Hunan University Campus “Teaching and Research Building Two” Preservation and Reuse Design

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Francesco Augelli [1], Yuwei Li [3], Su Liu [3], Matteo Rigamonti [2], Changqing Tian [3], Yu Yi[3]

[1] Polytechnic University of Milan-DAStU, Piazza Leonardo Da Vinci 26, Milan, Italy
[2] Istituto Europeo di Design, Via Amatore Sciesa 4, Milan, Italy
[3] Hunan University, School of Architecture, Changsha, People's Republic of China

matteo.rigamonti@me.com

Abstract. Hunan University Campus is an architecturally and historically relevant academic facility complex set in the city of Changsha, in People's Republic of China Hunan Province. Its modern era masterplan construction started in the 1920s, Teaching and Research Building Two" was the first building finished in 1926. In 2015 has been enlisted in "China Sites of Cultural Relics Protected at National Level" lists. As an international and multidisciplinary team the authors were, with different roles, called to study the building history, define its problems and decay episodes, and design solutions for its preservation and social and functional reactivation. In this scenario the present work will outline the results of the researches done on the building giving a brief overall view but mainly focusing on those aspects that had major impact on many choices in the subsequent phases. Then the general field diagnostic on the building will be presented, focusing again briefly on the general methodologies and results, then getting more specific into those aspects that had major influence in the project part. The design phase will be constituted by two aspects: The Preservation and the Reuse Design. As it might be evident, the first will concentrate on removing the most prominent decay episodes and their causes from the structure, the second will focus on the insertion of new functions and the subsequent user needs to ensure a contemporary life to the building. Apart from these basics it will be though evident that the reuse design strategies that are intended to enhance the user experience are directly connected to the conservation guidelines, trying to trace a common "minimum intervention driven" and "immediate awareness of the contemporary additions in the palimpsest" design strategy that will not hinder the problem solving aims nor the contemporary standards and expectations. In fact these two design aspects, even if presented as separate chapters for better comprehension, will appear as solidly interwoven: the common conservation aim and the firm interdependence of the strategies between the preservation and the reuse project as well as how these strategies are intermixed in the historical palimpsest layers of the building will possibly result as one of the most interesting aspect of this paper, and potentially an interesting case-study in modern building preservation design methodologies panorama.

1. General Project overview and Introduction

The Preservation and Adaptive Reuse Project for the *Teaching and Research Building Two* of the Hunan University Campus has been commissioned by the Chinese Literature Department of Hunan University to Hunan University Design Institute Company Ltd. and his consultants. The adaptive Reuse Design Project, whose main aim is the functional and social reactivation of the building, it is intended as a complementary work to the Preservation Design and Guidelines Report as the two project share the same broader objective: the future conservation of the building. *Teaching and research building two*, built in 1925, enlisted in *China Sites of Cultural Relics Protected at National Level*, represent an interesting example of Modern Chinese Architecture whose preservation are recently raising in interest in

Figure 1, 2, 3 *(from left to right): The Main Entrance of the building located on the Southern Façade; A detail of the eastern wooden staircase; A detail of the loggia on top of the Main Entrance Porch.*

the People's Republic of China. Complete integration between Preservation Design and Adaptive Reuse is also another emerging trend in global Architectural Preservation and this essay will try to present the whole project and put an accent on the systemic integration of its multidisciplinary approach.

2. Localization, Building main Characteristics, History and Values

Hunan University is located in the historical City of Changsha, in Hunan, a South Central Chinese Province. It is located on the Western side of the Xiang River, that cuts the city in two parts and is characterized by the Juzhou Island (figure 5). The island is not so far from the Campus, on its Eastern side, while the Yuelu Moutain and its extended park is located right on its West side. Hunan University is one of the few with open and non-walled Campus in China and greatly benefits from the green environment of the western side of the city. Formerly known as the Confucian Yuelu Academy, founded in 976 a.c. during the Song Dynasty, Hunan University in the 1920s started a 30 years long expansion and gradually became a large set of educational buildings, nowadays occupying a considerably large area. In 1903 Yuelu Academy underwent a major reorganization and merged with the Hunan Capital Academy into the Superior Academy of Hunan, this process led into Hunan University foundation in 1926.

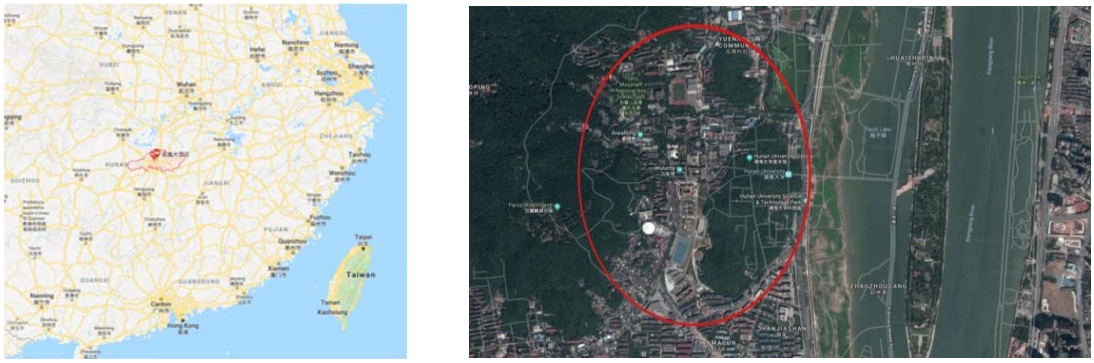

Figure 4, 5: The position of Changsha area in Central- South China; Satellite view of Hunan University Campus between Yuelu Mountain Park (Left) and Juzhou Island (Right)

The construction of the building object of this essay started in 1925, designed by famous architect and architectural educationist Liu Dunzhen, and it was the first building realized outside Yuelu Academy complex in Hunan University (figure 5). It has been named "Number Two" Building as Yuelu Academy was considered the "Number One" Building. It consists of two floors of bricks and wood structure and it is characterized by a sloping roof of western style but with a typical Chinese bend at the lower end. It is located in the northwest side of the Campus and it was initially intended to host Law and Finance classes. The construction finished in November 1926. It has been used for lectures for many years and at the moment it is partially being used as physics laboratories while waiting for a functional reconfiguration. From the architectural point of view it appears as a typical example of Eclecticism in

Modern Age. The original design established a shape resembling the Chinese letter "山" (meaning "Mountain"). but the floor plan geometry became rectangular when, in 1988, an addition increased the Total Floor Area from approximately 1.970 m^2 to 2.790 m^2. The structure covering the additional volume appears as a flat roof (figure 7). In 2012 an external volume for toilets was added as well as a new back door access leading to the Courtyard adjacent to the Northern Facade. For what concerns the history of the building it is important to notice that in 1937, during the Japanese invasion, it has been used as temporary station for the sick and wounded. In 1941, it was partly damaged during the second round of bombings by the Japanese army that had Hunan University and his Library as an objective. In fact, On April 10th, 1938, at 14 o'clock, warplanes of the Japanese army bombed Hunan University Campus and Library, destroying the biggest library in central and south China at that time. Unfortunately for this reason the whole collection inside the structure has been lost. No information is available about the rebuild that followed these damages. Probably the totality, or almost all the wooden structures (roof, floors, doors and many windows got burned) and after the war the timber structures of the roof were replaced with new wooden beams and the timber slabs and flooring systems were substituted with concrete and steel structures. Around 1968 the building hosted the Junior Middle School and later it has been used for laboratories of the School of Physics of Hunan University. In 2002 the building has been enlisted in the first batch of Historical Buildings under Protection from Changsha Municipality. In 2013 was enlisted in the 7th batch of Sites of Cultural Relics Protected at National Level, [1].

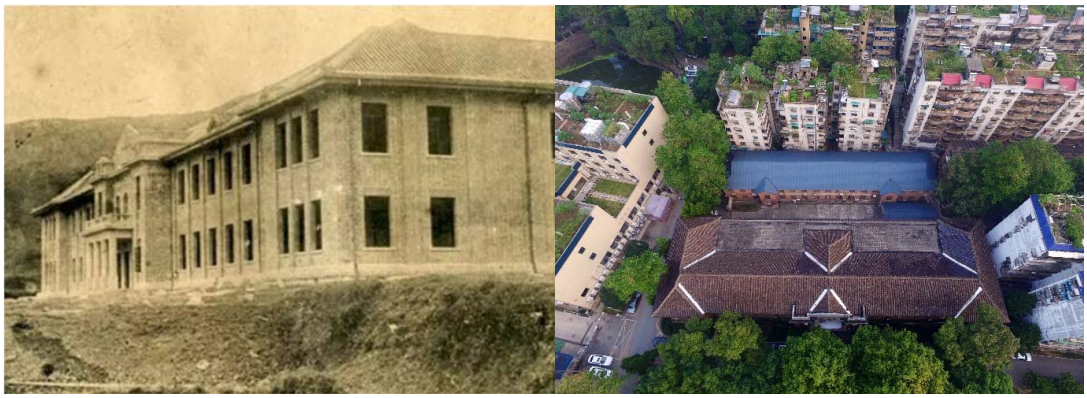

Figure 6, 7 (from Left to Right): A picture showing the final stages of Teaching and Research Building Two construction; A drone view of the building coverings showing the 1980s addition flat roofing system and the original Pitched Roof.

3. Material and Decay Analysis and Major Problems Definition

Teaching and Research Building Two decay episodes and possible identified causes have been identified via analysing the surveyed data and organizing the material in cross connected Material and Decay Data Sheets, some diagnosis oriented destructive intervention took place, as further presented, surveys and comparisons with other campus buildings features and situation were possible allowing for better comprehension. The general status-quo decay episodes' situation of the considered Building Two follows. Visible cracks and fissures are present in the building and different causes can be identified according to position and materials involved: erosions from natural environment, defects of building crafts or materials, static instability of materials, rusted iron elements, biotic erosions, or mortars with too much rigidity. Cracks on walls and plasters are possibly due to the absence of settlement joints and general uneven subsidence of the building. The causes of cracks on ceilings are that the base layer for plastering has lost carrying capacity, and that more layers of plaster were added inappropriately in later days. The damages during the bombing of the building could also have been caused cracks. Specific diagnostic tests and monitoring may be necessary in some areas to avoid any structural problem risk.

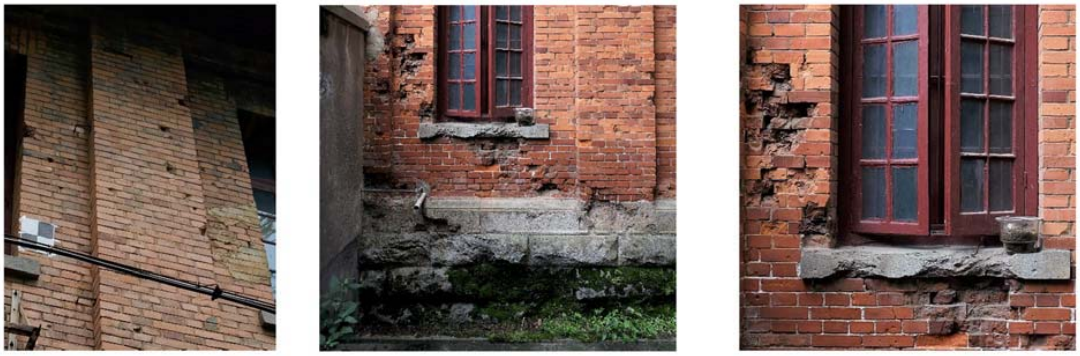

Figure 8, 9, 10: Mechanical Damage by impact Decay Episodes due to Second World War Bombings are present in many areas of the Building's Façades

Natural weathering caused erosion on facades mortar joints and bricks but also flows in brick cooking procedures might have played a role. Human activities caused severe mechanical damage by impacting objects in different areas. On the facade this is due to the Second World War Two Bombings (figure 8, 9, 10). Efflorescences and salt crust phenomena are also visible on materials characterized by a high degree of salinity exposed to dry-wet cycles. Efflorescences and humidity stains are extensively present in indoor and outdoor facing walls due to important ascensional humidity problems in the ground floor (figure 11, 12). The excess of humidity on wooden elements have caused some rot episodes too. A general lack of maintenance in the building may have caused the visible episodes of missing or instability of different elements, especially in doors and windows where abrasion and erosion phenomena are also present, interesting other elements in the building, especially the wooden, unprotected by coatings, ones. Uncontested water seepage episodes in the roof caused many detachments and missing phenomena. Naturally and artificially induced deposits are present in difficult to reach areas, this caused heavy dust to lay down and sometimes caused drains to be blocked with accumulated junks. Stains have been

Figure 11, 12 (from Left to Right): Efflorescences and Salt Crusts phenomena are extensively present on the totality of the lower part of the façades; Raising Dump related Decay episodes are also present on many indoor walls

provoked by inappropriate repairs that left painting and plastering remaining. Black stains under the eave and above the windows have been caused by bombings during wartime. Sometimes colour or aspect incongruous films are present in different part of the building due to old coatings and sealants or other protective materials. Some graffiti have been sprayed on walls or carved in wooden elements. Inappropriate repairing episodes and incongruous element placement are present, incompatibility of cement-based mortar with the original design materials composition has not been considered. Moss and vegetation presence have not been removed. Detachments on plasters of walls and ceilings is often visible. In the first case the causes could be due, both or separately, to infiltration from the top and/or of bending of timber structures of the floor, in the second case due to the high humidity from the foundations and in some cases by cement mortar based interventions.

Generally the presence of humidity seemed one of the most prominent problems in the building especially the decay episodes related to raising dump phenomena from the soil. This aspect needed to be investigated further, so some destructive tests were made to understand better the morphology of the original building, especially the foundation, slabs and ventilation shaft systems, and the characteristics of the additional interventions made during the late eighties, most importantly the substitution of the slabs with concrete and the landfill operation that closed all ventilation possibilities (figure 14).

Figure 13, 14, 15: (from Left to Right, Top to Bottom): One of the diagnostic tests realized unveiling the land filling realized to build the ground level floor slab; A detail of one of the closed technical shaft windows; The technical shaft seen from the South-Eastern corner of the Building

4. Preservation Project

The Preservation project has been developed according to the modern approach that rejects the in-style remakes aimed to come to an impossible (and sometimes counterproductive and contradictory) "original condition" of the historical building. Modern conservation pursues the maintenance of the status quo, of the authenticity, of the respect of the temporal overlapping of compatible and congruous material and elements, eliminating the causes and effects of degradation and eliminating the incongruous or incompatible elements that may compromise or deny the permanence of the historical building. Additions can be accepted as long as they are fully recognizable and the new suggested use results compatible. According to the Chinese Law about the "Protection of Cultural Relics" [2] [3], the principle of keeping intact the cultural relics shall be strictly followed. During the process of restoration, damaged elements shall be repaired and consolidated first, then reused if possible. Elements shall not be replaced and added casually, to preserve as much as possible the original elements without decreasing the historical values of the cultural relics. Because of alterations in different times during history, and changes in usage of building, the historical values of cultural relics have been decreased in the case of incompatible and/or incongruous materials and solutions. After repeated examines and researches on historical references, scientific references about the knowledge of the historical building have been obtained for its preservation partial restoration. Repairs should include removing alterations and added incompatible and/or incongruous parts with no values, removing threats to safety, recovering all kinds of historical information, repair decayed elements according to historical documents, conserve and represent the authentic historical values.

The project and action of conservation should follow the principal of the "Four Maintains": maintain the style, including the original layout, appearance, architectural characteristics and artistic features; maintain the structure; maintain the building materials; maintain the crafts and techniques. Conservation

project follow the principal of "minimum intervention" that mean to be applied to conservation of historical elements. Based on the condition of materials and elements, apply only consolidating, removing, partially repairing and jacketing the surface and so on, to continue the status quo as possible. Buildings of cultural relics usually have gone through several historical periods, so damages are inevitable, and it is often to see layout, structure, construction and attached cultural relics of various times, which have happened in the history. They might not be the original state but a state quo after a development of long time, and most of them have historical, artistic and scientific values, shall not be removed or altered easily. This is the essence of authenticity. The inappropriate adding and repairing, that effected environment, structure and appearance, shall be intervened. These two cases are completely different, which should be examined scientifically and treated differently.

History is a dynamic process that creates and accumulates information, so the conservation project shall not and will not be a terminal technical design. Along with the development of science and technology, there will be better conservative techniques, so every round of conservation shall be possible to be removed, without damaging the original elements and without erasing the compatible and congruous intervention done in the past and the new one. Many new techniques and new materials are involved in the conservation project of surface of No.2 Building. According to the related articles in Principals for the Conservation of Heritage Sites in China by China ICOMOS [4], we intend to apply materials that have been experimented repeatedly and widely accepted inside and outside china, and avoid re-damage to the cultural relics because of misusage of conservative materials. It is also intended to employ methods that do not affect future protection and treatment, so the conservation of cultural relics can be sustainable. Conservation projects for historic buildings should accepts concepts of values of all the whole nation, including aesthetic standards. In China, the holistic appearance of the building shall be kept harmonious, and the charms of historical architecture shall be maintained. In the process of construction, to achieve ideal results, the contractor will apply many intervention tests on each different surface with different methods and materials, to confirm the final project. For the plaster on walls, trials shall be conducted before and after construction, to harmonize the colours between new and old plasters. About some difficult techniques of treating the surface, experts in related field shall be consulted, and invited to guide works in-situ, achieve ideal results through these measures and guarantee holistic harmony.

Goals of conservation have been: Remove the causes of deterioration and instability; Remove inappropriate repairs in later periods; Protect and repair the authenticity of the building; Remove the threats to safety of the building of cultural relics, guarantee the continuation of historical styles, conserve the authenticity and integrity of cultural relics and their historical environment; Combine the renovation of building and exterior space, focus on improving the quality of interior and exterior space, to meet the current requirement of usage; Respect the history and prolong the life of the building; Find, if necessary, a new compatible use.

5. Adaptive Reuse Project System Scenario and Boundaries definition

The adaptive Reuse Design is intended as a conservation strategy for the building's future life as part of a unique and coherent Preservation Design process. From the methodological point of view this work started analysing the major problems detected, the qualities of the building to be preserved and possibly endorsed and the contemporary user's needs [5]. These are the three major clusters on which the adaptive reuse design system boundaries has been set. As a conservation oriented architectural intervention on an existing building, this project challenges are funded on choices of additions and subtractions that cannot be extracted from this system: each decision has multiple repercussions on the whole result so costs and benefits have been evaluated on the effects of the three identified groups of convergences. As the decay and structural analysis has been briefly outlined in the previous chapter and the principal qualities of the building has been outlined by the descriptions of the building made so far, it is now important to define the last cluster: the contemporary user needs. As the qualities of the building identified are many, it is important to underline thou that in the Adaptive Reuse Design the integrity of the facade and the preservation of the existing wooden doors and windows were set as a major priority.

The preservation and reuse of the building has been commissioned by the Chinese Literature Department of Hunan University whose main aim is to set inside the building the offices of the headquarters of the department and the administration, plus a substantial number of teaching and research personnel offices. Aside to these facilities few services were defined as important to insert: a library, a room dedicated to the Students Union, some discussion rooms, few restrooms with a shower room, a cafeteria, a reception that may host the keeper overnight, a flexible yoga and table tennis oriented relaxing room, some technical utility rooms. The majority of these functions had a fixed square meter standard fixed by the law: particularly the offices had a maximum space available per person to follow. This had major repercussions on the final spaces layout and purposed interior solutions especially considering the "minimum intervention" aims that led to reducing the demolitions to the lowest possible amount in the original 1925 part of the building and respecting the existing windows and doors. The space restrictions were set to 18 sqm each person for the two department leaders offices and ordinary professors, 12 sqm to associate professors, 10 sqm to administrative staff and 6 sqm to researchers. All furniture disposition requests and interior experience needs were arranged combining the two Department Leaders visions through a set of strategical meetings where the designers gave support into defining a satisfactory common ground, respectful of all local laws and standards. The department library is intended to host the many books possessed and offer volumes accessibility to mainly researchers but possibly students too. The possibility to expand the rooms in the future occupying a former discussion room (located on the First Floor and marked with number 19 in figure 16) had to be considered. A meeting room could perhaps host some visuals showing the history of the building, its memories and even the aims and solutions of the present Conservation and Adaptive Reuse Design. The only room, located on the second floor (marked with number 25 in figure 17) where the original wooden slab and flooring is still present and will be preserved by the present work intentions, seemed the most fitting choice according to the possible new functional layout design from the very early schemes and drafts. The upgrade of all implants especially the heating /cooling system and a new electrical and lighting system was also necessary, while the introduction of a lift, initially suggested, has been avoided due to local regulations impediments. The cafeteria and the creation of a reading garden between the considered building and an adjacent one possibly to be restored in the future were spaces intended also as connectors with external users: visitors, students, teachers or researchers from other departments may benefit from these spaces too, opening and not separating the new Chinese Literature Department Headquarters to Hunan University Campus life.

Figure 16: Adaptive Reuse Project Functional Layout – First Floor (Ground)

Figure 17: Adaptive Reuse Project Functional Layout – Second Floor

6. Adaptive Reuse Project

The Adaptive Reuse Design, as already mentioned, is intended as a complementary project to the Conservation Design aiming the same goal: the future preservation of the considered historical building. As raising dump resulted to be one of the major issues of the building to cope with, this has been set as one of the most important problems to solve from the existing building preservation point of view. The closure of an existing ventilation shaft during the 1980s renovations was most probably the major intervention that caused all raising water related decay episodes that, as already stated, are extensively present on the whole first floor (it should be noted that in China, as in Russia and in other countries, the Ground Floor is indicated as First Floor. In this report we will always assume the First Floor as the European Ground Floor) walls' lower part. Looking for a significant solution to stop the cause of this very extended problem, the demolition of the concrete ground slab realized in the 1980s to substitute the pre-existing wooden one appeared as the only possible way to reactivate the original ventilation shaft that was completely filled with soil and rubble to directly 8 (pieces of bricks and roof tiles from an unknown building were found during some invasive tests realized between the Preliminary and Definitive phase of the current project) lay the new concrete slab structure. This decision generates major opportunities in terms of building implants upgrade (figure 18). Moreover, creating a new structure, provided of its own foundation system and sustaining the first floor slab, will better bear the load of the new library to be hosted at ground level. As all implants on the First Floor will run through the technical and ventilation shaft, on the Second Floor will be hosted in the roof volume, again limiting the demolitions to minimum, but still guaranteeing contemporary standards and performances, possibly indicating the solution for even future upgrades. For what concerns the materials to be used we thought about a metal structure and a laminated timber with bamboo finish as a robust and durable choice for the flooring system at the same time showing the solution contemporaneity to immediately distinguish the intervention. Wires, distribution, plugs, recessed spot downlights and indirect lighting systems installation we decided to insert in specific locations drywall panels, adhering the existing walls, but avoiding demolitions for the insertion of implants (figure 19).

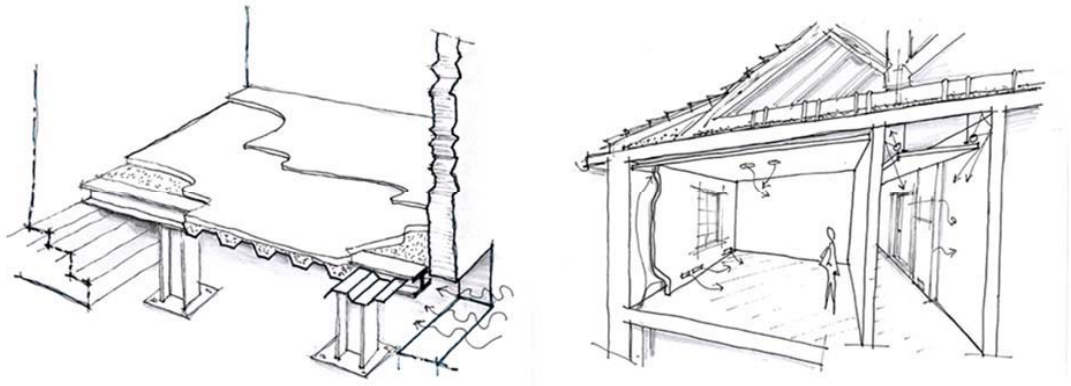

Figure 18, 19 (from Left to Right): A new Ground Floor Slab will substitute the 1980s concrete structure creating the opportunity to solve Raising Dump phenomena through the reactivation of the original ventilation shaft; New false ceilings and walls will be installed to allow for a complete implants upgrade of the building minimizing demolitions

These plasterboards, as an installation of independent elements that just "touch" the original materia [6], will be also distinguished from the existing ones by a smoother plaster surface or, in some occasion, a laminated bamboo boiserie that will suggest continuity with the flooring system choice. The bamboo boiserie solution will be mainly used in corridors where the drywalls will not just provide a technical shaft where to mask wires and implants but also serve as graphic design and way finding devices indicating, for example, rooms functions or facilities position, or masking accent lighting systems. In the corridors a false ceiling will again mask wires and the down lighting system: this new element will be few centimetres spaced apart from the corridor walls allowing to perceive the original proportion of this indoor space (figure 19). Led strips will be also integrated to underline this purpose. Another challenge was represented by the installation of a central heating/cooling station to host and at the same time mask the heat pump machines. At Preliminary Design stage we were thinking to host a deep technical shaft, covered with Cor-Ten metal mesh to ensure ventilation, right under the new cafeteria volume we will present as next topic in this paragraph. More recent advancements of the project showed the possibility to intervene on the North Courtyard and to demolish the existing but in bad condition external volume of the toilets (figure 16) replacing it with a technical volume to be used as heating station for this intervention and possibly the future conservation and adaptive reuse project of the adjacent building. This has been seen as a very good opportunity, also considerably reducing the overall costs of the operation, ensuring an easier maintenance intervention access and possible future system upgrades. One of the most visible aspect of the Adaptive Reuse Design will be the creation of a volume along the northern facade of the building, facing the already mentioned courtyard. The Literature Department asked for a cafeteria facility (this facility has been located on the First Floor and is marked with number 12 in figure 16) to be inserted in the building but that would have risked to lose significant space to be dedicated to offices or other necessary facility. The opportunity again came from the dialoguing system between the researches on the building history, the diagnosis data from the Conservation Project studies and the Adaptive Reuse on which this project methodology is based. In fact, to underline the building's historical layers stratification this project purposes the demolition of the central part of the 1980s facade to unveil a portion of the original one. A Cor-Ten metal structure, insertion at the same time independent and intimately in relationship with the building history [6], will be erected to support the roof and the new glass facade of the new cafeteria volume that will be extended toward the new reading garden to be created in the courtyard. From our point of view, the material choice and the extrusion of the volume toward the garden, even if somehow limited in dimension, underline the contemporaneity of the intervention while the exhibition of the central portion of the original facade reveals and expose the diachronic layer palimpsest like an archaeological display device bringing to light the history of the building (figure 20). Moreover, the cafeteria structure introduction permits a preferential relationship with the reading garden and full accessibility to the whole building as a ramp has been inserted in the volume, avoiding the necessity to position other structures or implants on the principal facade or the sides of the

building. For what concerns the bathrooms, originally not present in the building, they have been studied to be one on top of the other to clearly better fit the implants. They have been set inside the eighties addition volume to again avoid unnecessary demolitions in the original 1925 structure. Interior design furniture and layouts all new partitions to be inserted in the building will be light frame structures to ensure the possibility of being easily replaced if different future user needs and layout disposition will occur. Glass walls and insertions will be preferred to drywalls to enhance interiors general luminosity. For what concerns the disposition on the Second Floor slabs we tried to avoid in the rooms as much as possible central concentration loads abstaining from, if possible, beams or reinforcements introduction. Specific structural tests and analysis will be necessary.

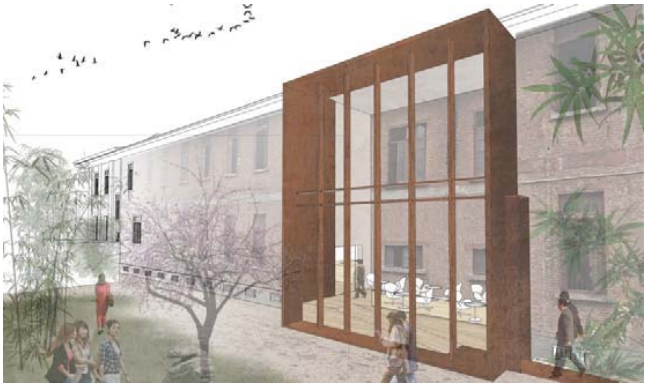

Figure 20: A collage rendering of the cafeteria volume addition, this architectural insertion allows the demolition of part of the 1980s North Façade unveiling portion of the original one

7. Conclusions

This essay, focused on the case-study of the intervention on the modern structure of the *Teaching and Research Building Two* located inside Hunan University Campus in Changsha, People's Republic of China, underlined how the Adaptive Reuse Design strategies, intended to enhance the user experience and focusing on ensuring a new life to the historical building through functional reactivation, are directly connected to the conservation guidelines, trying to trace a common "minimum intervention driven" and "immediate awareness of the contemporary additions in the historical building" design strategy that will not hinder the problem solving aims nor the contemporary standards and expectations. In fact these two design aspects, even if presented as separate chapters for better comprehension, appear as solidly interwoven: the common conservation aim and the firm interdependence of the strategies between the Preservation and the Reuse Project as well as how these strategies are intermixed in the historical palimpsest layers of the building could possibly result as one of the most interesting aspect of this essay, to be considered as part of International Modern Buildings Preservation Design Methodologies Discussion Panorama.

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