

THE ARCHITECTURE OF STORAGE AREAS IN CONTEMPORARY ART MUSEUMS

A comparative study between Austrian and Portuguese museums

VOLUME I

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RESUMO

A arte contemporânea é muito diversificada no conjunto de formatos e materiais que utiliza, tornando-se, por vezes, complexo para conservadores e curadores lidar com estas obras, do ponto de vista da sua conservação. A conservação preventiva da colecção de um museu é assegurada, em grande parte, pelo espaço das reservas que, para tal, deve possuir um conjunto de características específicas.

O presente trabalho pretende compreender quais as tarefas a desenvolver num projecto de adaptação de um espaço preexistente à nova função de reservas de arte contemporânea, focando-se nos requisitos arquitectónicos destas áreas, cruciais para a protecção e conservação deste património artístico. Para tal, foram seleccionados quatro casos de estudo – dois museus Austríacos e dois Portugueses – com o intuito de estudar casos concretos de reservas de museus instalados em imóveis preexistentes e reabilitados para o efeito. A análise comparativa destas reservas pretende aprofundar o conhecimento sobre o funcionamento das mesmas, as suas necessidades, problemas e também a relevância do projecto de arquitectura para a eficiência do espaço.

A análise comparativa destes casos de estudo permitiu realçar os aspectos mais importantes que um arquitecto deve ter em consideração quando projecta as reservas de um museu, nomeadamente características estruturais, organizacionais e espaciais das salas, mas também as suas condições ambientais e sistemas de segurança utilizados.

Palavras-chave: arquitectura de museus; reservas; museus de arte contemporânea; conservação de arte contemporânea; Áustria; Portugal.

ABSTRACT

Contemporary art is very diverse in the formats and materials it uses, which at times can be complex for conservators and museum curators to deal with, in particular regarding its conservation. The preventive conservation of a museum's collection is greatly assured by its storage area that must possess specific characteristics.

The current work strives to understand the tasks related with the adaptation project of a pre-existing structure to the new use of a contemporary artworks' storage area, focusing on the architectural requisites of this space, crucial for the protection and conservation of artistic heritage. In order to do so, four case studies were selected – two Austrian museums and two Portuguese ones – with the purpose of studying specific storages of museums located in pre-existing buildings, rehabilitated to this effect. The comparative analysis of these storages aims to clarify their inner workings, needs, problems and elucidate on how the architectural project is relevant for the efficiency of the space.

The comparative analysis of these case studies revealed the most important aspects an architect must have in consideration when designing the storage area of a museum, such as the structural characteristics and spatial organisation of the space, as well as its environmental conditions and security systems used.

Key words: architecture of storage areas; storage areas; contemporary art museums; conservation of contemporary art; Austria; Portugal.

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LIST OF ABBREVIATIONS

CACGM – Centro de Arte Contemporânea Graça Morais

DGPC – Direcção-Geral do Património Cultural (Directorate-General for Cultural Heritage)

ICOM – The International Council of Museums

ICOM–CC – The International Council of Museums – Committee for Conservation

MNAC – Museu Nacional de Arte Contemporânea do Chiado

MUSA – Museum Startgalerie Artothek

RH – Relative Humidity

UV – Ultra Violet

INTRODUCTION

“The sensualisation of the invisible is the precondition for each memory. By leaving something in an invisible, abstract and meaningless room, we leave it to oblivion. The museums’ deposits act like a fading trace of sensual experience, which we can use from time to time, to rearrange our knowledge, to redefine it.” (Ernst Lantermann in Roemer und Pelizaeus Museum, 2013, p. 3).

Dutch artist Berndnaut Smilde works with installations, sculptures and photographs, studying the “temporal nature of construction and deconstruction”, and referring both to the “physical state of a building as well as a moment of revelation that depicts either hope or fragility” (Smilde, n.d.). The artist creates clouds through the use of smoke, air, light or water, altering the weather conditions of the indoor spaces selected for his work. With an adjusted lighting, and when precise conditions are achieved, “a fog machine releases a heavy and damp dense mist”, creating an artificial cloud that lasts for ten seconds (Public Delivery, n.d.).

In the *Nimbus* series the artist creates moments in which he gracefully pairs his designed ethereal clouds with an architectural structure, confronting these two elements, which hold several antagonistic realities when put together: a ten seconds life-span against a perennial existence, the frailty of one’s materiality as opposed to the soundness of the other, the existence of an element traditionally experienced outside, now trapped inside another. These two opposing realities blend in and remain together through the photographic documentation of the work, which validates this fleeting moment. Such an artwork poses evident museographic questions, but also conservational ones. Both the performance and the photographic record of the artist constitute the artwork, but how do storage areas hold such art pieces? By storing the machine chosen by the artist to create his work?

Contemporary artworks challenge conservation paradigms, forcing this science to analyse itself and look further to answer some of these questions. As art evolves and develops into different and less conventional formats, there is a need to follow this development in regard to safeguarding the pieces. A reality that has an important effect upon these artworks is the space they are in, for the design of storage areas can be crucial for a conservator’s work. Are museum storage areas spatially prepared to accommodate these unconventional artworks?

Throughout the years museums have changed, accompanying its time and art production. A central space inside them are storage areas that have an important role to play, providing a well-structured environment that aids conservators in their tasks of storing and preserving artworks. The diverse forms in which art can be presented may pose a challenge to its preservation and storage. In light of this fact, it is essential to seek a kind of lasting moment of serenity, similar to the one captured in the *Nimbus* photographs, where art and its container work symbiotically.



Figure 0.1 | *Nimbus Duguan*, Berndnaut Smilde, Himalayas Museum, 2015 Digital c-type print

When studying museum architecture, storage areas are usually neglected. Many have been the studies conducted around the architecture of museums – from the cabinet of curiosities to the Guggenheim Museum in Bilbao. Nonetheless, when looking into these examples, the most explored themes are the various styles of architecture that marked museums, focusing on the exhibition rooms and other public spaces. The storage areas remain firmly closed off from these studies. One of the argued reasons is set on the fact that these spaces are under a high level of security surveillance, as they hold a significant part of the collection. However, nowadays, considerable steps have been taken regarding the accessibility of storage areas to museum visitors. Museums around the world are starting to open their storage spaces to the curious public, accentuating even more what Keene (2002, p.12) describes as the educational role of museums, pushing visitors to learn and participate in the world around them. This may be a path to an increased study of these *Unsichtbaren* (invisible) rooms, as expressed by Ernst Lantermann (Roemer und Pelizaeus Museum, 2013, p. 3).

Most museums in Europe are located in adapted buildings, many of which are of historical relevance, being protected and listed. As storage areas are in many cases neglected, ending up in basements and small rooms, usually not well-prepared or planned spaces, the challenge regarding the conservation of artworks becomes even more demanding. When dealing with such an architectural project it is necessary to respect the characteristics of the building, while at the same time working towards an appropriate environment. However, not all storage areas are located in such constrained spaces. Some museums resort to renting spaces outside of the museum building, which in some cases are buildings that underwent minor architectural interventions. All these cases have their own specificities that create different environments, which will be analysed in this thesis through the study of two museum realities in Portugal and Austria.

DELIMITATION, JUSTIFICATION AND GOALS

The current dissertation was developed within the framework of the Integrated Master Degree programme in Architecture at Instituto Superior Técnico of Lisbon. The choice of the theme was based on a continuous interest in the field of museum architecture and contemporary art. In addition to this, the chance to participate in the Erasmus Programme at the Graz University of Technology in Austria, was also decisive for the definition of the subject-matter.

The main goal of this research project is to develop a body of work that can give insight into the challenges of storing contemporary art in adapted buildings, informing on the needs of these spaces, as well as establishing a comparison between Portuguese and Austrian institutions – their different methods, spatial characteristics and biggest concerns. The literary sources regarding the technical descriptions of storage units are well represented by institutions such as The International Council of Museums (ICOM) and its Committee for Conservation (ICOM-CC). Nevertheless, these guidelines present (as they should) an optimal situation, which in most cases is difficult to achieve – either

due to management, economic or financial reasons. Furthermore, when dealing with adapted spaces, very often the previous spatial conditions turn out to be a restraint on a well-developed conservation plan. On the other hand, practical conservation strategies available nowadays are not well prepared to deal with the bold nature of contemporary art that defies such guiding principles with perishable materials and new formats of exhibitions. Even though steps have been taken by ICOM–CC through working groups, and by other specialised publications such as “Performing Documentation” in *Revista de História da Arte* (nº4, 2015), focusing on the subject of conservation of contemporary art, many art institutions and their staff still struggle with these aspects. Consequently, this thesis attempts to explore the architectural responsibility of storage units of contemporary art through the comparison of case studies from Austria and Portugal.

The architecture of a storage space can either help with the great task of protecting the artworks it holds, or the contrary, contribute to their decay. Therefore, this dissertation wants to fill the current gap in the field of architecture theory, bringing to the front the essential and guarded spaces of the storage areas.

METHODS

The case studies selected for this work correspond to museums installed in pre-existing buildings. In Austria the museums studied are the MUSA – Museum Startgalerie Artothek (founded in 1951) and Neue Galerie Graz (founded in 1941), two institutions representing the two biggest cities in Austria, Vienna and Graz respectively. MUSA is managed by the municipality of Vienna, while Neue Galerie Graz is, since 2003 a GmbH (Limited Liability Company). The museums studied in Portugal are the Museu Nacional de Arte Contemporânea do Chiado (founded in 1911) in Lisbon, managed by the Directorate-General for Cultural Heritage (DGPC) – Ministry of Culture, and Centro de Arte Contemporânea Graça Morais (opened in 2008), managed by the Municipality of Bragança. The museums selected have different architectural backgrounds, which manifest themselves in contrasting ways.

The development of this work was based on bibliographic research, which allowed for a deeper understanding of the several topics analysed on the thesis. The literary search not only proved to be a source of theoretical knowledge, but was also an element that helped to structure the thesis. In Austria, the main libraries consulted were the Graz University of Technology (Architecture Department) and the one of Neue Galerie Graz, while in Portugal, the Art Library of the Caloust Gulbenkian Foundation and the National Library were crucial, along with the study developed in the archives of the Bragança city hall. Additionally, several Internet searches were conducted, namely on institutional websites. Moreover, this paper was also elaborated through the use of direct sources such as visits to the museums and interviews with the museums’ curators, directors, conservators, and architects. The topics selected for the analysis were the same for the four case studies. Nonetheless, the information collected did not always meet every parameter. The interviews with different museum experts were essential for the writing of this thesis,

providing it with the in-depth and practical knowledge. In fact, this privileged contact assured a direct communication, revealing not only the functioning of the storage unit itself, but also the worries and expectations of the museum staff.

In parallel to the interviews, the fieldwork resulted in the gathering of other elements: photographic material, written documentation and spatial documentation. Being able to physically experience the storage areas allowed for a better understanding of the diverse ways of working in a storage unit, comparing the realities of two different countries.

The development of this study was based on a previously defined timeline. However, the development of the work was not so linear, as sometimes the arising of a certain factor led to a reorganisation of its structure. In addition to this, the task distribution was organised in a way not to generate long writing or drawing periods, which could lead to a decrease in attention.

STRUCTURE

The thesis is organised through two main chapters, followed by its conclusion, bibliography, sources and references, and annexes for the technical drawings and the case study information sheets used for the interviews.

The first part – “Theoretical Framework” – includes four chapters that explore the topics discussed throughout the thesis. The first one - “Contemporary Art Museums” – explains how these institutions appeared, contributing with an overview of the architecture of contemporary art museums from the twentieth and twenty first century. The second chapter – “Adaptation of pre-existing spaces” – makes it evident that this research project focuses on architecturally adapted spaces, and the third - “Conservation of contemporary art” – looks into contemporary art, considering its different formats and materials, focusing on how its inherent characteristics effect its conservation. After a brief glance into contemporary art, the topic “Preventive conservation” addresses conservation issues. This chapter emphasises the difficulties conservators and curators are faced with when dealing with contemporary works. The chapter then focuses on the main home of a museum collection – its storage area. This not so well-known space (at least to professionals outside a small staff member group), is here examined, mainly considering its spatial organisation, but also its storage systems and materials.

With the previous revision of the theoretical knowledge, the second part of the thesis introduces four case studies, being divided in two chapters that correspond to two countries – Austria and Portugal. In Austria the museums selected are the MUSA – Museum Startgalerie Artothek (MUSA) in Vienna and Neue Galerie Graz, while in Portugal the case studies are the MNAC – Museu Nacional de Arte Contemporânea do Chiado and the Museu de Arte Contemporânea Graça Morais (CACGM). In each case study there is an initial analysis of the museum’s history, which comprises its management and architecture background. This is followed by a description of the museum collection, to better understand the institution managing strategy and to understand its demands in terms of storage area. Finally, an analysis of the storage area is presented, with a direct

look into these spaces, revealing their inner work methods, but most importantly, their spatial organisation and how it affects the professionals' work and artworks' conservation.

The second part closes with a "Comparative analysis of the case studies", which confronts the previously studied institutions for a better understanding of how they work. The last chapter reflects on the research results. However, the discussion is left open, with many other questions to be put forward as well as answered to.

The technical drawings in the annexes are redrawn copies of the original ones, or schemes developed through the help of photographic elements produced while visiting the locations. The images presented in this work come from different sources: books, the Internet and photographs taken by the author. The interviews were recorded, having been a great source of information and inspiration for this thesis.

I – Theoretical Framework

According to Claire Bishop (2013, p.61), “museums are a collective expression of what we consider important in culture, and offer a space to reflect and debate our values; without reflection, there can be no considered movement forwards”. At a social level, museums are responsible for maintaining and stimulating a community’s identity through the preservation of its memory and knowledge. They do so by making knowledge accessible to everyone and by conserving their artworks (Keene, 2002, p. 16).

These responsibilities take place in buildings with different backgrounds. Museums can occupy new structures or buildings originally designed for a different function. The latter can be a bigger challenge to uphold, as a new identity must blend with the previous one. In the specific case of contemporary art museums, past architecture is adapting itself to house current art production, generating a symbiotic relationship where the structure helps preserve the art, which, in its turn, protects the building from becoming obsolete.

In any museum with a permanent collection, many of its artworks are found in the storage area, a place in which the main goal is to serve as a home for these objects, protecting them from any harm and offering an adequate resting place. As such, this space deals with several requirements and tasks that are essential for the well being of the objects it hosts, protecting the cultural heritage that keeps the mission of museums alive.

Conservation is nowadays described as: “all the measures and actions aimed at safeguarding tangible cultural heritage while ensuring its accessibility to present and future generations. Conservation embraces preventive conservation, remedial conservation and restoration. All measures should respect the significance and the physical properties of the cultural heritage item.” (ICCOM-CC, 2008, p. 1).

Although the above definition may seem simple, conservation is a very complex field that comes from the need to protect the objects we perceive as “heritage” (Viñas, 2005, p. 2). Conservation had its major development during the nineteenth century, with many theories being created and developing itself to protect cultural heritage. Simultaneously, the art world also changed, forcing conservation to adapt to the new cultural production.

Contemporary art emerged from a very particular moment in history. “After World War II (...) the commercial system of art production and distribution dominated the political system.” Initially “submissive to the power of the market”, art then separated itself from it by becoming “a critical and self-critical commodity” (Groys, 2008a, pp. 5-6). This new type of art production confronts the public with new questions, using new formats, materials and technology. This requires different conservation approaches, able to understand the multiple aspects within each piece, tackling the conservation problems presented by this new art form.

1 | CONTEMPORARY ART MUSEUMS

“The term ‘museum’ – from the Greek μουσεῖον (= place of the muses; place and dance floor of the muses and their mother Mnemosyne, the Greek goddess of memory) – was initially used in the ancient world to designate the schools of poetry and philosophy that came to be attached to the shrines of the muses.” (Naredi-Rainer, 2004, p. 3).

Evolving from the Greek term *mouseion*, the museum concept went through a long maturing process that can abruptly arrive at today’s definition by the International Council of Museums (ICOM) as:

“A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment.” (Desvallés & Mairesse, 2010, p. 57).

Contemporary art museums appeared in the nineteenth century from the desire to specialise in specific fields and time periods, leading them to separate the old masterworks from contemporary ones (Lorente, 1998, p. 22). The first contemporary art museum was founded in 1818 in Paris at the Luxembourg Palace, as the Musée des Artistes Vivants (Museum of the Living Artists), paving the way for similar names. Paris’s contemporary art museum came to be in the midst of an urban society that was innovative in cultural consumption. Moreover, the State’s support for the arts through strong cultural policies was crucial, just as it was for the emergence of contemporary art museums all over Europe (Lorente, 1998, p. 32-33).

After Paris, one of the following cities to exhibit contemporary art was London, where the opening of museums and galleries made art accessible not only to experts but also to the general public. In the early nineteenth century London became the centre for modern art marketing and collecting. However, the foundation of a museum such as the Musée des Artiste Vivants took a while, being materialised with the Tate Gallery in 1897 (Alexander, 1987, p. 30).

In Central Europe different models of spaces presenting contemporary art appeared: the *Kunsthalle* and the *Nationalmuseum*. These institutions were created early on, with the example of the Kunsthalle Basel, founded in 1839. Another relevant case is the Neue Pinakothek in Munich, created in 1842 by Ludwig I of Bavaria as a public museum exhibiting contemporary art (Lorente, 2011, pp. 44-49).

By the end of the nineteenth century the perspective on museums had changed drastically due to a rising tension between historical awareness and creativity. The museum was seen as a keeper of old memories that neglected the exhibit or, as Filippo Tommaso Marinetti described, “public dormitories”. However, contrary to Marinetti’s belief, museums kept on growing, experiencing their abundance period in the second half of the twentieth century (Lampugnani, 2006, p. 245).

The museums of contemporary art had a significant urban development in the nineteenth century and early decades of the twentieth century: the contemporary art museum in Brussels was called Musée Moderne; in Spain there was the Museo de Arte Moderno; in Dublin the Municipal Gallery of Modern Art appeared, while in New York the Museum of Modern Art (MoMA) was founded. This last denomination had a great success throughout the world, becoming the most frequent name for spaces with works of current artists (Lorente, 1998, p. 199-200). MoMA was founded in 1929. Architect Philip L. Goodwin and Edward Durell Stone designed a space, which opened only in 1939, and that was to serve contemporary artistic production ranging from painting, sculpture, architecture, photography, film and design. Initially, MoMA planned on having a collection that would change with a time span of fifty years. To enable this idea, the architects had to create a flexible space and, as such, the galleries were distributed through several floors, each an open space that could be subdivided with partitions, only interrupted by load-bearing pillar (Giebelhausen, 2006, p. 232-233).

MoMA's building embodied the modernist principles, separating itself from the "temple-like museum architecture". The entrance to the building was not high above a staircase but at ground level, through a glass wall with an inward curve, exploiting, as Grunenberg (1999, p. 34) mentions, "the lessons of contemporary commercial architecture." MoMA was responsible for the dissemination of the "white cube" aesthetic, having flexible and "neutral" spaces that sought to focus attention on the artworks, fully submersing the visitors in them. To achieve this idea, walls were painted white, "floors were monochrome, ceilings unadorned and functional, with unobtrusive tracking systems to provide flexible lighting conditions" (Giebelhausen, 2006, p. 233). The museum's international projection grew and with it, the "white cube" became the modernist style of display, dominating the second half of the twentieth century.

In Paris, the closing of the Luxembourg Museum was followed by the opening of the new Museum of Modern Art, designed for the International Exhibition of 1937. Initially, there were two separate museums: the Museum of Modern Art of the City of Paris and the National Museum of Modern Art that opened in 1947 (Lorente, 1998, p. 243). In 1999, the museum, which was renamed Palais de Tokyo, underwent a demolition work, stripping its concrete structure and creating the allure of an industrial space. Anne Lacaton and Jean-Philippe Vassal conducted this minimalistic intervention, opening the building in 2002 (Palais de Tokyo, n.d.).

After World War II museums were seen as exclusive for the elites and therefore, they lacked visitors. As a result, by the end of the fifties there were demands to transform modern art museums into centres for the exchange of ideas. In Europe, financial difficulties pressed museums to follow the American model, transferring them to the private sphere. This meant more autonomy and flexibility in architecture, which also came attached to "laws of commercial efficiency" (Naredi-Rainer, 2004, p. 17).

The "white cube" model was altered by the Solomon R. Guggenheim Museum. Opening in 1959, Frank Lloyd Wright created a widely recognised building, due to its



Figure 1.1 | Museum of Modern Art, New York (1939)



Figure 1.2 | Solomon R. Guggenheim Museum, New York

sculptural appearance, standing out from Manhattan's uniform grid. The white structure has a central atrium surrounded by a spiralling ramp where visitors are confronted with the art (Giebelhausen, 2006, p. 234). Although a Plexiglas cupola is supposed to light the space, this is not enough to properly illuminate the artworks. As Lampugnani (2006, p. 248) describes, "architecture is not behaving subserviently, but acting as the protagonist."

A project contemporary to the Solomon R. Guggenheim is the Louisiana Museum in Humlebaek, near Copenhagen. However, these two museums are radically different. As Lampugnani (2006, p. 246) describes, the Louisiana Museum "is a masterpiece of classical disciplined northern modernism", a space where architecture and nature work symbiotically, offering a peaceful place that is constant contact with nature, for the contemplation of its artworks.

The International Style proliferated in the Federal Republic of Germany due to the great economic development of the country. An example of this is Mies van der Rohe's New National Gallery in Berlin, which opened in 1968: a transparent museum, with glass walls and a steel roof under the inspiration of Schinkel and his neoclassicism architecture. The structure, placed upon a platform, has a strict axial symmetry that persists on the lower floor of the museum. The steel roof extends beyond the glass walls, being supported by eight cross-shaped, tapering columns (Tegethoff, 1996, p. 442). The exhibition rooms are on the lower floor, as it would not be appropriate to exhibit the artworks on the ground level, where the glass walls expose the artworks to a higher level of temperature and constant daylight. This project reveals the modernist will to work with materials such as steel and glass, which unfortunately were not compatible with the gallery's function (Lampugnani, 1999, pp. 11-12).

Another paradigmatic project is the Centre Georges Pompidou in Paris (1977) by Renzo Piano and Richard Rogers that renovated the old market district of Les Halles (Lorente, 1998, p. 252). The Post-Modernism building stood out for its futuristic design, with its technical systems exposed through coloured service pipes. The entrance to this high-tech structure is made through a large square where performances at times occur. The architects wanted to connect the visitors with the city's urban context, using a glass façade, lifts, escalators and the raising of the building on piles to do so, allowing the public to look inside/outside the museum (Lorente, 2011, pp. 238-239). This generated critics, targeting the way visitors have access to the building, allowing them to ride the escalators and enjoy the view of the city, without looking at the art exhibited and therefore promoting the commercialization of the museum space (Grunenberg, 1999, pp. 41-42).

The topic of architecture being used in service to architects' desires arose in the late seventies and eighties. Postmodernism brought to the table historicism, pushing for a reassessment of architecture's role in museum buildings. Museums were now welcomed by the population, seen as "urban catalysts" and so, desired by many to enrich their residential area (Lampugnani, 1999, pp. 12-13). With this, architecture gained one of its most required building types, with complex programs that include public facilities



Figure 1.3 | Louisiana Museum, Humlebaek (Denmark)



Figure 1.4 | New National Gallery, Berlin



Figure 1.5 | Centre Georges Pompidou, Paris

(restaurants and shops), promoting urban development and an aesthetic that showcases the architect's skills. However, the public's new appreciation for architecture took again, the attention away from the art it houses (Lampugnani, 2006, p. 254).

James Stirling's extension to the Stuttgart Staatsgalerie (1977-1981) is seen as the paradigm for postmodern articulation of museum architecture. The building is inspired in Schinkel's Altes Museum, having a central rotunda, which is surrounded by a series of sky-lit galleries on three sides. The front of the building has an undulating glass wall, with bright green frames, accessed by a ramp. This building combines nineteenth century architecture with the modernist "white cube" aesthetic (Giebelhausen, 2006, p. 234).

In the nineties, the museum's role as a social, political and economic force continued to expand and to have an important responsibility in urban development. The museum focused increasingly more on its visitors, catering to their taste with a variety of programs. The architecture produced is seen as a clear expression of the architect's style, as each architect seems to make an imprint of his/her technique on the building, manifesting itself through strong imposing structures (Schubert, 2009, p. 123), as is the case with the Guggenheim Museum in Bilbao (1993-1997) by Frank Gehry. The building stands out from its neighbouring industrial infrastructures along the river, creating a point of attraction in the city (Lapugnani, 2006, p. 255-256). The museum is known for its titanium sculptural shape, creating complex interior spaces that, as Karsten Schubert (2009, p. 122) states, "are extremely compromising when it comes to the effective display of art". This eccentric architecture is many times associated with the privatisation of these institutions where, according to Clair Bishop (2013, pp. 11-12), "the museum's external wrapper has become more important than its contents", which translates into a lesser "concern for a collection, a history, a position, or a mission".

An interesting aspect about museum architecture is that it personifies the art of building. Ideas are put into shape, and when comparing different museums, the variety of thought in terms of architecture and the world around us is clear. However, its weakness may be the difficult relationship it has with art, either by overpowering it or even by being too modest (Lampugnani, 2006, p. 260).

The above-mentioned projects correspond to purpose-built structures. However, there are a great number of museums placed in adapted buildings and in such cases a modern architecture must also reconcile with the pre-existing one. Nonetheless, the relationship between the various entities involved (previous architecture, a new one and the collection) is complicated to manage, more so since the new project must interact and respect the previous existence.



Figure 1.6 | Stuttgart Staatsgalerie



Figure 1.7 | Guggenheim Museum, Bilbao

2 | ADAPTATION OF PRE-EXISTING SPACES

“The conservation of a place of cultural heritage value is usually facilitated by the place serving a useful purpose. (...) Alterations and additions may be acceptable where they are necessary for a compatible use of the place. Any change should be the minimum necessary, (...) substantially reversible, and should have little or no adverse effect on the cultural heritage value of the place.

Any alterations or additions should be compatible with the original form and fabric of the place, and should avoid inappropriate or incompatible contrasts of form, scale, mass, colour, and material. Adaptation should not (...) adversely affect the setting of a place of cultural heritage value. New work should complement the original form and fabric.” (ICOMOS New Zealand, 2010, pp. 3-8).

Every community's identity is embedded in its culture and architectural history, which makes it so important to preserve. However, in most cases, the functions developed in a building have ceased throughout the years, leaving the structure obsolete (Kibble et al., 2008, p. 10). As described in the *New Zealand Charter for Conservation of Places of Cultural Heritage Value* (2010, pp. 7-8), a “place of cultural heritage” can be conserved through being useful to society. In order to do so, it is important to provide it with a new meaning. The adaptation of a place to a new use, also called ‘adaptive re-use’, may include additions, new functions and services, as well as the necessary changes for the protection of the place (ICOMOS Australia, 2013, p. 7). As stated in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (2013, p. 4), “a place should have a *compatible use*”, respectful of its cultural significance. This new programme should add minimal changes to the building, respecting its associations, meanings and fabric. If not, they are susceptible to decay and risk being demolished.

To preserve built heritage through the adaptation of architectural spaces to today's uses, while promoting a sustainable development is essential for a community, contributing to a better social, economic and environmental development (Kibble et al., 2008, p. 10).

The previously discussed concepts are organised by the New South Wales Department of Planning and the Royal Australian Institute of Architects (Kibble et al., 2008, pp. 11-14), which state that for a successful adaptation seven principles should be taken into consideration: understand the significance of the place; find a use which is appropriate to the heritage significance of the place; determine a level of change appropriate to the significance of the place; promote a reversible change and conservation of the place; conserve the relationship between the setting, preserving significant views; provide for the long-term management and viability of the heritage place; reveal and interpret the significance of the place.

The building being adapted can hold no particular significance to the community it belongs to, or it can be of great significance, representing its history. When the case is the latter, a careful analysis is crucial, for the adaptation project is not only a way to create a new museum facility, but also a way to protect the building's heritage significance. Instead

of leaving it to be forgotten by the years, with no purpose of its own, through an adaptation project the edifice is then filled with new possibilities, establishing again a connection with society (Barranha, 2003, p. 13). The conversion of a historical monument into a museum must develop according to each country's legislation, the principles defended in international charters for conservation and restoration of built heritage and, as Helena Barranha (2003, p. 13) states, by the following three components:

- **Functionality:** the architecture project must include structural, spatial and technological solutions that allow for the accomplishment of the programme: environmental and security conditions for the conservation/exhibition of the collection, the staff and visitors; accessibility systems to all.

- **Materiality:** establish a link between the preservation of the pre-existing structure and new materials and construction methods.

- **Aesthetic:** the appreciation of the building's visual characteristics, while combining them with current aesthetic values.

The museum staff must define the institution's programme requirements, which will outline the characteristics, needs and constraints of the spaces, serving as the base for the project. According to João Herdade (2003, p. 25), this information should consist of:

- “- Functions developed inside the building;
- Characterization and nature of the collection;
- Museum visitor's profile;
- Number and understanding of the work staff;
- Needs and demands of the exhibition;
- Needs and demands of the services;
- Total cost of the operation;
- Necessary licenses.”

The spaces should be analysed according to the distinction between public and private areas, which hold a variety of divisions that require diverse spatial needs, as well as different environmental conditions (ventilation, temperature, humidity levels) (Herdade, 2003, pp. 25-26). Ramsay & Hugony (2012, p. 12) state that the project of restoring, rehabilitating or adapting a historical building must pay attention to the areas which are to be modified, as well as for the spaces that are not to be altered. When designing the spaces for a museum, the priority should be permanent and temporary collection exhibition rooms, storage areas and appropriate public access.

When converting historic spaces into museums, the project team must conduct a research on the history of the building, recording its main characteristics, previous interventions and any structural problems. From this, the architecture team will be able to understand what are the key elements to maintain. The spatial organisation of the building may be a constraint to the project, as well as its location, technical or economic circumstances. Furthermore, the broadened scope of museums nowadays, through their educational and recreational role (with auditoriums, restaurants, libraries, shops, gardens), adds to the complexity of these types of projects (Barranha, 2003, pp. 13-14).

In order to avoid some of the problems that may occur in a conversion project, it is essential to put together an interdisciplinary team, which must evaluate if the edifice has a

compatible structure and spatial organisation with the project. Every building has its endurance, being crucial for the project team to understand the type of structural work required, in case it is necessary to reinforce it, or simply proceed with smaller restoration interventions (Herdade, 2003, pp. 25-29). Architects and their teams must work in constant communication with the museum representatives, promoting a balanced project that bears in mind the architectural pre-existence, as well as the museum programme's requirements (Barranha, 2003, pp. 18-19).

The requisites for adapting historic structures to museums is different when considering contemporary art museums, since these institutions are constantly updating themselves, and as such, "space versatility should include the plurality of scales and plastic supports inherent to 20th century art and the ongoing revision of the exhibition contents" (Tostões and Barranha, 2007, p. 35).

Italy is a country rich in architectural heritage, continuing to preserve its structures, which at times are adapted to welcome museums. An example of this is the Castello di Rivoli near Turin, which was inaugurated in 1984 and adapted by Andrea Bruno (Lorente, 2011, p. 261), occupying part of a castle, which is called Manica Lunga for its long shape. During the restoration the now contemporary art museum had several problems: water infiltrations damaged walls, ceilings, frescos and stuccos. The surviving historical traces of the life of the castle were preserved, as Andrea Bruno avoided falsifications and completions. Several rooms have rich decorations connected with the castle's royal period, while others are left unfinished. The steel and glass staircases and lift are located outside the building, allowing visitors to observe the unfinished structure. The architect used modern materials and structures while maintaining the building's character, making this project a great example of reversibility (Castello di Rivoli, n.d.).

The end of the twentieth century was marked by a sudden interest in disused industrial sites. These spaces, no longer fulfilling their initial purpose, started being reconverted into urban projects. This contemporary phenomenon amplified the preservation and reconversion of industrial spaces, in which one of the most popular solutions was to rehabilitate with a cultural purpose (Fernandes et al, 2003, p. 169). Contemporary art museums have been one of the most interested parties in occupying these buildings, promoting the regeneration of entire urban districts, especially in Europe.

One of the first cases of an industrial space adapted to a contemporary art museum was the Contemporary Art Museum of Basel, the Museum für Gegenwartskunst, established between 1976 and 1980 in two industrial structures. After this, many other museums followed the same approach, namely: the Hallen für Neue Kunst in the Swiss city of Schaffhausen that opened in 1982-83 in a remodelled former textile factory; the Ludwig Forum für Internationale Kunst opened in 1995 in the city of Maastricht on an old factory building; the Tapies Foundation in Barcelona, which opened in an industrial building in 1984 (Lorente, 1998, p. 256).

An unavoidable example of an adaptation project to a contemporary art museum is London's Tate Modern. Jacques Herzog and Pierre de Meuron embraced the task of



Figure 2.1 | Castello di Rivoli, Turin



Figure 2.2 | Hallen für Neue Kunst, Schaffhausen (Switzerland)

transforming a former London factory, the Bankside Power Station, into a modern and contemporary art museum, which opened in 2000 (Davidts, 2006, p. 31). The building was designed in the 1940s as a brick structure with a prominent central chimney on the façade. Initially, the conversion project intervened in the surroundings of the building, connecting it with the Thames through a park. From outside, the additional two-storey glass box stands out from the original brick façade and, inside, almost everything was removed (Mack, 1999, p. 46). The exhibition spaces, with their wooden floors, iron floor grilles accompanied with white walls that stand for the “white cube” model (Giebelhausen, 2006, pp. 238-239) were largely discussed with the artists during the planning stage of the project, allowing for them to help create a space that would accommodate their needs.

Davidts (2006, p. 32) points out how an industrial building space can be versatile: it is neutral without the coldness of the white cube, flexible yet not volatile and it has character without being overpowering. This identity and history of the industrial building forces the architect to adopt a respectful attitude towards the structure. Schubert (2009, pp. 111-112) defends that the Tate Modern’s adaptation project created a “harmonious balance between exterior symbolism and interior function, artistic requirements and audience need, intimacy and grandeur, utility and form.”

Factories are not the only chosen facilities for museums, but also railway stations, as we can gather from the Hamburger Bahnhof – Museum für Gegenwart – in Berlin. The building opened in 1846, being designed by Friedrich Neuhaus under a late neoclassical style, with its façade discernible by two towers that mark the entrance to the grand industrial hall (Lacuna, 2011). The space went through several projects, but the most decisive one occurred in 1996 by architect Josef Paul Kleihues, who adapted the building to a contemporary art museum. The adaptation project revealed a restrained intervention that respects the original purpose of the structure (Staatliche Museen zu Berlin, 2017).

In addition to the previously described cases, there are also conversions of large warehouses in old ports: a groundbreaking case was the Centre d’Arts Plastiques Contemporain (CAPC) in Bordeaux that was opened at the Entrepôts Lainé in 1979; in 1984 in Liverpool occurred the restoration of a nineteenth-century dock-warehouse, the Albert Dock; in 1986, Ostend’s Provincial Museum voor Modene Kunst was established in a former warehouse-workshop and in 1987, Antwerp’s contemporary art museum – Museum Van Hedendaagse Kunst Antwerpen – was inaugurated in a renovated grain silo (Lorente, 1998, p. 257).

As described by Australia & New South Wales (2008, p. 4), “adaptation projects link the past to the present and project into the future. This provides both a challenge and an opportunity for professional design teams to demonstrate their skills and creativity.” However, this does not mean that the project is to focus solely on the previous building’s characteristics. Instead, it should respect it, creating a symbiotic relationship between old and new. It is critical to create affinities with the local environment through emotional and cultural ties between the building and its users.



Figure 2.3 | Tate Modern, London



Figure 2.4 | Hamburger Bahnhof, Berlin (1927); Figure 2.5 | Foyer of the Hamburger Bahnhof, Berlin



Figure 2.6 | Museum Van Hedendaagse Kunst Antwerpen

3 | CONSERVATION OF CONTEMPORARY ART

3.1. MUSEOGRAPHY

“Everything that museums do flows from their collections. Thus a museum capital project [...] cannot succeed unless it assists the professional staff in their endeavour to care for the collections. (...) It is planning for collections that the uniqueness of each museum is truly recognised” (Nicks, 2001: 109-114, in: Yáñez, 2006, p. 81).

Cesari Brandi described museography as “a quadrivium of science, history, aesthetics and fashion”. Being a subcategory of museology, museography focuses on the concepts related with the presentation of artworks, through an appropriate exhibition method and technique (Kühne and Kirch, 2010, p. 120). Furthermore, it is also described as the techniques “developed to fulfil museal operations, in particular with regard to the planning and fitting out of the museum premises, conservation, restoration, security and exhibition.” (Desvallées & Mairesse, 2010, p. 52).

Contemporary art has a complex relationship with its own definition in a timeframe for until the late 90's it seemed to emerge after World War II, but after this, its birth was reedited to be during the 60's and now, there is also the perspective that the year 1989 should be seen as a milestone (the fall of communism and the rise of global markets). Furthermore, these distinct concepts only characterise the Western perspective, which leads to the realisation that “the attempt to periodize contemporary art is dysfunctional” and “unable to accommodate global diversity” (Bishop, 2013, pp. 16-18). However, throughout this work, the timeline followed will be the first one, in line with the case studies discussed further along, in which contemporary art collections include works produced after World War II.

To try to define contemporary art through its contribution in relation to other artistic productions is also an intricate affair. Bishop (2013, p. 19) summarises two approaches: “contemporaneity denotes stasis”, being an extension of postmodernism’s “post-historical deadlock”, or it represents a fracture from postmodernism through a “disjunctive relationship to temporality”.

Nineteenth and twentieth centuries, brought a wave of experimentation of materials and techniques in art that allowed for artworks to be transient and ephemeral, opposing to the so far permanence and immutability registered in art (Jadzinska, 2016, p. 190). This change in theme occurred during the 1960s and 1970s, through a critic “of the traditional and privileged art object, where artists attempted to undermine the artwork as a relic or commodity by merging art with life” (Frasco, 2009, p. 6). This also interfered with the passive relationship between artwork and the viewer, forcing the audience to have an active role, which is well represented in performance art. As Buskirk (2003, p. 12) explains, several dichotomies emerged, such as “original/copy, performance/document, object/context, high/low, representative/abstraction, or permanence/transience”. This

paved the way for a wide range of new materials to pop up in contemporary art, which were used in different movements and styles like Pop Art, installation, Arte Povera, Feminist Art, performance and new media art.

As Schinzel observes, contemporary art has a complex personality (2006, pp. 17-18):

“1. Anything can be art (unlimited expansion of art material started with ready-mades like Fountain, and Bottle Dryer, first exhibited by Duchamp in New York in 1917);

2. Different arts, such as music, literature and the visual arts, mix together (starting with the Fluxus movement in the 1960s and having been amply spread up till now - recent example the work of Laurie Anderson);

3. Deconstructive self-reflection is taking place in the visual arts, through the integration of philosophy and sociology, and through socio-cultural and institutional criticism, as in the work of Marcel Broodthaers, Michael Asher, and Joseph Beuys;

4. New media adapt compositional and other characteristics typical for traditional art. For example, Cindy Sherman's staged photographs, or Gilbert & George's conceptual photographs;

5. Traditional media adapt compositional and other elements invented and/or made possible by new media (the influences of all new media on painting);

6. Quotations from different artists in different media. Copying, a long-standing habit, is spreading in all media, the 'reviews' usually showing less skill than the works being imitated.”

Contemporary art production, with its diverse nature and concepts interferes with a past notion of how to exhibit and care for the pieces displayed. Its radical character goes against established principles, confronting not only an audience with its critique, but also the institution responsible for it.

The use of perishable materials and technology (which will eventually become obsolete), along with site-specific artworks and performances challenges curators and conservators whose education is oriented towards a more “conventional object-oriented approach to collecting and conservation” (van Saaze, 2013, p. 15). Conservation ethical guidelines should be revised, so to keep up with the continuous production of artworks. However, it is not only the museum team who needs to adjust to new artistic practices, for the museum building itself must integrate contemporary concepts and projects.

3.2. PREVENTIVE CONSERVATION

As shown in figure 3.1, *A classification of activities within the conservation field* (Viñas, 2005, p. 25), conservation has two main branches: preservation and restoration. The latter creates a noticeable change on an object that suffered deterioration or loss (ICCOM-CC, 2008 p. 2), while preservation, adds no deliberate perceptible changes, having three different areas: direct, environmental and informational preservation. The first one has a direct change in the object and its action is limited in time; environmental preservation does not affect an object directly, only changing the environment the piece is

in; informational preservation protects the information the object contains through recordings or reproducing some features of the object.

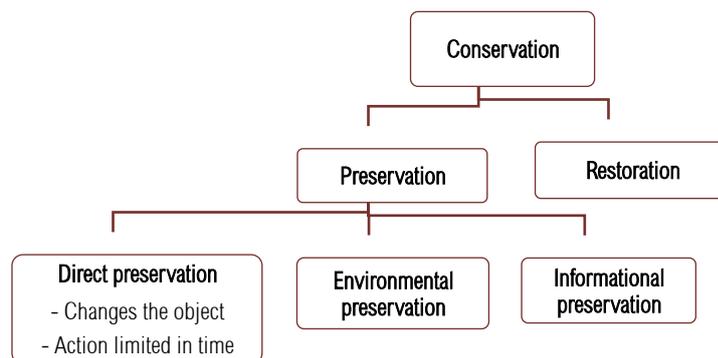


Figure 3.1 | A classification of activities within the conservation field

“Direct preservation” as previously described, can be compared to ICCOM-CC’s (2008, p. 2) “remedial conservation” which involves a direct action upon an object so that it stops its damaging process or reinforces its structure (it may modify its appearance). “Environmental preservation” is similarly described by ICCOM-CC (2008, pp. 1-2) as “preventive conservation”, referring to every measure taken to avoid and/or minimize future deterioration or loss. These actions are indirect, not interfering with the appearance of the object and focusing on an entire collection and its environment, such as: “registration, storage, handling, packing and transportation, security, environmental management (light, humidity, pollution and pest control)” (ICCOM-CC, 2008, p. 2):

Registration – The inventory is essential for the museum, as it assures the presence of all objects and registers their location. Museums can use digital software or a manual registration in a catalogue. Every object that enters the storage area receives a numbered code corresponding to its location, which is then registered (UNESCO, 2010, pp. 6-8).

Storing of artworks – Objects can be placed according to their size, form or weight, materials or type of objects, or by theme. “Large objects should be placed on lower shelves; small objects should be placed in drawers; lighter objects should be placed on top shelves; bulky objects should be placed within easy access of the storage area entrance”. According to the type and shape of object, they can be kept in different storage systems. Artworks cannot be in direct contact with the floor; heavier items should be kept on storage platforms with wheels to facilitate their mobility. Shelves should not be overcrowded with objects. Some pieces may need an individual and more protected support due to their fragile nature. The furniture used to store artworks should be durable and its materials must be compatible with the works (UNESCO, 2010, pp. 28-32).

Handling – Most damage to objects happens when they are being touched or moved. It is important to carry one object at a time, while wearing gloves (plain cotton or nitrile) and moving them carefully. Before moving an object, the staff must have in consideration certain procedures, such as: inspect its condition (structural

soundness and stability), and be sure the path it will go through is clear and its new location is prepared in advance (UNESCO, 2010, pp. 33-40).

Security management – Each storage area must have its own security rules, which should be set upon the access to the storage area, the prevention against robbery, fire protection and water damage. Only storage technicians and supervisors should have an ordinary access to the storage, while “researchers, conservators, cleaners and maintenance staff should be considered as visitors”, registering their movements in a logbook. External visitors should only be allowed in with a special permission, and be accompanied by a storage area staff member (UNESCO, 2010, p. 11).

Regarding fire protection, walls and ceiling should be fire proof; smoke detectors should be regularly tested and preferably be of pressurised water or carbon dioxide; “flammable objects should be stored separately”. Storage areas should not include loose electrical wiring, water, gas or drain pipes, nor heating ducts; control panels should be placed outside of the storage for an easier access (UNESCO, 2010, pp. 14-15). Each storage space should have a high-quality alarm system, and a secure barrier from the exterior.

Environmental management – There are several aspects to be taken into account when trying to create a hospitable environment in a storage area:

Biological agents: the environment should be dry and well ventilated so to reduce the risk of insect infestation and mould. Storages should be inspected regularly for infestations, as well as for frass (excrements of larvae) and droppings; insect traps should be installed. When an object arrives in the storage space it should be analysed and quarantined (UNESCO, 2010, pp. 16-17).

Humidity and temperature: there should be an appropriate and constant temperature and humidity levels, according to the type of materials in storage (UNESCO, 2010, pp. 18-19). Every museum must have a plan to protect its collection in the event that energy is cut-off, as well as a “priority list of organic objects in terms of their critical responses to environmental changes” (Johnson & Horgan, 1979, p. 28).

Lighting: Light damages organic materials. However, there should be enough light for observation and proper handling. With no one in the room the lights should be turned off. There should be no sources of natural light in the storage rooms. In case there are, windows should be covered with screens, blinds (UNESCO, 2010, p. 19). In addition to this, actions like dusting the artworks, cleaning the rooms, and monitoring both the pieces, as well as the conditions of the storage area are crucial to assure the control of the storage area’s environment (Keene, 2002, p. 16).

To preserve a collection means to take care of it, guaranteeing its safety at many levels. When considering Viñas’ choice of nomenclature for preventive conservation – “environmental preservation” –, it is clear that a conservational programme must look beyond its collection, extending its scope to the conservation and intervention upon the building that protects the artworks. The design of a museum (whether it is new or an

adapted building) must account for the preventive conservational needs of the collection, in particular the spaces used to store the collections (Yáñez, 2006, p. 89-90).

As Keene (2012, p. 23) states, at an international level, the Conservation Committee is the largest specialist committee of ICOM, helping discuss conservation and preservation problems of collections. Other institutions, such as the International Network for the Conservation of Contemporary Art (INCCA), which includes members from various fields like conservators, curators, scientists, registrars, archivists, art historians and researchers, are committed to “develop, share and preserve knowledge needed for the conservation of contemporary art” through the organising of meetings, workshops and research projects (Brake-Baldock, 2014, p. 16).

Any type of change to an artwork may compromise the meaning of the original piece, making it is essential to analyse the values the artist attributed to the piece, as well as a contextualisation of the circumstances under which the artwork was conceived – “the creation process, the role of place, space, materials, sensory elements and their interrelations, and the role of the viewer” (Jadzinska, 2016, pp. 189).

Conservators must work together with curators and other specialists to conserve not only the object in question but also “its cultural significance for present and future generations”, which in contemporary art goes beyond stopping any physical changes, as an artist’s intent may be contrary to the preservation of the piece. This questions two conservational values: the “preservation ethic” and the respect for the “true nature” of the art piece. Since neither legislation nor professional codes offer a strong guidance to deal with the complicated questions that arise with contemporary art, conservation professionals continue to adapt their approach, while in contact with artists, curators and other specialists (Wharton, 2006, pp. 164-166).

The conservation of an artwork relies greatly upon the documentation of the piece, whether this is written, video or a photographic documentation, and many times through a recorded interview with the artist (van Saaze, 2015, p. 56). However, even the gathering of this information can be challenged by the artwork itself.

It is clear that as contemporary art presents society with new sets of values, new conservation strategies must be developed. Preserving material parts of a work may be just as important as the preservation of its concept and therefore immateriality. However, sometimes these values collide, leaving conservators to deal with complex choices. To better deal with these situations it is essential to: create “ethical principles and guidelines that form an alternative to the standard ones of minimal intervention and reversibility”, to register in an artwork’s documentation the conservators’ dilemmas when deciding on their conservation strategies, and to have an open dialogue about the cases that challenge conservators (van de Vall, 2015, pp. 8-16).

The meeting *Conservation Issues of Modern and Contemporary Art (CIMCA)* revealed the importance of: research regarding “preventive conservation issues, including evaluation of optimum environmental conditions for modern materials”; documentation,

through standard methodologies and the use of new technologies; the sharing of information in the field (Getty Conservation Institute, 2008, p. 10).

Szmelter (2010a, pp. 46-47) presents guidelines for a new conceptual framework for the preservation of heritage of modern and contemporary art:

- “1. *Recognition and documentation* – the aim is to establish a knowledge base on the object (...).
- 1.1 *Procedure of acquisition* – should be conducted in conservation-curatorial collaboration with the artist and include an initial registration of the object.
- 1.2 *Documentation* – Photographic documentation and measurement (traditional and digital photography, three-dimensional documentation) supplemented with video, sound recordings, analyses of movement, sensory perception, etc.
- 1.3 *The investigative phase* – Artist interviews (...). The analyses should contain the following basic data: the artist’s definition of the embodied idea; the significance and composition of materials; and techniques and instruments, (...). Concerning the authenticity of the work, decisions should be made regarding the possibility of replacing elements and supporting structures (co-called preservation inserts), and other ready-made elements. The artist’s attitude towards conservation work, guidelines for reconstruction or reinstallation should be noted.
- 1.4 *Archives* – Expert and descriptive documentation of artwork has a wide range of features and functions. They are methodical and make available a broad range of related knowledge (...) for use by the conservation community and art historians.
 2. *The role of conservation* – the conservator first makes a diagnosis, which should set the goal and concept of preventive conservation, active conservation and restoration, and reconstruction. (...)
 3. *Conservation-curatorial care* – guidelines (...) address aspects that are external to the collection, such as documentation, transport and handling as well as exhibition design as an element in preserving the works integrity.”

In conclusion, it seems clear that the work involved in the preservation of contemporary artworks cannot limit itself to a set of predefined rules, as there is a multiplicity of situations to be considered. The key may rely on a methodology that takes into consideration both tangible and intangible values, including a wide range of materials and techniques, as well as diverse artistic concepts and proposals.

4 | STORAGE AREAS

A museum has the duty to share its pieces, educating, inspiring and stimulating. A great part of its collection is in the backstage, in the museum’s storage area, a space which most visitors are not fully aware of, not knowing its relevance to the museum. Some pieces are exhibited in up-coming exhibitions, some are loaned to other museums and others spend most of their time in storage. To achieve the goals set by museums, – “education, study and enjoyment” (ICOFOM, 2009, p. 57) – suitable storage areas must be a priority.

When planning the museum storage, one of the most important aspects to have in mind is the development of a strategic plan, which considers the type of collection, its

characteristics and future needs. This requires an appropriate selection of materials, as well as an understanding of the environmental characteristics used in the storage (Herdade, 2003, p. 33). However, most museums have low budgets, and, unfortunately, as Oláh & Griesser-Stermscheg (2014, p. 9) point out, the funds available for the storage area in a museum can usually be seen as an indicator of its conditions. Furthermore, the lack of a strategic plan for a growing collection will imperil its objects, for they will not have the appropriate spatial conditions to be preserved (Huber, 2014, p. 132).

Nowadays, the affluence of people in museums tends to be significant and dynamic. Nevertheless, storage areas are often perceived as still entities as their strict conditions do not allow for an interaction with the public. As Hochreiter (2014, pp. 37-38) describes, “as the latest, state-of-the-art depot furnishings in Austria demonstrate, these buildings [storage areas] are beyond anything commonly counted as architecture”. Not only in Austria, but in most countries, storage spaces - which protect our “costly cultural heritage” - are represented by an acute simplicity that seems to stand for utility reasons. However, the rising of technology, digitalisation and the Internet enable objects in storage areas to be closer to the public.

In recent years, some museums have started opening their storage rooms to the general public, allowing for the rest of the collection to be seen, and promoting a better understanding of the importance of these spaces, as is the case of the Schaulager – Laurenz Foundation, designed by Herzog & de Meuron. This institution combines the storing, studying and presenting of modern and contemporary art within one space. This unconventional approach where the storing of artworks is made openly, provides visitors with an easy access to them while ensuring the objects’ conservation (Laurenz-Stiftung Schaulager, 2017).

As Huber (2014, p. 132) describes, museum depots cannot be seen as warehouses where the museum collection is deposited and left to be forgotten. These spaces require a multitude of actions in order to achieve the museum’s task of “collect-preserve-research-educate”. For this, a museum collection strategy is essential for the planning of a storage unit, ensuring that long-term needs are guarded. A well-planned and organised storage space reduces the risks to the collection while providing access to it. This can be achieved through security and protection measures, appropriate handling practices, environmental conditions, storage techniques and through a good design (Duyck, 2012, p. 7:1).

4.1. SPATIAL ORGANISATION

“The storage area guarantees the preservation of and accessibility to the collection; proper care and management of collections in storage is an important challenge for museums, as they are pillars of knowledge, research and inspiration.” (UNESCO, 2010, p. 3).

Duyck (2012, p. 7:1-7:2) describes a collection’s storage as being composed of five protective layers, which protect at its core the elements of the collection:

“-*Building/facility envelope*: exterior (outside/external) walls of the structure housing the collection.

- *Room/space envelope*: walls of the room or space immediately enclosing the collection.

- *Equipment/storage furniture*: storage furniture such as a cabinet with gaskets, map unit, or shelving unit housing the object.

- *Container/housing*: container housing the object such as a box, tray, or other fully enclosed container.

- *Packaging/wrapping materials*: museum quality materials that cover and/or support the object inside of its container/housing, such as tissue, muslin, or polyethylene foam.”

Most storage areas are found in spaces poorly designed for these functions, occupying rooms that were the remaining areas available in the architecture project, not being able to adequately serve their mission. A fewer number of storages are located in newly built buildings, specifically designed for this purpose. In adapted spaces one of the biggest problems to deal with is ensuring the storage area will be able to accommodate a growing collection. This is one of the reasons that leads museums to rent other spaces outside of its building, gaining extra room for the collection, which is already at its full capacity (Griesser-Stermscheg, 2014, p. 17).

The expansion of museums to accommodate their collection is associated with high costs. Consequently, several museums in the last twenty years have opted to build new central depots to replace rented properties that are further away from the museums. In Austria, due to a relatively good financial situation of the public sector around the end of the century, the planning of storage areas lacked a future outline. This led for a rapid construction of storages that are currently struggling to adequately preserve their collections. As a result, institutions are renting other storage spaces, building extensions or opening new ones (Huber, 2014, p. 131). The choice of location for the storage unit should have in consideration certain factors (UNESCO, 2010, p. 12):

- Threats of natural disasters (floods, earthquakes, storms);
- The building’s surroundings and its location regarding pollution, vibration;
- Type of pre-existing building (materials, number of floors);
- Accessibility and infrastructure - With loading bays, exhibition and conservation areas;
- Specific location of the storage area inside the building, where a good location would be “in a central area protected from climatic fluctuation”.

When intervening in a space to convert it into a storage area it is essential to understand its conditions and constraints, so to protect the building’s integrity, while taking advantage of the possibilities to improve the space. A high-quality, well-organised and well-managed storage is an asset to a museum, promoting its development and saving money in the long term. Each storage area should follow a set of requirements, as Ambrose and Paine (2006, pp. 180-181) describe:

- Storage facilities need to be stored in secure and suitable buildings;

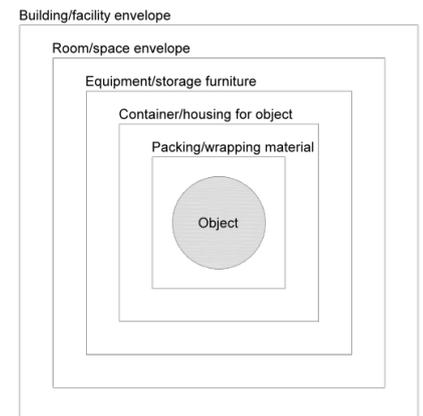


Figure 4.1 | Multi-layered protection of an object

- The space must be maximised, without compromising the secure movement of objects and people;
- Space for an extension of the storage area must be provided;
- Environmental conditions are to be controlled and monitored regularly;
- The conservation and security of the artworks should be assured through detailed documentation and a proper storage system.

When housing a museum in an existing building, the reconversion of spaces and their adaptation to a new use can be problematic. This is one of the reasons why less accessible areas to the public, such as basements, are many times used as collection storage facilities. The evident load-bearing capacity of a basement floor is beneficial to a collection, which is only possible on upper floors when the building was already structurally designed to receive such loads. Additionally, the inaccessible location of the storage to the public increases security and control (Johnson & Horgan, 1979, p. 15).

On the other hand, the existence of a storage area at basement level presents real disadvantages to a project, such as: lack of ventilation, excessive dampness and potential for damage due to flooding. Moreover, the lack of natural light, which can be beneficial to the artworks is however undesirable for the workers. As such, it may be necessary to separate the collection storage area from its supporting facilities or to transport natural light into these dark basement spaces (Johnson & Horgan, 1979, p. 15).

Nowadays, many collections are housed in industrial buildings (old warehouses or new industrial units), as they are low-cost spaces with large storing and load-bearing capacity. Nevertheless, these can have potential functionality and performance problems, requiring costly repairs and alterations. To receive a collection, a storage building must: be structurally sound and weatherproof; guarantee a secure and fire-safe location; present a controlled environment (temperature, humidity, pollutants); have good access and circulation inside; have low-energy and maintenance costs; hold a space for staff and visitors (Bordass, 1996, pp. 1-2). To achieve this, the presence of an interdisciplinary team of architects, engineers, curators, conservators and others is crucial.

According to Joanne Horgan, architecture planning and programming specialist, planning a storage facility can be easier when following these steps (Herreman, 1995, p. 10):

- a) “classification of collections according to type and use;
- b) preparation of the programme and the conceptual diagram;
- c) establishment of design criteria;
- d) communication with the architect.”
- e) “[identification of] basic functions of the museum [that might] affect and modify the storage areas.”

A storage area cannot be isolated from the other museum facilities, such as the exhibition rooms or the educational programme area. These spaces must be thought as a unit, since the organisation of one space influences the others, and their connection is important for the correct development of the museum’s activities. The objects go through different environments – they must arrive in the storage, be studied, packed, unpacked,

prepared for exhibitions and travels – and so, the storage room must be efficiently connected to all the other spaces in the museum (Hilberry & Weinberg, 1994, p. 176). A successful integration of these spaces will allow for an efficient processing of the museum objects, minimizing potential damages to the collection. Johnson and Horgan (1979, pp. 13-15) represented an optimal solution for the spatial relationship between the various rooms in a storage area visible in figure 4.2.

A direct and safe (with wide corridors and minimum level changes) connection between the “registration and holding area” and the exhibition room is important to avoid any conservation damages to the collection during the moving of the objects.

Determining the amount of storage area required for each museum is a complicated task. It is essential to analyse the size of the museum’s existing collection, as well as its growing rate. However, a collection’s size may vary greatly with the different needs of long-term exhibitions, travelling exhibitions and loans. Only a planning that takes into account the collection’s needs, will make a realistic assessment of the required space (Hilberry & Weinberg, 1994, p. 174). Johnson and Horgan (1979, p. 16) describe six steps that help assess the necessary area for the collection storage:

1. Divide the collection in categories (paintings, sculpture, etc.);
2. Understand the most important storing criteria of each category, considering conservation, security, access, retrieval and visibility requirements;
3. Select the storage systems to install, according to the category of objects;
4. Make a layout of the space with the necessary storage systems to understand the spatial needs of the collection and the dimensions of the systems required;
5. Calculate the annual increase of the collection by objects in each category. The space should be planned with a span of 10 years;
6. Follow the procedure in step 4 to assess the space increase in the future;
7. Understand which of the collection supporting areas are necessary for the museum.

When designing the storage unit, it is important for it to accommodate the existing collection, as well as guaranteeing enough storage space for the next 10 years of the museum’s activity. However, most museums do not have enough means to support such a costly plan (Hilberry & Weinberg, 1994, pp. 176-177).

A collection’s growth can develop in the existing museum or in a new building. If a museum does have the required land at its disposal, then it is important to develop a plan for this expansion. It is essential for this new storage facility to be integrated with the initial one and for the security controls and quality of the space not to be compromised. If a museum has a space that no longer serves its purpose, this might be converted into storage space. However, this strategy must be well developed, since it may be less expensive to build a new storage area.

A storage facility requires a great structural load capacity, so to support the weight of the collection and its auxiliary systems. In case the storage is occupying a newly built structure this will be thought out when designing the building. However, the situation can be complicated when the storage is in a historic construction, as these are likely to have a

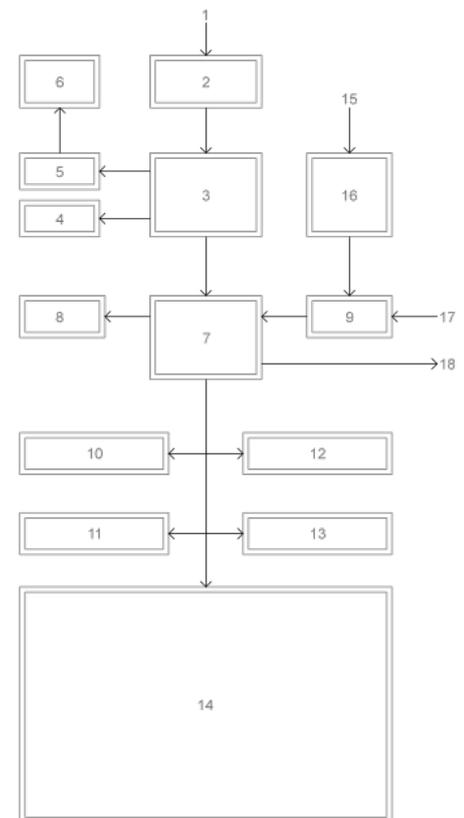


Figure 4.2 | Area relationships for collection storage facilities. For planning purposes, the areas that constitute the entire facility can be considered as one unit. The collection storage facility includes:

1. Service yard
2. Loading dock
3. Receiving area
4. Fumigation or specimen washing area
5. Crating area
6. Crate storage area
7. Registration and holding area
8. Records vault
9. Reception and secretarial area
10. Curatorial offices or laboratories
11. Collections research area
12. Photo area
13. Conservation laboratory
14. Collection storage areas
15. Outside night entrance
16. Security control station
17. Public and staff entrance
18. Connection to exhibition preparation areas and exhibition galleries

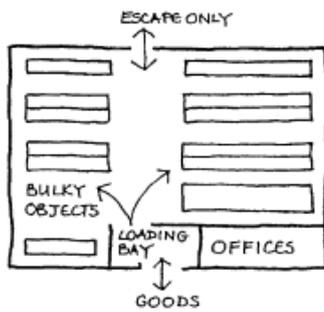


Figure 4.3 | Planning entrances and aisles

more limited load bearing capacity, which will hamper the occupation of the floors and the movement of objects.

Hilberry & Weinberg (1994, pp. 176-177) mention the importance of an adequate ceiling height for each type of object, as contemporary paintings for example, require at least 3 to 3,5 m. Linking elements such as doors, corridors and elevators are crucial for the safe transportation of the works. Therefore, doors should be as large as the connecting hallway – between 2-3 m high and 1.5-2.5 m wide – and preferably opening out of the room, saving interior space and acting as a security measure against theft.

The materials used in the storage affect the efficiency with which the tasks are developed also impacting the conservation of the artworks. It is essential to pay special attention to the finishing of the storage area: walls, floors and ceilings must have the appropriate features, for the safety of the collection (Duyck, 2012, pp. 7:9-7:10).

To protect against water, electricity, and gas pipe leaks, storage areas should not include loose electrical wiring, heating ducts, control panels (which should be located outside of the storage units for an easier access to the maintenance staff), nor water, drain or gas pipes. Regarding security, doors should be made of solid wood or be metal plated, with high-quality locks. To reduce the risk of insect infestations, the openings from outside should be sealed, doors and windows should be kept closed and ventilation openings should have a fine mesh screen (UNESCO, 2010, pp. 15-17).

To design an efficient storage area the design team must be informed of the different tasks developed, so to help determine the dimensions and the spatial layout of the room. This requires a knowledge of: how artworks are registered, catalogued and documented; the environmental conditions (light, relative humidity, temperature); security aspects (Herreman, 1995, pp. 10-11).

Considering an adapted historic structure, the best option to develop a suitable storage area is to create a “room within a room.” This acts as a layer of protection for the collection and the already existing structure, which should be as reversible as possible. This strategy is even more effective when the environmental conditions necessary to implement are strict, for the equipment that controls the storage environment must only work through the more favourable interior environment of the historic structure and not the harsher exterior one. Another important aspect when installing these systems is to locate them sufficiently away from the historic structure’s exterior, allowing for an easy inspection and repair.

In 2011, ICCROM-UNESCO conducted an International Storage Survey, recording the information given by 1490 museums, from 136 countries. The results show that at least 60% of museum collections in storage are in danger, with problems regarding the available space – 1 in 2 museums do not have enough storage units and have theirs overcrowded. This also impacts the circulation inside the storage which was deemed “difficult or impossible” by 25% of the museums (ICCROM-UNESCO, 2011).

The lack of space is usually the main problematic factor, since the storage area must keep offering enough space to accommodate a museum’s growing collection.

Furthermore, designing a storage area is a complicated endeavour due to the different tasks developed in this space, where several fields of expertise are at play. This shows how important it is for the architecture team to interact with the museum staff during the planning and development of the project, guaranteeing that the space will be able to provide a good working environment for the multidisciplinary team of the museum (Herreman, 1995, p. 9).

4.2. STORAGE SYSTEMS

Many curators can attest that the deterioration of collections comes from the inadequate conditions in which they are stored. Herreman (1995, p. 9) defends that most of these situations arise from neglect in the management of environmental conditions such as “temperature, humidity levels, pollutants, dust, insects and other pests and poor cataloguing and documenting”. As Wilcox (1995, p. 18) states, collections require a stable environment, free of deteriorating agents, with minimal human presence so not to compromise the objects and to achieve this there are several systems that must continuously and actively work. The elements that interfere with the preservation of artworks inside the storage were briefly described on chapter 3.2. On the following chapter there will be a more detailed view of the necessary environmental conditions, the security aspects and the storage systems that protect the artworks.

Environmental conditions

The storage and conservation techniques developed in a museum depend on the type of collection. Each material needs a specific set of conditions in order to be preserved: appropriate levels of relative humidity (RH), temperature and light exposure vary from object to object. Conservators understand the different effects that environmental factors have on objects, as well as how they can be controlled, being responsible for the setting up of the different systems used inside a storage area (Keene, 2002, p. 115).

The objects in a collection must be kept at a constant temperature and RH, since rapid changes to these characteristics cause severe damages. In fact, these changes should never be superior to 10% in 24h (Camacho, Mineiro & Nobre Dias, 2007, p. 60). As Johnson and Horgan (1979, pp. 27-29) describe, the temperature in storage areas is normally within 15 - 22 °C. However, according to the season, RH and temperature levels can lightly vary: a slight change in RH is admissible so to accommodate the building, which is why a museum may allow for indoor temperatures to drop as the outside ones do, maintaining humidity levels without costly energy consumption. Nonetheless, RH levels should never go below 25% or over 75%, as these will damage the works.

Contemporary art takes advantage of different materials, making it a more complicated task to provide the appropriate environmental conditions for each one (as

Type of object	Relative Humidity (%)	Temperature (°C)
Ceramic	40 - 60%	18 +/- 2°C
Wax	55 - 60%	15 - 1°C
Leather, parchments	50 - 55%	20°C
Graphic documents	55 +/- 5%	18 +/- 2°C
Wood	50%	19 - 21°C
Ivory	55%	18°C (16 - 24°C)
Underwater materials	100%	0 - 10°C
Photographic materials	30 - 40%	10°C - 15°C
Metal	0 - 45%	15 - 20°C
Paintings	45 - 60%	18 - 22°C
Feathers	50 - 55%	16 - 17°C
Glass	45 - 60%	18 - 20°C
Textiles	40 - 60%	18°C

Table 4.1 | Temperature and relative humidity levels according to the materials



Figure 4.4 | Digital data logger

registered in table 4.1), especially when an object is made out of different elements (Alarcão, 2007, pp. 25-27).

Ambrose and Paine (2006, p. 172) state that the RH in a storage space should be stabilised at 50-55% for a mixed collection, adding that in older buildings, “where condensation can occur at this level, 45-50% relative humidity is an effective compromise.” Museums must establish an upper and lower limit of RH and temperature, monitoring and registering these levels with the help of stop metering equipment (psychrometers, digital thermo hygrometers) or continuous ones (thermo hygrographs, digital data loggers) (Camacho, Mineiro & Nobre Dias, 2007, pp. 103-104).

There are several ways to passively control temperature and humidity levels (Camacho, Mineiro & Nobre Dias, 2007, pp. 61-62):

- Limit the number of people inside the storage;
- Not to place objects near light bulbs, windows, doors or external walls;
- Stop the rise of temperature with shades or blinds to block the direct sun light;
- Control relative humidity in microclimates with the use of silica gel;
- Use of materials that absorb and release humidity.

In regard to active methods, museums can take advantage of humidifiers, dehumidifiers, heaters, air conditioning and acclimatisation systems. A good climate control “requires a tight building envelope and reliable building heating and cooling systems” (HVAC system) that maintains the required levels of temperature and humidity, and filters gases and pollutant particles (Lambert & Hagan, 2013, p. 38).

Older structures were not designed including HVAC systems and installing them in walls, and ceilings that were not well insulated can be a complex task. Moreover, the use of vapour retardants (moisture barriers) paired with HVAC systems can cause moisture condensation, mould, warping, and other problems in the walls (Duyck, 2012, p. 7:30). As such, in adapted historical buildings, small alterations in the structure are the answer to a controlled environment, when combined with portable equipment (humidifiers, air conditioning, heaters) (Camacho, Mineiro & Nobre Dias, 2007, p. 62).

Pollution and the accumulation of dirt and dust is another hazard to the collection. As Michalski (2004, p. 80) describes, “airborne pollutants are gas, liquid, or solid contaminants carried by the air that are known to cause damage to objects.” Plenderleith and Werner (1971, p. 5) state that the ideal solution is for the space to have an air-conditioning plant incorporating a dust extractor, so to re-circulate the room air through a pollutant filter. By doing so, there will be a lesser risk of damage to the collection by atmospheric pollution. Furthermore, it is essential for the rooms of the storage to be cleaned regularly (Alarcão, 2007, p. 31).

To protect the collection against pests, it is important that every incoming object undergoes preliminary examinations. If necessary, an object must go through a laboratory analysis, cleaning, dusting, fumigation, and restoration (Johnson & Horgan, 1979, p. 32). To avoid the spreading of pests it is important, as Michalski (2004, p. 75) states, to create a “sanitary perimeter” around the building.

Alarcão (2007, p. 21) explains how light exposure, whether it is natural or artificial, causes damages to a collection's object, which can be irreversible. The longer the time exposure and the intensity of the light, worse will be the damaging effects (discoloration, changes in mechanical properties). The ultra-violet (UV) spectrum of light is the most harmful, therefore, any light bulbs or windows should be covered with a plastic film, so to block this radiation (Camacho, Mineiro & Nobre Dias, 2007, p. 99).

The lighting inside a storage area can be fluorescent, incandescent, halogen, tungsten or LED (Alarcão, 2007, p. 21-22). Each material has its level of sensitivity regarding light exposure, which is registered in table 4.2. Plenderleith and Werner (1971, p. 15) provide further notes regarding lighting requirements:

- Storage rooms should be kept in the dark when closed.
- Direct sunlight must be excluded with the use of blinds, louvers, or curtains.
- Illumination should not be direct, but reflected and diffuse.
- Use a type of fluorescent lamp that does not emit an excessive amount of UV radiation.
- UV absorbing filters should be used where appropriate.

Storage systems

As Ladkin (2004, p. 24) describes, the museum building is the first barrier against the outside environment, serving as the main and first protection for the collection. The division of rooms inside the museum determines another stage of protection and at a closer level there are the systems and packaging directly in contact with the objects.

UNESCO (2010, p. 21) explains the role of a storage area's furniture:

- "Provide physical support and protection for objects;
- Offer protection from causes of deterioration;
- Increase/facilitate the accessibility of objects;
- Make efficient use of space."

The objects should be stored bearing in mind their accessibility needs, so to make their access process more efficient (Bachmann & Rushfield, 1992, p. 7). Managing several dimensions of artworks can be problematic, which is why the size of the objects will also condition their organisation. Museums can also store their artworks by shape, weight, type of material, year or artist. To group the pieces according to their materials allows for them to occupy the same appropriate environment, which besides the positive conservational aspect, is also a good solution for smaller storage areas (Camacho, Mineiro & Nobre Dias, 2007, pp. 74-77). Small and stable objects should be wrapped, bagged or boxed as a protective measure between them and the environment. Fragile objects or ones that are too big to be wrapped should be placed in enclosed cabinets or shelves. No storage area should be overcrowded, as it may result in accidents with the collection (Ladkin, 2004, p. 24).

Lux (lúmen/m ²)	U.V. (MW/m ²)	Materials
≤ 300	≤ 75	Ceramic, glass, metal, rocks
≤ 200	≤ 75	Oil paintings, not coloured leather, hairspray, bone, wood, ivory, horn, black and white photographs
≤ 50	≤ 30	Watercolour, gouache, manuscripts, dyes, drawings, textiles, coloured photographs and leather

Table 4.2 | Recommended light levels according to the type of materials

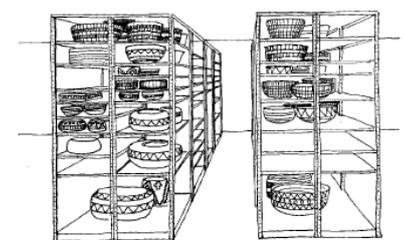


Figure 4.5 | Adjustable metal shelving

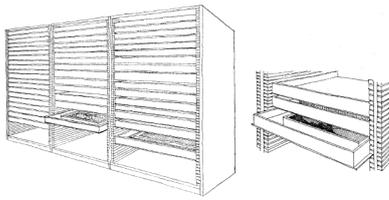


Figure 4.6 | Shallow wood open-drawer system

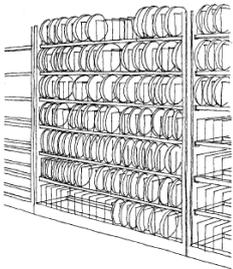


Figure 4.7 | Shelving for films or video cassettes

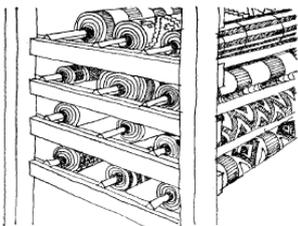


Figure 4.8 | Fixed or mobile hanging storage for textiles

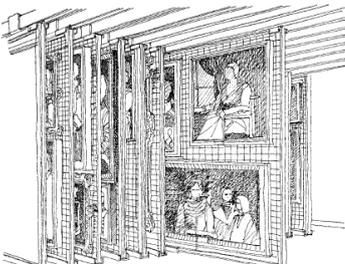


Figure 4.9 | Sliding rack storage with wire screening



Figure 4.10 | High-density mobile storage system

The type of storage furniture used must be chosen according to the type of objects in the collection and bearing in mind the characteristics of the space available. Johnson and Horgan (1979, pp. 35-54) offer a description of some of the storage systems:

- Adjustable metal shelving: Appropriate for open-shelf storage; it can be positioned together, creating more storage area, and providing access through all sides. Two types of shelving depths can accommodate objects with different sizes.
- Shallow wood open-drawer system: Stores light-weight objects in which air circulation is important or when contact with a metal may be damaging to the pieces. Adjustable metal shelving can be combined with open-drawers in the same structure, creating a more flexible system.
- Shelving for films or video cassettes: A variation of the basic shelving system, adapted to store films, consisting of two horizontal bars with U-shaped wire dividers, separating the individual reels along the length of the shelf.
- Fixed or mobile hanging storage for textiles: Fixed storage with wooden poles suspended within a wooden framing system. The textiles are rolled around a cardboard tube covered with acid-free paper, which slides over a wooden pole. The materials are covered in plastic, protecting them from dust. The mobile storage is hung from tracks attached to either the ceiling or a free-standing structure.
- Sliding rack storage with wire screening: The structure can be hung from the ceiling or from an independent structure; channels near the floor prevent the hanging screens from swaying back and forth when pulled out. The distance between screens varies according to the dimensions of the materials hung. The objects (usually paintings) are hung from the screen with hooks.
- High-density mobile storage system: Creates more storage capacity (approximately 50% more) by joining the different wagon shelves together, using only one aisle to access a specific wagon. This is possible with the use of rails installed on the floor, which allow for the movement of the system.

Security

To guarantee the collection's protection the museum must provide efficient security measures against different hazards such as: theft, damage by floods, fire or even gas leaks. As Keene (2002, pp. 67-68) states, many threats to collections can be avoided or reduced with good management and by a good planning and design:

- It is safer to divide a storage into smaller fireproof enclosures, containing the threat of fire instead of installing expensive sprinklers (which can be discharged by mistake);
- Services should never be designed with pipes that run through storage;
- Storages should not be below the water level, or near a source of flooding.

The security system of a museum should be built as a chain of subsystems with functional links. When considering theft, the building must have different levels of

protection: mechanical barriers, guards, and intruder detection systems. As mechanical barriers it is important for the museum to have its doors, windows, roofs, ventilation ducts and penetrable walls well-guarded against mechanical forced entry. Besides hiring guards to secure the perimeter, it is essential for the institution to have an electronic surveillance system and alarms, which should be connected to a police station, so that when the alarm is activated, an instant response will be triggered (Jirasek, 2004, pp. 182-183).

It is essential for the access to the museum storage to be restricted and controlled. Consequently, the staff should sign in and out, registering their activities regarding the collection (Ambrose & Paine, 2006, p. 203). Any visitors (researchers, students, conservators, cleaners and maintenance staff) must register their entry in a logbook and be supervised by storage staff (UNESCO, 2010, p. 11). However, the type of access to a storage area varies from institution, as some museums allow for the general public to enter their storage unit. Bearing this in mind, the storage systems must adapt, protecting the collection while allowing visits from a broader public.

The design of the building itself can help increase the level of security of the pieces. Through careful planning, the rooms can be sensibly connected so that a person must go through security first in order to access the different rooms of the storage (Johnson & Horgan, 1979, p. 19-22).

Fire usually leads to irreparable damage, making it a major threat to the museum's collection and staff. Most fires occur from unsafe handling of flammable liquids, faulty wiring and careless smoking, having increased over the years due to a greater use of electrical installations in museums (Johnson & Horgan, 1979, pp. 23-24). Architecture plays a crucial role in helping to prevent a fire from spreading, which is why the walls and ceilings of the museum must be fireproof, with the use of stone or gypsum (UNESCO, 2010, p. 14). Additionally, the CFPA-E (2013, p. 13) defends that spaces should be modular and have integrated systems, such as optical, heat, flame or aspiration detectors.

In regard to fire suppression, complementary automatic and manual systems should be integrated. The most used automatic fire extinguishing systems are water sprinklers or the release of carbon dioxide gas, while for manual systems there is foam, dry carbon dioxide and water and carbon dioxide extinguishers (Hilberry & Weinberg, 1994, pp. 190-191). The local fire department should assist in the museum fire protection training programme. Ideally, the fire detection and alarm equipment should be connected to a central station that will automatically alert the fire department in case of an emergency (Johnson & Horgan, 1979, p. 26).

As UNESCO (2010, p. 4) states, "good management of the storage areas is the first defence against the deterioration of its collection", helping slow down or avoid the deterioration of materials. A regular monitoring of the implemented systems is essential, in order to check if they are properly working. Collections are preserved through direct preservation, but also through its organisation, by monitoring, reporting, following procedures, along with the staff's training (Keene, 2002, pp. 115-116).

II – Case Studies

In this chapter four case studies will be analysed: two in Austria and other two in Portugal. For each museum there is an analysis of its history, architectural characteristics and collection. Finally, there is a detailed study of the storage areas. Underlining the study of the storages of each museum, there is the goal of gaining a better understanding of how these exclusive locations function and, therefore, what are the spatial requirements inherent to them.

For each storage there is a description of the building as well as of the restoration project it underwent, in order to better comprehend the architectural decisions involved in altering a space to receive contemporary artworks. Furthermore, the different spaces and facilities inside the storage unit are described, their functions, characteristics of the rooms, as well as the storage systems used for the different artworks. Since storages protect objects against damaging elements, characteristics such as environmental control, light, fire and flood security, theft, and pest control are also analysed.

As described by ICOM (2004, p. 24), “collections storage refers to the physical space where collections are housed when not on exhibition or being researched.” The term “storage area” can have different meanings, as it can be understood as the different facilities that interconnected allow for the artworks to be stored and it can also be perceived as the specific rooms where the artworks are kept. In the following case studies, when considering storages with several facilities – and even though these rooms (restoration laboratories, loading docks, among others) are also examined here –, the term “storage area” will be in regard to the rooms where the artworks are kept.

5 | AUSTRIA

“Apart from a few luxurious new buildings, most of depots are located in rather bizarre places, which no longer fulfil their original functions – factory buildings, a harbour building, a bunker, a historical cinema, a former hospital, a wine-cellar... Only a small minority of these offer ideal storage conditions. But everywhere work goes on behind the scenes.” (Martina Griesser-Stermscheg, 2014: 17).

5.1. MUSEUM STARTGALERIE ARTOTHEK

HISTORY AND ARCHITECTURE

MUSA are the initials for the Museum Startgalerie Artothek in Vienna, which opened in 2007 in a building in front of the city hall. The institution is administered by the Department for Cultural Affairs of the City of Vienna, which founded its collection of contemporary art in 1951 (MUSA, n.d.). This museum is the only Austrian (public or private) institution that focuses on contemporary art from Vienna (Cultural Department of the City of Vienna, 2007, p. 156). A comparison may be established with the Vienna Secession, since this was the “world’s oldest independent exhibition institution specifically dedicated to contemporary art” (Secession, n.d.). Founded by a group of artists represented by Gustav Klimt in 1897, their main purpose was to have a platform in which to express their modernist ideas. Nowadays, the institution displays contemporary international and Austrian art tendencies (Secession, n.d.).

Until 1991 the collection was kept away from the public’s eye, as it did not have a space to be displayed. It was Wolfgang Hilger (head of the Division of Fine Arts of the City of Vienna’s Cultural Department from 1985–2003) who led to the opening of the first exhibition of the collection – “*Ins Licht gerückt – Ein Museum auf Abruf (Brought to the Light – A museum on demand)*”. This exhibition, which took place in the Great Hall of the Vienna City Hall, was a success and proved the need for the collection to have a permanent home where it could be on display for the city (Denscher, 2007, p. 9).

As Denscher (2007, p. 9) describes, through the following years new exhibitions were presented, not only in Vienna but also in different countries. Meanwhile, the name “Museum on Demand” prevailed, reflecting the collection’s richness and the ambition to have a fixed stage to be in. By the year 1998, through an invitation by the *Vienna Kunsthalle*, the “museum” was presented in a large exhibition. This was a driving force for the collection to have a provisory home in a small gallery in *Makartgasse*, from 1998 to 2002. The Museum on Demand was closed on 2003, which pushed the institution to further accentuate its international connections, exhibiting its works of art in other countries (Achleitner et al, 2007, p. 12). Although, the institution was already looking for a permanent place since 2000/2001, its current name was only attributed in 2007, when the museum found a home in an office building in front of the city hall.



Figure 5.1 | Building location (MUSA)



Figure 5.2 | MUSA building

MUSA is composed of three different elements: an exhibition space for the collection, the *Startgalerie* and the *Artothek* (Art Library). Johannes Karel states that these three branches have one thing in common: “an opportunity for artists to become more well-known” (Cultural Department of the City of Vienna, 2007, p. 156). The exhibition space primarily displays works from the collection in thematic or solo exhibitions; the Start Gallery is a space where young Viennese artists can hold their first exhibitions, having their primary contact with the art world; the *Artothek* is better described as an “art library” that allows Viennese citizens to rent artworks, bringing contemporary art into their homes. MUSA is also the home for the institution “Eyes On – Month of Photography Vienna”, an international exhibition on contemporary photography (MUSA, n.d.).

The building is located in the first district of the city – the inner city – that is best known for its historical sites, having scarce residential areas. It was built by architect August Kirstein in 1916 and was one of his first steel and concrete buildings. Kirstein worked in projects such as the St. Francis of Assisi Church in Vienna (1902-1913) and the Kulturhistorisches Museum Magdeburg in Germany (1900) (Archinform, 2017). Primarily, the building housed Vienna’s poverty register (*Armenkataster*) and in 1921, it was adapted to house the municipal kitchen, where a public canteen was functioning until the 1990’s (MUSA, n.d.). The architect, who was mentored by Friedrich von Schmidt – responsible for the city hall (1872-1883) – took inspiration from the neo-gothic style of the City Hall, which is right across from the MUSA (Achleitner, 2016a).

The *Ringstrasse* surrounds the inner city of Vienna, developed through the second half of the nineteenth century, with many public buildings following a mixture of revival styles, such as the neo-gothic City Hall. As Varnedoe (1986, p. 25) describes, this type of constructions continued until the late 1880’s, moment during which the “eclectic façades became a metaphor for the discredited liberal era that spawned them – the token of a worldwide view based on makeshift pragmatism without unifying ideals, content to pastiche rather than create.”

The building has approximately the same height as the City Hall, being divided in eight floors, with one basement floor and where the last one has a sloped metal roof. The three first visible floors are decorated with limestone, with an ashlar’s masonry technique, distinguishing themselves from the upper floors that have a brick façade. The first and second floor have a clear separation in the façade of the building from the third floor through the use of a horizontal demarcation, with a distinction in the type of treatment to the stone used (which is here in a smooth surface). On the south side of the building’s façade the first two floors appear as one, through gothic (or lancet) arches, which create a circulation gallery. The third floor has vertically tripartite rectangular shaped windows.

The fourth and fifth floors are separated from the sixth floor with another horizontal limit, which is supported by stone console brackets. The tripartite rectangular shaped windows of the fourth and fifth floors are separated by a decorative diamond-shaped element. The windows on the sixth floor are also tripartite. However, they are shaped as gothic (or lancet) arches, separated by small columns, showing a resemblance with the



Figure 5.3 | Façade (MUSA)

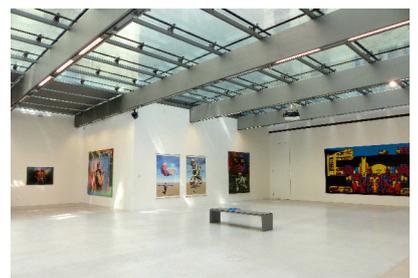


Figure 5.4 | Entrance (MUSA); Figure 5.5 | Exhibition room (MUSA); Figure 5.6 | Startgalerie (MUSA)

ones on the fifth floor of the city hall. The windows in the corner of the seventh floor have four vertical units.

MUSA - located on the ground floor and basement - shares its space with the *Magistratsabteilung 18 - Stadtentwicklung und Stadtplanung* (Municipal Department 18 – urban development and city planning) and the *Magistratsabteilung 21 – Stadtplanung und Flächennutzung* (Municipal Department 21 – urban planning and land use). The museum space houses its exhibition spaces for the collection, for *Startgalerie* and the *Artothek*, occupying 600 m² (Achleitner, 2016a).

Between 2005 and 2007, an architecture office of Vienna – Kiskan Kaufmann Architekten – worked on the building, adapting it to receive the MUSA. The architecture team created a new entrance for the building, on the west corner of the south façade. The floor of the entrance area had to be levelled with the street level and stairs were created to connect the entrance with the museum and the other facilities of the building located on the ground floor (Kiskan & Kaufmann, 2016).

The entrance of the building and the spaces belonging to the museum were painted white. The most striking transformation on the first floor can be seen in the central exhibition room, which was previously opened, as it was the building's inner courtyard. This space was covered through a self-supporting glass ceiling, bringing indirect light into the space. The exhibition space is flexible thanks to the use of modular walls, allowing for the space to take on many different events. The smaller exhibition area, which was previously used as a public canteen (with a kitchen area, now the *Startgalerie* and the column-hall, and a dining space, currently the exhibition glass hall), is currently displaying the projects of the *Startgalerie*. This space is marked by its columns, which remain from the original project and help organise the space (Achleitner, 2016a).

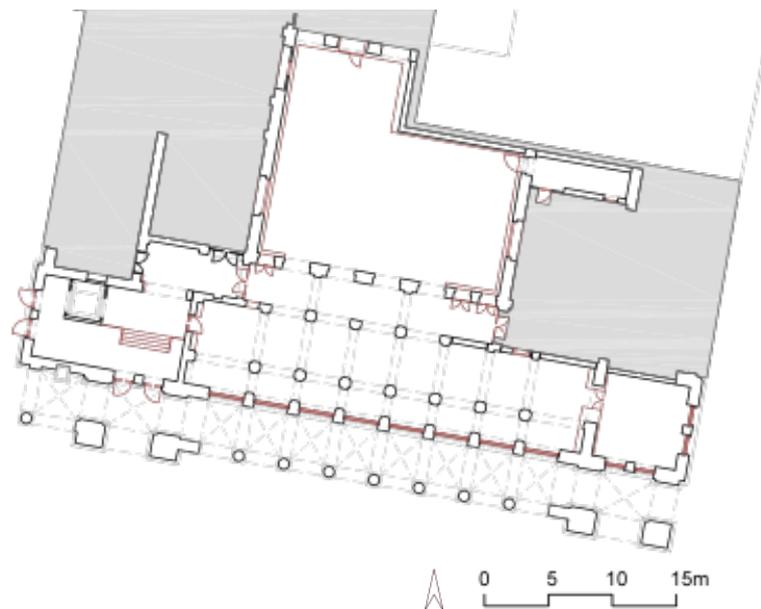


Figure 5.7 | Plan (MUSA)

As the architecture team Kiskan & Kaufmann (2016) describes, an important intervention on the building corresponded to the windows, originally window made of wood. The desire to renovate the windows with metal frames collided with the building's

status of historic monument. The reached solution keeps the wooden frames on the outside of the building – respecting the building’s history and architectural expression - while inside the rooms metal frames were installed, that fit the renovated inside space.

One of the requirements regarding the building and fire protection was for the spaces to be separated through fire protection doors, which enclose different rooms (Kiskan & Kaufmann, 2016).

The architecture team also designed a storage area, located in the basement, in order to provide an adequate place to preserve the artworks of the museum. The previous space had several small rooms, not having the right characteristics to house the museum’s collection. Kiskan Kaufmann Architekten proceeded to do some demolitions and to build new walls to rearrange the space, while also maintaining the pre-existing columns that help organise the space. The rooms were painted white and due to humidity problems, the walls were covered with *Gipskarton* (gypsum board) (Kiskan & Kaufmann, 2016).

COLLECTION

It was the growing of the collection started by the Cultural Department of the City of Vienna that contributed to find a new place for MUSA. This department started collecting works of art since 1951 and nowadays the collection includes approximately 40.000 artworks by 4.500 artists, making it the largest contemporary art collection in Austria (Achleitner, 2016a), gathering artworks with a variety of techniques, such as painting, graphic art, sculpture, installations, videos and photos. Around 1.800 artworks of the museum’s collection - including prints, graphics, watercolours and paintings – are part of the *Artothek* programme, being available for the citizens of Vienna to rent (Achleitner, 2016a).

The success of MUSA’s first exhibition motivated the subsequent displays, which took place in Vienna and in other countries, such as “Canada, Italy, Russia, Latvia, the Czech Republic and Greece”. The city’s collection, named “Museum on Demand” kept travelling the world, displaying and promoting Vienna’s art production (Denscher, 2007, p. 9).

From the beginning, the collection gathered works from artists either living, working or who were born in Vienna and by following this precept, the collection has become representative of the city’s history. The art in this institution showcases, as Boubnova (2007, p. 15) explains, the artistic developments in Vienna, “with all their traumas, “historical” mistakes, illusions and accomplishments.” In most cases, the act of collecting follows a “selection of artistic achievement”. However, Boubnova states that MUSA has been “free of the necessity of conforming to a strict ideological framework or agenda”. The curator adds that the logic behind the institution’s selection of artworks and the strategy for their representation are not closely related to each other, being a distinctive aspect of the museum’s vision.



Figure 5.8 | Kathi Hofer, *Portrait manqué*, 2009, installation (MUSA)

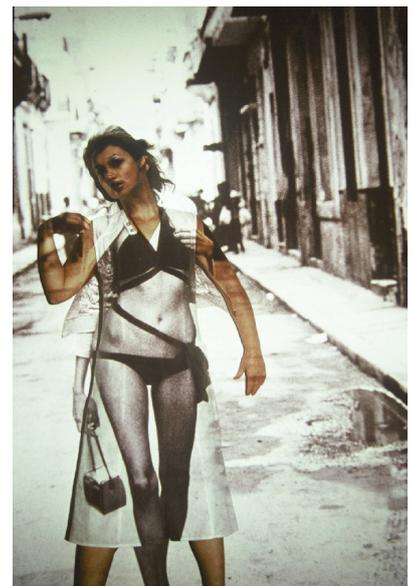


Figure 5.9 | Petra Buchegger, *Projizierte Frauenbilder*, 2003, slide (MUSA)



Figure 5.10 | Marlene Hausegger, *Himmel und Hölle*, 2010, sculpture (MUSA)

The works added to the collection are both from well-known Viennese artists and works with disparate perspectives. Berthold Ecker (Cultural Department of the City of Vienna, 2007, p. 154) mentions that one of the aspects to have in consideration when making a purchase is for the collection not to get too similar to other institutions'. In addition to the purchases made, the collection was also built on donations from artists and their families, all of which portray the evolution and different trends of Austrian art from 1945 until today (MUSA, n.d.).

Some of the purchases occur in association with the exhibitions developed under the *Startgalerie* programme. As curator Gunda Achleitner (2016a) describes, in almost every exhibition by these young artists, the museum buys one or two artworks for its collection. This support by the museum further emphasizes the institution's support to young artists and its belief that the best way to support artists is by buying their art (Cultural Department of the City of Vienna, 2007, p. 152).

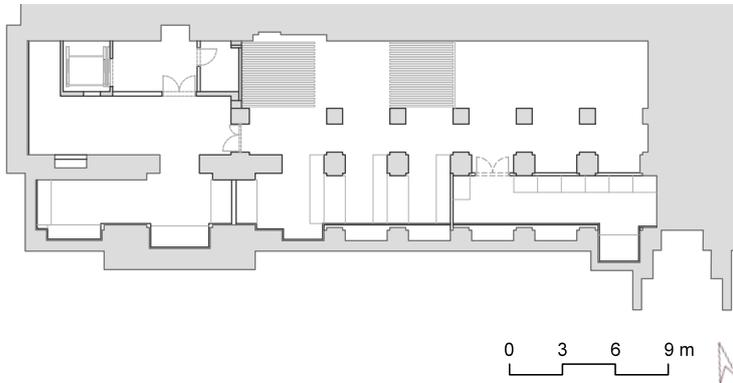
STORAGE AREA

As previously described, MUSA has three main platforms. However, from now on, when mentioning MUSA's collection it will be in reference to the artworks that can be exhibited under their name, therefore excluding the *Artothek* collection.

MUSA's collection can be found in two different storage areas. A selection of the artworks is kept in the building's storage area, located in the basement. Kiskan Kaufmann Architekten adapted this depot to properly receive and conserve the artworks. However, most of the collection is in a storage located outside of the city centre. This is a newly built structure, designed by German architect Karl Reuter, where the artworks occupy close to eight times the size of the storage area in the museum (Achleitner, 2016a). Regarding both storage areas MUSA seems to have a relatively open policy when it comes to connecting the public with these usually private spaces. The storage units are accessible to an interested subject-specific public, which can explore them with the guidance of the museum staff.

MUSA – Felderstraße storage area

“This is (...) an example of how you can do it [adapt a storage area] in a very easy and low-cost way.” (Kiskan & Kaufmann, 2016).



The Felderstraße storage area is in the basement of MUSA's museum building. As Johnson and Horgan (1979, p. 15) describe, when a museum occupies an existing building, “less desirable spaces must be used for museum functions. Areas less accessible to the public, such as basement areas, are often considered for the collection storage facilities.” The advantages of this location are also described as being its inaccessibility to the general public and “the load-bearing capacity of the basement floor”, which allows for a dense occupation of the storage (Johnson & Horgan, 1979, p. 15).



Figure 5.11 | Storage plan (MUSA);
Figure 5.12 | Storage location (MUSA)

Address:		Felderstraße 6-8, 1010 Vienna, Austria	
Type of structure:		Reinforced concrete and masonry structure	
Building construction year:	1916	Architecture intervention year:	2005-2007
Architects of the adaptation project:		Kiskan Kaufmann Architekten	
Number of artworks in the collection:	Approximately 40.000 objects	Number of artworks in the storage:	Around 5.000 objects
Number of rooms:	3 rooms	Storage's area:	316 m ²

Table 5.1 | MUSA building storage – Project Information

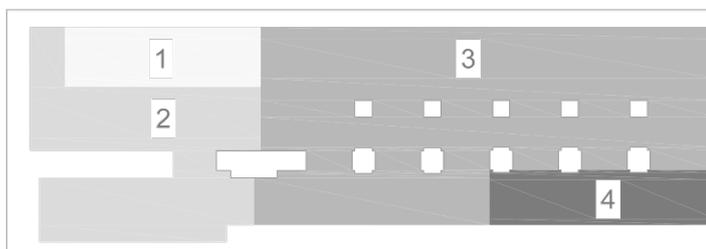


Figure 5.13 | Schematic representation of the functions of the storage area (MUSA): 1 – access, 2 – equipment room, 3 – paintings' room, 4 – media art and photography's room

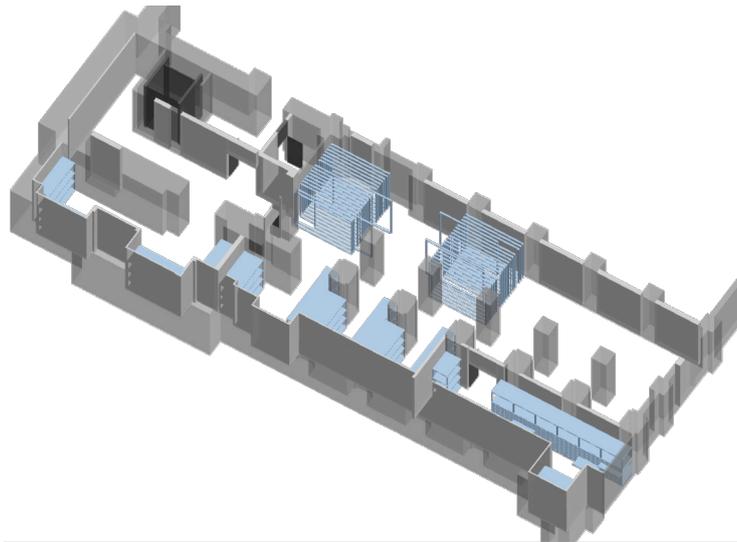


Figure 5.14 | 3D of the storage area (MUSA)

Restoration Project

In 2005, architecture firm Kiskan Kaufmann Architekten started rehabilitating the museum spaces, opening the institution to the public in 2007. The storage area was spatially very different prior to its architecture intervention in 2007. The architects were informed of the museum's requirements, choosing to demolish some walls and build others in order to create a practical and comfortable space for the artworks and staff.

The museum's storage unit is composed of three different rooms, with a total area of 316 m². The first room (83 m²) is used to store the materials necessary to set up exhibitions; the second room (197 m²) stores mainly paintings, as well as some cables for technical purposes; the last room (36 m²) stores media art and photography (Achleitner, 2016a). The rooms in the storage area were covered with a thin layer of screed to level the floor. The ceiling, which is a reinforced concrete beams and slabs system, did not have any great work done on it, except for the fact that it was painted over with white paint (Kiskan & Kaufmann, 2016).

The architects state that besides the economical and spatial constraints of working in an adapted building, the team faced additional problems: humidity and grids connecting with the street level. The basement of the building, which was from the beginning of the twentieth century, did not have a vapour barrier on its external wall, built with bricks and stone (Kiskan & Kaufmann, 2016). This was the most significant issue to be dealt with in this space. The architecture team opted to use *Gipskarton* – “drywall” or “plasterboard”, which was applied on the internal side of the external walls of the building, controlling the humidity levels. Additionally, the original building project had 14 grids connecting the basement with the street level. This air exchange affects the controlled environment inside the rooms, exposing the pieces to light, and temperature and humidity variations. To avoid this the openings were covered with drywall (Kiskan & Kaufmann, 2016).

The storage area is strongly characterised by its columns, which restrict the use of the space, affecting the unity of the room and demanding a well-planned organisation of the space. As such, the architecture team took different measures (described ahead),

taking advantage of these restrictions, creating more storage space. As the collection required a separate room for video art and photography, the architects decided to create a plastered brick wall on the southeast corner of the storage area, creating a room for this purpose (Kiskan & Kaufmann, 2016).

Accessibility and Security

The access to the storage level was made easier and more secure to the museum team by the installation of an elevator (1,60m × 1,95m) that allows for a maximum of 1600 Kg. In order to access the lower level a key must be used to activate the elevator. However, if an artwork is too big to fit inside the elevator, it must be taken downstairs through the building's main stairs (Kiskan & Kaufman, 2016). As Hilberry & Weinberg (1994, p. 176) state, the collection's rooms should be separated from its access by a controlled corridor, guaranteeing a higher level of security to the space, which is why the elevator does not open directly in the storage room, but outside the storage.

The main entrance door to the storage area requires the staff to use a code and key as an anti-theft system. As the security system is connected with the police station in the city hall, once the alarm goes off they will receive that information and go to the museum (Achleitner, 2016a). In case of fire, the main entrance door to the storage will automatically close, being prepared to defer the fire from spreading for 30 minutes, allowing for the fire department do arrive in time to act (Kiskan & Kaufmann, 2016). These types of systems are what Jirasek (2004, p. 182) describes as “a chain of subsystems with mutual logical and functional links”, which favour a higher level of protection.

Facilities and Equipment

Equipment room – This is the first room of the storage space, serving as a stock area for all things necessary to set up an exhibition, such as: different sized frames, catalogues, as well as materials for the educational team.

Painting's room – The equipment room connects with this space. There is a section used to store technical elements (cables and monitors) that should have a constant temperature. This room also has a sliding panel system used for paintings. Originally this space was bigger, as its northern wall did not exist. Nevertheless, the architecture team had to close the area so to create a separate room for the air conditioning unit (Kiskan & Kaufmann, 2016). As the columns occupying this space strongly restrict its use, shelves were set behind the columns, creating different spaces between them (Achleitner, 2016a).

Media art and photography's room – This room is the smallest one of the storage area, holding sensitive works such as videos and photography, mostly stored in metal drawers or in shelves, inside cardboard boxes (Achleitner, 2016a).

Restoration Works

Regarding the restoration of its artworks, MUSA works with several independent restorers in Vienna. An interesting partnership is the one with the Institute of



Figure 5.15 | Elevator to the storage area (MUSA); Figure 5.16 | Entrance control to the storage area (MUSA)

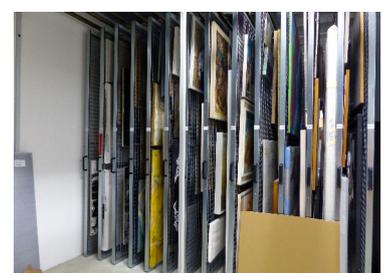


Figure 5.17 | Shelves with materials for exhibition purposes in the equipment room (MUSA); Figure 5.18 | Sliding panel system (MUSA)



Figure 5.19 | Photographs stored in metal drawers (MUSA)

Conservation-Restoration of the *Angewandte*, of the University of Applied Arts Vienna. This allows master students to have a specific case study for them to analyse. In most cases, the artworks are taken to the restorer's atelier. However, in case the necessary work is a minor one, taking only a couple of hours, the hired restorer will go the storage area.

Environmental Control and Maintenance

Equipment room – This space does not store works, not being climate-controlled.

Painting's room – This room has two climate boxes regulating the room's temperature and humidity levels – 18,7 °C and 48% relative humidity.

Media art and photography's room – These materials also have a climate box that assures a 15 °C temperature and a 47% relative humidity (Achleitner, 2016a).

The storage area is cleaned by the museum staff when necessary (Achleitner, 2017).

Artwork's organisation

MUSA uses the software *Artefact* to organise the information of its works (such as title, author, date, materials, technique, history, size). Every artwork is numbered and, by typing an objects number in the programme, it gives out the location of the object. MUSA has also a physical catalogue system, *Karteilkarten* – index paper cards with the previously mentioned information written on them. The existence of two different cataloguing systems is essential to protect the artworks in case either one of them is lost (Achleitner, 2016a).

Conclusion

The adaptation work developed to properly accommodate the artworks was crucial, particularly the works conducted to protect the space against humidity problems. One of the difficulties of the space is the access to the storage, with its small elevator. However, since the majority of the works stored here are small, this is not seen as a pressing matter.

In the future the collection may be under risk due to construction works that will be held directly underneath it so to install the city's new metro line. In addition to the vibrations associated with the construction period, and as described by Camacho, Mineiro & Nobre Dias (2007, p. 17), the instability caused by the continuous passage of a metro in the immediacy of the storage can result in damages to the objects.

Unfortunately, due to the lack of funds and spatial restrictions, these rooms can only hold a small fraction of the collection. Huber (2014, p. 131) states that after the main storage rooms of a museum are full, "external premises will come into use." Ideally the museum is able to build extensions. However, Huber adds that nowadays, the "rising inner-city land and real-estate prices" make additions to storages impossible to achieve. "Thus the fields of depot and infrastructure are increasingly moved out to the suburbs, often to make room for more exhibition space in the main location. Thus the ideal single location combining storage, conservation, research and exhibition is increasingly

dispersed” (Huber, 2014, p. 131). This is the case of the MUSA, as they started moving most of their works to a newly built storage area, outside the city centre.

MUSA – Simmering storage area

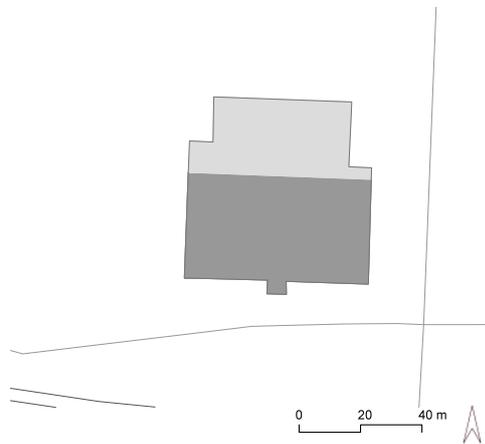
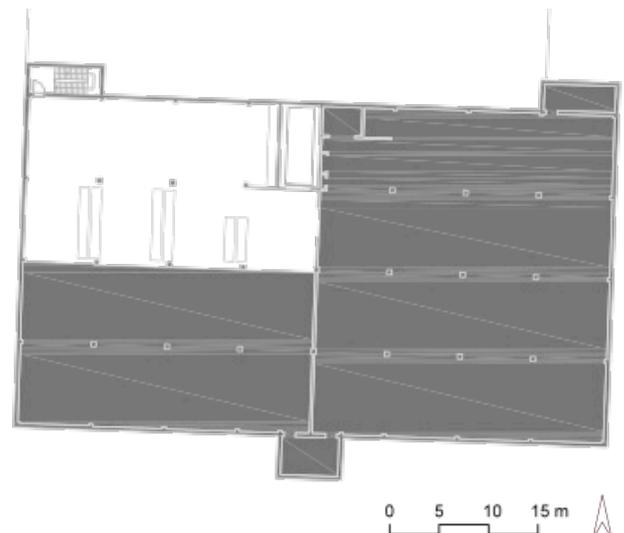
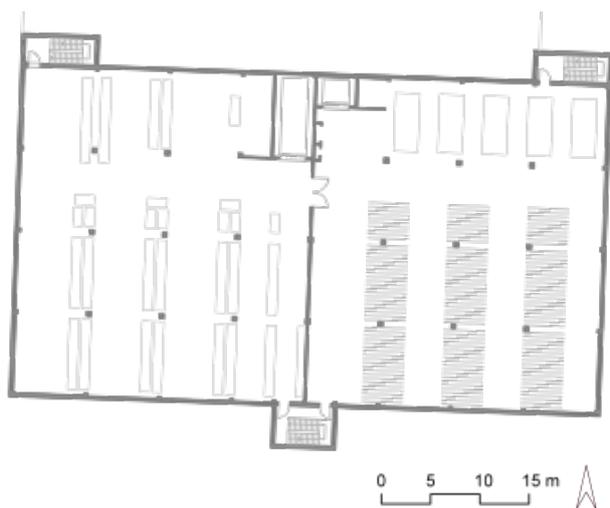


Figure 5.20 | Storage unit location (MUSA);
Figure 5.21 | Kunsttrans building (MUSA);
Figure 5.22 | Storage area plan, second floor (MUSA);
Figure 5.23 | Storage area plan, third floor (MUSA)



This storage area is located in the Simmering municipality, near the Vienna Central Cemetery. It was designed by German architect Karl Reuter in 2014-2015 and it belongs to the company Kunsttrans. This Austrian firm is “trained in logistics as well as the handling and packing” of artworks (Kunsttrans, n.d.), providing services in the realms of museums, art storage, art galleries, auction houses and private collectors.

The storage building is a purpose-built structure, with two functionally distinct volumes: one with offices and administration purposes, while the second and largest one holds the storage units. The latter is planned to deal with all the logistics inherent with the moving and storing of artworks. The rooms have an open plan, with high ceilings, making it an easy space to manoeuvre artworks safely. MUSA rents the second and part of the third floor, accommodating 15.000 works (three-dimensional works and paintings).

Address:		Bertl-Hayde-Gasse 4, 1110 Vienna, Austria	
Type of structure:		Contemporary warehouse	
Building construction year:	2014-2015	Architecture intervention year:	-
Architects of the project:		Architekturbüro Karl Reuter	
Number of artworks in the collection:	Approximately 40.000 objects	Number of artworks in the storage:	Around 15.000 objects
Number of rooms:	3 rooms	Storage's area:	2.500 m ²

Table 5.2 | MUSA Simmering storage– Project Information

Figure 5.24 | Schematic representation of the functions of the storage area on the second floor (MUSA): 1 – access, 2 – sculptures' room, 3 – paintings' room; Figure 5.25 | Schematic representation of the functions of the storage area on the third floor (MUSA): 1 – access, 2 – holding and crating area

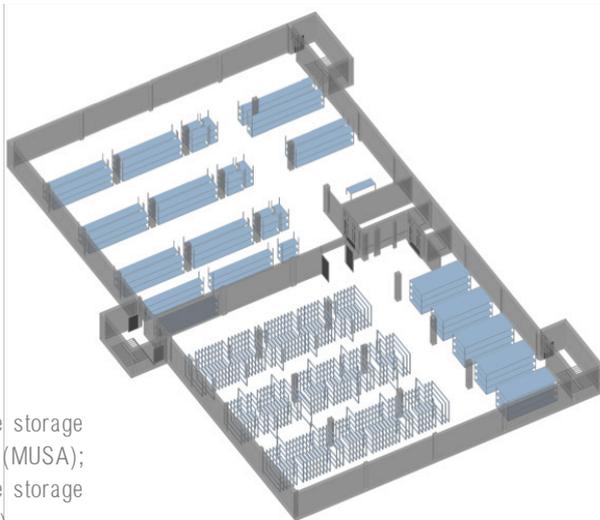
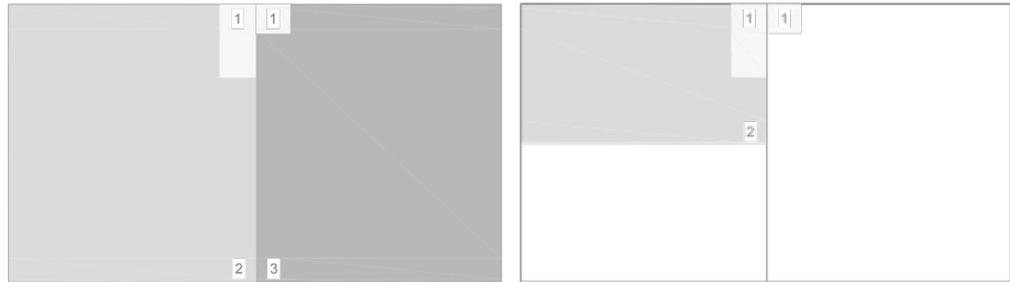
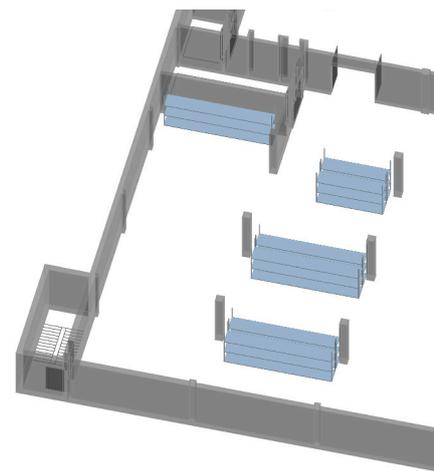


Figure 5.26 | 3D of the storage area, second floor (MUSA); Figure 5.27 | 3D of the storage area, third floor (MUSA)



Accessibility and Security

When the objects arrive in a truck they are taken into the building through a garage with an adjustable platform. This space is what Johnson and Horgan (1979, pp. 13-15) refer to “service yard”, which connects to the “loading dock” that is located above the “service yard” so to allow for a proper loading and unloading of the objects from the trucks. Curator Achleitner (2016b) explains that the inner door can only be opened once the outside door is closed, as it is essential for the external environment not to interfere with the inside conditions.

In the receiving area there are two elevators, for the transport of the works to their storage area. The largest one can take up to 6000 Kg (8,54m × 3,98m) and the other elevator can lift 2500 Kg, (2,96m × 3,98m). Both elevators have an external metal door, which is activated in case of fire, closing automatically, thus preventing people from going in. However, it has a door on it, so people can exit. As these elevators carry heavy weights,



Figure 5.28 | Adjustable platform for trucks (MUSA)

they are specially designed, having around them a metal structure that supports it when it is immobile. The elevators are activated through a card and code (Achleitner, 2016b).

As a security measure, every room has a fire and smoke detector system, paired with a fire extinguisher. On both ends of the rooms, there are metal doors, which serve as an access for the fire department.

Facilities and Equipment

Sculptures and installations' room (second floor) – With 1000 m², this room holds bigger sized sculptures and installations. The sculptures' room is spatially organised by what Johnson and Horgan (1979, p. 35-54) label as “adjustable metal shelving” that are custom made to fit pallets of different sizes on them. The flexibility of these shelves in adapting to the different sizes of objects optimises the storage space. The room also has a space where MUSA photographs its works.

Painting's room (second floor) – This 1000 m² room has a “sliding rack storage with wire screening” (Johnson & Horgan, 1979, p. 35-54), with 236 sliding metal panels with an area of 4.956 m² for hanging space. This space also has opened metal shelves with artworks waiting to be transferred onto the sliding system.

The room on the third floor is shared with the *Wienbibliothek*. In addition to storing artworks, this room also combines both the “crating area” - with the necessary materials to pack, protect and transport objects - and the “registration and holding area” – storing elements needed to set up an exhibition (Johnson & Horgan, 1979, pp. 13-15).

Every floor is built so to be structurally able to sustain 1 ton/m².

Restoration Works

In case an artwork needs restoration work it must be sent to a restorer's office to be worked on. In case the restoration work is a minor one, which takes a small amount of time, the restorer can go to the storage area to work there (Achleitner, 2016b).

Environmental Control and Maintenance

Every storage room of the MUSA is environmentally controlled, being at 20 °C and with a RH of 55%, also having dehumidifiers (Achleitner, 2016b). A professional company does the cleaning of this storage (Achleitner, 2017).

Conclusion

According to Achleitner (2016b), MUSA plans to use this archive for ten years, after which the institution believes the space will be fully occupied. The curator also expressed the museum's desire for the city of Vienna to build a storage facility able to hold its several collections (MUSA, Wien Bibliothek, Winner Stadt und Landesarchive (Vienna Municipal and Regional Archives)). This would allow the museum to refrain from renting the Kunsttrans storage, gaining extra freedom regarding the time and accessibility to the space.



Figure 5.29 | Receiving area for crates (MUSA); Figure 5.30 | Elevator external metal door (MUSA)



Figure 5.31 | Adjustable metal shelving (MUSA)



Figure 5.32 | Photographing area (MUSA)



Figure 5.33 | Sliding metal panels (MUSA)



Figure 5.34 | Metal shelves with paintings (MUSA)

The storage in MUSA, being a rehabilitated structure, has its spatial constraints, not allowing for the entire collection to be kept there, which would be desirable for a safer and more comfortable moving of the works. However, by having at its disposal the Kunsttrans storage, a purpose-built facility, the museum can continue expanding its collection, providing it with an enhanced quality of space – large storage, appropriate connections and materials. However, being detached from the museum building has a negative impact upon the management of the institution’s activities – regarding staff accessibility and the dangers with the artworks’ transportation.

5.2. NEUE GALERIE GRAZ

HISTORY AND ARCHITECTURE

Archduke Johann of Austria was responsible for the creation of the first public museum in Austria – the Universalmuseum Joanneum – in 1811, which at the time was known as “Inner Austrian National Museum Joanneum” and was part of a group of museums formed under the Austro-Hungarian monarchy (Neue Galerie Graz Joanneumsviertel, 2017). As described by Naredi-Rainer (2004, p. 15), the museum was created under the spirit of nationalism and reverence of the nineteenth century. Nowadays, the institution is a non-profit limited company with the name Universalmuseum Joanneum GmbH. However, the State of Styria is still the museum’s owner (Peitler, 2011, pp. 30-33).

After donating his collection to the province of Styria the archduke then became head-curator of the museum. As Koren (2011, p. 53) describes, the Joanneum aimed to have a great educational role in its citizens’ lives, offering public lectures, access to the collection and to the study rooms of the institution since 1812. Neue Galerie Graz was founded much later, in 1941, during the National Socialist movement, when the Landesbildergalerie of the Joanneum was subdivided in two: the Alte Galerie – for art up to 1800 – and Neue Galerie – for artworks after 1800 (Danzer, 2016).

As Peer (2011, p. 56) portrays, during the 60’s Graz gained a reputation for being a contemporary art centre, with Neue Galerie actively accompanying the artistic production of the time, producing exhibitions and documenting its growing collection. Throughout the 70’s and 80’s the museum expanded its contemporary international collection, as well as its nineteenth century collection. The 90’s were a special decade for the development of the collection’s international trends of contemporary art, especially regarding Europe the United States of America (Neue Galerie Graz Joanneumsviertel, 2017). Currently, Neue Galerie Graz is a centre of research on recent art history from the nineteenth century, as well as specialising in twentieth century and contemporary art.

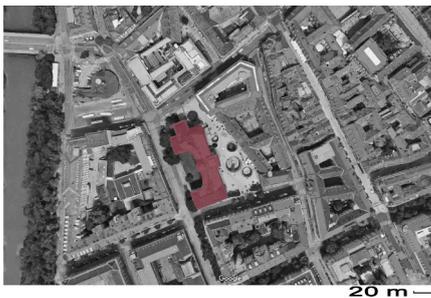


Figure 5.35 | Neue Galerie Graz



Figure 5.36 | Joanneumsviertel (Neue Galerie Graz)

Neue Galerie, initially housed in Palais Herberstein, in Sakstrasse, moved to its current location in 2009 – the Joanneumsviertel (Joanneum’s quarter). The museum shares its space with the Natural History Museum the Multimedia Collections, as well as the Styrian Provincial Library (Pakesch & Muchitsch, 2011, p. 208). The access to Neue Galerie’s building is not made through its main façade, but through the Joanneumsviertel. This square has a mixture of architectural periods that reflect the history of the Joanneum.

August Gunolt was responsible for the construction of the “Museum of Cultural History and Arts & Crafts”, as well as the Styrian Art Gallery that opened in 1895 with a “Viennese Baroque Revival style”. Currently, this building is the official home of Neue Galerie (Universalmuseum Joanneum, 2015). August Gunolt studied in Vienna, but moved to Graz, where he worked for the Graz Municipal Council. Gunolt took inspiration for the Neue Galerie building in the works of Johann B. Fischer von Erlach, an Austrian architect and sculpture, known for his combination of ancient Roman Renaissance, Italian Baroque and French Baroque architecture (Aurenhammer, 1998).

Neue Galerie’s building main façade is concave, meant to welcome visitors coming from Neutorgasse. This façade is symmetrical, with a small dome framing the entrance, which stretches out to the sides concavely until it reaches two small squared-planned turrets. When looking at the concave section of the façade, the building seems to have two visible floors. The entry is made through a roman arched door, surrounded by two columns on each side. On top of the door there is a broken curved-pediment. The windows on this floor are also roman arched structures. The first and second floor are well differentiated, as the ground floor has well carved rectangular-shaped stones, while the second is marked with pairs of Doric columns that frame each window. The transition from the second to the top floor is made with brackets that support the top balustrade. When reaching the turrets, it is clear the building has three visible floors. The columns that separate the windows unite the second and third floors. The façade of the building that overlooks the Joanneum Square displays four floors, where the first two are well marked from the upper ones.

The biggest architectural input for the museum occurred 200 years after its foundation, in 2011, by the Spanish architecture studio Nieto Sobejano Arquitectos and the Austrian team Eep Architekten. The Spanish office has a long repertoire regarding museums, with several projects in Spain but also in China, Germany, Estonia and Morocco (Nieto Sobejano, n.d.).

The project restructured the Joanneum square, articulating the different buildings and connecting the three institutions there – Neue Galerie Graz, the Natural History Museum and the Styrian State Library. Elpons (2016) mentions that the project started due to humidity problems in both buildings. The design links the two pre-existing buildings through an underground connection, so not to disturb the previous structures and allowing for the formation of a public area at street level.



Figure 5.37 | Neue Galerie Graz façade



Figure 5.38 | The Joanneum square – Nieto Sobejano Arquitectos and Eep Architekten (Neue Galerie Graz)

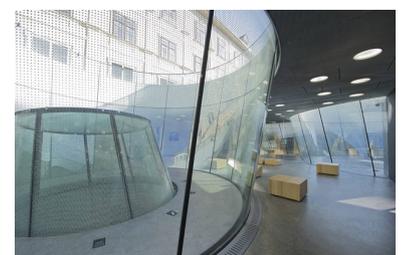
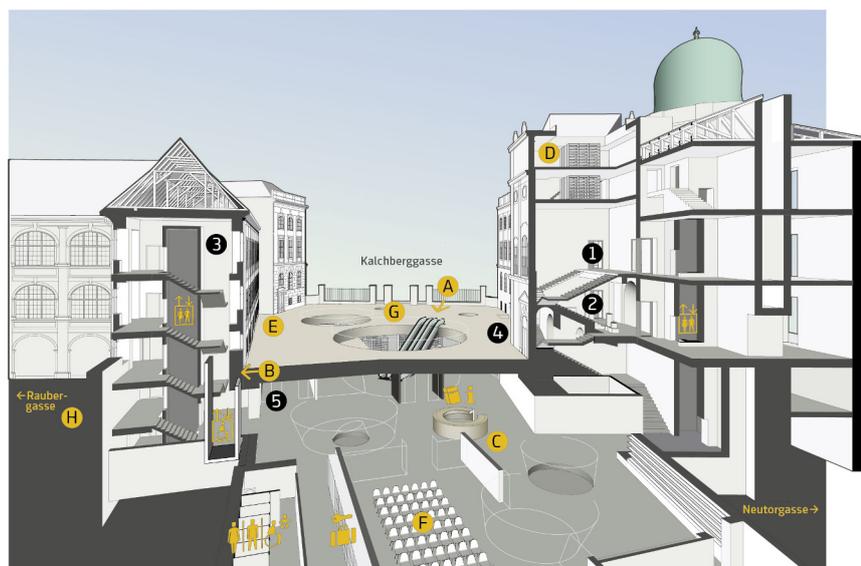


Figure 5.39 | Nieto Sobejano Arquitectos and Eep Architekten project (Neue Galerie Graz)

Figure 5.40 | Joanneumsviertel overview (Neue Galerie Graz). 1 – Neue Galerie Graz 2 – BRSEUM 3 – Natural History Museum 4 – Multimédia Collections (Office) 5 – Styria Provincial Library A – Entrance B – Level entrance with disabled Access C – Info and Shop D – Library Neue Galerie Graz E – Café D – Auditorium G – Joanneumsviertelplatz H – Lesliehof



The expansion of the museum was meant to have an impact upon the city's life, offering a new public space. The access to the institutions is made through the square – Joanneumsviertel – where glass-conic-shaped elements connect it to the level below. These structures allow for the underground level to have natural light during the day, and illuminate the square with artificial light by night. The entrance through the bigger conic element is very subtle, respecting the previous architecture of the location. The project included welcoming spaces, a conference hall, reading areas, as well as an archive and storage for the Styrian Library. This renovation respects the value of the existing historical architecture, not interfering with the original exterior appearance of the structures, while providing the space with much needed facilities (Nieto Sobejano, 2011).

With the 2011 project, Neue Galerie's exhibition space expanded, now occupying over 2000 m². The museum is located on the ground floor, the first and second floors. The south wing of the ground floor exhibits the permanent collection, with works from the nineteenth and twentieth centuries; the north wing of the ground floor hosts the Bruseum (with artworks of Austrian artist Günter Brus) and temporary exhibitions; the second floor is also used to display temporary exhibitions (Universalmuseum Joanneum, 2015).

COLLECTION

Nowadays, the Universalmuseum Joanneum is considered the biggest of its kind in central Europe, having around 4,7 million items in its collection, from seventeen museums (Eipper, 2017a). From this numerous collection, Neue Galerie Graz is in the possession of more than 60.000 objects which range from "2.500 paintings, 650 sculptures, 40.000 original and printed drawings, 1.500 photographic works as well as works of video and media art" (Neue Galerie Graz Joanneumsviertel, 2015b).

The Neue Galerie Graz collection has works from the nineteenth and the twentieth centuries, which were partially donated by private collectors and also acquired by the

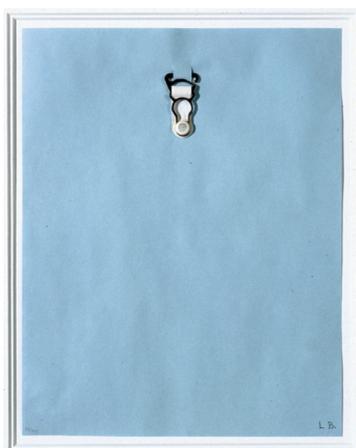


Figure 5.41 | Louise Bourgeois (1911, Paris – 2010, New York), from the Series *Anatomy* 1990, print (Neue Galerie Graz)

State. The private collectors' financial and intellectual commitment as well as the purchases made by the Chancellor's Office art section greatly contributed for the museum's international reputation (Neue Galerie Graz Joanneumsviertel, 2015b).

Nowadays, in addition to expanding their nineteenth century collection, the museum is focusing its efforts in collecting Austrian and international contemporary art (Neue Galerie Graz Joanneumsviertel, 2015b). As Pakesch and Muchitsch (2011, p. 206) state, the collection presently holds art movements such as Biedermeier, Realism, Jugendstil and regional forms of classical Modernity, works from Austrian and international artists after 1945, Viennese Actionism, Media and Conceptual Art, among others.

One of the most recent additions to the collection was made through the provincial government's purchase of artworks from the Styria artist Günter Brus. Until 1992, only three drawings by the artist belonged to the museum's collection. On this year, Neue Galerie held an exhibition presenting the artist's work, fuelling its desire to increase the number of artworks from Günter Brus. In 2009, by the time of the opening of the Bruseum, its collection consisted of 19 films, 1.181 individual photos of 19 actions as well as 39 cycles and pictorial poems (Pakesch and Muchitsch, 2011, p. 208). In addition to a permanent exhibition dedicated to the artist's work, the museum will create a scientific centre promoting the preservation of said artworks with the main purpose of a scientific research (Neue Galerie Graz Joanneumsviertel, 2017).

Information related to the collection is accessible to the public through Neue Galerie Graz's archive. This has documentation on the objects of the collection, as well as information concerning the artists, which include printed materials, articles, correspondence, photographs, autographs, artistic sketch material films and videos (Pakesch & Muchitsch, 2011, p. 208).

STORAGE AREA

Neue Galerie Graz has three storages for the collection: the smallest one is kept in the museum building, the second one is in a warehouse in the Lend district and the most spacious storage is in the north of Graz, in Andritz. The last one, being a reconverted space with the largest area as well as better conditions to receive the museum's collection, will be studied in closer detail than the other two.

The museum has a strict policy regarding the admittance of visitors to the storage areas. These spaces are accessible to a professional group of people, from researchers, scientists, curators and students with a related research, which are to be accompanied by museum staff.



Figure 5.42 | Jean Baudrillard (1929, Reims – 2007, Paris), Bogotá 1996, photograph (Neue Galerie Graz)



Figure 5.43 | Günter Brus, Friedrich von Schlegel. Zehn Sonette, 1988, oil chalk on paper (Neue Galerie Graz)

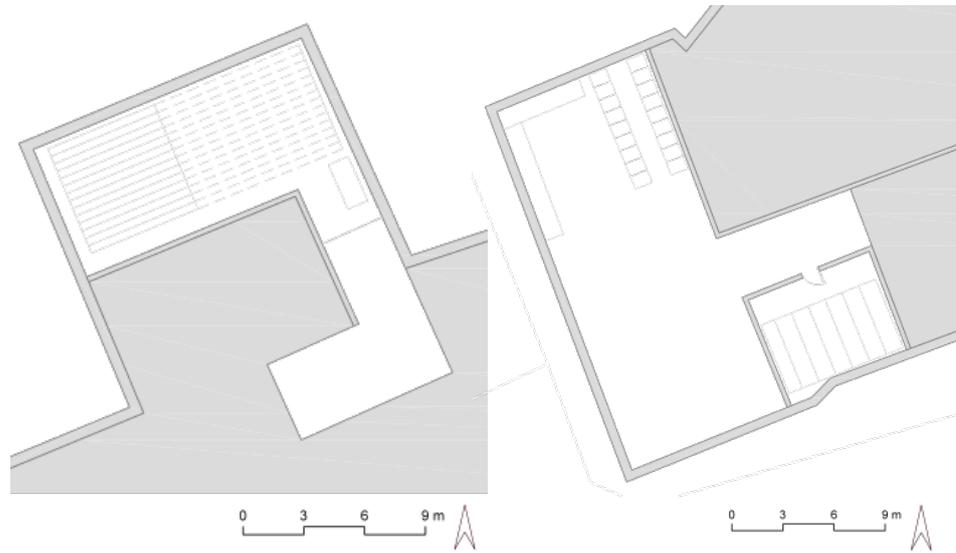
Neue Galerie Graz – Neutorgaße storage area



Figure 5.44 | Neutorgaße storage location (Neue Galerie Graz);

Figure 5.45 | Paintings' storage plan (Neue Galerie Graz);

Figure 5.46 | Photograph, video art and archive storage plan (Neue Galerie Graz)

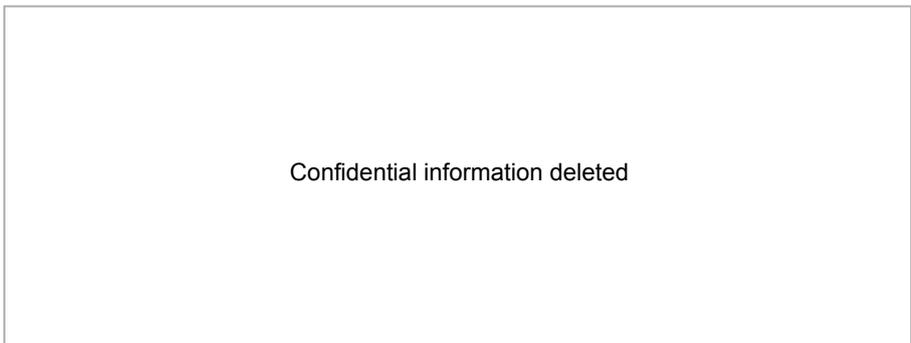


Built in 1893 by architect August Gunolt, this neo-Baroque building was designed as a museum to exhibit part of the Universalmuseum Joanneum's collection. It was only in 2009 that the building was chosen to be the official home of Neue Galerie. Since the storage area was not a priority when the building was created, there is not enough space for the entire collection, which leads the museum to rents other spaces.

Table 5.3 | Neue Galerie Graz building storage – Project Information

Address:		Neutorgasse 45, 8010 Graz	
Type of structure:		Neo-Baroque building	
Building construction year:	1893	Architecture intervention year:	2011
Architects of the adaptation project:		Nieto Sobejano Arquitectos and Eep Architekten	
Number of artworks in the collection:	Approximately 60.000 objects	Number of artworks in the storage:	unknown
Number of rooms:	3 rooms	Storage's area:	Close to 135 m ²

Figure 5.47 | Schematic representation of the functions of the storage area (Neue Galerie Graz): 1 – paintings' area, 2 – photograph and video art area, 3 – archive/files' area



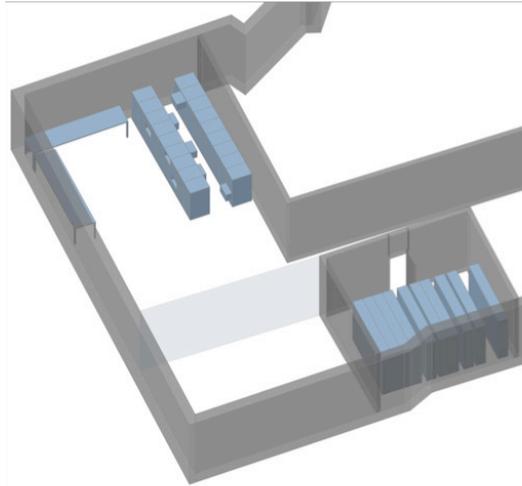
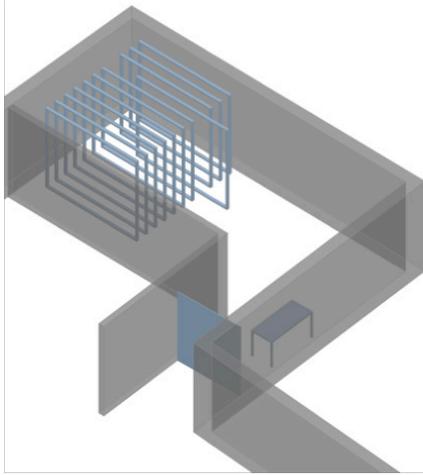


Figure 5.48 | 3D of the paintings' storage area (Neue Galerie Graz);

Figure 5.49 | 3D of the photograph, video art and archives storage area (Neue Galerie Graz)

Facilities and Equipment

The elements stored in this building are located in three different rooms, which are all in the staff offices' floor:

Painting's storage room (60 m²) – A closed off space with a metal gate, accessed using a code and key. The materials used to set up an exhibition are stored in shelves kept outside of this room. The space has a closed sliding rack storage system and a table used to unpack/pack artworks.

Photographs and video art's room (15 m²) – This space is a small room with environmental control regarding temperature and humidity. This space has a high-density mobile storage system, which occupies the entire length of the room.

Documentation room (60 m²) - As described by Roberts (2004, p. 31), every museum must have an accurate and accessible documentation on their collection. This is not only essential for its management, but it is also crucial for the good care of all of the works. The systems used may be manual and/or computer-based. However, both must ensure a detailed documentation of the collection. Neue Galerie's printed files regarding the collection are stored in metal drawers in the staff's office (Danzer, 2016a).

Conclusion

The storage area in this building was not a space that was initially seen as priority when the structure was erected. Nowadays, this aspect is shown by the lack of space to hold the collection, as well as the poor spatial connection between the different rooms.



Figure 5.50 | Entrance to the paintings' storage area (Neue Galerie Graz); Figure 5.51 | Pack/unpacking area (Neue Galerie Graz); Figure 5.52 | Sliding rack storage with closed system (Neue Galerie Graz)

Neue Galerie Graz – Lastenstraße storage area



Figure 5.53 | Lastenstraße storage location; Figure 5.54 | Storage area plan, ground floor; Figure 5.55 | Storage area plan, basement (Neue Galerie Graz)

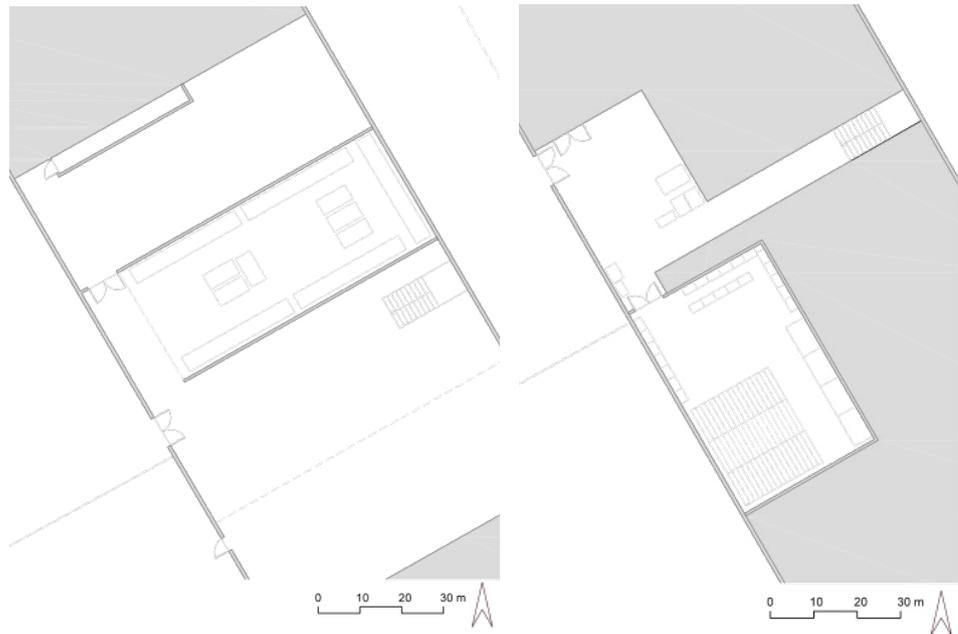


Figure 5.56 | Storage building (Neue Galerie Graz)

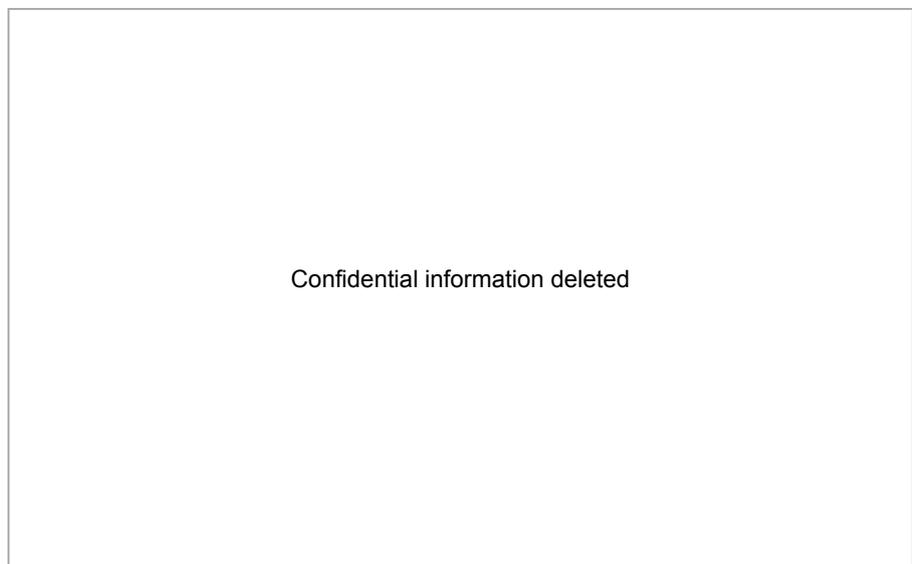
This storage area is in a building complex belonging to the shoe company *Humanic*. The Universalmuseum Joanneum rents one of the buildings, using it as one of its art storages, being Neue Galerie one of its occupants. In 1993, Neue Galerie Graz did an exhibition in this space and afterwards the museum decided to rent the space, bringing the artworks in 1996/1997. According to curator Gudrun Danzer (2016b), the space did not go through any architectural interventions before being occupied by the museum.

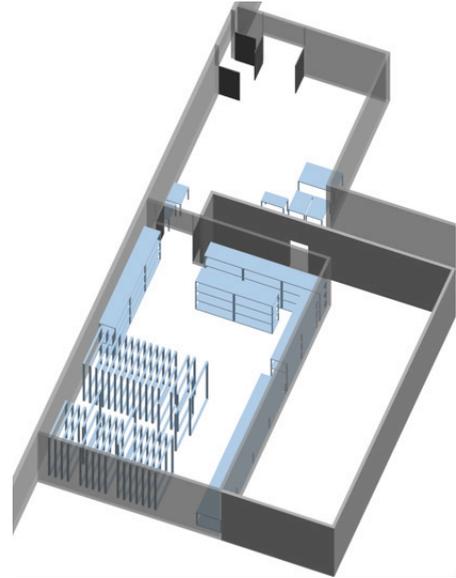
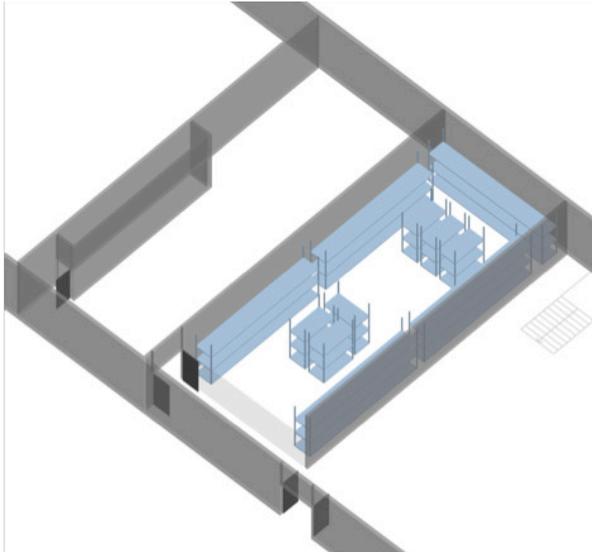
Table 5.4 | Lastenstraße storage – Project Information

Address:		Confidential information deleted	
Type of structure:		Warehouse	
Building construction year:	unknown	Architecture intervention year:	-
Number of artworks in the collection:	Approximately 60.000 objects	Number of artworks in the storage:	unknown
Number of rooms:	3 rooms	Storage's area:	340 m ²

Figure 5.57
Confidential information deleted

Figure 5.58
Confidential information deleted





Accessibility and Security

The storage is accessed with a key and a code that is only known by a small number of people that work in the building and the names of the visitors are always written down (Danzer, 2016b). This restriction in the access to the storage, accompanied by the registration of every entry and exit of people and objects is imperative to maintain the required level of security in the storage area (Camacho, Mineiro & Nobre Dias, 2007, p. 54). The ground floor storage space can be accessed through two different entries: smaller objects may enter through the main door, which has approximately 0.90 m width; larger objects must go through a two-door doorway with approximately 2 m width.

The underground floor is accessed through a driveway that leads a truck into the entry of the storage, assuring that bigger objects can be more easily moved into the space. In case the artworks arriving are small they can be carried through the staff entrance and taken down to the room through the stairs. Unfortunately, and as Hilberry & Weinberg (1994, p. 176) mention, intricate routes that involve unusual corridor configurations, ramps and flights of stairs that do not have a straight pathway can be a hindrance to the moving of artworks, requiring special attention.

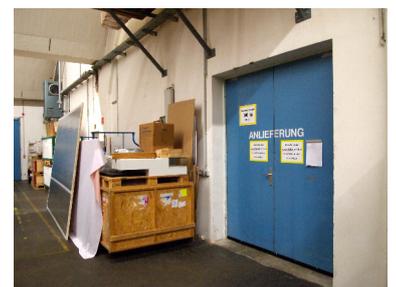
The storage rooms have smoke detectors installed throughout the ceiling, which will activate an alarm in case of fire. However, the building does not have a flood detection system.

Facilities and Equipment

The artworks are stored on the ground floor and on the underground level, occupying respectively an area close to 140 m² and 200 m². The ground floor storage space is used by several museums of the Universalmuseum Joanneum, allowing up to 500 Kg/m² of weight. This space is overcrowded with art pieces – mainly sculptures that are in cardboard boxes, bubble wrap, crates or exposed (Danzer, 2016b). On the

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Figures 5.61-5.62 | Entrance for large objects (Neue Galerie Graz)



Figure 5.63 | Sculptures in the storage (Neue Galerie Graz); Figure 5.64 | Narrow paintings' storage room (Neue Galerie Graz)

underground level there is a room used to store paintings and sculptures of the Neue Galerie's collection and an area used in small restoration works.

Sculptures' storage (ground floor) – A closed off area surrounded by a metal gate with an approximate area of 132 m². In this space Neue Galerie Graz mostly stores their largest sculptures. As described by Danzer (2016b) this space is to its highest capacity, which makes it complicated to circulate inside it, and more importantly, makes it hard to find a specific object, as well as dangerous to move it within this space.

Painting's storage (ground floor) – A narrow space (approximately 9 m²) with metal grids on the walls used for hanging paintings. This corridor is a complicated space to move in, which can be dangerous for the artworks.

Sculptures and painting's storage (underground floor) – This room takes up close to 130 m², having an area with sculptures, another with paintings and a corridor where the two types of artworks can be found. The sculptures are kept in open metal shelves, with their register number. Most of the paintings are hung on a sliding grid system, while some are waiting to be hung. These objects are on the floor, in front of the panel section where they will be placed, being protected with bubble wrap, paper or cardboard. The placement of object on the floor is a hazard to the objects. Camacho, Mineiro & Nobre Dias (2007, p. 77) suggest that each piece should be elevated at least 10 cm above the ground, so to avoid an accidental clash and to minimise damages that can come from a flooding.

Restoration Work

Restoration area – The space preceding the storage (where the crates arrive), also functions as a small restoration space and occupying an approximate area of 70 m². There is a table with different tools used by the restorers in minor works. When new artworks arrive, they must be left in the restorer's space for them to be inventoried. In case an object needs restoration work, the piece is sent to the storage in Andritz (Danzer, 2016b).

Environmental Control and Maintenance

Sculptures' storage (ground floor) – The room does not have an HVAC system to control its temperature or humidity. Nonetheless, Danzer (2016b) guarantees that the temperature and humidity levels registered are not harmful to the artworks, being stable. In regard to the illumination of the space, the museum team opted to cover the windows on the roof of the storage rooms, so to protect the artworks from the harmful effects of direct sunlight exposure.

Sculptures and painting's storage (underground floor) – The temperature and humidity of this room are also not controlled with the use of a mechanical system. Even so, according to curator Danzer (2016b), the room does not have damaging levels of temperature nor humidity to the artworks.



Figure 5.65 | Sculptures in open metal shelves (Neue Galerie Graz)

Artwork's organisation

The paintings hung are organised alphabetically by the authors' names. Curator Danzer (2016b) explains how it is easier to adopt this system with smaller paintings rather than with larger ones, as these take too much space, making it difficult to organise them.

The artworks in the collection have been organised on a digital database with the software *Filemaker* since 1996. In addition to this, the museum relies on a physical system, using index cards which contain the information regarding each art piece – title, name of the author, date of production, materials used, technique and history of the work. Each object has an inventory number that associates it with the shelf or the steel cart it is located on (Danzer, 2016b).

Conclusion

The space used by Neue Galerie Graz in this building is already to its maximum capacity, making it impossible to store additional artworks and already putting at risk some objects stored in this space. As described by ICOM (2004, p. 24) it is essential not to “crowd or overload shelves and drawers, as this will make it difficult to retrieve objects safely”. Bearing this in mind, the Neue Galerie team is discussing moving some of the artworks that are currently in this space into the other art storage the museum holds in Weinzöttlstraße, Graz. The museum currently rents a section of the first floor, and wishes to rent the ground floor to accommodate the artworks that are in this storage (Danzer, 2016b).

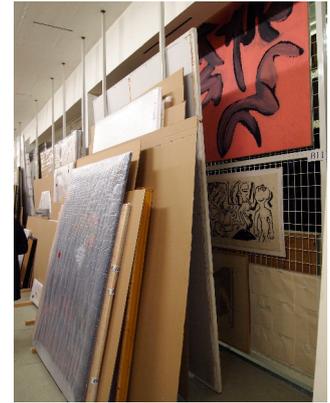
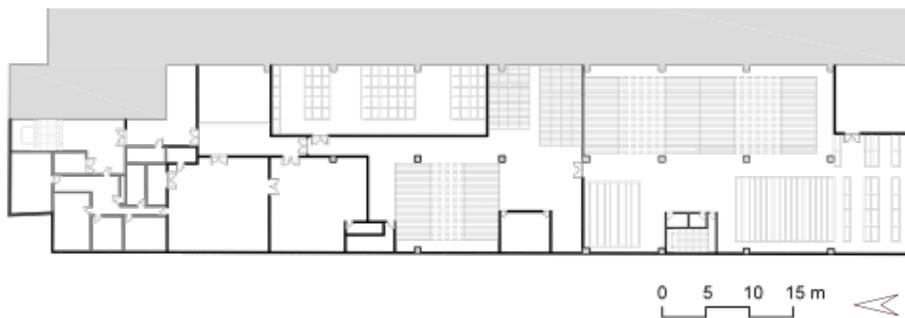


Fig. 5.66 | Paintings hung and in the process of being hung on a metal grid panel (Neue Galerie Graz); Figure 5.67 | Restoration area (Neue Galerie Graz)

Neue Galerie Graz – Weinzöttlstraße storage area



The Weinzöttlstraße storage is located in a building that belongs to the company *Humanic*. Neue Galerie Graz shares this storage with Alte Galerie (also belonging to the Universalmuseum Joanneum). In total the space hosts 1.700.000 art pieces, from which around 56.000 belong to Neue Galerie. According to restorer Dr. Paul-Berhard Eipper (2016), the joining of these two museums in a storage unit was essential for “the improvement of the working conditions”, since through the unity of both teams in one

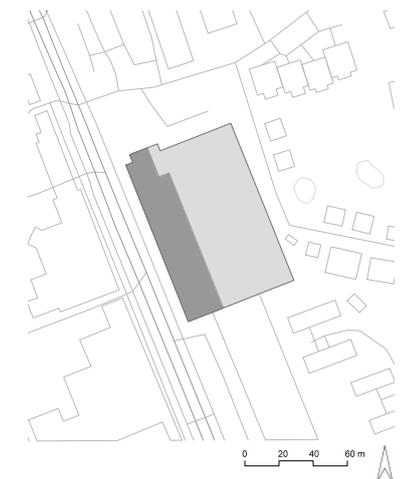


Figure 5.68 | Storage area plan (Neue Galerie Graz);
Figure 5.69 | Weinzöttlstraße storage location (Neue Galerie Graz)



Figure 5.70 | Weinzöttlstraße building (Neue Galerie Graz)

space they increased their work efficiency. The museum holds part of the first floor of the building, where it has its storage area, art-restoration offices and staff offices.

The building is an industrial structure – previously used to store commercial goods – with three floors and a flat-roof structure, having a trapezoidal metal cladding. Most industrial buildings have to undergo some work, upgrading their interior spaces and improving “weather tightness, air leakage, insulation, security, internal environment and pest control” (Bordass, 1996, p. 4). In 2009 the museum hired the Austrian architecture firm Wemmers Skacel Forenbacher to adapt the space to its new function (Lampl, 2016).

Address:		Confidential information deleted	
Type of structure:		Warehouse	
Building construction year:	unknown	Architecture intervention year:	2009
Architects of the adaptation project:		Wemmers Skacel Forenbacher architects	
Number of artworks in the collection:	Approximately 60.000 objects	Number of artworks in the storage:	Around 1.700.000 objects (56.000 from <i>Neue Galerie</i>)
Number of rooms:	6 rooms	Storage room and supporting facilities area's:	Approximately 2.070 m ²
		Storage's area:	Approximately 1.500 m ²

Table 5.5 | Weinzöttlstraße storage – Project Information

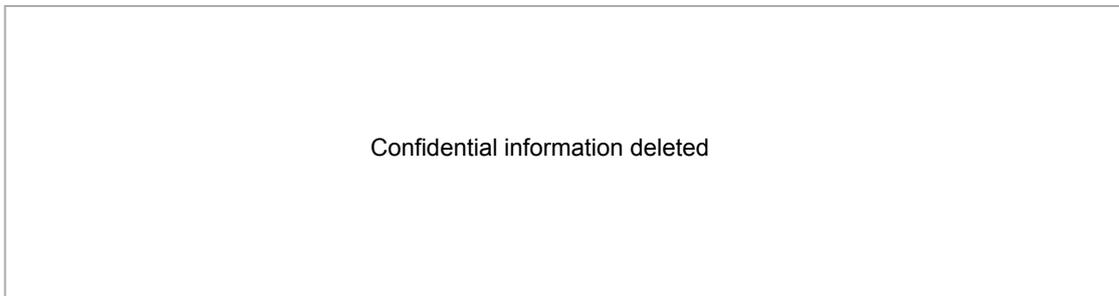


Figure 5.71 | Schematic representation of the functions of the storage area (Neue Galerie Graz): 1 – access, 2 – offices, 3 – restoration office, 4 – paintings' area, 5 – sculptures' area, 6 – resting area, 7 – graphic area, 8 – technical works of art;

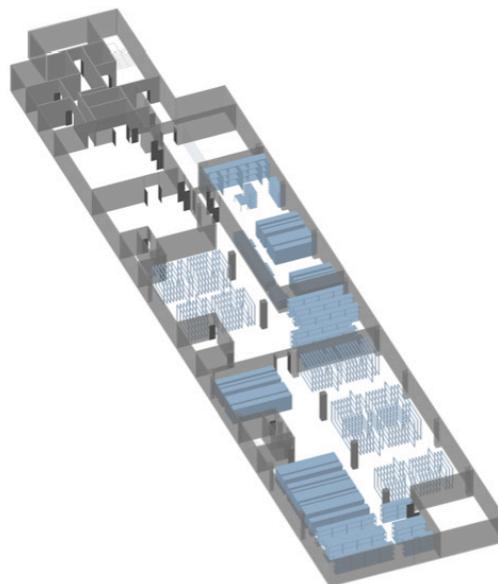


Figure 5.72 | 3D of the storage area (Neue Galerie Graz)

Accessibility and Security

The transportation of the pieces into the storage is made through stairs or a 2m-height elevator. In the case the artworks are too sensitive and do not fit in this elevator, they go in the storage room through a window in the restoration studio that is 3 meters long (Eipper, 2017a).

In order to access the storage unit, the staff must use a code and a transponder key. Beside the storage door there is a metallic board with the names of the team and metallic pins, so to help inform whether a person is inside the storage or not (Lampl, 2016).

In regard to protecting the artworks against theft, surveillance cameras are installed to help prevent a burglary. The building has smoke detectors inside the rooms and in the ventilation ducts. These are connected to a system that will display in which area the smoke comes from. Since the alarm is connected to the fire department, once it is activated the fire brigade will come (Lampl, 2016). Some paintings and sculptures have a red ribbon around them. This serves as an indicator to the fire department that these pieces are the most valuable and should therefore be the first ones to be taken out of the room if necessary and possible (Eipper, 2016).

In case of a duct blockage there is a system installed that can detect the speed of the water flow. If one is slower than usual, an alarm will be sent to the security team. This system allows for a faster and more efficient intervention avoiding, for instance, a water duct rupture, which can severely damage the artworks.

Facilities and Equipment

The storage unit is located in the first floor of the building, of which the floor is able to sustain up to 750 Kg/m² (Eipper, 2017b). The space consists of five different storerooms with a total of 1.500 m². The painting's storage is divided through two different rooms (730 m²) and has artworks both from Neue Galerie and Alte Galerie. One of these also holds sculptures from both museums (440 m²). There is a closed room only for photographs and smaller paintings (200 m²) and another one for kinetic art and other electronic pieces (75 m²). There is also another room used to momentarily keep the artworks when they arrive in the building (55 m²). Besides the rooms used to store the artworks, the unit holds several offices and a restoration studio.

Resting area – When entering the storage unit, there is a room separated from the corridor with a metal grid, where the incoming crates are initially stored. By staying inside the crates and in this space, the artworks slowly adjust to the change in temperature (outside-inside of the storage), avoiding any damage from temperature shock. Once the temperature inside the crates is the same as the outside one, they are ready to be opened so to proceed with an evaluation on the state of the piece.

Painting's storage – The artworks are stored in two large rooms with several sliding hanging systems. The space is only cut by columns, which are separated by each other by approximately nine meters. The paintings are hung in what Johnson & Horgan (1979, p.



Figure 5.73 | Staff location system (Neue Galerie Graz)

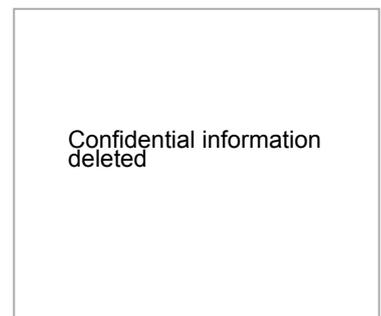


Figure 5.74 | Fire control details (Neue Galerie Graz)



Figure 5.75 | Sliding rack storage with wire screening (Neue Galerie Graz); Figure 5.76 | Pack/unpacking area and metal shelves (Neue Galerie Graz)



Figure 5.77 | Metal drawers (Neue Galerie Graz); Figure 5.78 | High-density mobile storage system (Neue Galerie Graz)

47) call “sliding rack storage with wire screening”. In front of the sliding rails there are tables that help box and unbox the art pieces that go into the storage or out of it.

Graphic storage – This space contains graphic works, such as aquarelles and photographs. These elements are stored in different places: metal cabinets, opened metal shelves, metal and wooden drawer units, sliding shelf systems. This last one works with the help of a turning handle, having adjustable platforms that allow for the storing of different sized materials. The boxes stored in the metal cabinets contain smaller and more fragile objects that must remain protected inside.

Sculptures’ storage – Most sculptures are kept in metal shelves. Some are covered with plastic sheets to avoid the contact of the artworks with dust and dirt (Eipper, 2016).

Restoration Work

Restoration studio – In this room (130 m²) a restoration team works to protect, analyse and repair the objects of the collection – working for the entire Universalmuseum Joanneum group (Lampl, 2016). As Eipper (2016) explains, the pieces must be cleaned and well prepared for them to be able to transfer into their remaining place in the storage unit. Besides monitoring the objects that arrive into the storage unit, the restoration team is also in charge of guaranteeing the pieces in the collection are in good conditions, restoring art pieces that have any type of damage to them. Despite all this work, the restoration unit can only guarantee the pieces are in a stable condition (e.g., no paint fades away, no cuts develop further). “Every element that is in the storage can rest there for 50-100 years without any intervention on them” (Eipper, 2016).

Environmental Control and Maintenance

Painting’s storage – The temperature and RH of the room during summer is respectively 25 °C and 55%, while during winter it is 20 °C and 40%. However, the temperature transition from one season to the other is a slow process, as it could have a damaging effect on the art pieces if it were too sudden (Eipper, 2017b).

Graphic storage – This room is at a constant temperature of 19,7 °C and a 45% of RH, as these are the appropriate levels for the conservation of paper (Lampl, 2016).

Restoration studio – The temperature and RH of the room is the same as the one registered in the painting’s storage. Since room has several windows and the materials inside it are sensitive to light, the glass on the windows has an ultraviolet protection film, as well as the light bulbs used, which are neon lights (Eipper, 2016).

Artwork’s organisation

The objects of the collection are organised alphabetically by the painters’ names. This system is not ideal for the restoration team, as it may be hard to locate a piece from an artist with a vast production (Eipper, 2016).



Figure 5.79-5.80 | Restoration room (Neue Galerie Graz)

As previously described, Neue Galerie works with the computer programme *FileMaker* and additionally, each piece has a *karteilkarte* (“index card” or “cataloguing card”) with its general information (Lampl, 2016).

Conclusion

The main storage spaces used by Neue Galerie are industrial buildings. These structures are one of the most used facilities for museum storage. Their benefits range from: low-cost space of suitable proportions and load-bearing capacity. However, industrial buildings also bear negative aspects, as needing more repair and alteration than initially anticipated, or by having an unsuitable location (Bordass, 1996, p. 1). In regard to the difficulties that some artworks may present when kept in the storage areas, Eipper (2017b) referred that this mostly happens due to the dimension of the pieces (since the doors in the Weinzöttlstraße storage are 3×3 m), the materials chosen by the artists or even by the concept of the artwork, which at times, limits the life of the work itself.



Figure 5.81 | Alphabetic organisation of the artworks (Neue Galerie Graz)

6 | PORTUGAL

“If the gallery is the museum’s public face, the storerooms are its private parts - the place where art is collated, concealed, and kept from view. (...) To visit the storeroom, where objects dwell cut off from critical aura, is to contemplate art in a state of temporal remission. Paintings hang in row upon graceless row, on rack after regimented rack. Sculptures mill about like excess baggage.” (Ingrid Schaffner, 1998, p. 11).

6.1. MUSEU NACIONAL DE ARTE CONTEMPORÂNEA – MUSEU DO CHIADO

HISTORY AND ARCHITECTURE

The Museu Nacional de Arte Contemporânea – Museu do Chiado (MNAC) is located in the historical centre of Lisbon. Its main building has its entrance through Serpa Pinto street. However, recently the museum expanded its area, northern of its original space, where previously the Civil Government was found. This addition hosts temporary exhibitions and has its entrance from Capelo street. The museum is under the direction of the Direcção-Geral do Património Cultural (DGPC) (MNAC, n.d.-a).

The institution was founded in 1911, after the separation of the collection of Museu de Belas-Artes. Part of it was transferred to the Museu Nacional de Arte Antiga while the rest was placed in the Museu Nacional de Arte Contemporânea. Initially chosen as a provisional space, the São Francisco convent is still the museum’s permanent home. This

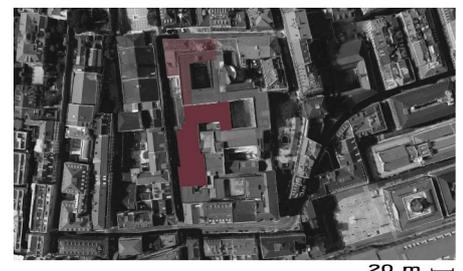


Figure 6.1 | Representation of the main building (south) and of the recent extension (north) (MNAC)

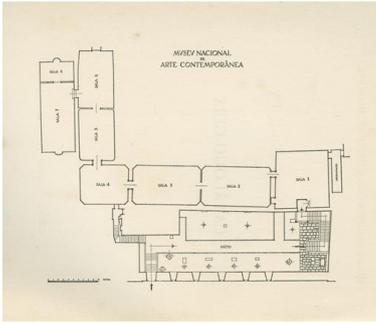


Figure 6.2 | Plan, 1945 (MNAC)



Figure 6.3 | Sculpture garden, 1945 (MNAC)



Figure 6.4 | Area of intervention of the renovation project by architect J-M Wilmotte (MNAC)



Figure 6.5 | Museum entrance, 2016 (MNAC)

space was shared amongst the Fine Arts Academy, the National Library, the Civil Government and the police (PSP), restricting the museum to a fragmented edifice (Barranha, 2011, p. XV).

The São Francisco convent was founded in 1217. Over the years the convent building went through many additions and reconstructions, mostly due to the fires that severely damaged the building in 1707 and 1741, along with the historic earthquake of 1755 (Ramalho, 1995, pp. 19-24). After the extinction of the Religious Orders in Portugal in 1834, the convent was appropriated by the State, being occupied by public services. Abraham Wheelhouse, an English businessman bought part of the building, opening a biscuit factory in Serpa Pinto street (current permanent exhibition entrance). Later on, Wheelhouse decided to build a third floor (current second floor – temporary exhibition’s room) where he installed four ovens (Monteiro, 1995, pp. 29-32). From the end of the nineteenth century until 1974, Litographia Salles used the second and third floors. The ground floor was used as a garage and warehouse of Refinaria Brasileira (Monteiro, 1995, p. 32).

The museum opened in 1911, occupying only three exhibition rooms, with its entrance through the Fine Arts academy. Until 1929 other rooms were created, one being dedicated to sculpture. In 1945 the museum opened daily to the public and with a new and independent entrance, from Serpa Pinto street. The building struggled to provide the necessary spaces to store and exhibit the artworks (Barranha, 2013, p. 297). Throughout the years, the museum went through different architectural interventions. One of the most interesting ones was the construction of the museum’s sculpture garden in the 1940s, taking advantage of the convent’s external wall (Barranha, 2011, pp. XXI-XXII).

In 1987 the museum closed due to the bad conditions under which its collection was kept. One year later, the fire that spread through Chiado threatened the collection and as a precautionary measure the works were taken out of the museum. Even though the museum building was not affected by the fire, the Secretariat of State for Culture determined that the works were not to return until a more appropriate space was selected (Silva, 1994, pp. 20-21). The French Government signed a protocol with the Portuguese State, offering to help with the reconstruction of Chiado, contributing with the renovation project of MNAC. French architect Jean-Michel Wilmotte was responsible for the rehabilitation project, as the architect had already experience regarding the adaptation of buildings into museums. The architect was faced with five different buildings that had diverse backgrounds, having to connect these spaces creating a coherent path between them (Tostões & Barranha, 2007, pp. 37-38).

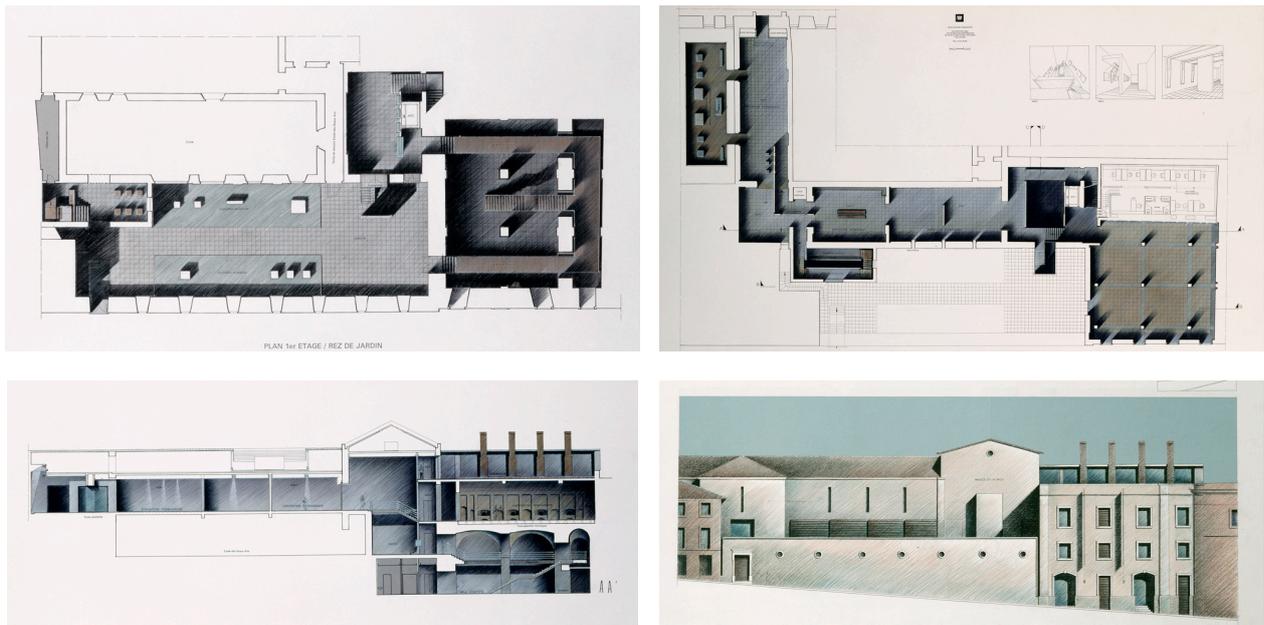
For Wilmotte (1995, p. 45) it was important to understand the origin of the building and, with this in mind, a data survey was conducted on the museum site. Through it, the architectural intervention was able to respect and value the building’s history, while providing the space with a contemporary environment prepared to deal with its current needs. This was achieved with the use of sensible materials that worked symbiotically with the pre-existing character of the space. The interventions in the building focused on

several goals (Herdade, 2003, p. 45): the amplification of exhibition rooms, linking spaces and access of the museum, the introduction of a cafeteria and shop, the instalment of an acclimatisation system and an improvement of security conditions, the expansion of service areas.

As described by Wilmotte (2013, p. 96), he chose to relocate the museum entrance, previously made through the garden and now through the new atrium. This room is also a sculpture gallery, having two pillars in Lioz marble stone that sustain a six-sided brick arched ceiling, typical of the Portuguese plain architecture. Wilmotte used a staircase in metal, glass and wood to connect the entrance floor with the upper one, not overpowering the pre-existing architecture. The architect is clear on wanting to integrate and highlight in the new museum space older structures of greater architectural significance. Another example of how Wilmotte paid attention to the building's history can be seen in the exhibition room on the upper floor, which previously was the ovens' room for the biscuits factory. The architect chose to keep the brick ovens, as well as the chimneys. As pointed out by Guimarães (2004, p. 301), the architectural intervention shows the intention to intervene without overpowering the urban setting in which the museum is placed, visible through the presence of simple volumes and the non-decorated façades.



Figure 6.6 | Ovens' room, 2016 (MNAC)



It was important to create a connection between the indoor spaces and the outside, allowing the southern light to go inside the building but always controlled by the internal requirements. In the building rehabilitation only the thick external stone masonry walls were preserved, which were combined with concrete pavements supported by pillars and beams built inside the walls (Herdade, 2003, p. 47). The materials used aim to establish a connection with the history of the space: local grey stone and a dark varnished wood. These materials are part of traditional Portuguese architecture, blending in with the museum space (Wilmotte, 2013, p. 96).

Figure 6.7 | Level 1 plan (MNAC);
Figure 6.8 | Level 2 plan (MNAC);
Figure 6.9 | Section (MNAC);
Figure 6.10 | Serpa Pinto street façade (MNAC)



Figure 6.11 | Exhibition room (MNAC)

The construction work lasted from 1992 until July 1994, when the institution reopened its doors. Even though the renovation project of 1994 was essential for the functioning of the museum, this institution still lacked space. Recently, the museum added the building adjacent to it, on the northern side, previously occupied by the Civil Government/Ministry of Internal Affairs and the Police (Barranha, 2013). As Maria de Aires Silveira (2016) states, even though this expansion was long desired, the museum is now in need of an architectural project that can unify these different realities.

COLLECTION



Figure 6.12 | *Concerto de Amadores*, 1882 by Columbano Bordalo Pinheiro, painting (MNAC)

The MNAC collection holds Portuguese artworks from 1850 until today, including paintings, sculptures, drawings, photographs and new media, amounting close to 5.300 objects expressing artistic currents from romantic, naturalist, symbolist, modernist and post-war generations (Silveira, 2017a).

After the extinction of the religious orders in Portugal (1834), the artworks previously belonging to churches and convents were gathered in the S. Francisco Convent in Lisbon, without any collecting methodology, nor classification system. Royal artworks were added to this collection and donations were made from aristocratic families, contributing to the growth of the collection. Moreover, Portuguese students abroad were required to send several artworks they produced, to their respective academy, allowing for a collection of the art production of the time to be made. After 1902, the collection also grew with the help of a donation from Visconde Valmor who left a portion of his wealth to the purchase of Portuguese or foreign artworks of relevance (Lapa, 2010, pp. XVII-XX).



Figure 6.13 | *Self-portrait in red*, 1962 by Paula Rego, painting (MNAC)

The museum was located in an especially creative area, where modernist artists gathered, discussing literature, art and even exhibiting their artworks at cafes. Unfortunately, the first museum directors had a conservative approach, delaying the incorporation of modernist art in the museum. The evolution of the museum's collection is therefore marked by the political climate of the country. This led modernist artists not to be well represented in the museum during their lifetime, as the institution was more inclined towards the Portuguese naturalism (Barranha, 2013, p. 294).

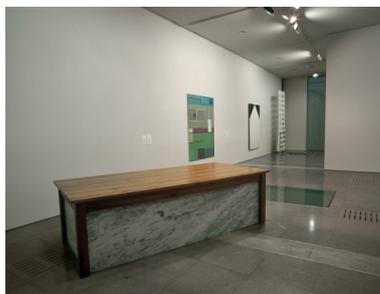


Figure 6.14 | *Sem título*, 1996 by José Pedro Croft, sculpture (MNAC)

Around 1994, the museum's acquisition policy turned to artworks of the second half of the twentieth century, so to fill the gap the museum had. In addition to this, the institution developed a programme of temporary exhibitions to showcase Portuguese artists that were not so well represented in the collection. Furthermore, another programme was created focusing on showcasing contemporary artists, which allowed MNAC to update its collection. From 1998 the museum started including other artistic formats, such as photography and video (MNAC, n.d.-b). One particularly remarkable is MNAC's 50's photographic collection, with works from Adelino Lyon de Castro, Eduardo Harrington Sena, Fernando Lemos, among others (MNAC, n.d.).

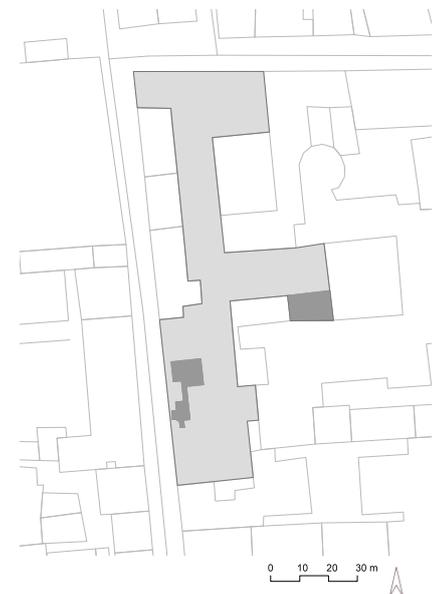
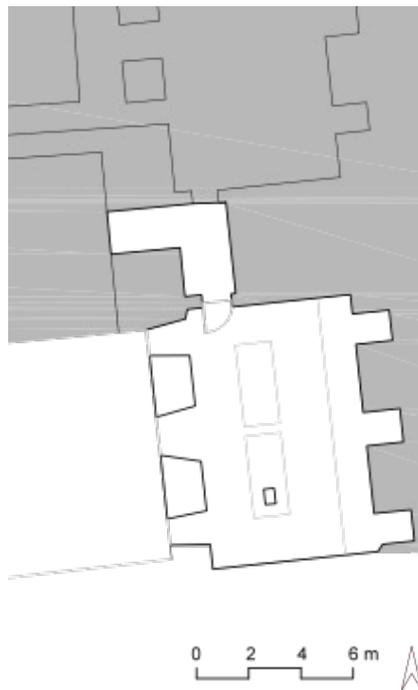
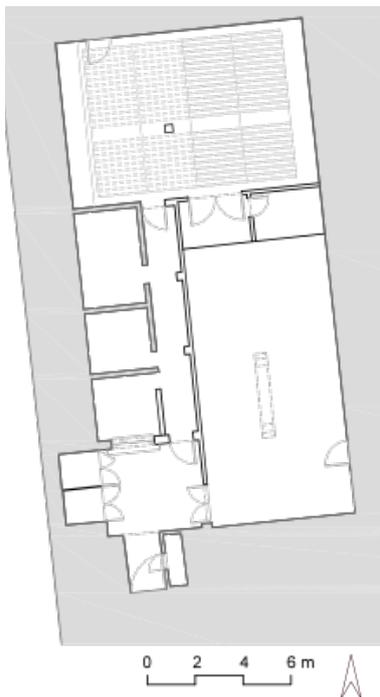
Through the recently developed programmes, MNAC was able to establish a new network of contemporary artists. During the 60's and 70's there was a newfound

avantgarde spirit that manifested itself different movements, such as: New Figuration, New Abstraction, the adaptation of Pop Art to the Portuguese environment; Land-Art and Post-conceptual movement (Tavares, 2012). As Barranha (n.d.) points out, due to the lack of funding from the State for acquisitions, the collection moved forward with contributions by artists, institutions and private collectors. The collection then incorporated works from younger artists such as: Filipa César, Gabriel Abrantes, Rodrigo Oliveira (MNAC, n.d.).



Figure 6.15 | *The Four Chambered Heart*, 2009 by Filipa César, video (MNAC)

STORAGE AREA



MNAC has close to 5.300 artworks in its collection. However, only 1.500 of its artworks are kept in the museum, since the storage area is insufficient to deposit the entire collection (Silveira, 2017a). The rest of the works are in public and private institutions. With an increase of the number of artworks in the collection, in 2008, the museum established a collaboration with the company Feirexpo, which received a selection of its pieces (Barranha, 2017). The works are kept in a purpose-built storage safe, occupying 40 m² of this rented space. The company provides services related with storing, handling and packing artworks, guaranteeing the safekeeping of the objects in an environmentally controlled space (Rangel, 2017). Furthermore, MNAC has a selection of its photographic collection in the Arquivo de Documentação Fotográfica (photographic documentation archive) of DGPC, currently located in the Forte de Sacavém (Silveira, 2017b). MNAC, along with other museums managed by DGPC, has some of its works in public institutions such as the Palácio de Belém, Palácio Nacional da Ajuda or Palácio de São Bento, and even in State museums as is the case of Museu José Malhoa in Caldas da

Figure 6.16 | Sculpture and Paintings' storage area (MNAC);
 Figure 6.17 | Drawings' storage area (MNAC);
 Figure 6.18 | Location of the storage areas (MNAC)

Rainha (Barranha, 2017). There are two storage spaces in the museum: the main one is directly connected with the street, being located under the museum’s garden, while the smaller one is on the second floor. These storages are closed to the general public, being only available to researchers, students and other groups of people with an interest in museum studies.

Address:		Rua Serpa Pinto 4, 1200-444 Lisbon, Portugal	
Type of structure:		Concrete and stone masonry structure	
Building construction year:	Around 1217	Architecture intervention year:	1991-1994
Architects of the adaptation project:		Wilmotte & Associés Architectes	
Number of artworks in the collection:	Close to 5.300 objects	Number of artworks in the storage:	Close to 1.500 objects
Number of rooms:	2 rooms	Storages' area:	168 m ²

Table 6.1 | MNAC – Project Information

Figure 6.19 | Schematic representation of the functions of the storage area (MNAC): 1 – access, 2 – paintings’ area, 3 – sculptures’ area, 4 – technical support zone; Figure 6.20 | Schematic representation of the functions of the storage area (MNAC): 1 – access, 2 – drawings’ storage area

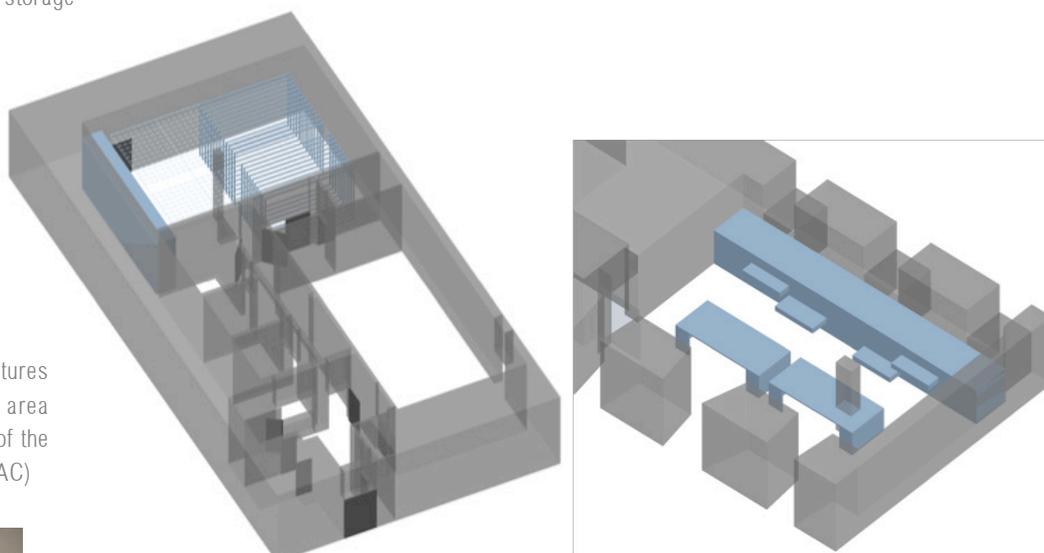
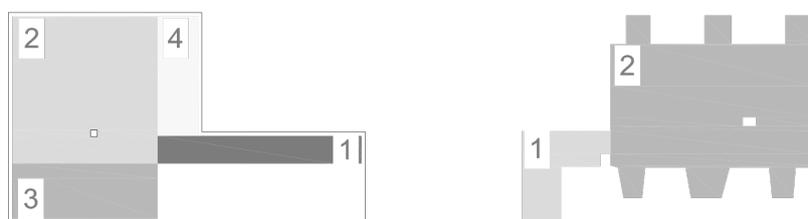


Figure 6.21 | 3D of the sculptures and paintings storage area (MNAC); Figure 6.22 | 3D of the drawings storage area (MNAC)



Figure 6.23 | Paintings and sculptures’ storage entrance (MNAC)

Restoration Project

During the restoration and expansion project the museum decided that a new storage space was needed. This new space was created near the entrance of the building, under the garden. During the project it was decided that the soil under the garden would be excavated to house not only the storage unit but also the access to the technical elevator, a temporary exhibition room and technical areas (Herdade, 2003, p. 46). The built temporary exhibition room adjacent to it has a direct access to the storage room,

facilitating the movement of artworks between these spaces. The other storage is found in the second floor of the museum, near the exhibition galleries having thick stonewalls.

Accessibility and Security

The main storage room is accessed through the entrance in Serpa Pinto street. A bell is rung, and the security guards inside will open the door for the museum staff. The storage area is located down the hall from the security guards' room. This security team is responsible for the entry of people in the storage area (Silveira, 2016). The incoming artworks go directly to the exhibition rooms. However, in case an artwork is to be stored in the storage, it will go through the staff entryway. If it is too large it will go through the temporary exhibition gallery, through a removable screen connecting with the storage.

The drawings' storage area is located near the documentation centre of the museum. Despite its glass door, the storage room has a tight security system, alerting to any intrusions, and being directly connected to the police. Throughout the museum there is a fire alarm system in place, linked to the fire department, so to promote a faster response. The storage area does not have a flood detection system. However, curator Maria de Aires Silveira (2016) assures the security staff has a good control of the space by video surveillance.

Facilities and Equipment

Both storage spaces make up a total area of 168 m². As described by Silveira (2017a), the main storage room is located at the entrance of the museum (100 m²), being used to store 800 paintings and sculptures; the other room (68 m²) holds 700 drawings. The floor in both rooms is covered with a blue-grey marble of Cascais (Silveira, 2016).

Painting and sculpture's room – More than half of the room is occupied by a paintings' sliding panel system that is at full capacity. In addition to being hung, some of the paintings are stored in boxes. Due to the lack of space, bigger sized paintings cannot be hung on the panels and must be taken to other institutions to be stored appropriately. In front of the sliding panel there is a shelf designed by Wilmotte to store sculptures.

Drawing's room – This room holds close to 700 paper drawings, which are kept in cabinets with drawers, designed by architect Wilmotte. These are practically hermetic, allowing for the drawings to be preserved in very good conditions. As described by Teixeira & Ghizoni (2012, p. 27), the drawings are kept in *passé-partout*, which offers protection and an easier handling of the objects, already prepared to be put into a frame. The room has thick stone walls, having a pillar in the centre of the space with two tables around (Silveira, 2016).

Restoration Works

In case an artwork needs to be restored, the piece will go to Laboratório José de Figueiredo. This laboratory is the one attending to the conservation and restoration needs of the institutions belonging to DGPC (Silveira, 2016). In case the required treatment is a



Figure 6.24 | Drawings' storage entrance (MNAC)



Figure 6.25 | Paintings' storage area, 1970 (MNAC)

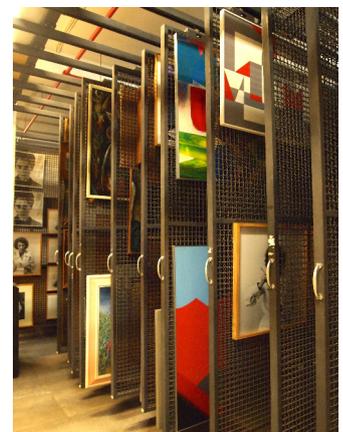


Figure 6.26 | Sliding panel system (MNAC); Figure 6.27 | Sculpture cabinet (MNAC)



Figure 6.28 | Drawing's room (MNAC); Figure 6.29 | Drawer cabinet in the drawings' room (MNAC)

minor one, a restorer from the laboratory is called to the museum where, in the recently added museum building, there is a small room in which the restorer can work. Maria de Aires Silveira (2016) mentions that there is a regular maintenance control regarding some artworks that are not yet treated and in *passe-partout* or with acid-free paper.

Environmental Control and Maintenance

Painting and sculpture's room – This room is kept at a varying temperature of 20-22 °C, having 55-60% of RH (Silveira, 2017a). There are no windows in this room so natural light cannot affect the artworks.

Drawing's room – The objects in this room require a temperature of 20 °C and a constant RH of 55%. Since this room has six windows, it is important to protect the artworks from the negative effects of natural light. Therefore, all the windows have blinds as well as U.V. filters (Silveira, 2016). Some of these filters can reduce the U.V. radiation in more than 99% and reduce the heat and transmission of visible light (Camacho, Mineiro, & Nobre Dias, 2007, p. 99).

According to Silveira (2016), the lights in the storage rooms are fluorescent and do not have any type of protection against harmful radiation. Throughout the museum there are several air handling units (AHU) with sensors that help control the levels of temperature and humidity inside the rooms. Furthermore, all exhibition rooms and the storage areas have thermo-hygrometers - spot metering devices that monitor the temperature and RH levels of the space, registering the highest and lowest levels (Camacho, Mineiro, & Nobre Dias, 2007, p. 104).

Artwork's Organisation

Painting and sculpture's room – The paintings are generally organised by timeline, starting with the romantic generation until contemporaneity. However, Maria de Aires Silveira (2016) mentions how difficult it is to store all the artworks from the same period together due to the lack of space in the sliding panels. The sculptures are mostly sorted by their size and material. The artworks in the collection are organised on a digital database with the programme *Matriz*, also used by all the institutions belonging to Instituto dos Museus e da Conservação (IMC).



Figures 6.30 | Restoration room in the added space (MNAC)

Conclusion

The decision to create a storage area during the restoration and expansion project was extremely important. Not only is it essential to have the museum's artworks in the building, but the access created through the storage area allows for large artworks to go inside the space securely. Unfortunately, the area available is not enough to store all the collection, which is also found in other institutions.

The recent museum expansion area is mostly used as exhibition spaces. However, it would benefit the institution to use a section of this building as an additional storage, providing MNAC with the opportunity to have its entire collection in the museum.

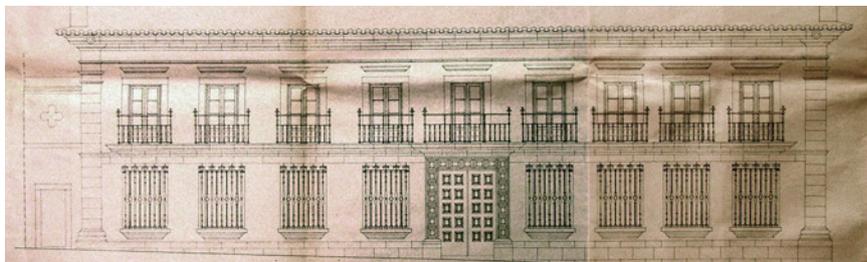
6.2. CENTRO DE ARTE CONTEMPORÂNEA GRAÇA MORAIS

HISTORY AND ARCHITECTURE

The Centro de Arte Contemporânea Graça Morais (CACGM) is located in the historic centre of the city of Bragança, being under the municipality's administration. The museum opened to the public on 30th June 2008, after a restoration and extension project by the Portuguese architect Eduardo Souto de Moura.

Director and curator Jorge da Costa (2017a) explains how this project was created upon the idea to develop two contemporary art centres outside the large urban centres – one in Bragança, Portugal and the other in Zamora, Spain. The museum in Zamora focused on the work of the artist Baltasar Lobo, while CACGM directed itself to the work of the Portuguese painter Graça Morais. These institutions were to have a close relationship with two other important museums – the Serralves Museum (in the case of CACGM) and Reina Sofia Museum (with Baltasar Lobo Foundation) – that allowed for the circulation of artworks between these centres. Unfortunately, the connection between the Zamora museum and CACGM has not been successful due to logistical aspects.

The museum occupies an eighteenth-century house named “Solar dos Vargas”, after its founding family, and a new volume created in the garden of the house. The restored building is used to exhibit the works of Graça Morais, while the new addition is reserved for temporary exhibitions that display other artists (Costa, 2017a).



The “Solar dos Vargas” is a rectangular-planned building with two floors and an accentuated horizontal façade, well representing one of the housing typologies in Bragança during the eighteenth century (Rodrigues, 1997, p. 143). The building is a masonry structure with a linear and symmetrical façade; the ground floor has four windows on each side of the entrance door, while the first floor has nine windows – aligned with the ones below – that open up to a balcony (Campos, 2015). Even though the balcony windows on the upper floor are separated from each other, the stone cornice placed just below them creates a sense of unity, which contributes to accentuate the horizontal quality of the building. As described by Rodrigues (1997, p. 198), these long rows of windows traditionally faced the main street, opening up the house to the exterior.

Wrought iron is used on the balconies of the first floor and in front of the windows of the ground floor. Every opening is framed with stonework, which around the entrance



Figure 6.31 | Museum location (CACGM)



Figure 6.32 | Restored building and main entrance, 2017 (CACGM)

Figure 6.33 | Façade of “Solar dos Vargas” (CACGM)



Figure 6.34 | New building, 2017 (CACGM)



Figure 6.35 | Façade, 2017 (CACGM)

door adopts a more distinct character. The extremities of the house also present a stone cladding: the base, the cornice and the sides of the building, which have two pilasters.

After being part of the Vargas family, the building was left to the Santa Casa da Misericórdia, and soon after, in 1943, the Bank of Portugal bought it. The house went through some architectural changes prior to the occupation by the bank, under which the main façade was altered. Architect Manuela da Rocha Casquilho conducted the bank's adaptation project, studying the initial design and replacing the windows with the original ones (Berenguel, 2015). The bank occupied the building until 1993, after which, in 2002, the City Council of Bragança bought it with the intention to transform it into a museum. In 2004 the construction work for the restoration and extension of the old house started under the project by architect Eduardo Souto de Moura (CACGM, 2015a).



Figure 6.36 | Ground floor plan (CACGM)



Figure 6.37 | First floor plan (CACGM)

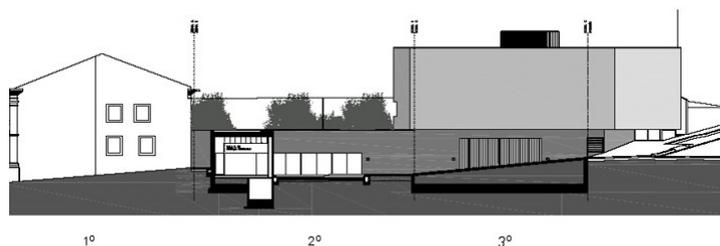


Figure 6.38 | East façade (CACGM)

The architecture project consisted of restoring the Vargas House and of building a new structure so to expand the museum space. Three elements were the main focus: the “Solar dos Vargas”, with its Graça Morais exhibition; the new volume that holds the temporary exhibitions; the connection between them, which is located in the garden, having further exhibition space and other facilities (Dal Co, 2009, p. 34).

When restoring the house, the original design of the building was greatly respected. However, some alterations were necessary, which led to the dismantlement of horizontal structural elements as well as to demolishing an annex placed in the garden (Souto Moura Arquitectos, 2004a).

The architecture team chose to keep the house’s elements as much as possible, so to preserve the building’s history and associated characteristics. Examples of this can be seen in certain constructive details: the decision to take out the wooden floors manually, with the intent to reapply them once treated; the ceilings of the first floor are either the original ones or they were rebuilt as such (since they were in very bad condition); the window shutters of the main façade are also the original ones, which were restored (Souto Moura Arquitectos, 2004a). Additionally, the ceilings and window shutters were painted in a light yellow, over the dark brown colour of the original wood (Costa, 2017a). The floor on the ground level of Vargas House was paved with granite slabs, on top of a reinforced concrete slab (Souto Moura Arquitectos, 2004a), being prepared to develop its new functions: the museum entrance, a library and a bar/cafeteria; the upper floor holds seven rooms dedicated to the work of Graça Morais (Neves, 2009, p. 56).

The connection between the old house and the temporary exhibitions building is made through a structure built across the garden, which houses the educational services, offices and documentation centre. This structure is linked on its north side to the temporary exhibition space, with 240 m² – found on the upper floor – and to technical areas (CACGM, 2015a).

Souto Moura (2009) explains: “Instead of designing as object, a museum, we wanted to propose a new urban strategy, highlighting the most valuable part of the city with a clean, clear building which surprisingly does not touch the ground.” This edifice takes advantage of the lands inclination and, as it is lightly lifted off the floor, from Emídio Navarro street, a triangle is formed beneath the structure, accentuating the strong geometry of the volume – also marked by the lack of openings on the façade. The public’s access is made through this conspicuous slope, which nowadays is closed, being used as an exhibition hall. Nonetheless, the public can access the museum through a ramp that connects the street with the garden and cafeteria (Dal Co, 2009, p. 34).

The new volume was built with a metallic structure coated with thermal insulation (“cappotto-viero”), having a roofing of zinc (“camarinha”) that allowed for the suspension of the building. The edifice has a green roof, while the interior pavement is made of a self-levelling layer on top of a concrete slab (CACGM, 2015a).

Costa (2017a) alludes to how the project harmoniously combines two distinct structures – with different building periods – that complement each other. Campos &

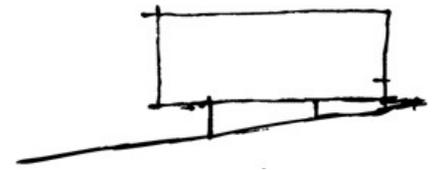


Figure 6.39 | Souto de Moura's sketch for CACGM



Figure 6.40 | Exhibition room in the Vargas House (CACGM)



Figure 6.41 | Garden of the museum (CACGM)



Figure 6.42 | Entrance to the new building (CACGM)

Matos (2010, p. 48) point out how the building has as a bivalent character, as it ignores “the architecturally poor language of the surroundings, but is harmoniously set in formal terms, seeming like it has always existed there”.

COLLECTION



Figure 6.43 | *Maria*, 1996 by Graça Morais, painting (CACGM)

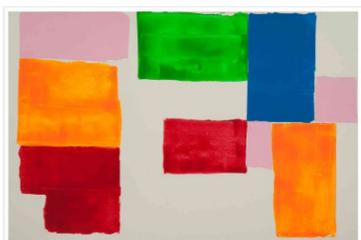


Figure 6.44 | *Travesso G*, 2012 by Pedro Calapez, painting (CACGM)



Figure 6.45 | Exhibition “Dvora Morag - Disruptive Order”, 2017, installation (CACGM)

CACGM displays national and international contemporary art from the late 60s up until today, focusing on the work of Portuguese painter Graça Morais. The museum holds temporary exhibitions in collaboration with different institutions such as: Fundação Serralves, Culturgest, Fundação Caloust Gulbenkian, Millenium BCP and António Cachola collection (CACGM, 2015b). CACGM also has co-productions with foreign museums, as is the case of the collaboration with Museo de Arte Contemporáneo de Castilla y León. These exchanges of artworks are essential, as described by Jorge da Costa (2017a), in order to guarantee that a particular population will be in contact with different and, therefore, more stimulating art experiences.

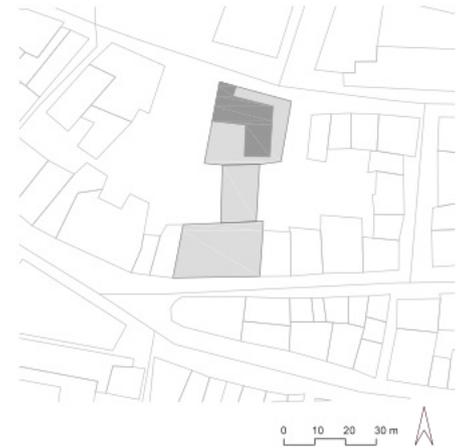
The collection started before the inauguration of the museum. Director Jorge da Costa (2017a) explains how it was developed through a protocol between the municipality of Bragança and the painter Graça Morais, who started by donating close to fifty artworks, and proceeded to contribute with art donations to the museum every year.

Nowadays, the collection has close to 130 artworks, which belong to one of two groups: one being the artworks from the Portuguese painter Graça Morais, and the other one its collection of contemporary art from the artists that have been displayed in the museum. Initially, the centre had a monetary fund to acquire some artworks from these artists. Even so, nowadays the collection is growing due to the artists’ generosity, as they donate their works to the institution.

Besides Graça Morais, other Portuguese artists are also represented in the collection, namely: Pedro Calapez, Paula Rego, Julião Sarmiento, Santiago Ydáñez, among others. Jorge da Costa (2017a) mentions one of the most recent additions to the collection as being a sketch by architect Souto de Moura – donated by the architect after the first architecture exhibition held in the Centre, which focused on the architect’s works. Another interesting addition is the one of the artworks by Israeli artist Dvora Morag, since most of the works displayed in the “Disruptive Order” exhibition were created in the museum itself.

All the exhibitions in the museum are temporary, even the ones that concern the Graça Morais space – which holds two different displays per year. This collection is shown in seven rooms located in the renovated building, while the other exhibitions are set up in the new structure (Costa, 2017a).

STORAGE AREA



CACGM has close to 130 objects in its storage, which are kept in the building. Unfortunately, some of the artworks by Graça Morais are kept in her atelier, due to lack of space. The storage area is located in the museum, in the volume built in 2004 by the architecture team Souto Moura - Arquitectos. This space is closed to the general public, being available only to the museum staff and occasionally to groups of students or researchers whose work is related to art and museums (Costa, 2017a).

Figure 6.46 | Storage area plan (CACGM); Figure 6.47 | Location of storage area (CACGM)

Address:		R. Abílio Beça 105, 5300-011 Bragança	
Type of structure:		Masonry structure; concrete and metallic structure	
Building construction year:	Eighteenth century	Architecture intervention year:	2004-2008
Architects of the adaptation project:		Souto Moura - Arquitectos	
Number of artworks in the collection:	130 objects	Number of artworks in the storage:	Around 130 objects
Number of rooms:	3 rooms	Storage room and supporting facilities area's:	210 m ²
		Storage's area:	38 m ²

Table 6.2 | CACGM – Project Information

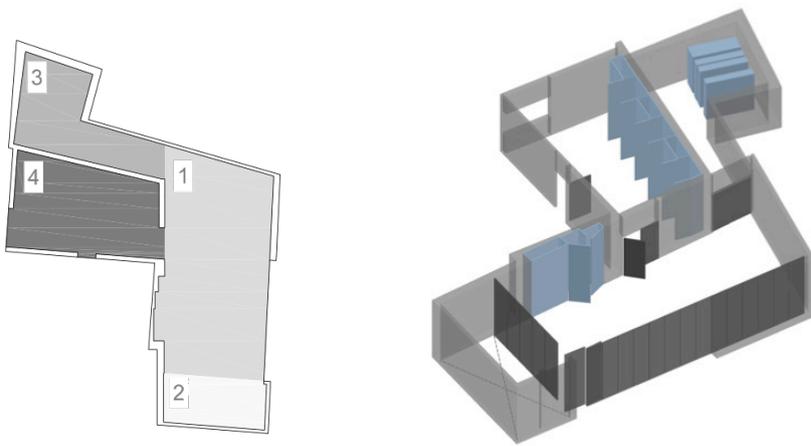


Figure 6.48 | Schematic representation of the functions of the storage area (CACGM):
 1 – loading deck;
 2 – artworks' elevator;
 3 – storage room;
 4 – exhibition preparation room;
 Figure 6.49 | 3D of the storage area (CACGM)



Figure 6.50 | Access to the storage area (CACGM)

Accessibility and Security

The access to the storage is made through the opposite street from the museum's public entrance: trucks enter the loading deck through a ramp that connects the street to the patio outside of the storage unit. The door that opens up to the patio is made of metal, having several panels that fold over each other, allowing for the incoming trucks to enter the space (Costa, 2017a).

When the automatic fire detection system is triggered, an argonite inhibitor gas system is activated, inhibiting the oxygen in the room so to cease the fire. This method allows for the fire to be extinct without producing more fumes and not presenting difficulties in regards to visibility. Moreover, this system guarantees that the artworks are protected from the flames but also from being in contact with either fire extinguishers or water that could damage the collection. Along with this system, the storage area door, which is fireproof will automatically close (Souto Moura Arquitectos, 2004a). In regard to floods, there is no technical system in use to detect the accumulation of water on the floor.

The museum has a detection system against intrusion, in the storage area, video surveillance and a constant presence of security guards.

Facilities and Equipment

The storage area is composed of three distinct rooms: the loading deck (97 m²), a preparation room for the setting up of exhibitions (55 m²) and a room where the artworks are stored (38 m²) (Souto Moura Arquitectos, 2004b).

Loading deck – Designed to be able to fit a truck inside it, this room opens to a patio where incoming trucks pass through so to transfer the artworks inside the space. Since this room has an elevator (3m × 6,60m) that connects with the exhibition room on the upper floor, after the artworks arrive, they immediately go inside it. The lift can take up to 6 tons (Costa, 2017b). This space also connects with the artworks' deposit room, which makes the handling of the artworks very simple (Costa, 2017a). This room also stores the machines used to help set up exhibitions.

Exhibition's preparation room – This room is the one through which the museum staff will enter when already inside the museum building. This place holds materials used to help set up the exhibitions.

Artworks' room – This space was designed with the purpose of storing paintings and drawings, having a high-density mobile storage system, which even though is useful in taking advantage of a limited space, is not enough to store some of the larger artworks by artist Graça Morais. Furthermore, this room has a height of approximately 2,50 m, which is an unfavourable to store bigger works (Costa, 2017a).



Figure 6.51 | Loading deck (CACGM);
Figure 6.52 | Artwork elevator and machines to help support the exhibitions (CACGM)

Restoration Works

Since CACGM does not have a laboratory to analyse the artworks, they work with different institutions from Lisbon and Oporto. These will then develop their work along

with a report that states the initial state of the piece, the different procedures and materials used (Costa, 2017a).

Environmental Control and Maintenance

The artworks' storage room has a machine that stabilises the temperature and RH of the room. There are dehumidifiers that guarantee the artworks safety, and the temperature of the room is kept at approximately 18 °C. The curator points out the disadvantage of not having a separation between paintings, sculptures and photographs, since these items require different temperatures, not being as protected as they should be. This is one of the reasons why some of the artworks inside the storage are kept in their travelling container (Costa, 2017a). The humidity levels of the storage room are the same as the ones in the exhibition rooms – between 55% and 70% (Costa, 2017b). The museum carries out daily controls of the humidity and temperature levels in the different exhibition rooms as well as in the storage (Costa, 2017a).

As Jorge da Costa (2017b) mentions, the light bulbs used in the storage area are fluorescent lights, having no protective filters.

Artwork's organisation

All the objects in the collection are inventoried both through a digital system (created in Microsoft Access) and recorded in paper. The programme used by the museum was created by a group of computer engineer interns that developed the system specifically for the inventory work of the collection. It records the information regarding each artwork: the inventory number, author, title, date, description, history and a picture of the work (Costa, 2017a).

Conclusion

Jorge da Costa (2017a) emphasises how difficult it can be to deal with the dismantling of an exhibition and the setting up of a new one due to the lack of space in the storage room. The space restriction causes logistical problems between receiving the incoming artworks and retrieving the ones from the previous exhibition. Additionally, the shortage of storing area naturally affects the quality of the preservation of the artworks, since not all the works are properly stored.

As previously discussed, contemporary art can pose certain problems in regard to its storage. So far, the museum has not had any problems relating with this. However, Jorge da Costa (2017a) alerts for the complications that can arise from the diversity of materials used in contemporary art. The continuing growth of the museum's collection accentuates the already present need to expand the storage area. The museum director (Costa, 2017a) manifests his idea of extending the storage room into the current loading deck area.



Figure 6.53 | Preparation room (CACGM)



Figure 6.54 | High-density mobile storage system (CACGM)

7 | COMPARATIVE ANALYSIS OF THE CASE STUDIES

The contemporary art museums selected under the framework of this thesis all have considerably different backgrounds, collections, and consequently, storage area spatial needs.

The Austrian case studies are two institutions whose collections were founded with a separation of 140 years, in which MUSA is much recent than Neue Galerie Graz. Nevertheless, both hold a great number of objects, mainly kept in warehouses (adapted or not) and purpose-built structures.

MUSA has two storage areas, one in the museum building's basement and the other in purpose-built warehouse. The first went through an architectural intervention so to properly receive the museum's artworks, which needed protection against the humidity and temperature irregularity of the reinforced concrete and masonry structure. Even though the architecture team restructured the space so to better accommodate the different storage systems required, it did not have enough space to hold the museum's vast collection, which is why the institution rents a storage area in a new and highly-equipped storage facility. Despite having excellent structures to safely transport the artworks inside the building, as well as state of the art security systems, the space has the inconvenience of being located far from the museum, requiring the team to go there in a specific and limited time frame – dictated by the renting company –, restricting their work-time.

The oldest institution studied - Neue Galerie Graz – belongs to a group of museums of the Universalmuseum Joanneum, sharing its storage area with them. The museum building has three rooms, which were altered so to receive the museum's documentation and a small number of artworks. Having a storage area near the exhibition space is essential. However, these rooms are not spacious enough to hold the entire collection, which is why the remainder is kept in two warehouses. In one of them, the collection is kept on the ground floor and basement, without an environmental control system, where the storage is at its full capacity. This space did not go through an adaptation project to better store the collection, contrary to the second rented space chosen to keep the artworks. The majority of the works are in an adapted industrial building: a fully equipped space, with different rooms, each with a controlled environment for the type of artworks it holds, and with a variety of storing systems that attends to the artworks' format diversity. This space also has its own restoration laboratory with a team that works for the different museums belonging to the Joanneum.

Similarly to the Austrian case studies, the Portuguese museums have different backgrounds, where MNAC – Museu do Chiado in Lisbon, is much older than CACGM in Bragança, which holds a small number of works in its nine-year collection. This allows for the museum to keep its works in the storage area of the museum building up to now, while MNAC keeps the majority of its collection in other institutions.

MNAC has two storage areas in its building, designed when the museum went through its last restoration project. One of the rooms is found in a stone masonry structure, from the original building, providing the works with an organised and spacious environment. The other room is a concrete-designed space, specifically created to accommodate the collection. Despite having good storage systems, this storage area is full, making it difficult to store the artworks in a more organised manner. The rest of the collection is distributed through institutions such as: the company Feirexpo – with its purpose-built facility that accommodates the artworks and the Arquivo de Documentação Fotográfica (photographic documentation archive) of DGPC.

CACGM holds the smallest collection from the four case studies, as its institution is the most recent one. The storage area was purposely built, being exceptionally well thought out regarding the accesses needed to transport the artworks (both from outside-inside and inside the building itself), with a loading deck, an artworks' elevator and supporting rooms to help with the setting up of exhibitions. However, the space designed to store the artworks is small, which is reflected in the museum's recent struggle with the lack of space and consequent need to rent an outside space, as the other institutions chose to do.

The Austrian museums have larger collections, which is partially the reason why these institutions have more storage space than the Portuguese institutions. The Austrian institutions are kept in adapted structures (the museum building itself or warehouses) or rented purpose-built structures; the Portuguese museums store their works in the museum building, in adapted and purposely built spaces.

The storage area in MUSA's building is better prepared to receive artworks than the one in Neue Galerie, as the different storage rooms of MUSA are all close together, which is better regarding the security of the collection. Moreover, MUSA has a larger storage area. CACGM's storage was purposely designed, having extremely well thought connections between its spaces, guaranteeing a safe handling of the artworks. Furthermore, in the case of MNAC, despite having its storage rooms separated from each other, the paintings and sculptures' room has a good connection with one of its exhibition spaces, facilitating the moving of the works.

The case of CACGM – a recent museum in which its storage area was planned during its architectural project – distinctly confirms the current need for a better understanding from designer teams on how these spaces function and what their requirements are, in order to provide these institutions with a storage that accounts for its future needs.

In the storages visited (apart from MUSA's purpose-built rented space), the lack of space is a common concern. This reflects the importance of bearing in mind the expansion of the collection when designing a storage area. Museum collections are not static, they keep on growing and even though it is impossible to create a storage that will eternally hold enough space for its artworks, a more careful planning should be developed when considering a storage unit. The case of adapted structures is a more

complex subject, since these structures have a fixed spatial configuration. Nonetheless, these spaces can be altered, expanding its area or even altering its original configuration in order to create new spaces that can provide safe and controlled environments for the works.

The main elements that characterise the museums studied and their storage areas, such as number of elements in the collection, the type of building structure, area, access, security aspects and storage equipment – are summarised in the table 7.1, confronting the four case studies and their different storages, so to better understand their circumstances.

MUSEUM	MUSA		NEUE GALERIE GRAZ			MNAC – MUSEU DO CHIADO	CENTRO DE ARTE CONTEMPORANEA GRAÇA MORAIS
	Foundation year	2007 (institution) 1951 (collection)	1941 (institution) 1811 (collection)	1911 (institution) After 1850 (collection)	2008 (institution and collection)		
Location	Vienna, Austria	Graz, Austria	Lisbon, Portugal	Bragança, Portugal			
No of artworks in the collection	Approximately 40.000	Approximately 60.000	Approximately 5.300	130			
No. of artworks	5.000	Unknown	1.500	130			
Type of building	Reinforced concrete and masonry	Warehouse	Concrete; stone masonry	Concrete			
Location	Basement	Ground floor and basement	Basement and top floor	Ground floor			
Number of rooms	3	3	2	3			
Area	316 m ²	340 m ²	168 m ²	38 m ²			
Access	Stairs; elevator (1,60×1,95m)	Loading dock; Stairs; elevators (8,54×3,98m, 2,96×3,98m)	Stairs; elevator (1,60×1,95m)	Loading dock; elevator (3×6,60m)			
Fire safety	Automatic detection system with closing doors; fire extinguishers	Automatic detection and extinguishing system with closing doors; access for firefighters; fire extinguishers	Automatic detection system; fire extinguishers	Automatic detection and extinguishing system with closing door			
Security	Code and transponder key; video, guard surveillance	Code and key-card; video, guard surveillance	Video and guard surveillance	Video and guard surveillance			
Lighting	Artificial (type unknown)	Artificial (type unknown)	Artificial (fluorescent light) and natural (UV film)	Artificial (fluorescent light)			
Storage equipment	Metal shelves, sliding panels, drawers	Metal shelves, sliding panels	Metal shelves, sliding panels, drawers, high-density system	High-density system			
STORAGE AREA	Felderstraße	Simmering	Neutorgasse	Lastenstraße	Weinzottlstraße	Rua Serpa Pinto	Rua Abílio Beça
	56.000	56.000	56.000	56.000	56.000	56.000	56.000
	Adapted industrial building	Adapted industrial building	Adapted industrial building	Adapted industrial building	Adapted industrial building	Adapted industrial building	Adapted industrial building
	First floor	First floor	First floor	First floor	First floor	First floor	First floor
	6	6	6	6	6	6	6
	1.500 m ²	1.500 m ²	1.500 m ²	1.500 m ²	1.500 m ²	1.500 m ²	1.500 m ²
	Stairs	Stairs	Stairs	Stairs	Stairs	Stairs; elevator (1,60×1,95m)	Stairs; elevator (3×6,60m)
	Automatic detection system; fire extinguishers	Automatic detection system; fire extinguishers	Automatic detection system; fire extinguishers	Automatic detection system; fire extinguishers	Automatic detection system; fire extinguishers	Automatic detection and extinguishing system; fire extinguishers	Automatic detection and extinguishing system with closing door
	Code and transponder key; video, guard surveillance	Code and key-card; video, guard surveillance	Code and key-card; video, guard surveillance	Code and transponder key; video, guard surveillance	Code and transponder key; video, guard surveillance	Video and guard surveillance	Video and guard surveillance
	Artificial (type unknown)	Artificial (type unknown)	Artificial (type unknown)	Artificial (type unknown)	Artificial (type unknown)	Artificial (fluorescent light) and natural (UV film)	Artificial (fluorescent light)
	Metal shelves, sliding panels, drawers	Metal shelves, sliding panels	Metal shelves, sliding panels, drawers, high-density system	Metal shelves, sliding panels	Metal shelves, sliding panels, drawers, high-density system	Shelves, sliding panels, drawers	High-density system

Table 7.1 | Comparison between the case studies

CONCLUSION

The work developed revolves around contemporary art storage areas, which resulted from architectural adaptation projects. These spaces are the backstage of museums, being accessible only to a restricted number of people and holding the museum's most important assets. The purpose of this thesis is to understand how architecture can contribute to the task of preserving contemporary artworks in adapted structures. In order to do so, it was essential to study the spatial requirements and characteristics of storage areas, as well as the architectural work within an adaptation project. Moreover, it was essential to study contemporary art, particularly certain requirements regarding its preventive conservation, since these have a direct impact on the architect's work.

The thesis analyses storage areas of museums in Portugal and Austria, constituting diverse examples, with different collections and institutional backgrounds. The institutions studied offered a detailed knowledge regarding each space and reflecting different ways of designing storage areas in adapted structures.

Unfortunately, the analysis of certain cases studies is lacking information on certain topics (such as the type of lights used, the temperature and relative humidity levels of a room) or more complete information regarding the architectural project (the materials used, techniques developed in the space). Not all architecture teams responsible for the projects were available to discuss the work developed, either due to security issues or logistical problems and in some cases the museum workers were not able to provide the information that was asked for. Moreover, due to institutional and time constraints, it was not possible to develop a complete analysis of MNAC's storage areas, since the supplementary storage spaces outside of the museum building were not studied.

As Nicks (2001, pp. 109-114) points out, "everything that museums do flows from their collections" (in Yáñez, 2006, p. 81), making the safeguarding of these objects a top priority for every institution. Unfortunately, storage areas around the world show problems in providing enough space for their artworks, which creates several inconveniences to the collections and, at times, their decay.

Compared to the Portuguese museums, the Austrian case studies have ample space to house their collections, in facilities that are better prepared to safely store the artworks, with a general well thought out set of systems (environmental conditions, fire, theft) and access routes. MNAC, founded in 1911, has a large collection and reduced museum storage space, showing difficulties managing its storage area. However, CACGM, which has a collection dating from 2008, is already dealing with a full capacity storage unit, revealing the importance of a project that has in consideration the collection's growth.

It is clear how every storage area is conditioned by a set of circumstances related with its institution – the museum building, its collection policy, economic situation – that influence its performance and efficiency. In the case of storage areas in which the space

was adapted to receive its collection, the challenge is bigger, forcing the adaptation architectural project to combine a pre-existing structure with a new use. The specific case of contemporary art storages holds pressing requirements such as considerable spatial needs and specific environmental characteristics, which can be difficult to guarantee in an adapted space. The architectural project has the interesting yet complex task of joining two distinct realities, rehabilitating a pre-existing structure with the purpose of accommodating contemporary art production.

The conducted study contributed to understand how different spaces can be adapted to house storage areas, being crucial to analyse the structure and the collection, as the first must adapt itself to house the latter. From the case studies analysed, a recurring factor begs to be mentioned: the need to plan for the expansion of the collection during the adaptation project. Even though the expansion of these collections is inevitable, along with their eventual exit from the museum storage due to lack of space, the case studies reveal an inefficient planning to delay these events.

From the study developed, three focal aspects proved crucial in order to design a well-structured and functional storage area in an adapted building:

- The architect, in collaboration with museums experts, must understand the type of collection the storage is for and their conservational requirements – number of objects, materials used, dimensions, environmental and security needs.
- It is necessary to develop a structural analysis of the space, in order to determine if it is stable and if it has the appropriate characteristics to help preserve the artworks, after which the necessary alterations should be made, to maximise the space, and to help create a stable and safe environment for the collection. The architectural project must have in consideration the collection's growth.
- Appropriate storage systems must be chosen for the space and artworks, selecting the storage furniture with the purpose not only to organise and safely store the works but also the storage room, helping define corridors and optimising the space.

The results gathered contribute to form a body of work that provides several approaches to storage areas, reflecting each museum's collecting policy and responsibilities. This study reveals different aspects that can influence the artwork's conservation and therefore, their safety, providing an insight into the significant role an architect has in the correct adaptation of storage units.

Regarding the future development of this subject, it would be interesting to proceed with a study of specific examples of contemporary artworks that pose a conservational difficulty in their storages, also analysing how architecture can contribute to improve these circumstances.

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THE ARCHITECTURE OF STORAGE AREAS IN CONTEMPORARY ART MUSEUMS

A comparative study between Austrian and Portuguese museums

VOLUME II

Ana Beatriz Morais Mafra

Thesis to obtain the Master of Integrated Degree in

Architecture

Supervisor: Prof. Helena Silva Barranha Gomes

Examination Committee

Chairperson: Prof. Ana Cristina dos Santos Tostões

Supervisor: Prof. Helena Silva Barranha Gomes

Members of the Committee: Prof. Maria Raquel Henriques da Silva

October 2017

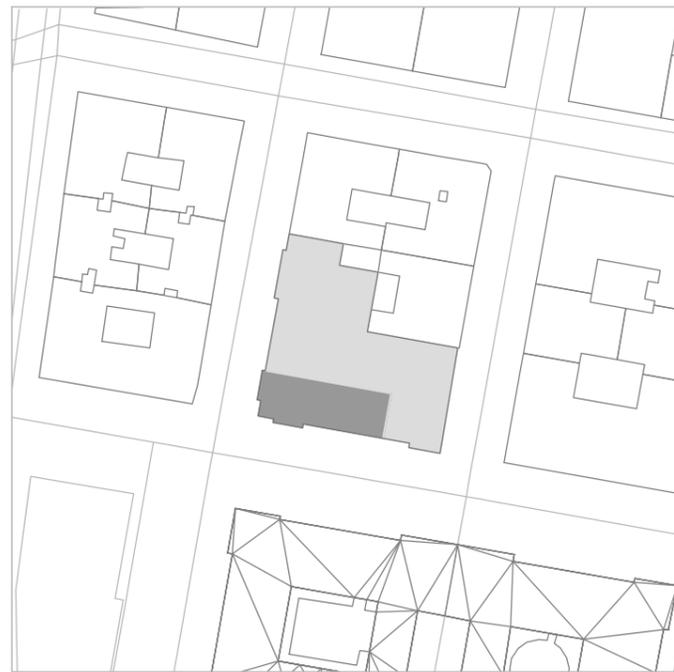
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Annex A. Technical Drawings

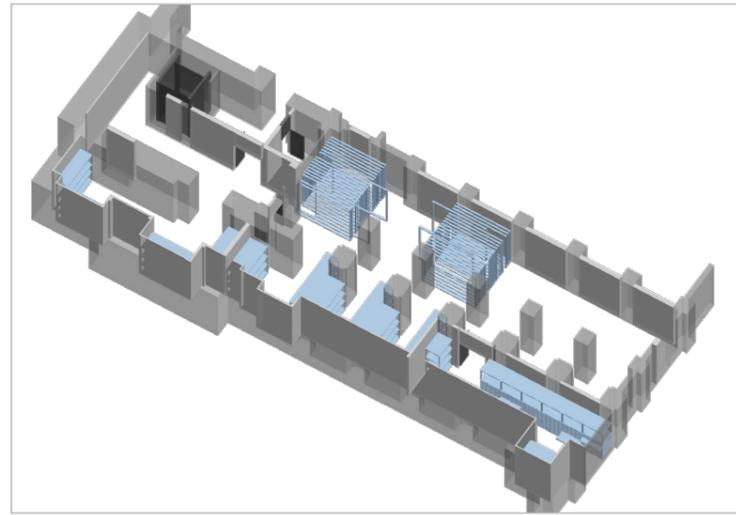
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Neue Galerie Graz	A3
Museu Nacional de Arte Contemporânea – Museu do Chiado	A6
Centro de Arte Contemporânea Graça Morais	A7

Annex B. Information sheet of the case studies

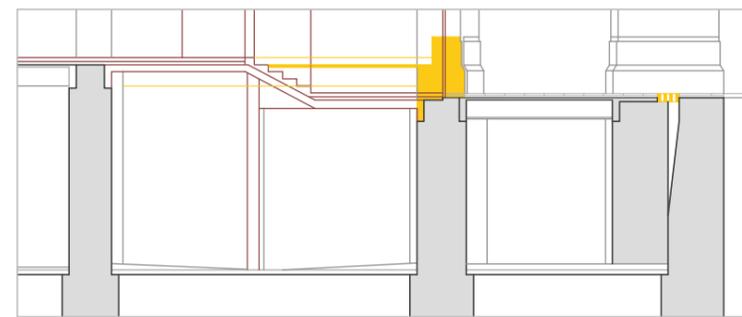
Museum Startgalerie Artothek	B1
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Site plan
Scale 1:2000

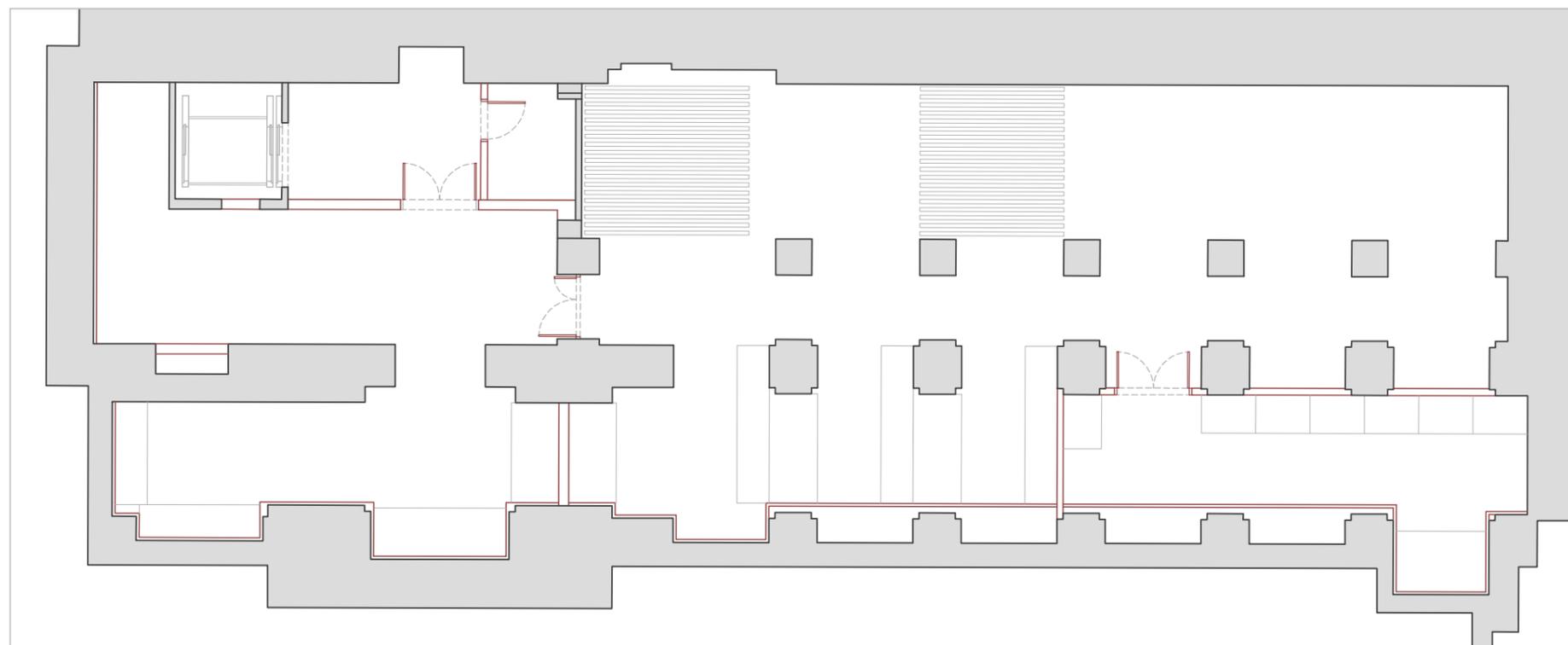


3D of the storage area



Section AA'
Scale 1:150

Demolished elements
Elements added in the adaptation project



Storage area plan
Scale 1:150

Elements added in the adaptation project

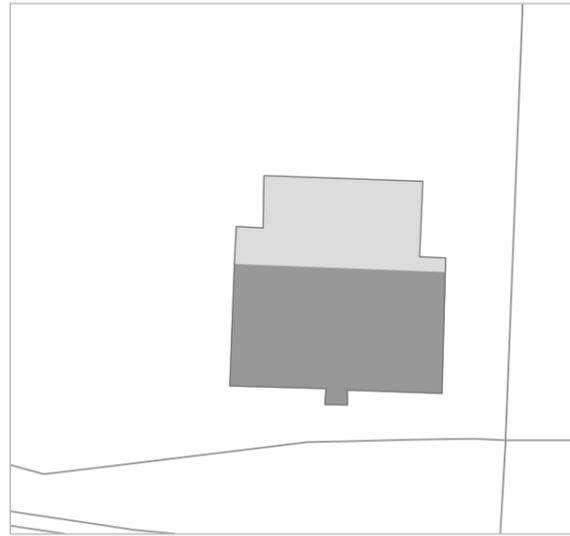
MUSEUM STARTGALERIE ARTOTHEK

Address: Felderstraße, Vienna, Austria

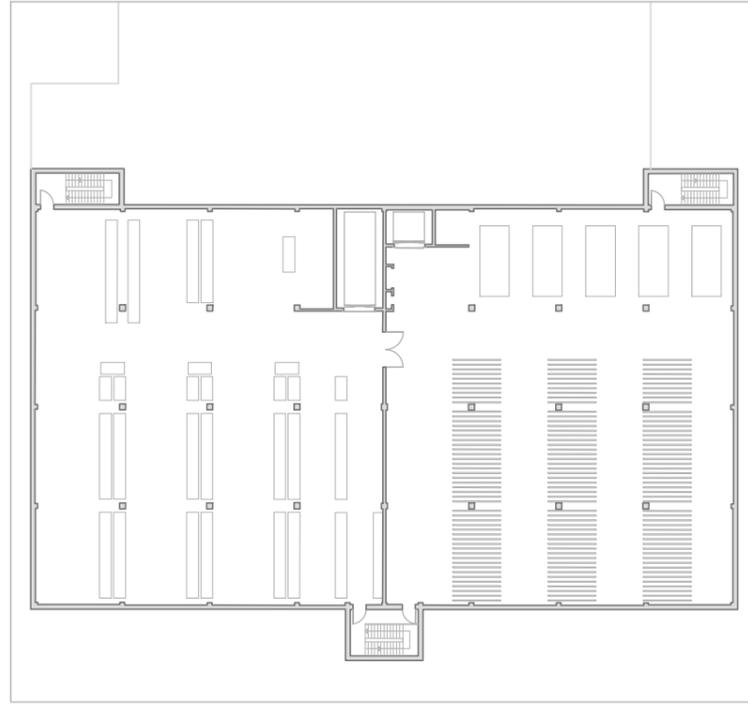
Space: Storage area

Location: Basement, floor -1

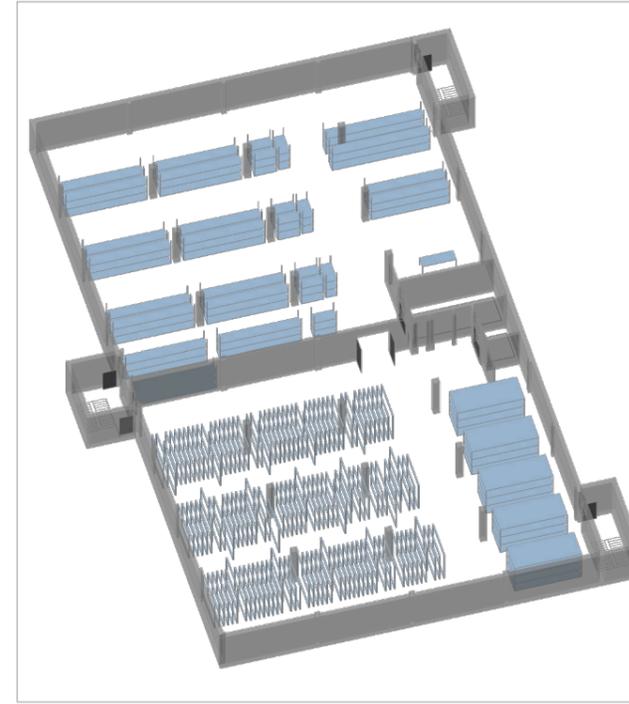
Architect: Kiskan Kaufmann Architekten



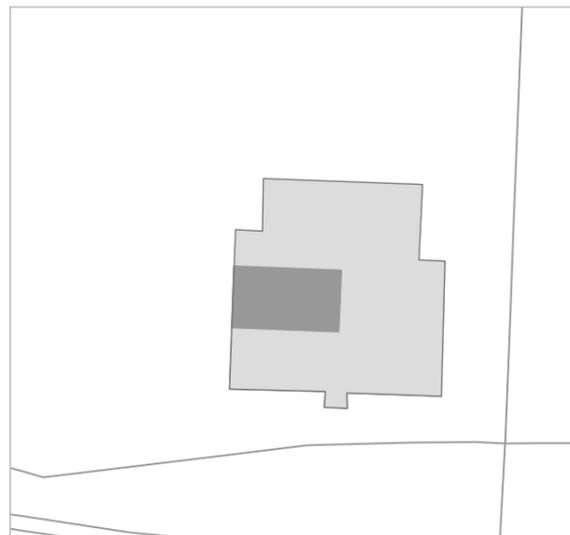
Second floor storage - Site plan
Scale 1:2000



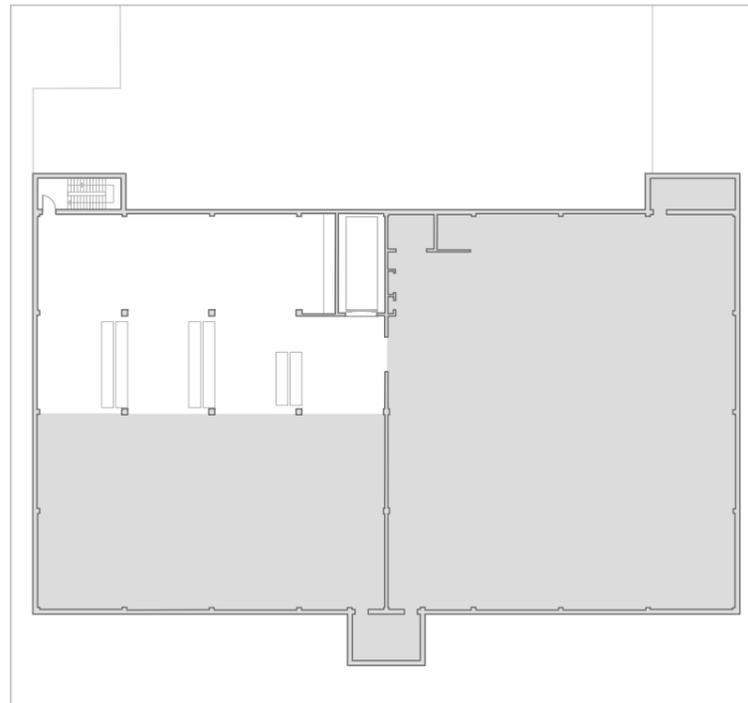
Second floor storage plan
Scale 1:600



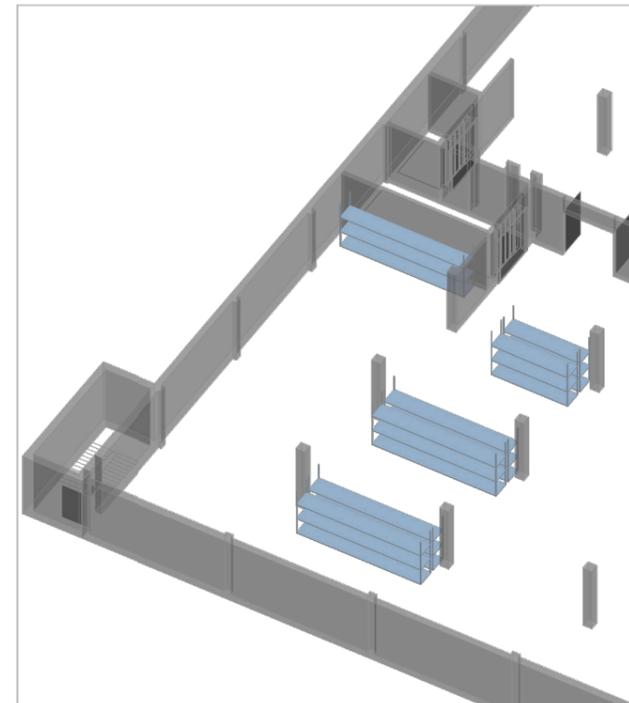
Second floor storage - 3D



Third floor storage - Site plan
Scale 1:2000



Third floor storage plan
Scale 1:600



Third floor storage - 3D

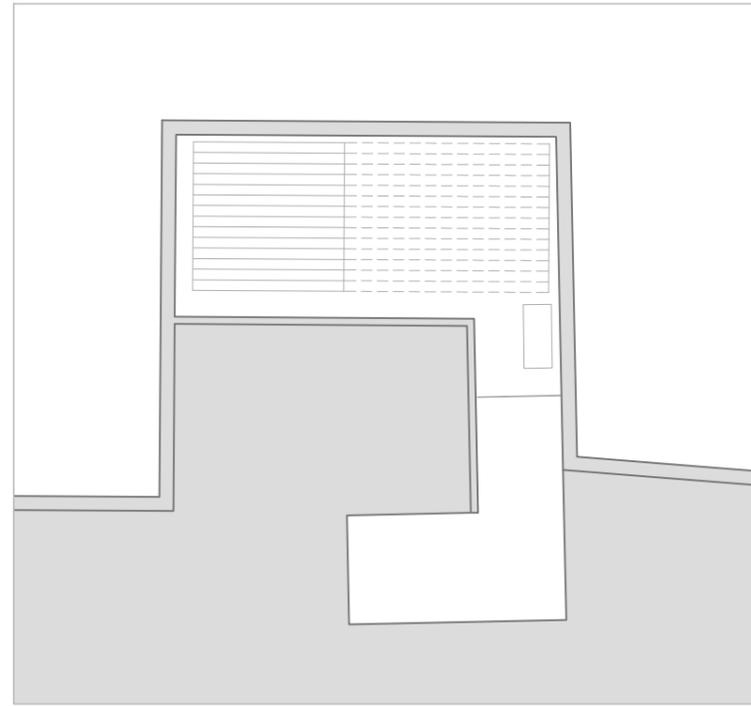
MUSEUM STARTGALERIE ARTOTHEK

Address: Simmering, Vienna, Austria

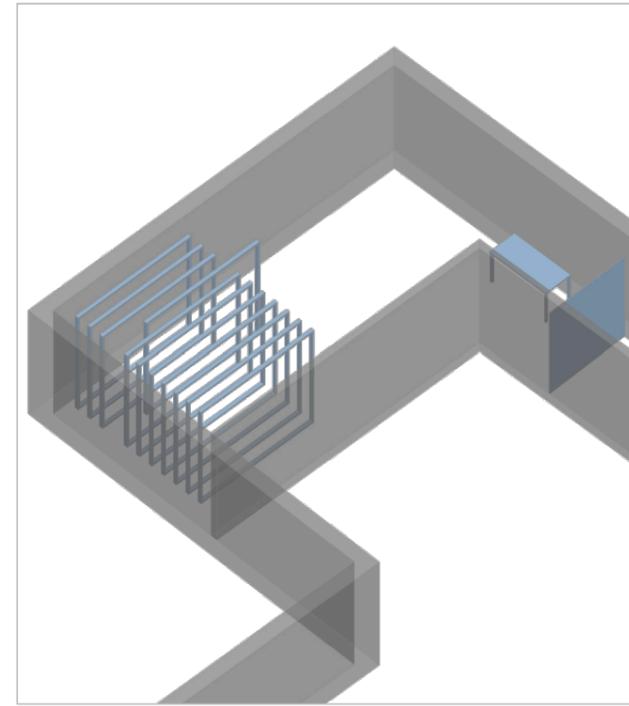
Space: Storage area

Location: Second and third floor

Architect: Architekturbüro Karl Reuter



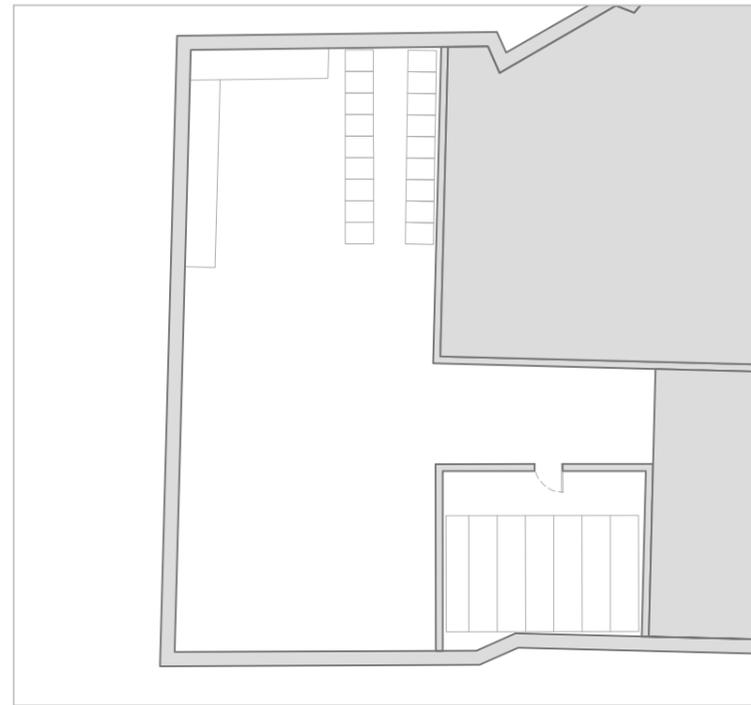
North storage plan
Scale 1:200



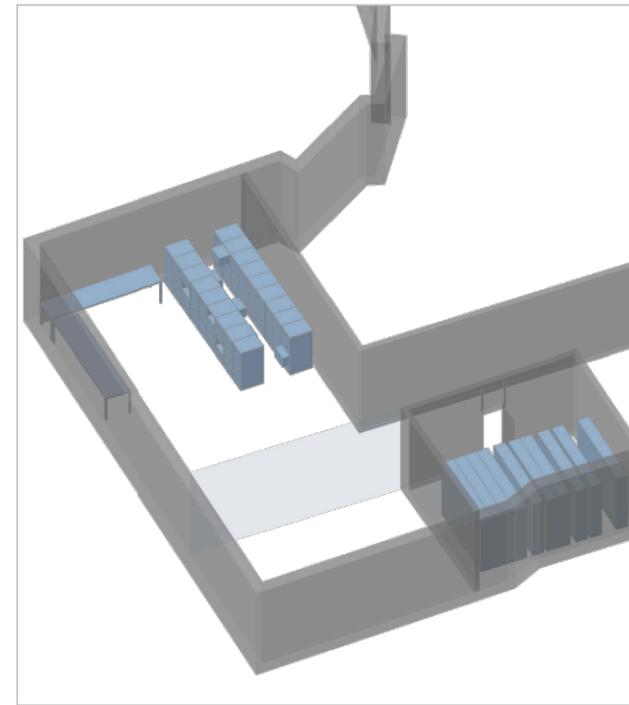
North storage - 3D



Site plan
Scale 1:3000

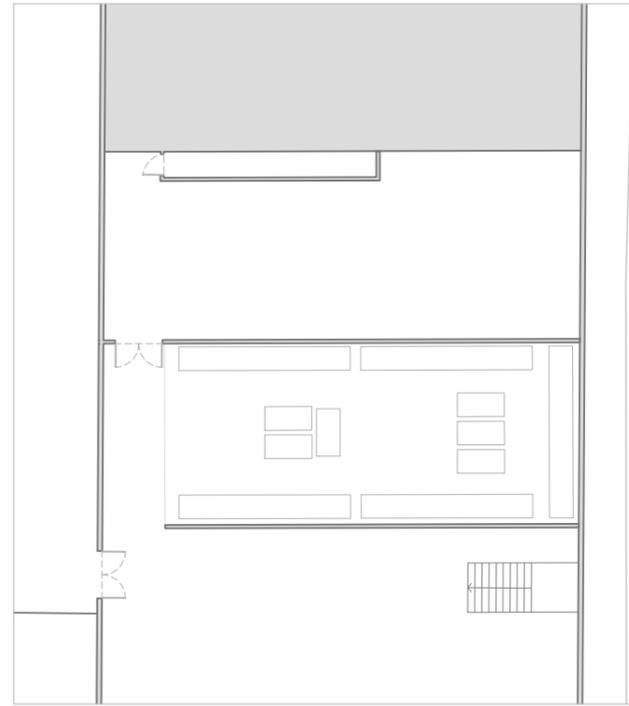


South storage plan
Scale 1:200



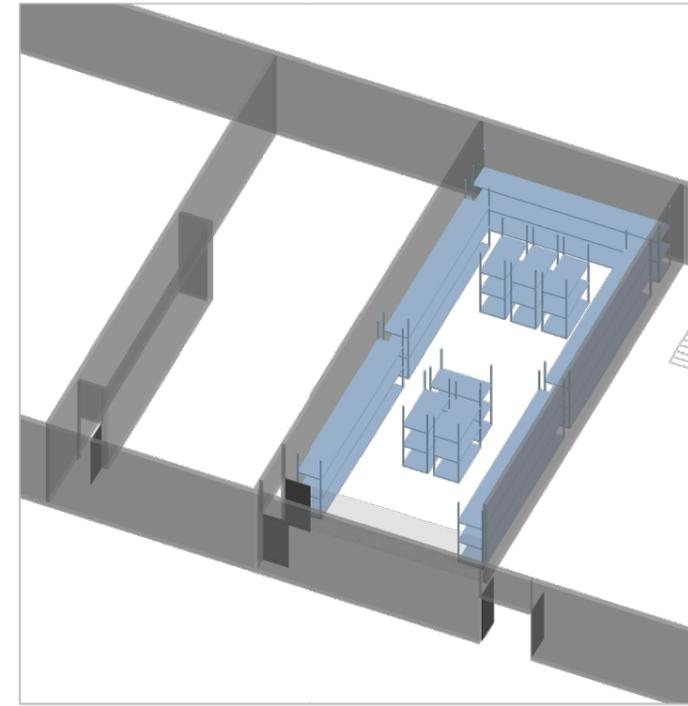
South storage - 3D

NEUE GALERIE GRAZ
Address: Neutorgaße, Graz, Austria
Space: Storage area
Location: Third floor
Architect: Nieto Sobejano Arquitectos
& eep architekten



Confidential information deleted

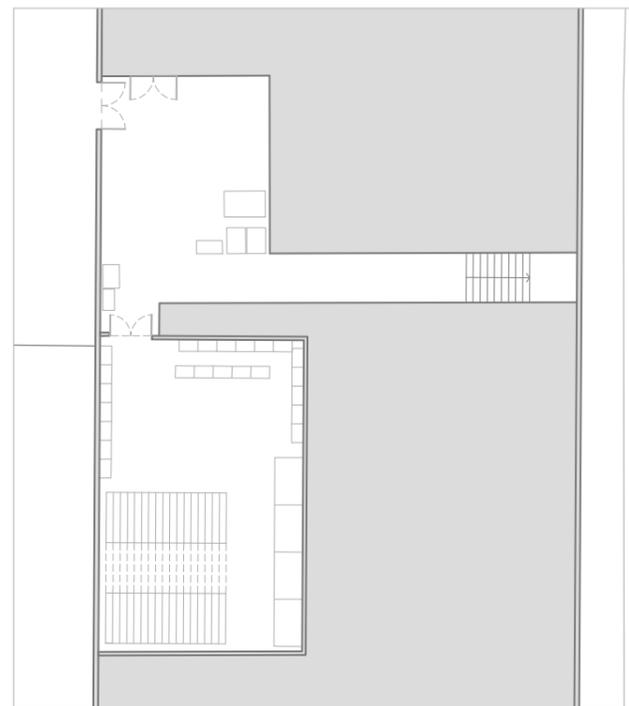
Scale 1:300



Confidential information deleted

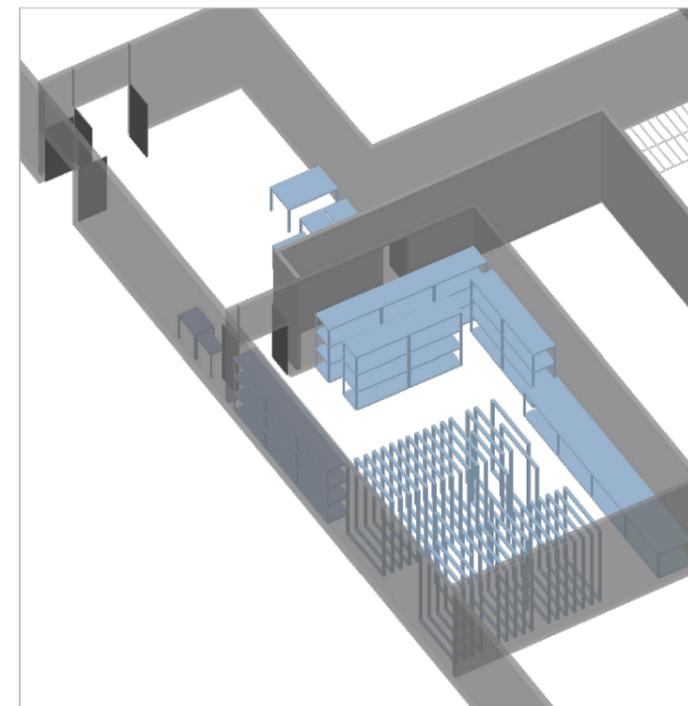


Site plan
Scale 1:2000



Confidential information deleted

Scale 1:300



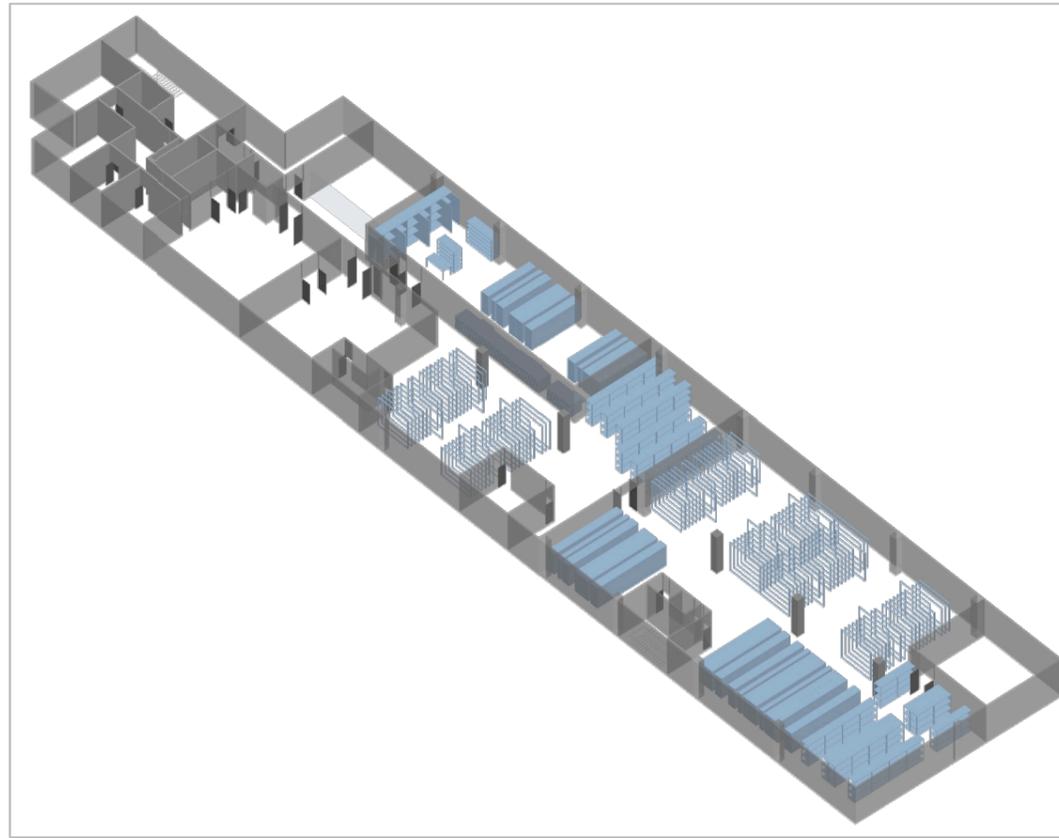
Confidential information deleted

NEUE GALERIE GRAZ
Address: Lastenstraße, Graz, Austria

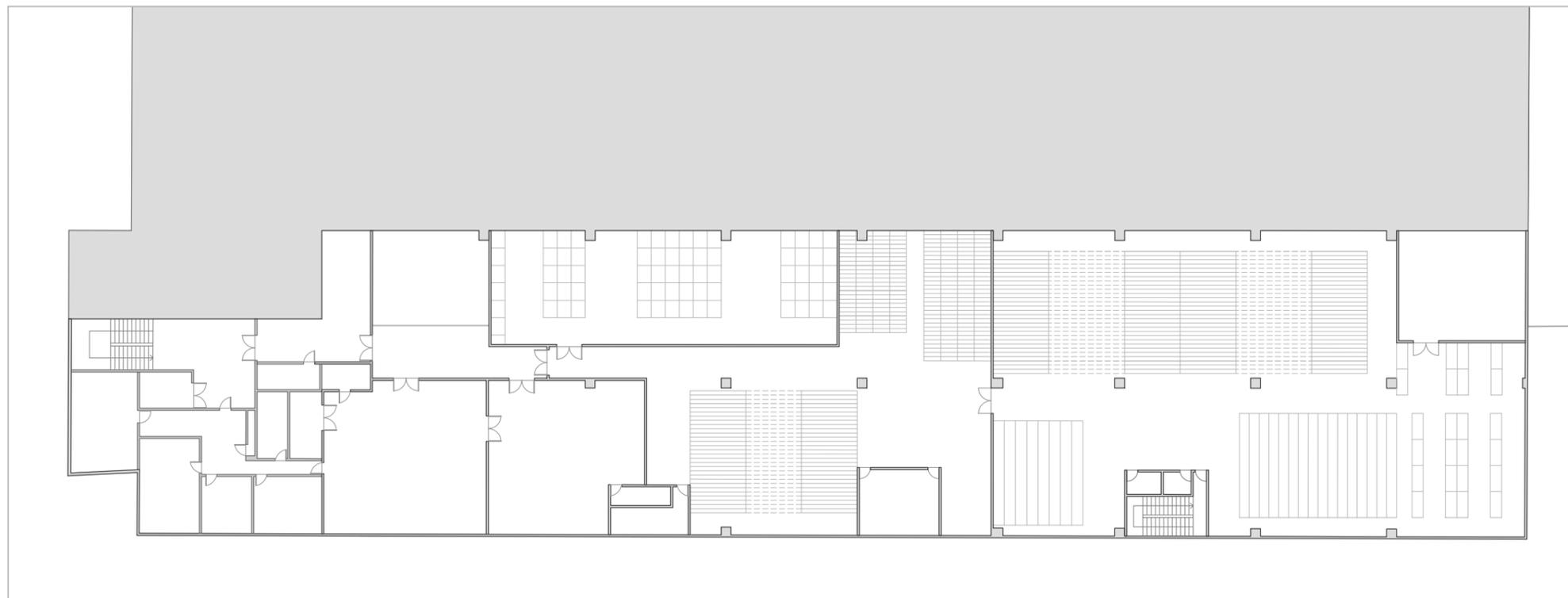
Space: Storage area
Location: Groundfloor, -1 floor



Site plan
Scale 1:3000

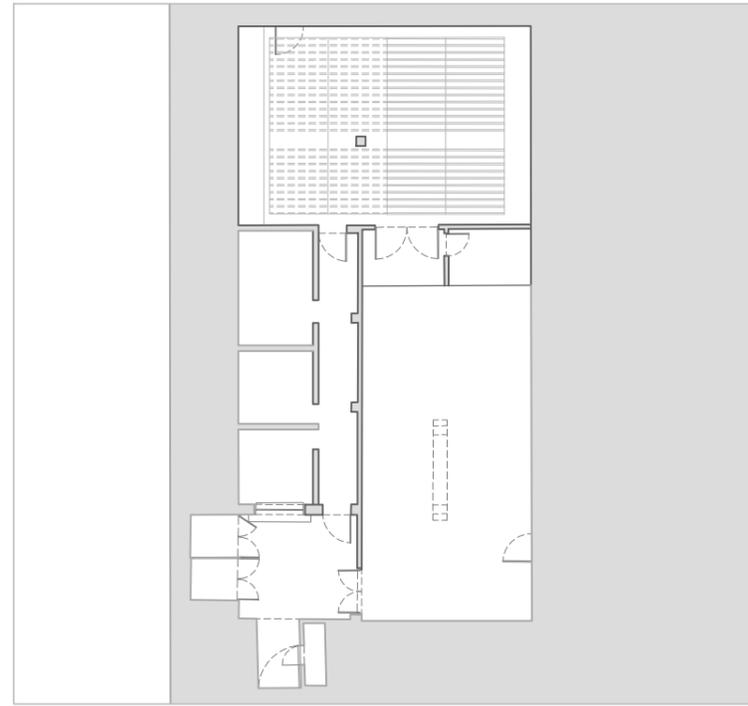


3D of the storage area

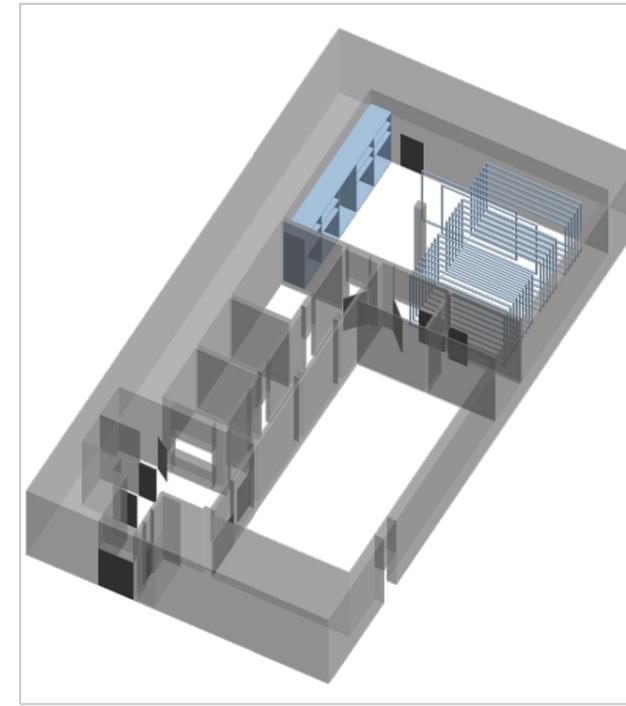


Storage area plan
Scale 1:400

NEUE GALERIE GRAZ
Address: Weinsöttlstraße, Graz, Austria
Space: Storage area
Location: First floor
Architect: Skacel Forenbacher architects



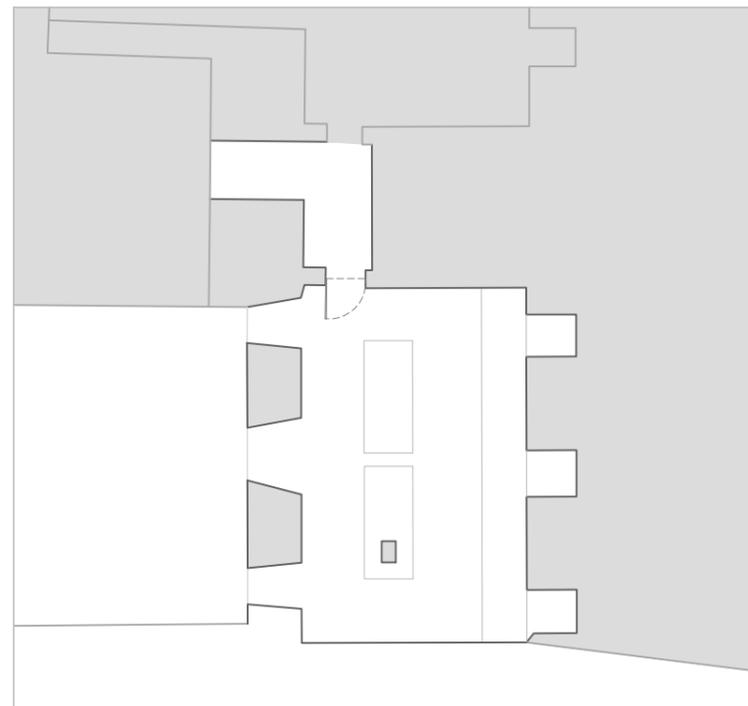
Groundfloor storage plan
Scale 1:250



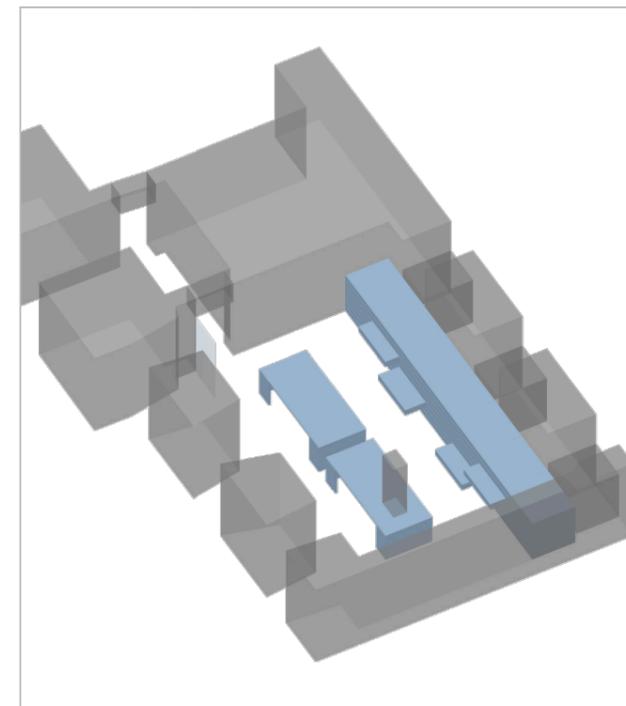
Groundfloor storage - 3D



Site plan
Scale 1:3000



Second floor storage plan
Scale 1:200



Second floor storage - 3D

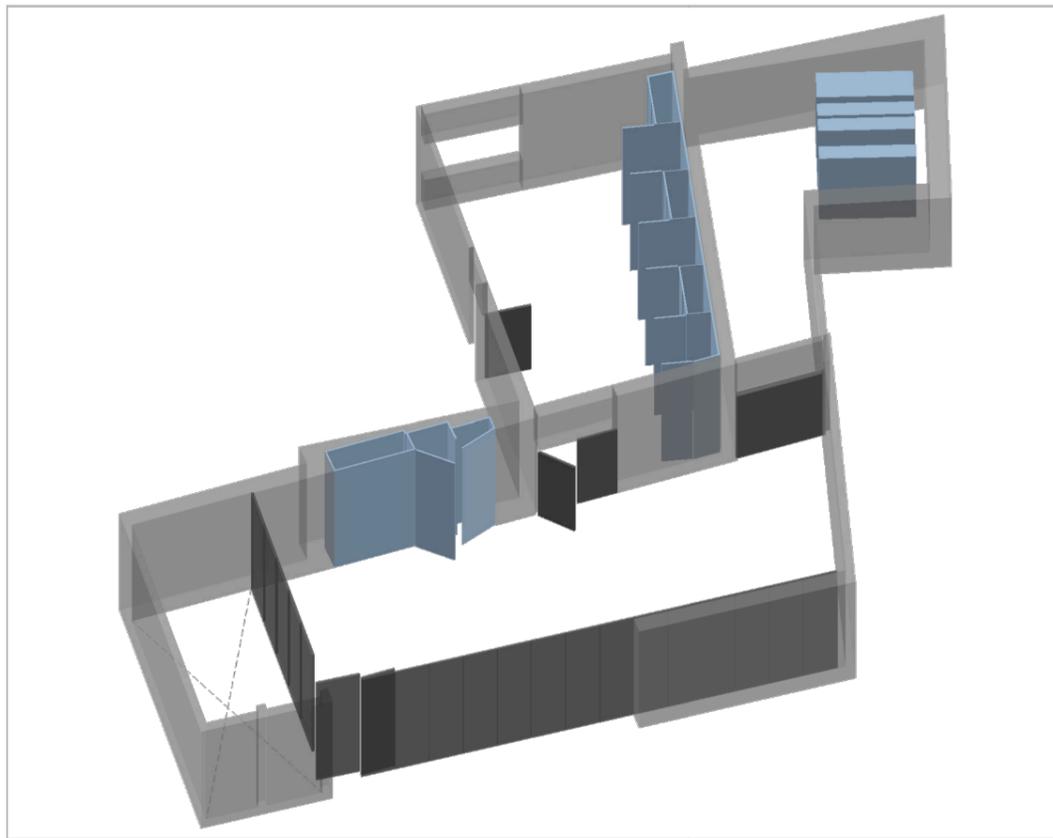
MUSEU NACIONAL DE ARTE CONTEMPORÂNEA
- MUSEU DO CHIADO
Address: Rua Serpa Pinto, Lisbon, Portugal

Space: Storage area
Location: Groundfloor and second floor

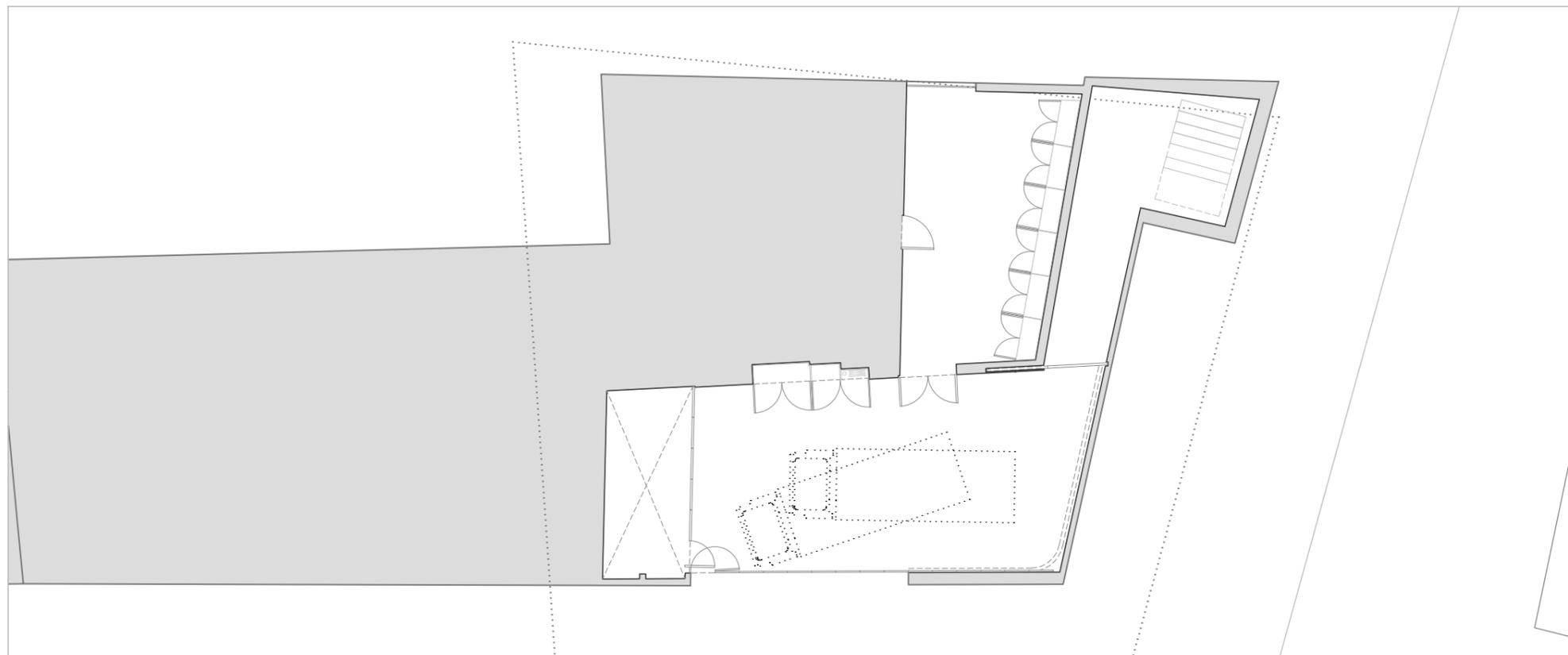
Architect: Wilmotte & Associés



Site plan
Scale 1:1500



3D of the storage area



Storage area plan
Scale 1:200

CENTRO DE ARTE CONTEMPORÂNEA GRAÇA MORAIS

Address: Rua Abílio Beça, Bragança, Portugal

Space: Storage area

Location: Groundfloor

Architect: Souto Moura Arquitectos

INFORMATION SHEET - MUSEUM STARTGALERIE ARTOTHEK

Date of Visit: 13.07.2016

Contact person: curator Gunda Achleitner

Photo of the Museum exterior



Museum Implantation



MUSEUM IDENTIFICATION

Name:	MUSA - Museum Startgalerie Artothek
Address:	Felderstrasse 1, 1010 Wien
Contacts:	(+) 431 4000-8400 musa@musa.at
Website:	www.musa.at
Foundation of the collection:	1951
Public opening date:	June 2007
Guardianship:	Cultural Affairs Department of Vienna
Director:	Berthold Ecker
Architect of the museum:	August Kirstein remodeled by: Kiskan Kaufmann Architekten
N° of objects in the collection:	40.000

ARCHITECTURE - MUSEUM GENERAL CHARACTERIZATION

Implantation and urban integration:	Centre of the city, in front of the Townhall
Origin of structure (new, rehabilitation):	Original building: 1916 Rehabilitation: 2005-2007 Architect: Kiskan Kaufmann Architekten
Implantation area:	unknown

FELDERSTRASSE STORAGE AREA

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	In the basement
Origin of structure (new, rehabilitation):	Original building built in 1916; adaptation (2005-2007)

Type of building structure: Reinforced concrete and masonry structure
 Gross storage area: 315,81 m²
 Structural load of the floor: -

STORAGE ORGANIZATION

N° of objects in the storage: 5.000
 Number of rooms: 3
 Type/Functions of rooms: 1st room - "Manipulation Room" (exhib. support, catalog)
 "Lab space" (mostly paintings)
 videos & photographs Room
 Type of Storage equipment: Shelves, slidding drawers and walls, boxes
 Programmes used: Digital system called "Artefact" + physical catalogue

SECURITY-SYSTEMS USED

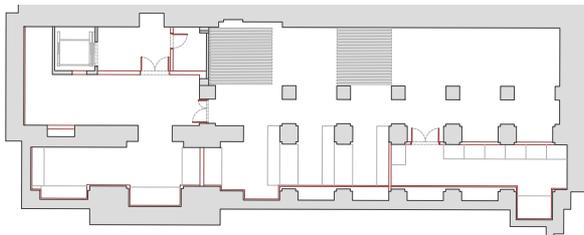
Intrusion detection: Code and transponder key, video and guard surveillance
 Fire and smoke detection: Automatic detection system with closing doors; fire extinguishers

ENVIRONMENTAL CONTROL

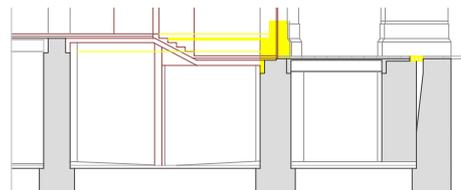
		Levels
Light	Artificial (type unknown)	-
	"Manipulation Room"	(not climatized)
Temperature & R.H.	"Lab space"	18,7 °C; 48% RH
	Photographs and video room	15 °C; 47% RH

TECHNICAL DRAWINGS

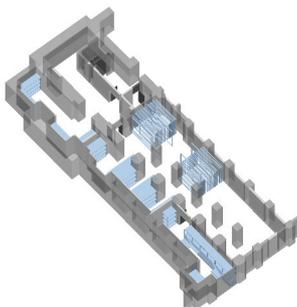
Plan



Sections



3D



SIMMERING STORAGE AREA

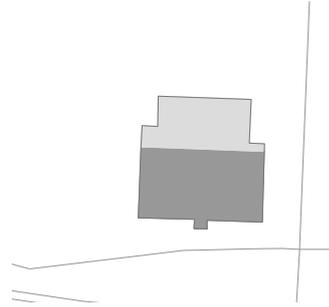
Date of Visit: 17.11.2016

Contact person: curator Gunda Achleitner

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	Second and third floors
Origin of structure:	New purpose-built warehouse (2014-2015)
Architects of the project:	Architekturbüro Karl Reuter
Gross storage area:	2.500 m ²
Structural load of the floor:	1 ton/m ²

STORAGE ORGANIZATION

N° of objects in the storage:	15.000
Number of rooms:	3
Type/Functions of rooms:	Sculptures and instalations' room Paintings' room Mixed art storage and crating area
Type of Storage equipment:	Adjustable metal shelving and slidding rack storage with wire screening
Programmes used:	Digital system called "Artefact" + physical catalogue

SECURITY-SYSTEMS USED

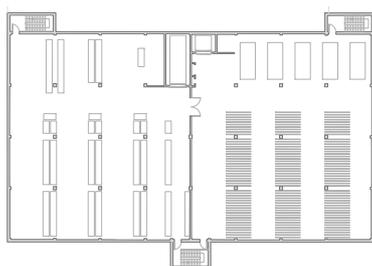
Intrusion detection:	Code and key-card, video and guard surveillance
Fire and smoke detection:	Automatic detection and extinguishing system with closing doors; specific access doors for firemen; fire extinguishers

ENVIRONMENTAL CONTROL

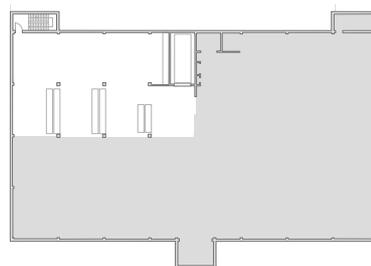
Light:	Artificial (type unknown)	Levels
Temperature & R.H.	All rooms	- 20 °C; 55% RH

TECHNICAL DRAWINGS

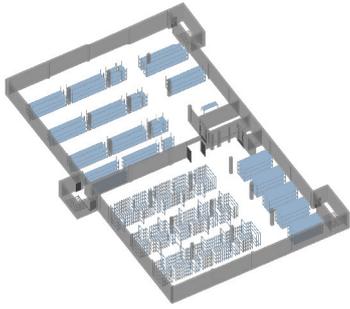
Plan (second floor)



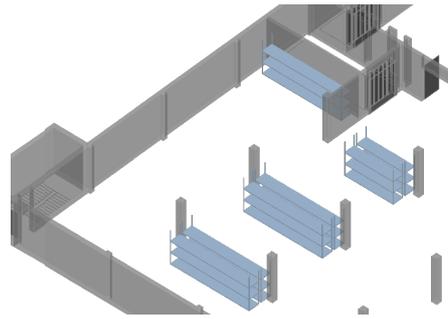
Plan (third floor)



3D (second floor)



3D (third floor)



Acronyms: S.U. - Storage Unit; R.H. - Relative Humidity

INFORMATION SHEET - NEUE GALERIE GRAZ

Date of Visit: 11.07.2016

Contact person: curator Gudrun Danzer

Photo of the Museum exterior



Museum Implantation



MUSEUM IDENTIFICATION

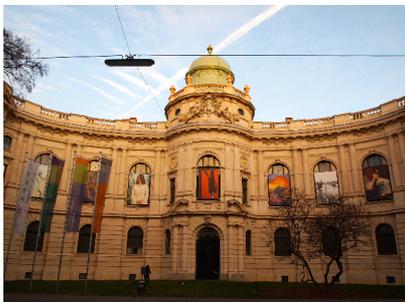
Name:	Neue Galerie Graz - Storage in Andritz (Weinzottlstrasse 16, 8045 Graz)
Address:	Kalchberggasse 8010 Graz, Austria
Contacts:	(+) 43-316/8017-9100 joanneumsviertel@museum-joanneum.at
Website:	www.museum-joanneum.at/en/neue-galerie-graz
Foundation date of the museum:	1941; located in its current building since 2011
Guardianship:	Universalmuseum Joanneum GmbH - Dr. Wolfgang Muchitsch
Director:	Mag. Dr. Peter Peer
Architect of the museum:	D.Sciassia (1665); A.Gunolt (1890); NietoSobejano+eep (2011)
Nº of objects in the collection:	more than 60.000

ARCHITECTURE - MUSEUM GENERAL CHARACTERIZATION

Implantation and urban integration:	Located in the Joanneumsviertel complex
Origin of structure (new, rehabilitation):	First building built in 1665 Recent project in 2006-2011 Architects: Nieto sobejano + eep
Implantation area:	unknown

KALCHBERGGASSE STORAGE AREA

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	Third floor
Origin of structure (new, rehabilitation):	First building built in 1665 Recent project in 2006-2011

Type of building structure: Stone masonry structure
 Gross storage area: unknown
 Structural load of the floor: unknown

STORAGE ORGANIZATION

N° of objects in the storage: unknown
 Number of rooms: 3
 Type/Functions of rooms: Paintings' room
 Photographs and video art room
 Documentation room
 Type of Storage equipment: Metal shelves, sliding panels, metal drawers, high-density storage system
 Programmes used: Digital system called "Filemaker" + physical catalogue

SECURITY-SYSTEMS USED

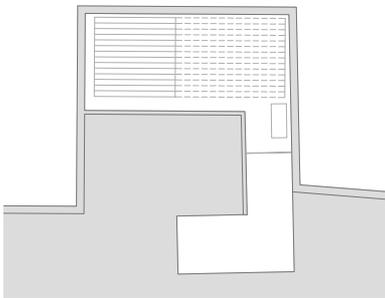
Intrusion detection: Code and key-card, video and guard surveillance
 Fire and smoke detection: unknown

ENVIRONMENTAL CONTROL

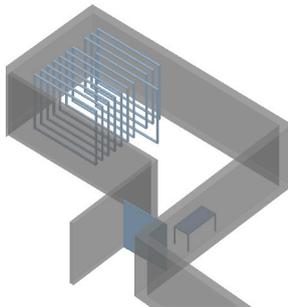
Light	Artificial (type unknown)	Levels
Temperature & R.H.	unknown	-
		-

TECHNICAL DRAWINGS

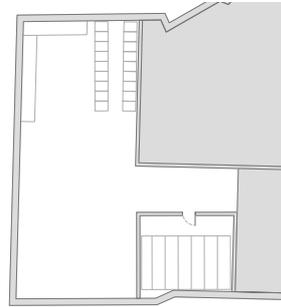
Plan (paintings' storage room)



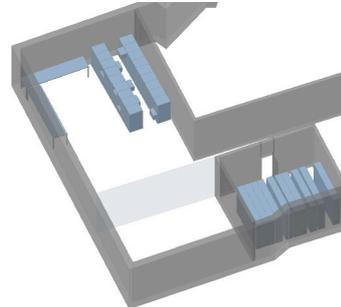
3D (paintings' storage room)



Plan (archive and video & photography storage rooms)



3D (archive and video & photography storage rooms)



LASTENSTRASSE STORAGE AREA

Date of Visit: 22.11.2016

Contact person: curator Gudrun Danzer

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	Ground floor and basement
Origin of structure (new, rehabilitation):	Warehouse (not adapted to store artworks)
Type of building structure:	Saw-tooth shed
Gross storage area:	340 m ²
Structural load of the floor:	500 kg/m ²

STORAGE ORGANIZATION

N° of objects in the storage:	unknown
Number of rooms:	3
Type/Functions of rooms:	Sculptures' room Confidential information deleted Paintings' room Confidential information deleted Sculptures and paintings' room Confidential information deleted
Type of Storage equipment:	Metal shelves, sliding panels
Programmes used:	Digital system called "Filemaker" + physical catalogue

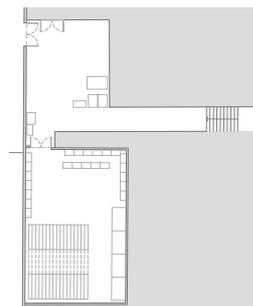
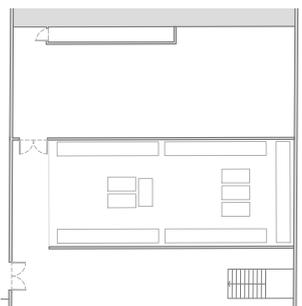
SECURITY-SYSTEMS USED

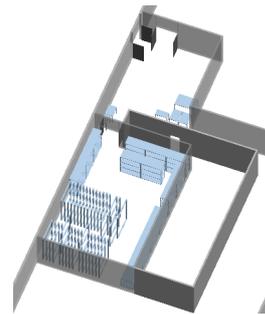
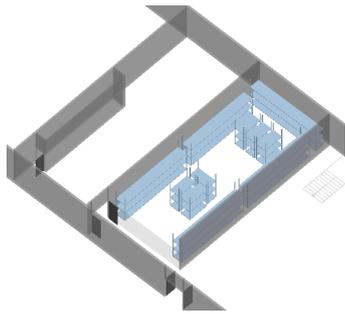
Intrusion detection:	Video and guard surveillance
Fire and smoke detection:	Automatic detection system; fire extinguishers

ENVIRONMENTAL CONTROL

Light	Artificial (type unknown)	Levels
Temperature & R.H.	The rooms are not mechanically acclimatised	-

TECHNICAL DRAWINGS





WEINZÖTTLSTRASSE STORAGE AREA

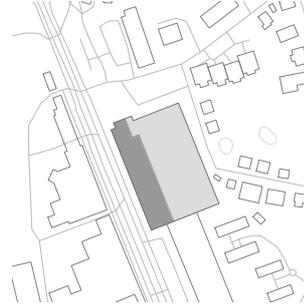
Date of Visit: 14.07.2016

Contact p.: Mag. Brigitte Lampl & Dr. Paul-Bernhard Eipper

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	First floor
Origin of structure:	Adapted industrial building
Architects of the project:	Wemmers Skacel Forenbacher architects
Gross storage area:	1.508 m ²
Structural load of the floor:	750 kg/m ²

STORAGE ORGANIZATION

N° of objects in the storage:	56.000
Number of rooms:	6
Type/Functions of rooms:	Resting area Paintings' room Graphic room Sculptures' room Restoration room
Type of Storage equipment:	Metal shelving, slidding rack storage with wire screening, metal drawers, high-density storage system
Programmes used:	Digital system called "Artefact" + physical catalogue

SECURITY-SYSTEMS USED

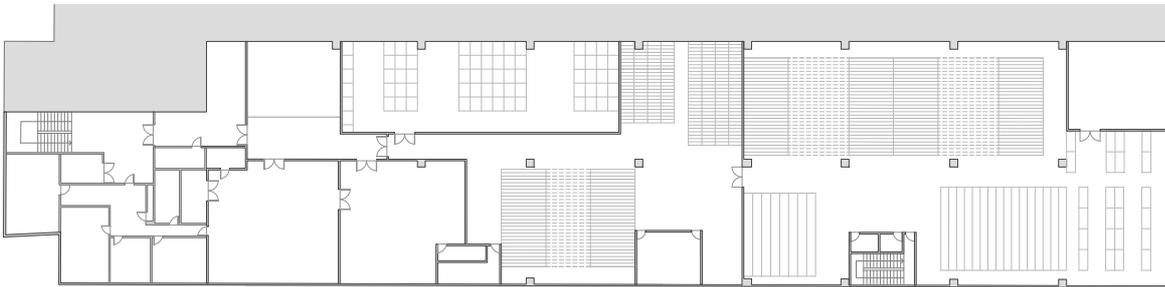
Intrusion detection:	Code and transponder key; video and guard surveillance
Fire and smoke detection:	Automatic detection system; fire extinguishers

ENVIRONMENTAL CONTROL

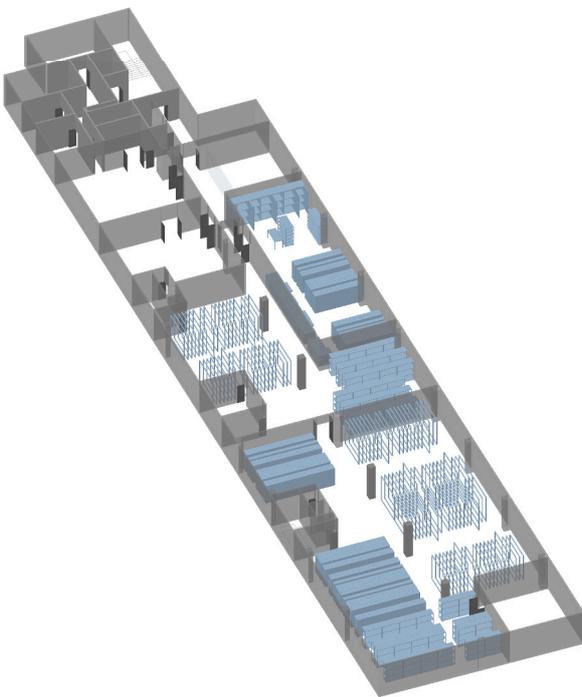
		Levels
Light	Artificial and natural (use of U.V. film)	-
	Resting area	unknown
	Paintings' room	Summer: 25 °C; 55% R.H. Winter: 20 °C; 40% R.H.
Temperature & R.H.	Graphic room	19,7 °C; 45% R.H.
	Sculptures' room	unknown
	Restoration room	Summer: 25 °C; 55% R.H. Winter: 20 °C; 40% R.H.

TECHNICAL DRAWINGS

Plan



3D



Acronyms: S.U. - Storage Unit; R.H. - Relative Humidity; U.V. - Ultra Violet

INFORMATION SHEET - MUSEU NACIONAL DE ARTE CONTEMPORÂNEA - MUSEU DO CHIADO

Date of Visit: 13.12.2016

Contact person: curator Maria de Aires Silveira

Photo of the Museum exterior



Museum Implantation



MUSEUM IDENTIFICATION

Name:	MNAC – Museu Nacional de Arte Contemporânea do Chiado
Address:	Rua Serpa Pinto, 4 Rua Capelo, 13 1200-444 Lisboa
Contacts:	(+351 213 432 148 e-mail: museuchiado@mnac.dgpc.pt
Website:	http://www.museuartecontemporanea.pt/pt
Foundation date of the museum:	26 de Maio de 1911
Public opening date:	1911, re-opened in 1994
Guardianship:	Direcção-Geral do Património Cultural (DGPC)
Director:	Aida Rechena
Architect of the museum:	Wilmotte & Associés SA (restoration project)
Nº of objects in the collection:	5.319

ARCHITECTURE - MUSEUM GENERAL CHARACTERIZATION

Implantation and urban integration:	Centre of the city; next to the Beaux-Arts Faculty S. Francisco da Cidade convent (built in 1217); expansion by king D. Manuel I (1517); restoration work after fire by king D. João V (XVIII century); renovation project by Wilmotte & Associés (1994)
Origin of structure (new, rehabilitation):	
Architecture Intervention:	Date: 1991-1994 Architect: Wilmotte & Associés SA
Gross building area:	3.400 m ²

STORAGE AREA

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	Basement and top floor
Origin of structure (new, rehabilitation):	Original building built in 1217 Most recent architecture restoration project during 1991-94
Type of building structure:	Concrete and stone masonry structure
Gross storage area:	168 m ²
Structural load of the floor:	-

STORAGE ORGANIZATION

N° of objects in the storage:	1.500
Number of rooms:	2
Type/Functions of rooms:	Paintings and sculptures' room (basement) Drawings' room (top floor)
Type of Storage equipment:	Shelves, sliding metal panels and metal drawers
Programmes used:	Digital programme named "Matriz" + physical catalogue

SECURITY-SYSTEMS USED

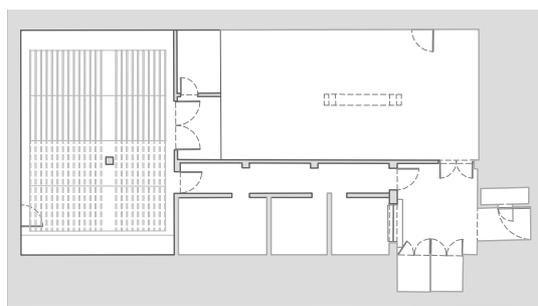
Intrusion detection:	Video and guard surveillance
Fire and smoke detection:	Automatic detection and extinguishing system; fire extinguishers

ENVIRONMENTAL CONTROL

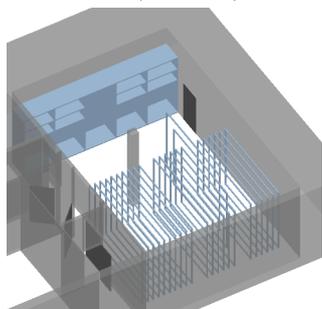
		Levels
Light	Artificial (fluorescent light) and natural (with U.V. film)	-
Temperature & R.H.	Paintings and sculptures' room	20-22 °C; 55-60% R.H.
	Drawings' room	20 °C; 55% R.H.

TECHNICAL DRAWINGS

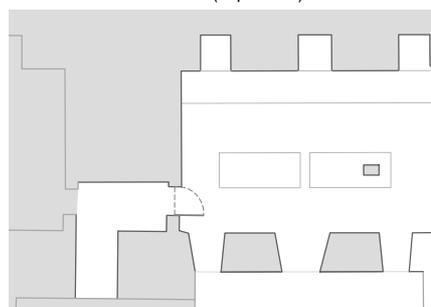
Plan (basement)



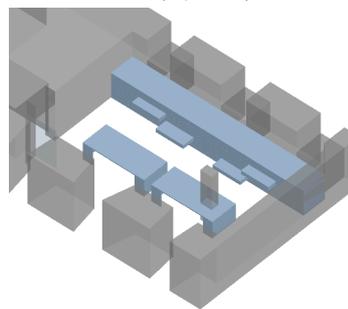
3D (basement)



Plan (top floor)



3D (top floor)



Acronyms: S.U. - Storage Unit; R.H. - Relative Humidity; U.V. - Ultra Violet

INFORMATION SHEET - CENTRO DE ARTE CONTEMPORÂNEA GRAÇA MORAIS

Date of Visit: 28.06.2017

Contact person: Director Jorge da Costa

Photo of the Museum exterior



Museum Implantation



MUSEUM IDENTIFICATION

Name:	Centro de Arte Contemporânea Graça Morais
Address:	Rua Abílio Beça, nº 105, 5300 – 011 Bragança
Contacts:	Tlf: (351) 273 302 410; E-mail: centro.arte@cm-braganca.pt
Website:	http://centroartegracamorais.cm-braganca.pt/pages/1
Foundation date of the centre:	2008
Public opening date:	30.06.2008
Guardianship:	Under the municipality's administration
Director:	Jorge da Costa
Architect of the museum:	Eduardo Souto de Moura (renovation and extension project)
Nº of objects in the collection:	130

ARCHITECTURE - MUSEUM GENERAL CHARACTERIZATION

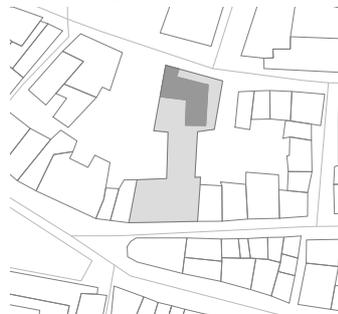
Implantation and urban integration:	City centre
Origin of structure (new, rehabilitation):	Original structure from the eighteenth century Restoration and new building project (2004-2008) Architect: Eduardo Souto de Moura
Gross building area:	-

STORAGE AREA

Storage Unit exterior photograph



Storage Unit implantation



ARCHITECTURE - STORAGE UNIT GENERAL CHARACTERIZATION

Implantation and building integration:	Ground floor
Origin of structure (new, rehabilitation):	Built new during the 2004-8 restoration and expansion project

Type of building structure: Concrete structure
 Gross storage area: 38,21 m²

STORAGE ORGANIZATION

N° of objects in the storage: 130
 Number of rooms: 3
 Type/Functions of rooms: Loading/unloading deck
 Exhibitions' preparation room
 Artworks' room
 Type of Storage equipment: High-density storage system
 Programmes used: Digital programme + physical catalogue

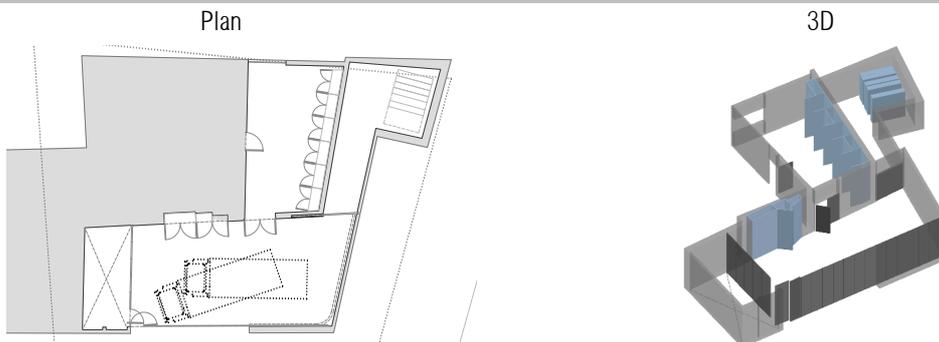
SECURITY-SYSTEMS USED

Intrusion detection: Video and guard surveillance
 Fire and smoke detection: Automatic detection and extinguishing system with closing door

ENVIRONMENTAL CONTROL

Light	Artificial (fluorescent light)	Levels
		-
Temperature & R.H.	Artworks' room	18 °C

TECHNICAL DRAWINGS



Acronyms: S.U. - Storage Unit; R.H. - Relative Humidity; U.V. - Ultra Violet