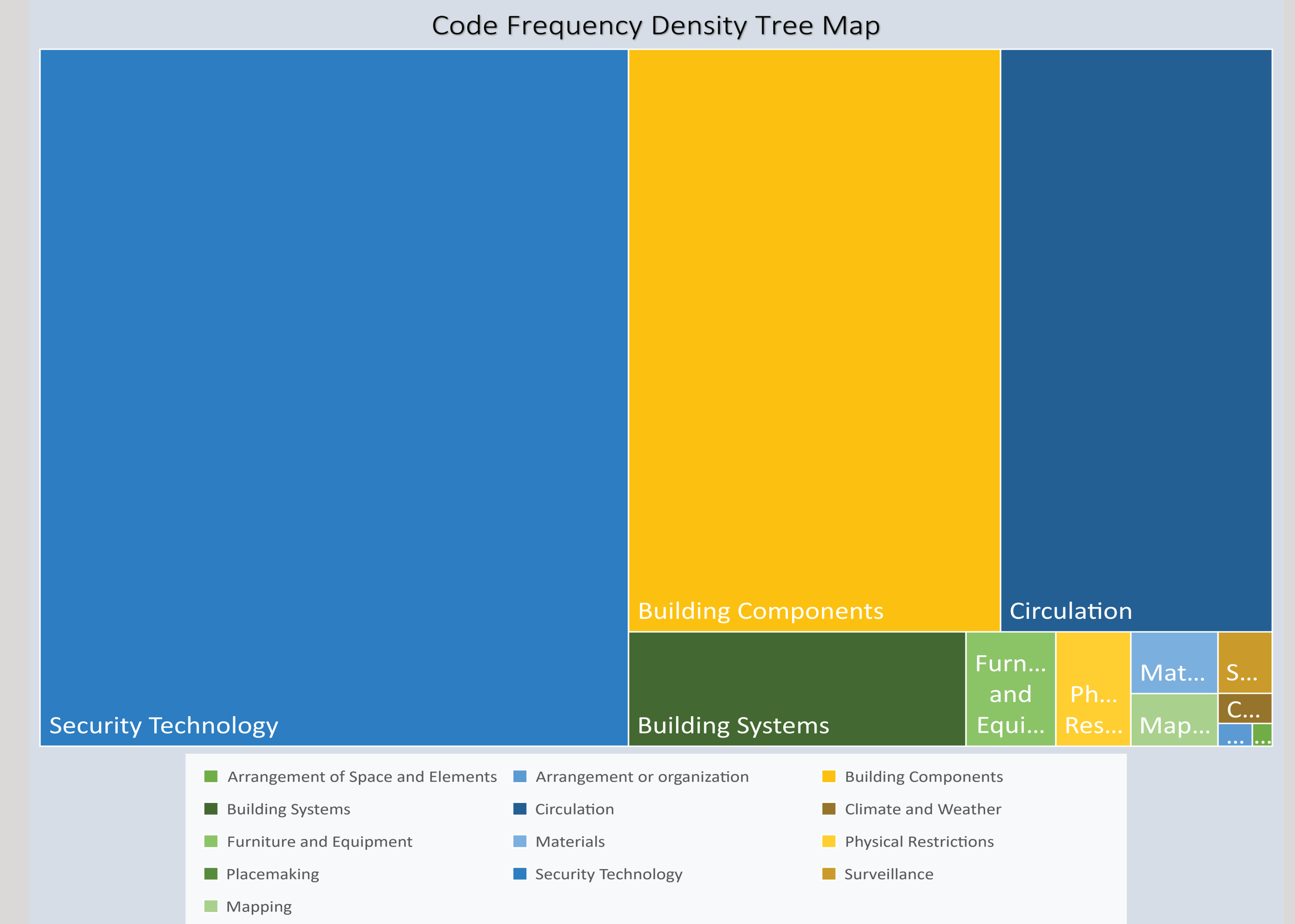

Code Frequency Density Tree Map

Building Components, Circulation, Security Technology, Building Systems, Furn... and Equi..., Ph... Res..., Mat..., Map...

- Arrangement of Space and Elements
- Arrangement or organization
- Building Components
- Building Systems
- Circulation
- Climate and Weather
- Furniture and Equipment
- Materials
- Physical Restrictions
- Placemaking
- Security Technology
- Surveillance
- Mapping

Figure 3: Tree Map of Total Code Frequency Densities for All Reports

Preliminary Findings

There has been a substantial improvement in the quality of official reports on these incidents over the years. However, the observed variability in report quality as part of this study highlights the necessity for additional official guidance on report writing, to guarantee their utility as valuable sources of research data. By examining the coded items, the study revealed that the most frequently mentioned aspects of the built environment were (1) security technology (cameras), (2) Building Components (Doors, Hallways), (3) Circulation (Access, Egress), (4) Building Systems (fire alarm system). These observations suggest that the effectivness of these environmental factors should be further examined in design research, i.e. the design of interventions, both passive (physical) approaches and active technology approaches, to be tested in crowd simulations.

1. Krouse, William J, and Daniel J Richardson. "Mass Murder with Firearms: Incidents and Victims, 1999-2013." Congressional Research Service, July 30, 2015. https://crsreports.congress.gov/product/details?prodcode=R44126.

2. Peterson, Jillian, and James Densley. The Violence Project Mass Shooting Database. "The Vzject.org/mass-shooter-database/.