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Assessing Fire Safety in Sports Halls: An Investigation from Samsun

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Abstract: Sport is essential in terms of physical health. For this reason, sports halls are one of the most important places for a life intertwined with sports. Together with its own sports halls, Turkey is one of the countries that understand the importance of sports. Beyond that, sports, along with their benefits, contains many risks. These risks may be caused by personal injuries and disabilities and equipment, materials, and physical space. There are measures to be taken due to the importance of sports halls, which are insufficient numbers to meet the needs of the sport in Turkey. One of the leading measures is against fire. Precautions to be taken against fire in sports halls are extremely important for athletes and spectators due to many people's physical structure and building. Fire is an event that occurs suddenly and is a danger that can seriously harm life and property. Fire safety is all of the measures taken to prevent and reduce fire to avoid the loss of life and property and to minimize the loss when it reveals. In addition, these precautions taken against fire from the design stage to the usage stage enable the users in the fire environment to move away from there quickly. Despite the importance of sports halls, unfortunately, Turkey has no clear statistical information regarding fires in sports halls and their causes. However, some historical data is vital in terms of measures to be taken against fire. It is considered essential to investigate and analyze fire safety and possible fire hazards in sports halls in this context. In this study, a sample sports hall is examined in the context of fire safety. Due to the importance of fire hazards, precautions to be taken against fire in the building are emphasized, and various suggestions are made.

Keywords: Sports, Sports Hall, Fire Safety

Introduction

The time to be devoted to rest and entertainment, which arises due to the fast living habit in today's conditions, is necessary for physically and mentally healthy individuals (Timur et al., 2011). Sports halls are among the most important places for a healthy life and a life intertwined with sports. Sports fields are open and closed spaces with athletics, swimming pools, tennis, volleyball, basketball, and football that meet the sport of people of all ages. Besides, urban and natural areas are also used for sports activities. In addition, sports halls include the purpose of creating an athlete infrastructure as well as meeting individual sports needs (Gençlik ve Spor Bakanlığı, 2019a).

The Ministry of Youth and Sports carries out stadiums, swimming pools, football fields, sports halls, athletics tracks, and similar sports facilities throughout the country and the maintenance, repair, and modernization of existing facilities. In addition, The Ministry builds sports facilities to be used in various international sports organizations it undertakes (Gençlik ve Spor Bakanlığı, 2020). In the 2019-2023 Strategic Plan of the Sports Services General Directorate affiliated to the Ministry, it is stated that there are 3567 sports halls in the current situation. In addition, it is mentioned that it is aimed to increase to 3863 in total, adding 48 of them in 2019, 80 in 2020, 65 in 2021, 50 in 2022, and 53 in 2023 (Gençlik ve Spor Bakanlığı, 2019b). Based on these data, it is seen that the presence of sports halls is sufficient for Turkey. The fact that sports are an element that entertains society and is the basis of a healthy life enables sports to reach the masses. As a result, participation in sports for entertainment and health increases day by day (Denizci, 2019). In addition, regardless of the establishment purpose and characteristics of sports facilities, certain general principles should be followed in the architectural

design. Ergonomic approaches, the comfort of use, health and safety principles should be considered for the human factor that will use the spaces (Karel, 2011).

There are some measures to be taken due to the importance of the sports halls, which are insufficient to meet Turkey's sports needs. One of the leading measures is against fire. Precautions to be taken against fire in sports halls are extremely important for athletes and spectators. It is a building with collective use. Unfortunately, Turkey has no ready-made statistical data regarding fires in sports halls. However, some historical data is vital in terms of precautions to be taken against fire.

Fire is an event that occurs suddenly and is a danger that can seriously harm life and property. At the same time, although there is a risk of fire in buildings, it is a precautionary phenomenon to prevent its onset and to minimize the damage (Şimşek & Çatıkkaş, 2020). Fire safety is all of the measures taken against fire to prevent and reduce fire to prevent loss of life and property and minimize the loss. In addition, measures are taken against fire to ensure that the users in the environment move away from the environment quickly. These measures against fire can be taken from the design stage to the usage stage. In this respect, the study aims at examining Mustafa Dağıstanlı Sports Hall, adjacent to Ondokuz Mayıs University Fine Arts Campus, in the context of fire safety, and drawing attention to the issue due to the importance of fire hazard.

Research Area

Within the scope of this study, Mustafa Dağıstanlı Sports Hall, located next to Ondokuz Mayıs University Fine Arts Campus, is analyzed in the context of fire safety. The Sports Hall is located within the borders of Samsun province, İlkadım district and takes its name from the Olympic and world champion freestyle wrestler Mustafa Dağıstanlı. Figure 1 shows its location and immediate surroundings.

Figure 1. Location of the building (Source: Google maps)

The sports hall is located near Atatürk Boulevard, one of the leading transportation roads, and Adnan Menderes Boulevard in Samsun. The building entrance and its surroundings, which are not affected by heavy traffic, generally do not encounter parking problems during the day except for sports competitions. Since it is in a central area, it is possible to reach the hall by different means of transportation such as tram, bus or minibus. Athletes who come to the hall with their parents provide transportation by private vehicle. There are no problems in terms of ambulance and fire brigade transportation.

The main entrance of the sports hall was built from the east, considering Adnan Menderes Boulevard. In addition, there is an entrance to the building from the west and north directions, and internal and external stairs can provide transportation between floors. The ground floor level is kept lower than Adnan Menderes

Boulevard, and the stair steps and ramps at the entrance are used to reach the ground level. Figure 2 shows the facades and entrances of the hall.

Figure 2. Entrances of the building (Source: Google maps)

Mustafa Dağıstanlı Sports Hall was opened in June 2013. The hall has three floors and has a spectator capacity of 2000 people. Except for pandemic conditions, it is possible to do sports in the hall every day of the week. There are basketball, volleyball, shooting, judo, taekwondo, karate, kickboxing, kung fu, muaythai, boxing, wrestling, fencing, table tennis, weightlifting, badminton, chess, goalball, wheelchair, basketball branches in the hall (Mustafa Dağıstanlı Spor Salonu, 2021b). There are free sports opportunities in these sports branches, but people who want to do sports must obtain a medical report and a license.

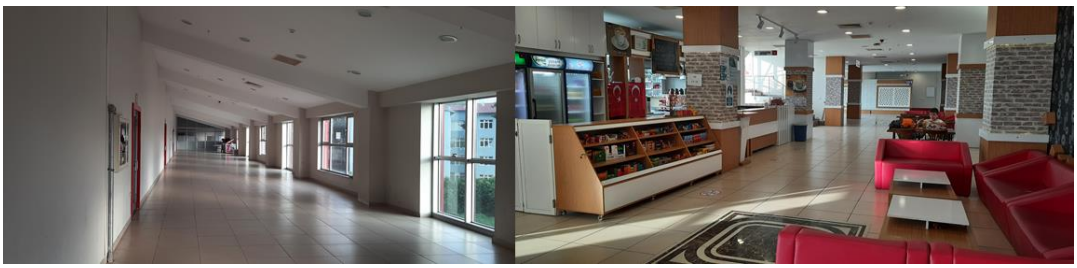

Figure 3. Some views from the interior volume (Source: personal archives)

Figure 3 shows some images from the interior volume of the hall. There is a canteen for athletes and spectators. The canteen service is located on the top floor, taking into account the number of spectators coming to the basketball court. Other athletes who want to benefit from the canteen service have to reach the service from other floors. The basketball court area, which constitutes the largest area of the sports hall and hosts other organizations such as national celebrations and various concerts, is covered with a steel roof that crosses a long distance. The structural system was built as a reinforced concrete carcass. Figure 4 contains images from the basketball court.

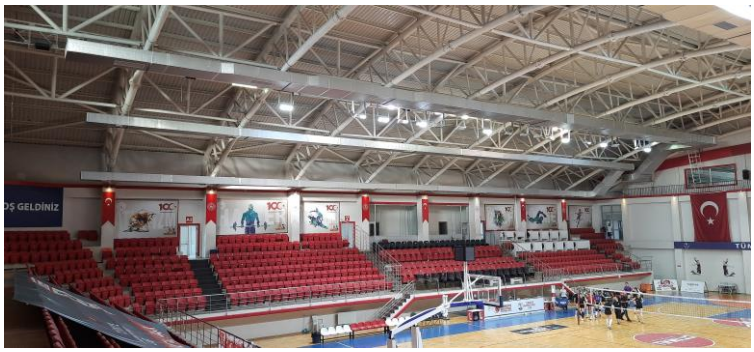

Figure 4. The basketball court (Source: Personal archives)

Within the scope of this study, various investigations have been made in the context of the measures taken against a fire that will occur in terms of athletes and spectators using the building, and the subject is tried to be analyzed in-depth within the scope of the findings.

Findings

In this study, Mustafa Dağıstanlı Sports Hall Building is examined within the framework of fire safety. Much progress has been made on fire safety in developed countries, but the history of fire protection measures in Turkey is very recent. In Turkey, The Regulation on the Protection of Buildings from Fire (BYKHY) entered into force in 2002 (Bodur, 2020). The examinations and analyzes carried out in this study within the scope of the regulation are detailed below.

The usage classes of the buildings are explained in the third part of the regulation. Accordingly, the sports hall included in the research is in buildings for collective use in the regulation. In addition, the hazard classes of the buildings are also specified in the regulation. However, there is no precise regulation about which type of danger class open and closed sports areas fall into. On the other hand, considering that other meeting areas such as museums, cinemas, theaters, concert halls are in the middle danger class, it can be stated that open and closed sports halls are also in the middle danger class.

Figure 5. Site plan (Source: Google maps)

When the location and site plan of the hall is examined, it is seen that there are no problems in terms of transportation and access. The layout plan of the sports hall is shown in Figure 5. Access to the hall located adjacent to the Fine Arts Campus is accessible from the coastal road (Adnan Menderes Boulevard) and Atatürk Boulevard. It will be straightforward for the fire brigade to reach the building during a fire, and this situation is considered positive regarding fire safety.

In the Regulation (Article 22), it is stated that "The horizontal distance from the last point where fire trucks can approach to any point on the exterior of the building can be 45 m at most". This provision could be provided for the building. As shown in Figure 5, fire trucks can access it from every facade of the building in case of a fire. In addition, there are hydrants on both sides of the building entrance for the fire brigade to use. Figure 6 shows the location of the hydrants.

Figure 6. Fire hydrants (Source: Personal archives)

Figure 7 shows the 1st-floor plan of the sports hall. As shown in Figure 7, the building's structural system is reinforced concrete, and the roof is covered with steel material. The fire resistance of the carrier system is evaluated by its load-carrying capacity, integrity, and insulation (Regulation, Article 23).

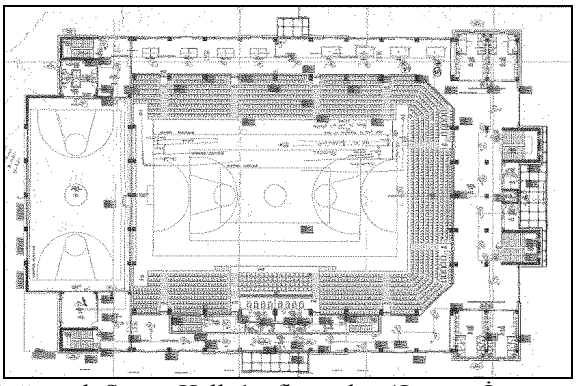

Figure 7. Mustafa Dağıstanlı Sports Hall, 1st floor plan (Source: İremnur Öztürk et al., 2020)

The primary purpose here is to evacuate people from the area in a sufficient period during the fire. For this to happen, the reinforced concrete and steel bearing system must be designed to remain stable. Provided that other standards and regulations are complied with, according to the BYKHY regulation, it is considered sufficient to insulate the steel elements in a temperature not exceeding 540ºC. It can be stated that the selected building was designed in terms of the structural system to allow people to evacuate from the area in case of a fire.

There are no fire compartments in the building. The criteria for fire compartments are given in article 24 of the regulation. According to this article, it is stated that "For non-residential buildings with a building height of more than 21.50 m and in residential buildings with a building height of more than 30.50 m, a maximum of three floors are arranged as a fire compartment". For this reason, it is not necessary to build a fire compartment in the sports hall, which does not pose a problem in terms of fire safety for the building. In addition, the regulation states that firewalls are built to separate adjacent regular structures from each other. Mustafa Dağıstanlı Sports Hall does not have an adjacent regular structure; therefore, firewalls were not required. In the fire regulation, it is stated that

1. all floors must be firewall nature,
2. The material interposed in gear floors should be the least hardly flammable,
3. The floor coverings should be covered with a screed layer of at least 2 cm thickness if normal flammable and if easily flammable heat insulation is applied.

When the building is evaluated, it seems complicated to say that an adequate and effective measure was taken against fire. In Figure 8, the floor coverings of the wrestling, weightlifting, taekwondo, and table tennis halls are shown, respectively. As seen in the figure, some halls have rubber-based flooring. Accordingly, it does not seem very easy to say that the floor coverings meet the regulation requirements.

Figure 8. Floor coverings of some training halls (Source: Personal archives)

The materials used in exterior facades are in A1 class and do not contribute to burning during a fire, as shown in Figure 9. It can be accepted that there will not be a problem in terms of fire safety, as the regulation accepts that these materials provide all the specified features sufficiently.

Article 28 of the regulation is about the measures to be taken against fire in the construction of roofs. The roof of the sports hall has a steel structure. In case of fire, it may be possible for the roof covering to form flame

drops, move to the neighboring roof in case of fire, and spread the fire under and inside the roof. This rule is not the case in terms of the selected building.

Figure 9.View from the building facade (Source: Personal archives)

What should be for construction materials is dealt with within the scope of Article 29. In the context of fire safety, it is not allowed to use easily flammable building materials in construction, except when converting into a regular flammable material in a composite. It is reported that structures with more than 100 people are made of the least hardly flammable material. In some training halls in the building, the flammability of the materials on the walls stands out as a factor that reduces the resistance to fire. Figure 10 shows images from some training halls.

Figure 10. Images from some training halls (Source: Personal archives)

Escape security principles are specified in Article 30. Escape safety is designed to enable people to move away quickly from the environment in emergencies such as fires. According to the regulation, escape measures should not be considered individually. They should protect people from the dangers arising from heat, smoke, and panic. They should have a suitable environment for all users to escape, and each exit should be visible. There are necessary directions for escape routes in the sports hall, but the corridors and stairs used for escape are the same as those used daily. In addition, Article 30 states that "… any gate or road leading to an exit that does not have an exit characteristic shall be arranged or marked so as not to be confused with the actual exit…". If this provision is not followed, the user will likely turn towards the building and other floors rather than the exit. Not all stairs in this building are fireproof, and this situation is not considered appropriate in terms of fire safety.

Article 31 explains the scope of escape routes. In the regulation, *escape routes* are defined as the whole of the continuous and unobstructed road from any point of a building to the street at ground level. Escape routes include exits from rooms and other independent spaces, corridors and similar passageways on each floor, floor exits, stairs reaching the ground floor, roads leading from the stairwells to the last exit of the building on the same floor, and the final exit. However, elevators are not included in escape routes. However, the exit capacity and escape distance are covered under article 32. According to the article, the building exit and capacities are designed sufficient in the Mustafa Dağıstanlı Sports Hall. Figure 11 shows an escape route in the building.

According to the regulation (article 33), the number and width of the escape routes cannot be less than the value found by multiplying the total number of users in the usage areas on a floor by the number of people passing through the unit width by 0.5 m. Accordingly, the user load coefficient in the hall should be three m² / person, and the escape route width should not be less than 150 cm. It can be stated that the number and width of escape routes are sufficient in Mustafa Dağıstanlı Sports Hall. In the 34th article of the regulation, the standards of fire

safety halls should be explained. Unfortunately, there are no fire safety halls in the building. With the emergency elevator, it is mandatory to build a fire safety hall in front of the escape ladder in buildings with a building height of more than 51.50 m. Since the building height of the sports hall is less than 51.50 m, there was no need for fire safety halls in the building.

Figure 11. View from an escape route (Source: Personal archives)

According to Article 35, as long as the building is in use, the obligatory exits should be easily accessible, the doors can be opened, and there should be no obstacles in front of them. In this respect, there is no problem in the building. The doors can be opened, and there are no obstructions in front of them. There are no protected internal escape corridors and passages (although specified in article 36) in the building. This situation is not favorable in terms of fire. External escape passages specified in Article 37 are not available in the building. However, this situation does not create a negative situation for the building in terms of fire safety.

Information on escape ladders is described in Article 38. According to the regulation, the standard stairs of the building that can be used in case of fire and other emergencies are accepted as escape stairs. Escape ladders are part of the whole of escape routes used in fire and other emergency evacuation and cannot be designed independently from other escape routes. When evaluated from this point of view, there are no stairs in the building that can be described as escape stairs. According to Article 39, in all structures, unless otherwise specified, at least two exits must be established, and the exits must be protected and as far from each other as possible. In this respect, the building appears to meet the requirements.

According to Article 40 of the Regulation, no matter where the fire occurs, escape routes and escape stairs must be positioned as alternatives to each other in order to ensure the exit of all people at that level. Escape routes and escape ladders must not be built side by side, and the location of the staircase nests should be chosen to facilitate the safe escape of the people in the building. In basements and high buildings, escape stairs must be entered through a fire safety hall or a protected hall. When evaluated from this point of view, it can be stated that the stairs in the examined building were designed to be alternatives to each other. However, they were not made conservatively, and no special precautions were taken, and this situation is not suitable for fire safety.

The features of the escape ladder are specified in Article 41. It is impossible to talk about a protected staircase in the form of an escape ladder in the building. Fire safety in the building is found to be negative in this respect. External escape stairs are dealt with in article 42, circular stairs in article 43, and escape ramps in article 44. There are no external escape stairs, circular stairs, and escape ramps in the building.

In Article 45, the essential features of escape ladder ventilation are specified. In Article 46, the conditions of the basement floor escape stairs are explained. According to this article, in case of an emergency, the ground-level platform of the staircase should be separated from the basement staircase by a door or similar physical obstacle, or an appropriate direction should be made. In the sports hall, regular stairs go down to the basement floor, but there is no proper orientation in the building. According to article 47 of the regulation, escape route doors must be at least 80 cm and have no thresholds. Besides, revolving doors and turnstiles cannot be used as exit doors. The building does not have a revolving door, and the door widths are sufficient.

Special regulations for buildings intended for collective use are explained in Article 51 of the Regulation. However, the article contains explanations for theaters, cinemas, auditoriums, concert halls, and no specific explanation for sports halls. In the "Building Sections and Facilities" section of the regulation, the measures to be taken for the parts of the buildings such as boiler rooms, fuel tanks, stoves and chimneys, shelters, parking lots, kitchens, roofs, elevators, lightning protection installations, transformers, and generators are shown. Adequate measures for these areas were taken in the examined building.

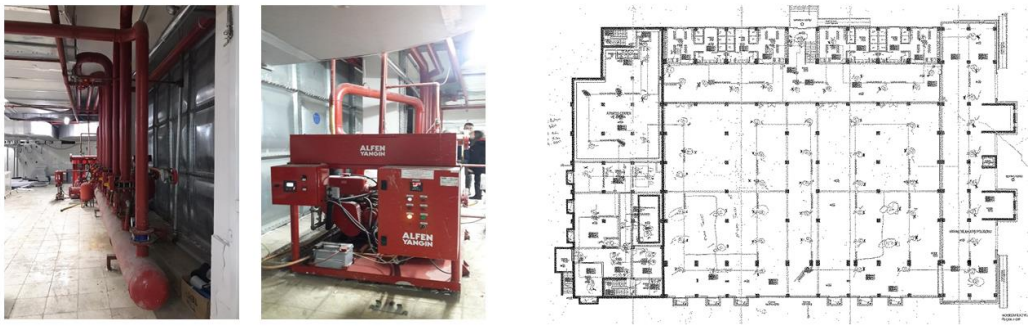

Figure 12. Fire extinguishing system and detection plan (Source: İremnur Öztürk et al., 2020)

Figure 12 shows the fire alarm and extinguishing systems in the building. As seen in Figure 12, there is also a fire detection system in the building. The detection system is directly related to the alarm and extinguishing system (the building has a sprinkler system) and is automatically activated in the event of a fire.

Evaluation and Conclusion

This study was planned to examine the Mustafa Dağıstanlı Sports Hall within the fire legislation framework and suggest the subject. The sports hall has a collective use. In the 15th article of BYKHY Regulation, a building for collective usage refers to all buildings or parts used for this purpose, where 50 or more people can come together for reasons such as ceremony, worship, entertainment, eating, drinking, transportation, and vehicle waiting. Hence, The fact that the number of users and their characteristics are variable and high in sports halls increases the importance of the measures to be taken against fire. For this reason, passive measures such as escape ladders, compartments, and active systems such as detection, warning, and guidance systems must be considered together against fire.

In buildings such as sports halls, due to the high number of users and why the users do not know the building sufficiently, the exit places and access routes to the escape stairs should be clearly described with direction signs and made visible with illuminated signs. These measures are of vital importance in terms of life and property safety. It is observed that in the sports hall examined within the scope of the study, the necessary conditions are met in terms of the absence of an adjacent regular structure, the access of fire trucks to the building, the fire evacuation plan, the sprinkler system, and the presence of directional signs. The most critical deficiencies in the measures taken within the fire safety framework in the building can be stated as the unsuitability of escape stairs and the possibility of the materials used in the flooring of some halls to release toxic gas during a fire. For this reason, measures for escape routes and stairs of sports halls should be put forward at the design stage. Considering the spread of smoke in the building, materials that will produce toxic smoke pose a significant risk. Minimizing the use of such materials would be appropriate in terms of fire safety. In addition, to prevent the fire from spreading to other areas, it is necessary to take measures such as a suitable compartment to prevent the spread of smoke between the sections or smoke screening.

It is essential for passive fire safety precautions that the sport hall managers know the fire hazard. Sports hall management and employees should be given training at regular intervals; drills should be made. It should be ensured that they are cautious against the situations that may arise during the fire. In the event of a fire, daily sports activities will be affected, and athletes and spectators. For this reason, it is crucial to train the personnel in terms of fire and control active and passive fire precautions.

People using sports halls must protect themselves in the event of a fire and leave the building safely. The measures not taken against fire will have severe consequences for the users. For this reason, every precaution must be taken against fire in buildings such as sports halls. One of the most important of those is the measures to prevent the outbreak of fire. In conclusion, one of the most critical ways of not putting users at risk in sports halls is through fire-fighting measures.

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Scientific Ethics Declaration

The author declares that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the author.

References

Binaların Yangından Korunması Hakkında Yönetmelik (2007, November). Resmi Gazete (Sayı: 26735). Access address: https://www.resmigazete.gov.tr/eskiler/2007/12/20071219-2.htm

Bodur, A. (2020). A Research in Buildings in the Meaning of Fire Safety: The Case of Samsun. *Disaster Science and Engineering*, 6(2020), 16-26.

Denizci, T. (2019). *Spor yaralanmalarında spor tesislerinin risk oluşturan kaynak, olay ve etki ilişkisinin incelenmesi (Investigation of the source, event and impact relationship that constitute the risk of sports facilities in sports injuries).* (Unpublished master dissertation). Institute of Health Sciences Department of Physical Education and Sports, Hitit University, Corum, Turkey.

Gençlik ve Spor Bakanlığı. (2019a, July). 2019 yılı kurumsal mali durum ve beklenti raporu. Strateji Geliştirme Başkanlığı. Retrieved from https://gsb.gov.tr/public/edit/files/strateji/2019_mali_durum_ve_beklentiler_raporu.pdf.

Gençlik ve Spor Bakanlığı. (2019b). Stratejik plan 2019–2023. Strateji Geliştirme Başkanlığı. Retrieved from https://gsb.gov.tr/public/edit/files/strateji/2019-2023-Stratejik-Plan%C4%B1.pdf

Gençlik ve Spor Bakanlığı. (2020, July). Kurumsal mali durum ve beklentiler raporu. Strateji Geliştirme Başkanlığı. Retrieved from https://gsb.gov.tr/Public/Edit/images/GSB/Kurumsal%20Mali%20Durum%20ve%20Beklentiler%20Raporu-Bask%C4%B1.pdf

Karel, T. (2011). *İstanbul'daki stadyumların ve kapalı spor salonlarının fonksiyonel işletimleri (The functional operation of the stadiums and indoor facilities in Istanbul).* (Unpublished master dissertation). Institute of Social Sciences Sports Management Master Program, Bahcesehir University, Istanbul, Turkey.

Şimşek, Z. & Çatıkkaş, M. (2020). Toplanma amaçlı yapılarda yangın güvenliği: Bir üniversite kampüsünde kültür merkezi örneği. *Journal of Social and Humanities Sciences Research*, 7(55), 1772-1785.

Timur, U, Timur, Ö, Şahin, C, Dağıstanlıoğlu, C, Çalt, Ö, Pektaş, O. (2011). Çankırı kenti spor alanlarının yeterliliği üzerine bir araştırma (A research on efficiency of sport areas in çankırı city). *Tekirdağ Ziraat Fakültesi Dergisi*, 8 (1) , 81-91. Retrieved from https://dergipark.org.tr/tr/pub/jotaf/issue/19043/201420

Url-1. Mustafa Dağıstanlı Spor Salonu. (2021a). Google Maps. Retrieved from https://www.google.com/maps/place/Kalkanc%C4%B1,+Atat%C3%BCrk+Blv.,+55100+%C4%B0lkad%C4%B1m%2FSamsun/@41.32407,36.3129433,17z/data=!4m12!1m6!3m5!1s0x408879cf873d9309:0x9760fd8b21c357c5!2zTXVzdGFmYSBEYcSfxLFzdGFubMSxIFNwb3IgU2Fsb251IMSwbGthZMSxbQ!8m2!3d41.323973!4d36.3151761!3m4!1s0x408879cf9ac16dbf:0x689c007dda24158d!8m2!3d41.3242096!4d36.3147081

Url-2. Mustafa Dağıstanlı Spor Salonu. (2021b). Mustafa Dağıstanlı Spor Salonu. Retrieved from http://www.sporkentisamsun.com/mustafa-dagistanli/

Url-3. Mustafa Dağıstanlı Spor Salonu. (2021c). Mustafa Dağıstanlı Spor Salonu. Retrieved from https://yandex.com.tr/harita/103833/samsun/?l=sat%2Cskl&ll=36.315147%2C41.323471&z=17

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