Towards a Disaster Risk Management Plan of Historical Centers: Case Study of The Historical Center of Gjirokastra

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ABSTRACT

Disasters, such as earthquakes, floods, wildfires, demonstrate that extreme events can have global impacts, threatening not only human lives and economy, but also cultural heritage. The UNESCO Venice Office, according to the priorities set by the government of Albania, have implemented the project "Natural Risk Preparedness and Mitigation - Building capacity in the field of risk mitigation for Cultural Heritage properties in Albania". The project aimed to streamline disaster risk management in the country, using its World Heritage properties as demonstration sites. The project was conceived to assist the country to enhance its capacity for Disasters Risk Management (DRM) and advancement in seismological and geological vulnerability of Cultural Heritage properties. This study identifies the key elements to take into consideration to draft an effective Disaster Risk Management Plan for the historic centres in Albania. In this framework, the World Heritage Property of the Historic Center of Gjirokastra is studied. The methodology used in this study and recommendations can be implemented also in the other historical sites.

Keywords: Disaster, Risk Management, Cultural Heritage, Gjirokastra

INTRODUCTION

As confirmed by the 2009 Global Assessment Report on Disaster Risk Reduction [1], Risk and Poverty in a Changing Climate, the number of disasters around the world increases every year. This is due to growing exposure in terms of people and assets, in turn caused by rapid economic development and urban growth in cyclone coastal areas and earthquake-prone cities, combined with poor governance and the decline of ecosystems.

A disaster arises when an extreme natural event strikes a vulnerable society. Present day disaster risk management seeks to reduce a society's vulnerability to extreme natural events so that even such events occur they do not result in a disaster. Natural events can generally not be prevented, but their impact can be mitigated. It should be borne in mind that vulnerability arises from the susceptibility, coping capacity of individuals, households, communities, and states. Reducing vulnerability therefore involves reducing the factors that contribute to it at all levels [3].

It was the world-wide traumatic event of the Indian Ocean Tsunami in 2004 that determined the momentum necessary to set a framework of critical actions to be followed by the international community in the frame of a new International Strategy for Disaster Reduction (ISDR). UN member states recognized that they had to find new terms of commitment on Disaster Reduction. The Hyogo Declaration and Framework for Action (HFA) was therefore agreed upon. The HFA five core commitments recognize that besides the need to have national plans for Disaster Risk Reduction and Management on paper, the role of education and the role of local communities and authorities are equally crucial to achieving relevant results on building societies more resilient to risks. Resilience must be implemented on site, at the local level, building capacities and empowering communities, including those at the grassroots level. This has recently been recalled and stressed also by the Synthesis report, "Consultations on a post 2015 framework on Disaster Risk Reduction" (HFA2- April 2013), where local action underpinning community leadership and engagement in DRR is considered a key element to mainstream International DRR principles and guidelines into national and local agendas for action [4].

Although heritage is usually not considered in global statistics regarding disaster risks, cultural and natural properties are continuously affected by events which are less and less 'natural' in their dynamics and causes. The progressive loss of these properties because of floods, mudslides, fire, earthquakes, civil unrest, and other hazards has become a major concern; partly because of the significant role that heritage plays in contributing to social cohesion and sustainable development, particularly at times of stress [2].

This study addresses three areas of concern: what to do before the hazard strikes, what to do immediately after, and what long-term actions remain to be taken. The main objective of this study is to introduce hints into formulating an integrated Disaster Management Plan in Historic Centers in Albania, focusing on a case study- the historical center of Gjirokastra.

HISTORIC CENTERS IN ALBANIA

Historic Centers, as a touchable Cultural-Historic Testimony, with urbanity-architectonic values are a very late occurrence which begins after the Second World War, if compared with other architectural monuments. These centers in Albania are mainly representatives of settlement which belong to the XVII-XIX centuries.

The Historic Center concept was known in Albania around the years 1960 as Museum City but in nowadays the concept is well-known internationally because of UNESCO merit. Today the Historic Center is considered a citizen or rural site which preserves historic-cultural values of its authenticity in different scales.

Decision No. 172, dated 02.06.1961 decided to proclaim the "Museum Cities of Gjirokastra and Berat; old part and subterranean of Durres city and Kruja Bazaar" under special state protection by the Council of Ministers of the Popular Republic of Albania. This decision indicated a very important result for the future of the Albanian monuments after the first list of cultural monuments issued in 1948. Immediately after the state protection of Berat Historic Center was compiled the Administrative regulation for this site and served as an essential principle and a reference point for protection of the different types of monuments. There are two types of monument categorization: first and second category cultural monuments. The first category monuments preserve: the compositional elements, architectural elements of exterior and interior, building technique and materials. The second category monuments preserve: their volumes and exterior façade; the interior compositional and architectural elements can be treated and changed accordingly.

THE HISTORICAL CENTER OF GJIROKASTRA

Gjirokastra is in Southern Albania, overlooking the Drino Valley. It is often named as "the Stone City" and its most distinctive feature is the silvery-colored roof with limestone tiles which gives the city its character. Two different types of limestones are quarried nearby and are used one in the construction of buildings and the other for roofs and streets paving.

Gjirokastra also with Berat are outstanding testimony to the diversity of urban societies in the Balkans. The town planning and housing of Gjirokastra are those of a citadel town built by notable landowners whose interests were directly linked to those of the central power. Berat bears the imprint of a more independent lifestyle, linked to its handicrafts and merchant functions.

In 2005 Gjirokastra was included in the UNESCO world heritage site and continues to be in the list of cities in danger.

The surrounding historical sites show evidence of the prehistoric period such as the Goranxi gorge. Evidence of other important sites in Antigoneia and Hadrianopolis testifies the importance of the region even during the greek and roman occupation. Both sites were abandoned because of more catastrophic earthquakes and consequent landslides [5].

The archaeology of Gjirokastra is relatively unknown. Because of the proximity of the Classical and Hellenistic settlement at Jermë (Antigoneia) and the Roman city of Hadrianopolis it has frequently been assumed that the medieval fortress represents the first occupation of the site. In fact, the town shows a 13th century founded Citadel, one of the biggest for-tress in the Balkans. With the decline of the Byzantine Empire, it became the residence of the powerful Zenebeshi feudal clan.

Latest excavations within the fortress have led to the discovery of ceramics from four different phases of occupation be-fore the Ottoman period: 5th -2nd centuries B.C., 5th -7th centuries A.D., 9th -10th centuries and 12th -13th centuries. The medieval fortress extension related to the second half of the 13th century, encompasses an area of 2.5 hectares.

The remains of five towers and three main entrances of the original fortress can still be seen, though the fortress was substantially rebuilt and extended to the south west in 1811-1812 by Ali Pasha of Tepelenë. Ali Pasha was also responsible for the construction of an aqueduct feeding the fortress from a water source on Mt. Sopot, some 10 km distant from Gjirokastra.

Complete sections of this aqueduct were still visible at the beginning of the 20th century but were destroyed in 1932. The fortress was used as a garrison in the 19th century. During the communism period the castle has also served as a prison for dissidents.

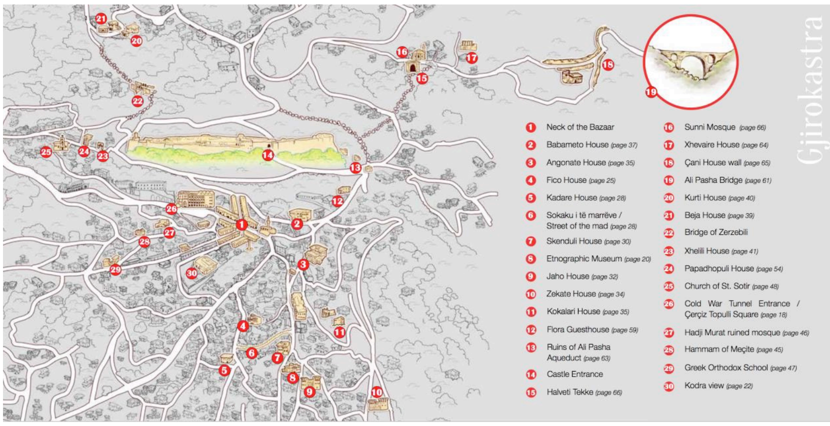

Figure 1. The Historic Center of Gjirokastra and key monuments

Hazard Identification and Risk Analysis in the Historical Center of Gjirokastra

The Historic Center of Gjirokastra site has recorded a set of natural threats affecting the property:

- Natural
• Seismic threat
• Wildland fires
• Erosion, landslides, rock falls

- Human
• Lack of financial support for the monuments
• Lack of a management plan
• Uncontrolled urban development of Gjirokastra

• Abandonment of the site by the inhabitants, which will contribute to the potential fire hazard and general degradation of the building over time

• Misuse of monument by the owner with the risk of damaging the authenticity and the integrity of the building.

Figure 2 represents some typical degradation of dwellings in Gjirokastra, Archive recordings of Institute of Cultural Monuments.

The Risk Analysis process consisted in:

- field survey for the collection of preliminary data on the state of conservation of the historic buildings;
- the methodology used was based on clear photographic data collection, technical schedules and identification of needs for interventions, leading to compilation of a preliminary list of interventions with cost list for each building (Figure 5);
- the results consisted of determining the nature of potential threats to the building:
    i. the ROOF, its condition is imperative to the state of conservation of the structure. If humidity infiltrates through and reaches the wooden structure, this is the starting point of degradation of the roof, leading to the wooden floors and the walls; the process is accelerated if the building is abandoned (Figure 3)
    ii. presence of HUMIDITY (capillary), LANDSLIDES, ELECTRICAL SYSTEM (Figure 4).

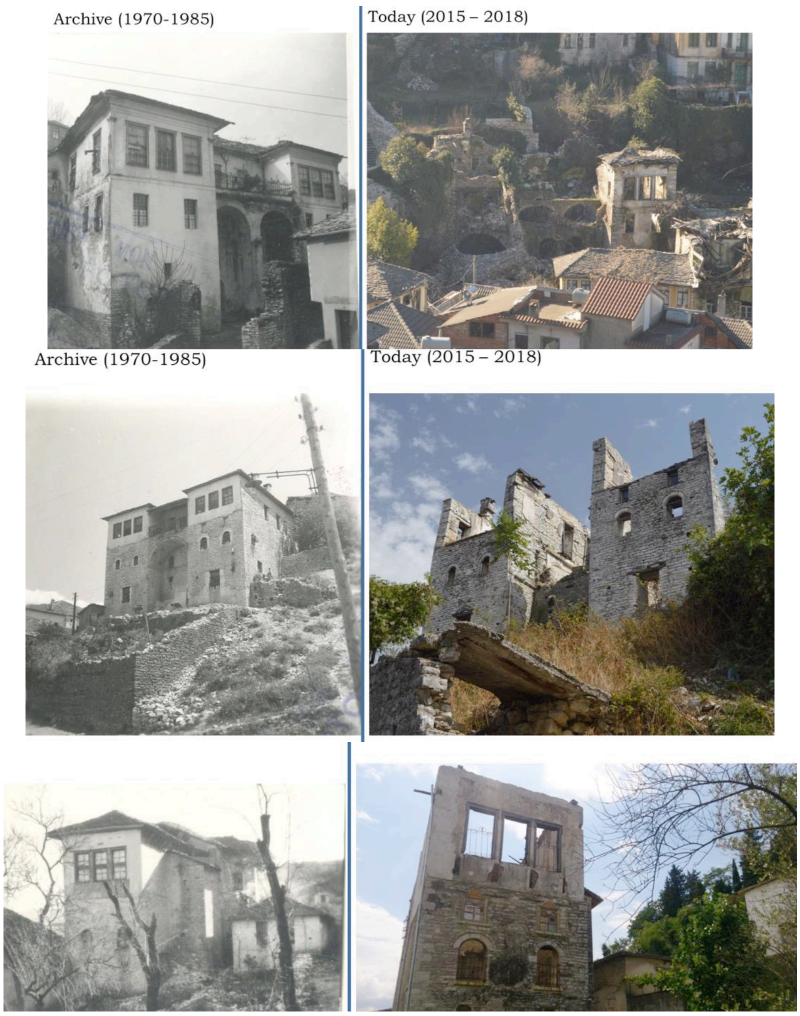

Figure 2. Degradation of dwellings in Gjirokastra [8]

Figure 3. Roof degradation

Figure 4. Presence of Humidity and degradation of wooden ceiling

14. BANESA " LOLOMANI " Kategori e II

VENDNDODHJA
Banesa ndodhet ne qender te lagjes " Pazari i Vjeter" . Eshte nje nga ndertesat me masive ne lagjen "Pazari i Vjeter" dhe me karakteristikja ne rrugen qe kalon permes kesaj lagje.

HISTORIKU/ PERSHKRIM ARKITEKTONIKO TIPOLOGJIK
Banesa ka te shenuar ne muret e saj daten 1886. Perfaqeson nje faze me rendesi te banesave ne arkitekturen e qytetit kur kemi dhe daljet me erker dhe stilizimet e ndryshme. Ruhen disa elemente edhe ne brendi qe te lene te kuptosh per nje perpunim te larte artistik te tavaneve dhe elementeve te tjere te brendise.

GJENDJA AKTUALE
Gjendet ne kushte te rendura si ne ekserier edhe ne interier. Catia eshte e rrezuar dhe degradimi po perparon. Tavanet jane pothuajse te shkateruara nderkohe qe eshte e braktisur nga pronaret dhe banohet nga familje te ndryshme. Nderkatet ne pjesen me te madhe jane te dekompozuar dhe mbeturinat e lena brenda baneses e rendojne situaten me peshen dhe lageshtine qe mbajne. Rrjeti i ujesjedhesit dhe kanalizimeve qe perdoruesit kane vendosur ka probleme dhe rrjedhje> lageshtia nga keto rrjete deperton ne strukturen e monumentit duke e vene ate ne nje rezik te perhershem. Rreziku nga zjarri gjithashtu eshte prezent. Banoret e tanishem e perdorin monumnetin pa kriter duke nderhyre me forma brutale.

NEVOJA PER NDERHYRJE
Nevojat te menjehershme ne pastrimin e monumetit, plotesimin e catise dhe murature s. Perforcime te nevojshme per sa i perket nderkateve etj.

RISKU KRYESOR :
Risku kryesor eshte zjarri. Nderhyrjet pa kriter jane nje rezik permanent. Gjithashtu kolapsi i catise dhe nderkateve hyn ne risqet e MEDHA qe ky monument po perballet.

PUNE PREGATITORE:
Skeda teknike dhe nje preventiv paraprak per rehabilitimin e baneses. Grumbullimi i materilit arkivor per kete banese.

KOSTO FINANCIARE PER NDERHYRJET SHPETUESE DHE RESTAURUESE:
2.500.000 - 4.000.000 AL

Pamja Jugore e monumentit.

Transformimi dhe degradimi i fasadave.

Rrenimi i catise se baneses.

Pamje e gjendjes te monumentit ne brendi.

Pamja e catise se baneses ne ansamblin e lagjes.

Figure 5. Example of the Risk Identification file [8]

List of buildings needing emergency interventions:

- The process realized in collaboration with RDNC Gjirokastra based on the survey on risk assessment carried out by CHwB
- Site survey of 82 historic buildings, gathering photos, notes on needed interventions, scale of degradation.
- The result is the identification of state of conservation, list of interventions, cost of interventions for rescuing the structure from the collapse state (Figure 6).
- An estimated cost = 2,440,000€, as detailed below:

- **1st category monument = 13 | cost of interventions 455.000 €**
  (1 does not exist, 4 are in ruins, 5 in collapse state, 3 state of advanced degradation)

- **2nd category monument = 66 | cost of interventions 1,935,000 €**
  (1 does not exist, 20 are in ruins, 22 in collapse state, 22 state of advanced degradation, 3 are inaccessible)

- **No status buildings = 3 | cost of interventions 55,000€**
  (1 does not exist, 1 in collapse state, 1 state of advanced degradation)

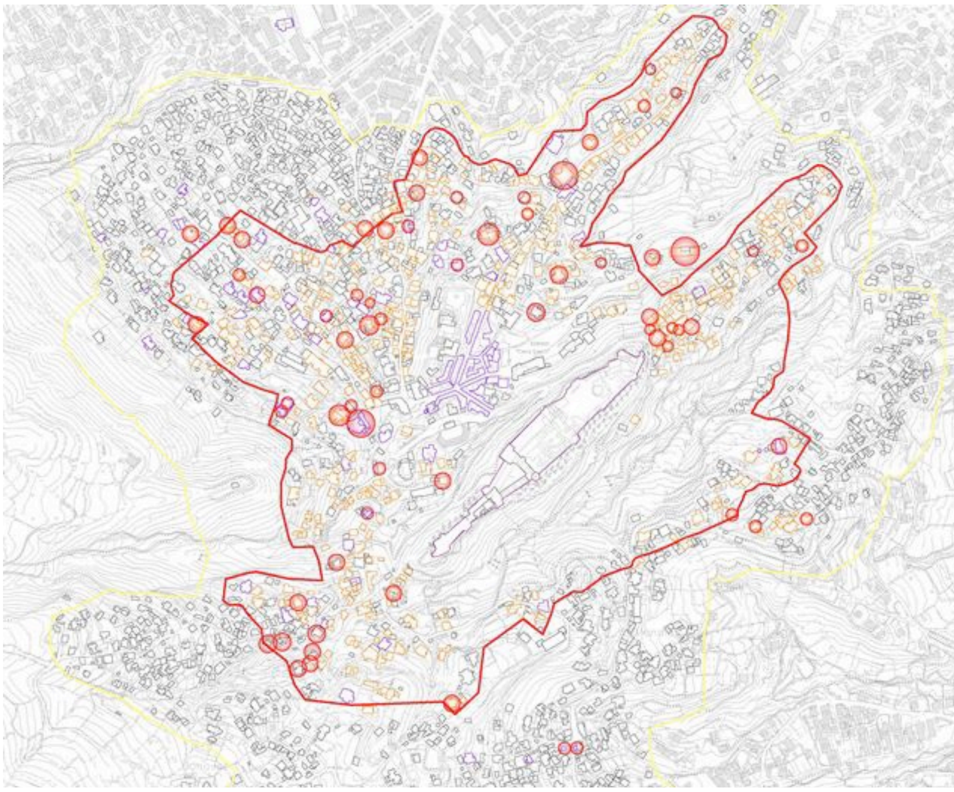

Figure 6. Map of the HC of Gjirokastra with the identified buildings at risk

Geological and Seismic Hazard of the Region

The region of Gjirokastra falls into the Ionian zone. This zone includes areas characterized by synclines and anticlines with NW-SE orientation, which from east to west are: Permeti syncline, anticline of Berat, the syncline of Memaliaj, anticline of Kurveleshi, syncline of Shushica and Cika anticline. These structures exhibit a westward asymmetry and are complicated by thrust faults located at their western flanks. The historic center of Gjirokastra is located, from a geological point of view, along the eastern flank of the Mali i Gere anticline, which is connected to the western flank of the Drino syncline. The deposits identified, mainly Mesozoic carbonates and Paleogene terrigenous units, constitute a homoclinic with a general NNW-SSE trend, gently dipping to ENE (ca. 20°). The terrigenous portion of the geological substrate, which houses the castle and much of the historic city center, lies in unconformity above the underlying carbonate units [6].

The seismicity of Albania is characterized by an intensive seismic micro activity ($1.0 < M \leq 3.0$), many small earthquakes ($3.0 < M \leq 5.0$), rare medium-sized earthquakes ($5.0 < M \leq 7$), and, very seldom, strong earthquakes ($M > 7.0$). As described by several authors, from the period of III-II centuries B.C. until the present, Albania has been stricken by 55 strong earthquakes with intensities Io ≥ VIII degree (MSK-64), of which 15 have had the intensity Io ≥ IX degree (MSK-64). The number of disastrous earthquakes reported has obviously been underestimated or hidden in the depths of historical times. Reliable evidence show that Durres (Dyrrahum) has been stricken several times by strong earthquakes that have caused serious human and economic losses. From old records we can see that this town was almost destroyed in the years 177 B.C., 334 or 345 A.C., 506, 1273, 1279, 1869 and 1870 [7].

In the centuries III-II B.C., there is evidence that Apollonia, another ancient town, was struck by strong earthquakes which caused large casualties and damage. In the year 1153, the town of Butrint (old Buthrot) in the south of Albania, was destroyed by a strong earthquake. Also, Berat has been hit by strong earthquakes several times. One of the strongest, well evidenced ones is that of October 17, 1851, which caused a lot of destruction. The fortress of the town was damaged and under its ruins 400 soldiers were buried. Cracks on the ground were observed together with fountains of sand and water mixed, and a kind of a sulfur dust, which made respiration difficult, was discovered. There were big landslides as well. The highest intensity for this earthquake had to be 9.0 degrees (based mainly on the degree of destruction of the fortress of the town). Gjirokastra is located only 35km north of Butrint and around 72 km south of Berat [7].

Methodology used for Geological and Seismological Risk mapping in Gjirokstra

Quick Duty Builder

It was primarily decided to act in such a way as to enable a rapid screening of Seismic Risk in Historic Centers at relatively low cost, ensuring repeatability in other similar realities. This process has its strong point in the definition, co-ordinated among all study groups, of a rapidly compiled and continuously improved file, even at the next stage of expanded experimentation envisioned in an area of study. It is specifically aimed at collecting in a short time a large amount of data by not very expert personnel and trained in a short time and in processing as little of the data as possible influenced by interpretation factors subjective, leaving this stage for a later level that can be achieved through weighted processing of the collected values.

It was decided to further limit research on the exterior of buildings, avoiding access within them, increasingly difficult and not always possible in the case of uninhabited buildings or in a state of degradation. The impossibility of access to these buildings, feasible and realistic in the case of Historic Centers, would jeopardize the return of inhomogeneous data and therefore high risk of error.

The lack of data on the ceilings creates objectively problems in interpreting in terms of the Vulnerability of Buildings and above all in comparison to the GNDT file data used by us as the basis for the Quick Duty Builder. However, such a more correct methodology was considered in the context of the study program's goals, such as repeatability of the analysis and speed in data collection.

This system seems ideal to enable large-scale analysis to provide useful guidelines for reducing seismic risk, starting from such elements that, on a large scale, represent a minimum percentage of error. However, it should be said that the second stage for the risk and vulnerability-related analysis has been carried out deepening and field verifications, such as to enable a more accurate determination of the final values. It was done through general surveys, while for the values associated with the vulnerability of the buildings a more detailed survey was conducted on some frequent typologies, to verify the credibility of the rapid campaign of the surveys.

The program prepared using GIS, finalized in the data throwing in the form of analysis statements and mapping project, makes it possible in very short time to find exactly within the area taken in the examination interventions which are more priority compared to others, thus enabling them to address funding and incentive policies related to the reduction of the Seismic Resistance.

Clearly, the importance of setting in very concrete terms the priorities that will allow in a recent analysis a direct result in terms of realistic risk reduction for the population concerned, above all in a moment as the current one is characterized by the availability of scarcity of resources.

The data was aggregated to the maximum, starting from each building as it looked from cartography, but later verified and sometimes modified on the ground during compilation of the file. The initial hypothesis envisaged linking buildings, via the address, with the civil status data available to the Municipality, and, where possible, with the ISTAT registration data.

The ability to maintain a common core unit for all levels of analysis, from fast to later, with a greater level of deepening, guarantees the traceability of the cognitive process, its reversibility and integration with new elements of evaluation.

Elements that enable risk assessment in Historic Center

The elements that enable seismic risk assessment in a Historic Center are those normally used in new residential areas, integrated with a relevance of historical-architectural features that in the ancient part of the city have a special significance above all in the case of those products that have made ancient and recent history. It was started from the danger assessment of the part on which rises the area with ancient dwellings.

The initial idea was to reach a truly seismic microsite based on the extensive experience gathered by the region in this sector in the post-quake phase, such a hypothesis proved unfeasible due to the scarce economic resources available. Thus, a series of field analyzes were preferred to approach as many as needed for the micro session and enable simultaneous collection of data on lithology and on the seismic response of the terrain. Such data crossed with morphologic elements, even those collected through GIS, are reprocessed by the group of studios. The processing of inter-relationships between the data collected has facilitated to transfer the seismic risk of the area to each building for each level of risk.

For Vulnerability of Buildings, it was processed through the definition of the matrices to enable the determination of the sensitivity level of the building in a rapid way, to go on to a complete (and even internally) survey of some common typologies. Such action has been made possible through the realization of a higher-level file that represents the link at a later stage with a much more detailed survey and carried out by expert personnel.

Regarding the other elements involved in the risk level assessment, the structure of the Technical-Scientific Coordination has defined in the experimental way the following analysis processes:

- *Exposure of population to seismic risk*

Population exposure to risk represents graphically that part of the population directly affected by earthquake-related damage.

Even in this case, it has been done through not the maximum possible aggregation of data by keeping it always connected to each building to allow the linkage of this assessment element with others taken to the examination and to reach a final synthesis.

- *Elements for Determining Risk Exposure*

S = Surface (derived from cartography)

H = height of buildings (extracted from survey files - number of floors above ground multiplied by the average height of the floor, h=3m)

D = The predominant destination of use (extracted from the survey file)

V = Estimated volume

NA = Estimated Resident Ability (Number of Residents)

- *Criteria for setting risk exposure values*

Definition of the volume of the building:

V = S x H

Destination Usage: the destination of the use of the building was examined by setting a m2 / p ratio, for residential, commercial, and tertiary use destinations, while public buildings are catalogued as Strategic Buildings by assigning the maximum risk category as the basic building for emergency organization.

- *Determination of estimated resident capacity*

In the case of Gjirokastra, the number of precious inhabitants is calculated by allocating to each inhabitant a volume equal to 200 m3 in consideration of low residential density, space for services and large deposits in historic buildings and of large thickness walls, using the following formula: NA = V / 200

In the case of constructions with tourist destination, this value has been modified by adding the number of tourists potentially present with a volume equal to 100 m3, this value is set in relation to the number of rooms present and the volume of each building, formulas that turns out to be: NA = V / 100 54

- *Criteria for Determination of Risk Exposure Levels*

For determining the level of risk exposure in the case of Gjirokastra, it has been determined by setting an increase in the function of the largest inhabitant of precious value with the following system:

N ° residents EXPOSURE LEVEL
From 0 to 2, Low
2 to 5, Medium
5 to 15, High
> 15, Very high

Results in the case of Gjirokastra (which for a building number taken on an examination equal to 922 represents an important sample) have identified a percentage of buildings equal to 34.92% that are part of the Exposure level High and Very high, while one third of the buildings (30.30%) are part of the Low exposure level.

- *The importance of historical-architectural characters*

The importance of historical-architectural characters represents the element of continuity with the Reconstruction Plan, from which, in fact, the intervention categories were derived using the basis for assigning values for each building.

The importance attached to the Historic-Architectural Value of the building makes it possible to evaluate in detail the importance of the building in the historical context, assigning a value in relation to its potential loss in relation to the historical memory and the urban structure just as it has been structured over the years.

- *Elements for determining exposure to risk:*

Are used Intervention Categories defined by Recovery Plan:
IP - Public Interest Building
CO - Contrast Building
TM - Small Structure
CU - Cultural Heritage Building
ST - Typical Building
TU - Protected Buildings

- *Criteria for setting risk exposure values*

It has considered the great or minor importance of the building in relation to what is stated in the Reconstruction Plan whose values are taken dogmatically. In the case of Gjirokastra, the review of the Reconstruction Plan was integrated with the studies carried out by the Office of the Plan for finding the buildings of Italian Rationalism in the 1930s and the 1940s.

- *The vulnerability of road infrastructure*

Such an analysis has led to the examination of the vulnerability of road infra-structures as a fundamental element in the event of an earthquake on the removal of residents and for the arrival of the aid.

The vulnerability is divided into two perspectives, one of which examines the vulnerability of the infrastructure based on the constituent elements and is defined as the direct vulnerability, the other that examines the elements that the road traffic is in direct connection because located in their vicinity (i.e., with their damage may aggravate the conditions of use in case of earthquake) that is defined as induced vulnerability.

- *Direct vulnerability*

Direct Vulnerability deals with constituent elements of road passage such as dimensions (width), slope, presence of stairs, roadbed, etc. Most of these elements were derived from aero-photogrammetric cartography and dogmatic deductions from the Recovery Plan in terms of road surface.

They are linked to each other by defining vulnerability classes in function of the number of parameters that affect a certain part of the road. Even in this case, the evaluation is of the fast type and each of the elements has been given the same weight, in order to avoid the same as for the rest of the interview of the expert staff intervention.

- *Induced Vulnerability*

Induced vulnerability deals with those elements that interact with road passage and that normally represent significant benefits but that in case of earthquake can turn into the weak link chain and stop access to important areas of the historic city.

Even in this case being treated for quick analysis, the information derived from normal aero-photogrammetric cartography was used to determine the walls on both sides of the road, those that serve the road itself, the bridges for the passage of streams or canals, underpasses.

The state of maintenance or the correct dimensioning of these elements has not been examined to avoid static analysis of certainly complex levels.

We have decided to add as additional elements the risk of the presence of Highly Vulnerable Structures (deduced from the Vulnerability Analysis) present on the sides of the route taken in the examination, because without preventive interventions can be considered as high-risk products that may interfere negatively with the use of road infrastructure in the event of a seismic event.

As a further factor the risk was to consider the collapse of the façades that make up the side of the road, giving them a hypothetical blocking capacity of the width equal to one-third of the height of the entire facade.

RESULTS

From the above parameters, a risk analysis table is created for buildings as well as for transport infrastructure facilities. Such a chart points to the immediate and, to a lesser extent, expert, the weakest points of the historic center system, points at which the greatest criticisms are centered, and thus allows the start of work, which at the stage of analysis, for the first determination of the elements necessary to reduce the risk.

Reclaiming the work done before actually faces the determination of interventions in order to significantly improve the situation with marked actions and calibrated on the available budget.

In fact, it may be very easy to think of the necessary investments to reach an acceptable level of security and whether it is necessary to control intervention based on available funds.

The Risk Reduction Table becomes the newest element that can be used as a supportive approach to planning of the Historic Centers.

In fact, by introducing the risk analysis table in the Traditional Reconstruction Plan, this important part of the city can be assessed from another perspective in such a way as to allow balanced choices not only of the state of degradation of buildings but also of people in the Historic Center who reside or want to reside, who should be aware of the level of risk they must face except that any construction interference made in this subtle part of the city interferes with the whole system.

CONCLUSION

The increase of awareness on disaster risk has induced an increased awareness of risks in cultural heritage as well. Damage and destruction of high-profile heritage sites has drawn attention to some measures to be taken before, during and after an earthquake:

- Create an inventory database of all cultural heritage sites/objects, encoded, and detailed with photos, plans and other important records, including geological studies of underground soil profile/structures.
- Perform risk analysis for critical infrastructure, such as roads, water/gas/electricity installations.
- Prepare evacuation plans and make them visible for public.
- Use insurance as a complementary plan for movable objects.
- Crate and train an emergency group, specialized on cultural properties, preferably with multidisciplinary team members.
- Prepare and update continuously disaster zonal maps, by performing disaster studies, developing vulnerability curves, etc.
- Continuously update and improve the building codes and publish guidelines for local builders.
- Increase the awareness, culture, and education on the importance of disaster risk management.

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