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Article

Risk Management and Physical-Housing Vulnerabilities in a Historic City Center

Administración de riesgos y vulnerabilidad físico-habitacional en un centro histórico

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ABSTRACT

Aim: To identify threats associated with physical-housing vulnerabilities in Protection Area No.1, historic city center of Camagüey, which might be managed with a Risk Administration approach, at the Municipal Housing Office.

Methods: theoretical-documentary method for national and international analysis; systemic-structural method and scientific observation based on interviews to specialists and local residents; and design of tables containing information associated to dangers and risk factors in the habitat.

Main results: Identification of dangers and natural and anthropic risk factors in local homes with economic-financial implications. Detection of hiring insufficiencies in relation to services for repair and construction at the Municipal Housing Office in Camagüey, affecting risk management.

Conclusions: It was clear that since the onset of the first risk management stage _the study of the problem and identification of dangers_ in buffering zones of the World Cultural Heritage Site in the city, greater efficiency and control was needed from decision-makers

of the Housing System in the city of Camagüey. The case study at Protection Zone No.1 revealed the association of these effects to financial expenses and relevant economic impacts, along with a significant relation to the loss of already-built heritage.
Key words: risk management; historic center of Camagüey; physical-housing vulnerabilities; protection zones; buffering.

RESUMEN

Objetivo: Identificar las amenazas vinculadas a la vulnerabilidad físico-habitacional en la Zona de Protección 1 del centro histórico de Camagüey, Cuba, que pudieran manejarse desde la administración de riesgos, en la Dirección Municipal de la Vivienda.
Métodos: método teórico-documental en el análisis nacional e internacional; el sistémico-estructural y la observación científica, apoyados en entrevistas a especialistas y a residentes de dicha zona, además de la elaboración de tablas con aspectos relacionados con los peligros y factores de riesgo en el hábitat.
Principales resultados: La identificación de los peligros y factores de riesgo naturales y antrópicos en viviendas del área de estudio, que tuvieron implicación económico-financiera. La detección de insuficiencias en el proceso de contratación de servicios para la reparación y construcción en la Dirección Municipal de la Vivienda de Camagüey, que afectan la administración de riesgo.
Conclusiones: Se evidencia que desde la primera etapa de la administración de riesgo que abarca el estudio de la problemática y la identificación de peligros- en las zonas de amortiguamiento del Área de Patrimonio Cultural de la Humanidad de la ciudad de Camagüey, se requería mayor eficiencia y control por parte de los decisores que respondían al Sistema de la Vivienda en Camagüey. El estudio de caso en la Zona de Protección 1, reveló la vinculación de estas afectaciones con costos financieros y efectos económicos relevantes de impacto, además de una importante relación con la pérdida del patrimonio construido.
Palabras clave: administración de riesgos; centro histórico de Camagüey; vulnerabilidad físico-habitacional; zonas de protección; amortiguamiento.

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INTRODUCTION

Historical cities are an example of habitat sustainability, as their buildings, inherited infrastructure, and heritage, which in many cases are unique examples, are given proper use. However, these ancient structures are currently endangered as a result of inefficiencies to respond to possible unexpected dangers or slow and accumulative risk factors, which are increasingly becoming less natural, both in terms of the causes and the dynamics, degrading the residential potential (Jian, 2014). Neither is the integrality in territorial treatment perceived in terms of plans conceived for management and administration of risks of heritage sites, since attention is generally given to the preservation of monuments, heritage spots, and world heritage sites, not having the same considerations for their location or surroundings at a larger scale (Guzmán, 2014).

The area surrounding the world heritage site is known as buffer zone. The ever-increasing problems generated in the zone are creating a critical housing issue where the lack of resources and inadequate planning and risk management promote greater vulnerabilities. Accordingly, there is a need to implement risk management at a territorial scale, particularly at a local level, for an adequate management of the physical vulnerability of buildings.

The greatest impacts of natural risks, which are amplified by anthropic actions, are reported in residential areas. This reveals the unfavorable conditions of housing, with an aged infrastructure, poor basic services, and inadequate preservation conditions. As a result, the higher physical-housing vulnerability levels make structures and elements of homes more susceptible to physical damage caused by natural and/or anthropic actions. This is associated to internal factors evaluated through their materiality and preservation state, and by external factors that affect buildings from the surroundings (Angeleri, 2013). Inadequate risk management _as a process of identification, evaluation, and management_ is responsible for increased physical vulnerability of housing in the heritage areas. Therefore, it is important to recognize their direct link, and to work in

synergy with decision-making entities, on housing, in keeping with social, economic, political, and environmental factors.

In the Cuban context, the practice of risk management is performed partially. This is the result of neglecting the economic and financial aspects (Infante, 2009). One of the buffer zones of the historical center of Camagüey was chosen for this study. It will be given the term “protection zone”, in accordance with the regulations set by the Network of Historian’s and Preserver’s Offices in Cuba. This is Protection Zone No. 1, which is the closest to the site pronounced World Cultural Heritage in the city of Camagüey.

The methods applied were analytical-synthetic, systemic-cultural, and scientific observation. All were backed by interviews to the inhabitants and representative reporters, and a diagram design that illustrates the hiring process of the main entity involved.

The rationale of this study was reviewed, including the Territorial Planning and Urban Development plans, in some cases referenced to as partial plans, master plans or governing plans, which are planning instruments where urban and architectonic transformations of the city are laid out. Risk management of these instruments is oriented from the environmental variable, from which the models or strategies to reduce them are designed. Within the context of the historical center of Camagüey, the Partial Plan emphasizes on the area declared World Cultural Heritage, though a survey of the dangers is still insufficient, especially due to risk factors and anthropic vulnerabilities.

This also occurs because this variable is not operated with proper diagnostic of the site or area to study, which, as a result, does not help determine existing vulnerabilities locally, depending on the origin of threats. Additionally, the environmental variable is poorly related to the housing variable, which affects work on the risks influencing residential degradation in the traditional sector of the city.

The international experience in this topic was reviewed in several documents, some of them legal, which have been approved for territorial planning and urban development of heritage cities (Wamsler, 2007), (Spanish Network of Cities for the Weather, 2015). This experience review and the work with planning instruments internationally, evidences that risk management is somehow integrated to urban planning and housing. However, the guidelines for land-use planning and integrated risk management are not always

functional, because there must be a synergy among the social, economic, political, and environmental factors.

The few bibliographic references corroborate that at the national level, the integration of risk management and urban planning in residential heritage sites, has not worked out properly. Hence, based on a risk management approach during the first stage, the aim of this paper is to identify the main threats linked to the physical housing vulnerabilities of Protection Zone No.1, whose economic-financial implications call for risk management assessment to be done by the Municipal Housing Offices in a more effective way.

In order to contribute to those studies from a specific zone, the direct physical risks identified together with financial, legal, and operational risks on the housing stock of the area studied, were tabulated. Besides, a short analysis of some deficiencies in hiring at the Subsidized Unit of the Municipal Offices of Housing in Camagüey, which effect on the rise of physical-housing degradation.

DEVELOPMENT

Need of risk management in face of residential vulnerabilities in buffer zones

The term “buffer zone” is a very specific term in world heritage management. When limits are established in these areas, the World Cultural Heritage sites are determined as the protecting belt in charge of cushioning possible impacts on the site. It can be illustrated through several studies, like the research done by Mexican specialist Guzmán (2014), who said,

> (...) the role of the buffer zone with regards to the protected site (refers to the World Heritage Site), will depend on an efficient long-term management strategy that anticipates local needs and global trends that might affect the site, allowing uses and activities that help preserve local traditions and lifestyles that contribute to protection, and foster the participation of local communities (p.46).

In other words, it is a shelter that protects against threats, which helps prevent and manage threats to preserve the World Cultural Heritage site. However, reality reveals that the necessary conditions are not created *per se*; on the contrary, it generates dangers and vulnerabilities that could further have negative effects, including the destruction of the site.

The most concrete definition of these zones was first used in 2005, in the Vienna Conference on the ways to regulate development and modernization of heritage cities most properly. As a result, the Vienna Memorandum was issued (United Nations Organization for the Education, Science, and Culture [UNESCO], 2005). One of the most explicit concepts of these zones is the one given at the Convention on World Heritage, 1978, which established that in order to protect the accepted heritage sites, it is important to set a buffer area around it, whose use and development would be legally and/or by common law restricted in order to ensure its protection. The document adds that the area adjacent to the site should be taken into account. (UNESCO, 2008) (Fig.1).

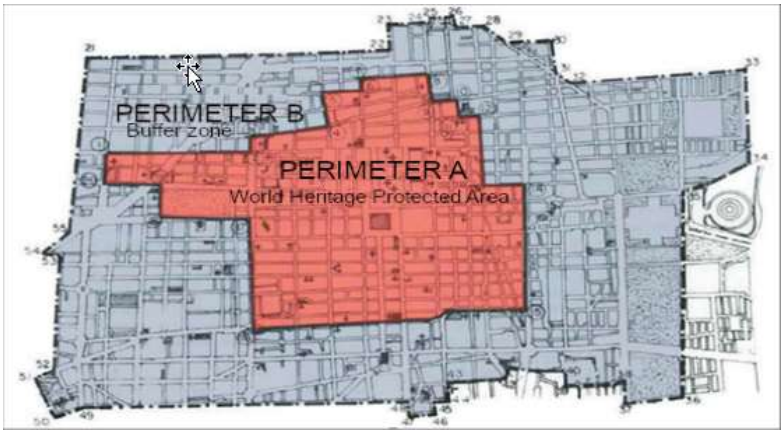

Fig. 1. Map of the historical center of the City of Mexico Perimeter A World Heritage Site, perimeter B (gray area) buffer zone

Source: Guzmán (2014).

Then, knowing that in these zones, mechanisms, regulations, and controls are weaker, and in some cases, inexistent, the presence of risks makes up a reality that people should face every day. Therefore, the likelihood of losses derived from the occurrence of certain events must be thoroughly considered to achieve positive results from any activity type

under risky situations. The authors coincide with the previously presented definitions, and acknowledge that the role of buffer zones eventually produces inverse effects.

Now, the existence of risks is a condition that inhabited historical centers must cope with on a daily basis. Hence, the likelihood of losses derived from the occurrence of certain events must be considered carefully, in the search of positive results from any activity type under risky situations. In this particular case, the society and decision-making entities need to acquire knowledge about elements like ever-growing and unpredictable natural disasters, a more competitive and demanding market, increased potential damage to third parties and the environment, and a rise in the value of assets which are exposed to risks.

Therefore, risk management is an innate activity of humans, so from this perspective, it is a traditional practice found in any place, at any moment in history. Actually, the time when humanity replaced the ancient methods guided by superstition, instincts, and blind faith by risk quantification techniques, goes back to 350 years ago. Today, modern risk management is the result of that evolution.

Other pillars were laid since the beginning of the TWENTIETH Century. In 1955, the term *risk management* was finally coined; since then, this type of management is permanently improving, based on a broad scope and far-reaching structure. Likewise, to make it simpler, risk management is the process used to identify, analyze, and exert economic control over risks that might affect assets, or the income capacity of an entity.

When risk management was used in developed countries for the first time, the most transcendental socio-political changes were taken place in Cuban history. These included the promotion of a predominantly state economy, and the development of a in-depth social program, which conditioned very particular traits of risk management.

The Cuban practice in risk management has been characterized by the existence of numerous administrative, and science and technology institutions that regulate partial aspects. One of them is Civil Defense, whose performance has been recognized both nationally and internationally. Nevertheless, there are still other elements to be developed, especially at the local level, particularly in the oldest areas of cities.

Risk classification

It is important to classify risks to study them. Some definitions (Pérez, 2007) will be briefly commented in this paper, in order to provide a general notion of the most common risks:

Static and dynamic risks: the static risks are connected to losses caused by the irregular action of nature or errors and crimes of human behavior, which are a loss to society. Within that group, the authors refer to the natural or anthropic risks that generate potential and real damage to the housing stock in heritage areas. In turn, the dynamic risks are associated to changes of human requirements, and improvements of machinery and organization.

Fundamental and particular risks: the fundamental risks are those originated by the loss of control of individuals or groups of individuals, causing a catastrophic and extensive effect, whereas the particular risks are more personal as to cause and effect, since they are originated by individual reasons like fires, explosions, robbery, etc., and affect individuals in particular ways. Their occurrence can be somehow controlled by people.

Financial and non-financial risks: the financial risks are so classified when they are susceptible of economic assessment in monetary terms. For instance, the loss of a home, a car, losses with consequences, and even civil liability, can be measured in monetary terms. With this definition, from the perspective of economic sciences, it is important to calculate and quantify the financial costs, and relevant economic effects associated to risk-generated events. Within this position are economic and financial impacts, though other standpoints that limit the inclusion of human resources are insufficiently treated. This perspective is also characterized by a more objective vision. Hence, the non-financial risks are the opposite. They cannot be strictly measured in monetary terms, such as the risks of getting married, having children, or choosing a university degree.

Pure and speculative risks: pure risks imply possibilities of loss, and in the best of cases, generate a non-winning situation; instead, the initial situation is kept. These are insurable risks, whose realization always consists of damage or loss. Furthermore, speculative risks, as opposed to the previous, lead to the possibility of winning something under a given situation.

Legal risks: these occur when a counterpart lacks legal or regulatory authority to make a transaction. To other researchers, this contingency means the loss that emanates from complying with the laws, regulations, practices, or ethical norms.

These aspects were mainly established in the area of business, but in this particular case, they overlap with the historical urban scenario. Then, the ultimate objective of risk

management is to reduce the negative results of dangers, at the least possible cost, for which they must be identified, evaluated, and controlled. The detection of static risks; that is, risk causing damage to buildings, machinery, and work processes, is the main focus of this activity.

Risks of the housing stock in protection areas adjacent to the World Cultural Heritage site in the historical center of Camagüey city

The historical center of Camagüey, the object of this research, consists of 54 hectares that make up the oldest core; the buffer zones comprise 276 hectares distributed in 8 zones **(**Fig. 2.). Therefore, to coincide with the terminology used by the Historian's Office of the City of Camagüey (OHCC), this study will use the classification of protection zones equivalent to the national level of buffering.

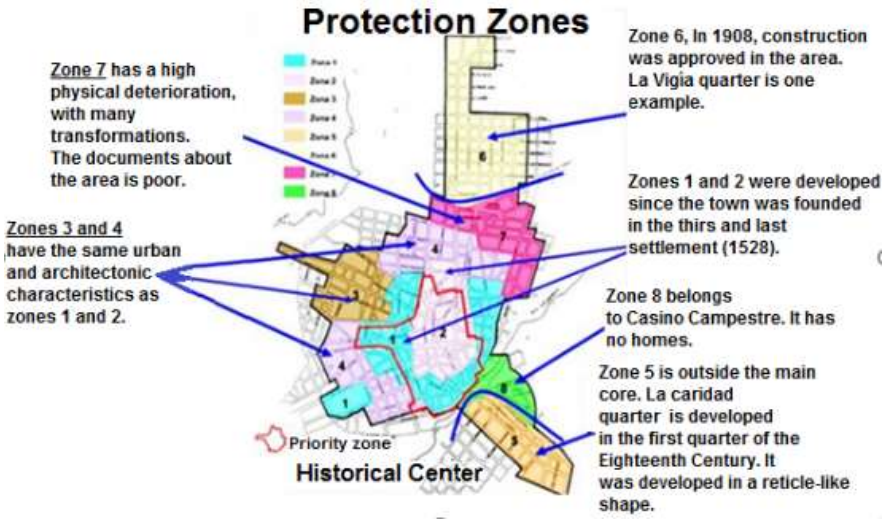

Fig. 2. The eight protection zones of the historical center of Camagüey

Source: Made according to the Master and Management Plan of the city (OHCC, 2017).

The establishment of these zones was the result of a general inventory done several years ago, along with an urban characterization, according to the study of typological areas. During the process, value criteria of the typology, soil use, hierarchy of buildings, and the maximum extent of the historical center to ensure legal protection, were defined. This traditional sector of the city is exposed to natural disasters caused by technology, sanitation issues, and humans. The highest vulnerability percentage is mainly located in areas adjacent to the World Cultural Heritage site, however. Urban risks have been

determined to be of natural and physical origins, such as strong winds and floods due to heavy rains (Ministry of Science, Technology and the Environment of Cuba [CITMA], 2012). A potential physical risk is posed by earthquakes, and others generated by the threat of physical events, which are essentially created by human intervention. The latter type of events is the consequence of mismanagement of resources and wastes, the destruction of the habitat, pollution, and destruction of the constructed heritage.

The most affected protection areas are the oldest, located adjacent to the World Cultural Heritage site, including: Protection Zones No.1, No.2, No.3, and part of No.4. The absence of integrality in risk management in the historical center of Camagüey is a reality, so the main actions and measures for disaster management are performed in the World Cultural Heritage site, which the OHCC denominates a priority zone for preservation, somewhat leaving the 8 protection zones on their own.

This lack of attention is even observed in the urban regulations of the historic center of Camagüey. Such legal tool is mostly devoted to the priority zone. However, dealing with risks in those areas is not comprehensive, since not all the incidences can be covered. It only focuses on risks to human life caused by sanitary issues, and others that cause the loss of structures, elements of road structures, and technological grids, according to Rodríguez *et al* (2012).

In other words, inadequate risk management of heritage in the historical center is another threat of anthropic origin that speeds up housing degradation processes with their corresponding losses of real estate and property, as well as government expenditure on recovery from disasters caused by extreme events.

Identification of risks in the blocks of Protection Zone No.1 in the historical center of Camagüey

The urban risks of protection areas around the historical center in Camagüey were identified by blocks, as the unit of analysis. The review of the database, including the technical sheets provided by the Master Plan and Management Office of the OHCC provided valuable information. Likewise, studies of danger, vulnerability, and risk, previously done in the province by CITMA and the Group of Risk Assessment at the *Ignacio Agramonte Loynaz* University of Camagüey, were consulted.

As previously stated, Protection Zone No.1 has been given greater interest; it comprises three sub-zones whose east-southeast part has turned out to be the worst, in terms of physical-natural dangers of floods due to heavy rain, and its proximity to the banks of Hatibonico River (Fig. 3). To identify the risks that cause natural and anthropic threats, a 2016 study of six blocks with the highest exposition to a variety of dangers, was used as reference. They are located in the east-southeast section of Protection Zone No.1, and have revealed their structural vulnerability to dangerous events, like floods, strong winds, and earthquakes, which has been corroborated by estimations in relation to these dangers, based on national established methodologies (CITMA, 2009) and (Environmental Agency, 2014) (Table1).

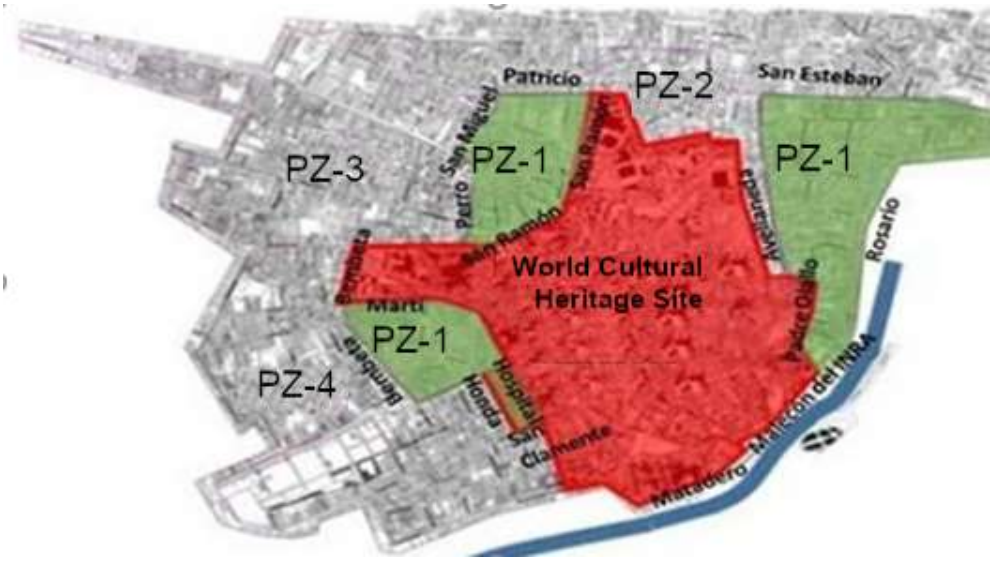

Fig. 3. The three sub-zones in Protection Zone No.1 (green), and the area of Cultural Heritage (red)

Source: Made by Kenia Suarez, according to the Master and Management Plan (OHCC, 2017).

The six blocks with the highest exposition to environmental risks, according to the evaluation of physical vulnerability were 163, 164, 171, 307, and 308 (Fig. 4). Their proximity to Hatibonico River has created a great influence, but the local inhabitants also reported other dangers associated to urban dynamics, such as the lack of maintenance, dangers due to vibration of structures and constructive elements produced by rolling, heavy, fast, and noisy traffic. Additionally, vandalism and dismantling of constructive

elements will largely increase residential vulnerability if they are not taken into account. The subjects interviewed claim progressive deterioration of such damage in roofs, walls, floors, electric and hydraulic grids, loss of original architectonic and constructive elements, the effect of moisture, and total or partial collapse.

Table 1: Analysis of risks in the Protection Zone No.1 of the historical center of Camagüey

Typology of threats to housing in PZ1	**Main causes of risk**	**Most recurring economic and financial impacts**
RISKS HYDRO-METEOROLOGICAL Floods caused by heavy rains Strong winds Heavy rains Storms or hurricanes	Settlement between rivers Hatibonico and Tinima Scourge of hydro-meteorological events. Floods caused by nearby dams. Deterioration of buildings Inhabitants with few or no resources	Financial risks -Increased expenditure due to the absence of a budget for disasters in the housing stock in the heritage areas. -There is a rise in the Other Expenditures item with the Repair and Maintenance budget sub-account, because in several economic periods it has been used to relieve the effects of disaster in the housing stock in heritage areas.
TECTONIC-GEOLOGICAL RISK: Earthquakes This is a potential risk	Location of the province in the seismic area of Bartlett-Caimán. High concentration of buildings and inhabitants. Poor technical state of homes and inadequate constructions.	-Increased neglect and lack of home maintenance, because the population has no idea of how to access credits for rebuilding, renovation, and home extension.
RISKS OF ANTHROPIC ORIGIN Collapse of structures. Adequate interventions leading to structural damage and lack of safety to people. Affectation to infrastructure grids. Loss of heritage values. Loss of habitability conditions. Interruption of vital services. Deterioration of constructions due to air pollution.	Significant levels of overcrowding. Little or no economic possibilities of the population to intervene the home. Aging of buildings and infrastructure. Poor habitability conditions and occurrence of several breakdowns. Land occupation. Need to live downtown. Deficient water supply and sewage systems. Inadequate life styles and illegal land ownership and construction actions.	Legal risks -Likelihood of deterioration or collapse caused by violation of legal regulations by the people and entities in charge of housing in high heritage value areas in the city. Operational risks. -Increased number of impacts and damage caused by extreme natural events on housing, due to higher physical vulnerability produced by inappropriate preservation management of the existing heritage. -Loss of heritage values due to natural and anthropic disasters, resulting from incorrect heritage assessment as an economic resource of the historical city center.

Vandalism of the structure of abandoned buildings.	Physical deterioration of the housing stock. Inadequate constructive practices of renovation and construction of new homes. Increasing number of transformations of facades and interior spaces. Lack of interest in the local history and the importance of the urban surrounding. Deficient garbage collection system. Air pollution.	-Insufficient information to the inhabitants in relation to technical counseling requests and construction services in home interventions or transformations. Risks generated by human actions. -Vibrations and cracks in buildings, caused by inadequate transit of vehicles. -Unfavorable situation of roofs (many date back to the Eighteenth Century). -Mismanagement of solid waste disposal. -Sewing issues that emerge during and after floods. -Inadequate constructive interventions of home extension and repair.

Source: self-made

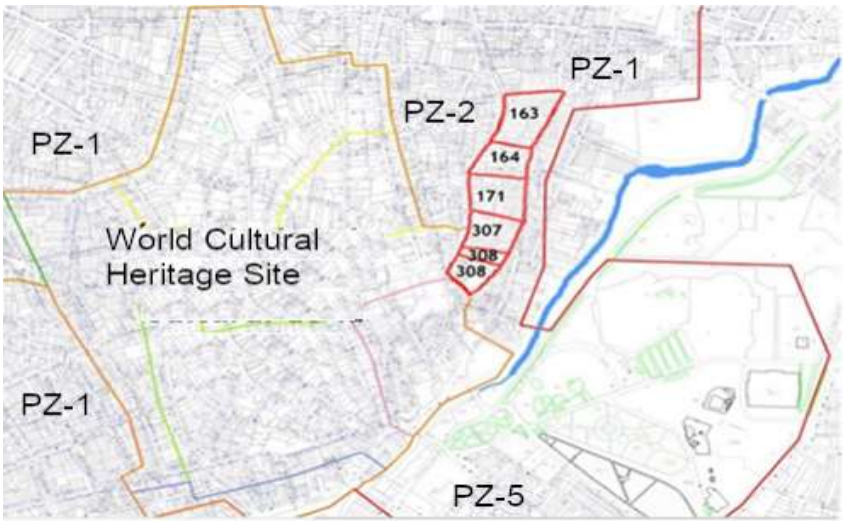

Fig. 4. Location of the six most affected blocks in Protection Zone No.1 because of their proximity to Hatibonico River

Source: Made according to the Master and Management Plan of the city (OHCC, 2017).

This problem calls for an analysis of risk management assessment of the residential stock under extreme natural events, and the anthropic risk factors declared by residents. Accordingly, it is important to consider the institutions in charge of residential interventions in the historical center. One of these institutions is the Municipal Public Administrations´ Service Unit of Housing in Camagüey, at 62 Avellaneda Street. It belongs to the Municipal Council of Administration of the People's Power in Camagüey. Its operation depends on

the resources earmarked to the entity, together with fix, circulating, allocated, and long-term assets in its patrimony. Its object is,

- To promote, control, and work to guarantee the compliance of the General Law of Housing and other legal provisions on this matter.
- To control the enforcement of provisions and standards established for the stock of state-owned homes.
- To participate in definitions, and control the implementation of home preservation and rehabilitation actions, and sales of construction materials to the population.
- To participate in the control and implementation of the investment process of home construction and urban development.

Insufficiencies in hiring services from the Municipal Housing Office in Camagüey, which affect risk management

In the comments below, the procedures and economic activity of this office in Camagüey are evaluated through Versat Sarasola software. Likewise, it is deemed necessary to report briefly on certain insufficiencies of risk management, and resource availability to cope with the physical residential vulnerability in this public administrations´ service unit:

- Accounting at the Municipal Housing Office has many deficiencies. Concerning disasters, a plan of climatic affectations is designed, but the stock of risks is managed by the provincial and municipal governments.
- The plan of climatic affectations is explicitly used in attending partial loss issues with roofs, total roof loss, and collapse of buildings, which is a shortcoming of ancient buildings concerning the extent of constructive interventions.
- The company does not have a methodology to assess risks.
- There is no counseling to employees who can design a budget plan that includes risks.
- An item named “Other Expenditures” covers some unexpected cases of emergency.
- The startup budget of the Municipal Housing Office is used to mitigate the impact of disasters that affect the implementation of ongoing plans.

- The provincial government is the only institution in charge of providing support in case of emergency and damage.
- The demands of the affected population remain constant due to the high structural vulnerability of some areas; resources and intervention priorities are unavailable.
- The technicians at the Housing Office are in charge of detecting affectations, and report to the Civil Defense. When the annual interventions are planned, no new cases can be included in the plan, even after the occurrence of severe impacts.
- The affectations used to be discussed at the Council of Administration. Currently, assessment of the existing affectations is made in the middle of the year.
- The Office cannot pay a construction team of its own, so it must hire construction workers from different companies, though this budget item can be reviewed.
- The municipal government checks the execution of the plan, and deposits the definitive sum earmarked without considering the real diagnosis of that entity.
- Generally, home interventions are the priority in the World Cultural Heritage site, because the OHCC pays for the resource, and the Municipal Housing Office provides them.

CONCLUSIONS

This study demonstrated the need to identify natural, anthropic, and economic-financial risks, to reduce physical housing vulnerabilities in areas with heritage values.

The diagnosis produced a report to the Public Administrations´ Service Unit Municipal Housing Office in Camagüey, to support the home risk plan in protection areas of the historical center.

Risk identification is indispensable in the absence of integrality in terms of heritage management, which is manifested in sites declared World Cultural Heritage. Accordingly, the efficacy of risk management of the housing stock is affected.

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Conflicts of interest and conflict of ethics statement

Author Kenia Suarez Gerard states that this is an original manuscript, and has not been submitted to another journal for publication. The author also states the responsibility of all the authors in the contents submitted, and assures the absence of any plagiarism, and interest or ethical conflicts. The author assumes all responsibility and exempts the journal from any ethical or legal commitment.

Author contribution statement

Kenia Suárez Gerard: Search and redaction of theoretical referents, in addition to field work and processing of the main results.

Yanet Miranda Sánchez: Support in the search and collection of theoretical referents, in addition to processing the main results.

Rosa González González: Contributed with background information. Participated in the collection of information at different entities of the Historian’s Office of the city of Camagüey (OHCC).