



DAMAGE AND RISK ASSESSMENT

Report to promote risk-informed cultural heritage first aid actions in Ukraine









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Introduction

Almost a year into the ongoing Russia-Ukraine war, all types of heritage across Ukraine are at risk. Recognising the urgent need to protect and safeguard cultural heritage in Ukraine, ICCROM's First Aid and Resilience for Cultural Heritage in Times of Crisis Programme (FAR), in collaboration with the Ministry of Culture and Information Policy of Ukraine, Maidan Museum and Heritage Emergency Rescue Initiative (HERI) has trained on-the-ground teams to carry out a systematic on-site damage and risk assessment for all types of heritage, which is enabled by a mobile and web-based application. Hosted on a secure sever, the multi-lingual app has customized damage and risk assessment forms for movable, immovable and intangible heritage in Ukraine and can be used both online and offline.



This app has been used to collect damage and risk data at multiple sites in Ukraine. This report provides an analytical summary of the data collected at four heritage sites in Ukraine, with the aim to identify priorities for action, as well as estimate costs involved in providing first aid to the damaged heritage. Additionally, this preliminary report assesses the degree of damage at each site and identifies prevalent risks.

The on-site expeditions were led by teams of architects and engineers from the Maidan Museum and HERI. The data was analysed by ICCROM-FAR Team and external experts.

ICCROM-FAR's Emergency Response

Rapidly implemented post-event damage and risk assessments, whether conducted remotely or on-site, are integral to efficient emergency response for the protection of cultural heritage. A wide lens for collecting site-specific heritage-based damage and risk data, this step helps identify and prioritise actions, estimate the funds, resources and supplies needed, as well as enhance preparedness by mitigating immediate risks. ICCROM's First Aid and Resilience for Cultural Heritage in Times of Crisis (FAR) Programme specialises in this methodology and is experienced in helping governments to define priorities, estimate costs and recommend risk-informed interventions in the aftermath of large-scale emergencies.



Rapid needs assessments for cultural heritage; post event damage and risk assessments for all types of cultural heritage.

On-site training for volunteers, professionals and humanitarians to salvage and stabilize damaged heritage; and building capacity for planning as well as implementing post-disaster recovery operations at scale.



Setting up of inter-agency coordination mechanisms.

To this end, the Programme is seeking partners to use the damage and risk assessment application in different emergency contexts.

To seek technical advice and assistance, Member States can write to the FAR Programme at: <u>far programme@iccrom.org</u>





Damage and Risk Assessment Analysis Report

Ascension Church, Lukashivka



Name of the site	Ascension Church
Status of the site	Monument of local architectural value A one-story church located in the plain countryside and surrounded by some forest. Built-in 1913, the brick masonry is cross-domed with a central vault over the naos.
Current use of the site	Church
Owner/manager of the site	Church Community

PRIORITY OF INTERVENTION					
High	Medium		Low		

DEGREE OF DAMAGE					
Severe	Moderate	Minor			





Degree of damage

The primary cause of damage: Artillery fire

A short description of the overall damage

Moderate to severe structural and non-structural damage is observed. The historical flooring, roof and vault, as well as wall paintings, have been destroyed. The brick masonry around is chipped on all sides of the façade. All electrical wiring and devices are severely damaged and the collections in the church including wall paintings, frescos, lamps, iconostasis, etc. are burned down.

Damage to the exterior of the building

- The overall structure including the foundations, walls and columns is moderately damaged
- Deep cracks are observed on the northern and southern walls above the nave area and the central entrance. The façade on all sides is severely chipped.
- A large hole was punched in the vault of the central nave due to artillery shelling, leaving the interior structure exposed.
- The gabled roof and the dome above the bell tower have been destroyed.



Damage to the interior of the building

- Doors, windows and staircases have been severely damaged or completely destroyed. Electrical fixtures have been completely destroyed and are non-functional.
- All wall paintings on interior walls, iconostasis and other decorative elements such as lamps, chandeliers, etc. have been burned down or severely damaged. One icon on the wall has been partially preserved.
- Exterior decorations, cornices and carvings have suffered moderate damage and evacuated outside.
- The historical flooring in the church has been destroyed with no remaining fragments or traces.







Immediate risks identified



Risk of Partial Collapse: Severe damage to the southern part of the walls and the unstable roof structure may result in a partial collapse of the structure.



Risk of Flooding: Another imminent risk due to the hole in the roof is heavy rains and snow, which could lead to flooding,



Risk of Injury: Debris blocking from the broken flooring, wall fragments and fallen roof access to the building on-site can injure inspectors, and first aiders going on-site.



Risk of Vandalism and Looting: Damaged doors and uncovered windows may lead to vandalism and looting of the damaged collections on-site.

Recommended actions and interventions

Problem statement

This unreinforced brick masonry building has suffered mechanical damage to several vaults, the roofs, and the roof of the tower. The exterior surfaces have been damaged by blasts exposing the soft interior core of the (low-fired) brick masonry. The interior, including the wood floor structure, masonry, and paintings on plaster has been extensively damaged by fire. Windows and doors have been lost and the interior is exposed to the elements. Decorative metal bars that remain over the openings have been damaged by fire and oxidation has begun. There are copious amounts of debris in the interior and exterior with religious items.

Priority for intervention and cultural first aid (List of recommended actions)

- Protection of the remaining wall painting elements
- Collection and storage of objects of religious value
- Safeguarding the interior and brick from moisture damage, preventing the accumulation of water in the interior, and exposed masonry
- Protection of the remaining decorative metal elements
- Structural stabilization at areas of a larger loss
- Examine the wall painting elements, retrieve the damaged parts and engage the users and the local community in the decision-making process

Protection of remaining wall painting elements

The priority is the **temporary protection of the remaining wall paintings** from further detachment from the masonry and freeze-thaw action during the winter. Each remaining wall painting element must be evaluated in detail, and documented, and any large detachments must be secured. The wall paintings must then be documented, cleaned and consolidated. Debris should be searched for any wall painting fragments. They should be salvaged to be documented and safely stored in a temporary storage. If possible, they should be reattached.









Secure remaining wall paintings, clean, and search for detached fragments

Safeguard objects with religious value

There are many objects in the debris of religious value. These should be carefully documented before moving, collected, inventoried, tagged, and securely stored somewhere near or within the church. If possible, this should be done with a priest or someone knowledgeable about these elements.

Protect the interior and brick from moisture damage

- The remaining debris should be cleared from the interior. If complete debris removal from the interior is difficult, drainage channels should be created in the debris under areas where the vaults have been lost to prevent the accumulation of rainwater in the interior and the subsequent moisture damage to the base of the masonry.
- The complete removal of the debris would allow the community to temporarily use the structure for religious purposes. The immediate reuse of the structure as soon as possible must be an important consideration.
- Fortunately, the structure is substantial with walls over 1m thick; however, some vaults have been partially lost. It also appears that the wooden pitched roof structure and cladding over the masonry vaults have been lost. These remaining roof structures, cladding, metal gutter, and downpipe elements are to be removed.
- All debris must be removed from the roof and careful documentation conducted with a structural engineer. The roof could be treated with a thin hydraulic lime coating with mortar repointed and 'cant' strips created between surfaces to ensure improved water protection.
- Any exposed or damaged masonry wall top elements should be treated with a lime mortar cap to prevent water from entering the core of the wall.
- A temporary structure is to be built over the lost vaults to protect the interior from rain and the accumulation of snow. This can be created with light wood framing bearing on the surrounding undamaged areas of the vault and secured to the masonry.





- Cladding can be corrugated galvanized metal panes nailed to the wood framing. Wood
 framing secured to stable portions of the masonry with masonry anchors. A similar structure
 can be created over the lost roof of the tower if access is possible and safe working conditions
 are present. The temporary roof structure will also allow the religious structure to be used
 during the winter and spring.
- The exterior brick surfaces have their soft cores exposed from the mechanical damage of the blasts. The exposed core will allow the accumulation of moisture and subject the bricks to freeze-thaw action. These exposed areas should be cleaned of loose material with a natural bristle brush and lime-washed. If possible, several coats, at minimum one coat. The lime wash of the structure will also inexpensively improve the appearance of the religious structure and demonstrate that protection efforts are underway. A lime wash should also be applied to the exposed bricks in other damaged vaults and interior areas.
- Exterior debris should be removed from the immediate vicinity of the base of the walls. Low areas where water could collect near the base of the walls should be drained away and the earth compacted.



Protection of remaining decorative metal elements

- Most of the window openings contain wrought iron or steel decorative elements. These have been damaged by the fire and are subjected to oxidation. The remaining wood window frames and other debris should be removed, documented and stored.
- The metal was cleaned with wire brushes and treated with rust-inhibiting primer. Other metal elements such as the **gutters and downpipes should be removed**.
- The remaining doors should be secured.





Structural stabilization at areas of a larger loss

- Fortunately, the structure is built, and the main structure is not at risk of collapse. But some areas should be reconstructed. The temporary infill masonry can also secure the structure where doors have been lost if it is impossible to replace them immediately.
- All areas of **new masonry should also be limewashed**.



Actors who can implement the actions

There are two types of actors to implement these actions skilled and unskilled.

- A highly trained wall paintings conservator should evaluate and secure the remaining wall painting fragments. Or at least advise remotely to collect the fallen plaster elements and temporarily secure the remaining elements.
- A **skilled carpenter** must be employed to create the temporary roof structure over the areas of loss.
- A skilled mason is desired for work on the roof and masonry.
- Unskilled workers, or handymen, are needed to assist the carpenter and masonry and for the acquisition and transportation of the materials, erection and movement of the scaffolding, and lime washing.
- The unskilled labourers can brush, clean, and paint the metal, remove the remaining debris, clean up the site after work and create drainage channels. Five to six unskilled labourers are needed.
- For the collection of objects of religious value, a priest or someone knowledgeable of these objects should be present.
- A structural engineer should visit the site including the roof for a more in-depth evaluation.





The recommended timeframe in which the intervention must be made

Ascensio	n Church												
months			1				2				1	3	
weeks		1	2	3	4	5	6	7	8	9	10	11	12
no.	activity												
	1 Wall paintings stabalization and salvage												
	2 Recover religious objects												
	3 Clear debris, create drainage												
	Remove debris from roof												
	5 Structural evaluaton in situ												
	5 Close small masonry openings												
	7 Wood frame roof over openings												
	3 Lime wash												
	elean the site, drainage												
10	Protect metal elements												
1	Repair masonry from blast												

The cost for all recommended actions has been estimated and submitted to the relevant local actors.





Damage and Risk Assessment Analysis Report

Tarnovskyi Library, Chernihiv





Name of the site	Regional youth library (Previously known as the Tarnovskyi Museum of Antiquities)
Status of the site	A Monument of Local Importance
	Regional youth library (building of the 19th century). Earlier the Museum of Ukrainian antiquities was named after V. Tarnovskyi.
Current use of the site	Regional Library
Owner/manager of the site	Communal Property

PRIORITY OF INTERVENTION					
High	Medium		Low		

DEGREE OF DAMAGE					
Severe	Moderate	Minor			





Degree of damage

The primary cause of damage: Bomb Strike

A short description of the overall damage

Severe structural and non-structural damage; Library collections were damaged and were wet, dirty, and torn. They were initially kept in the main hall. These damaged books have been evacuated to a safer location.

Damage to the exterior of the building

- The structure sees planar distortion. Severe damage has been observed to the roof, especially to the beams supporting the roof structure over the office and yard.
- The southeastern part of the library, which was directly impacted by the bomb sees severe damage to the floor, walls, as well as structural columns and beams.
- The floor and roof on the north-western part of the library only have a moderate damage



Damage to the interior of the building

- Severe damage is observed to the doors and windows, as well as stained glass windows of the building. Electrical fixtures and false ceilings have been severely damaged.
- Exterior decorations, cornices and carvings have suffered moderate damage.
- Shelves have toppled due to the impact of the bomb, causing damage to both the books and the flooring.

Immediate risks identified

Risk of Full Collapse: A major structural planar distortion is observed in the building. The structure is highly vulnerable to shocks and vibrations and could collapse. As it is located close to one of the main roads, vibrations caused by vehicular traffic could lead to a full collapse.

Risk of Flooding: Another imminent risk is damage caused by rains, which could lead to flooding, due to severe damage to the roof. Broken glass, debris on the site and the destruction of the building a substantial risk to experts going on-site.

Risk of Vandalism and Looting: Damaged doors and uncovered windows may lead to vandalism and looting of the damaged collections on-site.

Recommended actions and intervention

Problem statement

The load-bearing masonry structure has been severely damaged and has lost integrity. It is near collapse in most areas. It is highly unsafe, and no one should enter.

- Complete loss of several arches and portions of the exterior and interior walls
- Out-of-plane deformation in remaining standing walls
- Detachment of the pilasters from the main plane of the wall
- Through cracks at the arch centres
- Detachment of the cornice
- Diagonal web cracking
- Detachment and loss of the masonry finials protrude above the cornice
- Loss of corners at the cornice
- Loss and detachment of the decorative lattice parapet
- Loss of the peak of the steep masonry gable
- Loss of masonry walls of the attached annexe buildings

There is also a complete loss of the pitched roof and horizontal wood structure. The roof structure has collapsed into the interior. In addition to the loss of the roof and damage to the masonry, the wood doors and their decorative wood panels are heavily damaged with a loss of the stained-glass windows and wood frames. The interior plaster finish has been lost or detached. Books, shelving, and furniture remain in the interior. There are some decorative interior finishes such as the floor and plaques.

It should be explored if the library could be saved. It may cost more to repair than rebuild. Viable options could be to preserve and stabilize parts and incorporate them into a new structure or preserve portions as a memorial and build a new library nearby.

Priority for intervention and cultural first aid (List of recommended actions)

- Temporary shoring, scaffolding, removal of masonry elements
- Removal, protection, and safe storage of movable elements
- Structural stabilization
- Protection of any decorative finishes that must remain in place
- Protection of the remaining decorative metal elements

Temporary shoring, scaffolding, and removal of near-collapsed elements

- Entering the structure is extremely dangerous and should not be attempted without personal protective gear. Extreme caution during any work must be used as the structure is not safe and near collapse.
- Temporary timber shoring in some openings should be provided to create a safe entry and egress point.
- Scaffolding should be erected at the exterior and large detached masonry elements, such as the finials and cornice, removed for safety. Movable scaffolding should then be installed in the interior to create a safe working environment for the removal of books and other interior elements. An assessment of the value of the books and other materials should be made separately.
- Before shoring and scaffolding are installed, where possible, evacuate and cover books before starting work. After the building is stabilized, document the collection and evacuate them in a temporary storage. If evacuation is not possible, plastic sheets must be installed over all books, archives, and other delicate items. The plastic sheeting should be weighed down at the edges and overlaps between sections of the sheet should be 2-3 meters. This will protect the materials until removal.
- Debris should also be removed at this time to create safe access and egress points. The
 adjacent less significant and damaged structures, walls, and debris should be immediately
 removed for safe working on the main structure.
- The removal of key architectural elements of each type should be saved if possible. This could include an example of the cornice, parapet, section of the arch, and other decorative masonry elements.

Removal, protection, and safe storage of movable elements

- After temporary shoring and movable scaffolding, the remaining books, archives, the card catalogue, furniture, and other materials for safekeeping. This includes portraits, Plaques affixed to interior and exterior walls.
- Book stacks should be evaluated for salvage and reuse in an appropriate location such as temporary storage and other more seriously damaged stacks remain.

 Fallen architectural elements such as decorative wood window frames should also be moved if possible. Portions of the decorative door panels should also be removed and stored for safekeeping.

After stabilization and creation of a secure workspace, remove valuable works, protect in place other books, etc.

- After temporary worker protective scaffolding is erected, plastic sheeting should be used to cover any books or interior finishes.
- After the construction of the new masonry infill and buttresses, a temporary light wood frame roof could be considered. This should be evaluated after stabilization.

Structural stabilization

- The building is severely damaged. It is questionable if it can be conserved. Consultations should be held to determine the feasible options:
 - a) Preserve a portion of the building as a memorial and build a new library building on an adjacent space
 - b) Incorporate the parts or portions of the remains into a new building on the same site
 - c) Conserve the remains. A new supportive structure could be built within
- For the third option, structural stabilization is an intensive and extensive operation given the severe structural deficiency of the masonry.
- Masonry infill should be constructed starting at the more stable arches and openings moving progressively toward the less stable portions. The width of the masonry should match the existing walls and be constructed upon the existing foundation if stable.
- If no foundation exists, a foundation must be created. Masonry buttresses perpendicular to the walls should be constructed at the exterior. Foundations for these buttresses will also have to be constructed.
- Once a portion of the building has been secured, the roof should be removed in stages. The remaining portions of the walls can then be reconstructed.
- The cornice and finials and the gable ends could then be stabilized.

This structural stabilization will take considerable time and may not be possible before next summer. At the point of the bomb impact, the soil near the structure should be removed and replaced.

Protection of the remaining decorative metal elements

 There remain small metal decorative elements that should be removed and safely stored once the exterior scaffolding is erected.

Actors who can implement the actions

- Two to three carpenters are required to erect the timber shoring.
- A team of five to seven skilled masons are required for the blocking of the openings and reconstruction of the walls.
- A team of unskilled workers, numbering eight to ten are required to protect the books and eventually remove them. These same unskilled workers are required to remove debris.
- Unskilled labourers are needed for the acquisition and transportation of the materials, erection and movement of the scaffolding, and lime washing. The unskilled labourers can and assisting the brushing, cleaning, and painting of the metal, removing the remaining debris and cleaning up the site after work. Two to three unskilled labourers are needed.

The recommended timeframe in which the intervention must be made

- Sufficient safe areas should be supported by shoring and scaffolding to protect the books and other materials. This should happen in the next month.
- Given the winter, the construction of stabilizing masonry infill and buttresses would not be possible until next spring. The **removal of important texts, original manuscripts, and artwork** should be immediately removed. Other less significant materials can be protected by plastic for the winter. This protection can extend to any decorative finish.
- Emergency shoring, scaffolding, and masonry support should be constructed within the next three months. The removal of the roof structure and decorative metal elements should wait until the masonry stabilization after next spring.
- A definite timeline cannot be provided until a direction is made as per the future of the building

Tarnovsk	yi Library														
months				1				2				3			
weeks		1	2	3	4	5	6	7	8	9	10	11	12		
no.	activity														
1	Timber shoring to allow safe access														
	Scaffolding to create safe working														
2	environment														
3	Removal of key architectural elements														
	removal of significant books and other														
4	decorative elements														
5	Protection in place of books to be left														
e	Masonry infill and butress construction														
	Removal and storage of metal decorative														
7	elements														

The cost for all recommended actions has been estimated and submitted to the relevant local actors.

Damage and Risk Assessment Analysis Report The Shop of the Merchant F Kurylo

Name of the site

Status of the site

Current use of the site

Owner/manager of the site

The Shop of the Merchant F Kurylo A monument of local importance

Originally built as a store

Commercial object, a store

Communal property

PRIORITY OF INTERVENTION					
High	Medium	Low			

DEGREE OF DAMAGE					
Severe	Moderate	2	Minor		

Degree of damage

The primary cause of damage: Artillery Fire and Missile Strike

A short description of the overall damage

The structure has been severely damaged and sees partial collapse. The entire roof has been entirely destroyed, leaving the entire structure exposed. Building utilities such as water, gas, heating and electricity are non-functional. The walls and columns are freestanding with structural beams, and floors and bracings are severely damaged. the foundation has sustained minor damages.

Damage to the exterior of the building

- The entire roof has fully collapsed. Metal bracing, beam and columns have sustained fire damage, keeping the exterior structure upright. Partial collapse is seen on the wall of the second floor of the northern entrance. The foundation sees minor damages.
- The exterior façade is burned but sees no major structural cracks.
- The flooring, noon-historical in nature has been severely damaged on the second floor, while sees moderate damage on the first floor. Other than chipping and burning of bricks, the loadbearing walls have sustained minor to moderate damage, with no structural cracks.
- The plinth on the exterior façade, which was decorated with ceramic tiles, has been moderate- to severely damaged with missing fragments.

Damage to the interior of the building

- The main façade is severely burned, and all interior walls are chipped. Some decorative elements and carvings on the main façade and interior walls, cornices and roof are severely damaged or completely destroyed.
- Doors on the main façade with historical value are non-existent. Other doors, and windows, including lintels and parapets have been severely damaged.
- A metal staircase sustained damages and allows for access to the second floor of the building.
- The heating, ventilation and electrical system, as well as the drainage and plumbing system have been completely destroyed and are non-functional. Wall partitions and built-in furniture such as shelves and showcases are completely destroyed.

Immediate risks identified

Risk of Partial Collapse: The severe damage to the walls, as well as the absence of a roof structure, may result in a partial collapse of the structure.

Risk of Flooding: The exposed structure due to the absence of roofing, doors and windows can add to the risk of flooding due to rains and snow.

Risk of Vandalism and Looting: Damaged doors and uncovered windows may lead to vandalism and looting of the damaged collections on-site.

Recommended actions and intervention

Problem statement

There has been a complete loss of the roof for the two structures and the internal connecting stair/corridor. The interior first-floor structures have also been lost. The two small lean-to structures behind the internal courtyard appear to be undamaged. Adjacent buildings have been similarly impacted. In addition, the masonry has lost some lateral support and may have been weakened by the blast/fire. There remain two main steel internal lateral supports at the roof line. There is also an interior longitudinal steel or cast-iron mezzanine structural support. However, the (unreinforced) brick masonry appears well-constructed and is substantial. The masonry is intact except for a large loss near the corner. The interior stair, while exposed, appears to be structurally stable. All windows and doors have also been lost. The interior and masonry are exposed to the elements. There does not appear to be a basement but there is a crawl space as the buildings are approximately 30cm above the surrounding pavement.

Priority for intervention and cultural first aid (List of recommended actions)

- Structural stabilization, particularly at the large masonry loss near the corner, close openings to reinforce the upper level
- Protection from the elements and freeze-thaw action in the exposed masonry
- Safeguard remaining decorative metal elements
- Protect the existing stair

Structural stabilization

- Masonry must be stabilized at the site of the blast reconnecting the main façade with the corner. This will stabilize the corner and provide lateral support against any wind load. This masonry should be reconstructed temporarily and can be inserted or woven into the existing masonry.
- The window openings do not have to be reconstructed yet the repair should extend to the roof line, if possible. The door opening under the blast point must be filled in with masonry as this will provide additional stabilization. The one large opening is a "soft story" and should be infilled with masonry.
- The other two openings on the same façade should also be infilled. The two window openings on the other façade near the corner should also be infilled with masonry as this will provide additional support for the corner.
- The four-door openings on the other façade could also be infilled with masonry for security purposes. Infill beam niches reinforce the wall and prevent water infiltration and other areas where brick has been lost.
- Adjacent buildings should be inspected to determine if they pose a structural risk. Install crack monitors on both perpendicular façades to monitor any movement.

Protection from the elements

- The exposed soft core of the bricks is vulnerable to freeze-thaw action, particularly at the roof line where snow and ice will collect on the horizontal surface.
- The wall top of both structures should be cleaned of all remaining debris and loose brick and mortar pieces. The wall top should be capped with a lime-sand mortar mix of 20-30 cm and shaped into a dome to shed water. This capping will adapt to irregular and damaged masonry wall tops.
- At this time, the two horizontal lateral steel supports should be inspected for damage. These suffered in the fire after the blast and then weakened. They should be secured to the rooftops with mortar and painted with rust-inhibiting paint, especially near the masonry.
- The same treatment of lime mortar capping should be applied to the horizontal surfaces of the damaged window openings.
- Sheet metal capping exists on one wall top. This should be inspected for stability and if acceptable remain in place. If not means to secure this to the masonry below should be made.
- The interiors also have areas of exposed masonry. These should be washed to remove the ash and then treated with a lime wash.
- The newly constructed supportive masonry should also be limewashed with several coats for protection but also appearance.
- The openings in the masonry for the first floor and roof horizontal structures should be inspected and if necessary, masonry inserted, and lime washed.

Safeguard of the remaining decorative metal elements

- There are remains of small metal decorative elements on the cornice. These should be inspected and if secured, remain in place. If not secured it should be inspected and if possible secured to the masonry, through the new mortar capping. If not possible to secure the metal elements should be removed and placed inside the adjacent lean-to structures.
- In either case, the metal should be brushed with a steel wire brush to remove the surface oxidation and treated with rust-inhibiting primer paint. Paint the exposed steel of the stair with rust-inhabiting paint.
- Remove metal rain gutters and downspouts.

Actors who can implement the actions

There are two types of actors to implement these actions skilled and unskilled.

- A skilled mason is required for the preparation of mortar and bricks, inserting the masonry, and the mortar capping. This could be accomplished by a single mason with assistance.
- Unskilled labourers are needed for the acquisition and transportation of the materials, erection and movement of the scaffolding, and lime washing.
- The unskilled labourers can and assisting the mason with brushing, cleaning, and painting the metal, removing the remaining debris, and cleaning up the site after work. Two to three unskilled labourers are needed.

The recommended timeframe in which the intervention must be made

The cost for all recommended actions has been estimated and submitted to the relevant local actors.

Damage and Risk Assessment Analysis Report Krasnotrostianetska Forest Research Station, "Trostyanetsky"

Name of the site	Monument of Garden and Park Art "Trostyanetsky" (former house of the manager of the estates of L. Koenig)
Status of the site	Monument of national importance
	The office of the Krasnotrostyanets branch of the Ukrainian Research Institute of Forestry and Forest Melioration was named after G. Vysotskyi
Current use of the site	Research Institute of Forestry
Owner/manager of the site	State-owned

PRIORITY OF INTERVENTION					
High		Medium	Low		

DEGREE OF DAMAGE		
Severe	Moderate	Minor

The primary cause of damage: Fire due to the impact of a tank strike, and intentional destruction during the retreat.

A short description of the overall damage

Severe structural damage and partial destruction is observed in the heritage building. Building utilities such as water, gas, heating and electricity are non-functional. A large part of the roof is destroyed, and beams and bracings are exposed. No fragments of flooring are left, but walls and columns sustained minor damage.

Damage to the exterior of the building

- Several large holes have been punctured through the roof, façade walls and all windows, exposing the entire structure on many fronts.
- The exterior façade is burned but sees no major structural cracks. The overall structure including the foundations, walls and columns sees minor to moderate damage.
- The spires from both wings have toppled and collapsed.
- Structural beams, especially roof bracings have been severely damaged, making the structure unstable in some parts.

Damage to the interior of the building

- Doors, windows and staircases have been severely damaged or completely destroyed. The historical flooring is now in rubble.
- The heating, ventilation and electrical system, as well as the drainage and plumbing system have been completely destroyed and are non-functional.
- A historical fireplace located in the east wing room is partially destroyed and a few other similar fireplaces are almost completely destroyed
- Most partition walls have completely collapsed. Built-in furniture such as shelves and showcases are destroyed. Wooden carvings and other historical objects are severely burned in a fire that followed the bombing.

Immediate risks identified

Risk of Partial Collapse: If left unattended, severe damage to the walls, as well as the unstable roof structure may result in a partial collapse of the structure.

Risk of Flooding: The exposed structure due to lack of roofing, doors and windows can add to the risk of flooding due to rains and snow.

Risk of Vandalism and Looting: Damaged doors and uncovered windows may lead to vandalism and looting of the damaged collections on-site.

Recommended actions and intervention

Problem statement

The structure was **damaged by a blast which ignited a subsequent fire destroying the wood horizontal structure, roof rafters, and interiors**. Some elements of the horizontal steel structure on the first floor remain but have been damaged. **The roof cladding is lost in three portions** of the building; however, in the main two-story portion and a wing, the metal sheet roof cladding remains and is supported by the horizontal steel members. This poses a risk as snow and ice can accumulate on this remaining roof cladding adding unnecessary weight to the damaged steel horizontal members which will then transfer this load to the masonry walls and tall slender brick masonry chimneys. This will also cause problems of uncontrolled water access into the masonry walls.

The chimneys are a particular risk given their width-to-height dimensions and lack of lateral support. There is a total of 13 chimneys, 9 of which are interconnected and incorporated into the load-bearing walls. However, 4 of these chimneys appear to be unsupported and have lost their lateral support with the loss of the horizontal floor/roof structure. These require lateral support.

Other masonry problems include **exposed wall tops** that will allow water to enter the walls. In many parts of the wall and upper sections of the chimney, there was metal coping, but this has been lost in some areas and **requires reattachment or other means of waterproofing**. Brick surfaces have also been damaged by the blast and fire exposing the softer inner core which is susceptible to freeze/thaw action. The niches within the walls that supported the lost wood rafters and beams are also open and will allow water to penetrate the wall interior. **All the windows have been lost contributing to the water problems in the winter and spring**. Exterior plaster decorative elements remain near the windows but have been damaged by smoke. Decorative tile is extended on one fireplace but on others has been detached and damaged.

Priority for intervention and cultural first aid (List of recommended actions)

- **Reduction of the potential snow load** on the remaining roof cladding, to be removed
- Structural stabilization, laterally of the tall slender masonry chimneys
- Protection from the elements and freeze-thaw action in the exposed masonry.
- Protection of the remaining decorative elements

Removable of the potential snow load

- While the roof wood members have been lost, the horizontal steel members remain in many portions. In the main portion of the building, in a wing and connecting (stair?), the metal roof cladding has collapsed onto this horizontal structure. This will allow snow to accumulate on the horizontal surface adding an unnecessary and uneven load on the already damaged horizontal and load-bearing masonry. This could lead to a collapse causing more damage than necessary to the masonry walls, chimneys, and any structure below.
- This metal cladding must be removed. This will also allow for a better inspection of the steel and masonry, particularly the vertical chimneys. The metal cladding is beyond salvaging as it has been damaged by the fire and has already oxidized; nevertheless, the type of metal cladding, attachment to the structure, and details must be carefully recorded during removal for a suitable replacement roof during a later restoration project. This applies particularly to the corner tower and onion dome and the connection between metal elements.
- The metal coping on top of the masonry roofs at the cornice and chimney tops must be inspected. This coping should remain as it can protect the wall over the winter but should be secured. If damaged elements of this coping are located or detached, they could be replaced.

- There are several remaining horizontal floors/balconies/roofs intact but with an accumulation of debris. This includes the covering over the entry, the balcony and the wing to the right of the entry.
- The **debris must be removed**, and the horizontal structure inspected.
- These flat areas will also collect snow, so measures must be taken to prop up the structure is unstable. If these horizontal structures are stable, measures must also be taken to ensure positive drainage off of the slope. During the winter after every heavy snowfall, the building must be inspected and excessive snow removed, particularly in these areas.

Structural stabilization

- The four tall slender masonry chimneys (or others should they be determined unstable after inspection) must be supported laterally since the floor diaphragm and roof have been lost. Four of these chimneys appear to be free-standing and not integrated into the load-bearing walls so are at greater risk.
- After the removal of the roof and debris these four chimneys should be inspected for cracks and support and propping should be constructed of treated wood to provide this lateral support. Two collars of wood can be placed around the chimneys at the first floor and roof levels and propped to the adjacent load-bearing walls.
- The remaining steel horizontal structure should be inspected to see if it also can be incorporated into this new lateral support. Where the steel beams meet the masonry, additional support may be needed to secure these beams and reconnect them to the masonry.
- The transverse masonry walls should also be inspected and if necessary additional lateral support between walls provided.
- In addition to the chimneys, there are several slender decorative finials at the roof line of the wings, these should be inspected and if required supported either through propping or masonry.
- The chimneys should be capped with plastic to prevent water from entering. All debris from the interior must be removed to reduce any excess load. Inspection for any objects must be conducted during debris removal.

Tall slender chimneys have lost their lateral support

Remaining metal roof cladding removed to prevent accumulation of snow load

Horizontal areas to be cleaned and inspected. If unstable propped to support snow load

> Assess existing coping and secure on chimneys and wall tops

Tall slender chimneys have lost their lateral support must be stabilized.

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Remaining metal roof cladding removed to prevent accumulation of snow load

Protection from moisture

- The brick masonry has been damaged in many places exposing the tops of the walls to rain and accumulation of snow. This will allow moisture to penetrate the walls causing future damage.
- The wall tops should be cleaned of all remaining debris and loose brick and mortar pieces. The wall top should be capped with a lime-sand mortar mix of 20-30 cm and shaped into a dome to shed water. This mortar capping will adapt to irregular and damaged masonry wall tops. Exposed horizontal surfaces near the damaged window openings should also receive this mortar capping.
- The horizontal steel members must also be inspected. These suffered in the fire after the blast and then weakened. They should be cleaned with a wire brush and painted with a rust-inhibiting paint, especially near the masonry. The same treatment of lime mortar capping should be applied to areas where these steel beams intersect the masonry.
- Sheet metal copings exist on the wall tops, other areas, and sills. These metal copings should be inspected for stability and if acceptable remain in place. If the copings are not secure, they should be secured to the masonry below. If detached copings are found, an attempt should be made to reinstall. The damaged gutters and downspouts should be removed.

- The exposed soft core of the bricks is vulnerable to freeze-thaw action, particularly at the roof line where snow and ice will collect on the horizontal surface. Exposed or damaged brick should be cleaned and treated with a lime wash.
- Any new masonry should also be lime-washed. If it is not possible to lime wash all exposed bricks, the priority should be toward the horizontal surfaces followed by the upper portions and then 1m all around the base.
- The ground around the structure must be inspected to ensure that snow and water are not retained against the building.
- Debris from around the base of the building must be removed and drainage channels must be dug to drain water away from the base of the building. The debris must be inspected for objects. If objects are found, they should be stored securely in a place within the building.
- **The structure has a basement**; however, its condition is unknown. The small windows should be bricked closed at their base to prevent the intrusion of water.
- The windows should not be completely closed to block off all airflow. The site should be inspected periodically during the winter to remove any snow from around the base of the building.

Protection of the remaining decorative elements

- The metal decorative finial that was atop the onion dome should be removed from the roof, cleaned, and treated for oxidation, and then stored safely. Other metal decorative elements should also be secured and assessed for treatment.
- The decorative metal awning support at the rear should be inspected and treated with rustinhibiting paint. This same treatment should be applied to any other decorative metal elements found on site.
- There are also decorative interior tiles, particularly at the chimneys. These should be documented while in place. If they are detached from the masonry, they should be carefully removed, collected, and safely stored on site. Other tile fireplaces with decorative tiles that is stable should be documented and any loose tile secured.
- The decorative plasterwork at the exterior cornices and windows should be inspected, and carefully cleaned with a fibre brush to remove the soot and then loose elements consolidated. It should then be limewashed until conservation can take place.

Actors who can implement the actions

There are two types of actors to implement these actions skilled and unskilled.

- **Two skilled carpenters are required for the stabilization of the masonry chimneys**. There is a minor amount of masonry work, so the skills of a single mason are sufficient.
- The mason should also inspect the lime and sand for mortar capping and work with unskilled labourers to mix the lime wash and apply.

 Unskilled labourers are needed for the acquisition and transportation of the materials, erection and movement of the scaffolding and lime washing. The unskilled labourers can assist the carpenter and mason in brushing, cleaning, and painting the metal, and cleaning up the site after work. Five to six unskilled labourers are needed.

The recommended timeframe in which the intervention must be made

Immediate action recommended within the coming 3 months

The cost for all recommended actions has been estimated and submitted to the relevant local actors.