CERL Seminar on Preparing for and using a remote storage facility

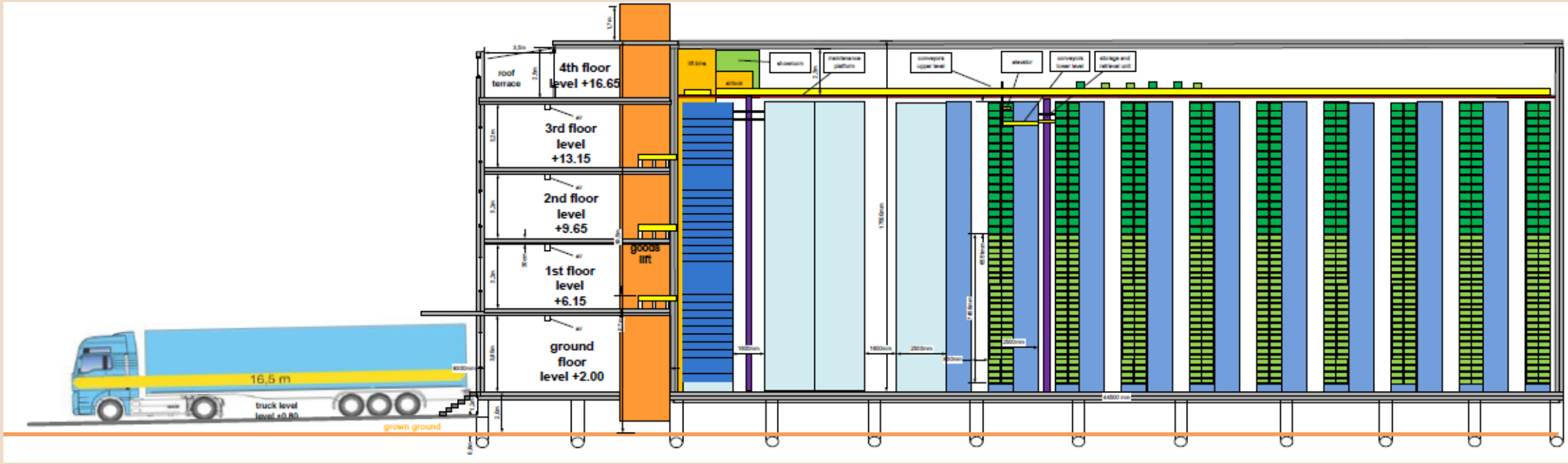
Consortium of European Research Libraries

18 & 19 November 2019
KB National Library of the Netherlands

KB nationale bibliotheek

Planning for it

1. Specifications for the building, climate control or not



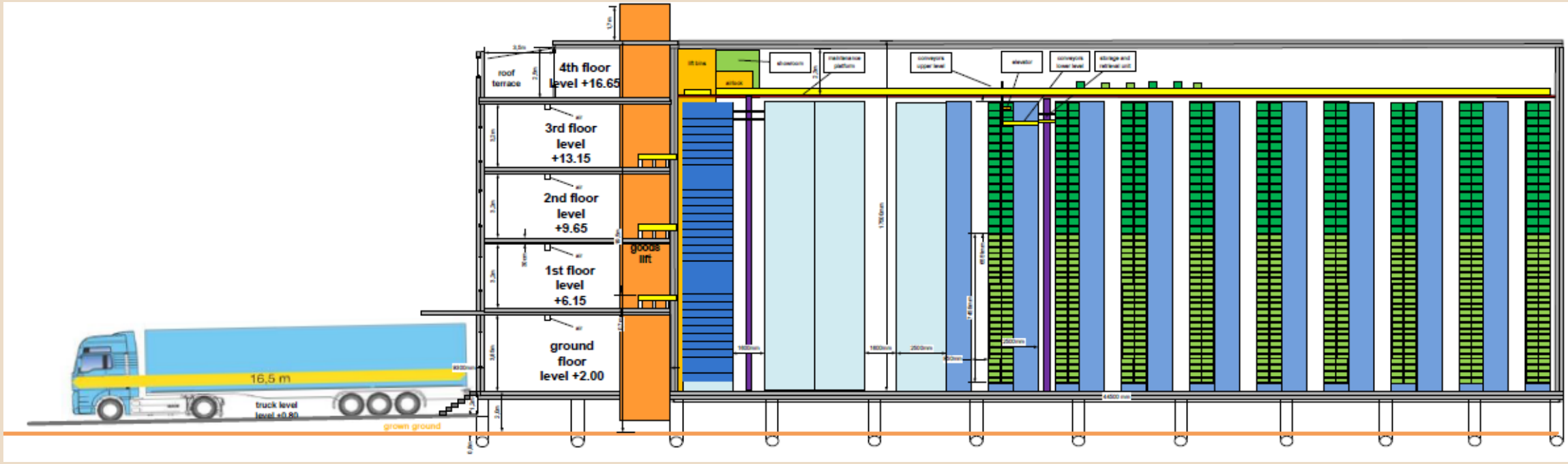
Foekje Boersma
Head of Collection Care
KB National Library of the Netherlands

KB nationale bibliotheek

Planning for it

1. Specifications for the building

CLIMATE CONTROL: ACTIVE or PASSIVE?



Foekje Boersma
Head of Collection Care
KB National Library of the Netherlands

KB nationale bibliotheek

Brief introduction

Foekje Boersma

Head of Collection Care since August 2018

Previously at:

Getty Conservation Institute
(Managing Collection Environment initiative)

National Archives of the Netherlands

….

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Why a new repository (and main building) for the KB?

- Current location is not ‘future-proof’
  - Limited space for collection growth
  - Renovation is too costly
  - Long term exploitation is not sustainable
  - Storage on top location
- Change in collection use
  - Reduction in request for physical collection (except for Special Collections)
  - Ongoing digitization increases online access

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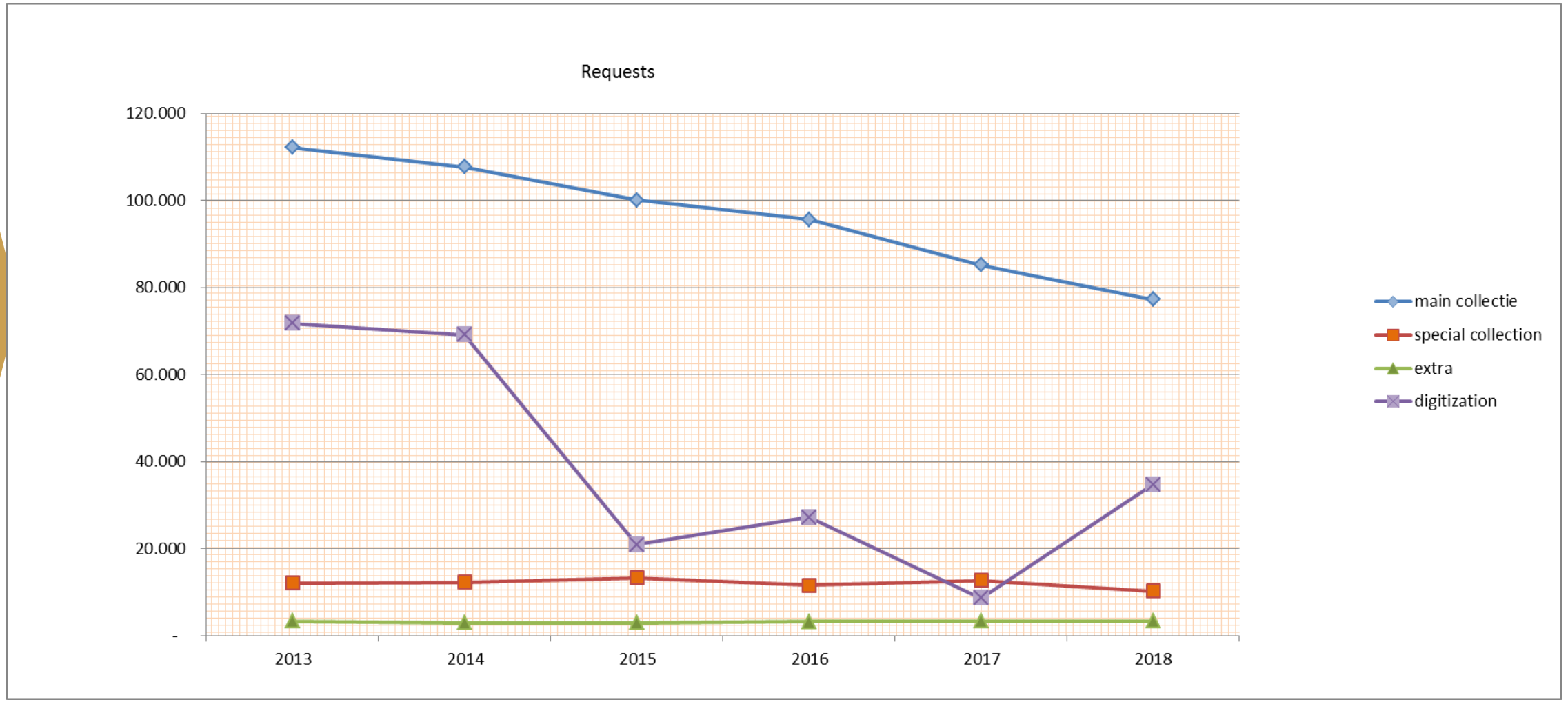
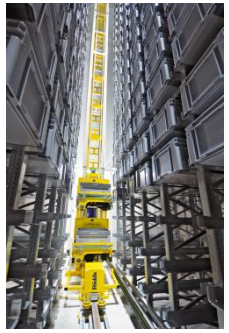
Requests for access



Survey



Robotized storage

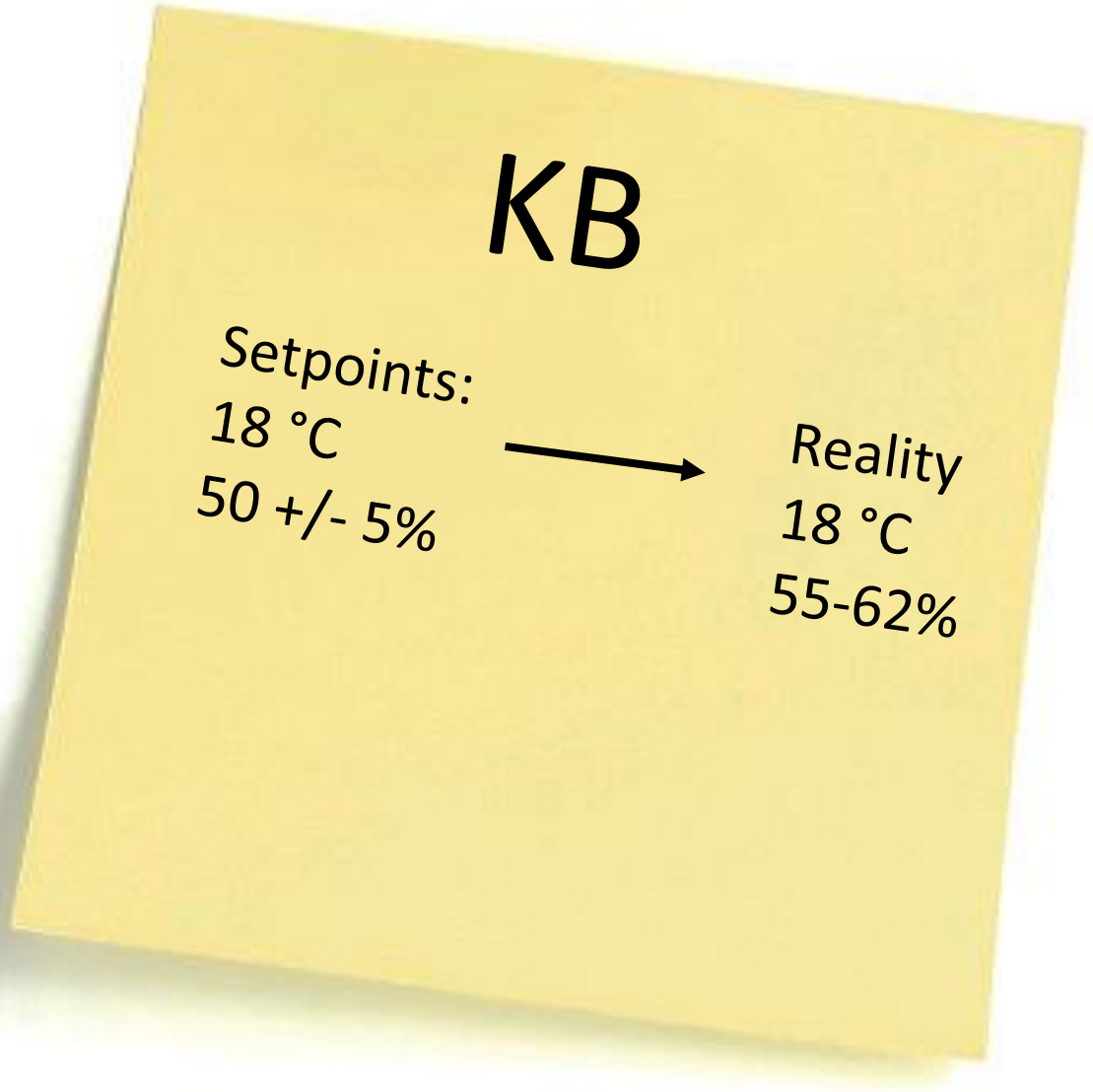
Super high density storage

Compact library storage

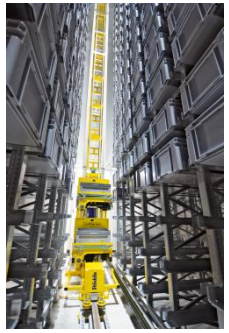
Static library storage

Internal storage

Remote storage


KB
Setpoints:
18 °C
50 +/- 5%
Reality
18 °C
55-62%

Survey



Robotized storage

Super high density storage

Compact library storage

Static library storage

KB

Aim
10-22 °C
40-55%

If you have more than one storage facility → use 1, 2 etc.

KB

Setpoints:
18 °C
50 +/- 5%

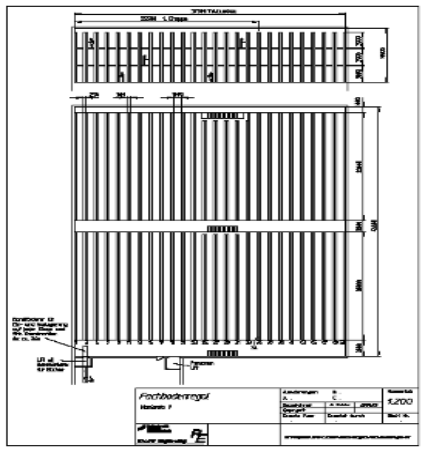
→

Reality
18 °C
55-62%

Internal storage

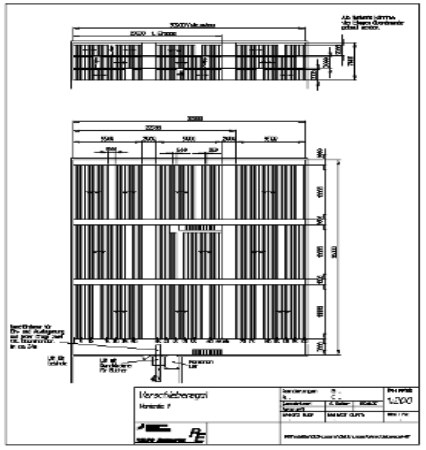
Remote storage

Survey



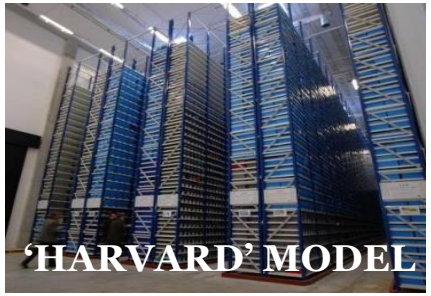
1

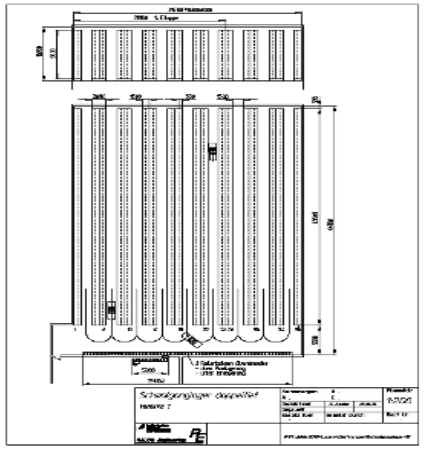
Static library storage



0.68

Compact library storage





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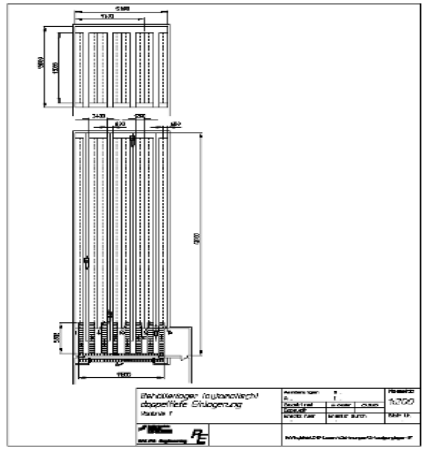
Super high density storage



0.32

Robotized storage

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Calculation of costs

Budget-Berechnung						Ausbaustufe 1: 4 Mio. Bib-Einheiten		
Nr.	Positionen		Preis/ Einheit [€]	Stück	Preis V5 [€] manuell	Stück	Preis V1 [€] automatisch doppelt tief
1	Bücherrückgabe / Vereinnahmung				2.123.500		2.123.500
2	Fachbodenregal				19.858.000		
3	Automatisches Kleinteilelager						12.380.700
4	Sonstige Bereiche Lager				50.000		50.000
5	Kommissionierung				24.000		157.500
6	Warenausgang				36.000		2.400
7	Zubehör/Sonstiges				105.800		67.000
8	Brandschutz				1.850.000		2.850.000
9	Gebäude "Zusatzflächen"				2.805.000		2.805.000
10	IT-System				500.000		1.000.000
11	Summe				27.352.000		21.436.000
12	Verschiedenes/Unvorhergesehnes	10%			2.735.000		2.144.000
13	Nebenkosten (Planung, Behörden etc.)	20%			5.470.000		4.287.000
14	Gesamtinvestition				35.557.000		27.867.000

Universitäts- und Stadt Bibliothek Köln

Universität zu Köln

University Library of Cologne
Ralf Depping / USB Köln
6th Kuopio Conference
Basel / March 15th 2018

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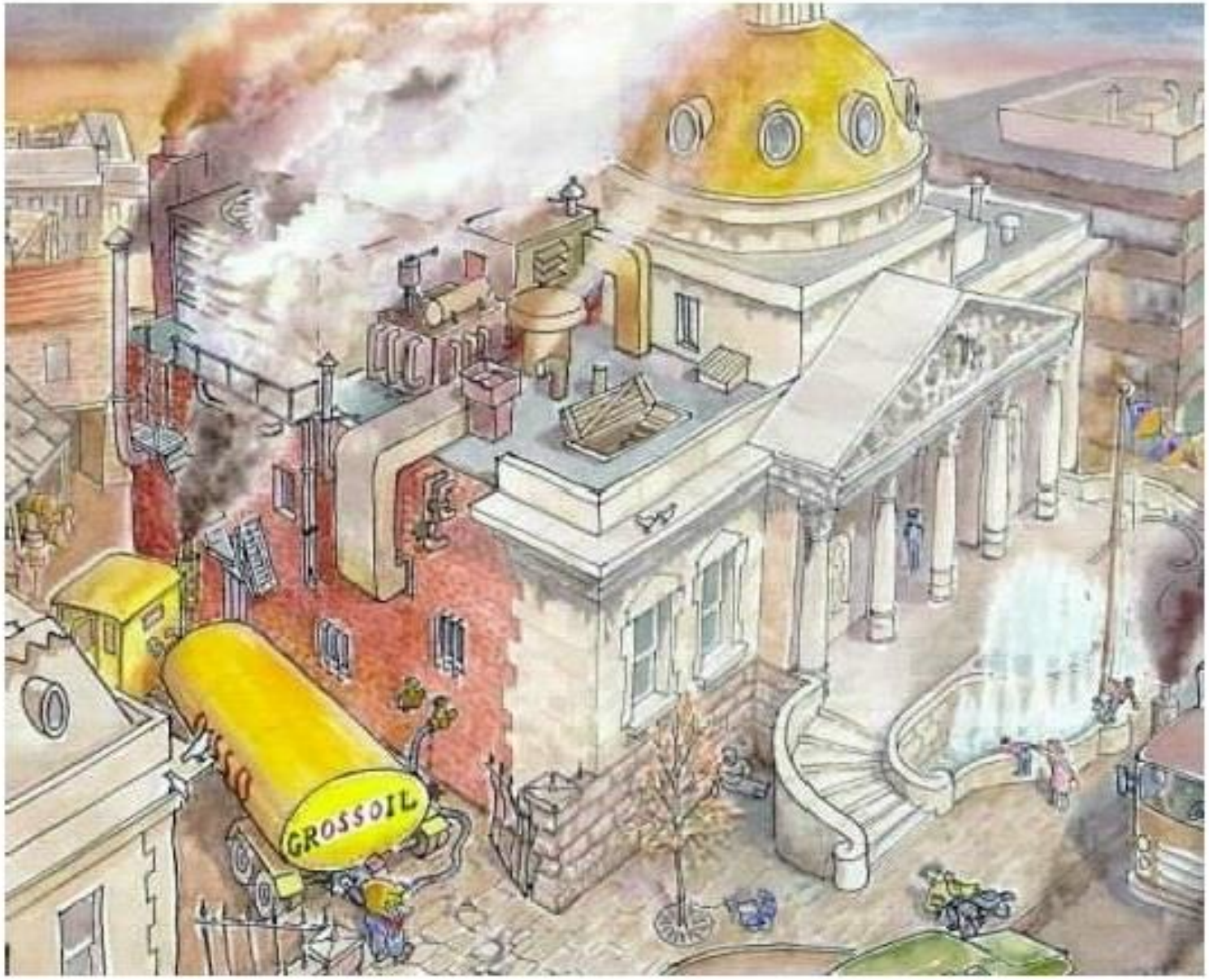
Climate control



Tim Padfield

New storage facility THE chance to:

- introduce more sustainable climate control strategies
- tackle energy consumption

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Climate control

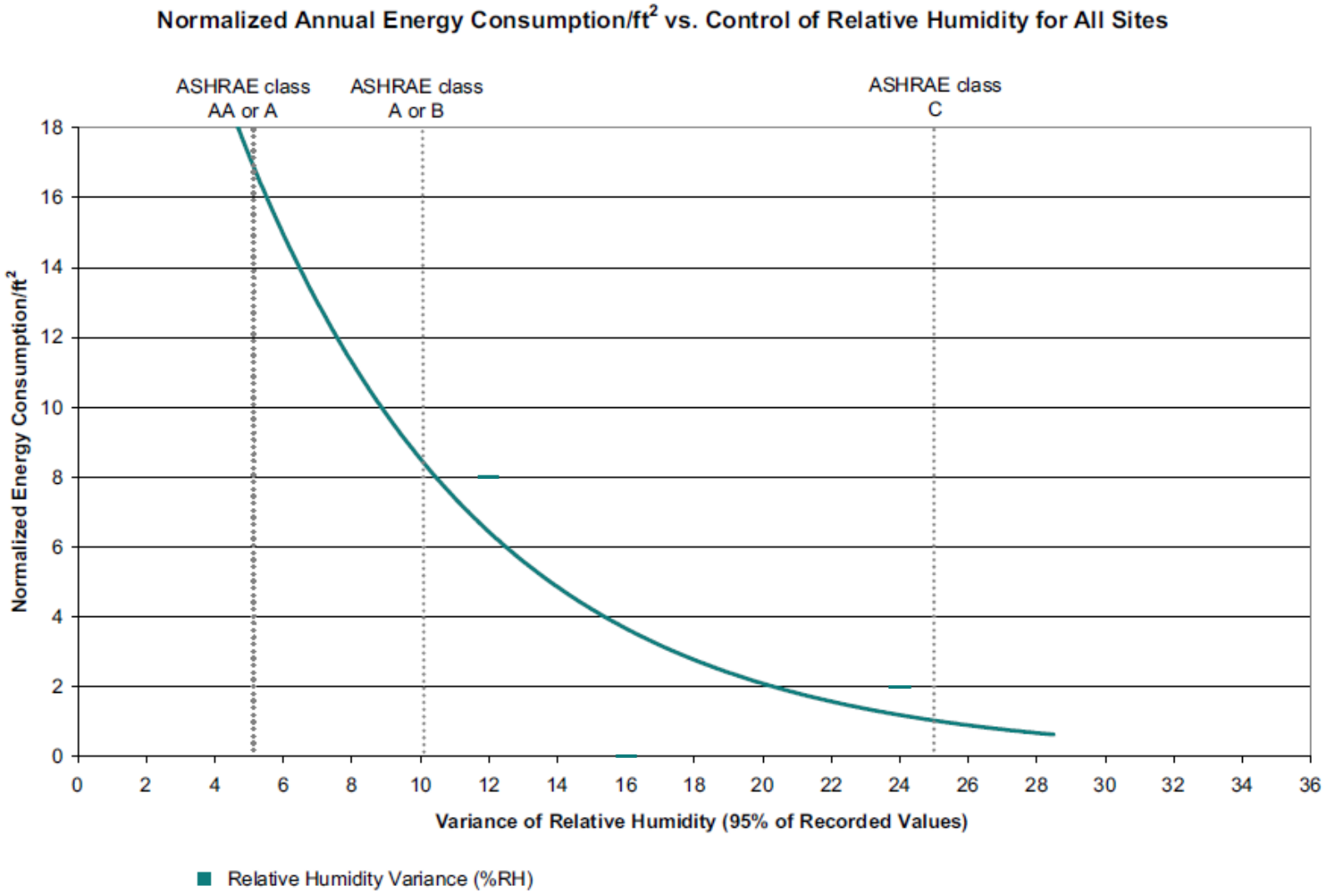


Figure 35: Normalized Annual Energy Consumption per Square Foot vs. Control of Relative Humidity for All Sites, Including ASHRAE Classes of Control.

Based on David Artigas, 2007, University of Pennsylvania Thesis

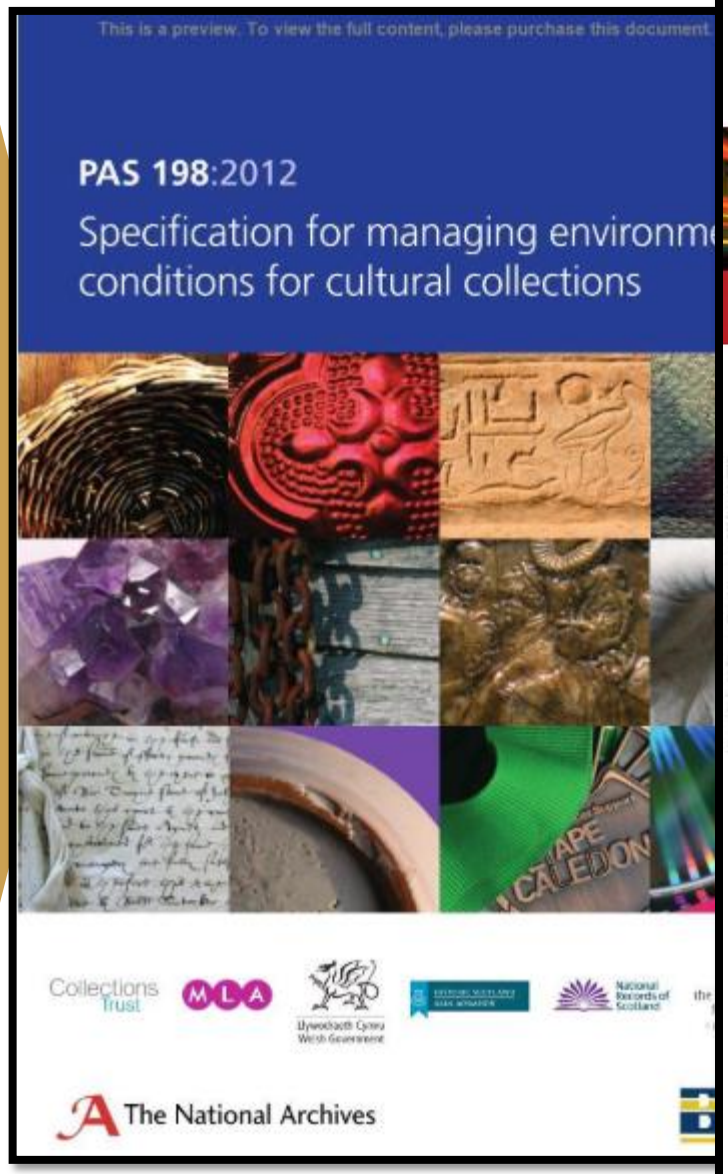
*those commissioning new and refurbished spaces to specify the use of low tech and **low energy methods** to create reasonably stable environmental conditions.*

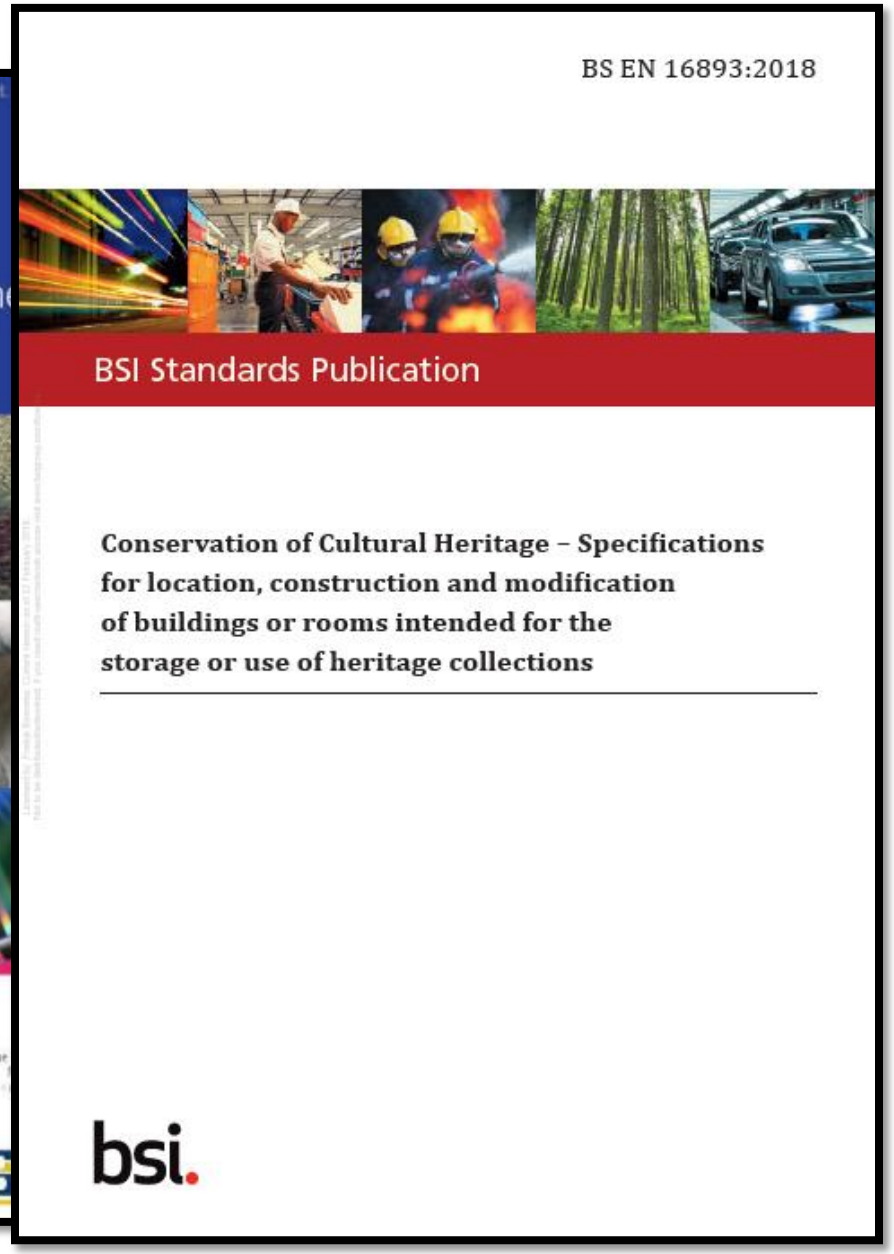
Mark Jones, Director of the V&A
2008 Nov - Museums and Climate Change

*Care of our art collections should therefore be expressed in a way that **does not assume air-conditioning** or any other current solutions.*

Nicholas Serota, director of Tate
2008 May - Museum Environmental Conditions in an Era of Energy Constraint – Paper to the Bizot Group Meeting

Change in guidelines





…recommends the following parameters for the storage of mixed library and archive collections:

- 13°C to 20°C
- 35% RH to 60% RH

The ranges recommended accommodate the most sensitive traditional library and archive materials such as beeswax seals and parchment (but not photographic and audio visual materials).

For boxed paper records that are rarely handled (for example in remote stores) the ranges are wider:

- 5°C to 25°C
- 25% RH to 60% RH

PD 5454:2012
Guide for the storage and exhibition of archival materials

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Change in guidelines

PAS 198:2012

Specification for managing environme
conditions for cultural collections

Collections Trust · MLA · Llywodraeth Cymru Welsh Government · Historic Scotland · National Records of Scotland · The National Archives

BS EN 168

BSI Standards Publication

Conservation of Cultural Heritage – Specificat
for location, construction and modification of buildings or rooms intended for the storage or use of heritage collections

bsi.

CHAPTER 24

MUSEUMS, GALLERIES, ARCHIVES, AND LIBRARIES

THIS chapter presents best practices and advice on planning, designing, and implementing environmental strategies for long-term preservation of cultural heritage that also support access in an economically and environmentally responsible way. It aims to support a holistic approach, taking into consideration the types of collections, buildings, and environmental control systems that can sustain appropriate conditions for specific collections with their own climate histories. It acknowledges that any strategy will have to be an integral part of heritage preservation as a whole. The chapter is applicable to museums, galleries, nonresidential historic buildings, reference libraries, and archives, as well as to both new and existing structures. It is not designed for buildings with public access that only hold collections not intended for preservation, such as school libraries.

This chapter is primarily directed at HVAC engineers and facility managers involved with indoor climate control projects in cultural heritage institutions, including new construction and extensions, renovations and upgrades of existing systems, and the adjustment of climate control strategies towards sustainability. Because this chapter has been widely used by allied professionals in a much broader context, it informs all stakeholders involved in the decision-making process on designing and implementing environmental strategies for cultural heritage collections. These include, but are not limited to, engineers, architects, collection owners, cultural heritage administrators, collection managers, conservators, conservation scientists, curators and registrars.

The information in this chapter focuses on mechanical and, to a limited extent, nonmechanical approaches to the control of temperature, relative humidity, and indoor air quality. Tables and graphs are used to provide clear and easy access to specific information, but the underlying text is necessary to understand the full context.

1. TERMINOLOGY

The terminology used in this chapter derives from the professional conservation field and, except where noted, is taken from the website of the American Institute for Conservation of Historic and Artistic Works (AIC 2018).

Cultural property includes objects, collections, specimens, structures, or sites that have artistic, historic, scientific, religious, or social significance.

Tangible heritage includes buildings, historic places, and monuments, as well as objects and collections significant to the archaeology, architecture, science, or technology of a specific culture.

Intangible heritage, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO), includes traditions or living expressions inherited and passed on within a culture, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge, and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts (UNESCO 2017a).

Digital heritage includes valued knowledge or expressions that have been created digitally, or converted into digital form from existing analogue resources (UNESCO 2017b).

Preservation is protection of cultural property through activities that minimize chemical and physical deterioration and damage and that prevent loss of informational content. The primary goal of preservation is to prolong the existence of cultural property.

Conservation is the profession devoted to preservation of cultural property for the future. Conservation activities include examination, documentation, treatment, and preventive care, supported by research and education.

Preventive care (also called **preventive conservation**) is mitigation of deterioration and damage to cultural property through the formulation and implementation of policies and procedures for the following: appropriate environmental conditions; handling and maintenance procedures for storage, exhibition, packing, transport, and use; integrated pest management; emergency preparedness and response; and reformatting/duplication.

2. KEY CONSIDERATIONS

2.1 HERITAGE

"Heritage is our legacy from the past, what we live with today, and what we pass on to future generations. Our cultural and natural heritage are both irreplaceable sources of life and inspiration" (UNESCO 2018).

Cultural heritage (tangible, intangible, and digital) is considered essential to the understanding and appreciation of humanity's diverse cultures and history. The importance of cultural heritage may be national, regional, or local, and it may have symbolic, aesthetic, cultural, social, historical, scientific, and monetary values that are frequently impossible to estimate. Thus, access to and preservation of cultural heritage is important and may even be legally mandated.

This chapter addresses preservation of tangible heritage: physical objects such as books and documents, works of art, historic tools and utilities, archaeological artifacts, specimens of natural history, examples of popular culture, products of various technologies, and historic buildings.

The preparation of this chapter is assigned to TC 9.8, Large Building Air-Conditioning Applications.

Table 13A Temperature and Relative Humidity Specifications for Collections in Buildings or Special Rooms

Type of Collection and Building	Type of Control	Long-Term Outer Limits[a]	Annual Averages	Seasonal Adjustments from Annual Average[b]	Short-Term Fluctuations plus Space Gradients[c]	Collection Benefits and Risks[d]
Museums, Galleries, Archives and Libraries in modern purpose-built buildings or purpose-built rooms **Temperature at or near human comfort**	**AA** Precision control, no seasonal changes to relative humidity	≥35% rh ≤65% rh ≥10°C ≤25°C	For permanent collections: historic annual average of relative humidity and temperature. In public display areas, human comfort temperatures can apply.	No change to relative humidity Increase by 5 K; Decrease by 5 K	±5% rh, ±2 K	Mold germination and growth, and rapid corrosion avoided. No risk of mechanical damage to most artifacts and paintings. Some metals, glasses, and minerals may degrade if rh exceeds a critical value. Chemically unstable objects deteriorate significantly within decades at 20°C, twice as fast each 5 K higher.
	A1 Precision control, seasonal changes in temperature and relative humidity	≥35% rh ≤65% rh ≥10°C ≤25°C		Increase by 10% rh Decrease by 10% rh. Increase by 5 K; Decrease by 10 K	5% rh, ±2 K	Mold germination and growth, and rapid corrosion avoided. No mechanical risk to most artifacts, paintings, photographs, and books; small risk of mechanical damage to high-vulnerability artifact. (Current knowledge considers the specifications A1 and A2 as causing the same low risk of mechanical damage to vulnerable collections. Slow seasonal adjustment of 10% rh is estimated to cause the same mechanical risk as rapid fluctuations of 5% rh, because of significant stress relaxation occurring within three months of a slow transition.)
	A2 Precision control, seasonal changes in temperature only				% rh, ±2 K	Chemically unstable objects deteriorate significantly within decades at 20°C, twice as fast each 5 K higher.
Museums, galleries, archives, and libraries needing to reduce stress on their building (e.g., historic house museums), depending on climate zone[e]	**B** Limited control seasonal changes in relative humidity and large seasonal changes in temperature.[f]	≤30°C	For permanent collection: historic annual average of relative humidity and temperature.	Increase by 10% rh Decrease by 10% rh Increase by 10 K Decrease by up to 20 K	±10% rh, ±5 K	Mold germination and growth, and rapid corrosion avoided. Chemical deterioration halts during cool winter periods No risk of mechanical damage to many artifacts and most books. Tiny risk to most paintings, most photographs, some artifacts, some books. Moderate risk to high-vulnerability artifacts. Objects made with flexible paints and plastics that become brittle when cold, such as paintings on canvas, need special care when handling in cold temperatures. Chemically unstable objects deteriorate significantly within decades at 20°C, twice as fast each 5 K higher. Chemical deterioration halts during cool winter periods.
	C Prevent relative humidity extremes (damp or desiccation)	≥25% rh ≤75% rh	Within 25% to 75% rh year-round. Temperature usually below		Not continually above 65% rh for longer than *X* days.[h]	Mold germination and growth, and rapid corrosion avoided. Tiny risk of mechanical damage to many artifacts and most books; moderate risk to most paintings, most photographs, some artifacts, some books; high risk to high-vulnerability artifacts Even greater care is needed than provided in B when handling

Introducing:

- Historic average is leading
- Local climate & climate change
- Seasonal changes
- Cooler conditions

Cooler conditions

Arrhenius equation: double the life for each five-degree drop

Lifetimes at Various Temperatures*				
	High Stability	**Medium Stability**	**Low Stability**	**Very Low Stability**
60°C, heat treat, sun	~4 years +	~1 year	~6 months	2 months
30°C, hot room	~250 years +	~75 years	~25 years	~7 years
25°C, warm room	~500 years +	~150 years	~50 years	~15 years
20°C, room	**Millennia ~1000 years**	**A few centuries ~300 years**	**One human lifetime ~100 years**	**One human generation ~30 years**
12°C, cool	~3200 years +	~1000 years	~320 years	~100 years
4°C, cold	11 000 years +	~3300 years	~1100 years	~330 years
–20°C, frozen	750 000 years +	~225 000 years	~75 000 years	~22 500 years

Source: Modified from the tables "Chemical sensitivity of materials to room temperature" and "Approximate lifetimes of the materials at various temperatures" (Michalski 2018)
**Lifetime* defined here in terms of effects or utility described for each material listed in the top row. Lifetimes expressed in each row have considerable uncertainty, but relative improvement from top to bottom rows is certain.

2019 ASHRAE Handbook Chapter 24

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What if you can combine it all?

- Affordable storage for the future
- Robotized storage
- Seasonal changes in T
- Cooler temperatures

- No active climate control - passive building solution?

Table 13A Temperature and Relative Humidity Specifications for Collections in Buildings or Special Rooms

Type of Collection and Building	Type of Control	Long-Term Outer Limits[a]	Annual Averages	Seasonal Adjustments from Annual Average[b]	Short-Term Fluctuations plus Space Gradients[c]	Collection Benefits and Risks[d]
Museums, Galleries, Archives and Libraries in modern purpose-built buildings or purpose-built rooms **Temperature at or near human comfort**	**AA** Precision control, no seasonal changes to relative humidity	≥35% rh ≤65% rh ≥10°C ≤25°C	For permanent collections: historic annual average of relative humidity and temperature. In public display areas, human comfort temperatures can apply.	No change to relative humidity Increase by 5 K; Decrease by 5 K	±5% rh, ±2 K	Mold germination and growth, and rapid corrosion avoided. No risk of mechanical damage to most artifacts and paintings. Some metals, glasses, and minerals may degrade if rh exceeds a critical value. Chemically unstable objects deteriorate significantly within decades at 20°C, twice as fast each 5 K higher.
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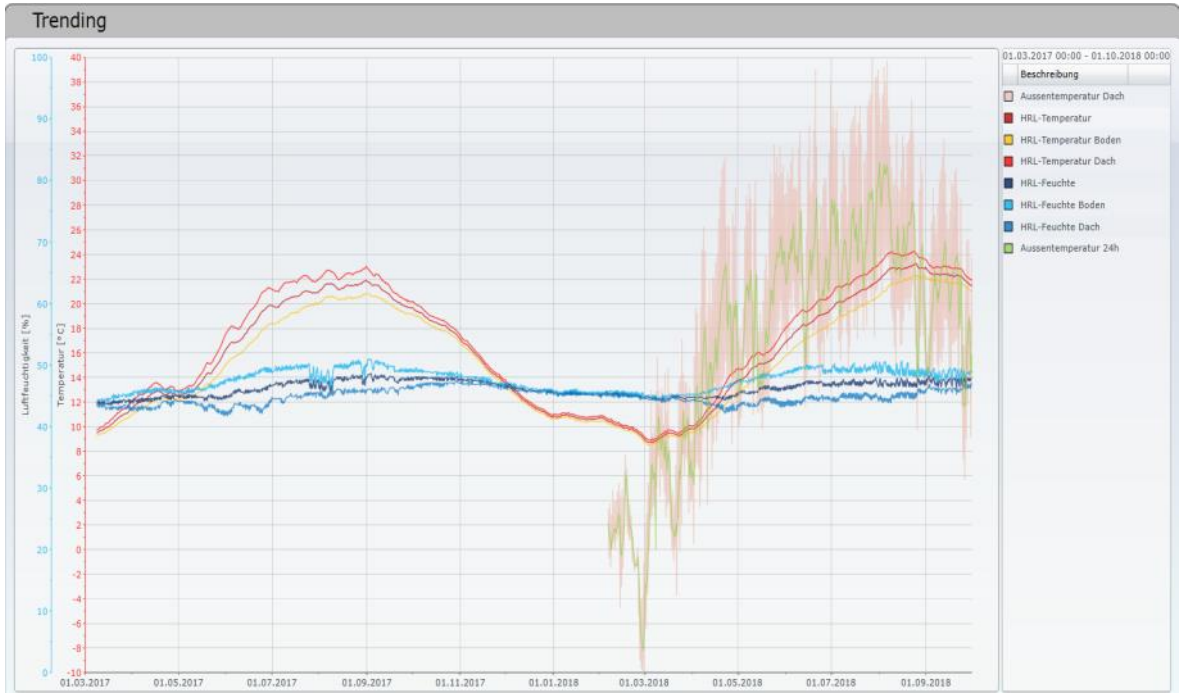
Museums, galleries, archives, and libraries needing to reduce stress on their building (e.g., historic house museums), depending on climate zone[e]	**B** Limited control, seasonal changes in relative humidity and large seasonal changes in temperature.[f]	≥30% rh ≤70% rh ≤30°C	For permanent collection: historic annual average of relative humidity and temperature.	Increase by 10% rh Decrease by 10% rh Increase by 10 K Decrease by up to 20 K	±10% rh, ±5 K	Mold germination and growth, and rapid corrosion avoided. Chemical deterioration halts during cool winter periods No risk of mechanical damage to many artifacts and most books. Tiny risk to most paintings, most photographs, some artifacts, some books. Moderate risk to high-vulnerability artifacts. Objects made with flexible paints and plastics that become brittle when cold, such as paintings on canvas, need special care when handling in cold temperatures. Chemically unstable objects deteriorate significantly within decades at 20°C, twice as fast each 5 K higher. Chemical deterioration halts during cool winter periods.
	C Prevent relative humidity extremes (damp or desiccation)	≥25% rh ≤75% rh	Within 25% to 75% rh year-round. Temperature usually below		Not continually above 65% rh for longer than *X* days.[h]	Mold germination and growth, and rapid corrosion avoided. Tiny risk of mechanical damage to many artifacts and most books; moderate risk to most paintings, most photographs, some artifacts, some books; high risk to high-vulnerability artifacts Even greater care is needed than provided in B when handling

And there are already some examples:

Speicherbibliothek, Büron
Super high density robotized storage



Climate curves 2017-2018 (copyright: Mike Märki, CSLS)

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KB Mission statement “Care for the written word”

Sustainable and **safe** storage of our physical collections

- Optimal preservation conditions
- As little dependency on technical climate control installations as possible:
  - RV has to be stable and within safe boundaries
  - T is allowed to follow seasonal changes

KB follows the international movement in the cultural heritage sector to

more sustainable collection management

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