

FOOTBALL STADIUM SECURITY MEASURES

Nikola ČAJKOVÁ, Zdeněk KALVACH
n_cajkova@utb.cz, kalvach@utb.cz

Abstract

This article focuses on the analysis of the football stadium in Brno as a reference object. Football stadiums are classified as soft targets. Soft targets are characterized by a low level of security measures and a high concentration of people. Considering that football matches are attended by thousands of visitors who come to the reference object at the same time, it is very challenging to maintain a high level of security. This article deals with the evaluation, analysis, and suggestions for security measures. The aim of this article is to identify the weaknesses of the reference object and to use expert methods to propose appropriate security measures to improve the security situation in terms of prevention.

Key words

Attacks, Brno, Escape Plan, FMEA Analysis, Football Stadium, Mechanical Security, Risk Analysis, Security, Soft Targets, Technical Security, Terrorism.

Introduction

The security of football stadiums and soft targets, in general, is currently often discussed in the media. Specifically, measures taken by security forces at football stadiums are addressed. An important step in any analysis is to find out the undistorted information and the real state of the reference object. It is possible to create an analysis within the obtained data. In this case, Failure Mode and Effect Analysis will be chosen, which, after assessing the risks, can capture the structure of the level of threat.

The article will assess the internal and external security of the city football stadium Srbská. The stadium was last renovated in 2001. Internal security will be divided into procedural and technical aspects of security. External Security will be focused on the immediate surroundings of the reference object. The article aims to choose appropriate security measures based on the analysis and thus strengthen the level of security.

There are a large number of security elements nowadays, but it is necessary to analyze a specific reference object and individual assessment for the most suitable security support proposal.

The reference object is the city football stadium Srbská

The first mentions of the football stadium date back to the end of the Second World War, when Moravská Slavia began its construction on the premises of the former Royal Polish Brickyard. The sports ground was opened in 1949 with a capacity of 30,000 spectators. At that time, the stadium belonged to SK Královo Pole, with which the original Moravská Slavie was merged [1]. In addition to football matches, other sporting activities took place here in the past, such as the final of the athletics league in the triathlon between ATK Praha × Rudá hvězda Praha × Sparta Brno ZJŠ in 1952, as well as races in the flat track and on horses.

The stadium was also used for the city's spartakiade, for five years. Football matches were very popular here, which can be proven by the attendance in 1959 in the number of 35,000

spectators of the then Nations Cup (today known as the European Championship) during the match with Denmark, in which our national team won with five goals scored against the opponent's one [1].

The walkways of the Královopoles Stadium witnessed the first league matches only in the 1961/62 season. Later, the club did not do very well and over time fell to the level of the third league. A more favorable future was promised by the arrival of businessman Bořivoj Kresta, under whose leadership the club was renamed SK LeRK . The intention to rebuild and modernize the stadium was not realized and the club moved to Prostějov [1].

After many changes regarding the ownership of the stadium, the City of Brno became the holder, which has managed it to this day.

In 2001, the stadium was completely reconstructed, and the repair costs are reported to be one hundred and ten million Czech crowns, and the stadium is thus in line with UEFA 2003 standards. The current capacity is for 10,200 spectators, including 50 members of the press. [1]



Fig.1
The current form of the Municipal Football Stadium Srbská [2]

Risk analysis using the FMEA method

The first method used for risk analysis is the Failure Mode and Effects method Analysis known as FMEA Analysis. The name in translation refers to the analysis of the possible occurrence and impact of defects. Risk assessment is based on the evaluator's opinion when available information is taken into account.

According to one's judgment, each risk is assigned a degree of probability of its occurrence, subsequent severity, and detection time. The most serious risks are those that have an impact on a larger number of people. The worst possible scenario is always taken into account.

The risk calculation is based on the equation:

$$R = P \times Z \times O$$

- **R** Risk
- **P** Probability of occurrence
- **Z** The severity of the risk
- **O** Risk detectability [3]

The following table adjusts the parameters for the probability of occurrence, severity, and detectability of the risk. By substituting them into the above equation, it is possible to obtain the value of the risk, which is further assessed according to its degree of severity.

Table
Risk assessment [3]

The probability of occurrence	P	The severity of the risk	Z
Random	1	Damage to the health of a minor nature / accident / commission of an offense	1
Unlikely	2	Absentee injury with incapacity for work / major property damage	2
Probable	3	More serious injury requiring hospitalization / higher damage/necessity to interrupt the match	3
Very likely	4	Severe injury with permanent consequences / high damage / early termination of the match	4
Permanent	5	Fatal injury/very high property damage	5
Risk detectability	O	Level of risk	R
Disclosure during negotiations	1	Insignificant risk	≤ 3
detect (within 30 minutes)	2	Acceptable risk	4-10
Detectability is not easy (within one day)	3	Moderate risk	11-20
Detectability is not easy (more than one day)	4	Unwanted risk	21-39
Undetectable risk	5	Unacceptable risk	≥ 40

The risk assessment for the Municipal Football Stadium Srbská is based on the fact that football matches take place here as a priority and it is used for cultural events rather rarely. Processing is based on the opinion of the evaluator.

The experience with football fans, which resulted from interviews with members of the security forces and the security manager of the stadium, is also taken into account. The most common illegal act is trying to utter and use pyrotechnics inside the stadium.

Table
Risk assessment [author]

Srbská football stadium	P	Z	O	R
A display of pyrotechnics	3	4	4	48
Weapon delivery	2	5	4	40
Pronunciation of alcohol	3	3	3	27
The intrusion of a spectator with a ban on entry to a sports match	3	3	4	36
Unauthorized entry without a valid ticket	3	2	4	24
The intrusion of fans into the opponent's sector	3	3	2	18
Encroachment of fans onto the field of play	2	3	1	6
Throwing objects onto the playing surface	3	3	1	9
Xenophobic expressions	3	3	2	18
Use of pyrotechnics	5	4	2	40
Fire	2	5	1	15
The collapse of the grandstand	1	5	1	5
Improper parking and disabling of IZS	4	5	2	40
Theft	3	2	4	24
Vandalism	3	3	4	36
Profanity toward police forces	1	3	1	3
Assault on police units	3	4	2	24
Assaulting the referee/players	3	4	2	24
Brawl outside the stadium	3	4	3	36
Brawl inside the stadium	2	1	2	4
Violence against other visitors	3	1	2	6
Provocative behavior of visitors toward police units	2	5	3	30
Destruction of stadium equipment	2	5	1	15

According to the stated results, the most serious risk is the use of pyrotechnics and the use of weapons when such actions endanger the public interest, which is the life and health of the people present.

Improper parking can also be classified as a very serious offense, which can have an undesirable impact not only on the people present in the stadiums but also on the public in the surrounding buildings when such behavior makes it impossible for traffic to pass through for the needs of the IZS units. The entry of a person without a valid ticket, i.e. a spectator who is prohibited from entering the stadium, can also be classified as undesirable behavior.

Security of inputs

The organizer is obliged to ensure the safety of visitors to events held at the stadium. In the case of football matches or the organization of a concert or other cultural event, internal security is therefore entirely up to the organizer.

Each organized event is thus provided individually, however, the general principles and interests in maintaining safety are the same for all. The security of participants in the immediate vicinity, i.e. external security, is ensured by the Brno Municipal Police and the Police of the Czech Republic.

Participating police patrols jointly supervise the observance of public order. Every visitor to the stadium is obliged to comply with the visitor rules, and violations can be punished

by expulsion from the stadium, invalidation of the permanent ticket, a monetary penalty, and possibly a ban on entry to other organized events.

The visiting regulations authorize the security agency to carry out checks on incoming visitors to prevent the introduction of prohibited items. In particular, these are items, whose use could cause harm to a third person, such as:

- Hazardous flammable substances, sprays and paints.
- Racist, defamatory, vulgar, or indecent material.
- Guns
- Pyrotechnics
- Alcohol and addictive substances
- Animals
- Poles for flags and banners [4].

Each of the visitors is obliged to undergo an entrance check, during which they show a valid ticket. In case of detection of a situation showing elements of a possible security threat, when this would conflict with the visiting regulations, such a visitor is not allowed to enter the stadium. Supervision of compliance with the visiting rules is primarily the responsibility of the organizer, however, this can be ensured in cooperation with the Police and MP Brno [4].

The visiting regulations further regulate the issue of personal data when the stadium is monitored using a camera system with recording. The record may further be used to identify persons, in full accordance with the Personal Data Protection Act No. 101/2000 Coll. and Police Act No. 273/2008 Coll. The range of possible processed data consists of name and surname, date of birth, residential address, identity document number, photographic, video, and audio recording, and also determines the specification of the disputed action and the method of resolution and measures or sanctions adopted [4].

Security Agency

The security agency ensures the validity of the purchased ticket for a specific event, which entitles the visitor to enter the stadium. Another task is to inspect the visitors before entering the stadium.

This consists of physical control of arrivals, where the goal is to prevent the introduction of pyrotechnics or other prohibited items into the stadium. At each entrance, a search is provided by the security agency by a pair of men and women.

According to previous experience, it is women and children who try to bring prohibited items into the premises. Detectors are used more in risky matches. Usually, existing matches are rated category A as non-risky.

Evacuation plan

The evacuation plan also forms part of the stadium's security documentation. Attached for illustration is a schematic drawing of the evacuation plan for the main stand, 2nd floor when it forms Annex PI and P II. The entrance gates of the stadium are intended for the evacuation of visitors to the stadium, which is open throughout the event.

With a lower number of visitors, some may remain locked when their opening is not necessary for the smooth access of visitors to the stadium. In this case, a responsible person will be assigned to ensure that they are unlocked if necessary. The image below shows a map of the stadium showing the entrance gates.

EMS and FRS components

One ambulance with a crew of two is available at the stadium for the entire duration of the event. At the same time, a tank truck belonging to the unit of the volunteer fire department of the municipality, specifically of the Královo Pole district, is being brought to the scene. The

staff consists of the commander and five members of the volunteer fire department. The location of both components of the IZS is usually in the range of sectors B and C. A preview of the division of the stadium into sectors is available in the picture below - the diagram of the stadium.

Police and Municipal Police Brno

The external security of the stadium is the responsibility of the security forces when it comes to Police and MP Brno. They supervise the entire event through patrols set up around the stadium. The heads of the participating departments have their posts at the operations center, from where they have a proper view of, among other things, the events at the stadium and where the camera system is also being monitored.



Fig. 2
Scheme of the Municipal Football Stadium Srbská [5]

Technical aspects

The stadium has a camera system that is part of the Municipal Camera Surveillance System of the city of Brno. Its purpose is to serve security forces during organized sports and cultural events.

The total number of cameras used is ten, of which four are static, and the rest are rotating. Their strategic deployment enables coverage of individual sectors of the grandstands and, at the same time, monitoring of the entrance gates, including the immediate surroundings. The recording of the event is archived and serves as evidence if necessary.

Communication between the security agency, the organizer, and the security forces takes place via mobile radio stations, which are used on two independent circuits. These can be connected. For communication with the public, it is possible to use the radio with forced listening, or megaphones are prepared for this purpose.

Proposals to strengthen the security level

Procedural aspects

The procedural aspects of the physical security parties form a system of measures ensured through human resources. In the case of a football stadium, the proposal to strengthen the level of security is addressed to the organizer, i.e. the security agency. Here, the fact that these are not direct employees who do not have local knowledge can appear as a shortcoming. Emphasis must therefore be placed on training and familiarization with all the necessary rules, arising mainly from local realities and the visiting regulations.

Technical aspects

The recommendation regarding increasing the level of security in the sense of technical security is based on the intention of simplifying the procedural procedure not only for security agency workers but also for members of the security forces. When considering the technical aspects, the problem of the audience staff is therefore solved.

In summary, it can be determined as the main idea of the technical aspects of allowing entry only to unproblematic visitors, knowing their number and location in the stadium. To ensure the safety of visitors and the peaceful course of the organized event, the presence of persons who have been banned from entering is not desirable. Bans are issued based on previous inappropriate behavior, either at the club level or an administrative or judicial decision. From the point of view of the club's level, this is a violation of the visiting rules or an illegal act. Personal data of persons with a sanction may be passed on to others football clubs that organize competitions under the auspices of FAČR and LFA. The scope of personal data processing is subject to Act No. 101/200 Coll. on the protection of personal data.

The club's record of the violator is given by information consisting of first and last name, date of birth, ID number, and photo. At the same time, a video and audio recording of a specific offense can be kept, as well as a description of the proceedings and a list of measures taken. [4]

The second category consists of persons to whom an entry ban was granted based on the decision of an administrative authority or a court when this was imposed as a form of punishment. These are registered to the necessary extent by security components.

In practice, it is a rather difficult task for security agency workers to find out the presence of banned persons, when precisely concerning the Personal Data Protection Act, they cannot be provided with a list of registered banned persons, nor can they get their hands on their photos. The presence of such a person in the stadium is only subsequently detected by the Police using camera systems. However, this only happens when the rioter is already in the stadium. The goal is to prevent such a situation.

The proposed solution consists of the use of a biometric face reader, which has a list of undesirable persons in the database. If the visitor matches the person listed in the database, the event is evaluated as an attempted unauthorized entry, and such a person is handed over by the security officer to members of the security forces. To easily remove such a person from the place designated for access to the stadium, a dedicated alley forms part of the entrance area, which does not delay other visitors. [4]

Another proposed recommendation consists of entering only a specific sector according to the purchased ticket and counting those arriving at the stadium through the use of the turnstile system. This fact is essential for solving security incidents or other extraordinary events at the stadium. Concretely, it can be given in the example of the evacuation of people, when the exact knowledge of the number of people in the stadium in total and in the division into individual sectors makes a significant decision in solving the incident and the strategic deployment of the people who manage the evacuation.

Every visitor undergoes an entrance check, the purpose of which is to detect items that are prohibited from being brought into the stadium. Subsequently, his face is compared using a biometric reader, which is installed on the access turnstile.

Both systems, the reader and turnstile, are mutually integrated. If the visitor's biometric data matches the database, entry is not permitted through the turnstile. The face detection functionality is superior to the reader device that checks the validity of the ticket.

Another proposed element of technical security is the installation of turnstiles that have an integrated ticket reader. The visitor to the event does not have to show a valid ticket directly to a security agency worker, but entry to the stadium is enabled by using a ticket and placing it on the turnstile reader.

The reading device can recognize the ticket intended for a specific sector, which makes it possible to maintain the division of fans into “home and host” fans so that they do not mix and possible unwanted conflicts in the stadium.

If a visitor tries to get to the wrong sector of the stadium and the turnstile does not allow him to enter, a dedicated aisle is also designated for these purposes, which allows such a person to leave and then move to the correct entrance. [4]

Biometric reader

Video analysis was also considered an option in terms of face detection and comparison.

However, the intention is not to make a record of all incoming persons, but only to recognize those who have been granted an entry ban. For this and also for economic reasons, a biometric face reader is proposed as the final solution. [6].



Fig. 3
Biometric face reader [6]

Rotary turnstiles

Turnstiles enable greater efficiency in checking the validity of tickets entitled to enter the stadium, as they help people check in more quickly, which leads to a reduction in the waiting time for arrivals to enter the stadium. Another advantage is knowing the exact number

of people in each sector, which is enabled by the turnstile function in counting people. From a safety point of view, the turnstile is also equipped with an anti-panic function.

The top cover allows the installation of any reader, terminal, or ticket system keyboard. Prominent pictograms are placed on both sides, which have an informative function regarding the free passage. It includes an integrated control unit that allows checking and setting all optional functions, consisting in particular of choosing one-way and two-way passage, control of pictograms, or setting the time for passage.

The integrated control unit also enables the connection of all types of reading devices. The turnstile in the basic design can be supplemented with the required functionalities, such as an external control panel, an access control system, a foldable anti-panic arm, and a passage counter. [7] [8]



Fig. 4
Rotary turnstile [7]

The proposals for security measures lead to a strengthening of the security level and take into account the current state of the stadium. From the point of view of procedural aspects of security, it is mainly about the activities carried out by security agency workers, their thorough training, and their familiarization with the key elements of the reference object. From the technical aspects, there is a physical transformation of the stadium, and the operation and process aspects are also affected. The main criterion for procedural and technical security is to strengthen the level of security by changing the existing procedure. [9]

Conclusion

This article discusses the security of the football stadium in Brno. Security was evaluated from the point of view of process aspects and technical aspects. In both cases, gaps were found and improvements were suggested after the FMEA analysis with the result of the highest threat in the form of pyrotechnics release, weapon release, and grandstand collapse.

The proposed recommendations leading to the strengthening of the security level take into account the current state of the stadium. The greatest added value would be to strengthen the technical aspects of football stadium protection. Specifically, it would be a biometric reader that could recognize in advance persons who would not be welcome in the reference object. For example, this would be people who have historically had problems with the law. Thanks to the

biometric reader, these persons would not have the opportunity to enter the premises and the work of physical security would be facilitated.

Another security measure is a rotating turnstile, which would greatly facilitate the work of physical security. In particular, a rotary turnstile for ticket systems would be chosen, which can quickly process data from visitors' tickets, thus avoiding the formation of queues in front of the stadium area. The most ideal version would be a combination of all the proposed security supports. Future work could consist of real-world testing of security features and monitoring of crowd behavior and verifying proposals for increasing safety in real.

This contribution was made with the support of the grant project IGA/FAI/2023/002 and European Structural and Investment Funds, Operational Programme Research, Development and Education under the project The Development of Capacity for Research and Development of TBU in Zlín, reg. no. CZ.02.2.69/0.0/0.0/16_028/000624.

Literature

- [1] City football stadium SRBSKÁ [online]. 5/9/2017 [cit. 2022-10-18]. Available from: <https://www.fczbrno.cz/zobraz.asp?t=klub-stadion->
- [2] Municipal football stadium Srbská [online]. [cit. 2022-10-14]. Available from: <https://www.ticketlive.cz/cs/venue/mestsky-fotbalovy-stadion-srbska>
- [3] QUIET, Sweetie. *Risk control: analysis and management*. Prague: CH Beck, 2006. Beck's edition of economics. ISBN 80-7179-415-5.
- [4] Visiting regulations [online]. [cit. 2022-10-15]. Available from: <https://www.fczbrno.cz/zobraz.asp?t=klub-stadion-navstevni-rad>
- [5] How about Serbia? [online]. [cit. 2022-10-15]. Available from: <https://www.fczbrno.cz/zobraz.asp?t=klub-stadion-planek-stadionu>
- [6] Brno City Police [online]. [cit. 2022-10-21]. Available from: <https://www.mpb.cz/kamerovy-system/>
- [7] TRIPOD M22 [online]. [cit. 2022-10-01]. Available from: <https://magtrade.cz/turnikety-89k/tripodove-turnikety-97k/tripod-m22-202/>
- [8] MRÁZKOVÁ (ĎURICOVÁ), Lucia, Dora LAPKOVÁ a Martin HROMADA. Hodnotenie stavu bezpečnosti mäkkých cieľov. *The Science for Population Protection*. 2019, vol. 11, č. 2, s. 87–95. ISSN 1803-568X.
- [9] McENTIRE, DA. Introduction to homeland security: understanding terrorism with an emergency management perspective. USA, 2009, s. 1–335.