URBAN COMPLEX RENEWAL OF THE HISTORIC CITY OF CIACOVA, ROMANIA

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ABSTRACT

The city of Ciacova is situated in the western edge of Romania; it played different roles during the history, from military outpost (XIVth to XVIIIth century) to market town (XVIIth – XXth century). The city form is dominated by the market square surrounded by valuable heritage buildings (XVIth – XXth century). North of the square there is a late XIXth century „garden city” development containing the city hall, a cottage hospital, the train station and the XIVth century tower – the last relic of the medieval citadel. The Politehnica University of Timisoara devised a strategy based on the modern re-use of the architectural heritage in order to revive the city, and the following directions emerged: the market place and the surrounding structures are to become the support for events (festivals, concerts), and the northern park will recover its landscaped outlook, the city hall and the historic tower will be endowed with cultural functions, a new „landform” will be created in order to spatially re-create the presence of the citadel; finally the original connections between the market square and other districts will be recuperated and the restauration of the pavements is considered. A full range of interventions are to be addressed in a multidisciplinary way: risk assessment and seismic behavior analysis of the selected buildings, rehabilitation and structural safety for the damaged buildings – considering the modern re-use of the historic tower together with structural rehabilitation. The aim is to obtain the re-insertion of the city center into the modern life.

Keywords: Multidisciplinary, Modern re-use, Risk assessment, Rehabilitation, Landscape

1. INTRODUCTION

1.1. General information. The evolution of the city

The city of Ciacova is situated in the western plain of Romania on the left bank of the “Death Timis” river, less than 20 km south of the regional centre of Timisoara (Fig. 1). The small city (7 800 inhabitants) has a long and complex history and has played several distinctive roles during its evolution.

Fig. 1 Ciacova’s territorial connexions

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It was an important military outpost between the XIVth and XVIth century, built around a fortification on the left bank of the river. Only the main tower of the fortification survived on the river bank, integrated now in a recreative area. The tower, inadvertently called “Kula” is not a typical mid-eastern isolated fortification but rather a “donjon” type, the central piece of a circular precinct (Fig. 2).

![Fig. 2 The fortification and the remaining tower](image)

After the Habsburg conquest (late XVIIth century), the city became an important market town until the 1940’s. As a consequence the market square grew consistently, accommodating the weekly market and various other activities. Both the market square and the main access roads were covered with cobbled stone; important commercial buildings were either upgraded or newly built (XVIth to XXth century) creating a valuable tissue of heritage structures (Fig. 3, Fig. 4a).

![Fig. 3 Ciacova – the evolution of the urban form](image)

![Fig. 4 a) The main market square XVIIIth Century, b) The new City Hall XIXth Century](image)

![Fig. 5 Historic changes of the tower’s area](image)
In the north of the square, a new City Hall (Fig. 4b) has been built in the late XIXth century marking the beginning of a new “garden city” development on the river bank, containing a park, a cottage hospital, a public bath and a landscaped environment of the tower.

In the early XXth century the railroad appeared along the river together with some light industries. After the Second World War an inevitable decline started for the once bustling market city. The market was transformed into an unhappily designed square, the beautiful park was fragmented and deteriorated, the old industries were abandoned, the tower was transformed into a water reservoir serving the communal swimming pool (Fig. 5).

1.2. Renewal strategies

In 2007 the city of Ciacova requested professional assistance from the Faculty of Architecture (Politehnica University of Timisoara) in order to revive the city core. Successive studies (urban, architectural, structural, restauration) have produced the elements of a coordinated strategy of renewal, containing three main steps.

Foremost was to recuperate the capacity of the main square to become a platform for new activities - cultural events, festivals, market for regional products [10]. The relationship with the former access roads and points of interest has to be revived, the old cobbled texture to be recuperated, along the traditional green spaces (Fig. 6).

The old arcaded commercial buildings are to be revived “en masse” and converted to a new life as a complex physical and spatial structure; finally, the City Hall must be fully restored and cleaned from the marks of previous “renovation”, accepting new functions (social, cultural, artistic).

![Fig. 6 Ciacova renewal strategies. The renewal of the Market Square](image)

The next step is to recreate the relationship between the market square and the landscaped park on the river bank.

The third step is the most complex – creating a landscaped environment on both riverbanks, including the tower, the train station, some of the old industrial buildings and the early XXth century concrete bridge (Fig. 7).

![Fig. 7 The riverbank rehabilitation plan](image)
The centerpiece of the new area will be a “landform” as defined by Charles Jencks [11], mimicking the old precinct of the medieval fortification [12]. A new open-air theatre on the opposite river will enhance the city’s capacity to host events; the existing industrial structures will be converted in artist’s and craftsmen workshops, hostels, restaurants, etc.

The tower itself, after delivering the water reservoir, it will become an exhibition space and the main viewpoint (Fig. 8).

![Image](image_url)

**Fig. 8** Landscaped development of the river banks

Because the city of Ciacova is situated in the middle of an active seismic area, the first step in order to engage in renewal projects was to produce a Seismic Vulnerability Study of the Buildings – The Market square structures, The City Hall, the Tower.

### 2. SEISMIC VULNERABILITY STUDY OF BUILDINGS

#### 2.1. General information

The revival of urban historic centres is made by evaluating the vulnerability of the component historic buildings. This study must be made because the urban historic centres are the result of unplanned development of buildings and therefore these buildings vary in shape, size, elevation and the technologies and materials used. Until the present time there were developed several calculus methods and studies in the seismic vulnerability field of historic buildings such as: Bendetti [1], Mazzolani & Formisano [2, 3], Langomarsino [4], Dolce [5], Modena [6, 7], Modena &Binda [8]. Results based on Mazzolani & Formisano’s [2] calculus methods of seismic vulnerability of buildings for the historic complex from Ciacova, Timis County are presented in this article. It was computed the value for the seismic vulnerability index for three distinct types of buildings from the historic centre: number 6 building complex denoted by I, the City Hall Palace denoted by II and the Tower of defence denoted by III. The layout of these buildings from the historic centre is presented in Figure 9.
2.2. Vulnerability study for historic building complexes

Along with structural damages caused by the intervention of man and the forces of nature, the buildings from the historic centres can have some damages that are difficult to evaluate due to pounding with adjacent buildings. These damages appear as a result of direct contact with adjacent buildings, or the erection of new buildings which discharge the loads on existing neighbouring buildings. Currently in Romania, the code for assessing the vulnerability of buildings is P100/3-2006, and it doesn’t have special provisions for complexes of buildings. In conclusion, in most cases the vulnerability is evaluated individually for each building, obtaining values for the vulnerability index far from the real one. The comparative computations performed in this domain by Mazzolani [2] and Langomarsino [4] with the aid of the 3MURI software shows that the vulnerability of the buildings from historic complexes must be analyzed as for a complex of buildings which share the loads between them, highlighting the different values obtained for the vulnerability for the same building. The advantage of using this calculus method consists in the simplicity of the computations performed for determining the vulnerability index. By identifying correctly the method of composition of the structure and the interaction between the buildings, the index can be determined without calculating the bearing capacity of neither the building elements nor the ultimate displacements. Buildings are classified in 4 classes of vulnerability A-B-C-D, defined by the increase of the danger level and it uses 10 parameters which take into account the geometrical and mechanical characteristics of the buildings and 5 parameters which account for the structural interaction between adjacent buildings. After calculating the vulnerability index \( I \) for all 6 buildings from the complex presented (Fig. 10) it has resulted values between 0.62-0.82, which indicates that urgent consolidation measures have to be taken for building no. 22 (\( I_v = 0.82 \)) and setting new structural consolidation measures for buildings no. 14,16 and 20. The smallest computed structural vulnerability is found at building no. 18 \( I_v = 0.58 \).
2.3. Vulnerability study for the City Hall Palace

The City Hall Palace was built in 1743. The building has an U shape, having the in plane dimensions of 40 m × 13.45 m, 2 wings with the dimensions of 9.0 m × 10.20 m and a maximum height of 14.65 m at the ridge (Fig. 11). The bearing structure is made of brick masonry. In time there have been several interventions on the resistance structure. So, during the expansion works in 1898 some structural elements and new materials have appeared, such as slabs on steel vaults, the use of mixed sand and lime mortar instead of clay mortar at the ground level, reopening of holes in the walls, the demolition of some walls at the ground level, a new staircase from prefabricated elements and a new roof.

In the present time, the building is severely damaged due to unauthorized interventions, earthquakes and poor maintenance. Due to the lack of maintenance some failures of wooden slabs have occurred, as a result of rainwater infiltration through the roof framing. Such was the case for the wooden slabs from the first floor and attic (Fig. 12a) and many other elements of the roof framing have rotten (Fig. 12b).

Unauthorized interventions on the resistance structure lead to the cracking of the masonry, severe deformations of the slabs and failures of the arches above the doors and walls (Fig. 12c). Now, the steel structure of the prefabricated staircase is highly damaged because some steel components were overloaded and pounded with different materials. The building records settlements in the zone in which the shanks and gutters are broken and allow the infiltration of rainwater directly underneath the foundation of the building.

The seismic actions produced damages at the bearing structure, by X fracturing of some walls, breastworks and masonry lintels. The value of the vulnerability index calculated with Benedetti’s [1] method was $I_v = 0.81$, which show that some consolidation measures of the resistance structure need to be taken. The solutions proposed in during the project [9] insure the increase of the bearing capacity of the building by the use of reversible consolidation technologies, which do not change the actual rigidity of the structure and insures a good special collaboration of the whole building, thus using all the bearing capacity reserves of the building. The consolidation project consists in consolidation at the level of the foundations, walls, slabs and roof framing. The masonry walls will be consolidated by replacing the broken bricks with bricks of the same type, cleaning the zones with degraded mortars and injecting higher resistance mortars, steel wire meshing and injecting the cracks. Where the wooden bracing walls have been demolished, new steel walls will be erected. The arches, masonry
columns and the prefabricated reinforced concrete stairs will be consolidated with steel profiles. Steel bracings that will form a rigid diaphragm will be displayed at each level in order to provide a consolidation for the wooden beams. The foundations affected by settlements will be consolidated by underpinning with reinforced concrete.

3. THE CIACOVA DEFENCE TOWER

It is built in 1395, and it has a height of 23.0 m with the base dimensions of 10.30 m and 11.33 m. The bearing walls are made of brick masonry with lime mortar, having a thickness of 2.70 m at the base and 80cm at the superior part. Severe damages were observed in the walls due to earthquakes and settlement of the foundation ground after a water reservoir was mounted in 1936 at the level +16.15 m. The tower developed a very well known failure mechanism in the vulnerability field (Fig. 13a) after the earthquake from 1991, forming vertical continuous cracks between the door openings and window openings (Fig. 13b).

![Fig. 13 Failure mechanisms of towers a) theoretical, b) recorded at the Ciacova tower](image)

The consolidation works from 1992 have affected the authenticity of the historic bearing structure by demolishing the wooden slabs and introducing 5 new reinforced concrete slabs and contour beams and some frames in the zones with openings. These consolidation works are irreversible, they increase the bearing capacity of the tower, but they didn’t resolve completely the deficiencies of the structure. In the present time in the structure are recorded damages due to settlements as a result of the high loads introduced by the water reservoir. The seismic vulnerability index of the tower after consolidation has a value of $I_v = 0.56$, hence urgent consolidation works for the structure aren’t necessary, but minimal restorations of the bearing elements must be done. It is necessary that the water reservoir should be removed in order to reduce the load and inertial mass of the building and some consolidation works must be done for the foundations, using micro-piles.

4. CONCLUSIONS FOR THE VULNERABILITY STUDIES

In this article there are presented the results of the seismic vulnerability of the buildings from the historic centre of Ciacova, carried out in order to obtain an urban rejuvenation of the city. For the first time there is calculated the vulnerability of complexes of buildings in Romania, in spite of the lack of clear provisions regarding this subject in the Romanian norm P100/3-2006. The method of computation is simple, reliable and doesn’t need intricate computations for determining the bearing capacity and ultimate displacements. The results of this method were checked with the help of 3MURI software and can be applied both by engineers and architects involved in these studies of urban renewal.

5. CONCLUSIONS

The Vulnerability Study establishes a rational guideline for the further advancement of the complex renewal project. The historic buildings are the centerpieces of a layered design strategy encompassing
urban planning, landscaping, restauration and reconversion of historic building and finally- elaborating valuable social and cultural projects in order to bring life into this attractive environment.

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