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Operational plan for responding to and rescuing works of art in the event of a fire: a case study for the Sacred Art Collection in **Trogir, Croatia**

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Objective: To develop a model of an operational plan for rescuing cultural heritage on the example of the Sacred Art Collection in the city of Trogir, Croatia.

Methods: We assessed the situation in the Sacred Art Collection, evaluated the existing safety measures, estimated the value of artifacts, made prioritization by value, measured each artifact, and developed grab sheets.

Results: We produced an operational plan containing the general facility information, interior and exterior contacts' list, the evacuation of people procedure, risk assessment, floor plans, list of priority artifacts, management structure, artifact evacuation procedure, triage room location, temporary storage areas, and grab sheets.

Conclusion: The specific measurement for responding to and rescuing work of art in case of fire should be separate for each heritage micro and macro site in the historical cities. These measures differ from other similar measures because they take into consideration the material and non-material value of a work of art, which differ from case to case

Keywords: cultural heritage; policy; urban planning; safety; firefighting; disaster prevention



Introduction

Managing fire outbreaks within urban areas has been a complex problem throughout history. There is almost no city center that has not been ravaged by at least one catastrophic fire in its history, a fire that changed its landscape or that of its suburbs. To name just a few examples: the Great Fire of Rome in 64 (Walsh, 2019), the Great Fire of London in 1666 (Hanson, 1989), or the Great Chicago Fire in 1871 (Skarbek, 2014). In Croatia, a devastating fire in Dubrovnik occurred in 1296 (Statut grada Dubrovnika: sastavljen godine 1272, 2002) and in Varaždin in 1776 (Petrić, 2009). In the City of Trogir in Dalmatia, historians recorded a great fire in 1443 (Andreis & Rismondo, 1977). In fact, it was after the fire in 1898, in which the church of The Holy Spirit and numerous other assets of this rich Trogir Brotherhood were lost, when activities were undertaken for the establishment of the first voluntary fire brigade (Buble, 2013). In the last 15 years (2007–2022) there were 48 fires in heritage buildings in the historic center of Trogir, with as many as 4 fatalities (Dobrovoljno vatrogasno društvo "Trogir", 2007–2022; Javna vatrogasna postrojba Grada Trogira, 2019–2022).

Most European historical urban centers have a higher fire risk compared to modern cities for many reasons (Granda & Ferreira, 2019). First, they were built with the use of traditional materials and building methods and without preventive fire protection measures. Second, historic cities raised on Greek and Roman plans or founded as medieval settlements (Suić, 1976) are densely built up, resulting in houses with shared roof structures and separating walls. In addition to that, narrow and often irregularly shaped streets hinder intervention access and operational work of fire engines, making resident evacuation difficult as well (Alfa Atest, 2023). Although in Dalmatia, where the building material is mainly stone, the interiors, such as floors and roofs, are made of timber, and the partition walls, staircases, and shutters are also all made of wood, which makes these buildings have a high fire load. Also, many of these buildings still hold historic wooden furniture, and valuable private and public collections of artifacts, books, and archives (Jović Gazić, 2011). The Historic Urban Area of the City of Trogir is also a nationally protected cultural property (Ministarstvo kulture i medija, 2011; Buble & Popović, 2022b), and the Historic City of Trogir, enlisted on the UNESCO World Heritage List in 1997 (UNESCO World Heritage Centre, n.d.) due to its outstanding universal value, i. e. urban continuity that dates to the 3rd century BC, is no exemption. Its ancient matrix, which is preserved both in the grid of today's historical core, but also in the archaeological layers of public and private, open, and closed spaces, was enriched in later historical-artistic periods with individual secular and sacred buildings, as well as art and craft objects, some of which today have national significance.

The Croatian City of Trogir is in central Dalmatia, 25 km west of Split, within the Split-Dalmatia County. It has an area of 34.88 km² and, compared to other local self-government units of Split-Dalmatia County, is one of the smallest in size. At the same time, in terms of population density, it is one of the most densely populated (Alfa Atest, 2023).

In addition to urban and building factors, fire risk in Trogir, is further heightened by low maintenance of private houses, outdated electrical supply system with above-ground supply hubs, the poor state of interior electrical installations, a high number of chimneys



without basic maintenance, and an increased number of open-fire kitchens of restaurants opened during the tourist season.

Although there are several studies and documents that study protection in cultural heritage sites, many of them are based only on threat response or only on management response, while some of them are hybrid (Ferraro & Henderson, 2011). These plans are mainly focused on the responses of the staff in the institution in question. The major issue for implementing such practice in Croatia was that there are no guidelines or field practice in this subject. Another aggravating factor was that cultural heritage institutions in Trogir do not have employed personnel in these locations. Instead, they have only a parish-church administrator who is not an expert in any of the concerned fields (cultural heritage, conservation, protection, fire safety). During an exhibition's open hours, the temporary workers are employed (usually via a student's contract) and they are not obligated to have any training in the named fields. Finally, neither the firemen nor the conservators involved in the development of this plan had previously evaluated cultural heritage in terms of prioritizing objects for salvage, making the involvement of the community, both the town's civil protection sector professionals and the citizens, in the process even more valuable. In these cases, there is a necessity to develop a hybrid model where first responders take over the roles of complete salvage and rescue operations, without a necessity of any other jurisdiction.

This is why the approach to the creation of the plan for responding to and rescuing works of art in case of fire was twofold: to serve as a practical tool in case of an emergency for a specific location in Trogir and at the same time, as well as a model for its systematic implementation in other heritage places across Croatia since the practice of non-staff-based heritage sites is common in Croatia.

Methods

Study on best practices in implementation of response and rescue plan for cultural heritage collection

The study on creating and implementing a response and rescue plan for the Parish house building included a search of the databases of relevant institutions regarding fire risk mitigation on heritage. The database published on the pages of Historic England (2021), the London Fire Brigade (n.d.), and the Swedish National Heritage Board (Riksantikvarieämbetet, 2019) were taken as the most relevant. Published guidelines, manuals, and toolkits on saving cultural heritage in times of crisis were researched, primarily those published by the International Centre for the Study of the Preservation and Restoration of Cultural Property – ICCROM (ICCROM, n.d.). Finally, two Croatian sources on the topic were used: the manual and guidelines on how to evacuate artifacts in case of an earthquake, issued by the Museum Documentation Center (Muzejski dokumentacijski centar, n.d.).

The initial phase of work established the structure of the response and salvage plan and showed what data needed to be collected next for the document to be complete.



On-site data collection

The next phase of data collection was done through fieldwork, checklists, observations, and interviews. Collected data included basic information about the location of the Collection, the list of contacts, and the phone numbers and names of personnel including their personal information.

A set of information regarding the building itself and artifacts was collected on the premises. The building was thoroughly inspected and analyzed in terms of access, evacuation routes, construction and other materials, flammable parts, existent fire prevention measures, etc. This data was used to assess the fire risk of the location. All these findings were then compared to the existing blueprints of the building, and the floor plans were corrected accordingly.

A priority list of artifacts was first produced by conservators, using the existing national database. It was then cross-checked regarding the criteria used in its making through interviews with the staff, owner, users, firemen, and the local community.

Measurements were taken for each artifact, their materials described, and their position in space, which was then marked on the floor plans.

The analysis of the documentation on firefighter interventions within the area of the old city center of Trogir was carried out in the archive of the Voluntary Firefighting Brigade of Trogir and the Public Fire Brigade of the city of Trogir. All this data was studied and organized through an interdisciplinary approach of firemen and conservators.

A scenario of a large fire taking place in Trogir was simulated in the initial phase of this research. This scenario exposed major points of vulnerability in ten locations with a high concentration of movable cultural heritage. These were: the City Museum, the Cathedral of St. Lawrence, the Collection of Sacred Art of St. Lawrence Parish, the church of St. John the Baptist, the "Kairos" collection of the Benedictine monastery, the collection of the Dominican Monastery, the church of St. Peter, the church of All Saints, the church of Our Lady of Carmel and the southern city gate or the so-called Sea Gate. Therefore, it was concluded that, apart from producing a comprehensive response plan for the entire historic center in case of a large incident, specific rescue plans were needed for each of the above-mentioned locations in case particular fires broke out in these locations (Buble & Popović, 2022b).

Setting a pilot project

The Collection of Sacred Art of the Parish of St. Lawrence was chosen as a pilot project for three main reasons. First, it was assessed as the most valuable collection within the Historic City of Trogir. Second, at the time of the preparation of the rescue plan, it contained only 18 artifacts. Third, during the earlier renovation of the building in which the collection was located, blueprints of the building were produced. This meant that a huge part of the initial work needed for the rescue plan to be executed had already been done (Buble & Popović, 2022b).

The concept of the Operational Plan for Responding to and Rescuing Works of Art in the Event of a Fire for the Sacred Art Collection in Trogir (in further text: Plan), rescue procedures and grab sheets were produced following the guidelines and templates published on



the Historic England (2021) and the London Fire Brigade (n.d.) websites. These included the name and inventory number, a photo representation of the artifact, its dimensions, and the number of people required to bring it out, with notes on how to safely remove and carry it. A single sheet with all the information also included a table for documenting any damage to the object that might occur during the rescue intervention.

Once the Plan (Buble & Popović, 2022a) was complete, it was tested in an advisory meeting in two phases: a tabletop discussion and a fire outbreak simulation on the site, involving all relevant stakeholders within the Historic City of Trogir.

Results

The structure of the plan

The Plan included the following seven sections: 1) information about the location where an incident may occur, 2) risk assessment, 3) priority list of artifacts and their placement, 4) persons responsible for the evacuation and salvage of artifacts, 5) equipment for evacuation and artifacts rescue, 6) places of evacuation and 7) actions of persons who will carry out artifact evacuation.

The Plan was structured in three separate but interconnected parts, in a logical order as it should be used in case of emergency. The main body of the document was supplemented by additional material to be used in case of an emergency.

The first part of the plan – basic information, evacuation procedures and risk assessment

This part was intended mainly for the Collection curators and personnel (partially also for rescue teams) and contained an introduction, general facility information, interior and exterior contact list, people evacuation procedure, and risk assessment.

Among some general information and definitions, the introduction contained information about Plan storage locations and the planned time of the document's revision. The other important documents contained facility information: the address, textual location description, location on the satellite map, and main contact for the building (**Figure 1**).

In addition to that, we made two separate contact lists. The first one contained internal information about all persons in the organization with specified home addresses, to estimate the employee's living distance from the facility and the possibility of fast arrival at the site. The second included the contacts of emergency services (firemen, police, ambulance) with local and emergency numbers and contacts of communal services for the electrical grid and water supply. We also included the evacuation procedures that contained a detailed plan for different scenarios depending on whether a person sees the outbreak or spreading of fire or some other dangerous situation or hears the fire alarm going off in the facility. Also, instructions for the persons who will leave the facilities last were given, along with some basic fire safety recommendations. The first part also included a fire risk assessment for the building, which was carried out using the most basic method of safe-





Figure 1. The city center of Trogir, the location of the Parish house building is marked in yellow (Buble & Popović, 2022a, reprinted with permission).

ty inspection. The assessment states the descriptions and considerations about possible improvements related to the contents of the collection, fire risk, flood risk, access to the building, water supply for extinguishing, fire partitioning, evacuation routes, fire alarm system, panic lighting, fire extinguishers, and evacuation exercises. The overall fire risk was characterized as "moderate", which means that further measures need to be undertaken to reduce it. The table of record for control for future assessments was also made.

The second part of the plan – infrastructure details and spatial location of artifacts

It was mainly intended for rescue services, and more detailed information about the location and the contents of the Collection were listed.

That includes data with special notes on the location of door keys, procedures for unlocking the facility, location of water shut-off place, place of disconnection of electrical energy, distance of external hydrants, and distance of the building from the fire station. The available entrances to the facility were marked on the maps with an attached photo. On the floor plan of the space (ground and first floor), relevant data, such as meeting place, access point, fire alarm control panel, manual fire alarm, fire extinguishers, etc., were marked. Also, the locations of the artifacts in the space were marked on the map. We also made a list of priority artifacts and their placement in space. A total of 18 objects were exhibited in the collection, and the priorities for rescue and evacuation were determined according to the following criteria: authorship, item age, uniqueness within the type, and degree of preservation. All level-one priority items were listed in the form of a catalog, complete with small photographs and layout plans showing the exact location of the item within the specific room (Figure 2). Also, for the purpose of recording damage and/or steps taken



during an incident, a table of the entire inventory was made with slots for remarks on possible damage, packaging, and placement within a designated temporary storage place.





The third part of the plan – evacuation and salvage procedures

In this part, the management structure of responsible persons, the procedure for the evacuation, locations of triage area and temporary storage areas, supporting documentation, and equipment inventory were listed and elaborated (**Figure 3**). This part of the Plan was intended for the joint operation of first responders, collection staff, and other external participants.

A diagram was used to visually represent the emergency management hierarchy, which included all the roles that, in an ideal case, would be necessary to systematically carry out the rescue operation.

Although standard operational plans usually do not provide detailed descriptions of roles and necessary actions, this part was nevertheless included as a short reminder to better familiarize the staff with the planned procedures, since the non-operational personnel are not trained to respond in emergencies.

The specificity of this Plan in comparison to the other similar plans is that it uses the capacities of the City of Trogir for emergency response. All the first responders have agreed



Buble & Popović



Figure 3. Management structure of the responsible personnel (Buble & Popović, 2022a, reprinted with permission).

to such responsibility distribution, and all the activities are planned according to the law. In a usual setting, the person in charge would be an institution manager. In our case, as there is no staff that has expertise in this field, the person in charge of rescue and salvage procedures is the firefighter commander. This person takes care of all the operations and coordinates the team in case of emergency.

Regarding the artifact evacuation action procedure, the Plan instructs the Public Fire Brigade of the City of Trogir to inform the responsible person for the Collection, the Trogir Police Station, and the Head of the Conservation Department. The process of evacuating the works of art begins at the discretion of the fire commander, in consultation with the responsible person and a conservator on site, based on an assessment of the condition of the building and the level of danger for the works of art in the Collection.

According to the Plan, the conservator on site assumes the role of the chief coordinator of art evacuation and continues to proceed according to the plan (**Figure 4**).





Figure 4. Procedures for art salvage in the parish House Building (Buble & Popović, 2022a, reprinted with permission).

The operating room within the facility was chosen as the location for the triage and packing of items, provided, of course, that it was not affected by the incident. The reasons for this are the accessibility of the room from the collection area itself, a separate exit for taking out objects, sufficient size, and a good possibility of securing the space.

We also anticipated three locations to act as temporary storage areas according to the criteria of the proximity to the facility, the size of the space, and the possibility of securing the items. The first location is at 60 meters; the second at 200 meters and should be used in case the first location is not available; and the third is located two km away, outside the historic center of the city, can be used in the event of a major emergency (**Figure 5**). The specificity of this plan, as the cultural institutions in question, are non-staff based is that the items are salvaged in the facilities belonging to the other institutions, for example, the fire brigade.





Figure 5. Temporary storage areas in the city of Trogir. Yellow – Parish house building; Blue – temporary storage areas (1 – St. Lawrence Cathedral; 2 – Atrium of the Town Museum; 3 – Firehouse). The locations of critical infrastructures: overground hydrant; underground hydrant, electrical substation; locked ramp) (Buble & Popović, 2022a, reprinted with permission).

The Plan envisages the vans of the police and the fire brigades to move the items. The obligation of insurance at temporary storage places is agreed upon by the responsible person of the collection in consultation with the responsible persons of the temporary storage facility and the police.

Since the second and third temporary storage places are owned by a different party, the Plan provided two simple legal documents, i.e., certificates of receipt of the artifacts. With their signature, the recipient confirms receipt and undertakes to store the art in a safe and adequate place, protected from damage or alienation, with the obligation to return it to the owner when they request it. The owner, on the other hand, undertakes to ensure the conditions for the return of the art at his own expense as soon as possible.

The final part of the Plan lists the necessary inventory of equipment and accessories, starting with personal protective clothing documentation accessories, packing accessories, and another miscellaneous inventory. Operationally, the most valuable part was the so-called grab sheets or rescue cards (**Figure 6** and **Figure 7**) that were created for each single artifact.



10. GRAB SHEETS



Figure 6. Grab sheet example for the Crucifix of St. Andrew Trogir (Buble & Popović, 2022a, reprinted with permission). Besides the photo of the crucifix, the instructions about the removal are shown on the grab sheet. Note: For the protection of this cultural heritage the special placement does not correspond to the actual situation.



Buble & Popović







Other attachments included a map of access to the facility by fire truck, a floor plan map of the operating room for organizing work in it, a map of the locations of temporary storage locations, and floor plans for all locations of storage locations.



The advisory meeting resulted in a clear insight into the Plan's strengths and weaknesses. As a downside, it was shown during the simulation that the incident management structure had to be simplified, and that additional training, real-time exercises, and simulations are required to improve coordination and communication. The most important positive side was that the firefighters, with the first use of the Plan and without prior knowledge of space, successfully located and retrieved the replicas of the artifacts.

Discussion

The proposed Plan is the first plan in the Republic of Croatia that was developed for cultural heritage salvage and protection. This was developed as a proof of concept for the City of Trogir. Upon its successful completion, additional plans will be developed for the whole City. Additionally, although similar plans exist, for example in the USA (Ferraro & Henderson, 2011), the UK (Historic England, 2021), and Sweden (Riksantikvarieämbetet, 2019), the specificity of this plan is that it had to be adapted to the local situation and institutions that do not have an employed staff as experts in any of the relevant field of expertise.

Cultural heritage is of utmost importance and receives special protection as stated in the Constitution of the Republic of Croatia (Hrvatski sabor, 2010). The primary concern for the protection of Croatian cultural heritage falls under the Ministry of Culture and Media and the conservation departments organized within its Directorate for Protection of Cultural Heritage (Ministarstvo kulture i medija, 2022). The services organized within the Ministry of Culture and Media and heritage professionals working in museums have significant experience in rescuing arts in times of crisis, gained in the Homeland War and in the earthquake of 2020 (Laszlo, 1992; Podgorski, 2021). This experience has been transferred into several manuals and guidelines (Laszlo, Perčinić Kavur, & Stublić, 2010; Vranešević, 2021). These manuals, as well as international ones, advise on creating documents that would define standard procedures in case of an incident, but very few heritage places have this document produced and implemented. Unfortunately, heritage buildings in the Republic of Croatia are classified in the lowest – fourth – category of priority salvage, for which fire risk assessments or operational plans are not a legal obligation. The classification of buildings into fire risk categories is carried out regarding the amount and type of flammable or explosive substances that are produced, stored, and/or processed, the purpose and area of the building and premises, and the number of employees. Buildings for public and business purposes that have rooms where 20 to 300 people can gather are placed in the lowest, fourth category (Ministarstvo unutarnjih poslova, 1994). This is why the approach to the creation of this Plan was twofold: it was to serve as a practical tool in case of an emergency for a specific location in Trogir, and at the same time, as a model for its systematic implementation in other heritage places across the country.

The specific, local rescue plan as described in this article increases the security of the heritage site in question and endows its staff with the potential of high-quality cooperation with members of the emergency services. The curators and other staff at a cultural heritage place can help ensure the firefighters understand priorities, objects' position in



space, their significance for the local community, and vulnerabilities that may be embedded in the material or construction of the artifacts. With all that information, firefighters' response, especially in terms of handling objects, is improved. From the fireman's standpoint, it must be kept in mind that any fire intervention at a cultural heritage institution would represent a complex operation, and moving and handling objects inside the building with high smoke levels while wearing protective equipment is much easier and faster when the rescuers are already familiar with the layout of the building. One of the most significant in a series of examples where such conditions did not exist is the fire in Notre Dame Cathedral in 2019, where 600 firefighters fought the flames for more than 12 hours which resulted in the destruction of one of the most iconic heritage buildings in the world (Ferreira, 2019).

This study pointed to the need for the cooperation of various professionals, as firefighters are not specially trained for cultural heritage salvation and the conservators should also be familiar with fire risk for heritage and risk reduction measures. The Operational Plan for Responding to and Rescuing Works of Art in the Event of a Fire for the Sacred Art Collection in Trogir created for the Sacred Art Collection helped to enhance understanding of the nature of fire risk for heritage, improved local firefighting operations, built location's resilience, reduced fire risk within the building and build strong interdepartmental cooperation. Also, it was shown that the issue of successfully implemented firefighting intervention on cultural assets is a much more complex topic and that it requires closer interdepartmental cooperation between the firefighting and cultural heritage conservation services. In an intervention on a heritage property, it is not only firefighting that is crucial but also the handling of art, which, if evacuated unprofessionally, can be additionally damaged. For that part of the operation, additional training is needed, with an interdisciplinary approach.

Some guidelines address the external and internal contact lists that include rescue and utility services as well as professional advisors for external and members of the organization for internal lists (Historic England, 2021; London Fire Brigade, n.d.; Riksantikvarieämbetet, 2019), and our operational plan adds the need for the involvement of heritage professionals. As each historic building is unique, each requires its own individual risk assessment and solutions to the various problems that may arise (Donnelly, 2020). Other specifics of our plan include the artifact rescue plans as a list of priority items and their exact locations in space. It is a list of the most valuable items on site, which allows their first removal, if possible, in an emergency, either by members of staff or the emergency services.

Prioritization, i.e., determining the value and ranking of each item within the collection, is a complex problem for managers and many are not sure how to determine the value and priorities. Certainly, when an object or collection is assessed in terms of its value, one should know which objects represent the greatest value and thus involve a working group or cultural heritage experts in the planning (Jernæs, 2021). The forms of priority lists can vary from a simple record of artifacts to one that lists in detail all the items kept on-site in the form of a catalog, with photographs and layout plans showing their placement within the rooms. Photographs of items and their location on the floor plan are of immense help



to emergency services and rescuers in their retrieval. Group lists of items by priority for emergency removal can also be used as a record list of salvaged goods (Donnelly, 2020).

Also, the plan should contain data on pre-planned triage locations and storage locations. The area for triage, the place where damaged items could be placed, taken care of, and packed in case of emergency relocation, must be determined in advance. It should be an easily accessible place as close as possible to the intervention site (but not compromised), and large enough to accommodate the moved items (Donnelly, 2020). Heritage professionals should keep in mind that in an incident there is often no time, resources, or ability to evacuate oversized or extremely heavy items such as statues or wall-sized oil paintings, etc. For such items, one should provide preventive measures on the site (Tandon, 2016).

A hasty or hurried relocation can further expose valuable cultural assets. That is why the decision should be made by an authorized person, according to the prescribed procedure, only if all the following conditions are met the threat to the cultural institution and collection is real, existing protection measures cannot prevent damage, the intended safe storage location is available, official authorization for evacuation and relocation of facilities must be secured. Finally, sufficient manpower and resources to carry out the relocation action should be determined, so that there is no immediate danger to the safety of the persons performing the intervention (Tandon, 2016).

Also, there are legal aspects of artwork rescue. This includes obtaining the necessary permits for the relocation of objects, as well as permits for temporary storage at a safe, precisely determined location. This document must be signed, along with other important information, such as item identification, date, time, and place (Tandon, 2018).

In our case, as the institution in question did not have staff that could be responsible for the salvage and protection, the leading role had to be taken by the fire-brigade commander, and the inclusion of other first responders had to be justified by legal regulations. The Civil protection law regulates the stakeholders of civil protection (Ministarstvo unutarnjih poslova, 2022), while the Law on firefighting regulates the firefighting system and organization (Hrvatska vatrogasna zajednica, 2019).

This rescue team should undergo theoretical and practical training and familiarization with the plan, as well as basic art handling as soon as the plan is produced before an incident occurs. Training should aim to ensure that team members act with confidence, without causing further damage, and with the ability to recognize when specialized technical assistance, such as conservation, is necessary. If possible, regular practical exercises should be conducted once a year (Donnelly, 2020).

In our case, a new approach to cooperation in development had to be considered. Professionals of both disciplines did not divide work so that parts of it fell into the frames of their respective fields. Instead, both sides first learned the basic principles of the other profession, so that a common ground of understanding of value, risk, hazards, object handling, etc., was formed. These were the foundations from which the plan was developed, until a point was reached where all points of view had been considered, considered, and decided. It was a process with an open end, since the plan needs to be revised regularly, and new staff trained as well.



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