Republic of Serbia
Ministry of Defence
MILITARY ARCHIVES

CONTEMPORARY TACTICAL AND TECHNICAL REQUIREMENTS FOR THE CONSTRUCTION OF AN ARCHIVE AS A SPECIAL PURPOSE FACILITY FOR THE ACCOMMODATION, STORAGE AND PROTECTION OF ARCHIVAL MATERIALS

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1. INTRODUCTION

Archives and archival storage facilities are buildings that provide suitable conditions for the accommodation of records and materials that require continuous protection for historical and permanent storage, preservation and protection.

These facilities must be high-performance buildings whose systems must be designed to operate continuously at a very high level with zero tolerance for errors.

This type of facility must be designed:

- to accommodate the load of the materials to be stored
- meet the sensitive requirements for environmental conditions
- functional efficiency
- safety, security and comfort of visitors and employees
- protection of archival materials from fire, flood and the harmful consequences caused by human errors and actions

To meet these complex requirements, such buildings are the result of a comprehensive, holistic, integrated or “whole building design” approach (WBD) that optimizes and harmonizes the different design requirements to achieve the desired high-performance building.

This process involves all building representatives and design professionals from the very beginning of the project.

1) **Accessibility/Availibility:** Meeting the specific needs of users, including the needs of people with disabilities.

2) **Aesthetics:** Designing storage facilities is challenging because they are often large, massive buildings with large, featureless wall surfaces.

3) **Cost-effectiveness:** An effective archive and records facility should be evaluated using economic and material life-cycle assessment models.

4) Functionality/Operability:

- Flexible capacity organization to accommodate growing collections of materials requiring varying storage conditions.
- Cost-benefit analysis and trade-offs between different storage systems and methods.
- Movement between archive rooms must be simple, logical, and efficient.
- High ceilings to allow vertical compact storage / goal of offsetting the increase in building area / facilitating future vertical expansion.
- Adequate space for storage, maintenance and repair of electronic information and media systems.
- Workstation space requirements for the use of electronic technologies by staff and researchers.
- For multi-storey archival depots mechanical and electrical service areas should be vertically aligned to eliminate horizontal traversal .
- Design vertical column shafts with sufficient space for future expansion and adoption of future technologies.

5) **Historic Preservation:** Specific actions within the historic setting of the surrounding area, whereby building elements and strategies can be classified as: preservation, rehabilitation, restoration, or reconstruction.

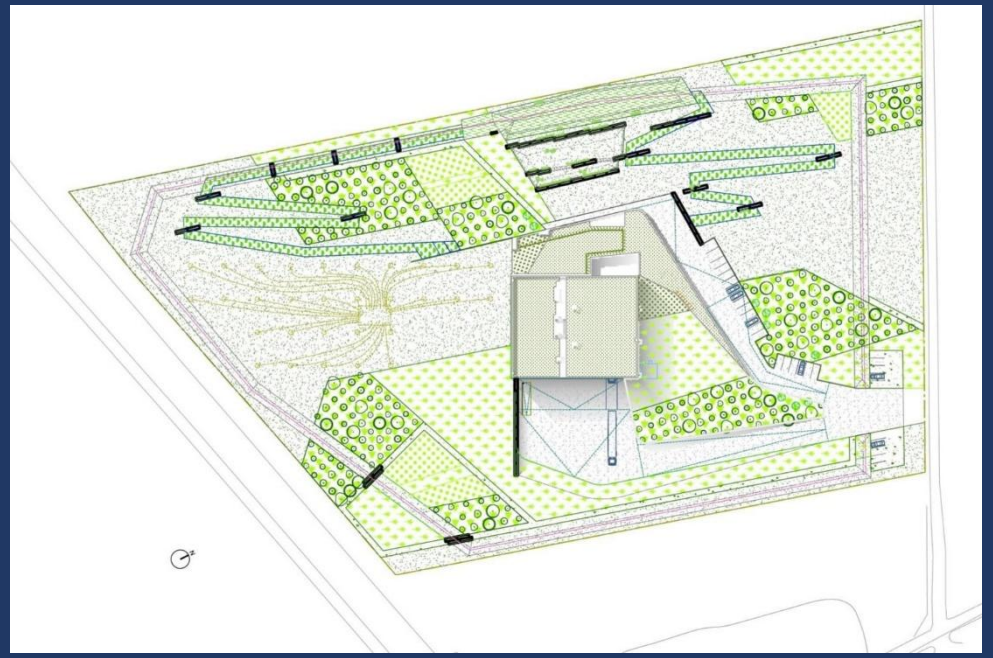
6) **Productivity:** Health, safety and comfort of employees in a highly efficient building are of paramount importance.

- Natural ventilation, non-toxic and low-emission materials and systems, indoor air quality control, separate rooms for air-polluting materials used in archival preservation processes should be implemented.
- Individualized climate control in the office space is desirable. However, critical conditions for the preservation of archival materials may require a constant environment.
- It is widely accepted that worker satisfaction and performance increase with providing a stimulating and dynamic work environment (so-called psycho-social value of space).
- The acoustic environment designed and integrated with other architectural systems and office equipment. Particular attention to noise control in open office spaces, with absorbent finishing materials, masking of “white noise” and enough space for employees.
- Ergonomics and worker safety. Storage systems should eliminate the need for ladders and heavy lifting.

7) **Safety/Security:** The safety needs of individual buildings are determined through a thorough hazard and vulnerability assessment and risk analysis, and appropriate and reasonable design solutions are incorporated into the design of the facilities - the protection of users, property and contents is of utmost importance.

Archive of French Energy Company “EDF”

External appearance and Bird’s eye view plan



- Consider entrances and vehicular access with control points / direct inspection.
- Implement location barriers, fencing and explosion protection, access control and intrusion detection, entry control, open space to allow employees easy visual observation.
- Main passageways should be clear and logical. Consider installing larger signs, providing safety information and a site map. Regularly review and evaluate safety plans.
- Fire protection design - a key element of the project, which includes building’s fire resistance rating and a pressurized nozzle or sprinkler system. Locate main water mains outside the storage premises (depots). Fire protection systems designed to extinguish a fire as quickly as possible, with no adverse effects on people and with minimal collateral damage to the building and its contents.

- Rapid ventilation of heat and smoke from a fire (smoke extraction systems). This may be a difficult task in the case of archives and records storage facilities located in basements.
- With multi-storey storage facilities consider the impact on firefighter access and smoke and heat extraction systems from upper floors
- Provide backup systems for all critical functions in the facility, for the safety of users and the preservation of records.
- Consider the synergy of sustainable strategies for energy conservation and the appropriate sizing of safety and emergency backup systems.

8. **Sustainability:** Sustainable design depends on the size of the building, the local climate, the user profile and the costs. Achieving sustainability may include

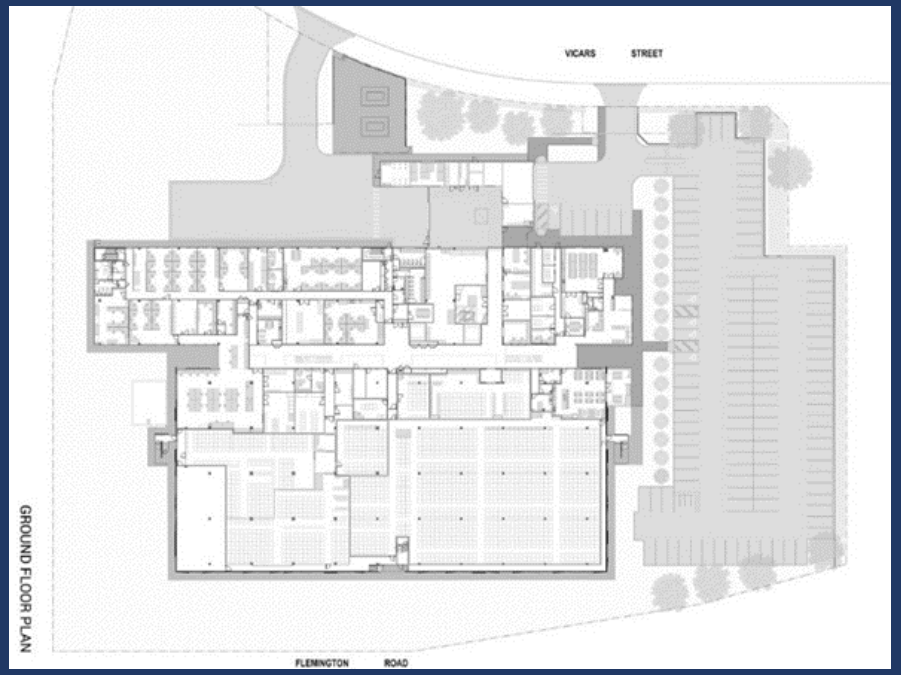
- integrating the building with the location; adjusting the building orientation and the position of windows; optimizing the physical boundaries (reducing infiltration, improving insulation), etc.
- Proper sizing of heating, ventilation and air conditioning systems.
- Installation of highly efficient equipment - mechanical and electrical, and lighting.
- Incorporating LID (Low Impact Development) technologies for stormwater drainage into the construction project.

The National Archives of Australia

External appearance

8. **Sustainability:** Sustainable design depends on the size of the building, the local climate, the user profile and the costs. Achieving sustainability may include

- Ecological roof design – the application of renewable energy systems such as integrated photovoltaic systems that generate electricity, solar thermal systems for hot water, etc.
- Geothermal pump systems - use the thermal capacity of the ground to operate the heating, ventilation and air conditioning system.
- Application of other energy distribution systems, including micro-turbines, fuel cells, etc., which provide reliability and independence from the grid in emergency situations and reduce dependence on the fossil fuel-based grid.



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Ground Floor Plan

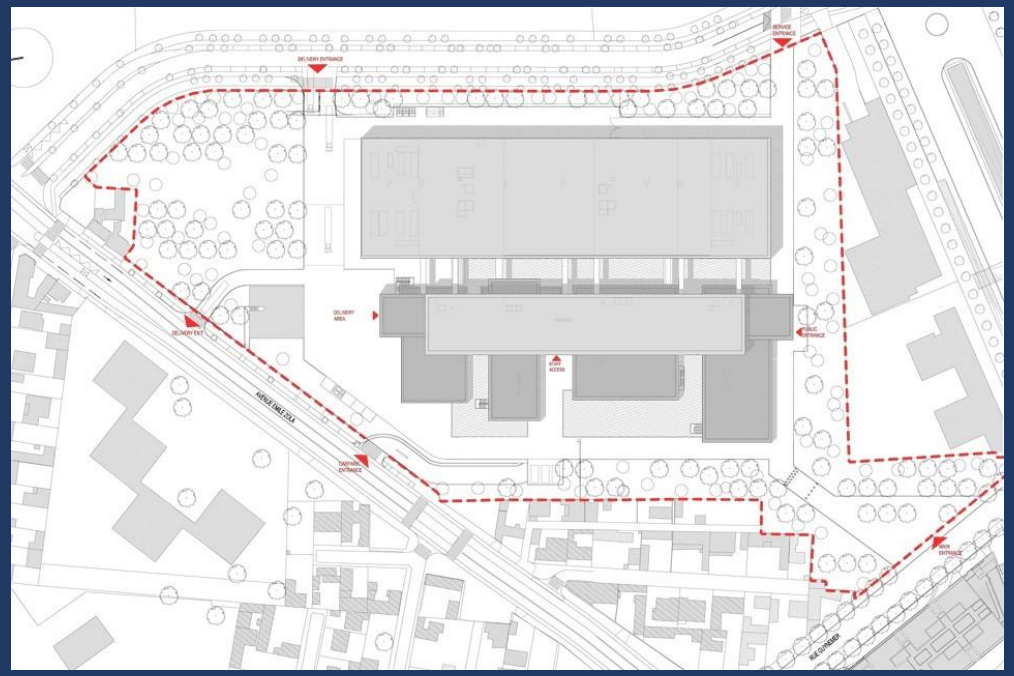
2. THE GOAL OF CONSTRUCTING A NEW FACILITY

The main goal of constructing a new purpose-built archive facility as a legally recognized cultural institution in the Republic of Serbia is to create the conditions for it to be able to carry out its core activity:

the protection and preservation of national cultural property of all levels of importance as well as the reception, protection and preservation of archival materials created in the work of those entities over which the archive has jurisdiction.

National Archives
of France

External appearance



National Archives
of France

Bird’s eye view plan

In order to achieve this, it is necessary to improve the external physical boundaries, mechanical systems, telecommunications infrastructure, security and internal elements, improve the quality of the working environment, energy efficiency, safety, the ability to adjust to the flow of users, ongoing maintenance costs and the expected lifespan of the facility.

3. LOCATION SELECTION

Given the cultural and historical value of archival materials and the complexity, diversity and number of factors that need to be met in order to preserve and protect historical heritage, the selection of the location where the construction of a new facility is planned is of primary importance for each archive facility.

Regardless of potential locations, two studies should be prepared:

- "Study on the Results of Geotechnical Investigations"
- "Study on Geotechnical Conditions for the Planning and Construction of the Facility"

The report must contain the textual part of the report and graphic attachments:

- *Engineering geological properties of the terrain* (morphological properties of the terrain, physical and mechanical characteristics of the soil, hydrogeological characteristics of the terrain, seismicity of the terrain, terrain stability, seismic hazard parameters).
- *Geotechnical conditions for the design of the facility* (general technical characteristics of the facility, conditions in the foundation soil, geostatic calculations for the conditions of the foundation and excavation protection (bearing capacity, load, settlement, etc.)).
- *Other geotechnical conditions.*
- *Conditions for the construction of external infrastructure.*
- *Graphic attachments:* terrain situation, foundations and cross-sections of the facility and terrain, legend.
- *Results of other prescribed soil tests* that must be performed.

4. GENERAL REQUIREMENTS

4.1. Facility location requirement

The location selection should be in accordance with point 4 of the ISO 11799:2015 Information and documentation – Document storage requirements for archive and library materials standard and meet the requirements of the “Convention for the Protection of Cultural Property in the Event of Armed Conflict” (The Hague, 14 May 1954).

4.2. Requirements for the development of design and technical documentation and the complexity of the facility

For a new archive facility, it is necessary to develop projects in accordance with the Law on Planning and Construction, and the regulations adopted on the basis of that law:

1) A conceptual design as a graphic verification of the concept and project program
2) A detailed design with a defined position and capacity of the facility at a specified location.
3) Architectural project: According with the "Category of buildings according to the degree of complexity for the purposes of architectural design" (Serbian Chamber of Engineers) can be classified in the 5th category.

4) Structural project: According to the same document as in 3), building and archive is considered as demanding construction.
5) Mechanical installation project: The installations have high design requirements. According to the same document as in 3), the facility can be classified into three categories.
6) Electrical installation project (electrical power and telecommunications, lighting, lightning protection installations, etc.): In accordance to the complexity, requirements and needs, the archive facility can be classified into the 4th category according to the same document as in 3).

7) Technological project: necessary to develop as a separate report because the technological and work processes that take place in the archive are of an interdisciplinary nature, diverse and complex, and the number, layout and size of the working, administrative, storage and other spaces and its technical and technological equipment depend on them. It also specifies the costs for the purchase of equipment and machinery, personnel training, and other things that are not included in other projects.
8) Thermo-technical installation project: as a facility with greater requirements for integration into the environment, with expressed multifunctional and design requirements, with complex installations and construction, it belongs to the 4th category in accordance with the Categorization of facilities according to the degree of complexity for the work of preparing thermal protection reports.

9) Waterproofing protection of the facility elaborate: This report must provide a presentation of the solution for protecting the facility from precipitation, water, especially underground watercourses and moisture from the soil.

10) Noise protection elaborate: The report must identify noise sources from individual systems, determine technical data on noise sources, a technical description of the applied noise protection solutions, necessary supporting calculations, the value of the expected maximum noise in individual rooms and workplaces.

11) Fire protection design: Fire protection must be designed from the very design phase of the structure and the selection of materials for the foundation, floors, walls, facade, roofs, electrical, mechanical, air conditioning, ventilation and ICT infrastructure installations, including devices, equipment and furniture planned for installation.

12) Occupational Health and Safety Annex: must contain a written statement from the designer who has incorporated the prescribed occupational health and safety measures relating to the facility and the technological process in accordance with the requirements specified in this document, supplemented or elaborated in the technological project.
13) Water supply and sewage installation project.
14) Risk assessment and protection against natural disasters (drought, flood, earthquake, tsunami, wind, rain, snow).
15) Main project.
16) Detailed project.
17) Project of the completed facility.
18) Other necessary projects.

4.3. Legal and technical requirements

In order to plan the future horizontal expansion of the archives, which must be foreseen throughout the development of all projects, if the land for the expansion meets the requirements, even at the stage of obtaining and regulating the legal documentation for the construction of the facility (location permit, construction permit, etc.), it is necessary:

- To secure ownership of the land.
- Register the plot in the real estate cadaster.
- Determine protection zones around the facility.
- Ensure decisions from authorities that no residential, industrial or other commercial buildings may be built in these zones.
- Record land for the expansion of archives in spatial and urban plans with construction bans in the protection zone.

5. BUILDING FEATURES

A facility for storing archival materials that represent cultural property must have a safe, secure, healthy, comfortable, durable, aesthetically pleasing and accessible working environment.

Important design requirements for an archival building are as follows:

1) Accommodation of archival materials with maximum efficiency and utilization of volumetric space.

2) Flexibility - the ability to accept new materials that need to be archived and new archiving technologies.

3) Requirements and estimates for the horizontal and vertical expansion of archives.

National Archives of Australia
Part of the depot layout

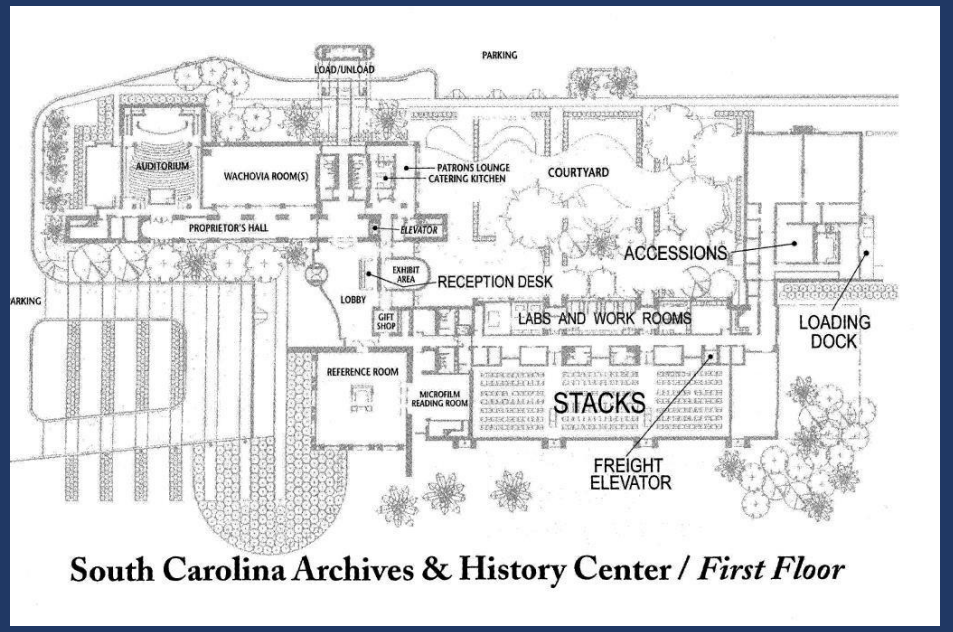
4) Protection of stored archival materials is, for this type of building, a fundamental design issue.

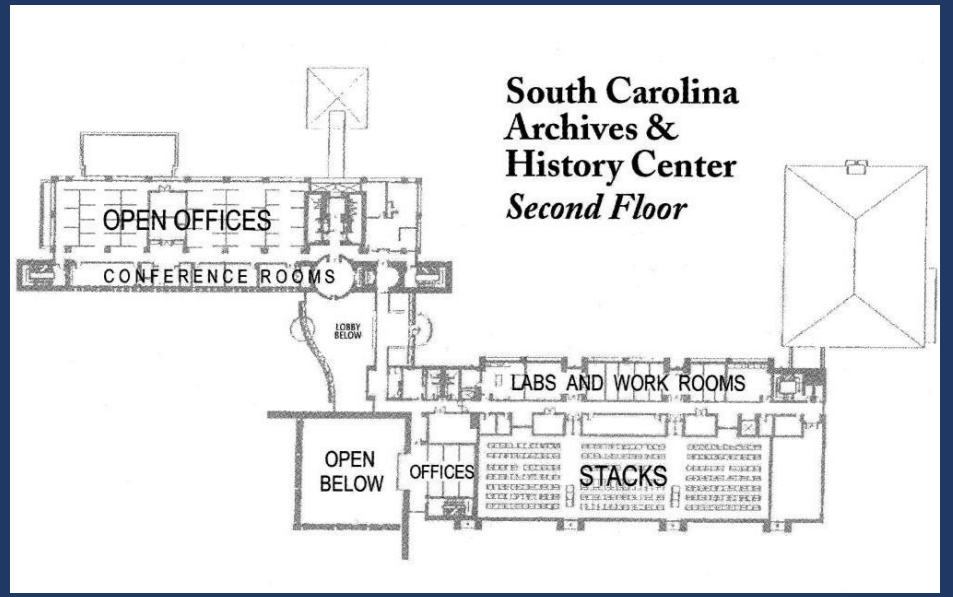
5) Sharing of storage space (physical and electronic) to limit its loss in the event of catastrophic loss due to fire or information system failure.

6) Protection of stored material from fire, exposure to water and harmful environmental influences (smoke, dust, harmful gases, aerosols).

7) Safety of staff and visitors.

8) Prescribed environmental conditions (temperature, relative humidity, pressure, lighting, etc.) which may vary depending on the type of archival materials stored in the depots or in the protection/preservation rooms.





9) Natural daylight for the comfort of employees, but not such as would damage the archival materials or adversely affect sensitive environmental conditions.

10) Controlled access to the archival space.

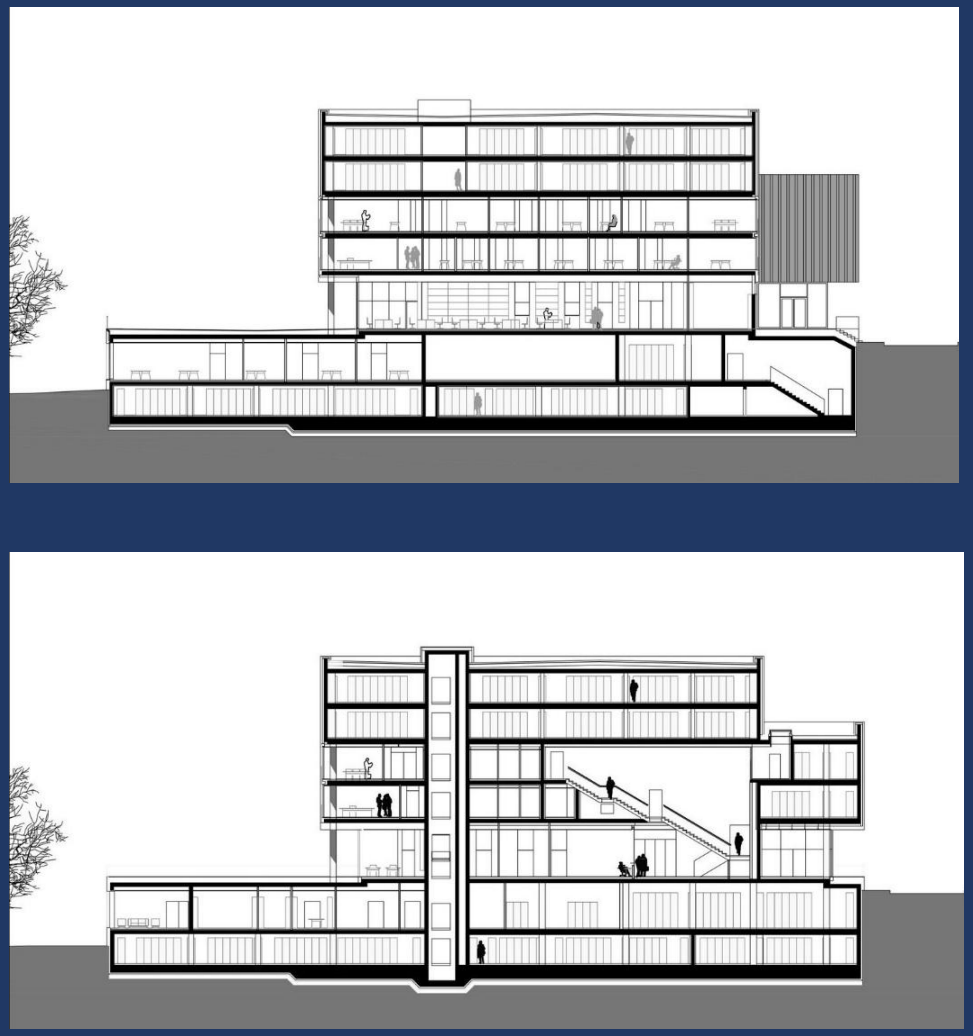
11) Safe and secure area for taking over and receiving of archival materials.

12) Secure and controlled space for receiving visitors/researchers.

13) Building control and management system.

14) Protection of electrical, mechanical and communication systems.

15) Building access and road.



Archives of the Evangelical Lutheran State Church of Bavaria, Nueremberg

Longitudinal sections

5.1. Basic data for the facility

The basic data for the future archive facility were designed based on the experience and scope of work of the Military Archives of the Ministry of Defense of the Republic of Serbia, the amount of archival materials it currently stores, and future projections of the receipt of new archival materials.

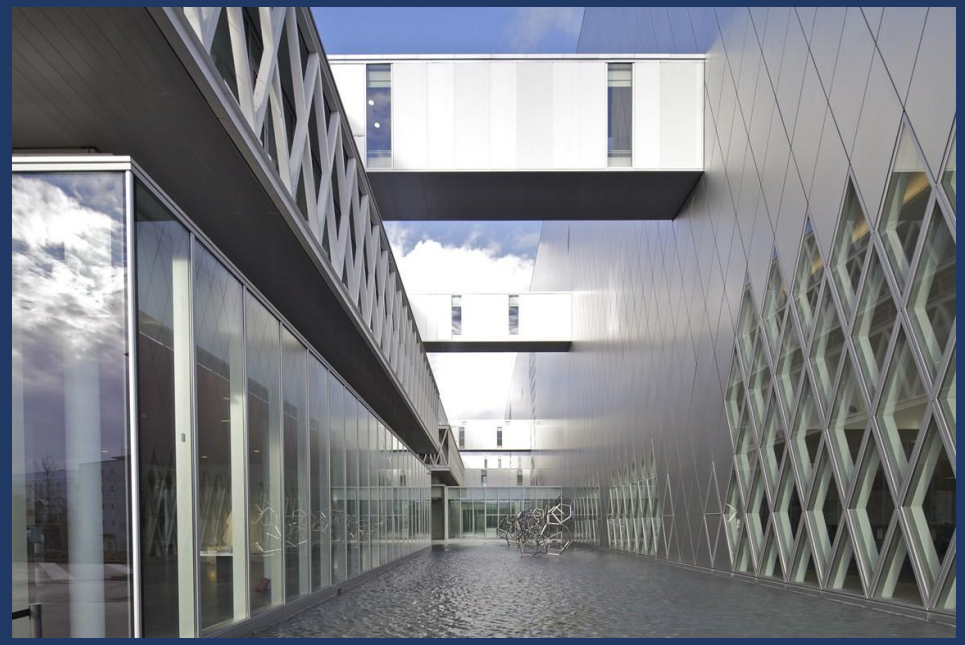
Full and detailed scope of data are given in the work.

5.2. Requirements for accessibility of archives for persons with disabilities

The access to the facility itself should be designed to enable accessibility of archival materials for persons with disabilities:

1. Access for persons with disabilities in the parking lot and the entrance to the archive.
2. Inside the facility: access to the toilet and in the reading room an adapted work area.
3. Toilets, stairs, signage in case of needing assistance for a disabled person.

6. TYPES AND PROPERTIES OF SPACES



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Interspace

The archive as a facility for storing archival materials includes a number of types of premises with the aim of meeting the needs of employees and visitors.

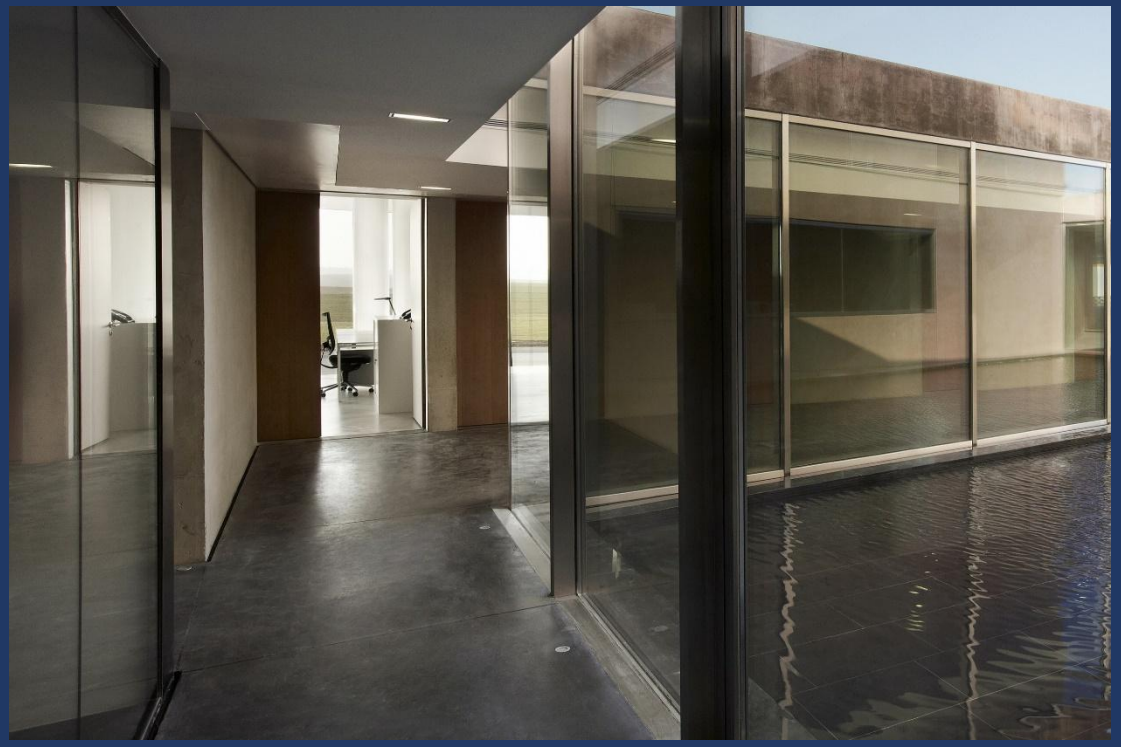
Movement between archive premises must be simple, logical and efficient.

Walls and columns must be effectively placed and designed to facilitate future expansion.

Future growth and expansion should be taken into account at the very beginning of the design.

The premises of the future archive can be divided as following:

- ADMINISTRATIVE PREMISES – These premises constitute an administrative unit that is separate from the public areas. They consist of different office spaces for employees, general affairs office, reception room, cafeteria-kitchenette, sanitary blocks, corridors and elevators, emergency exit, etc.



Archive of French Energy Company “EDF”

Interior space / offices

- PUBLIC AREAS – must be designed and constructed to allow for the natural flow of visitors to the parking space, main entrance, exhibition spaces, library, reading and multimedia rooms, conference rooms, sanitary blocks, emergency exits, etc., so that visitors cannot access work space – offices, laboratories, storage facilities (depots) and other auxiliary spaces.

Reading room

National Archives of France

Conference room

- WORK ROOMS – must have conditions for comfortable and safe work of all permanent employees and those who may be engaged occasionally in temporary jobs, in accordance with the regulations on occupational safety and health, and their layout must be functional so that the work and technological processes that take place in the archive have a natural flow. The dimensions of the work rooms must correspond to the purpose and the number of persons who work in them, including auxiliary rooms.

Auxiliary rooms must be constructed so that they do not violate general and special fire protection measures, that they cannot be the cause of fires or other accidents, nor enable the transfer of fire and accidents to neighboring or surrounding areas.

The floors, walls and ceilings of working and auxiliary premises must be resistant to damage from mechanical and other influences, fireproof, waterproof, and constructed in such a way as to provide protection against atmospheric influences, noise and vibrations and prevent the penetration of hazardous substances.

Some of the work rooms one archive should have:

- ✓ receiving/taking over new archival materials
- ✓ disinfection, decontamination, cleaning and fumigation
- ✓ archival processing and organizing of newly received archival materials
- ✓ laboratory for restoration, conservation and treatment of
- ✓ photo laboratory and laboratory for reprography and microfilming
- ✓ digitization facilities
- ✓ server and back up rooms

- AUXILIARY ROOMS – are those that do not require permanent staff presence, except for security service rooms that fall into this category. These are usually wide range of storage rooms (for hazardous substances, hygiene products and consumables, bureau equipment, office and administrative materials, defective/expired resources, changing rooms, first aid, sanitary blocks, garages, motor vehicles access area for unloading new archival materials, air conditions and ventilation chambers, electronic systems, burglar and fire alarm systems, etc.)

- STORAGE SPACE – DEPOTS - The specifics of the space also depend on the type of archival materials being stored. In addition to the materials currently stored, new types of materials must be foreseen, and in this regard, independent regulation and maintenance of microclimate parameters.

The archive has the following categories of archival materials, which are thus arranged in depots:

1) Depot of classified archival materials with rooms for a special storage regime in accordance with the level of secrecy.
2) Depot of archival materials classified as “STATE SECRET”.
3) Depot of archival materials of a general type, without a level of secrecy.
4) Depot of archival materials of judicial bodies, security and defense bodies, and personnel files.
5) Cold rooms for storage of microforms.
6) Books and other library materials.
7) Film and audio materials.

*some of depot organization is according to type of archival material kept in Military archives

7. INSTALLATIONS AND SYSTEMS

7.1. Electrical installations

Electrical installations of archives should meet strict requirements in terms of design and execution, given the extremely high risk of fire outbreaks and loss of valuable historical and cultural heritage. The risks of fire outbreaks must be minimized by all preventive measures, especially during the design and construction of the facility, primarily by using technical solutions in the design of electrical installations and by applying non-combustible (fire-resistant) materials, assemblies, parts of devices and equipment.

Electrical installations must be designed and executed in accordance with existing and valid standards and norms (rules, instructions, etc.), taking into account in particular that the purpose of the facility is to accommodate, store and protect national cultural assets - archival materials and their electronic copies stored on sensitive electronic devices.

* Detailed specifications on electrictal installations and systems, design and materials are given in the work.

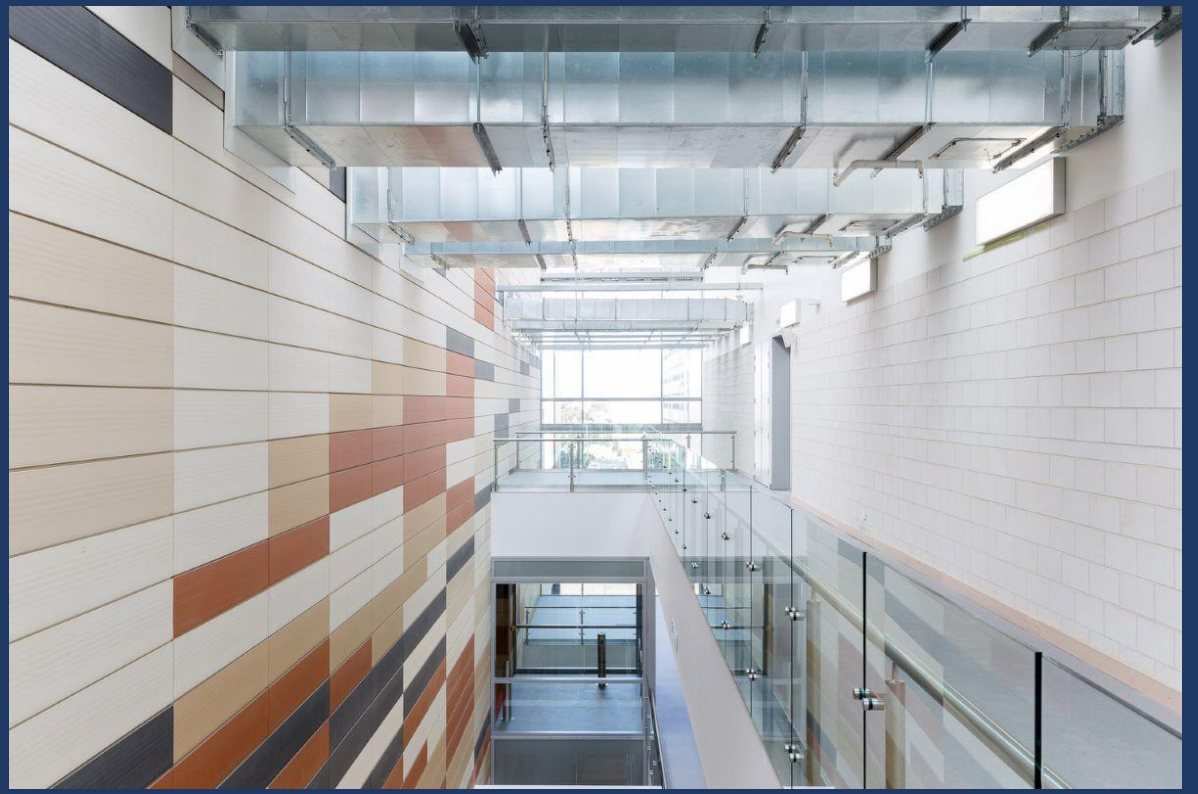
7.2. Heating, ventilation, air conditioning and fluid installations

- Installations for distributing fluids (compressed air, gases, steam, water, technological solutions and liquids, etc.) must be designed and installed so that they do not pose a hazard that can cause fire or explosions.

- The supply of thermal energy to the building must be reliable, efficient, and uniform, both for smaller and larger spaces (corridors, halls, staircases, galleries - exhibition spaces, conference rooms, storage areas - depots).

- The design of maintaining the prescribed microclimate conditions in depots, including heating, must be carefully implemented, since the subject of storage and preservation is archival materials of various contents that require different microclimate conditions.

- The materials used in the construction of the installations must not generate or retain static electricity.
- To maintain the required relative humidity within the prescribed limits, air humidifiers should be provided.
- The air cleanliness must be equal to that found in the so-called “White” - cleanrooms in accordance with international or national standards.



*Detailed specifications are given in the work

7.3. Fire protection

The building of each archive, considering its purpose and tasks as an institution of culture and protection of archival materials, as well as the importance of the cultural heritage it preserves, must be designed and constructed in such a way that all subsystems ensure minimal risk of unwanted events and maximum protection against natural disasters, accidents, disappearance and destruction of archival materials.

Given this, fire protection is one of the most important subsystems to which special attention must be paid even at the earliest stage of design.

In this regard, the project developer must propose and develop:

- In the Conceptual design – at least 3 variants of fire protection
- Fire Protection Concept – at least 3 variants of fire protection
- Main fire protection project – 1 basic system and at least 1 backup system

The Fire Protection Concept and the Main Fire Protection Project should include structural, organizational and technical protection measures, i.e., even at the conceptual design and detailed design stages, it should be taken into account that the facility, given its importance, belongs to the first category of facilities in terms of fire risk.

*Detailed specifications of fire protection are given in the work

7.4. Telecommunications, information, electrical equipment, miscellaneous equipment

1. Several physically separate Information Communication Technology (ICT) networks must be designed in the facility:
   - LAN network for all organizational units ot the archives
   - Local network with a server and equipement intended for digitization process
   - Internet network
   - Internal video surveillance system

2. Server Room and Backup room for storing backup copies of digitized archival materials.

CONCLUSION

In the context of quality implementation, special attention should be paid to the coordination and synchronization of the overall complex reconciliation with all designers: architectural solutions, construction, internal installations, equipment, etc., with the aim of ensuring quality, both aesthetic and functional solutions.

Of course, future projects of a modern special-purpose building are subject to changes and involve monitoring technological and IT progress, the emergence of new materials, as well as any changes to legal regulations that accompany the entire process of designing a complex and demanding building such as an archive.

Thank you