STRATEGIES IN ARCHITECTURAL CONSERVATION

CASE STUDY OF THE MACKINTOSH BUILDING AT THE GLASGOW SCHOOL OF ART

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INTRODUCTION TO ARCHITECTURE CONSERVATION, RESTORATION AND RECONSTRUCTION

Architectural heritage has a crucial role in forming the national identity, the cultural consciousness and the quality of our lives. We value buildings for different reasons: some places are important for us personally, for example, the house we grew up or the first school we went to; other places are appreciated by a group of people and even have national or global importance. Therefore, almost everybody would agree on the importance of keeping specific places conserved as a part of the historical heritage.

Historic buildings have architectural, aesthetic, historic, economic, social and even spiritual and symbolic values. Looking at architecture as a symbol is only the start of listing the reasons for architecture conservation and restoration. For example, the Big Ben is a symbol of London and an icon of the parliament in the capital; the Eiffel Tower is a symbol of Paris, most of the cities have their iconic buildings – symbols of the cultural identity and continuity – a significant part of the heritage. Architecture can become symbolic due to many characteristics – the shape, the kind of the construction, the materials, the details – they all contribute to the way we read a building.

Furthermore, conservation of architectural monuments may be a cultural aspect of it but it also makes a financial contribution to the national incomes of many countries. For example, as Greece and Britain are having their main income on the monuments and buildings that people are visiting, many other places rely on the number of visitors too. The local economies of many countries rely on it and the number of visitors.[1] Another fundamental reason for building conservation is that some places contain information which could not be photographed, filmed or documented, in a way to represent the experience of the actual place. Historic buildings give us knowledge about the people and culture of their time and place. When a building has been conserved, it is an acknowledgment of its cultural and historic importance, keeping it alive for the future generations.

1. Bernard Feilden, *Conservation of Historic Buildings*, (Oxford: Butterworth-Heinemann, 1994),3

Conservation is the action to prevent decay. Of the causes of decay in historic buildings, the most universal are gravity, followed by the actions of man and then climate and environmental effects. The conservation process includes all the activities of looking after a place in order to retain its cultural significance. It includes **maintenance, preservation, restoration, reconstruction and adaptation**, in many cases, it is a combination of two or more of these. All of the actions, included in the conservation, are different but they act together. [2]

Maintenance involves protecting the building by controlling the environment, in order to prevent decay. It includes control of the humidity, the temperature, and light, as well as measures to prevent from fire, theft or vandalism. The object of the preservation is to keep the cultural property in its existing state and to prevent any damage in order to preserve the structure.

Restoration aims to revive the original concept. It includes replacing of missing or decayed elements, integrating them harmoniously with the original structure. Reconstruction of valuable historic buildings may be needed after disasters such as fire, earthquake or war. It must be executed based on documents and evidence and even upon assumptions. [3]

Within the whole conservation process, it is important to work with a variety of professionals to truly understand the layering of a place, for instance, archaeologists, architects, engineers, planners, landscape architects, suppliers, museum professionals. Architects have an important role in the process of maintaining and repairing buildings' structures and functions. It is their task to ensure that the interventions are not damaging the structure or the historic significance. They also have the skill and knowledge to read buildings on many different levels and analyse the significant features of the building. Architects who have not taken the time to read and understand the building risk not only to damage significant historic fabric but also to waste time designing inappropriate alterations. They should have good knowledge of all periods of architecture, combined with a detailed understanding of modern building practice.

2. Feilden, 3
3. Feilden, 12

The role of the conservation architect is to preserve the historical and artistic value of the old structure and design schemes which are satisfactory to the modern requirements. That is why before considering any actions it is important to carry out a careful analysis of the building – the construction and the materials, the relation with the site, and after that to make any decisions about the future of the place and propose any changes. Furthermore, a part of the professional's duties is to inform the owner of the building how to look after the place in future in order to avoid damage in future.

A crucial aspect of the conservation is keeping the messages and the values of cultural property. The values assigned to a cultural property come under three major headings: emotional values, cultural values, and use values. Prioritising them is essential in order to make a decision which interventions could be made, without damaging the significance of the building. [4]

The intervention on historic monuments by specialized professionals demands historical, technical and methodological knowledge. The conservation of historic buildings forms an inter-professional discipline combining a variety of aesthetic, historic, scientific and technical methods. By its very nature, conservation is a multidisciplinary activity, involving a range of experts, who respect one another's contribution and cooperate to form an effective team. It has taken centuries to articulate the progress of philosophical, aesthetic and technical progress, in order to form the modern principles for organisation and application of the conservation interventions.

4. Feilden,7

THEORIES OF ARCHITECTURAL CONSERVATION

The principles for protecting heritage have been developed throughout the history and significantly influenced the modern methods for architecture conservation. Heritage has been evaluated differently during the different periods and the idea about preserving it has changed through the time. Authors and their theories have complemented or contradicted one another by creating new approaches and perspectives.

John Ruskin (1819-1900) and Eugene Viollet-le-Duc (1814-1879) are considered by many authors to be the first true conservation theorists. They were leading figures of architectural monument protection theory. John Ruskin was a prominent art critic of the Victorian era, his writings "Seven lamps of architecture" and "The stones of Venice" (1853) were very influential and they are still in print today. According to Ruskin, the signs of history are one of the most valuable features of the object, because they are part of it, representing its history and without these signs of the past, the object would lose the important elements of its actual nature. In "Seven lamps of architecture" he wrote that architects must keep the history of the buildings as a precious heritage. For him, nothing new should distract the fragments of the past. Ruskin credits the process of restoration of a building as "the worst manner of destruction... Restoration is always a lie... It is impossible, as impossible as to raise the dead...". According to him, the traces of the hands' craftsman in combination with the traces of the time, create an exalted unity and even a very accurate reproduction with modern tools has no value compared to the original. [5]

In 1877 based on the teaching of Ruskin, William Morris founded Society for the protection of Ancient buildings (SPAB). He took Ruskin's idea one step further, suggesting that ancient buildings should be repaired, not restored, in order to keep the whole history as a cultural heritage. The SPAB manifesto states that "we are guardians of the ancient buildings and we inherit, for future generations. We should not feel free to do with them as we please now." [6] The society's main purpose is to guide the work of the restoration of ancient buildings in order to prevent their destruction in the fabric and the authenticity. It is still very active

5. John Ruskin, *Seven lamps of architecture* (Sunnyside, Orpington, Kent, 1889), 162
6. Nick Lee Evans, *An introduction to architectural conservation* (London: RIBA Publishing ,2014) , 6

MODERN CONSERVATION STRATEGIES

While it is true that we can never restore buildings back into their original condition, does it mean they should be left to be destroyed by time, weather and the alterations of men? I do not believe so. Buildings can be conserved very smartly and efficiently, remaining true to the vision of the architect and at the same time being functional for their current use.

There is a variety of reasons why buildings might need to go through changes. Firstly, no buildings stay absolutely the same when the time passes. Furthermore, when the needs of the people change, so some buildings may become redundant and need a new use. However, it is vital to balance the need for change against the significance of the structure.

Preserving the character of a building does not necessary mean preventing change. Old buildings sometimes have to go through changes in order to adapt them for modern occupation and conserve them better. However, when new facilities have to be incorporated in the building, it should be executed in carefully, without damaging the significance of the place or the fabric of the building. That is why there are basic principles in architectural conservation and restoration, which architects should follow in order to avoid damaging the historic fabric. Before considering any change, the building should be examined carefully on different levels, which includes analysing its age and style, the relation with the site, as well as construction method and the use of materials. What is significant about the building should also help figure how to look after it and what interventions could be appropriate. After the analysis decisions for the future of the building could be made and it could be developed a conservation plan. A crucial part of the whole process is the record keeping. The state of the place, before any change is made, should be carefully documented to avoid the loss of any information.

The question of how to look after the ancient building is also the main subject of ICOMOS (the International Council on Monuments and Sites) - the only global non-government organisation of this kind, devoted to promoting the application of theory, methodology and scientific techniques to the conservation of architectural and archaeological heritage. Its work is based on the regulations set in the International

Charter on the Conservation and Restoration of Monuments and Sites in 1966(the Venice Charter) and it works as a guide for the conservation architects nowadays. Eleven years after the adoption of the Venice Charter, Australia ICOMOS started to examine the applicability of the Charter in Australia.[8]

At a meeting in 1979 in the historic mining town of Burra was adopted the Australia ICOMOS charter for the conservation of places of cultural significance, given the short title **Burra Charter**.[9] Burra Charter provides a guidance for the conservation and the management of places of cultural significance and it is based on the knowledge and experience of Australia ICOMOS members. It defines the basic principles and procedures to be followed in the conservation of heritage places and it is used not only by architects and archaeologist but by everyone involved in the conservation process, e.g. property owners and managers, legislators and administrators of planning laws, member of the National Trust and other community conservation organisations. As it is defining the basic principles of conservation it could be used as a guideline for the conservation of a wide range of places – ruins, monuments, courthouses, archaeological sites and even rock paintings and engravings.

Article 1of the chapter consists the definitions, included in it, and descriptions of their meaning, in order to make the text unambiguous. The Burra Charter identifies three levels of repair for heritage structures.[10]

- Preservation - Maintaining the fabric of a place in its existing state and preventing further deterioration.
- Restoration - Returning the fabric of a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.
- Reconstruction - Returning a place as nearly as possible to a known earlier state and is distinguished by the introduction of new materials to the fabric.

8. ICOMOS, Introducing ICOMOS. International Council on Monuments and Sites, 2011-2015. accessed on 15.12.2016, https://www.icomos.org/en/about-icomos/mission-and-vision/mission-and-vision
9. Peter Marquis-Kyle and Meredith Walker, *The Illustrated Burra Charter: Making good decisions about the care of important places* (Australia: Australia ICOMOS Inc., 1994), 7
10. Peter Marquis-Kyle and Walker, 22

The main idea of the charter is that conservation is not only to preserve and repair the building physically but to maintain its cultural significance in whatever way this could be achieved. The approach to conservation is individual according to the place, however, the essential steps to follow the Charter are:

1. Understand the significance of the place – gather and analyse evidence
2. Develop policy – decide conservation strategy
3. Manage in accordance with the policy

The chapter states that the existing fabric should be respected and during the conservation process the physical changes should be kept to a minimum.[11] It emphasises that very often it is needed more than one person to contribute the analyse of the building and the planning for the conservation. The conservation should consider all the aspects of the cultural significance. If the applied knowledge, skills or even care are not enough, then some aspect could be discounted.

Conservation demands cultural, historical and technical knowledge it is a complex activity, involving many professionals from different fields, working towards the same goal. The main reason for that is that the different professionals can develop a more refined understanding than one person. When more specialists are involved in the conservation process, then the full scope of the cultural significance could be discovered and the best decisions could be made. According to article 4 "conservation should make use of all the disciplines which can contribute to the study and safeguarding of a place". [12]

Specialist knowledge and experience are required to identify the major problems and find the appropriate solution, suitable in long term. The modern techniques and materials should be used very carefully, simply because some of them may be ineffective or even distractive. Very often in architectural conservation, it is necessary to introduce new services, in order to adapt the building for its current occupation. The new facilities in the building should not interact with the fabric or damage the cultural significance.

11. Peter Marquis-Kyle and Walker, 26
12. Peter Marquis-Kyle and Walker, 29

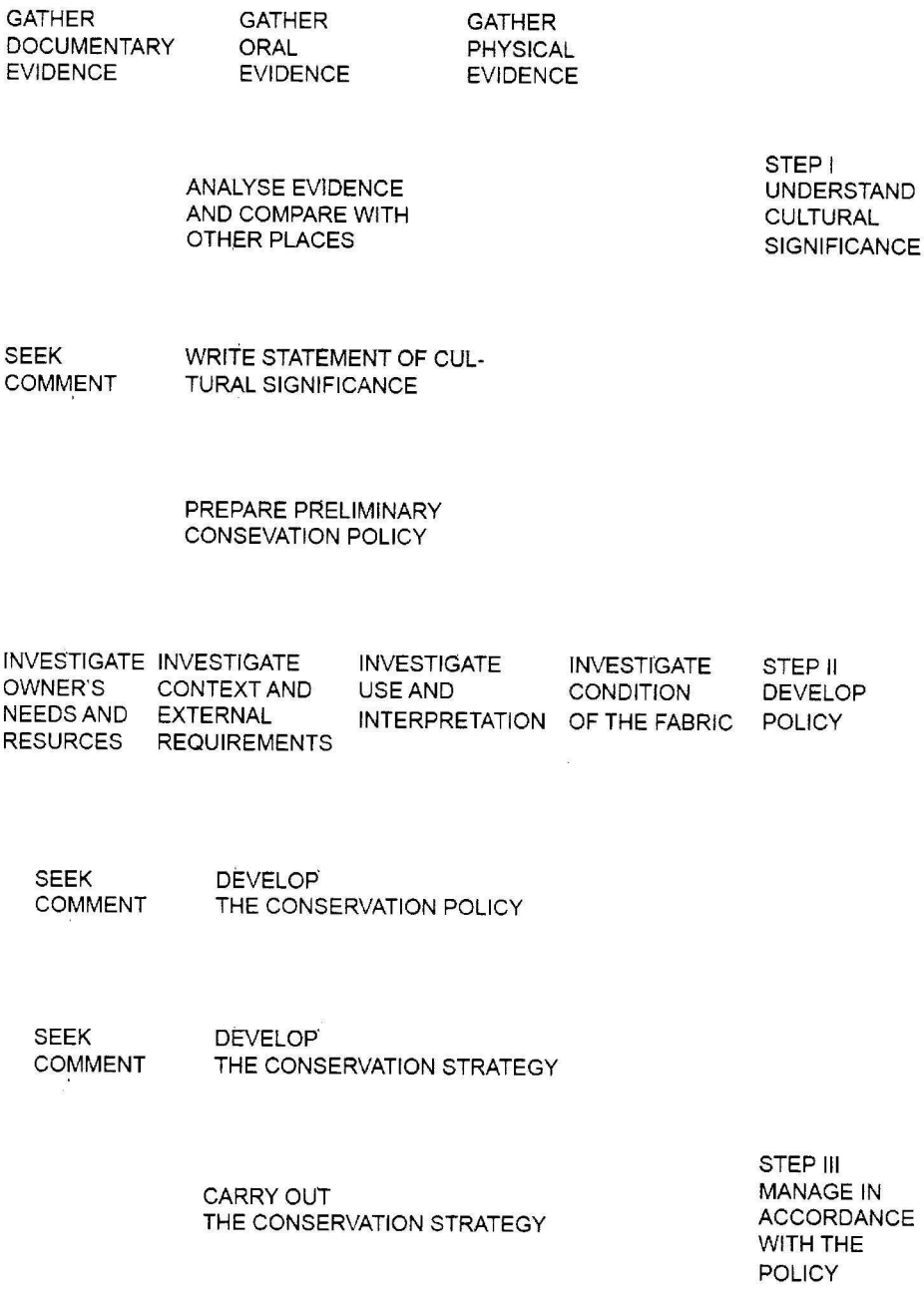

Figure 2. Diagram illustrating the decision-making process according to Burra Charter

CASE STUDY INTRODUCTION

The restoration of the Mackintosh building

Figure 3 'The Mack', North elevation

The Glasgow school of art was originally founded in 1845 as Glasgow's Government school of Design, and it changed its name to Glasgow School of Art in 1853. In 1885 Frans Newbury became a director of the school in 1885. Due to his skilled leading of the school, the number of students increased significantly and required a new building to accommodate the activities. An architectural competition for designing the new building of the Glasgow School of art was announced in 1896. The local practice Honeyman & Keppie won the competition with an outstanding design, which was the work of Charles Rennie Mackintosh, who at this time was one of the junior draughtsmen in the practice.[13]

The Mackintosh building is located in the Glasgow city center, on Renfrew street. Due to the restrictive budget of 14,000 GBP the building had to be built in two phases. During the first phase (1897 – 1899) were constructed the eastern and the central part of the building, including the Museum, the Headmaster's Room and the Board room. The west wing of the building, where the iconic library is located, was built during the second phase between 1907 – 1909.[14]

13. 'About GSA', Glasgow school of art accessed on 03 October 2016, http://www.gsa.ac.uk/about-gsa/history-and-future/our-history/
14. William Buchanan, *Mackintosh's masterwork: The Glasgow school of art* (Edinburgh: Chambers, 1994), 17.

of arts. The practice has the approach to analyse the structure, materiality and craftsmanship building piece by piece, room by room and then as a whole piece of architecture and in this way to bring it back to a working building.[17]

The whole process of bringing the pieces back together allow us to have a fresh look to the building and to explore its materiality and details on a very deep level. During the restoration, the building has been examined as never before giving us new knowledge about Mackintosh and his masterpiece. The fire added a new layer on the history of the building so will the restoration.

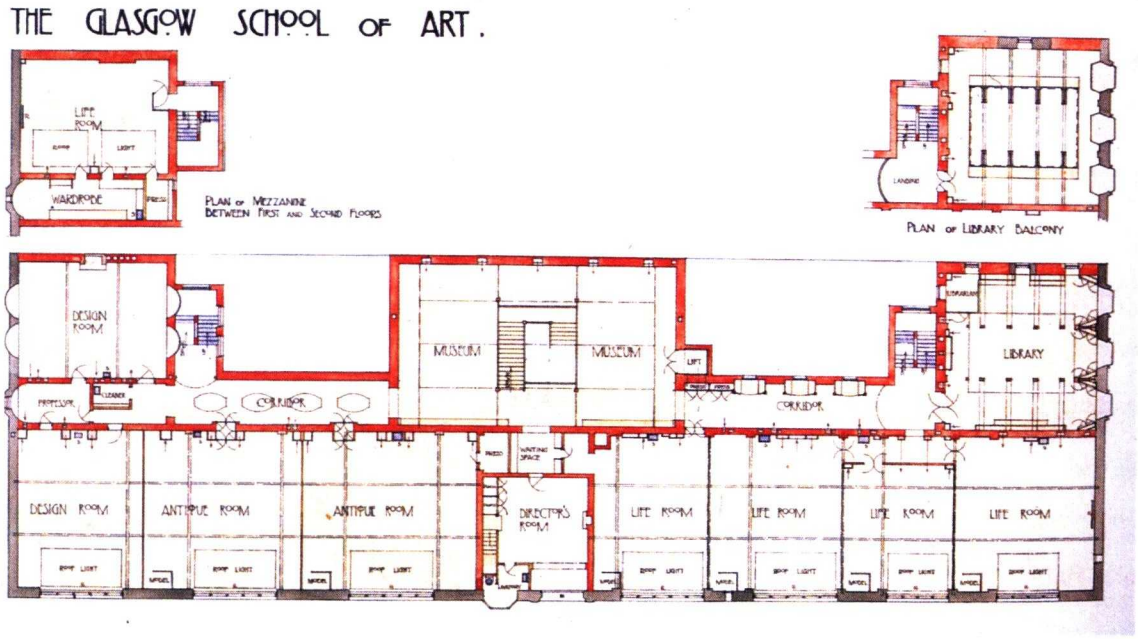

Figure 5. Charles Rennie Mackintosh, Plan of the first floor of the Glasgow school of Art, November 1910

17. Jessica Mairs, 'Page/ Park appointed to restore the Glasgow school of art', Dezeen, accessed 03 October 2016, https://www.dezeen.com/2015/03/31/page-park-glasgow-school-of-art-restoration-fire/

II. ANALYSIS
REBUILDING 'THE MACK'

23RD MAY 2014

The day of the fire and the weeks after it were very busy, emotional and important for all the staff and students at GSA. Many individuals, working in the heritage sectors, as well as the citizens of Glasgow, remember where they were when the fire happened.

> "It felt like a loved one was dying ... and I know that sounds rather dramatic. But again, I wasn't alone in this feeling. Everyone was in shock, falling apart." Dr. Robyne Calvert [18]

Nobody was injured and the fire brigade worked very hard to make sure the blaze didn't spread through the whole building. They completely understood the nature of the building and once they made sure no one in danger, they worked very hard to protect the precious archives and collection in the building, as well as the work of the students.

FIRE DAMAGES

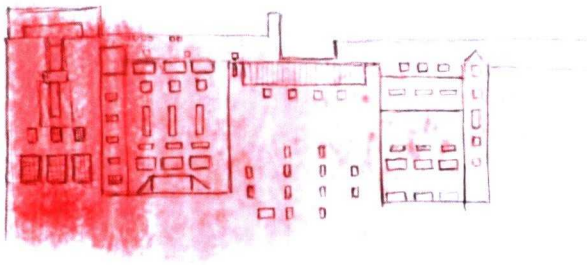

Figure 6. Sketch diagram of the south elevation of 'The Mack', illustrating the fire affected areas

Key staff of the GSA entered the building the day after the fire, including the library and archive team, along with a group of organisations, e.g. Historic Scotland, which had an important role in the excavation process. The first task was to see which areas were affected by the fire and then to start bringing out the student and the staff belongings, namely student art works and archives and collections material. [19]

18. Calvert, Robyne, Interview by Dr. Sabine Wieber, *Nineteenth century art worldwide*, Volume 13, Autumn 2014, aaccessed 28 March 2017, http://www.19thc-artworldwide.org/index.php/autumn14/wieber-interviews-dr-robyne-e-calvert#_ftn1
19. Ibid

"We went in the building with very, very heavy hearts, expecting the worst. The first piece of really bad news is that we have lost the iconic Mackintosh library, but the brilliant news is that about 90% if the building is completely intact. Even, including the Mackintosh lecture theater which sits below the library, is just smoke and water damaged. A lot of the student work has survived. Some, of course, has not survived at all... The wonderful thing about it is that after the darkness of yesterday is how wonderful this building has survived." Murial Gray, Chair of the GSA [20]

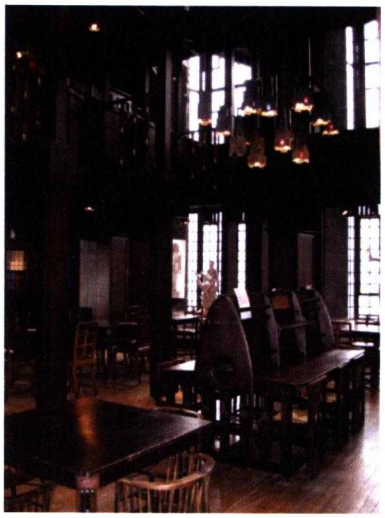

Figure 7. The Mackintosh library before the fire (left)
Figure 8 Remains of The Mackintosh library after the fire (right)

The archives and heritage collections of the Glasgow School of Art are an exceptional resource for the field of study of art, design and architecture. The Mackintosh building was the home for archives, textiles, paintings, and object collections which were housed in four dedicated storerooms, plus a large number of plaster casts and examples of Mackintosh Furniture that were located throughout the building. [21]

A critical aspect of the period after the fire was to clear out the building and look at the collections and the archives. The fire occurred, while students were preparing for the final-year degree show, so a crucial part was to check which pieces of work could be salvaged. After the fire, collections had to be moved to the Reid building at the GSA. Every single piece of the collection had to be unwrapped to see if it was damaged and then packed again. [22]

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20. Gray, Murial 'Bruised, not destroyed: Glasgow School of Art survives fire', Interview by Channel 4 News, 24 May 2014
21 'The Glasgow School of art's archives and collection', The Glasgow school of arts, Accessed 28 March 2017, http://www.gsaarchives.net/about/
22. Dr. Robyne Calvert, Personal interview, 28 March 2017, Glasgow, Scotland

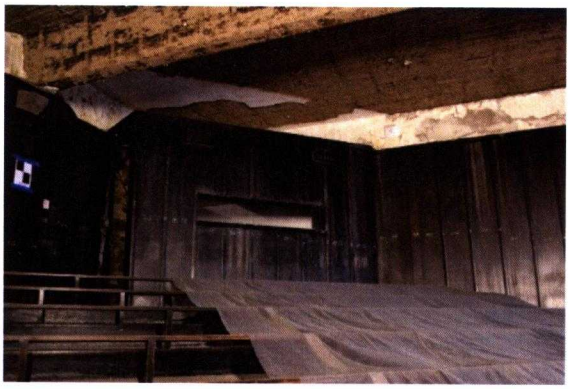

Fig. 9 The Mackintosh lecture theater during the reconstruction

Besides, gallons of water were used to douse the flames. This also damaged the building, including the plaster ceiling in the Mackintosh lecture theater:

"The lecture theater, amazingly even that is in the west part of the building a few layers below the library, was not affected by the fire. But the water came in and the plaster ceiling had to be taken down very quickly afterwards because they were afraid it will just collapse and break all the seating in the lecture theater "Dr. Robyne Calvert [23]

Unsurprisingly, the metal was the only material, which did survive the fire – mainly cabinet hinges, escutcheons and locks appeared among the remains and have been accurately documented. About 65% of the Mackintosh-designed light fittings, suspended in the library, have survived and have been analysed carefully in order to be repaired and used again. [24]

Fig. 10 Mackintosh lights in the library before the fire (left)
Fig. 11 Remains of the Mackintosh lights after the fire (right)

The fire caused extensive damage to the iconic piece of world architectural heritage, however, it was decided that because of the significance and the use of the building, it would be restored. On 23 May 2014, when the extent of the fire loss was known our Chair stated: "We will rebuild and rebuild well". [25]

23. Dr. Robyne Calvert, Personal interview, 28 March 2017, Glasgow, Scotland
24. Davidson. Elizabeth, 'Remains of the day: the Glasgow school of art fire two years on', Interview by Icon, 17.05.2016, Icon – The institute of Conservation, accessed 06 January 2017, https://icon.org.uk/news/remains-day-glasgow-school-art-fire-two-years
25. 'Restoration intent', Glasgow school of Art, accessed on 03 October.2016, http://www.gsa.ac.uk/mackintosh-restoration/restoration-intent/

A restoration team was formed and charged with the enormous responsibility to bring 'The Mack' back to its original function. The GSA appointed two conservation trained project managers to build around them a professional team of conservation accredited architects, surveyors and engineers. The Glasgow School of art also has a very active and committed academic team, working on the restoration. As a result, this is already manifesting itself with student work and projects based on the building and will result in a fine legacy of work that has been generated as a result of the trauma of the fire and the comprehensive re-thinking from first principles of how the school will re-occupy the building. [26]

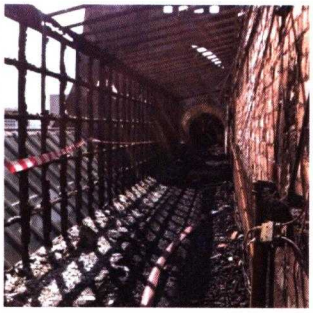

Figure. 12'Hen run' corridor on the top floor before the fire (left)
Figure. 13 'Hen run' corridor severely damaged after the fire (right)

FUNDING FOR THE RESTORAION OF 'THE MACK'

The funding for the project is one of the many challenges, the restoration team has faced so far. The fire was of course, not planned, so there was no budget prepared for the restoration of 'The Mack'. The costs of the project were estimated to reach £20m to £35m with additional costs to recover the contents. [27]

> 'The final assessment was made on the basis of a 60:40 quality: cost appraisal, and the winning tenderer, therefore, had to strike a fine balance between offering good value and exceptional quality.' Elizabeth Davidson, Project manager [28]

A basic source of funding for the project is the insurance but inevitably when such a disaster happens it is needed much more than the insurance settlement. The reason for that is that it will only cover what the insurance company sees as losses in the building and only half of the building has been affected. That is

26. Davidson. Elizabeth, 'Remains of the day: the Glasgow school of art fire two years on', Interview by Icon, 17.05.2016, Icon – The institute of Conservation, Access on 06 January 2017, https://icon.org.uk/news/remains-day-glasgow-school-art-fire-two-years
27. 'Mackintosh Campus Appeal', The Glasgow school of art, accessed 12 March 2017, http://www.gsa.ac.uk/about-gsa/history-and-future/our-future/mackintosh-campus-project/
28. Davidson, Elizabeth, 'Remains of the day: the Glasgow School of Art fire two years on', Interview by Icon, 17 May 2016, accessed 06 January 2017, https://icon.org.uk/news/remains-day-glasgow-school-art-fire-two-years

why the GSA launched an appeal fund in a bid to raise up to £20m for the restoration. The Mackintosh Campus appeal has already raised up £17m towards the final target of £32m to help the restoration.[29]

> "The day after the fire, people were phoning and writing to ask where they could send funds to – before the appeal had even been launched! As many folks have said since, if we had had a large enough bucket in Glasgow on 24th May 2014, we could probably have put it on Sauchiehall Street and raised pretty much all we needed in a matter of hours! "Elizabeth Davidson[30]

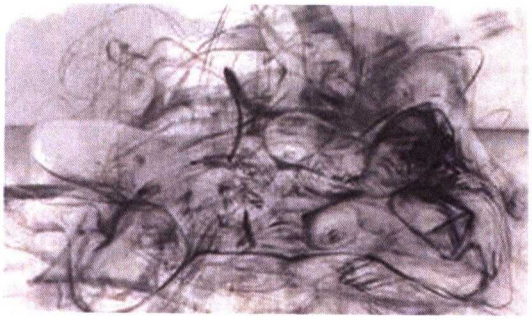

Figure 14 Jenny Saville's Ashes piece raised £269,000

Ash to art

At the beginning of 2017 twenty-five international artists created artwork using the ashes from the fire-damaged school. The exhibition was called "Ash to art" and the pieces were sold in London to raise money for the Mackintosh campus appeal. [31]

THE RESTORATION TEAM

The scope of the project requires the knowledge of a wide range of professionals. The core restoration team is a large interdisciplinary group. There are Project Managers, who act on behalf of the client, in this case GSA. The professional team consists of Page\Park Architects, David Narro Associates Engineers, Harley Haddow Mechanical and Electrical Engineers and Gardiner Theobald Cost Consultants) There are also conservators, carpenters, lighting experts and metal workers, who have all been selected for their expertise to work on the project. Last but not least, there is a research project team, which does research on the building and discoveries which have arisen from the restoration or were revealed by the fire. [32] Furthermore, various craftspeople have been involved so far in the project, working with the original materials, which have been salvaged and preserved – from horse hair plasterers to lead glaziers. For instance, the brass fittings of the library light have been salvaged from the ash by forensic archaeologists. The fragments and material that they managed to save are enough for to remake 29 complete lights. [33]

29. 'Mackintosh Campus Appeal', The Glasgow school of art, accessed 12 March 2017, http://www.gsa.ac.uk/about-gsa/history-and-future/our-future/mackintosh-campus-project/
30. Davidson. Elizabeth, 'Remains of the day: the Glasgow school of art fire two years on', Interview by Icon, 17.05.2016, Icon – The institute of Conservation, accessed 06 January 2017, https://icon.org.uk/news/remains-day-glasgow-school-art-fire-two-years
31. Hannah Ellis-Petersen, 'Glasgow school of art ashes turned into artworks to fund rebuild', Guardian news and media, accessed 12 March 2017, https://www.theguardian.com/education/2017/feb/01/glasgow-school-arts-ashes-turned-artworks-fund-rebuild
32. Rachel Purse, Personal communication, 28 March 2017, Glasgow, Scotland
33. Libby Brooks, 'The Glasgow school of art's library begins in earnest', The Guardian, accessed 12 March 2017, https://www.theguardian.com/artanddesign/2016/nov/24/glasgow-school-of-art-mackintosh-library-fire-restoration-begins-in-earnest

the School of Simulation and Visualisation, again aided by partners at Historic Environment Scotland, undertook a comprehensive 3D digital design survey of the entire building. This is still an ongoing project, which will carry on throughout the restoration.[36]

The data from the scans has an essential role, informing the decision-making process on the conservation of Mackintosh building after the fire. Furthermore, the scans of the building have been used as a base for a Building Information Model of The Mack, which has an essential role in the reconstruction process of the building. This model has been very useful for Page / Park, giving them highly accurate measurements of the building – the size and scale of the spaces.[37]

PRINCIPLES, APPROACH AND CHALLENGES IN THE RECONSTRUCTION OF 'THE MACK'

> "Mackintosh did not work with precious materials. He worked with precious ideas and that can be rebuilt." Murial Gray[38]

Page/ Park has a significant background in the architecture conservation field but the Mackintosh building restoration is the largest project of its type that the practice has undertaken before. The project is more pure restoration with a greater focus on the original design and design intent. In comparison with the previous conservation projects, the practice has undertaken, the research of the Mackintosh building has been much deeper. Not least that Mackintoshes design is unique but also the building is of international importance. The existing archive record of the building is more extensive than most other historic buildings. The project warrants such in-depth research to accurately inform the reconstruction.

Building fires are rare so the practice has only had to restore such buildings a couple of times. Page\ Park was appointed to manage the initial recovery and enabling works contracts on the building before the main

36. GSA Events ,The Glasgow school of arts, , Accessed on 15.12.2016, http://www.gsa.ac.uk/life/gsa-events/events/%E2%80%9C/%E2%80%9Cthe-mack%E2%80%9D-digital-recovery-begins-physical-re-imagining/?source=archive&utm_medium=email&utm_campaign=Mackintosh%20Restoration%20Project%20Update%20November%202016&utm_content=Mackintosh%20Restoration%20Project%20Update%20November%202016+CID_377c8df9d1c3a1e8331df861c73ba798&utm_source=Email%20marketing%20software&utm_term=The%20Mack%20Digital%20Recovery%20Begins%20Physical%20Re-imagining
37. Dr. Robyne Calvert, Personal interview, 28 March 2017, Glasgow, Scotland
38. Gray, Murial, 'Bruised, not destroyed: Glasgow School of Art survives fire', Interview by Channel 4 News, 24 May 2014

restoration project started. They had to quickly obtain the guidance of experts and publication to learn how the building should be protected during the aftermath of the fire.

There were many questions which had to be answered before the reconstruction begins. As soon as the architects considered submitting the proposal for the restoration, they started asking questions such as what does the project needs and what does the program require? Furthermore, they approached some eminent experts in the field and Mackintosh to act as peer reviewers. The architects' team had also to think about who are the best service and structural engineers for the project and how they should interpret the project brief.

> "How best to collaborate and engage the client and users? How do we consult the users? How can we make the building better? There were many, many more questions than these and too many answers to cover here. "Malcolm Mitchel, Architect at Page/ Park

PAGE/ PARK METHOD FOR RECONSTRUCTION [39]

I. Undertaking a detailed in-depth research of the development of the design from the original 1897 drawings to the final designs of 1910. This will include an analysis of the historical development of the space by looking in particular at each element with reference to other works of Mackintosh, such as the Oak Room, Ingram Street tearooms

II. Completing an assessment of the physical evidence, meaning a thorough examination of the timber elements remaining after the fire by checking their sizes and construction

III. Building a model of timber component in 3D program

IV. Producing a physical model in the 1:10 Scale

V. A review of the results produced until then will be undertaken with the Expert Panel and involve timber conservation experts

VI. The prototyping of relevant elements will be done in 1:1 scale

39. Malcolm Mitchel, Personal communication, Glasgow, Scotland, 5 April 2017

PAGE/ PARK'S TEN PRINCIPLES FOR 'THE MACK' PROJECT [40]

At the AJ's Retrofit Awards at the London's Brewery on the 16th September 2015 the directors of Page/ Park – David Page and Brian Park, outlined the ten fundamental principles for the restoration of 'The Mack'.

1 Art school and its legacy

2. Room and space

"There are two types of spaces: fixed spaces – like the library, and fluid spaces – the art studios. "

3. Use
4. Access
5. Nurture
6. Catalyst
7. Light

'For all who have walked through the building one of the things which are so special is the way Mackintosh used light in a remarkable way. It is one of the early electrically-lit buildings, but in order to cut costs, it was also one for the first off-peak systems. The building was originally only lit from 7 – 9 pm.'

8. Enhancing building performance

'The Mack has become a spaghetti of services. Working with services engineer we are looking at using the ducts again and enhancing them in a way which Mackintosh couldn't. Our contribution to the building will be how to make it perform better.'

9. Imperceptibility
10. Functionality though future

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40. Laura Mark, 'Page/ Park: We have been entrusted with an incredible challenge', Architects journal, accessed 10 March 2017, https://www.architectsjournal.co.uk/news/pagepark-we-have-been-entrusted-with-an-incredible-challenge/8689048.article

Before the fire, the Mackintosh, building housed the school's Fine Art Department, exhibition spaces, and administration offices. However, many of the rooms had been locked because they were too valuable and important to be used by the students. The director of Page/ Park – David Page commented: "The fire enables us to question whether the building is a museum or a working art school. "[41]

The intent of the restoration is to bring back the original academic configuration of a collaborative school of art, as it was designed by Charles Rennie Mackintosh. The restored Mackintosh Building will accommodate the entire first-year community, giving all the art student unforgettable experience of studying in its inspirational spaces.[42]

A major part of the project is the reconstruction of the library, which has been completely lost. Fortunately, it has been the most documented space of the building. The restoration team had access to the original construction drawings and a large number of photographs of the space. These documents in a combination with the digital scans of the building gave the architects the opportunity to rebuild the library as Mackintosh designed it. [43]

Figure 16.Visualisation of the reconstructed library interior BU p12

Before the fire, there was a huge sense of preciousness about the library, so it could not be used as a functional space. Page/Park architects' aim is to bring it back as close to its original design, rather than replacing it with a new and modern library. They will smartly improve the services and adapt the space for the use in the 21st century, keeping the original ideas of Charles Rennie Mackintosh. After the

41. Page, David, 'Page/ Par triumphs in Mack contest', Interview by Laura Mark, *The Architects' journal*, March 31, 2015, accessed 12 March 2017, inhttps://www.architectsjournal.co.uk/news/pagepark-triumphs-in-mack-contest/8680748.article
42. Glasgow school of art, Mackintosh Campus project, accessed on 28 April 2017, http://www.gsa.ac.uk/about-gsa/history-and-future/our-future/mackintosh-campus-project/
43. Malcolm Mitchel, Personal communication, Glasgow, Scotland, 5 April 2017

reconstruction, the library will be a completely functioning space, inspiring not only the students of the art school, but also the public visitors. Due to the special meaning of the space, the architecture practice tries to reconstruct the whole structure on the basis of the original plans from 1910, rather than what was in the building before the fire. Nevertheless, they will acknowledge the important of the existing fabric and keep it undisturbed whenever is possible. [44]

The restoration team had to import poplar wood from the Atlantic coast of America, named Tulipwood. This is the original wood used in the library's internal fittings. It has been sourced and will be used again during the restoration process. [45] There were many discussions about the finishing about the finishing of the wood – most people remember the dark stain in the library, while the photographs of the space present a lighter nuance.

> "One of the major differences that people will notice on visiting the restored library will be the colour of the wood." Says Elizabeth Davidson [46]

There were and continue to be big challenges for the restoration team, in order to do right by the building. For example, uncovering relevant evidence within the mountain of uncatalogued archive records in advance of design. Another challenge for the architects was to compile such a detailed 3D Revit and BIM model to incorporate the wealth of information they have found and make sure the production information was so precise it avoids any errors in the reconstruction. [47]

> "The use of Revit and BIM model on a historic project of this complexity is breaking new ground and it is probably the second most sophisticated behind the current Houses of Parliament project. "Malcolm Mitchell [48]

Many details in the building have never been documented. To work out these elements in the building, Page/ Park have conducted numerous surveys of the existing building some involving opening up finishes to see what lies behind. The charred remains have been the most informative for the architects. They have allowed them to take parts of the construction apart so they can check how they went together and what size they

44. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017
45. Rachel Purse, Personal interview, Glasgow, Scotland, 28 March 2017
46. Davidson. Elizabeth, 'Remains of the day: the Glasgow school of art fire two years on', Interview by Icon, 17.05.2016, Icon – The institute of Conservation, accessed 06 January 2017, https://icon.org.uk/news/remains-day-glasgow-school-art-fire-two-years
47. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017
48. Ibid.

were. Developing the Revit model meant that they had to build the individual part accurately. That exercise revealed any errors in their survey and they would Revit the survey until everything fitted.[49]

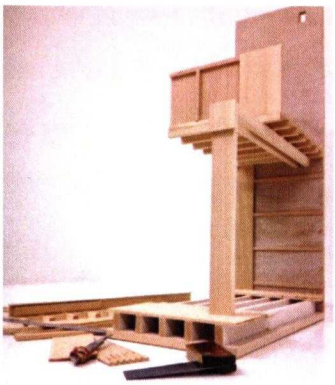

Figure 17 Page / Park scaled model

The architects from Page/ Park have produced over 1100 architectural drawings so far and there are several hundred more services and structural drawings. They have made numerous 1:1 models of timber details to explore and understand how and why the timber was joined in a particular and sometimes unique way.[50]

"Our drawings are scaled to suit how they will be used and interpreted and depending on the level of detail required. The Revit and BIM model allow us greater flexibility in the type of drawings we can produce and makes what we want to convey much clearer. Especially with the 3D images that accompany dimensioned 2D images. "Malcolm Mitchell

After a detailed research of the design and the construction of the space, it has been produced a full-size prototype of the library. It was made using the GSA's archives and the original drawings held in the Hunterian and it is a big step towards the restoration. This method provided invaluable practical information about the supply chain of the tulip wood, the construction and the finishing of the wood. [51]

ADAPTATION

Thought-out the years and before the tragical event, the Mackintosh building had ingested a century of adaptation through use. A crucial aspect of the restoration process is the understanding of what was the original intention and what was an adaptation. However, the building design is still well fit for purpose as an art school even after more than a 100-year-old, so it does not need alteration of the existing spaces but mainly improvements in the construction and services. [52]

The most crucial improvement is the compartmentation and fire stopping of voids within the building and new mist fire suppression system. Improvements in the service installations generally heating and cooling, light, power, data and water will allow the building to be much more flexible in use than ever before and

49. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017
50. Ibid.
51. 'Library bay prototype to help art school restoration', BBC 2017, accessed on 28 March 2017, http://www.bbc.com/news/uk-scotland-glasgow-west-38842465
52. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017

make it fit for the future use. The services will be installed more discretely allow a better appreciation of the aesthetics of the building. [53]

In order to make the building energy efficient, thermal insulation will be added within the roof build up, as well as double glazing to the big north facing windows of the studio spaces. These changes aim to improve the comfort of the occupants and substantially reduce heating costs.

> "And for us, one of the most exciting dimensions of the restoration is to bring back into use the remarkable services spine hidden within the masonry walls. The fans were turned off soon after completion because they did not have heat recovery and were burning 19 tons of coal a week to heat the building inadequately. A hundred years on we have the technology, control systems, and fans to make it work. That is exciting." Justin Fenton [54]

NEW DISCOVERIES

> "We have learnt a huge amount about the building that we would never have known were it not for the disaster of the fire." Justin Fenton, Head of conservation, Page/ Park [55]

During the reconstruction project, the building has been examined on a level which has never happened before. The fire allowed us to see the building under a completely light and in a positive way, it revealed some secrets about the building, especially about the construction and the materials, which were used in the building.

Before making any decisions about the future of the building, Page/ Park have undertaken a detailed research with the help of archaeologists, materials scientists, specialist historians, archivists and digital recorders. They excavated the story of the making of the original building and importantly understood how it has changed over the last 100 years. The research also included close investigation of the timber species, stone, paint, finishes and the remaining parts of the building, which added to that knowledge. Some of the

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53. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017
54.Fenton, Justin, *Conservation specialist challenges 'replica' restoration on Mac Library'*, Interview by Richard Waite, *Architects' Journal*, December 3 2014, accessed 03 April 2017,https://www.architectsjournal.co.uk/news/conservation-specialist-challenges-replica-restoration-of-mac-library/8673516.article
55. Fenton, Justin, 'Glasgow school of art restoration study, Interview by Merlin Fulcher, *Architectural review*, March 27, 2017, accessed 03.04.2017 http://www.architectural-review.com/10018299.article?mkt_tok=eyJpIjoiWXpFeU1qTm1PREV3TXpsbSIsInQiOiJcL29iRE9EN200QzZCdjN5UkdEVXNSY1FkOXZwbUhwTURneTVWdTd3eTZ2YXZ1ZGVZamttcEV6Y21GYVg1bFwvZXZYbmg4dXAyXC9hZ3pUZzJQa09ucVJQenhqWVUrTzcrTVF5TGtVcDBlQ3k4VGNWR2RlTkhZNkptNzhSNkdQN3E3ciJ9

stones has been shattered and too weak to be reused. Every stone is individually made with skilled tooling, that is why each one has been numbered and taken out for testing. [56]

The technical analysis has given a new understanding about 'The Mack' and furthermore, it has revealed new knowledge and information about the building. One of the most interesting discovery is about the construction of the library. It has been published in many books that the library was a hung space. Actually, only the library store above hung, but the library was fitted in the masonry shell. [57]

The analysis of the materials has revealed that the library was not made out of oak – as it has been published in many books, neither out of pine, as it has been documented in the archives. Actually, the analysis has shown that the wood used in the library is a poplar from the Atlantic coast of America named Tulipwood, often also referred to as Canary Wood. This wood has been sourced and will be used again in the library. [58]

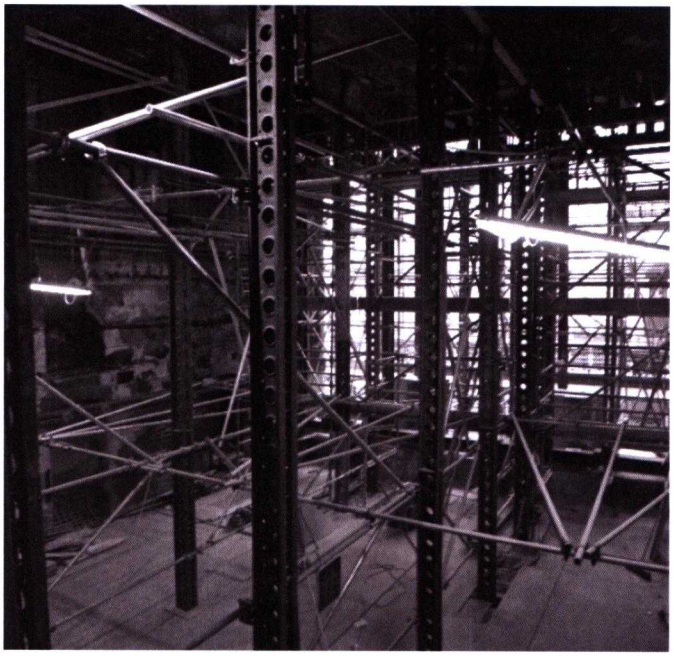
Figure 18.The paint of the interior wall after the fire

Another interesting discovery is about the interior painting of the building. It has been thought that the building was painted white, but actually, during the history of the building, it has been painted in greens, blues, and reds.[59] (Fig.17)

Furthermore, the reconstruction project gives us a fresh look at the building and help us think about Mackintosh's approach towards architecture and ask the question how this building fits in his larger design work? "It is both - rethinking what we knew about Mackintosh and also bringing the attention of the new generation of people to the symbolist aspects and the decorative work in the building." Dr. Robyne Calvert [60]

56. Malcolm Mitchel, Personal interview, Glasgow, Scotland, 5 April 2017
57. Dr. Robyne Calvert, Personal interview, 28 March 2017, Glasgow, Scotland
58. Rachel Purse, Personal interview, Glasgow, Scotland, 28 March 2017
59. Dr. Robyne Calvert, Personal interview, 28 March 2017, Glasgow, Scotland
60. Ibid

RECONSTRUCTION IN PROGRESS/ BUILDING VISIT 20 JANUARY 2017



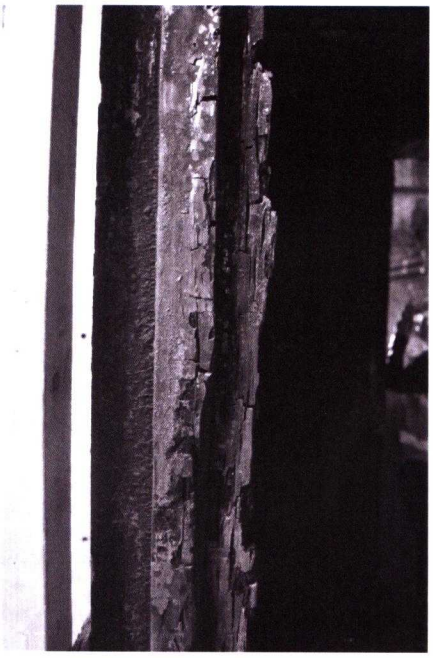


Figure 19. Reconstruction in the library (left)

Figure 20. Wood in the library (right)

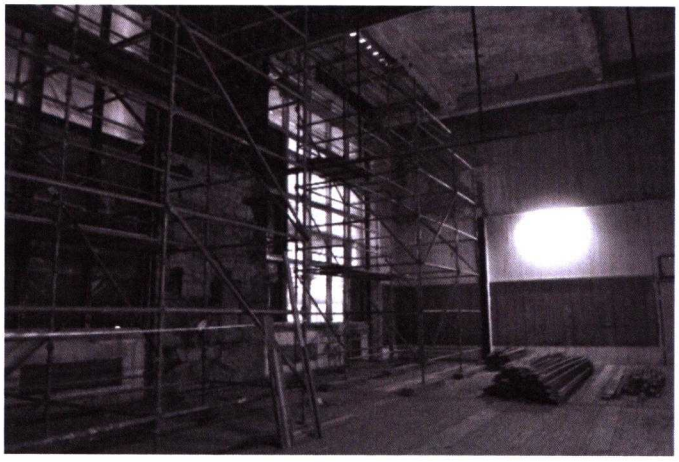


Figure 21. Reconstruction process in the studio spaces

Figure 22. Salvaged elements after the fire

III. CONCLUSION

"What the eye sees will be Mackintosh. What Mackintosh sees will be the 21st century". – Tom Inns [61]

This essay questioned the importance of architecture conservation in the 21st century. It described how the theory of conservation has developed through time and analysed the methods and the process of the architecture conservation today. The project particularly concentrated on the restoration of the Mackintosh building at the Glasgow school of art after the devastating fire in May 2014. The work successfully identified the crucial aspects of the reconstruction process and analysed the approach and strategies. The research explored the ideas and methods used in the reconstruction to piece the Mackintosh building back to a completely functioning school, suitable for its current use.

To sum up, architectural heritage has in an important role for our cultural consciousness. It has historic, aesthetic, economic, social and even symbolic value. Furthermore, buildings can provide us information or experience which cannot be documented. That is why architectural conservation is still practiced today. Keeping historic buildings alive for the future generation is an acknowledgment of their cultural and historic significance.

Architectural conservation includes a variety of activities such as maintenance, preservation, restoration, reconstruction and adaptation. It is a complex activity, it involving a large interdisciplinary group of professionals. In the process is required the knowledge of many specialists, for example, archaeologists, architects, engineers, planners, landscape architects, suppliers and museum professionals. Only by combining their knowledge together, they can make the best decision about the future of a certain historic place. As time passes, the needs of the people change, so does the architecture. Therefore, historic buildings also need to be adapted for their current use, meeting the needs of the occupants.

61. 'Restoration intent', Glasgow school of art, Accessed on 09 April 2017, http://www.gsa.ac.uk/mackintosh-restoration/restoration-intent/

The role of the architects in the process is crucial in the restoration process. Architects have the knowledge and skills to understand the layering of the building and make the decision which interventions are appropriate. Architects role in the conservation process is to determine how to conserve the building and adapt it for its current use while preserving its cultural significance and the fabric.

There are organizations, such as ICOMOS, which are dedicated to the conservation of the world's monuments and sites. Their mission is to promote the conservation, protection, use and enhancement of monuments, building complexes, and sites. It participates in the development of doctrine and the evolution and distribution of ideas and conducts advocacy. Its work is based on the principles enshrined in the 1964 International Charter on the Conservation and Restoration of Monuments and Sites (the Venice Charter). Among the members of ICOMOS are architects, historians, archaeologists, art historians, geographers, anthropologists, engineers and town planners. They work together and exchange knowledge and experience in order to preserve architectural heritage.

This research project is particularly concentrated on the restoration process of the Mackintosh building at the Glasgow school of art. It described the devastating event at the GSA in 2014 and the damages after the fire. Through analysis of documents, articles, drawings and personal interviews, the paper examined the reconstruction strategies and methods of bringing the building back to a functioning school. This paper explored the challenges and difficulties of the project. It concentrated on the approach of the restoration team to successfully restore the Mackintosh building without damaging its cultural significance, while ensuring it is fit for the purpose of an art school in the 21st century.

The restoration of 'The Mack' is a long and complex process. Before making any decisions about the future of the building Page/ Park architects had to answer many questions, such as what are the program requirements, what services the building needs and generally how they can make the building better while keeping its character. The scope of the project requires a multidisciplinary group of professionals, including research project team, project managers, conservation architects and engineers, as well as carpenters,

lighting experts and metal workers. By combining their skills and knowledge they are bringing back 'The Mack' back to its original functions.

The intent of the restoration team is to achieve an admirable restoration, using accurate and detailed conservation skills in a combination with technology and design innovation. The approach to the restoration is bringing back Mackintosh's configuration and design of a collaborative school of art. The building is going to accommodate all first-year students before moving to the specialist building in the later years of their education. The idea is that every developing architect, designer or artist would be able to experience this inspirational space.

The Mackintosh library has international significance, that is why its reconstruction has been a major part of the project. The Mackintosh's library, one of the world's finest examples of art nouveau design, has been completely lost after the fire. Throughout the years, the space has absorbed many changes and adaptations. Thus, some of the features of the original design have been lost. The reconstruction intent for this space is to build a functional library, as close as possible to the original design, but also smartly to adapt the needed services, e.g. Wi-Fi, underfloor heating, etc.

The restoration team has faced many challenges during the project. But thanks to the deep investigation not only of the building but the wider work of Charles Rennie Mackintosh, they manage to solve the problems. The fire damaged severely the Charles Rennie Mackintosh' iconic building but in the same time, it revealed details in the structure and layers of information which have been hidden so far. It allows us to experience the space on a completely different level and see details, which have been overlooked so far.

Overall, this essay questioned whether historic building could be preserved, while adapting them for their modern occupation. The reconstruction of the Mackintosh building at the GSA is a great example, proving that it is possible. The building would never be the same as it was before the tragedy and many of damages are irreplaceable but the fire presented is a great opportunity to go back to the original Mackintosh's design, while improving the services in the building so it is suitable for its function of a modern art school. Moreover,

the reconstruction process presented a great opportunity to bring back into use the remarkable services spine hidden within the masonry walls, as well as to upgrade safety, lighting, heating, cooling internet and fire protection. Hereby, after the reconstruction, the Mackintosh building will be a school satisfying the needs of the students and staff and in the same time a very inspiration and authentic space for working and studying.

Personally speaking, I will not be able to experience 'The Mack' as a student at the GSA. However, it has been an amazing experience to observe the reconstruction process through the window, as well as personal motivation to undertake this research project. I am looking forward to visiting the recovered building. I believe it would be an amazing experience, totally different from the first time I visit the building, before the devastating fire. The fire became a part of the history of the building, so will the restoration.

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