

Journées d'étude : « Les sites de conservation robotisés »

Lundi 12 juin : 12H30 - 17H

Bibliothèque nationale de France, site François Mitterrand
Quai François Mauriac, Paris 13^e
Belvédère (Tour T2)

- A partir de 12H30 : Accueil par la Présidente et le Directeur général
- 13H : Déjeuner
- 13 H 45 – 17 H30 : Séance de travail, présentation des projets

Bibliothèque nationale de France
Par l'équipe Projet Amiens.

Koopérative Speicher Bibliothek à Büron (CH)
Mike Märki, directeur.

Koninklijke Bibliotheek, La Haye (NL)
Foekje Boersma, Head of the Collection Preservation Department,
Hans Jansen, Strategy Advisor at Koninklijke Bibliotheek.

The British Library (GB)
Andy Appleyard, The Head of Operations (North).

Schweizerische Nationalbibliothek (CH)
Damian Elsig, Director Eidgenössisches Departement des Innern EDI.

Mardi 13 juin : 9H30 - 14H30

Bibliothèque nationale de France, site Richelieu
58 rue de Richelieu, Paris 2^e
Salle Emilie du Châtelet

- A partir de 9 H 30 : Café d'accueil
- 10H-12H30 : Séance de travail ; discussions transverses, conclusions et perspectives
 - Robotisation (nb de cellules, robot, coûts, dimension bacs, plateaux, densité, phasage choix roboticien, retour d'expériences, etc.)
 - Construction (perf. énergétiques, environnementales, qualité de vie au travail)
 - Conservation (le magasin : matériaux, épaisseur, performances, acoustiques, éclairage, électromagnétisme, dérive t°/ hygro., etc.)
 - Plan de sauvegarde des collections (dans le cas d'un magasin de grande hauteur robotisé : espace de repli ? organisation ?)
- 12H30-13 H 30 : Déjeuner
- 13H30-.... Visite du site Richelieu (espace patrimoniaux / musée)

Study Days “Robotic conservation sites”

Monday 12th June: 12.30 - 5 pm

French National Library, François Mitterrand site
Quai François Mauriac, Paris 13th
Belvedere (Tower T2)

- **From 12.30 pm: Welcome by the President and Chief executive**
- **1 pm: Lunch**
- **1.45 – 5.30 pm: Working session, project presentation**

Bibliothèque nationale de France
Project Team Amiens

Koopérative Speicher Bibliothek in Büron, Switzerland,
Mike Märki, Director

Koninklijke Bibliotheek, The Hague
Foekje Boersma, Head of the Collection Preservation Department.
Hans Jansen, Strategy Advisor

The British Library
Andy Appleyard, Head of Operations (North)

Schweizerische Nationalbibliothek (CH)
Damian Elsig, Director Eidgenössisches Departement des Innern EDI.

Tuesday 13th June: 9.30 am – 2.30 pm

Bibliothèque nationale de France, Richelieu site
58 rue de Richelieu, Paris 2 ème
Emilie du Châtelet room

- **From 9.30 : Welcome coffee**
- **10.00 – 12.30 : Working session; transversal discussions, conclusions and perspectives**
 - Robotisation (no. of cells, robot, costs, size of bins, trays, density, phasing, choice of roboticist, feedback, etc.)
 - Construction (energy and environmental performance, quality of life at work)
 - Conservation (the shop: materials, thickness, performance, acoustics, lighting, electromagnetism, temperature/humidity drift, etc.)
 - Back-up plan for collections (in the case of a robotised high-bay shop: back-up space? organisation?)
- **12.30 – 13.30: lunch**
- **13.30 -.... Site Richelieu visit (heritage area / museum)**

Journée d'étude 12/13 juin

Participants

Koopérative Speicher Bibliothek à Büron, Suisse,

Mike Märki, directeur

Koninklijke Bibliotheek, La Haye

Foekje Boersma, Head of the Collection Preservation Department.
Hans Jansen, Strategy Advisor at Koninklijke Bibliotheek (KB)

The British Library

Andy Appleyard, The Head of Operations (North)

Schweizerische Nationalbibliothek NB

Damian Elsig, Director Eidgenössisches Departement des Innern EDI, Bundesamt für Kultur BAK

Bibliothèque nationale de France:

Laurence Engel, Présidente de la Bibliothèque nationale de France
Kevin Riffaut , Directeur général

Délégation aux relations internationales :

Ophélie Ramonatxo, directrice déléguée aux relations internationales
Bruno Sagna, adjoint à la directrice déléguée aux relations internationales
Hélène Bergès, chargée de missions

Equipe Projet Amiens

Cheng Pei, directeur du projet Amiens
Patrice Ract, adjoint au directeur
Nadia Perigaud, responsable administrative, architecturale et fonctionnelle
Sofiane Elkhou, responsable des opérations
Géraldine Peoc'h, responsable collections : chargée de la préparation des collections
Fabien Aguglia, responsable collections : chargé d'implantation et de transfert des collections
Michel Garrec, chargé de chantiers informatiques et d'implantation des collections
Arnaud Duplessis : chargé de magasinage et de transfert des collections

Comité de suivi du Projet Amiens

Direction des collections :

Sylvie Carreau, chef de service de la Coordination et des ressources
Laurence Gramondi, coordinateur de la conservation et de la reproduction
Julie Ladant, directrice du département Droit, Economie, Politique

Direction des Services et des réseaux :

Olivier Piffault, directeur du département de la conservation
Philippe Vallas, adjoint au Directeur du département de la conservation (mardi)
Annie Bonnaud, chargée de mission IGDC pour le DSC
Adote Chilloh, adjoint au directeur du département des Systèmes d'information

Direction de l'Administration et du personnel

Stéphane Alcandre, directeur du département des affaires juridiques et de la commande publique
Eric Melet, département des Moyens techniques, Chef du service support maintenance et supervision
Marie-Hélène Koenig, Conseillère de prévention



KB



{ BnF CENL }

Elise Cherel, service Hygiène sécurité environnement, adjointe au chef du service

Experts

Emmanuel Aziza, Directeur du département Son, vidéo, multimédia

Stéphane Bouvet, Responsable du laboratoire DSC sur le site Bussy

Céline Allain, Coordinatrice du plan d'urgence pour la sauvegarde des collections (mardi)

Valentin Rottier, Technicien de recherche en conservation

OPPIC (Maîtrise d'ouvrage déléguée)

Valérie Ferrand, cheffe du département des études préalables et du suivi architectural

Gwenaël Loubes, chef de projets

Setec (Programmiste)

Edouard Meyvial, chef de projet (mardi)

Agathe Segard, programmiste (lundi)

ETYO (AMO intralogistique)

Etienne Page, chef de projet

Christophe Vautherot, chargé de missions

Pôle de conservation d'Amiens

Centre de conservation et conservatoire national de la presse

Bibliothèque nationale de France

Journée d'étude : BnF/BL/KB/CSLS

BL : British Library

CSLS : Coopérative Storage Library Switzerland

KB : Koninklijke Bibliotheek, National Library of the
Netherlands

Bibliothèque nationale Suisse , berne

12 juin 2023



Co-financé par
l'Union européenne



La BnF en quelques dates

The BnF : a few dates

DE LA BIBLIOTHÈQUE ROYALE À LA BIBLIOTHÈQUE NATIONALE DE FRANCE: 650 ANS D'HISTOIRE

From the kings to the Nation library : a 650 years history.



1368
Bibliothèque de Charles V

Charles V' Library



1537
Dépôt légal institué par François I

François Ist legal deposit



1721
La Bibliothèque s'installe à Richelieu

The Library moves to Richelieu street



1996-1998
Bibliothèque nationale de France et site Tolbiac

BnF Tolbiac



2022
Renaissance de Richelieu

Richelieu revival



2029
Pôle de conservation Amiens

Amiens' conservation center

Trois grandes missions différentes « évidemment associées et d'égale importance »*

Three different major missions "obviously associated and of equal importance ".*.

Décret n°94-3 du 3 janvier 1994 (codifié) :

1° [...] collecter, cataloguer, conserver et enrichir dans tous les champs de la connaissance, le patrimoine national dont elle a la garde, en particulier le patrimoine de langue française ou relatif à la civilisation française ;
 2° [...] assurer l'accès du plus grand nombre aux collections, sous réserve des secrets protégés par la loi, dans des conditions conformes à la législation sur la propriété intellectuelle et compatibles avec la conservation de ces collections

1° [...] to collect, catalogue, conserve and enhance, in all fields of knowledge, the national heritage in its care, in particular the heritage of the French language or relating to French civilisation ;
 2° [...] to ensure that as many people as possible have access to the collections, subject to any secrets protected by law, under conditions that comply with intellectual property legislation and are compatible with the conservation of these collections.

Avis du conseil scientifique (28 juin 2022) * :

Une mission patrimoniale, réunissant la collecte, notamment par le dépôt légal, la conservation et l'étude d'un patrimoine écrit, numismatique, iconographique, sonore et audio-visuel.
Une mission d'aide à la recherche, centrée sur l'accession de ce patrimoine d'un public d'usagers, dans des conditions modulées en fonction du statut de l'usager et de son projet.
Une mission culturelle : la mise en valeur de ce patrimoine, à destination d'un public élargi au-delà des seuls chercheurs, au travers de diverses manifestations [...]

A heritage mission, involving the collection, in particular through legal deposit, conservation and study of written, numismatic, iconographic, sound and audiovisual heritage. A mission to assist research, centred on access to this heritage for a public of users, under conditions that vary according to the status of the user and their project. A cultural mission: to promote this heritage to a wider public than just researchers, through a range of events [...].

Les ordres de grandeurs

Collections et catalogues en chiffres au 31 décembre 2021	
Livres et recueils	15 900 000
Périodiques	410 000 titres
Manuscrits	370 000 volumes
Estampes et photographies	15 800 000
Partitions	2 000 000
Cartes, plans, globes	950 000
Monnaies et jetons	440 000
Médailles	150 000
Autres objets	60 000 dont 42 000 objets archéologiques, 6 500 costumes, 1 500 marionnettes, plus de 500 masques, etc.
Documents relatifs aux spectacles	3 000 000
Enregistrements sonores	1 650 000
Vidéogrammes	380 000
Multimédias	185 000
Archives du dépôt légal du web	44 milliards de fichiers collectés (URL) 1 600 To
Documents numériques sur Gallica	8 946 026 documents dont 8 204 183 consultables librement à distance

480 km de collections
41 Millions de documents

2 300 agents

A few numbers

Fréquentation 2019
(avant la crise sanitaire)
et 2021
(crise sanitaire)

Capacité d'accueil	3 228 places 1 461 en salles d'étude et 185 en accès libre; 1 582 en salles de recherche
Entrées en salle de lecture	920 818 en 2019 574 658 en salles d'étude, 346 160 recherche 379 495 en 2021 (-59%)
Visiteurs d'expositions	335 545 en 2019 140 087 en 2021 (-58%)
Participants aux conférences	25 361 en 2019 8 059 en 2021 (-68%) 2 024 téléchargements de conférences en podcast en 2019 18 919 téléchargements de conférences en podcast en 2021 (+3544%)
Visiteurs d'éducation artistique et culturelle	34 903 en 2019 et 18 919 en 2021 (-46%)
Visites sur les sites bnf.fr	40 923 050 (44 607 099 en 2021, + 9%) dont 15 534 326 visites incluant une fréquentation de Gallica (18 561 525 en 2021)
Documents communiqués dans les salles de lecture	942 073 (495 779 en 2021, -47%)

7 sites
300 000 m² SHON

257 M€
Budget 2022

Les principaux enjeux du projet Amiens pour la BnF

The main challenges of the Amiens project for the BnF

- Désaturer les sites parisiens et prévoir une capacité d'accroissement pour les 50 ans à venir
- Améliorer les conditions de conservation, notamment celles de la presse en créant un conservatoire national de la presse
- Réorganiser les activités de conservation en installant des ateliers de restauration et de numérisation au sein même du pôle d'Amiens
- Créer une dynamique de coopération culturelle avec les Hauts-de-France
- *De-saturate the Parisian sites and provide capacity for growth over the next 50 years*
- *Improve conservation conditions, particularly for the press, by creating a national press conservatory*
- *Reorganise conservation activities by setting up restoration and digitisation workshops within the Amiens centre itself*
- *Create a dynamic of cultural cooperation with the Hauts-de-France region*

Calendrier

Calendar

- Notification du marché de programmation à la Setec : juillet 2021
- Finalisation de l'AMI, choix du site : octobre 2021
- Validation interministérielle du plan de financement : octobre 2021
- Signature convention-cadre avec les collectivités : mars 2022
- Validation du préprogramme et lancement de la programmation détaillée : début juillet 2022
- Validation du programme par la CMPI le 8 janvier 2023
- Lancement de l'AAPC : le 9 février 2023
- Remise des dossiers de candidatures : le 23 mars 2023
- 1^{er} jury : 21 avril 2023, sélection des 4 candidats
- ■ Envoi du DCC aux candidats retenus : le 9 mai
- Remise des offres : début août (remise des maquettes début septembre)
- 2nd jury : 9 novembre 2023, désignation du lauréat
- Notification du marché MOE : janvier 2024
- Études de la MOE : 2024 – 2025
- Consultation des entreprises : début 2026
- Travaux : printemps 2026 - printemps 2029
- Mise en service du site : avant fin 2029

Le concours d'architecture

The architectural competition

- Commande publique / it is an obligation : public commissioning
 - En deux temps / in two steps
 - ✓ Le choix de 4 équipes qui auront les compétences
(Phase candidatures / submission phase : 9 February - 21 April)
 - ✓ Le choix d'un projet qui répondra aux enjeux
(Phase Offres / offers phase : 21 April - 9 November)
 - La composition du jury / The composition of the jury

The submission phase

Phase candidature Submission phase

- 9 février : publication
 - 23 mars : 104 dossiers déposés
104 files submitted
 - 21 avril : 1^{er} jury : choix de 4 équipes
4 selected teams
-
- ❖ très important car l'objectif est de sélectionner de 4 candidats (sur 104) qui devront avoir la capacité d'apporter une réponse pertinente aux enjeux du programme.
 - ❖ very important because the objective is to select 4 candidates (out of 104) who must be able to provide a relevant response to the programme's challenges.

Phase candidatures : les compétences demandées

Submission phase: required skills

- Les compétences demandées = jugement des offres
The required competences
 - ✓ Architecturale (projets similaires : surface ou couts)
Architectural / similar projects: area or costs
 - ✓ Intra logistique / Supply chain
 - ✓ Architecture avec approche environnementale / Breeam
 - ✓ Paysage / VRD Landscape
 - ✓ Tous corps d'états
 - ✓ Economiste
- Capacités techniques et financières / Technical and financial capacity

Phase candidature : les 4 équipes retenues

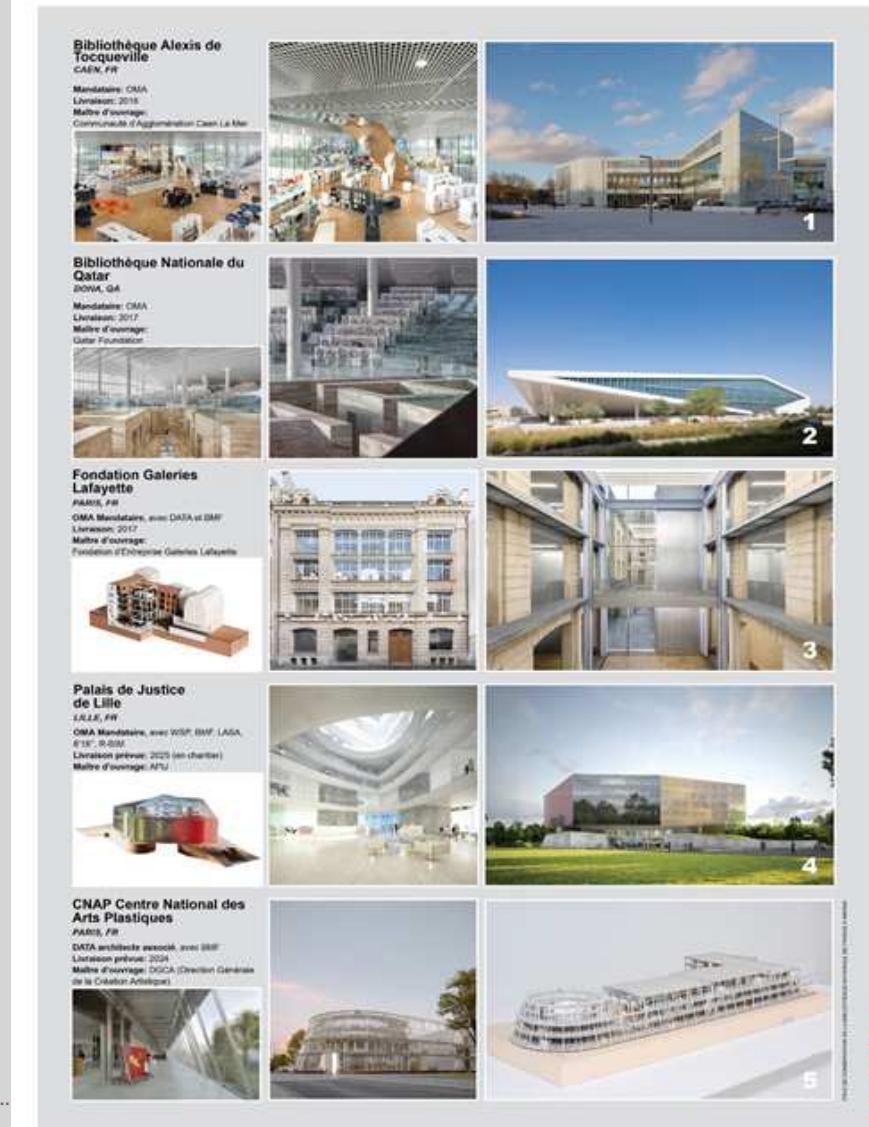
Submission Phase : the 4 selected teams

- ✓ Office for Métropolitan Architecture : **OMA – pli 27**
- ✓ Atelier d'architecture Philippe Prost : **AAPP – pli 64**
- ✓ Rogers Stirk Harbour + Partners : **RSHP – pli 82**
- ✓ Pierre Alain Trévelo et Antoine Viger-Kohler : **TVK – pli 94**



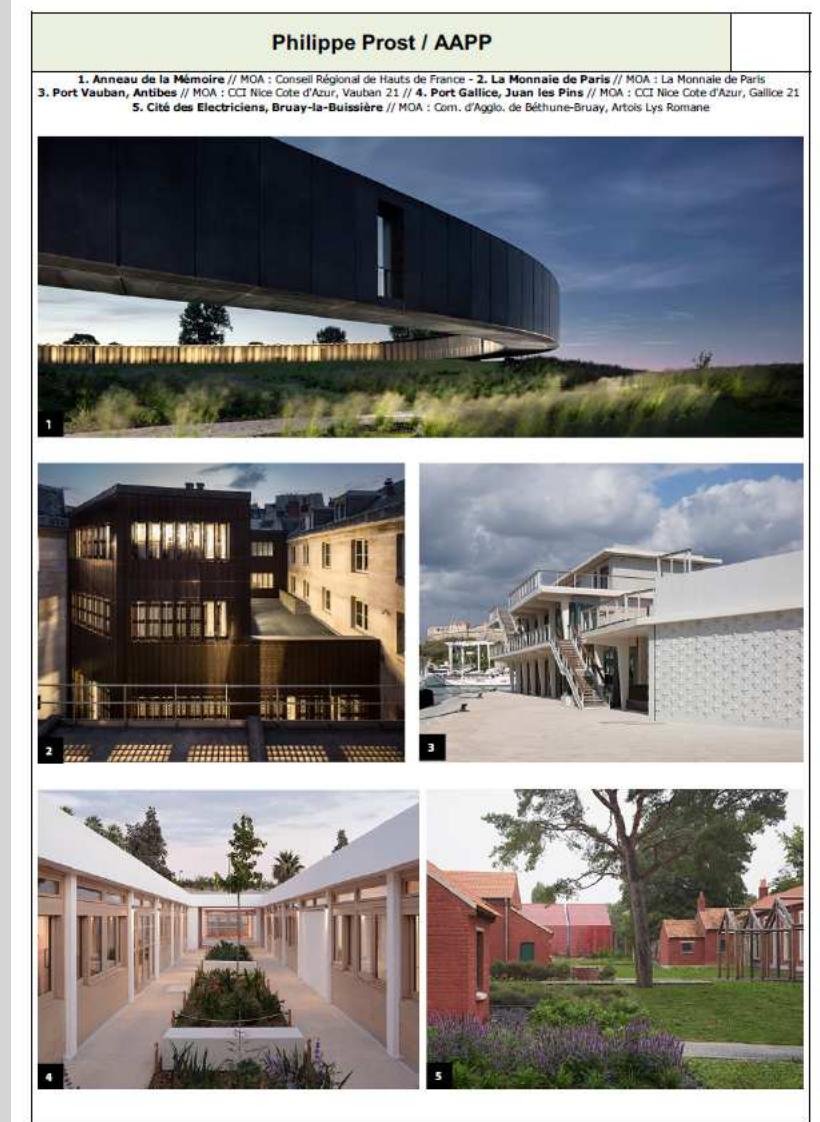
Office for Metropolitan architecture : OMA

- 1. Mandataire : OMA**
- 2. Architecte associé : DATA Architectes**
- 3. Economie de la construction : BMF**
- 4. BET TCE : WSP France**
- 5. Intra logistique : Simco**
- 6. HQE : Eléments ingénieries**
- 7. BE Acoustique : LASA**
- 8. Concepteur Lumière : 8'18"**
- 9. Paysagiste : D'ici là**
- 10. Enveloppe : T/E/S/S atelier d'ingénierie**
- 11. Architecte spécialisé : FL&CO**
- 12. Designers signalétique : Polygraphik**
- 13. Bim Manager : R-BIM**



Philippe Prost : AAPP

1. **Mandataire** : Philippe PROST
2. **Economie de la construction** : ECO+CONSTRUIRE
3. **BET TCE / Intra logistique** : ARTELIA
4. **HQE + BET Thermique** : SARL SCOP SYMOE
5. **BE Acoustique** : META
6. **Paysagiste** : TAKTYK SARL
7. **Bim Manager** : BIM BZM BOOM



Rogers Stirk Harbour + Partners : RSHP

- 1. Mandataire : RSHP**
- 2. Architecte associé : Atelier WOA (ingénierie bas carbone)**
- 3. Architecte spécialisé : conservation préventive : FL & CC**
- 4. Economie de la construction : VPEAS**
- 5. BET TCE : INGEROP**
- 6. BET Electricité CFO / CFA/ SSI : GLI (Filiale INGEROP)**
- 7. Intra logistique : DIAGMA**
- 8. HQE : FRANCK BOUTTE Consultant**
- 9. BE Acoustique : AVLS (Filiale INGEROP)**
- 10. Spécialiste Hypoxie : ELCSI**
- 11. Paysagiste : MICHEL DESVIGNE**
- 12. Bim Manager : Ingerop**

RSHP Références

Concours de maîtrise d'œuvre pour la construction d'un pôle de conservation pour la Bibliothèque nationale de France à Amiens sur le site de l'ancien Centre Hospitalier Nord (CHU Nord)

RSHP - Centre de Conservation du Louvre
Musée du Louvre / Marie-Lys Marguerite



RSHP - World Conservation and Exhibition Centre
British Museum



RSHP - Distillerie Macallan
Edrington Group



RSHP - Extension British Library
British Library



WOA - La maison ONF
Office National des Forêts



Trévelo et Viger-Kohler : TVK

- 1. Mandataire : TVK**
- 2. Architecte associé : CARMODY GROARKE**
- 3. Economie de la construction : VPEAS**
- 4. BET TCE : EVP ingénierie et INGEROP**
- 5. Intra logistique : Willhey Ltd**
- 6. HQE : INGEROP**
- 7. BE Acoustique : AVLS (filiale INGEROP)**
- 8. Paysagiste : ATELIER ROBERTA**
- 9. Bim Manager : INGEROP**



Coming up : the offer phase

La phase offre The offer phase

- ✓ **4 août** : remise anonyme du projet
submission of the project
- ✓ **4 septembre** : remise anonyme des maquettes,
submission of models
- ✓ **9 novembre** : Jury des offres , Jury
 - Le niveau de rendu :
The level of rendering
 - ✓ Niveau de conception correspond à une **l'Esquisse / Sketch / draft**
 - ✓ Maquette blanche du projet 1 / 500 et une maquette détail (une trame façade et une partie volume intérieur au 1 / 50) **Model**
 - Indemnités : 150 000 €HT par équipe / **Compensation: €150,000 excl. tax per team**



Phase Offre : jugement des projets

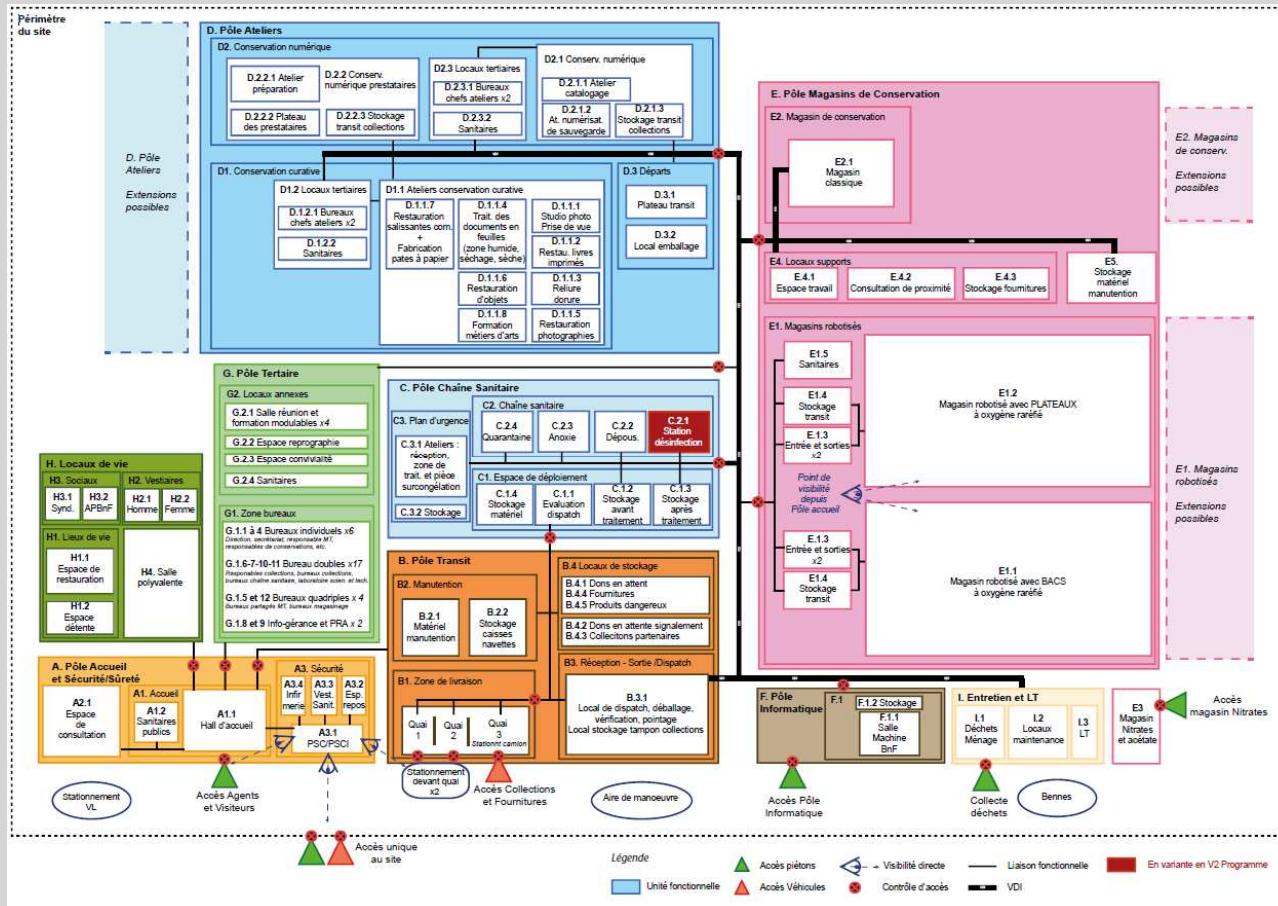
Offer phase: Projects evaluation

- Les enjeux = les critères de jugement des offres
- Critère N° 1 : la qualité et pertinence du projet architectural , fonctionnel et technique et environnemental, en réponse au programme .
Criterion No. 1: the quality and relevance of the architectural, functional, technical and environmental design in response to the programme
- Critère N°2 : l'intégration dans le site, possibilité d'extension future
Criterion No. 2: Integration into the site, possibility of future extension
- Critère N°3 : Faisabilité technique, qualité et pertinence des magasins robotisés
Criterion No. 3: Technical feasibility, quality and suitability of robotic shops
- Critère N°4 : Economie globale du projet
Criterion No. 4: Overall economics of the project
- Critère N° 5 : L'organisation de l'équipe.



Critère N° 1 : la qualité et pertinence du projet architectural , fonctionnel et technique et environnemental, en réponse au programme .

Criterion No. 1: the quality and relevance of the architectural, functional, technical and environmental design in response to the programme



■ Magasins / Storage : 6211 m²
 ■ Ateliers / conservation studio : 1848 m²

■ Tertiaire / offices : 763 m²
 ■ Chaîne sanitaire / sanitary chain : 550 m²

■ Locaux de vie / living spaces : 491 m²
 ■ Tlogistique hub t : 475 m²

■ Informatique : 230 m²
 ■ Accueil et Sécurité : 206 m²
 ■ Locaux techniques / technical rooms: 146 m²

■ Surface utile : 10 920 m²
 ■ = 128 000 square foot

■ En option : Station de désinfection 185 m²
 ■ Optional: Disinfection station 185 m².

Critère N° 1 : développement durable Sustainability – Green certification



CERTIFIÉ PAR
CERTIVEA

- We have chosen to certify the project : **HQE Bâtiment durable, high performance level, is similar to BREEAM certification, in France**
- The design (technical, architectural, environmental) specifications and the environmental management are audited, during a meeting conducted by the French building certification organization (“Certivéa” which belongs to the French Building Government Agency)
- The environmental approach is included in the overall cost of the project



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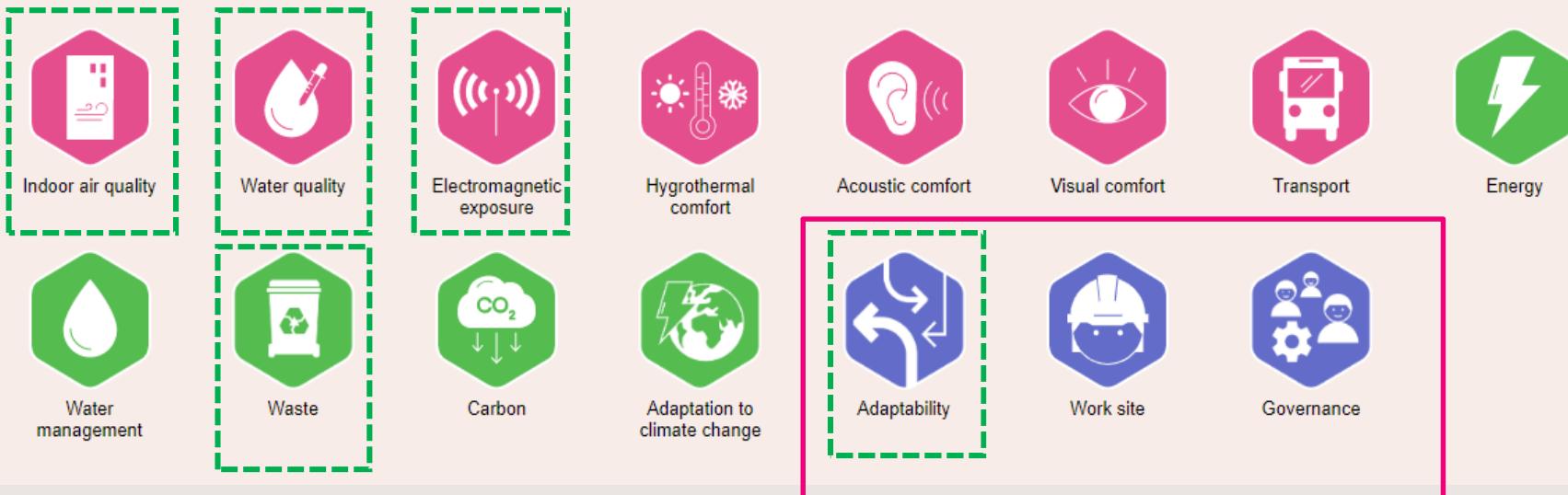
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CERTIVEA

Critère N° 1 : suite ... Performance - Theme

HQE
BÂTIMENT
DURABLE
CERTIFIÉ PAR
CERTIVEA

HQE Building under Construction



Best performance of the project

Management

Environmental best performances aim to improve indoor air quality, water quality, electromagnetic exposure, adaptability and waste management

Critère N° 1 : suite... Performance – level indicators



AXE HQE BD	Objectif	Thème	Niveau minimum à atteindre	Notation par thème	Notation par engagement
ENGAGEMENT 1 : QUALITÉ DE VIE	Objectif 1 : Des lieux de vie plus sûrs et qui favorisent la santé	Qualité de l'air intérieur	C	B	3 étoiles
		Qualité de l'eau	C	A	
		Ondes électromagnétiques	C	A	
	Objectif 2 : Des espaces agréables à vivre, pratiques et confortables	Confort hygrothermique	C	C	
		Confort acoustique	C	C	
		Confort visuel	C	C	
		Accessibilité	C	B	
	Objectif 3 : Des services qui facilitent le bien-vivre ensemble	Transports	C	C	
		Services	E	B	
ENGAGEMENT 2 : RESPECT DE L'ENVIRONNEMENT	Objectif 4 : Une utilisation raisonnée des énergies et des ressources naturelles	Energie	C	C	2 étoiles
		Eau	C	C	
	Objectif 5 : Une limitation des pollutions et la lutte contre le changement climatique	Déchets	C	B	
		Carbone	C	C	
		Adaptation au changement climatique	E	C	
		Analyse en cycle de vie	E	C	
		Biodiversité	C	B	
	Objectif 6 : Une prise en compte de la nature et de la biodiversité	Maîtrise des coûts	C	A	
		Non traité dans ce millésime de référentiel	/		
		Economie locale	C	C	
ENGAGEMENT 3 : PERFORMANCE ÉCONOMIQUE	Objectif 7 : Une optimisation des charges et des coûts	Adaptabilité	C	C	2 étoiles
		Chantier	C	C	
		Commissionnement	E	A	
	Objectif 8 : Amélioration de la valeur patrimoniale, financière et d'usage	Contexte	M1	M1	
		Engagement	M1	M1	
SMR : Pilotage maîtrisé	Objectif 9 : Contribution au dynamisme et au développement des territoires	Planification	M1	M1	3 étoiles
		Ressources et moyens	M1	M1	
		Evaluation	M1	M1	
	Objectif 11 : Pilotage pour un projet maîtrisé	Amélioration	M1	M1	
Système de management Responsable	Objectif 10 : Organisation adaptée aux objectifs de qualité, de performance et de dialogue	Niveau atteint :		TRES PERFORMANT	M1
	Objectif 12 : Evaluation garante de l'amélioration continue				

Global indicator:
HIGH PERFORMANCE



(BnF) Bibliothèque nationale de France



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Critère N°2 : l'intégration dans le site, possibilité d'extension future

Criterion No. 2: Integration into the site, possibility of future extension



- L'AMI lancé en juin 2020, soixante-douze candidatures reçues
- Choix du site Amiens en septembre 2021
 - ✓ L'adéquation du foncier proposé au programme du pôle de conservation de la BnF
 - ✓ Les délais et la qualité de la desserte par les transports en commun du site
 - ✓ L'implication de la collectivité et de ses partenaires dans le co-financement du projet
 - ✓ Le cadre de vie et le tissu urbain environnant du site
 - ✓ Le partenariat culturel

Critère N°2 : l'intégration dans le site

Criterion No. 2: Integration into the site



Photographies aériennes



Carte de l'état-major (1820-1866)



Porte d'Abbeville (entrée nord)



Le projet de Renzo Piano

Critère N°2 : Possibilité d'extension future

Criterion No. 2: Possibility of future extension



- Un terrain bâti propriété du CHU d'Amiens de 3,5 ha pour le projet de construction.
- Un terrain non bâti propriété de la commune d'Amiens de 2,8 ha pour une extension future.
- Première phase de construction sur la parcelle CHU de 3,5 ha, avec une prise en compte dès la conception d'une perspective d'extension.

Critère N°3 : Faisabilité technique, qualité et pertinence des magasins robotisés

Criterion No. 3: Technical feasibility, quality and suitability of robotic shops

- Preliminary analysis concludes :
 - Construction of one or two high-density, low-energy consumption robotized storage building
 - Oxygen rarefaction (controlled hypoxia)
 - Zero water supply, wastewater or rainwater pipes into the robotized warehouse storage
 - Passive air conditioning (Design the building in order to use very low or zero HVAC system)

Critère N°3 : Faisabilité technique, qualité et pertinence des magasins robotisés

Criterion No. 3: Technical feasibility, quality and suitability of robotic shops

We have carried out a preliminary study and benchmark on the robotized warehouse with two spaces and described in design specifications :

- Zone S_b : Stockage bacs
- Zone S_p : Stockage plateaux
- Zone P_b : Postes de travail zone bacs

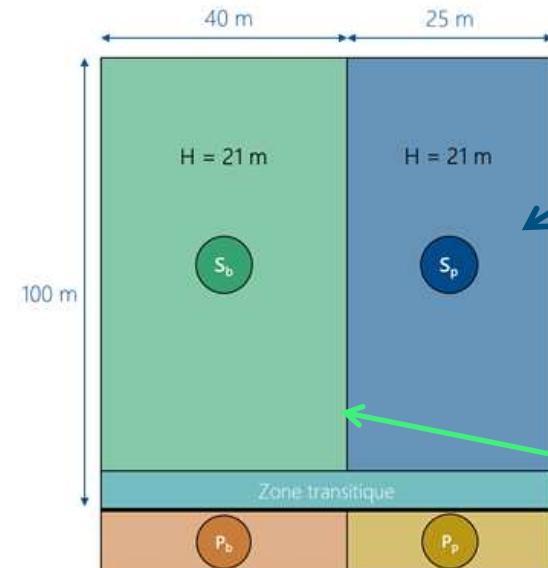
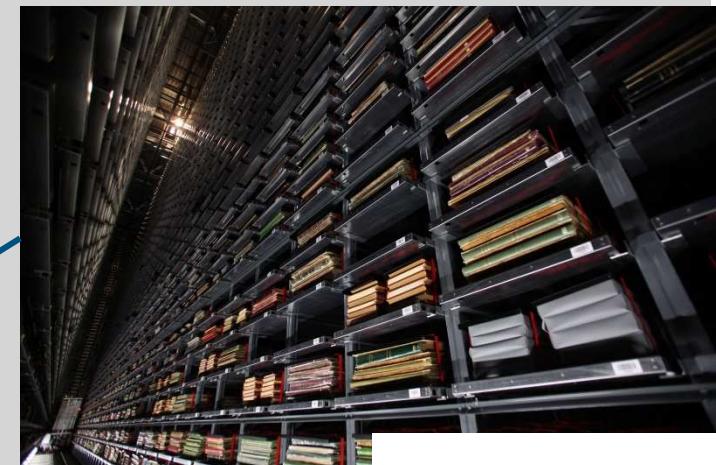


Figure 1 : Dimensions des bâtiments

- Zone P_p : Postes de travail zone plateaux



Benchmark : Boston spa



Benchmark : Speicherbibliothek

Critère N°4 : Economie globale du projet

Criterion No. 4: Overall economics of the project

- Estimation du coût de construction est estimé à 52,88 M € HT (octobre 2022) -
Construction cost is estimated at €52.88 million excluding tax (46 Million pounds / 51,56 M Francs Suisse)
- 42,4 M€HT affectés aux travaux de construction
42,4 M€HT allocated to construction works
- 10,48 M€HT affectés à la robotisation et l'intra logistique
10,48 M€HT allocated to robotization and intra logistic
- Enveloppe budgétaire totale incluant les dépenses hors construction : 96,2 M€-
Total budget including non-construction costs: €96.2 M€ (93,8 M Francs Suisse - 83,82 £)
- Consideration of maintenance operating systems and activities, in particular level of energy consumption

Merci à tous

Many Thanks

Les acteurs / The actors

- MOA : Maîtrise d'ouvrage - Project management : BnF
- MOD : Maîtrise d'ouvrage déléguée - Delegated project management : OPPIC : L'Opérateur du patrimoine et des projets immobiliers de la Culture
- MOE BnF : maître d'œuvre - project manager : architecte / groupement
- MOE Amiens : maîtrise d'œuvre ZAC CHU NORD : agence Office Anyoji Beltrando
- AMO (Assistant à Maîtrise d'Ouvrage- Project Management Assistant) or Etudes Studies
 - ✓ Intra logistique – robotized wharehouse specialist : Etyo
 - ✓ Programmation – design specifications : Setec
 - ✓ Mission géo technique - Geo-technical mission : Fondasol
 - ✓ Maquettiste - Model maker : Patrick Lemoine
 - ✓ Géomètre - Geometer : Damien DESOEUVRE
- Organisme certificateur / Certification Authority : Certivéa



KB National Library PROJECT UPDATE



Hans Jansen Foekje Boersma
12/13 June 2023, BNF Paris
Study Days “Robotic conservation sites”

KB } national library
of the netherlands



Where are we now?

- Recap
- Building
 - Climate simulation
 - Robotic system
 - Collection preparations

Current building KB, The Hague



1982 main building, reading rooms
and (underground) storage



2007 additional storage



VISION 2017
KB Nationale Bibliotheek

Vision 2017: storage off site

1. Storage off site
2. Facility is storage only
3. Storage for all collections
4. Optimal preservation conditions:
 - Passive building
 - Low oxygen
 - Robotised
5. Optimal use of collections based on demand (1-3 times per day, within 10-15 km)
6. Possibility to extend (after 2040)
7. Above sea level (NAP > 1,5m)



Physical collections

Books	3.500.000
Periodicals	700.000
Newspaper	100.000
Special collections	575.000

Total > 4,4 million items
125 linear kilometres



PLANNING

- 2021 State Building Agency (RVB) commissioned
- 2022 Advisory team for construction and robotic system
 - Selection of Architect: Office Winhov
 - Start with collection preparations
- 2023 Prelimanary design building
- 2023 Selection of supplier robotic system: DBM
- 2024 Final design building; building permits; start construction
- 2026 Start collection move
- 2028 Finish collection move



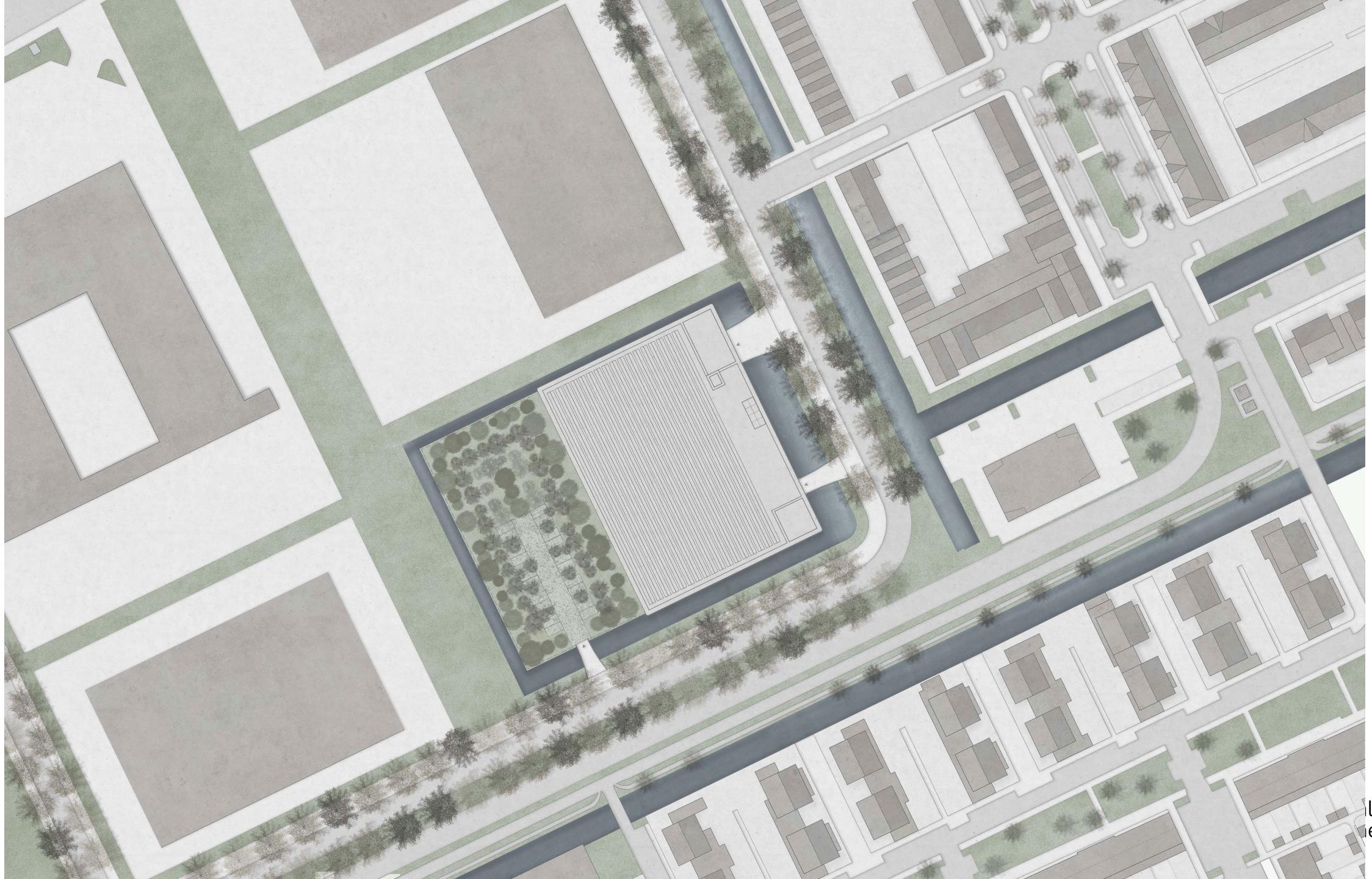
Where are we now?

- Recap
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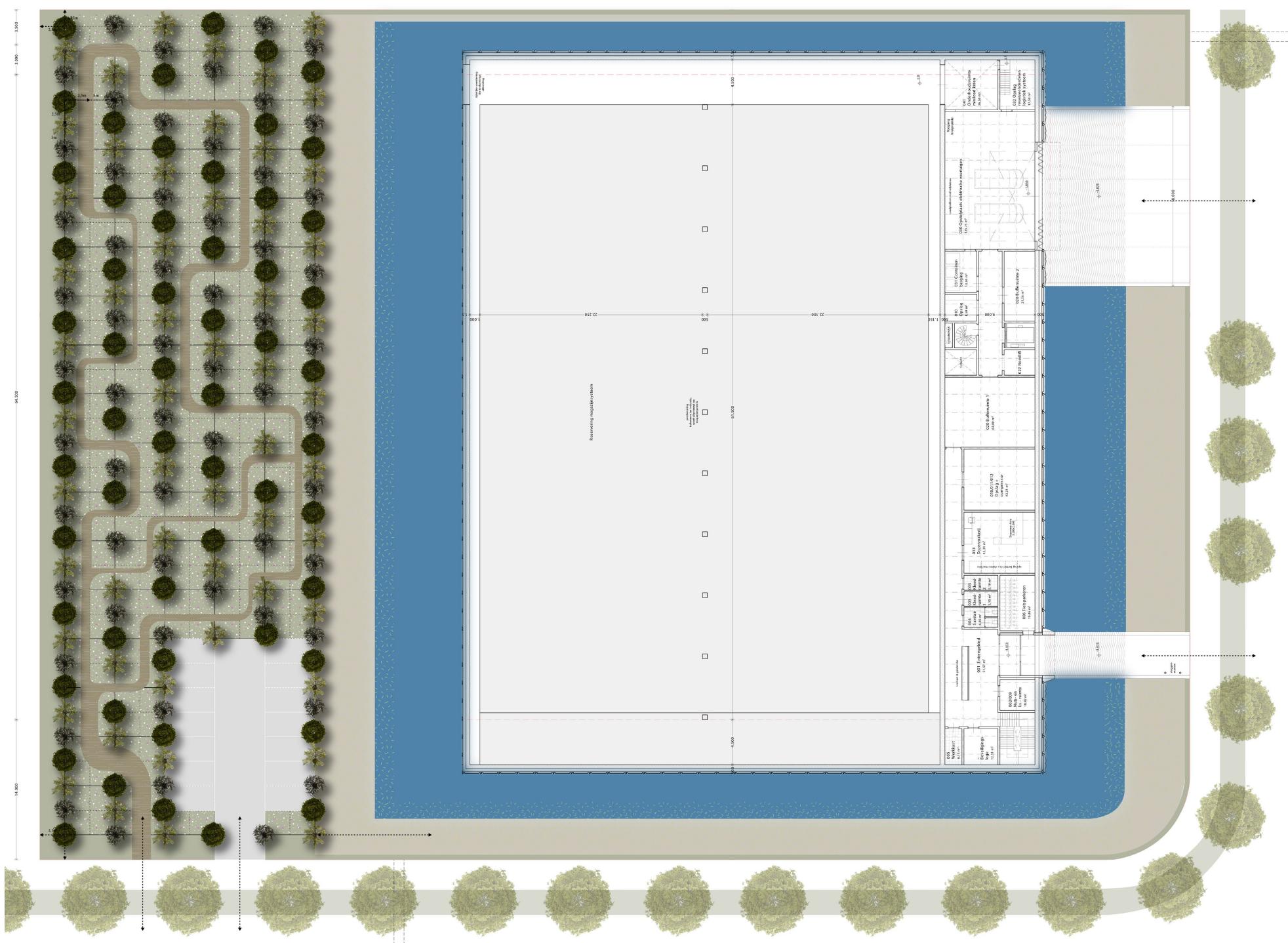
Preliminary design



hale
theek



le
eek



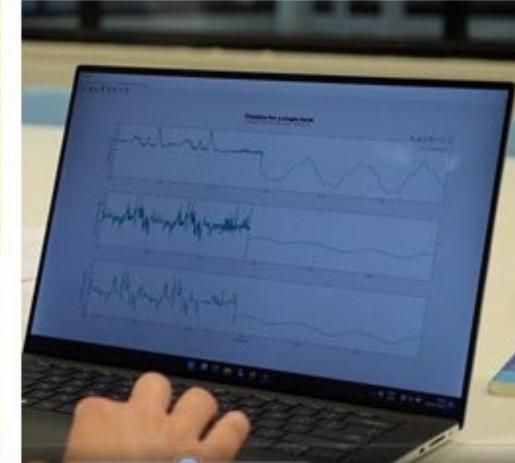
nationale
bibliotheek



KB } nationale
bibliotheek



Climate simulation



Project team:

Foekje Boersma - KB national library of the Netherlands
Marco Martens - Helicon conservation support, Dyseco
Bart Ankersmit - Cultural Heritage Agency
Marc Stappers - Cultural Heritage Agency
Seojin Kim - Cultural Heritage Agency



Cultural Heritage Agency
Ministry of Education, Culture and Science

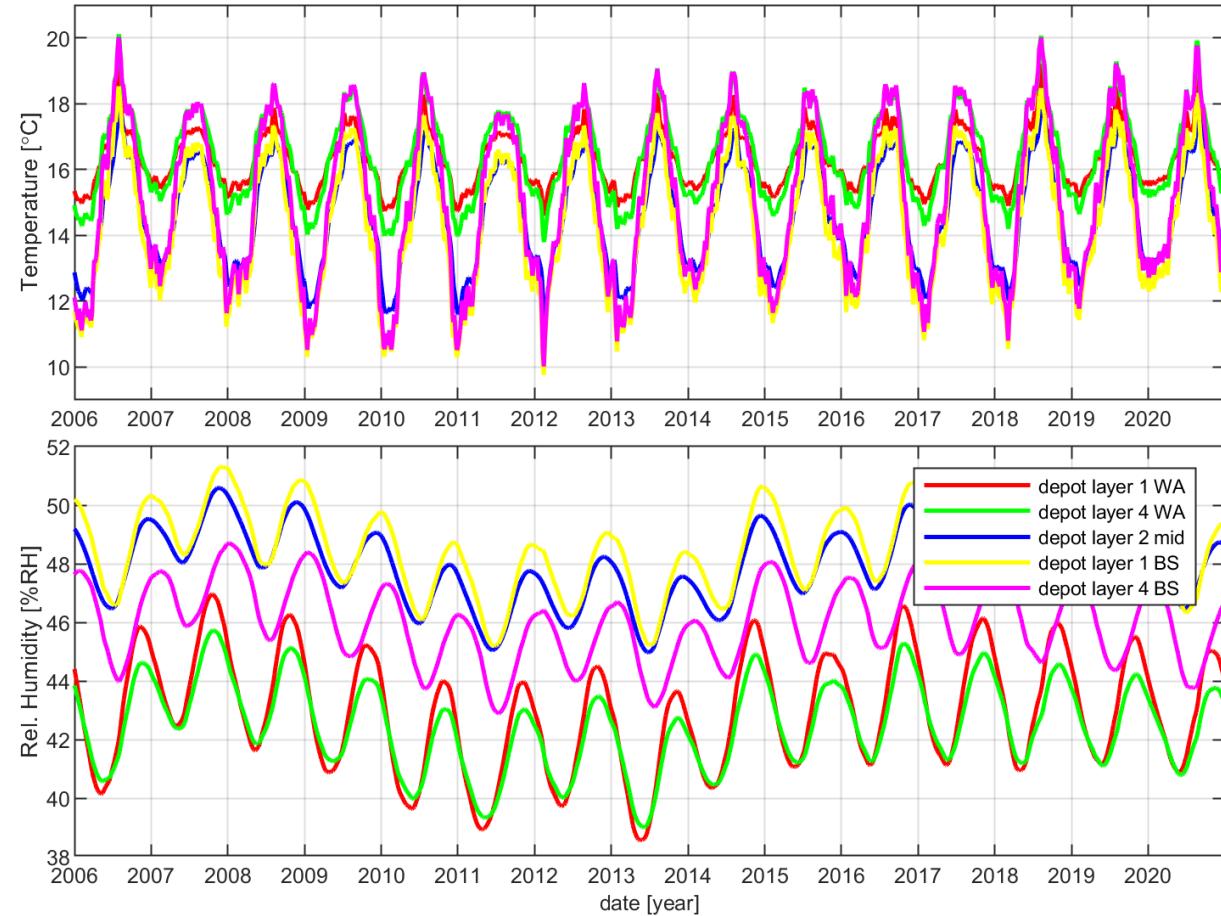
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Climate simulation

- What is the most optimal building construction?
 - Insulation thickness of walls and roof
 - Color (absorption factor) of the roof covering
- What is the effect of internal air flow within the building?
 - Effect of ingest of containers
 - Effect of stratification and reduction measures
- What is the influence of the local environment?
 - Effect of climate change over a longer period
- What is the effect of a low oxygen system?
 - Inflow of very dry air
- What is the effect of collections on indoor environment?
 - Effect of an empty versus a full building
 - Effect of a steady ingest of collections over 2 years
 - Effect of the outdoor weather conditions during ingest period

KB National Library, Realistic Optimized Model

01-Jan-2006 to 01-Jan-2021

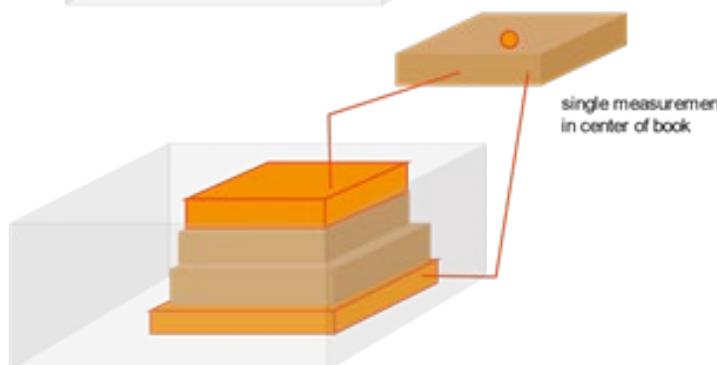
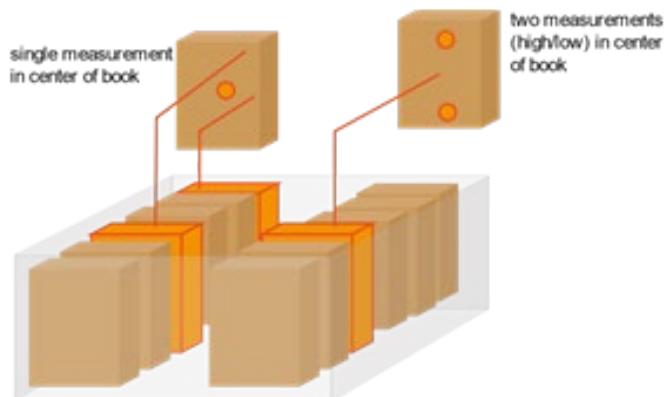
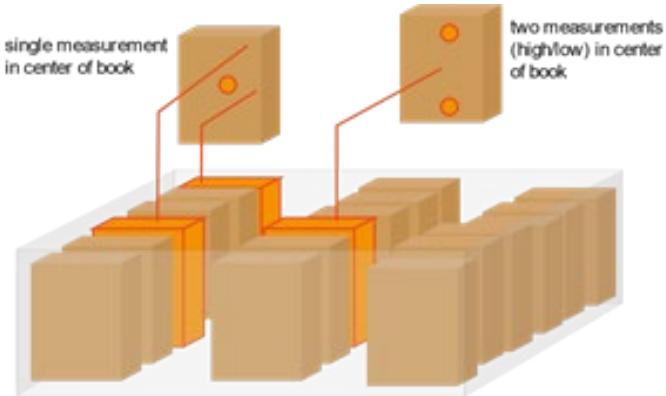


*Dynamic hygrothermal simulation model by
Marco Martens*

Climate simulation

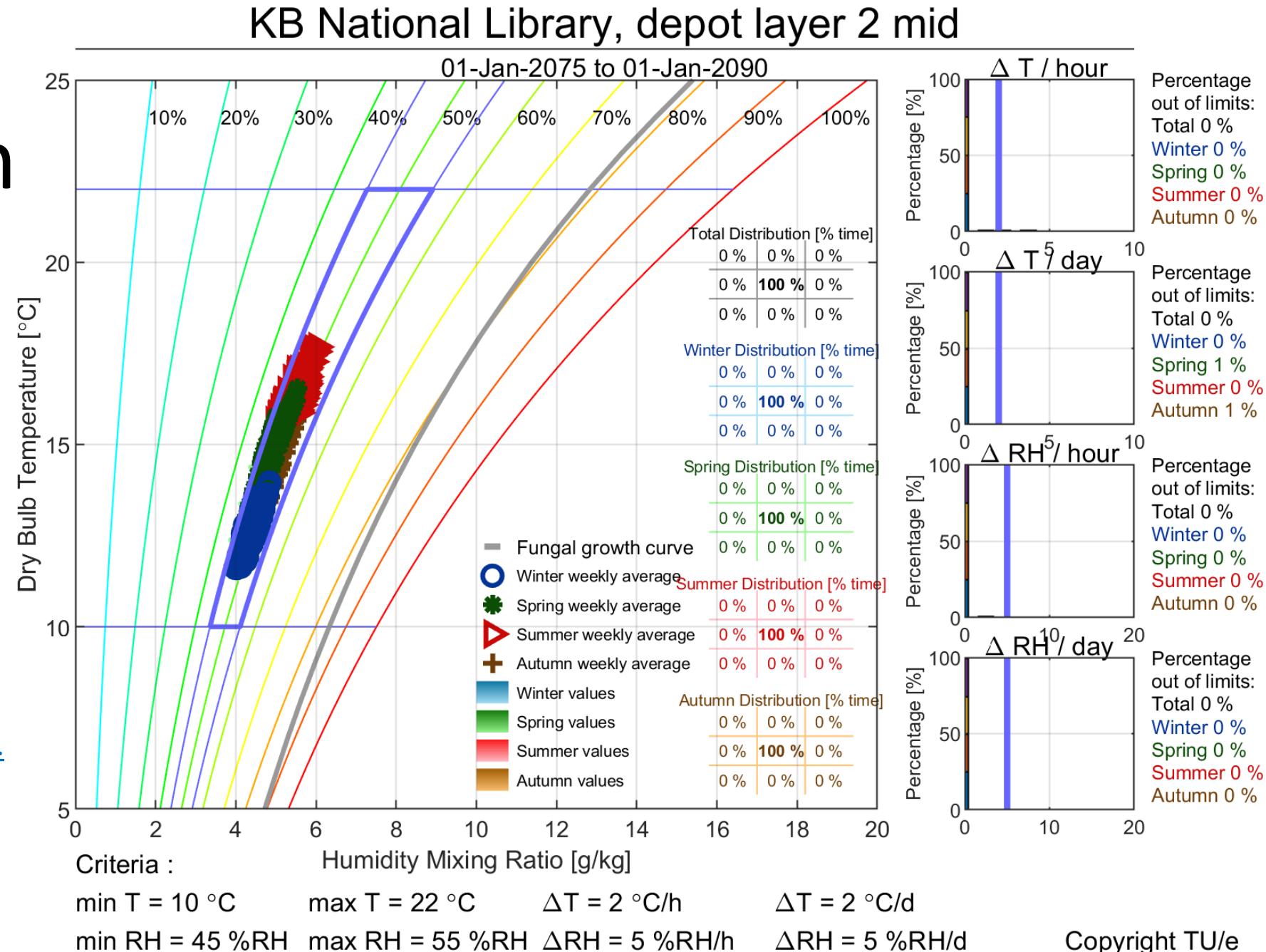
Variant	Description	Effect	Impact
1	Soil settling	Minimal	Minimal
2	Lower roof absorption	Positive, if RH compensated for	Small
3	More insulation walls and roof	Positive	Fair
4	Less insulation walls and roof	Negative	Fair
5	Additional heating workspace	Positive, but 27 % extra energy use	Fair
6	Empty repository	Negative	Large
7	Low-oxygen system on	Positive, if well adjusted and mixed	Huge
8	Airflow by ingest	Negative but not avoidable	Fair
9	Raised soil temperature	Positive for RH	Small
10	Lowered soil temperature	Negative for RH	Small
11	Extra mixing for stratification	Positive	Fair
12	Extra internal air mixing	Negative	Small
13	Reduced air tightness	Negative	Large
14	Extra heat production robot	Negative for T, but RH seems better	Huge

Climate simulation – impact of collections



Climate simulation

More information:
Foekje Boersma, Marco Martens, Bart Ankersmit & Marc Stappers (2022)
A Robotic Storage Facility for the Dutch National Library Collections
In: Studies in Conservation
DOI: [10.1080/00393630.2022.2045420](https://doi.org/10.1080/00393630.2022.2045420)

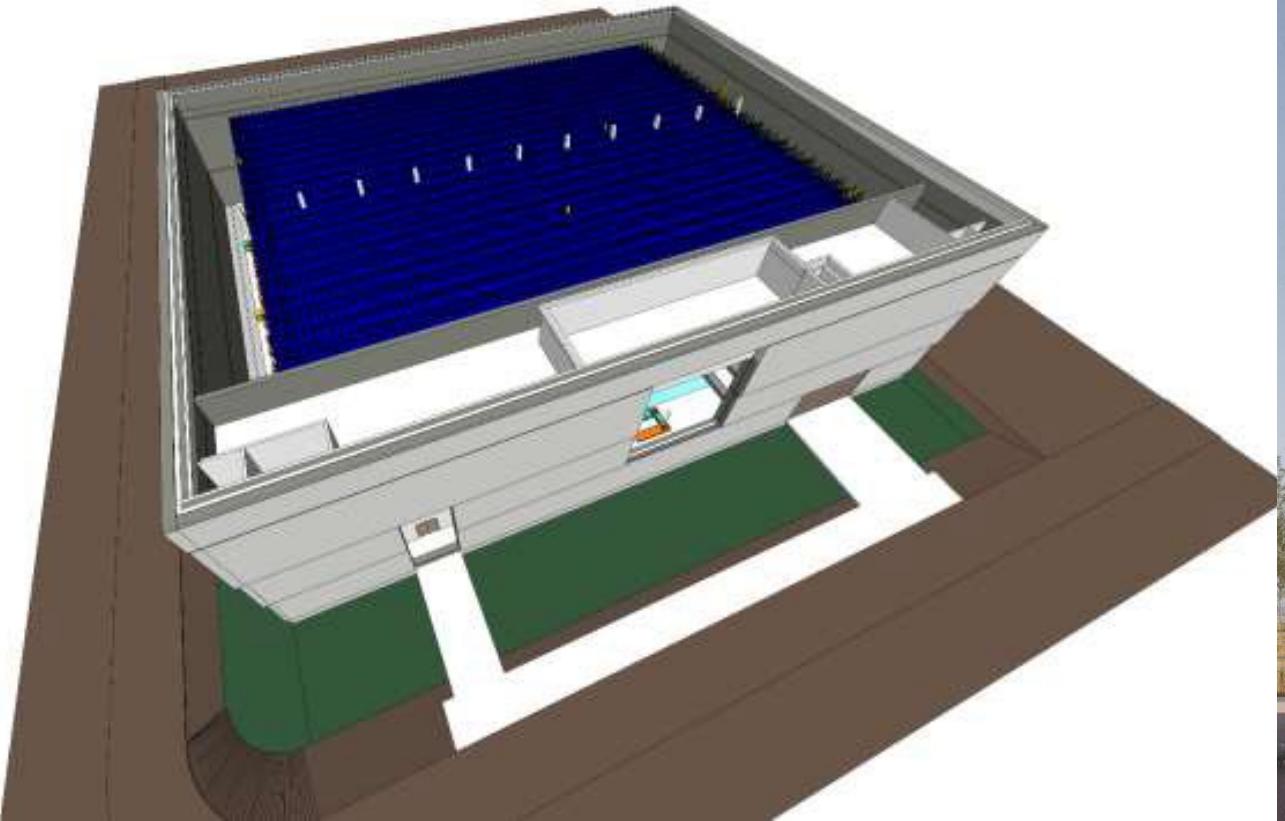




Where are we now?

- Recap
- Building
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- Collection preparations

Robotic system



Tender process

- RFI → reference solution
- 5 companies pre-selected – 2 submitted
 Stöcklin and TGW
- Dialogue sessions to come to offers
- Selection based on quality and price

Reference solution

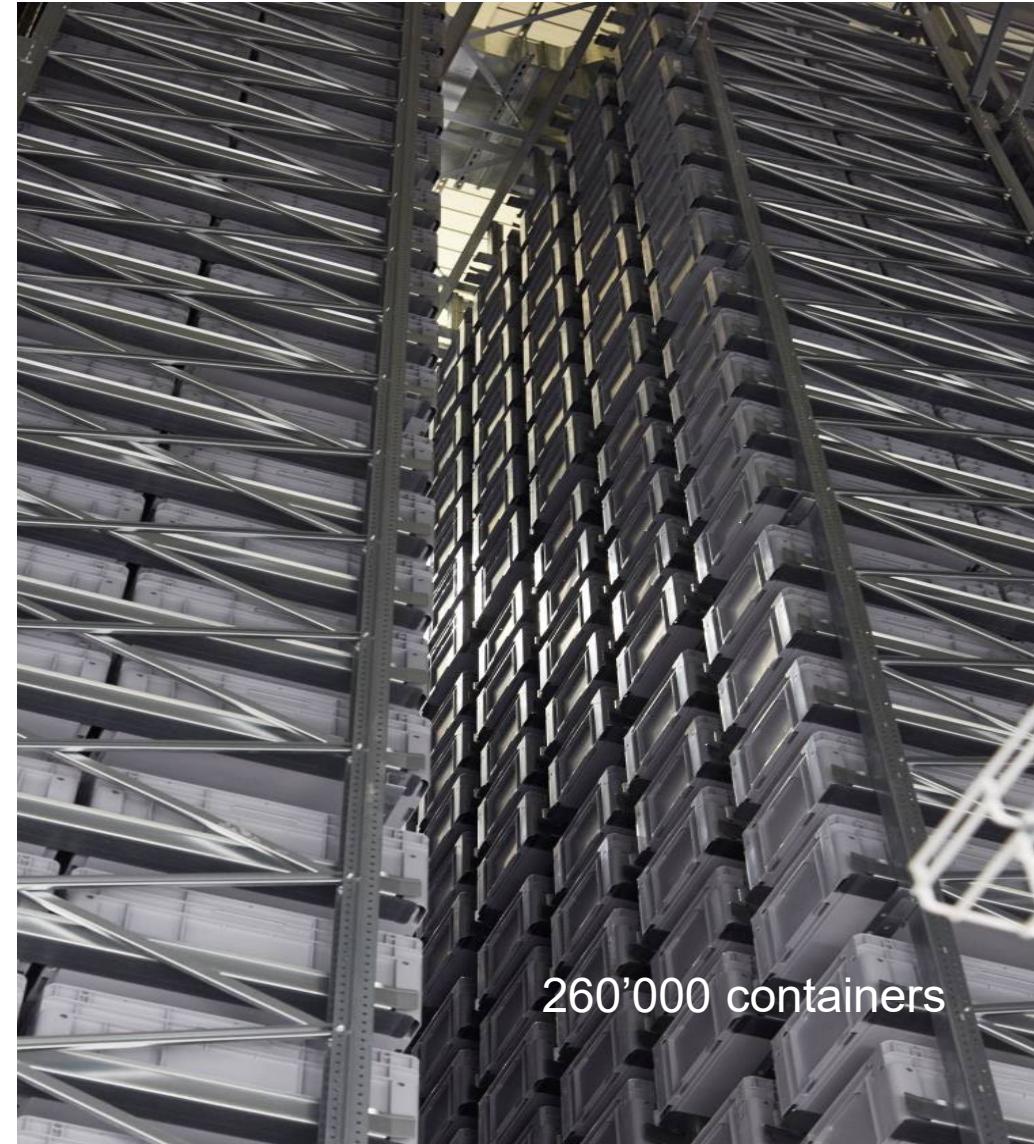
- Containers of 3 different sizes (outside dimensions):
- Dedicated area for maintenance outside the storage area.
- All miniload cranes will have one “fast-mover” area.
- Miniload cranes will pick and drop containers at AMR's (Autonomous Mobile Robots) at frontside of racking.
- AMR's will bring and take containers to the working stations.
- 6 picking stations



Containers

The system must be able to handle and store the following types of containers:

- 400x600 (outside) x 250 (inside)
Average weight 30 kg, max 45 kg
- 400x600 (outside) x 350 (inside)
Average weight 40 kg, max 60 kg
- 800x600 (outside) x 250 (inside)
Average weight 60 kg, max 90 kg





Where are we now?

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Collection preparation



Vooronderzoek 2.2

- Vindbaarheid collectie (2.2.1)
- Standcontrole BC (2.2.2)
- Opschonen (2.2.3)
- QuickScan (2.2.4)
- Conditie BC (2.2.5)
- Omgevingscondities (2.2.6)

Schoon 2.3

- Stof en schimmel (2.3.1)
- Insecten (2.3.2)
- Schoonmaak collectie (2.3.3)

Werkzaamheden 2.4

- Vindbaarheid (2.4.1)
- Beschermen (2.4.2)
- Restaureren (2.4.3)

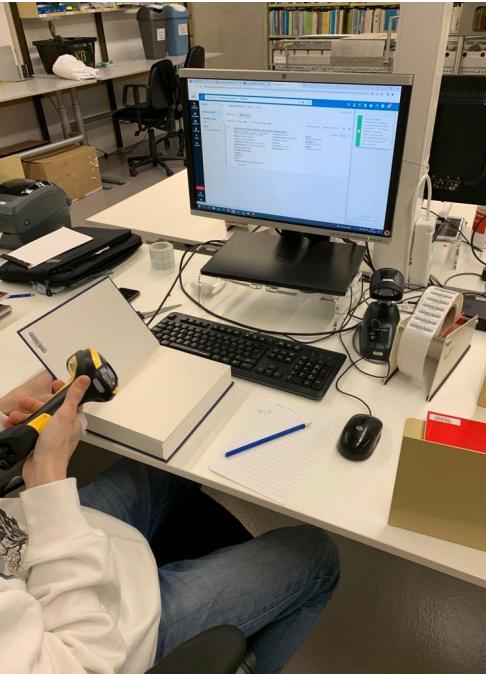
Verhuizing 2.5

- Aanpak (2.5.1)
- Ingest (2.5.2)



Collection Preparation

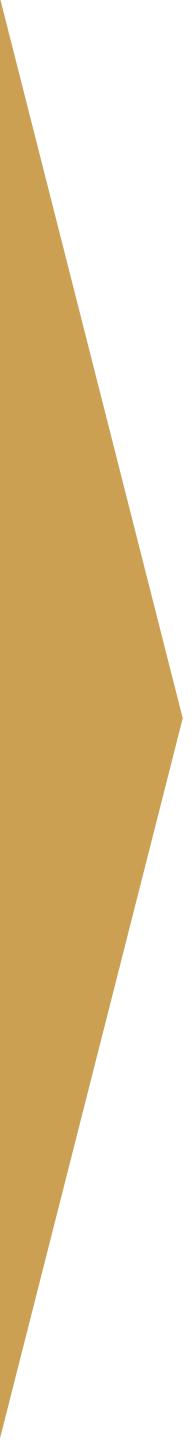
- Cleaning collection (and spaces)
- Protection: (re)packing, conservation
- Retrievability collection:
 - Barcoding > 2 millions items
 - Backlogs in registration



Business as usual

We do this
while we
remain open!





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Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'intérieur DFI
Office fédéral de la culture OFC
Bibliothèque nationale suisse BN

Le projet de transformation et rénovation complète de la Bibliothèque nationale suisse





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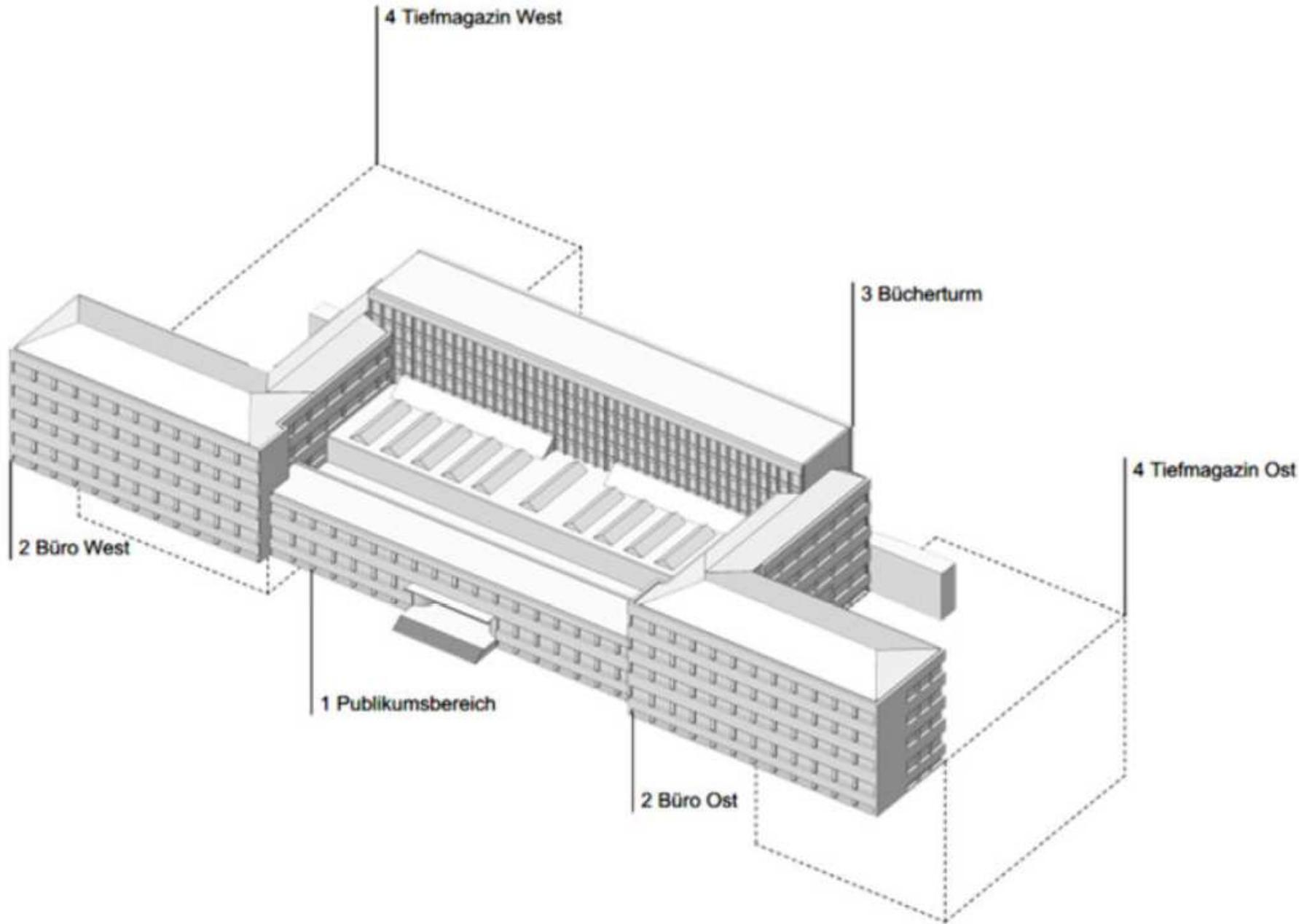
Le contexte

- Bâtiment construit en 1931
- Classé monument historique
- Représentant du mouvement «Neues Bauen»
- Tour de livres attenante au bâtiment principal
- 1997: construction d'un premier magasin souterrain à rayonnages mobiles (7 niveaux + 1 niveau technique)



Le contexte (2)

- 1998-2001: rénovation et modernisation du bâtiment principal; tour de livres transformée en espaces de consultation et en bureaux
- 2008: construction d'un deuxième magasin souterrain à rayonnages mobiles (4 niveaux + 1 niveau technique)
- Fin 2017: découverte de problèmes de statique dans la tour de livres
- Projection fin 2024: magasins souterrains saturés





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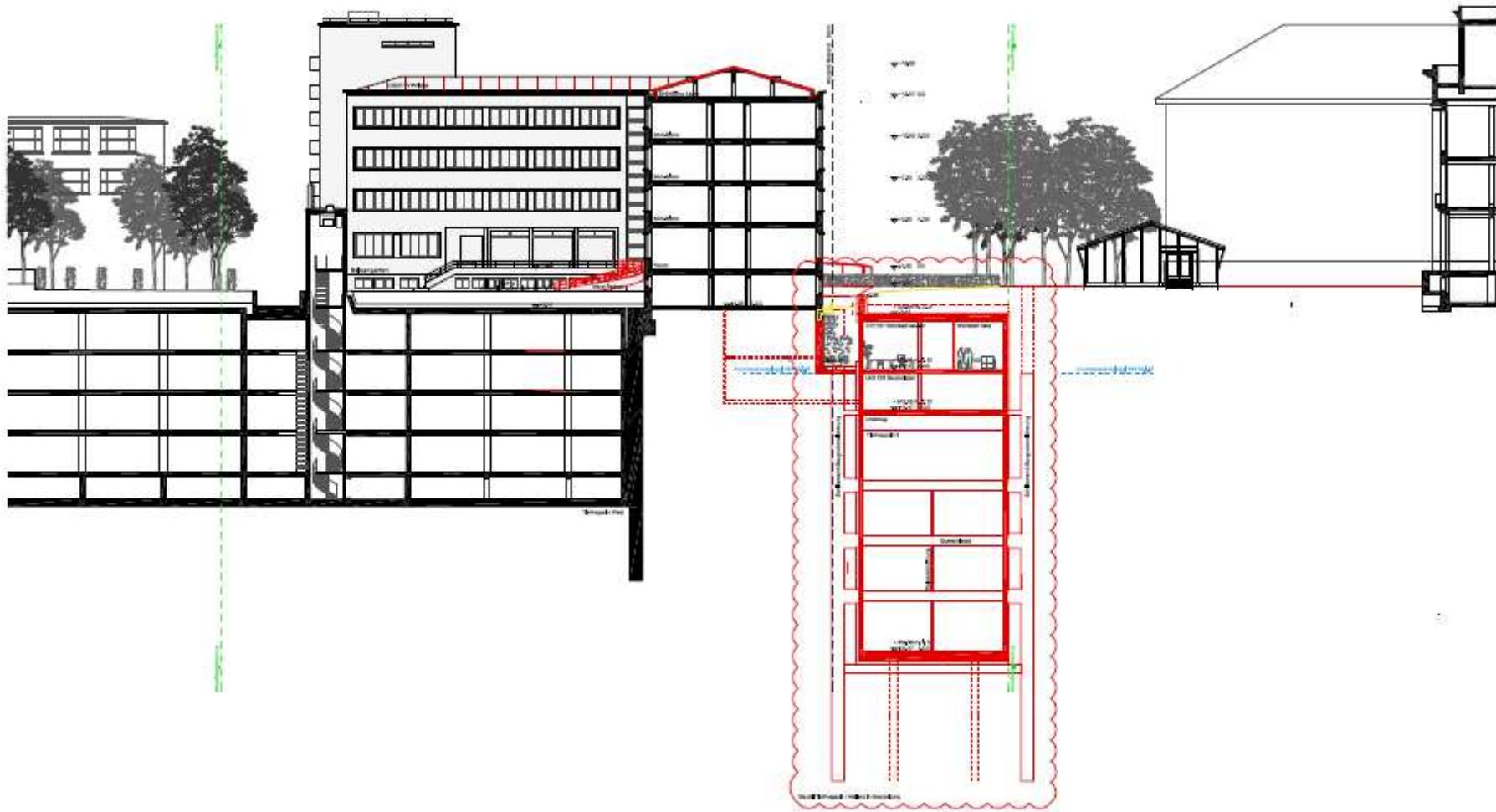
Le projet

- Concours lancé sous forme de mandat d'étude parallèle par l'Office fédéral des constructions et de la logistique
- Printemps 2022: sélection de 6 équipes de planification générale parmi les 32 candidats
- Fin 2022: choix du projet *NATBIB* de l'équipe d'architectes Christ & Gantenbein de Bâle
- Fin 2022: décision de construire un 3e magasin souterrain attenant au site actuel



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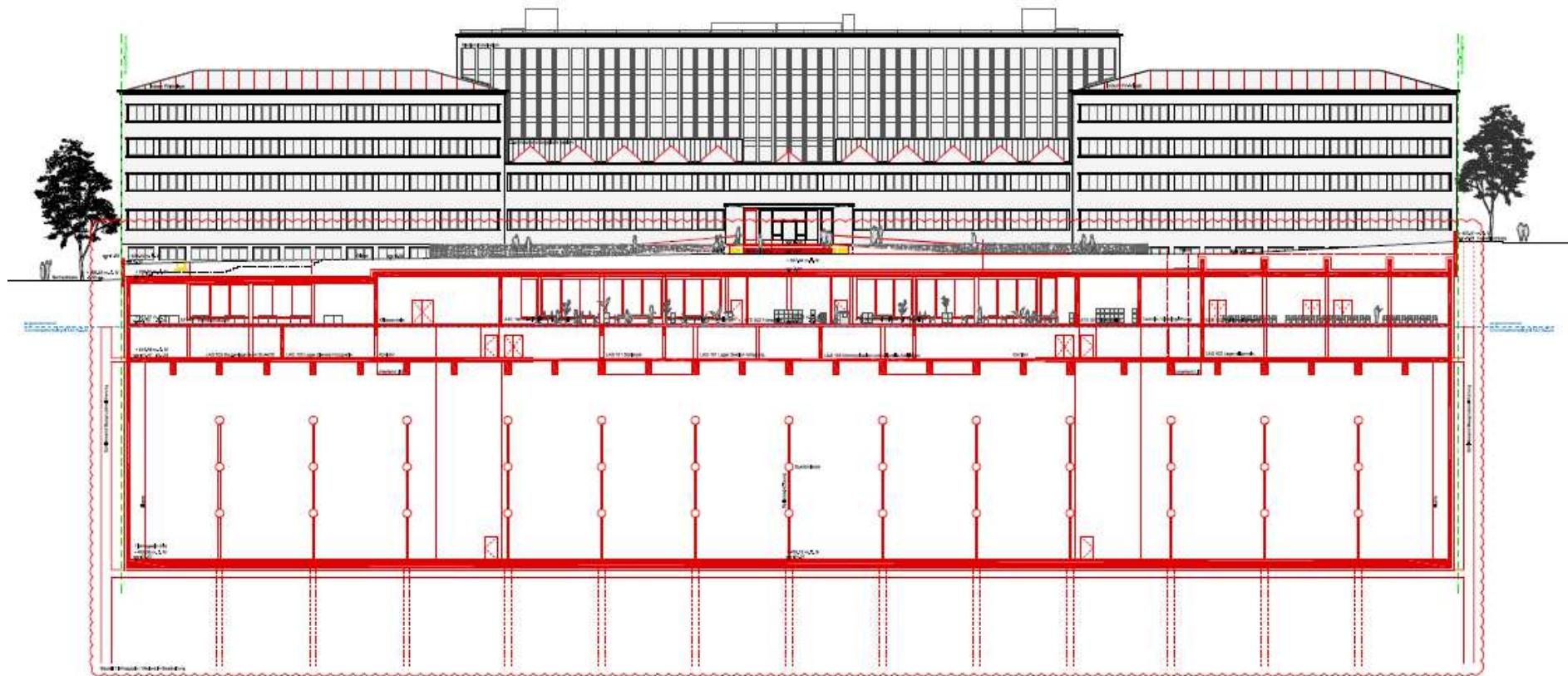
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Exigences envers le 3e magasin souterrain

- Stockage automatisé à hauts rayonnages
- Climat: haute stabilité thermique, température 15-22°C +/- 1°C en 24h, humidité 45-50% +/- 5%
- Faible teneur en oxygène
- Aucun système de protection anti-incendie



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Systèmes de stockage

Systèmes de stockage en lice :

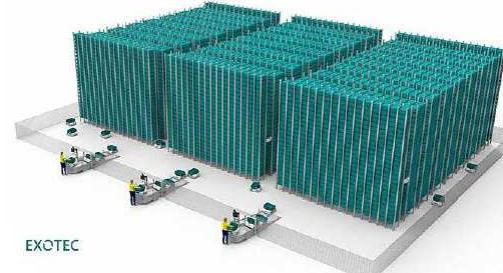
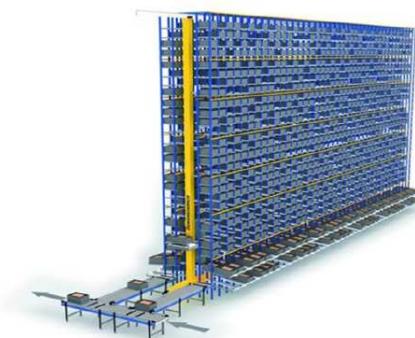
- Skypod
- Stockage automatique pour petites pièces avec transstockeur
- Multi-Shuttle
- AutoStore



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Systèmes de stockage

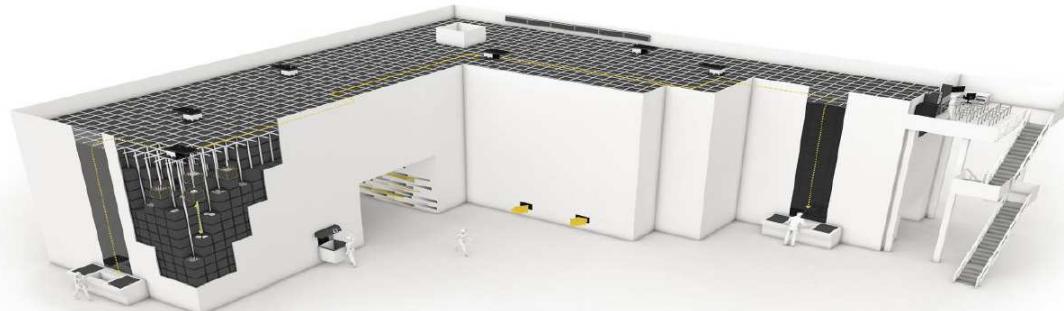




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Systèmes de stockage





Systèmes de stockage: questions

NOMBREUSES QUESTIONS OUVERTES, NOTAMMENT:

- Conservation des documents
- Protection anti-incendie: oui/non?
- Ventilation/aération
- Puissance nécessaire du système
- Volumétrie et infrastructure nécessaires en fonction du système de stockage choisi
- Exemples de systèmes de stockage automatisé dans d'autres institutions patrimoniales

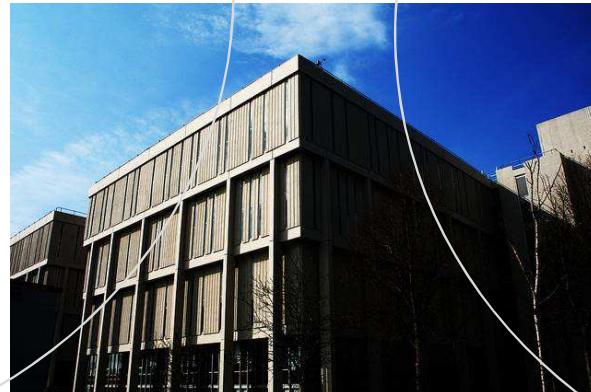
Boston Spa Renewed Programme Status update

Three Construction Programmes



STP Transformed

£750m new centre for scientific research with new BL galleries and learning centre and HQ for Turing Institute



Boston Spa Renewed capital programme futureproofs BL into second half of 21C, becoming engine-room of Library services North and South



Leeds Presence

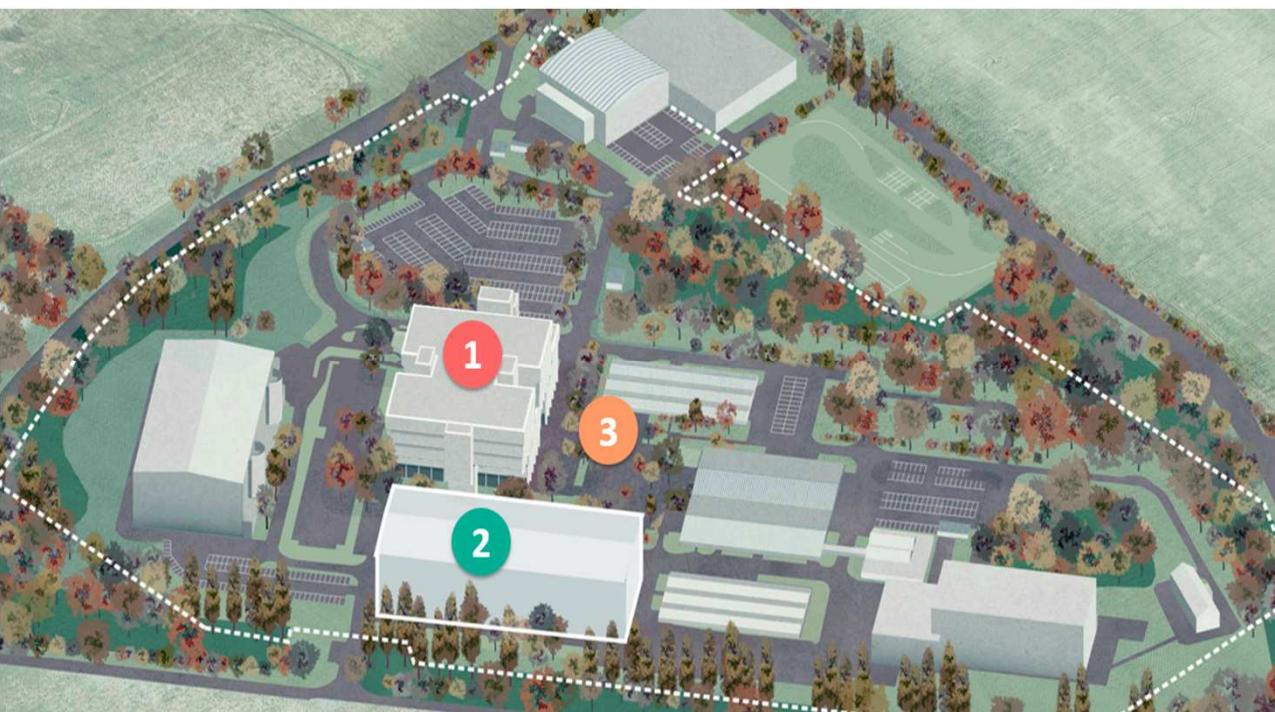
in the historic Temple Works in Leeds, making national collection accessible to some 11m people across North of England



Before ...

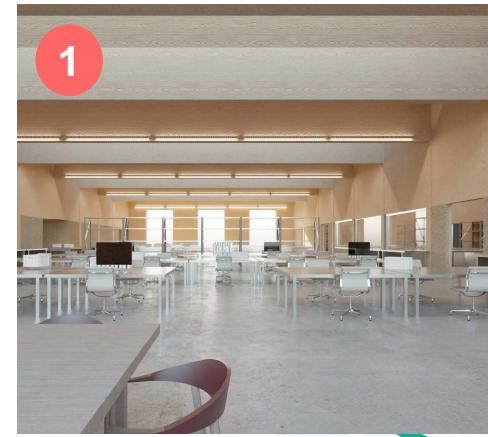
Programme outcomes

- Growth space for national print collection to mid-century
- Relocation of 5m items currently stored in unsuitable conditions (1940s buildings)
- Need to improve carbon footprint.
- Improved office environments for Staff (solutions for this outcome being re-designed owing to affordability)



bl.uk

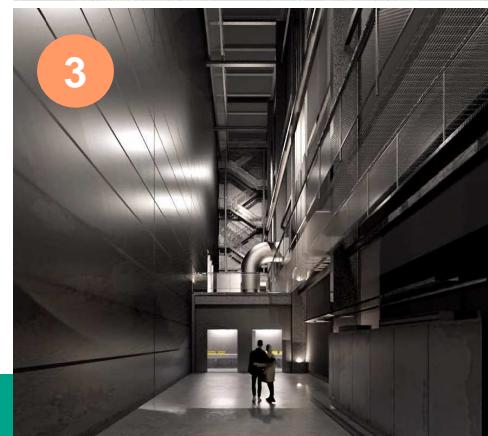
NEW WORKING SPACES - create efficiency gains and remove older buildings.



NEW STORAGE BUILDING - 225km storage space for growth of the national collection to 2045



VISITOR EXPERIENCE improve public offer and build sustainability into the site's operation



A new storage building and logistic hub



Storage building ‘behind the scenes’



Storage Building facts and figures

- Provide growth capacity until c2045 (225 linear km).
- High density, automated storage.
- Low oxygen reduces fire risk.
- Passivhaus – maintains environment without energy (air tightness important).
- Lightweight construction.
- Logistics hub and staff building. Cataloguing and triage site wide logistics.
- Metallic finish - blends into skyline .



Progress to date



Enabling works and demolition completed



103km of collections were relocated



c400 colleagues into temporary accommodation



Comparison B31, B32 and proposed B33

Key Design Parameters	Additional Storage Building 31 – c£25m	National Newspaper Building 32 – c£22m	New Storage Building 33 – c£50m
Storage	262 linear km	40 linear km	225 linear km
Retrieval speed	300 dual cycles/hr	90 dual cycles/hr	1,000 dual cycles/hr
Preservation (temperature and relative humidity)	Meets BS5454: 2000 Archival Preservation standard	Meets BS5454: 2000 Archival Preservation standard	Meets PAS198 Updated Archival Preservation standard
Mechanical services	Fully air conditioned	Fully air conditioned	Passive – no air conditioning
Fire protection	Reduced Oxygen	Reduced Oxygen	Reduced Oxygen
Storage air tightness: Air Leakage Index ^(note 1)	0.5 ALI (design); 0.165 ALI (actual)	0.5 ALI (design); 0.165 ALI (actual)	0.02 ALI (min.) - 0.05 ALI (max.)
Logistics Building	Bld 31 ingest & retrieval only	Bld 32 ingest & retrieval only	Logistics Hub serving whole site
Energy/ Environmental Certification	n/a	BREEAM Very Good	BREEAM Outstanding (target) PassivHaus (target)
Construction delivery	2006-2008	2011-2013	2023-2025 (planned)
Construction cost	£25m	£21m	ca. £50m

Higher speed to meet greater demand (new publications)

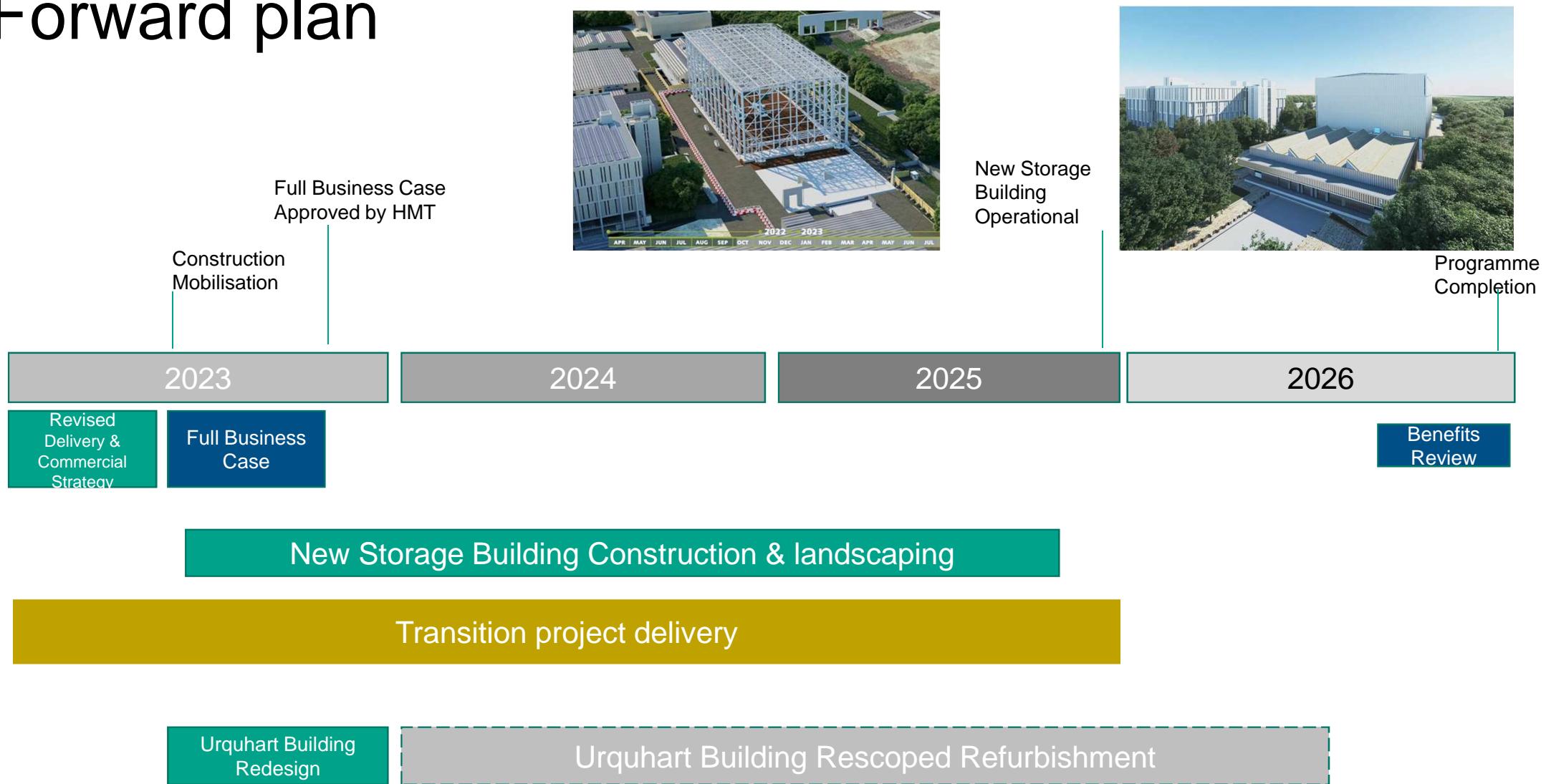
Massive reduction of energy requirement and carbon impact

High air tightness to enable low energy use

'Straight to shelf' process efficiencies

^(note 1)ALI: air tightness measured in m³ loss per hr over each m² of external fabric

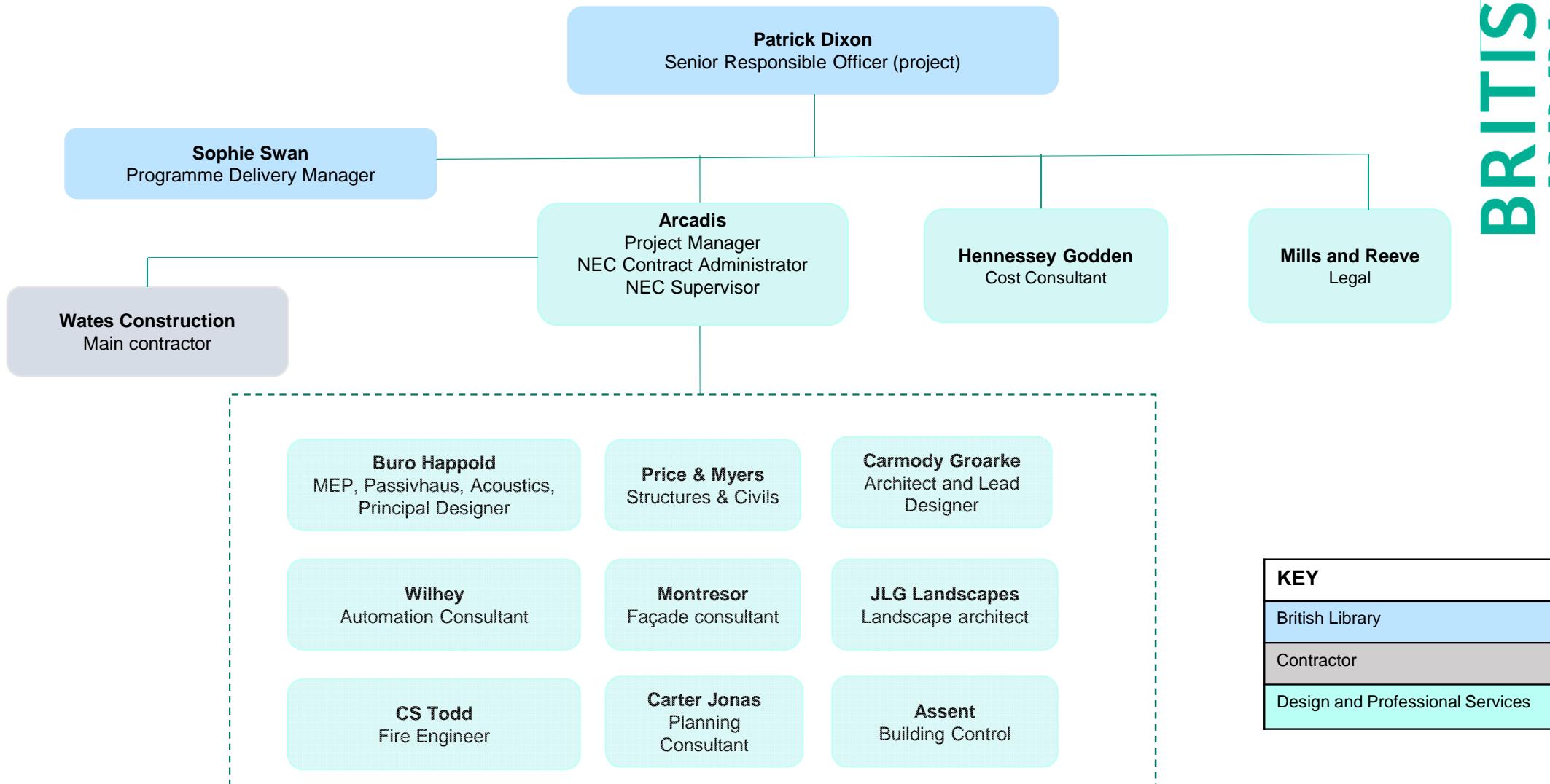
Forward plan



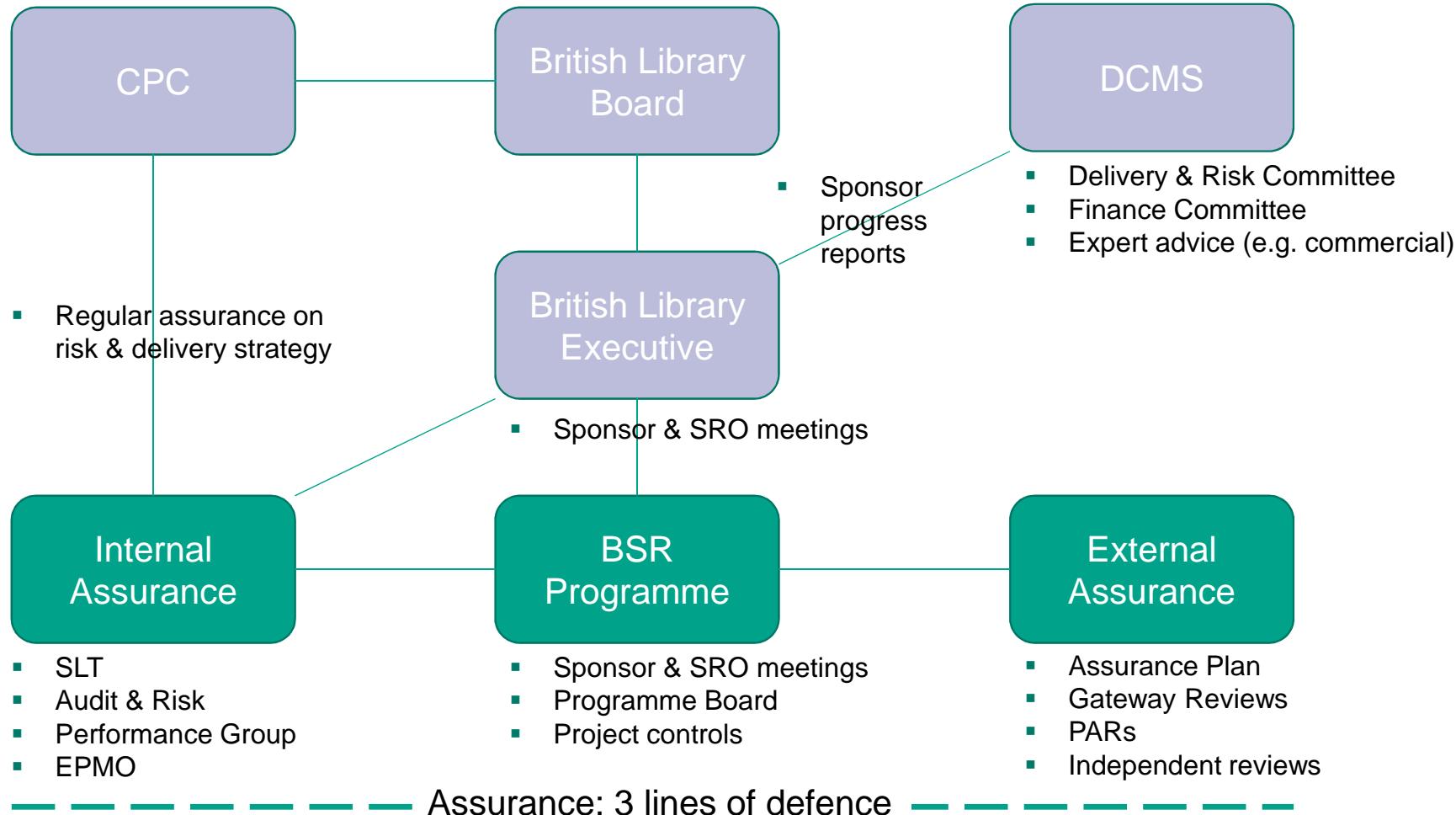
LIBRARY BRITISH

Thank
you!

Design and Construction project structure



Governance & Assurance provided oversight



Extension plans of the CSLS

Study Days “Robotic conservation sites”,
12.-13.06.2023, BnF Paris

Mike Märki

Topics

- CSLS
- Current building(s)
- Planned extension modules
- Realisation variants
- Project status and challenges
- Other important projects

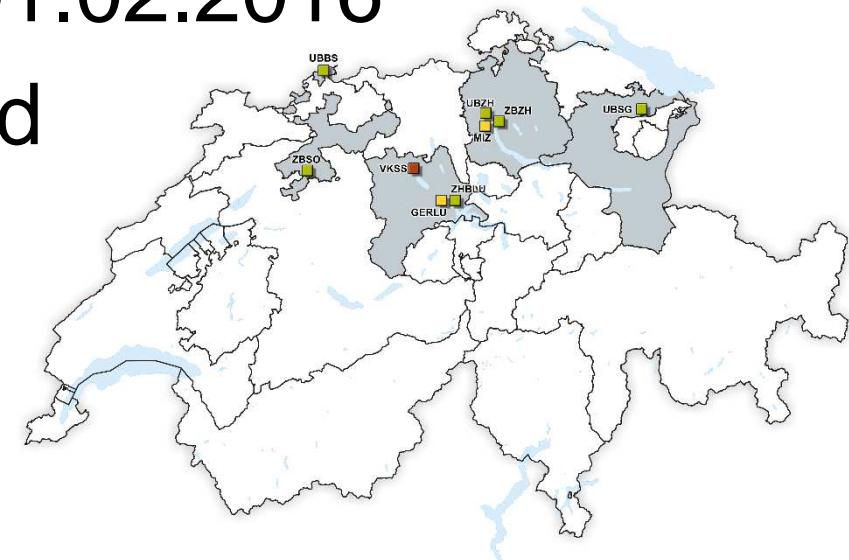
Cooperative Storage Facility Switzerland
www.csls.ch

Mike Märki

CSLS

The Cooperative Storage Library Switzerland

- Cooperative storage for 6 libraries
- Modular concept – open to further partners (e.g. Lucerne Cantonal Courts)
- operational since 01.02.2016
- Provides library and storage services
- 7.8 FTE



How is it organised?

- The CSLS is an independent institution, it does not belong to one of the partners
- A twofold organisational structure:
 - a plc that owns the building and rents it to the association
 - an association of the participating libraries that deals with all operative aspects
- Both are non-profit organisations.

Vision / Strategy CSLS

Vision

In Switzerland, the Cooperative Storage Library Switzerland is a leader in the long-term, cost-effective preservation of written and cultural heritage of all kinds and enables easy access. It supports members and customers with a targeted, efficient range of services.

Strategic goals

Securing long-term operation through growth

The Storage Library secures its successful ongoing operation, good reputation and lean cost structure in the long term and for the benefit of its members and customers through targeted, continuous growth.

Reduction of costs for members through the use of synergies

The storage library sustainably reduces costs for members and customers through economies of scale and synergy effects from growth and the centralisation and further development of processes.

Cooperative Storage Facility Switzerland

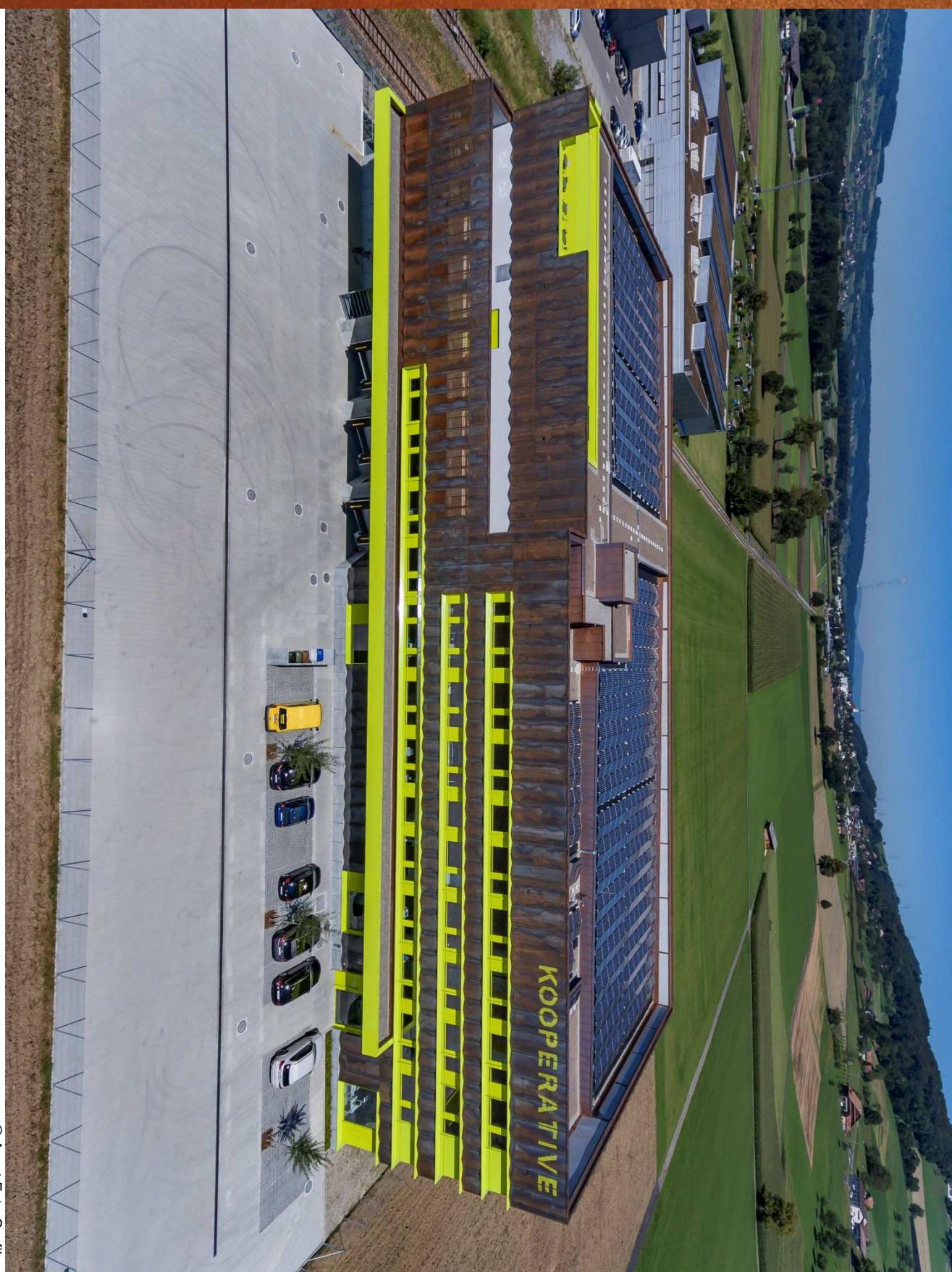
www.csfs.ch

Current building(s)

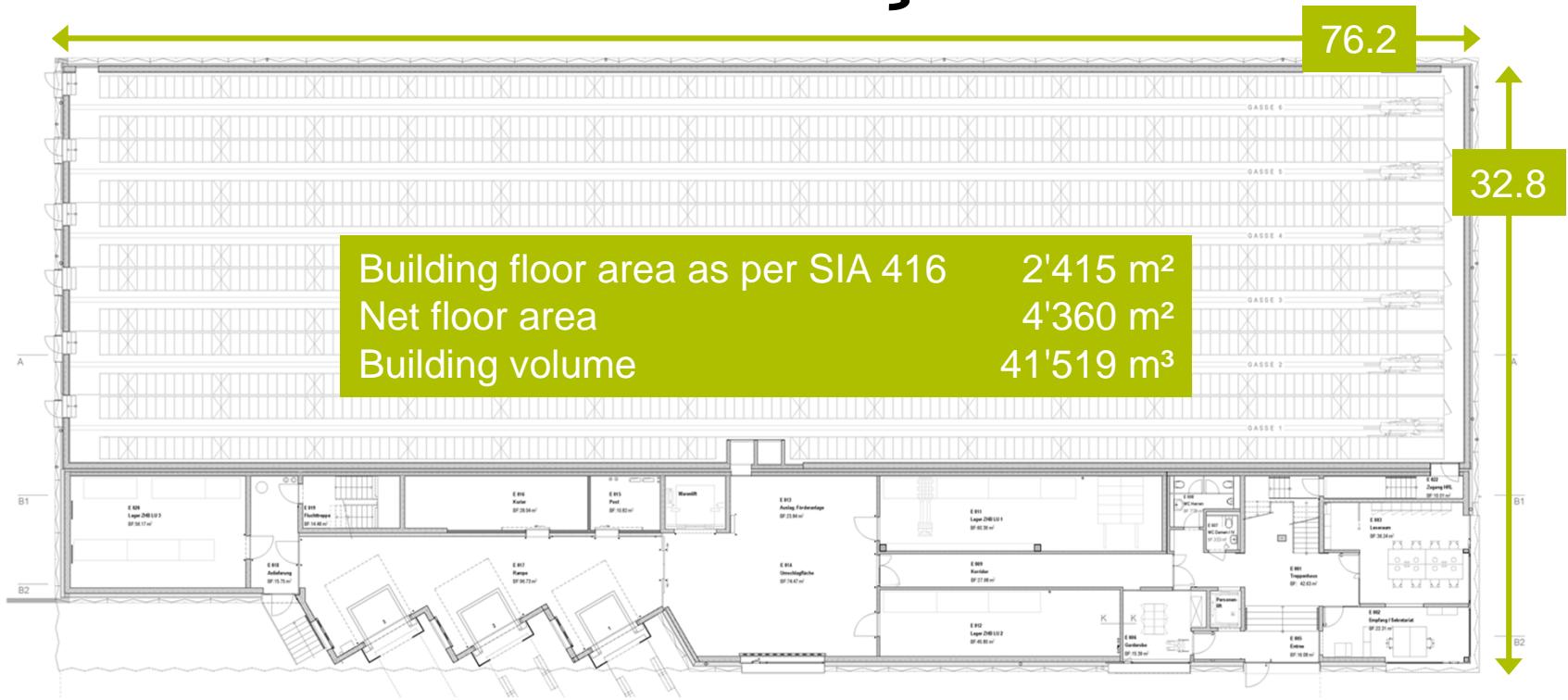
Mike Märki

Cooperative Storage Facility Switzerland

www.csls.ch



Two buildings... ... one façade



The high-bay warehouse is preceded by a 4-storey administrative wing. Operations are located on the right of the building, delivery and technical service areas on the left.

Cooperative Storage Facility Switzerland

www.csfs.ch



© Ulrich Niederer

Cooperative Storage Facility Switzerland

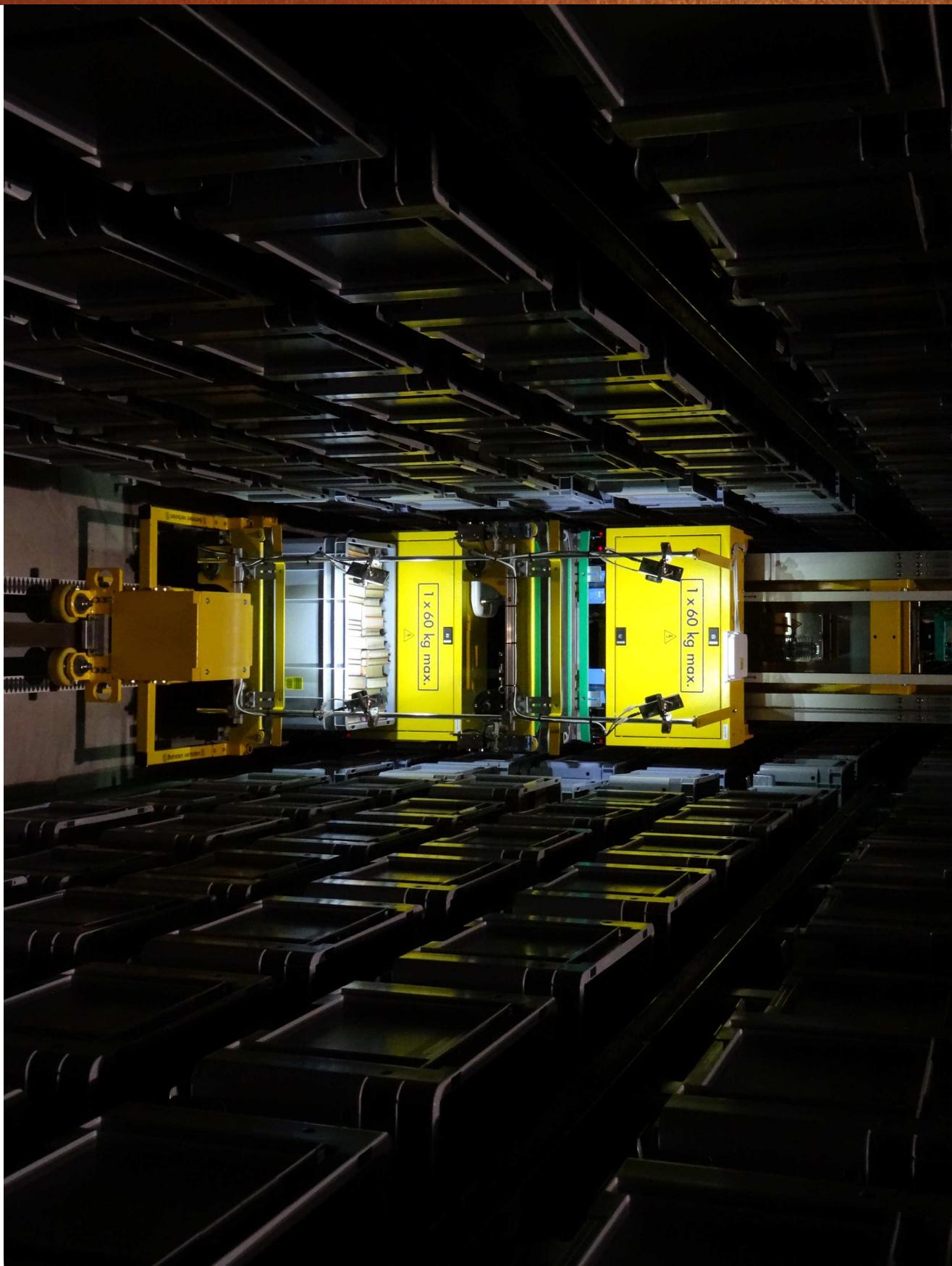
www.csfs.ch



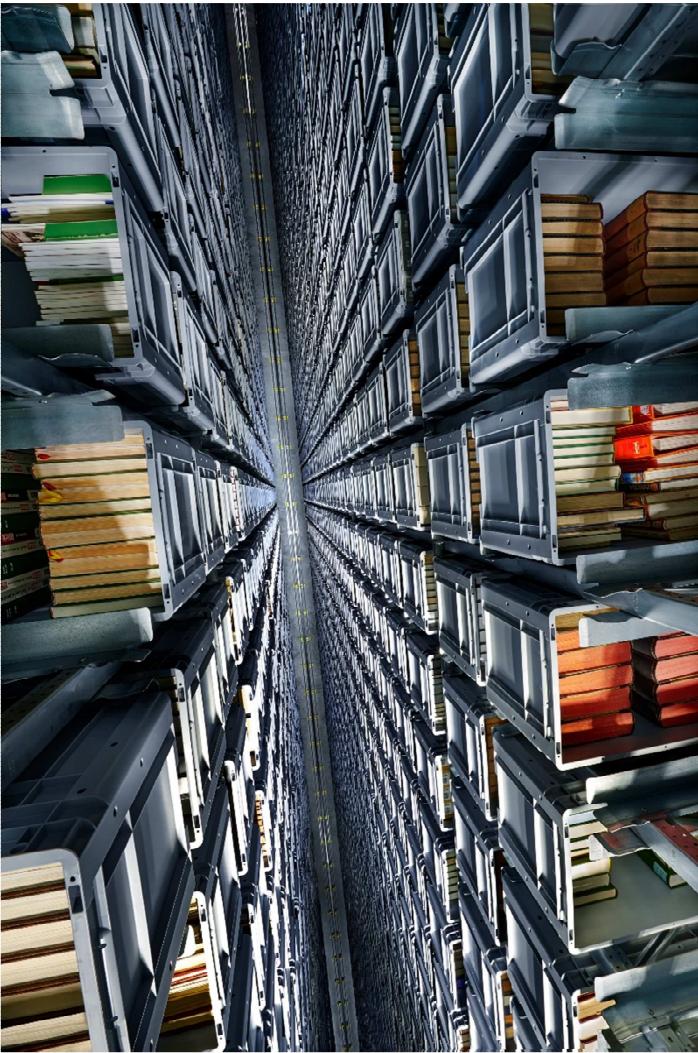
© Luca Zanier

Cooperative Storage Facility Switzerland

www.csls.ch



Fully automated high-bay container storage module



Purpose

Storage of paper-based items and cultural property in containers

Dimensions

- 76 x 22 x 18.25 m (l x w x h)
- 1'672 m², 30'500 m³
- 6 alleys, 112'000 containers

Capacity

- 3.1 m items (planned), 4.4 m (forecast)
- 2.9 m stocked

Climate

- 13.5 % O₂
- 8 °C - 22 °C (< 2 Δt in 48 h)
- 45 % ± 5% rH

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Planned extension modules and areas

Mike Märki

Fully automated high-bay container storage module 2



© Luca Zanier

Purpose

Storage of paper-based items and cultural property in containers

Dimensions

- 76 x 22 x 18 m (l x w x h)
- 1'672 m², 30'500 m³
- 6-8 alleys, ~ 112'000 containers

Capacity

- 3.1 m items
- Doubling total capacity to 6.2 m items

Climate

- 13.5 % O₂
- 8 °C - 22 °C (< 2 Δt in 48 h)
- 45 % ± 5% rH

Fully automated high-bay pallet storage module



© HÖRMANN Logistik GmbH

Purpose

Storage of large paper-based items, cultural property, uncatalogued holdings and other goods on pallets

Dimensions (depends on variant)

- ~ 60 - 76 x 5 - 14 x 18 m (l x w x h)
- ~ 300 - 830 m², 5'400 - 15'100 m³
- 1 - 3 alleys, ~ 1'050 - 3'100 2-frame pallets

Capacity

- Depends on goods

Climate

- 13.5 % O₂
- 8 °C - 22 °C (< 2 Δt in 48 h)
- 45 % ± 5% rH



Fully automated high-bay container cold storage module

Purpose

Cold storage of photographs and other audiovisual media (acetate, nitrate, glass, tapes, etc.) in containers

Dimensions

- 76 x 8 x 18 m (l x w x h)
- ~ 610 m², 11'000 m³
- 2 alleys, ~ 43'500 containers

Capacity

- Depends on goods. ~ 26'100 linear meters

Climate (not finally defined)

- 13.5 % O₂
- 0 °C - 8 °C (< 2 Δt in 48 h)
- 35 % ± 5% rH
- Several acclimatisation zones

Fully automated high-bay desinsection module



© Ulrich Niederer / Mike Märki

Purpose

Cyclic, automatic extermination of pests for all storage types with a not yet defined technology (temperature, radiation, etc.)

Dimensions

- 60 - 76 x 9.5 x 18 m (l x w x h)
- ~ 570 m², 10'500 m³
- 2 alleys, ~ 14'500 containers/1'050 pallets

Capacity

- 0.5 m items in containers
- Items on pallets depends on goods.

Climate (not finally defined)

- Ideally identical to other storage modules
- Depends on technology research

Surface storage



Purpose

Storage of large objects that do not fit on pallets.

Dimensions

- 6.0 - 8.5 m x 50 m x 3.1 m (l x w x h)
- ~ 820 - 1'200 m², ~ 2'550 - 3'750 m³, splitted over 3 floors

Capacity

- Depends on goods.

Climate (not finally defined)

- Ideally identical to other storage modules.

Working areas



Purpose

Creation top modern workplaces for an optimal support of all processes, work steps and services

- Workplaces,
- Meeting Rooms,
- special Workzones storage related
- Arranging

Dimensions

- ~ 750 – 2'400 m², ~ 2'325 – 7'440 m³
- Height: 3.1 m

Climate (not finally defined)

- Air Conditioning integrated
- Normally 21 - 26 °C

Additional Requirements

- Structural optimisations
 - Air Conditioning
 - Enlargement PV
 - Integration UPS-System
- Organisational optimisations
 - Lending and return station should be useable outside normal business hours
 - Enlargement and reallocation of the cafeteria

Additional Requirements

- Logistical optimisations
 - Replacement of the warehouse management system
 - Improvement of the reliability and performance of the logistics system
 - Adding additional automation steps
 - Optimisation of the picking workplaces
 - Reduction of empty space within containers

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Realisation variants

Mike Märki

CSLS

variant North

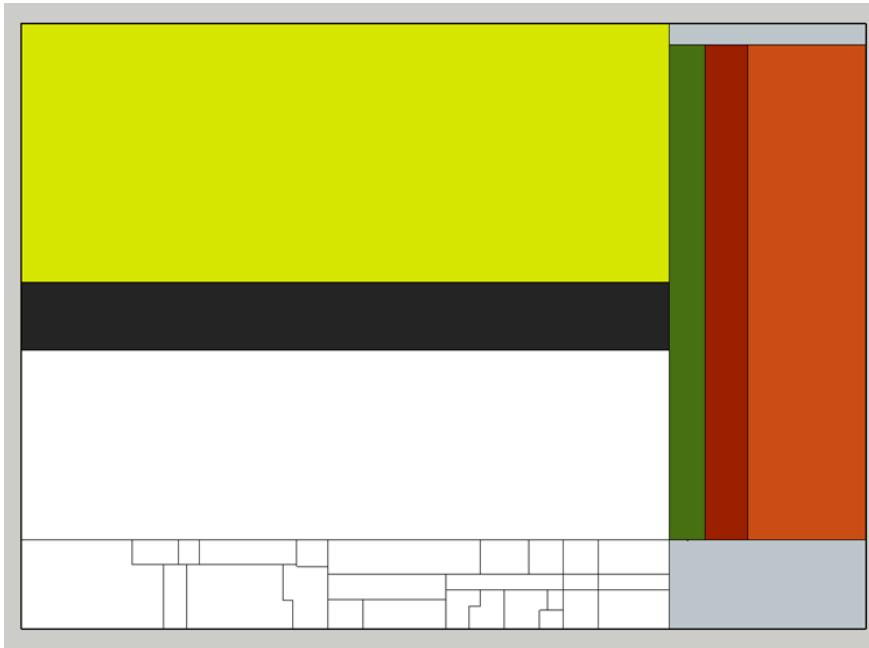


- High-bay container storage
- High-bay container storage Desinsection
- High-bay pallet storage
- High-bay pallet storage Desinsection
- High-bay container cold storage
- Current building

North variant requires the modification of container module 1 and is not optimal in terms of logistics and construction time.

CSLS

variant North/East



- High-bay container storage
- High-bay container storage Desinsection
- High-bay pallet storage
- High-bay pallet storage Desinsection
- High-bay container cold storage
- Infrastructure and ancillary areas
- Current building

This variant is logically optimal and offers expandability in two directions but is more expensive.

CSLS + CACL

About CACL

- The "Cultural Assets Centre Lucerne" project has been launched and unites cantonal collections under one roof:
 - Collection and offices of Archeology & Monument Preservation
 - Collection and offices of cantonal museums
 - Collection and offices of Photo-documentation Foundation
 - Collection of historical furniture
 - Collection of cantonal art

CSLS + CACL

Synergies and common goals

- Scalable, flexible approach that can cover the long-term storage of cultural assets at a high conservational and technological level.
- CSLS has been dealing with topics such as IPM and the storage of photo/AV documents for a long time. With the integration of other institutions, this know-how can be bundled and used profitably.
- Synergies regarding
 - Investment Costs
 - Operational Costs
 - Space efficiency

CSLS + CACL

variant SLZ

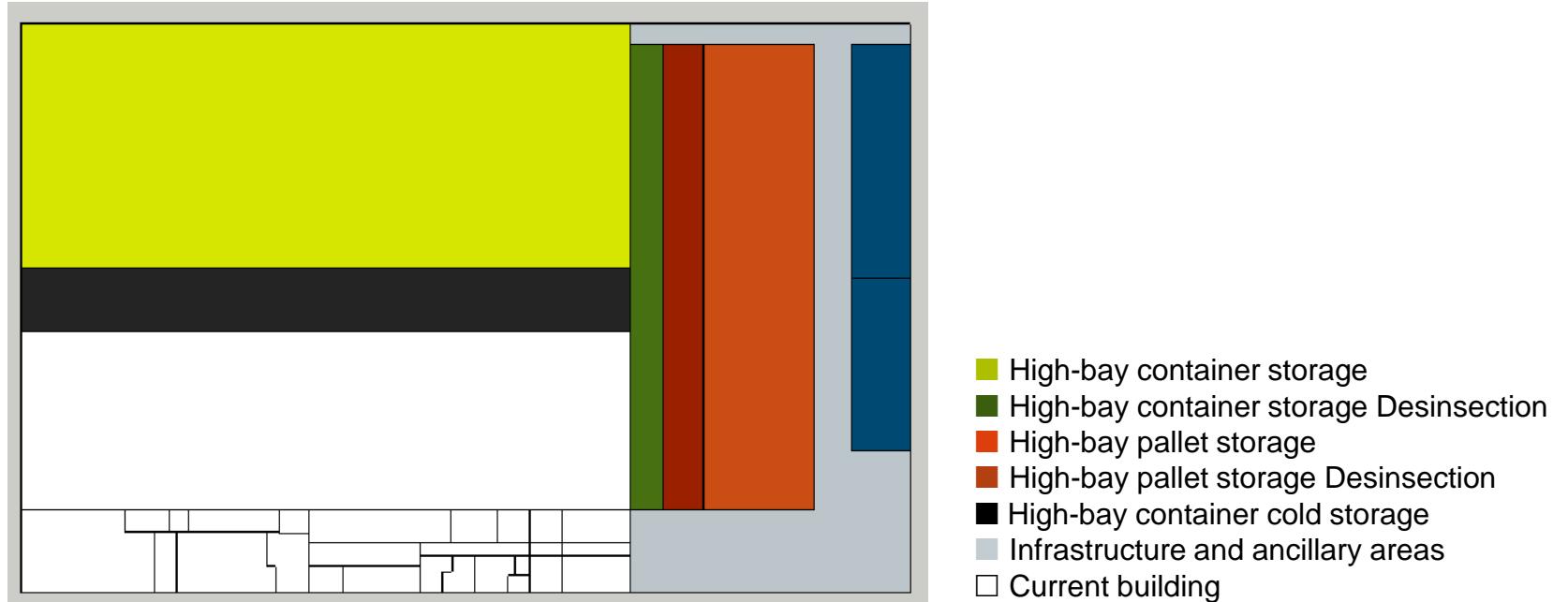


- High-bay container storage
- High-bay container storage Desinsection
- High-bay pallet storage
- High-bay pallet storage Desinsection
- High-bay container cold storage
- Infrastructure and ancillary areas
- Current building

The SLZ variant has an additional extension on the east site to cover the requirements of this scenario regarding storage surface, additional office surface and infrastructure space.

CSLS + CACL

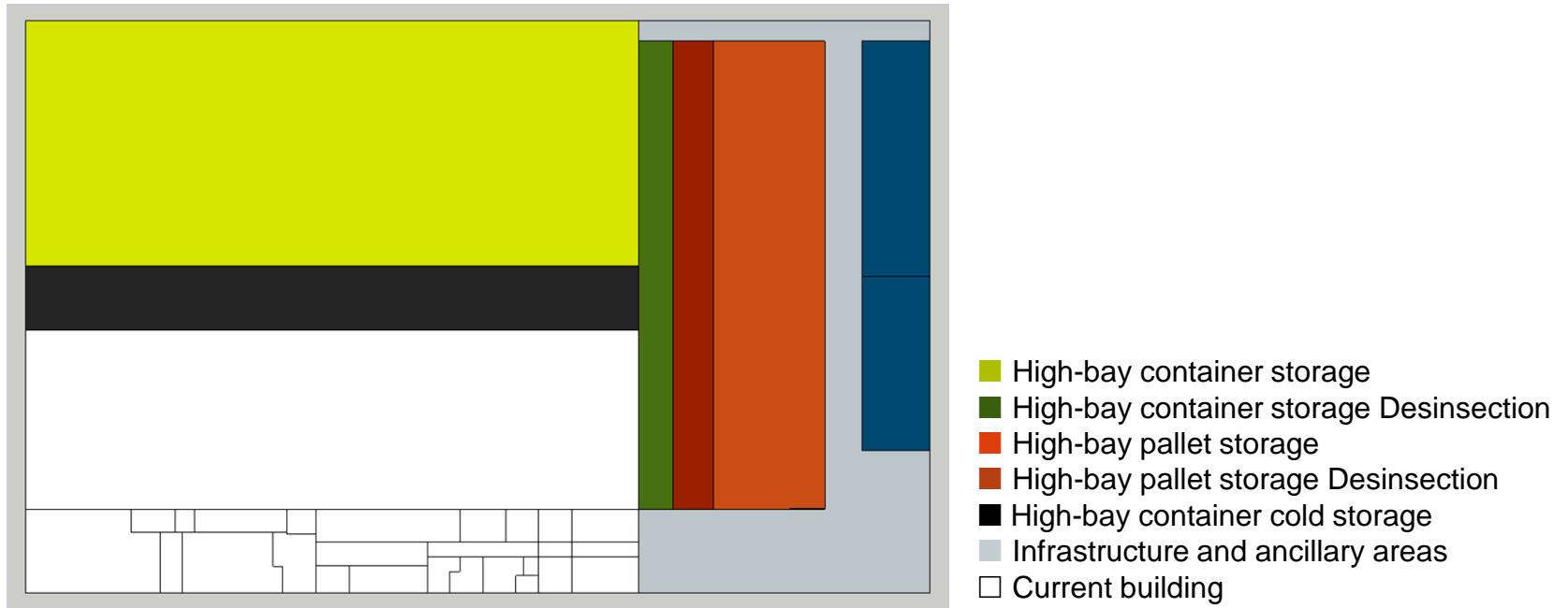
variant KGHA



The KGH-A variant has larger additional extension on the east site to cover the requirements of this scenario regarding storage surface, additional office surface and infrastructure space.

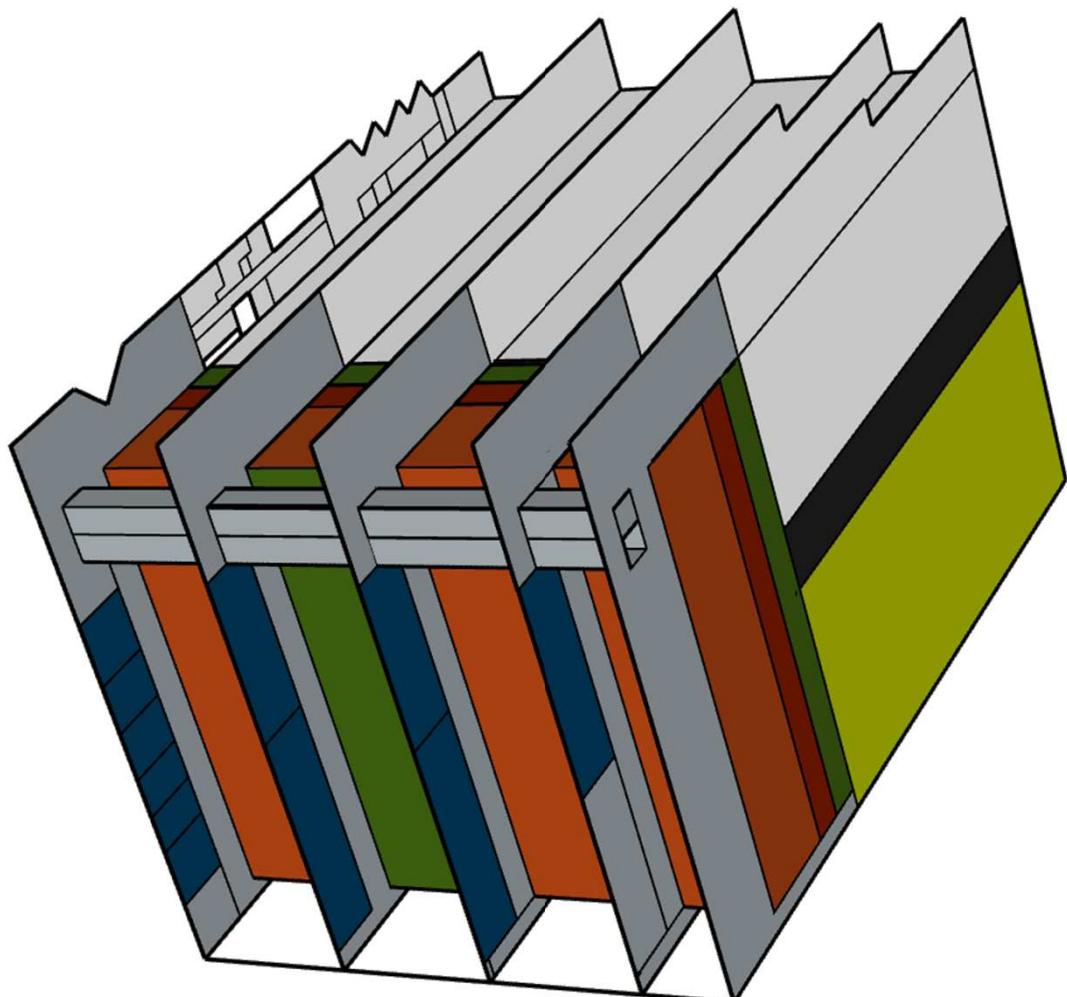
CSLS + CACL

variant KGHB

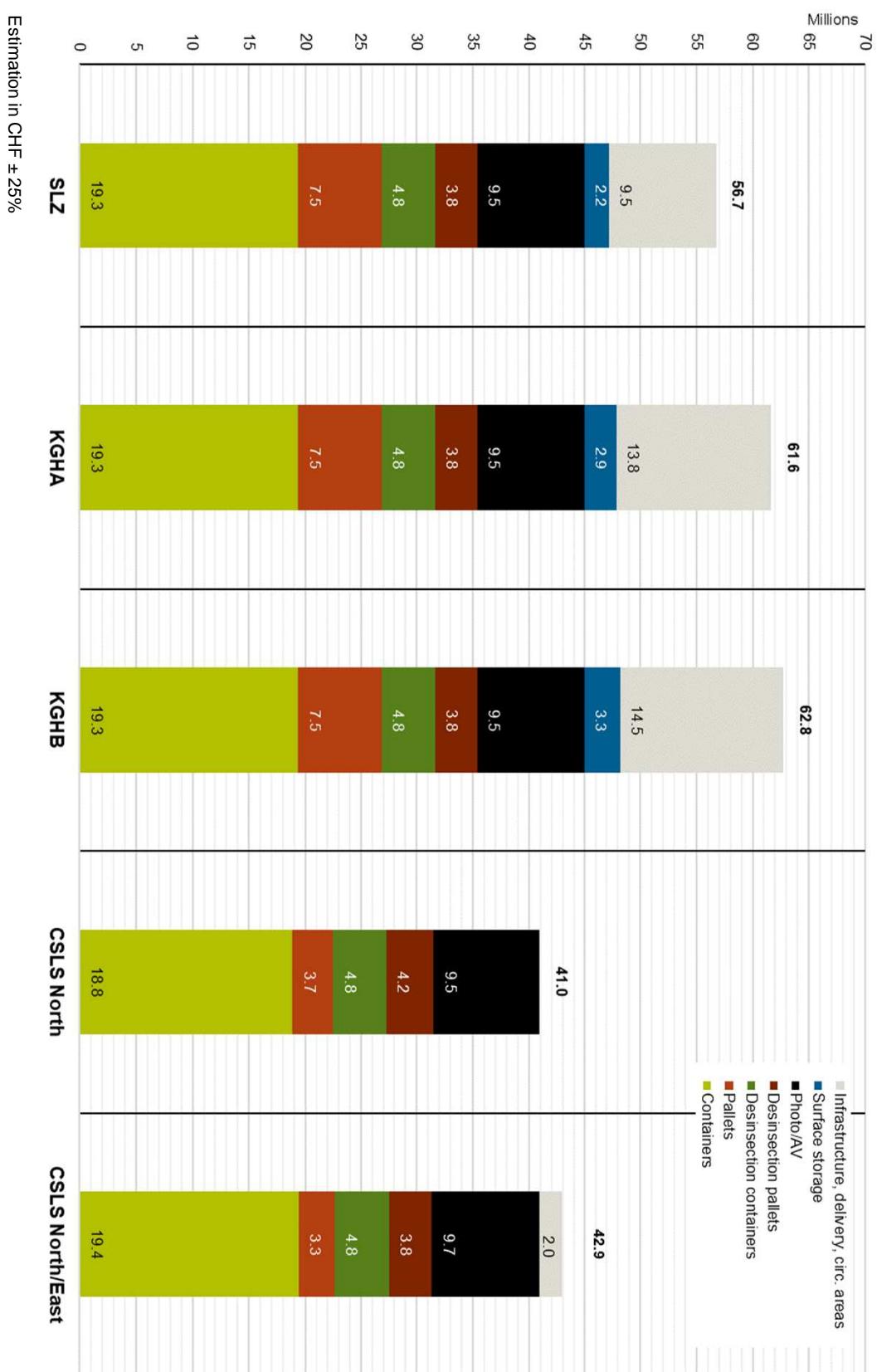


The KGH-B variant has again a larger additional extension on the east site to cover the requirements of this scenario regarding storage surface, additional office surface and infrastructure space.

CSLS + CACL Visualisation variant KGHB



Investment comparison



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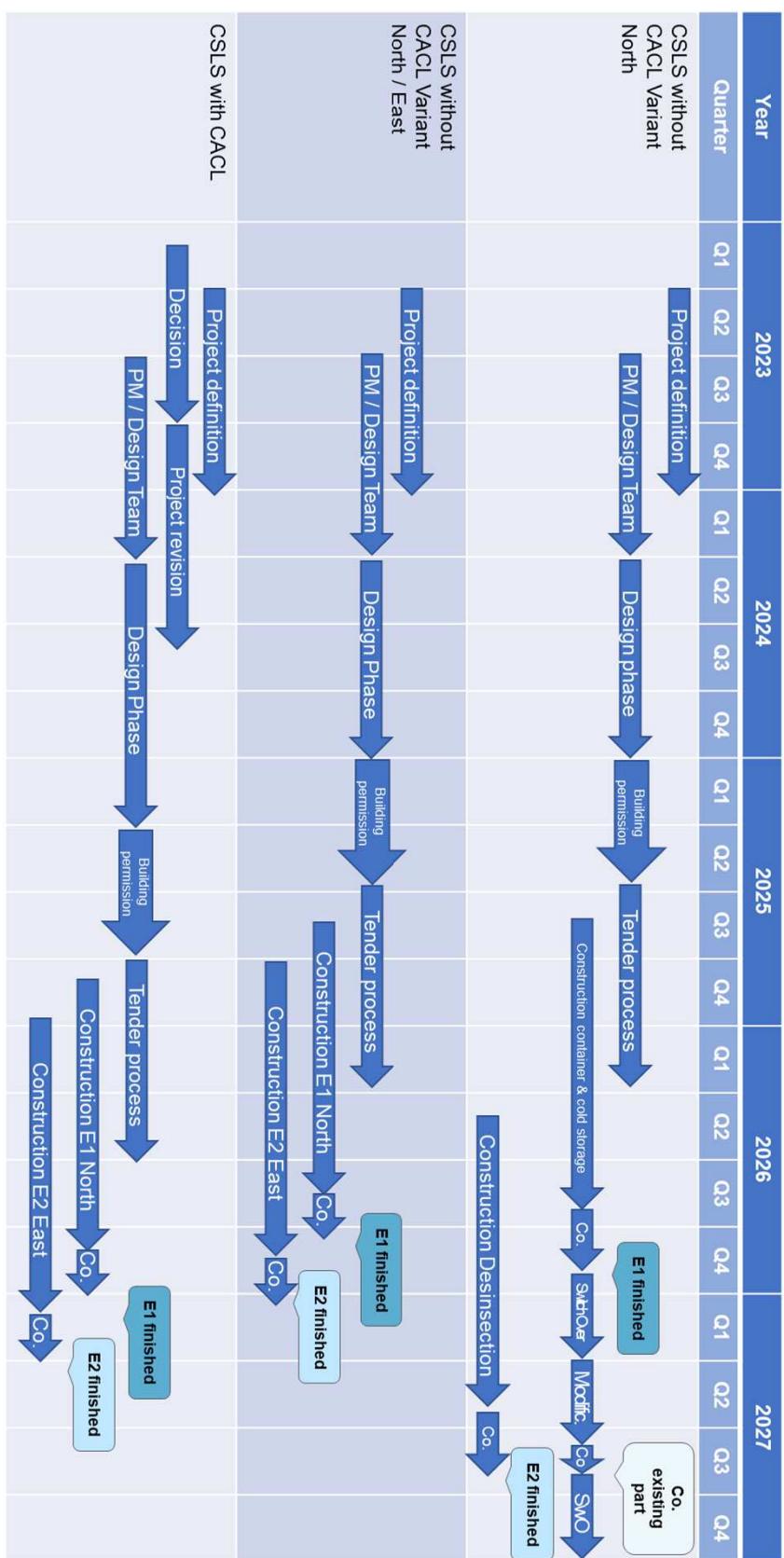
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Project status and challenges

Mike Märki

Project schedule

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Challenges

- Container module 2 is urgently needed because space is running out.
- Slow decisions on the KGZL variants.
- Clear need for photo/AV module, but only 25% reserved without obligation.
- Unclear technological requirements for photo/AV and desinsection modules.
- Resources strongly tied up by ALMA problems.

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Other important projects

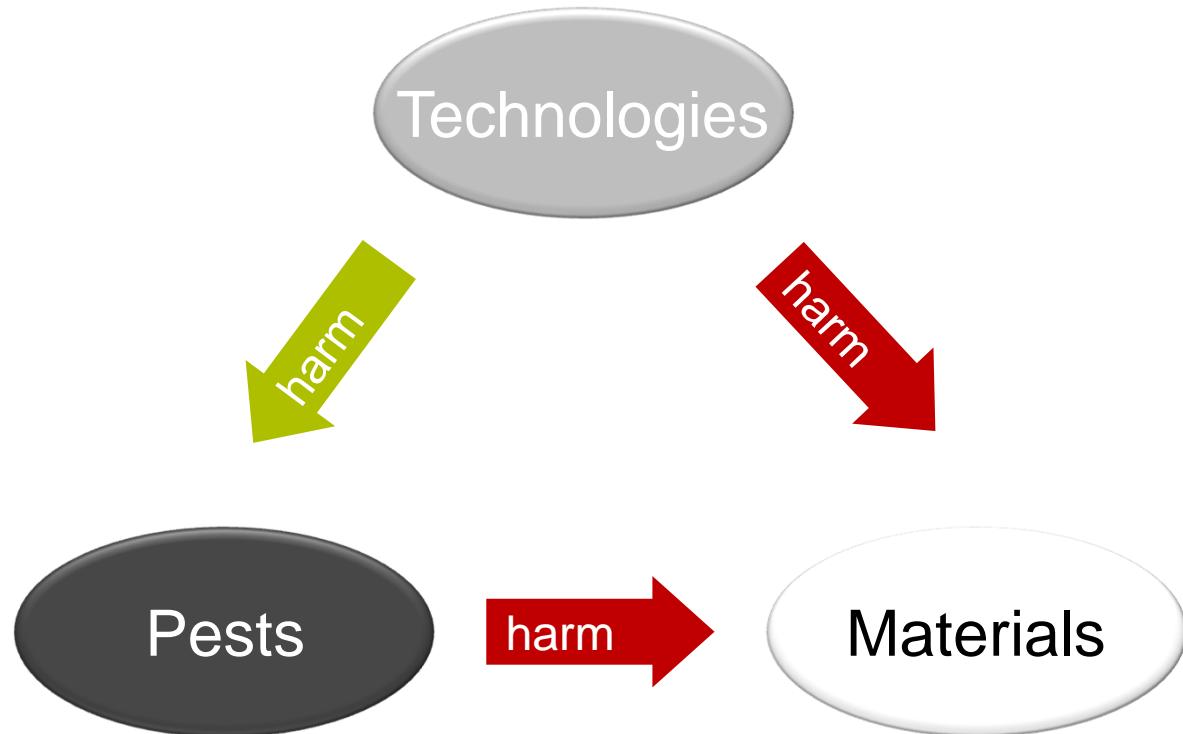
Mike Märki

Integrated Pest Management (IPM)

- Implementation of strict IPM and monitoring.
- Research about how to
 - detect pests in containers/pallets in the high-bay storage.
 - kill pests of different cultural goods without harming the goods.
- Definition of requirements for the desinsection module.

Integrated Pest Management

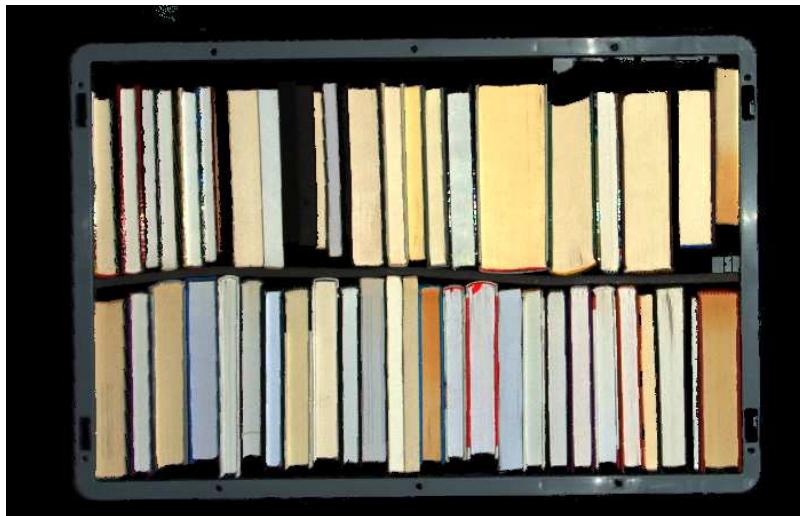
Conflict triangle



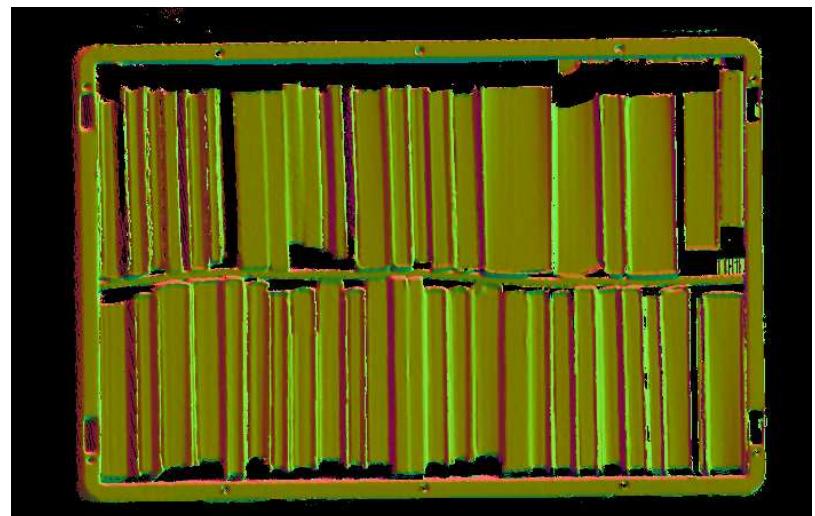
Optical space optimisation and damage detection (OPSS)

- Innovation research project to
 - recognise and optimise empty space in containers.
 - record item heights for the planning of new modules.
 - detect potential damage on items with AI.
- Each container is 3D scanned when it is moved into storage.
- Algorithms and UI currently under development.

Optical space optimisation and damage detection (OPSS)



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See you soon in Büron!

Questions & Answers

Study Days “Robotic conservation sites”,
12.-13.06.2023, BnF Paris

Mike Märki

Topics

1. Temperature and humidity
2. Ventilation
3. Maintenance
4. Energy
5. Automation
6. Building
7. Picking stations
8. Conservation
9. Bins & Containers
10. Communication
11. Questions of CSLS
12. Appendix

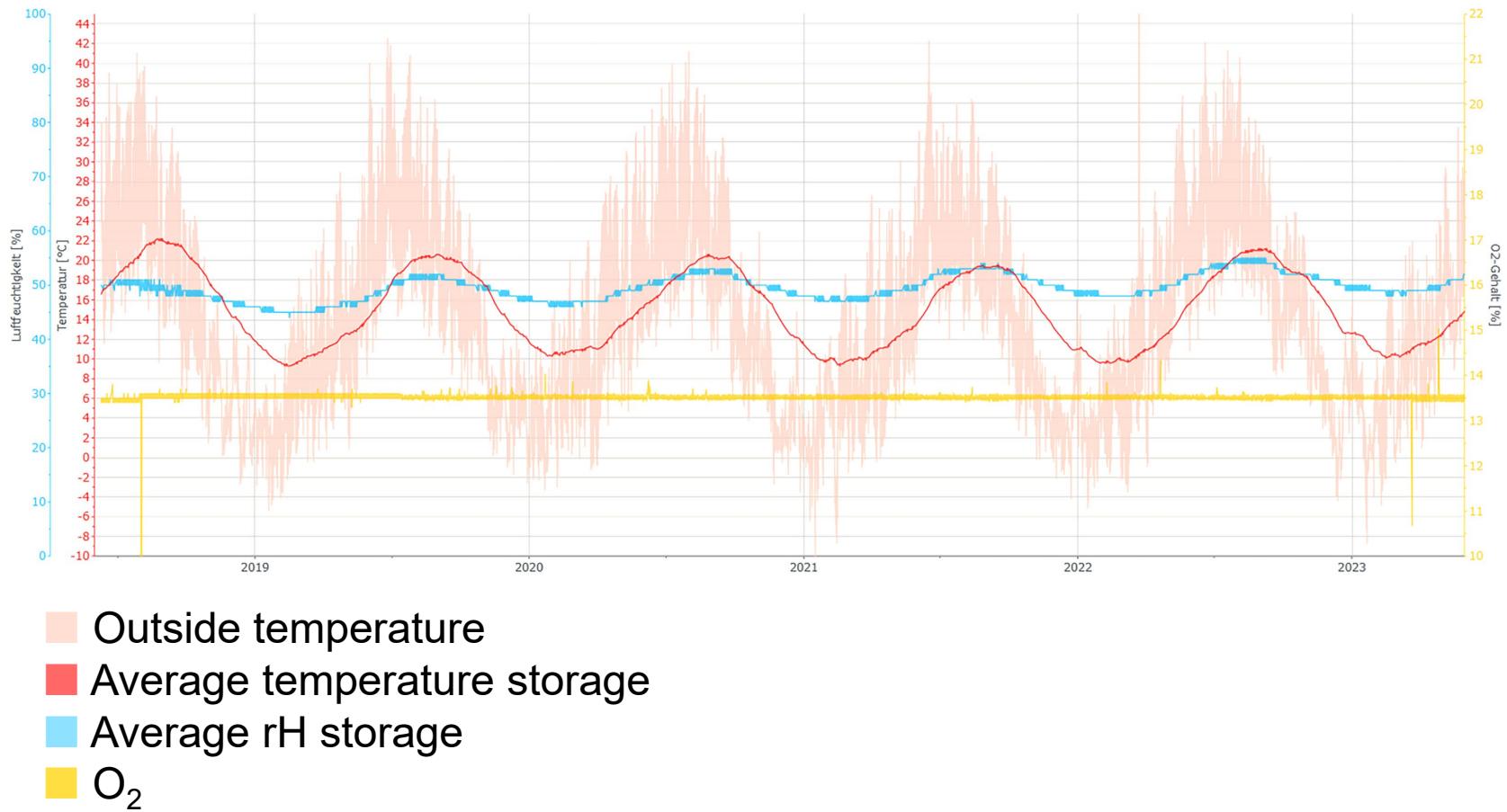
1. Temperature & humidity

Mike Märki

1. Temperature & humidity

- a) Do you have internal temperature and RH graphs over time with external climate data?
- ➔ Detailed data available. Shared with KBNL and they validated their climate simulation model.
 - ➔ Building management system (BMS) is capable of setting lower and upper alarm values on individual sensors.

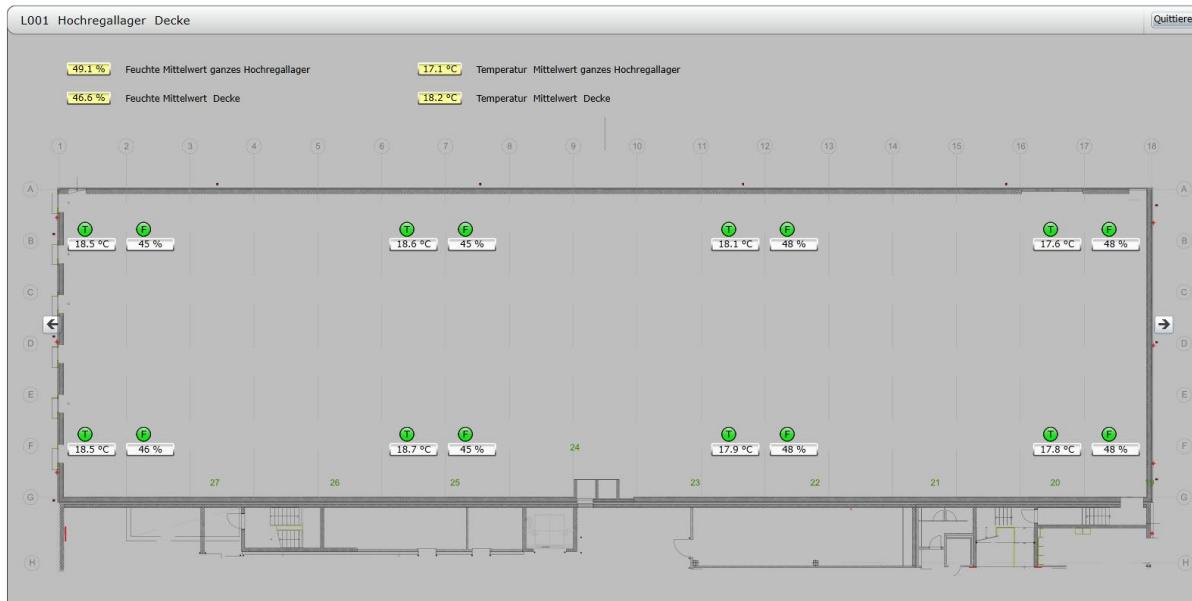
1. Temperature & humidity



1. Temperature & humidity

b) How many and where are the sensors that record the conditions located?

- Temperature and rH sensors in storage are 3 m and 15 m above ground (8 per layer) and 12 dynamically in containers.
- Many other sensors in the rooms of the administrative building.



1. Temperature & humidity

- c) Have they noticed any issues with stratification?
 - ➔ There is a Δt of 1.5 – 3.0 °C between both layers, but we haven't seen any stratifications so far.
 - ➔ Ventilation is done by robots. They run at least every 2h twice back and forward the alley.
 - ➔ Many other sensors in the rooms of the administrative building.

1. Temperature & humidity

d) Have you monitored surface temperatures?

- ➔ Not regularly. We took a measurement over six months in 2020.
- ➔ Conclusion: The concrete cross-sections release smaller amounts of moisture into the room.
- ➔ With the influence of the greater heating of the high-lying zones in summer, the moisture release is higher there than at ground level, where lower temperatures are present.
- ➔ Due to the drying of the building moisture, it is to be expected that the moisture release of concrete walls without ground contact will decrease in the future, while it will remain approximately the same for the floor area with ground contact.

1. Temperature & humidity

- e) Have any issues been observed with the condition of the collection?
 - ➔ No.

- f) Do you run a form of audit on the stored collections to do a condition check?
 - ➔ No, not yet actively. Passive through normal picking and OPSS.

1. Temperature & humidity

- g) Have you had to retrospectively introduce any HVAC systems to control humidity or temperature?
- ➔ No, but ventilation ducts are installed in the storage in preparation for this.
 - ➔ The installed humidification system was never in operation and is deactivated.
 - ➔ With the extension project air conditioning will be installed to break the lower and upper temperature peaks (< 8 °C / > 22 °C) during a few days and in view of global warming.
 - ➔ This also enables automatic dehumidification if the upper rH-limit is exceeded at any time.

1. Temperature & humidity

h) Have you noticed the impact of the heat load from the robots?

- ➔ No, we have not found any measurable effects.
- ➔ According to our energy measurements, the robots draw a total of 60.54 kWh between 0700-1600, and 125 kWh in 24 hours.

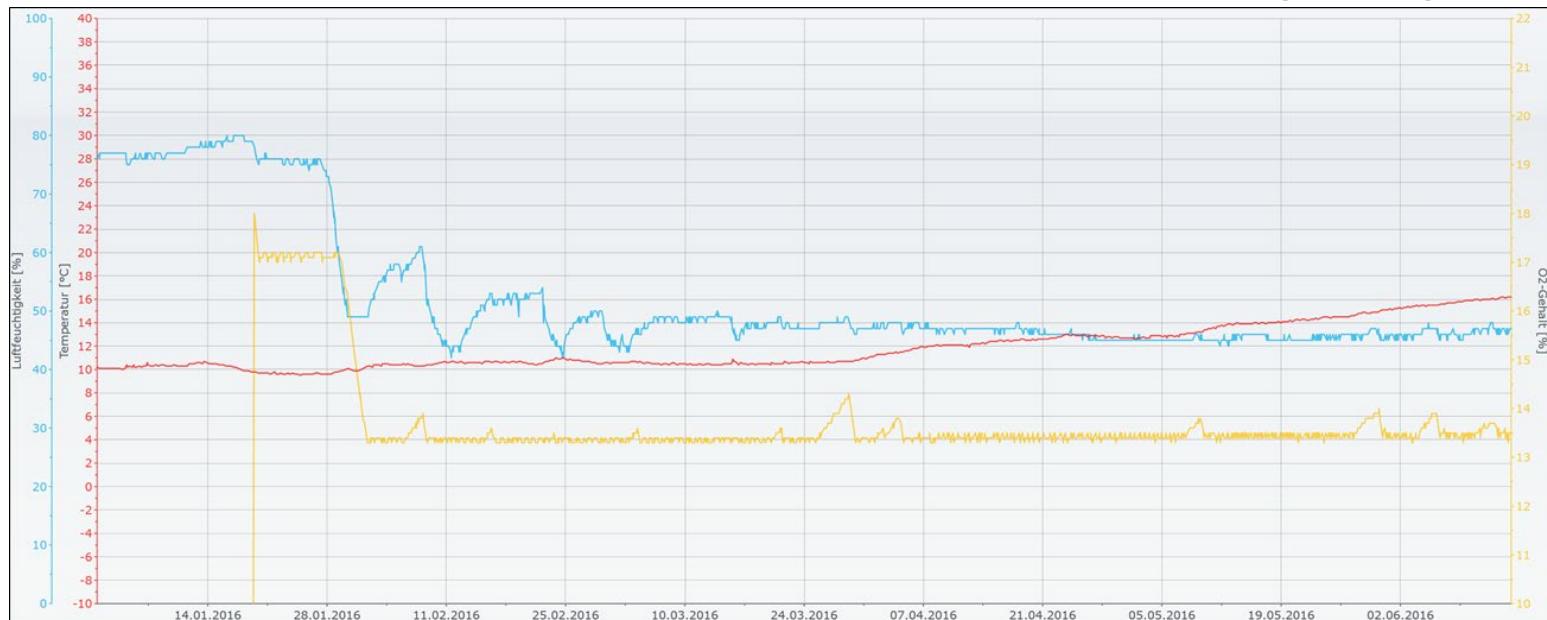
Building	Power consumer	Position	Detail position	Consumption kW		Comments
				Base load	in operation	
Storage	Total			6.280	8.647	6 robots / Passarelle
	1 robot	Total		0.850	1.009	
		Control cabinet Load carrier	Total	0.098	0.116	
			Laser/AP/LED/Power supply.	0.098	0.116	Operating consumption extrapol. linearly
		Control cabinet robot	Total	0.639	0.759	
			2 LENZE drive control XY	0.512	0.608	Operating consumption extrapol. linearly
			24V power supply	0.100	0.119	Operating consumption extrapol. linearly
			Transformers	0.027	0.032	Operating consumption extrapol. linearly
		Control cabinet alley	Total	0.098	0.116	
			Power supply	0.098	0.116	Operating consumption extrapol. linearly
Passarelle			Power transmission rail	0.000	0.000	Operating consumption extrapol. linearly
		Various		0.015	0.018	Operating consumption extrapol. linearly
		Total		1.180	2.593	
		3 Control cabinet		0.630	2.043	14 Measurements in operation.
		1 ICT-Rack		0.550	0.550	24h in operation

1. Temperature & humidity

- i) What is the temperature of the low oxygen inlet?
 - We do not measure or monitor this temperature. It corresponds to the normal room temperature of the administration.
 - Humidity and temperature correspond to the storage climate 20 cm next to the outlet nozzle.
 - Approximately 530 m³ of nitrogen is injected into the storage in average per day via 3 lines along the entire length (1 top centre, 2 bottom north and south).

1. Temperature & humidity

- j) Would you have TH curves to put next to the initial filling of the storage?
- ➔ The concrete shell was completed before the shelves were built so that it could dry out.
 - ➔ Industrial dehumidifiers were also used at the beginning.



1. Temperature & humidity

- k) What are your temperature/hygrometry drift objectives, in particular the mini-maxi limits? Per day and per week?
- ➔ 8 °C - 22 °C (< 2 Δt in 48 h)
 - ➔ 45 % ± 5% rH, allowance to go up to 55%
 - ➔ Following external research in 2018, our values meet ASHRAE's AA+ standard.
 - ➔ 13.5 % O₂

2. Ventilation

Mike Märki

2. Ventilation

- a) Air quality – is it monitored and is there any data collection over time that we could see?
 - ➔ Particle measurement (0.1-0.5 µm, 0.5-1 µm, 1-5 µm) and residual oil measurement are installed at the intertisation unit.
 - ➔ It must be replaced because calibration is expensive and time-consuming and the measurements are currently not reliable.
 - ➔ It is unclear which purity class has been defined according to ISO 8573-1. The system is designed for class 2.
 - ➔ We don't have history data yet.

2. Ventilation

b) We are concerned about dust and particulate soiling – do you monitor this?

- ➔ We don't have any issues with this.
- ➔ The building was deliberately built in an area fine dust-free as possible.
- ➔ There is a slight overpressure in the storage.
- ➔ There is no monitoring in the storage yet. Filtering and measurement could be installed via pre-installed ventilation system.
- ➔ The air is filtered several times during the nitrogen-conversion (supply air, compressor, activated carbon) and monitored at the inerting plant.
- ➔ Air in the administration building is filtered twice - but there is still dust there. The opening of windows should be prevented as far as possible.
- ➔ Most of the dust in the storage results from inadequate construction cleaning and subsequent construction work.
- ➔ We plan to use hoover robots in storage and administration building.
- ➔ The administration is cleaned twice a week, the storage annually.

2. Ventilation

c) Do you monitor VOCs and mould?

- ➔ We would like to measure VOCs, but it is unclear exactly which substances should be measured where.
- ➔ We have started a project on this, but are grateful for input.
- ➔ The measurements should be as automatic as possible.
- ➔ We measure mould every six months at 15 measuring points in all the aisles, in the ventilation and in the administration building with Petri dishes, which are sent to a laboratory.
- ➔ An automatic measurement of mould would be desirable.
- ➔ All initial ingestions go through a quality assurance process, where moisture and mould are also measured at random. This room and the book cleaning machine is regularly treated by nebulisation of hydrogen peroxide.

2. Ventilation

- d) Have you introduced any permanent ventilation supply other than Nitrogen?
 - No, but the ventilation ducts in the storage are prepared and the robots are used for ventilation (see 1c).
 - We will install this within the extension project

- e) Have you planned a quarantine space?
In the robotic store?
 - Yes, we have a kind of quarantine room and are currently implementing a rigorous IPM.
 - A quarantine storage is planned (see separate presentation).

3. Maintenance

Mike Märki

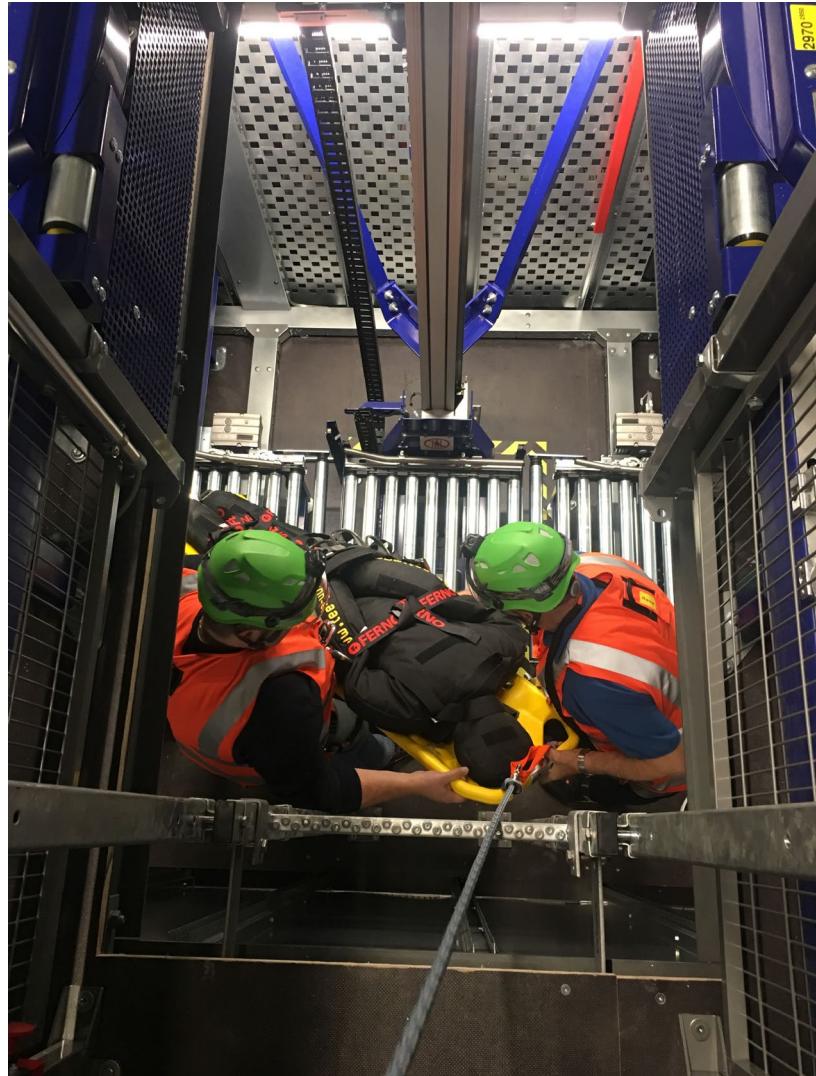
3. Maintenance

- a) Have you experienced anything significant in terms of maintenance requirements that we could learn from?
- ➔ We have annual maintenance by the manufacturer and a support contract with short response times.
 - ➔ It is worthwhile to keep many components in our own spare parts storage or to have availability guaranteed.
 - ➔ Our own specialised personnel can quickly rectify faults and maintain themselves and intervene preventively.
 - ➔ Sensor monitoring at component level can detect faults preventively.
 - ➔ Staff and external must be allowed to work in the oxygen-reduced warehouse (annual, half-day health check).

3. Maintenance



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© VKSS

3. Maintenance

- b) Do you ever have to purge the collection storage area to bring it back up to atmospheric O₂ to undertake maintenance (or for any other reason)?
- ➔ No, we have never had to raise the O₂ level.
 - ➔ We have had to empty areas to clean the shelves. It is helpful to have a corresponding function in the LVS.

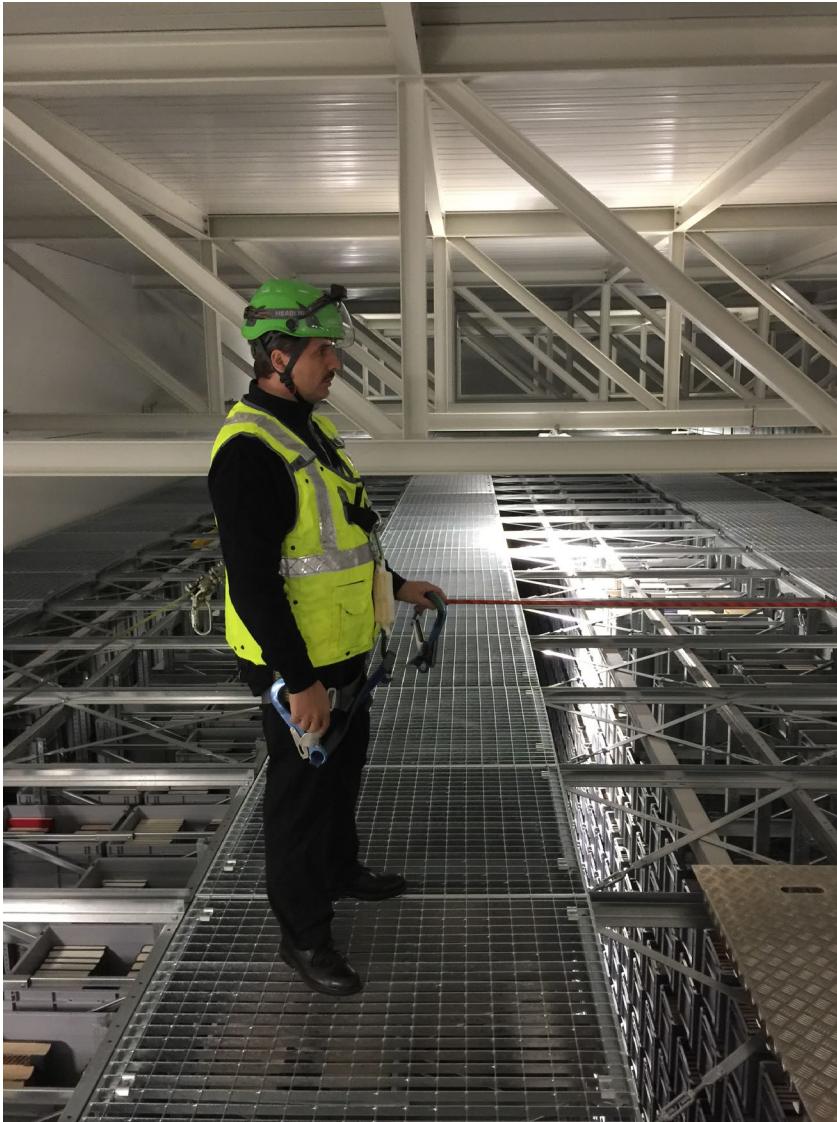
3. Maintenance

- c) If you do purge, do you permit retrieval or do you have alternative fire prevention regulations?
 - ➔ When the electricity is switched off in the whole storage, the O₂ level might be raised.
 - ➔ Alternatively, in consultation with the fire insurance company, a permanent fire watch can be set up so that work can continue even at normal O₂ levels.

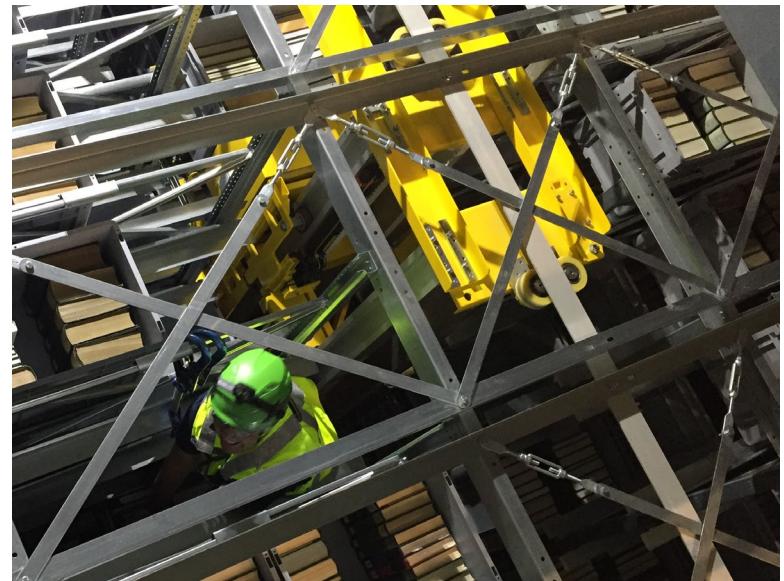
3. Maintenance

- d) We are concerned for pollution from wear and tear of the conveyor belts and maintenance of the robots. What is your experience in this?
- ➔ We did not notice any visible traces on containers or items.
 - ➔ Lubrication of the robots should be done carefully, especially on the upper guide rail.
 - ➔ We notice soiling (due to dirt on shoes) mainly through the maintenance walk over the storage. Specific areas we have protected, but not all.
 - ➔ Abrasion is mainly caused by containers dragging along the belt and from container production.

3. Maintenance



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4. Energy

Mike Märki

4. Energy

a) Do you have any sub metered energy data for the automation system?

- No, unfortunately we don't have any active measuring points yet. We will retrofit them as part of the extension project
- But we once made a measurement. See also above (slide 1h).

Building	Power consumer	Position	Detail position	Consumption kW		Comments
				Base load	in operation	
Storage	Total			6.280	8.647	6 robots / Passarelle
	1 robot	Total		0.850	1.009	
		Control cabinet Load carrier	Total	0.098	0.116	
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		Various		0.015	0.018	Operating consumption extrapol. linearly
		Total		1.180	2.593	
		3 Control cabinet		0.630	2.043	14 Measurements in operation.
		1 ICT-Rack		0.550	0.550	24h in operation

4. Energy

- b) Do you have any sub metered energy data for the OxyReduct systems?
- ➔ No, unfortunately we don't have any active measuring points yet. We will retrofit them as part of the extension project
 - ➔ But we once made a measurement. Then it switched on 3 times a day for approx. 11 minutes. Over 24 hours, this gives a linear average of 0.42 kVA (kW). When operating for these 11 min., the average power is 6.3 kVA (kW). The base load (standby consumption) is 0.28 kVA (kW).
 - ➔ However, the data should be taken with caution.

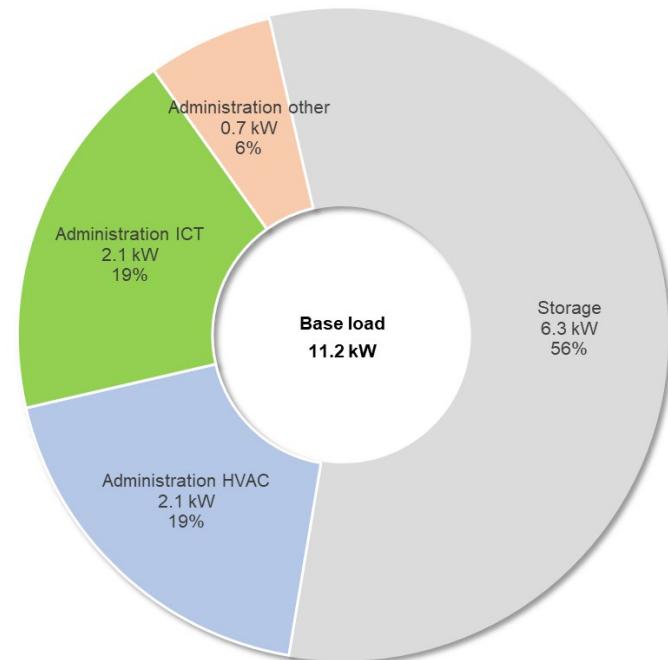
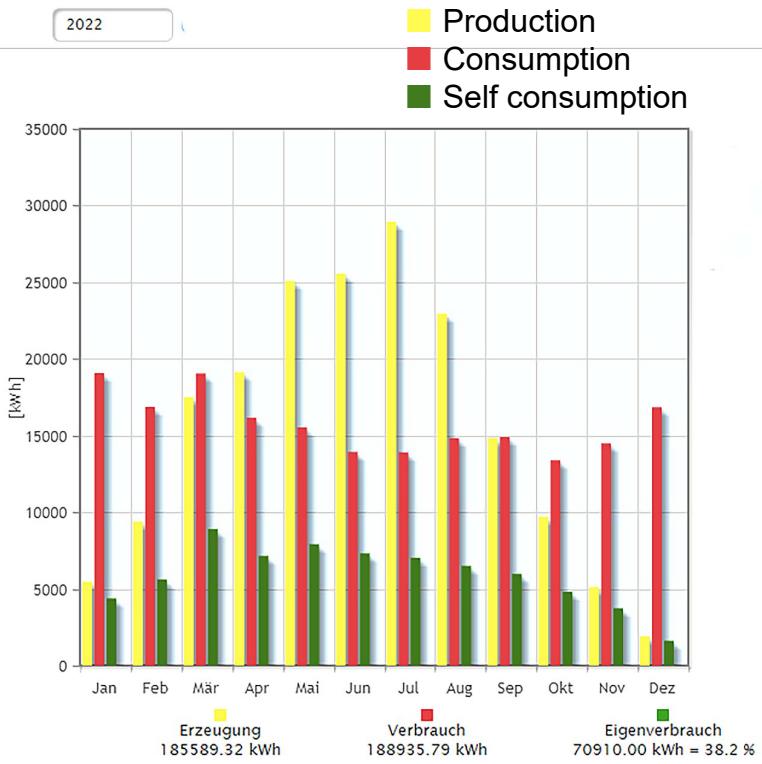
4. Energy

- c) Is it possible to turn off the robots when not in operation, or are they always on or on standby? If so, can you deduct what the energy usage is in standby mode?
 - The robots are not switched off.
 - On the one hand because of the ventilation (see slide 1c), on the other hand there can be problems when switching on again if the WMS is still moving containers. The WMS should therefore be able to cut the power, which isn't implemented.
 - For electricity data, see slide 4a

4. Energy

d) What energy performance is required?

- Overall, we have a base load of approx. 11 kW and an operating load of 20.6 kW.



5. Automation

Mike Märki

5. Automation

a) Do you have any data on the throughput of materials – capacity v actual – e.g. cycles per hour during operation?

- ➔ Maximum capacity calculated on a day with 8h and max. capacity small goods vertical lift: Ground floor 1120 containers, 3rd floor 1912 containers.
- ➔ The rotation of the picking levels provides a cycle capacity of 400 containers/hour.
- ➔ Thus, per stacker crane, ~ 20 cranes are to be stored and ~ 10 removed as nominal load per hour, corresponding to 30 individual cycles per hour.
- ➔ Bottlenecks occurred when the storage was first stocked with containers because of the vertical lift.
- ➔ The vertical lift is also the bottleneck in day-to-day operations due to a lack of order prioritisation.
- ➔ The vertical lift will be replaced or retrofitted as part of the expansion project.
- ➔ A capacity comparison has not yet been made. As a rule, the current 2000 container movements (500 orders + 500 returns) per day are unproblematic.

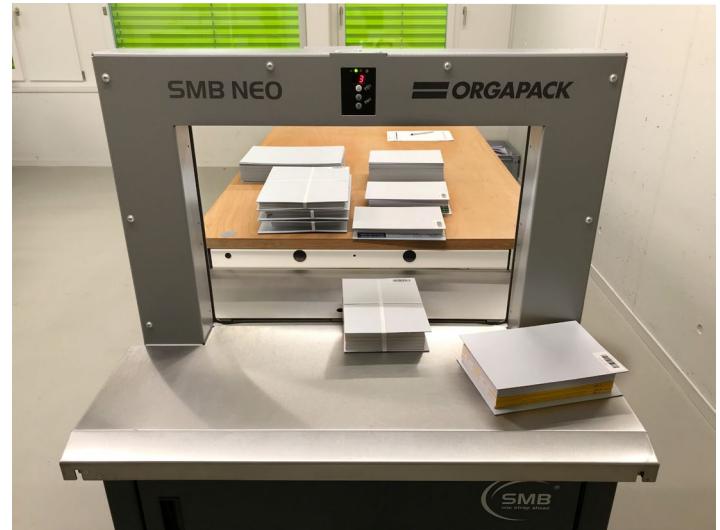
5. Automation

- b) How do you process periodicals? Are individual items ingested when they become available, or do you gather them in a different location to be ingested in bulk?
- ➔ The libraries collect the journals on site and deliver them annually (moving wall).
 - ➔ Usually they are delivered without boxes, but only tied together with a rubber band. We strap them afterwards, which is much cheaper than boxes or book binding and saves space.
 - ➔ Boxes or stand-up collectors are still possible, however.

5. Automation



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5. Automation

- c) Do you have a fast moving lane where containers are stored that have had a request, so they can easily be recalled when the item returned?
 - ➔ No. Only about 10% of the items are returned to storage on the same day.
 - ➔ But the WMS would be capable of storing freshly moved containers in the first alleys.
 - ➔ Prioritisation of orders is available but does not work and is not configurable. This will be retrofitted in the extension project.
 - ➔ Sorting of the containers before picking is missing so that they don't arrive in the same order as ordered. This will be retrofitted in the extension project.

5. Automation

- d) Do you have different zones in your storage area where specific items are stored? We are thinking of a special collections' zone at the core of the building, where conditions are stable.
 - ➔ No. The allocation is weight-optimised. But the WMS is capable of assigning other zones to the storage locations.
 - ➔ We only allocate zones in connection with different storage modules, where we can define different climatic conditions.

6. Building

Mike Märki

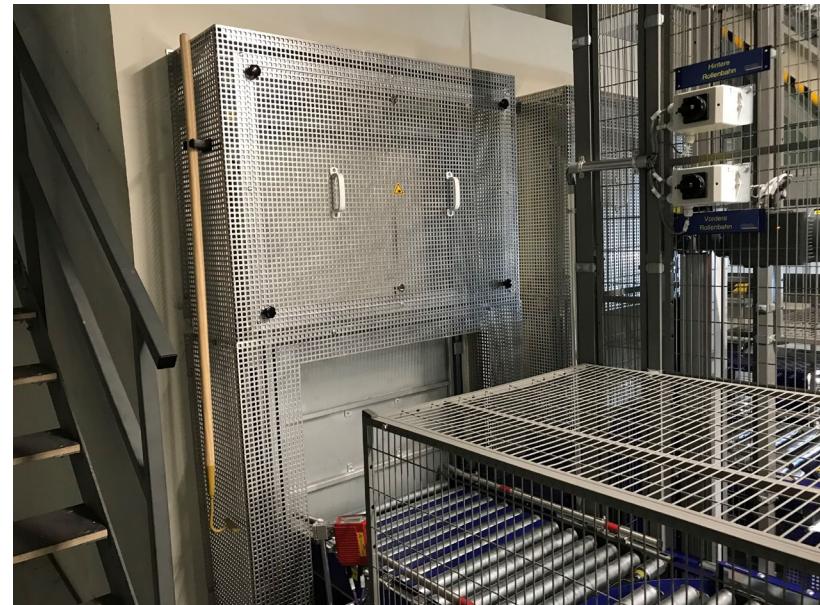
6. Building

- a) Have any issues been observed with airlocks and doorways which move collections through?
- ➔ No, but they reduce the throughput.
 - ➔ Sometimes they also have to be deblocked.
 - ➔ The escape doors from the warehouse are a bit more of a concern because they are a thermal bridge and are not completely tight.

6. Building



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6. Building

- b) Has airtightness been reviewed at any point following completion?
- Yes, a blower door test was carried out in connection with the handover of the building.

6. Building

c) Are there any building issues they are experiencing?

- ➔ We have unventilated rooms.
- ➔ Certain rooms get too hot in summer and cannot yet be air-conditioned.
- ➔ The two buildings are moving and causing cracks in the connecting zones.
- ➔ Gypsum partition walls are unsuitable in the inerted area. The escape route (not inertised) in the roof is thus insufficiently separated from the inertised area.

6. Building

d) Looking back, would you have designed anything differently now you have significant experience of the building in use?

- ➔ We have 47 change requests as part of the extension project.
- ➔ Air conditioning Administration and HRL.
- ➔ Ventilation of unventilated rooms.
- ➔ Larger offices and cafeteria.
- ➔ Integration of the peripheral system into the BMS.
- ➔ Additional visitor access to the high-bay storage.
- ➔ Redesign of secretary's office and visitor zone.
- ➔ Other design of order picking workstations.
- ➔ UPS for building.
- ➔ Consideration of the picking of pallets.

6. Building

e) What is the relationship between the architectural project and intra logistics?
Do you choose the intra logistician before the plans are validated?

- ➔ A logistics planner was already involved in the preliminary project to define the requirements for the architectural tender.
- ➔ During the construction project, the logistics planner ran under the general planner, but with a contract through the client. This was not optimal.
- ➔ In the extension project, the external user representative defines the basic logistics requirements for the specifications. The architect/general planner will then put the logistics planner out to tender.

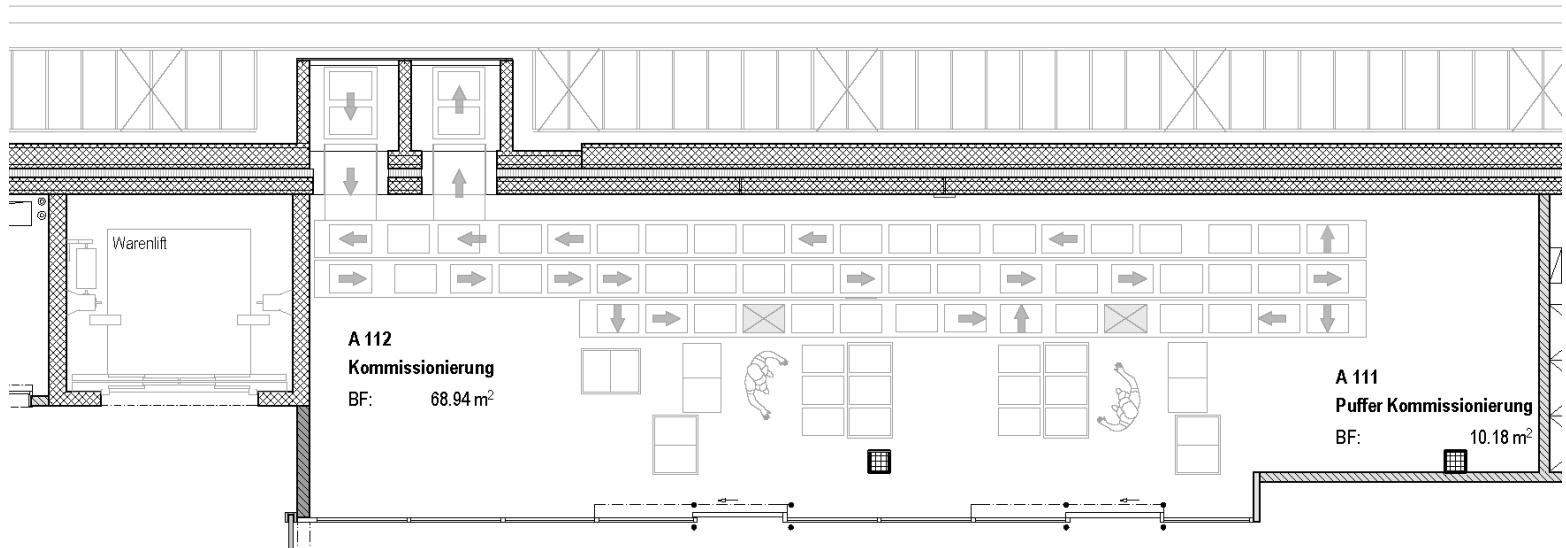
7. Picking stations

Mike Märki

7. Picking stations

a) How many stations? Do you have a plan?

- 2 mirror-image order picking stations per floor and 1 emergency station.
- A total of 6 workplaces on 2 floors, 3rd floor can be extended.



7. Picking stations



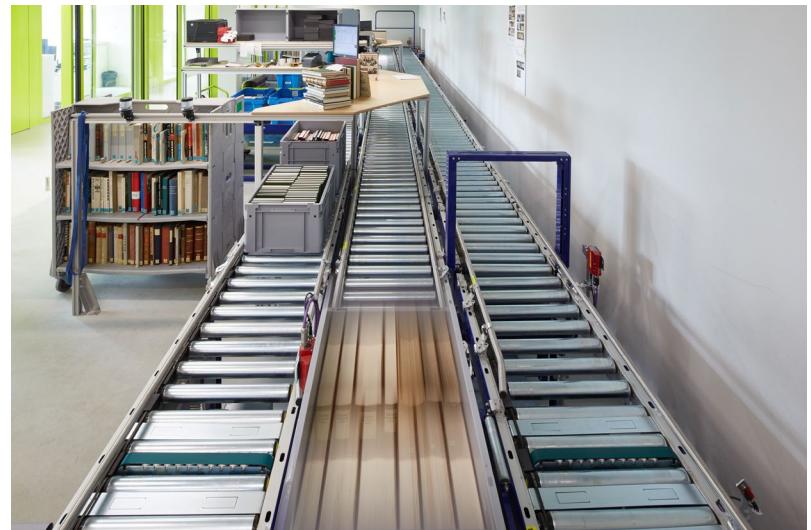
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© VKSS



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7. Picking stations

- b) How many pickings per operator per day?
- ➔ 1000 picks per day and picking station feasible.
 - ➔ We do job rotation, so no one is at the picking station all the time.
 - ➔ One person is responsible for orders and scans for one week, another for returns and scanning support and others for initial storage and optimisation.
 - ➔ For initial storage, approx. 800-1600 copies per picking station are possible.

7. Picking stations

c) Are the stations "specialized": either document input or output ?

- All normal picking stations can be set to either input or output mode.
- In output, specific destinations can be assigned to the picking station.

The screenshot shows a software window titled 'Masterconsole (Masterconsole) - Arbeitsplatz-Betriebsart'. The menu bar includes 'System', 'Ansicht', 'Aktionen', 'Speicherbibliothek', 'Korrekturen', 'Administration', and 'Hilfe'. Below the menu is a toolbar with icons for home, search, file operations, and help. The main area is titled 'Arbeitsplatz-Betriebsart' and contains a table with columns for 'Funktion/Arbeitsplatz' and six checkboxes labeled EA11, EA12, EA21, EA22, and XP01. The rows list various locations and services, each with a checked checkbox under EA11. A vertical sidebar on the left lists categories like 'Einlager', 'Luzern', 'Zürich', etc., with some items highlighted in green.

Funktion/Arbeitsplatz	EA11	EA12	EA21	EA22	XP01
Einlager	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Luzern Kantonsgericht (KGGLU)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Luzern ZHB LSO (LULSO)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Luzern ZHB SEMP (LUZHB)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Luzern ZHB UPG (LUUPG)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
MyBib (DOCDEL)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Postversand (Post)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Postversand an ZB Solothurn (SO)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SLSP-Kurier (SLSP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Abholschalter (VKSSA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Google Books (VKSSG)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Kassation (VKSSK)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Leseraum (VKSSL)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Selbstabholung (VKSSS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VKSS Showprogramm (DEMO)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Conservation

Mike Märki

8. Conservation

- a) Robot/audiovisual documents on magnetic media: do you have any data?
- ➔ No. We will work on this as part of the Photo/AV module and are grateful for input.
 - ➔ We don't see any problems with magnetic sources at the moment.
 - ➔ Manufacturers also offer specially protected logistics systems. If necessary, other containers could also be used for such objects.

8. Conservation

- b) Do you have backup procedures in case of emergency in robotized warehouses? If not, would it be possible to have the name of a contact person?
- ➔ The question is too unspecific to give a clear answer. It depends on what is understood by emergency.
 - ➔ In the expansion project we are planning to add redundant horizontal lifts, to be able to run the system bidirectionally and to enable emergency picking in the alley.
 - ➔ WMS, database, domain controller and network are already redundant.

9. Bins & containers

Mike Märki

9. Bins & containers

a) How many different sizes? impact on robotics? costs? price of a module?

- ➔ The plant specifies the surface area and maximum height.
- ➔ We can run containers with a base area of 40x60 cm.
- ➔ This should correspond to an optimal height distribution of the stock. The more heights, the more expensive the procurement and the more difficult the handling.
- ➔ We have heights of 27/37 cm, of which 2 cm are for the reinforced floor.
- ➔ For our items, 28 cm would be better from our experience.
- ➔ With OPSS we will find out the optimal heights for container module 2 and probably introduce 2 more heights.
- ➔ In the photo/AV module, we add three container-types with internal heights 115/165/215 mm.
- ➔ The price of the robot and the container is mainly influenced by the maximum weight of the container.

9. Bins & containers

b) How can container storage be optimised (research project in Switzerland, OPSS)?

- ➔ If possible, items are delivered roughly sorted for the first ingestion.
- ➔ At the picking station, they are stored with a trained eye according to different placement patterns.
- ➔ For OPSS see other presentation.

9. Bins & containers



10. Communication

Mike Märki

10. Communication

- a) What about a breakdown in communication (robot or computer failure, etc.)? has this happened in libraries already equipped? what is the fallback plan (apart from rapid maintenance intervention)?
- ➔ In such cases, delivery is usually no longer possible, and the libraries are informed.
 - ➔ The trained staff can resolve most disruptions themselves.
 - ➔ Emergency picking in the alley is planned.
 - ➔ Manual access to the storage would also be possible, but not recommended.

10. Communication

- b) Do you have a procedure for intervening in the store in the event of a breakdown?
- ➔ There is no procedure because the breakdowns are different.
 - ➔ The trained staff can fix most of the problems themselves and have most of the spare parts on site.
 - ➔ Otherwise, the manufacturer can provide telephone support, access the systems remotely or provide technicians who can be on site within half a working day.

11. Questions of CSLS

Mike Märki

11. Questions of CSLS

- a) Do you have experiences from your projects that you can share with us?
- b) Are there any experiences/guidelines for the storage of photo/AV materials?
- c) How do you operate IPM, especially in the automated storages?

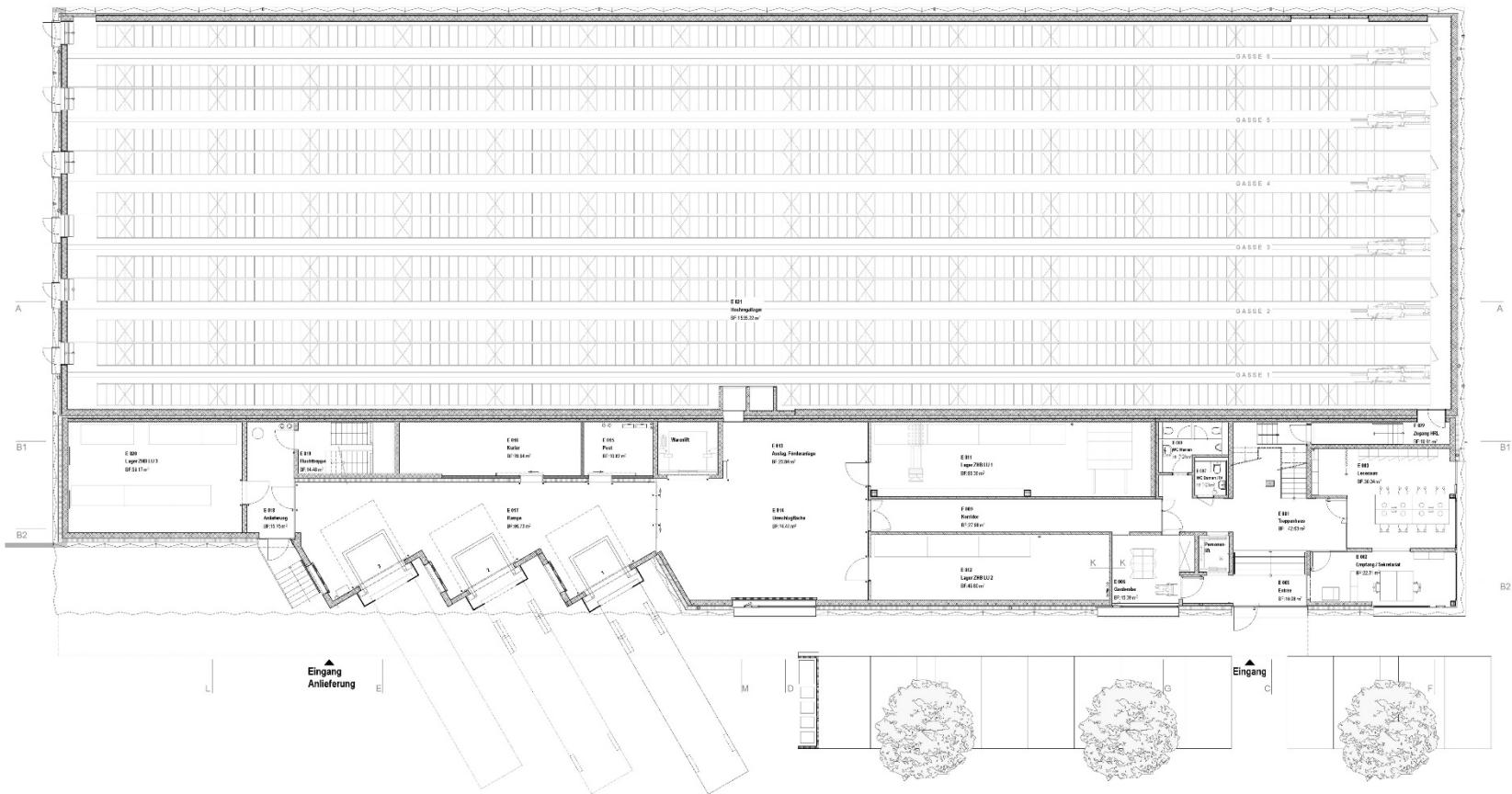
12. Appendix

Mike Märki

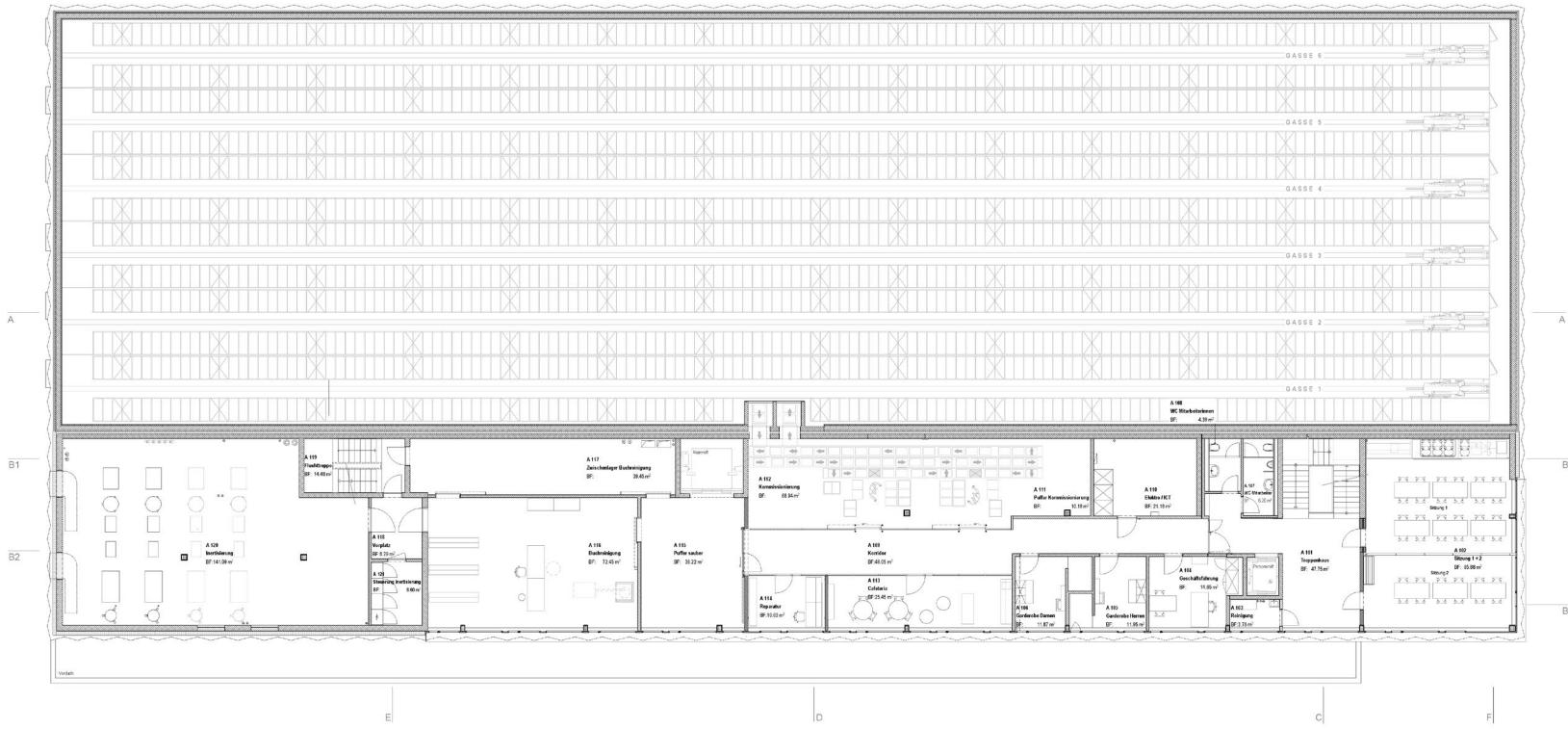


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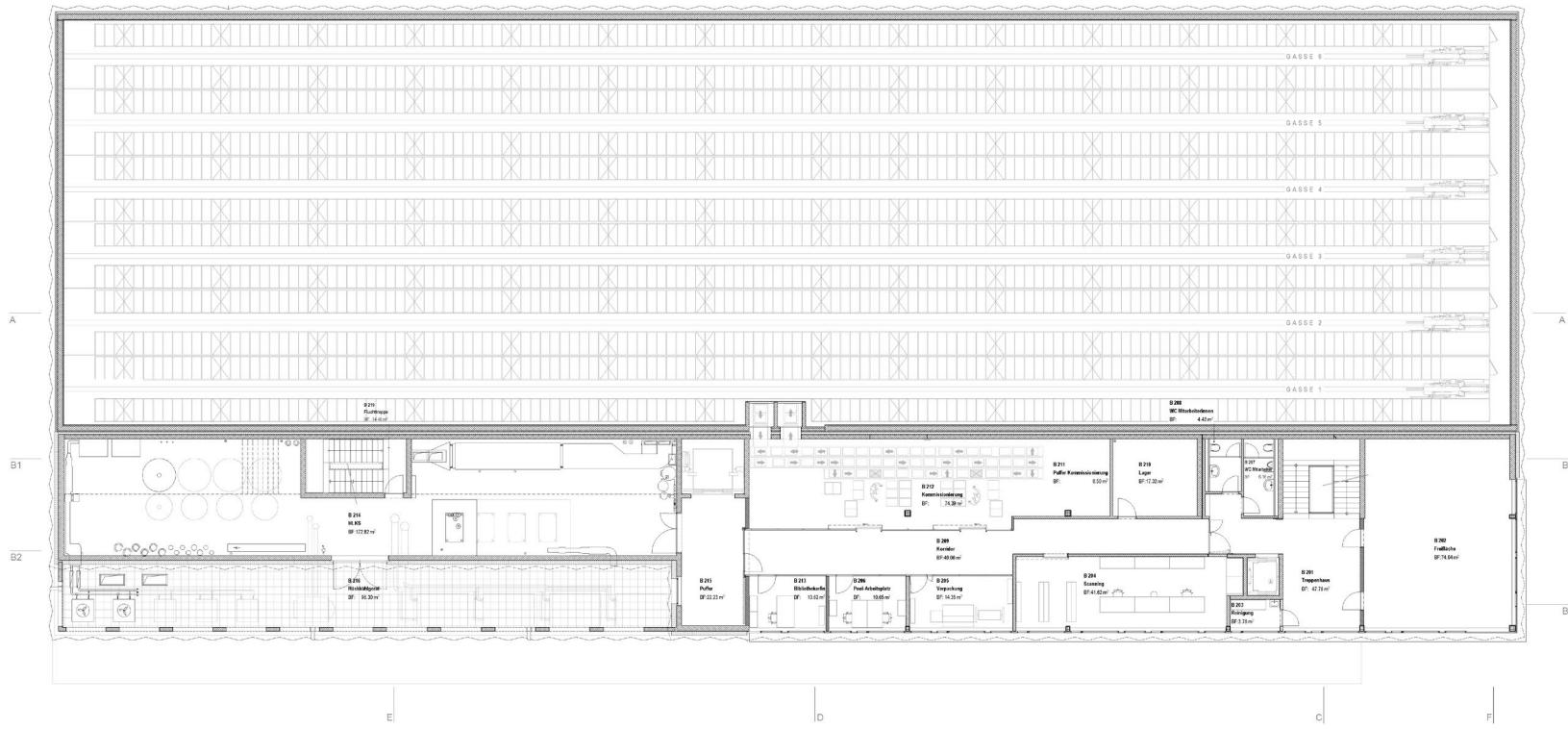
Ground floor



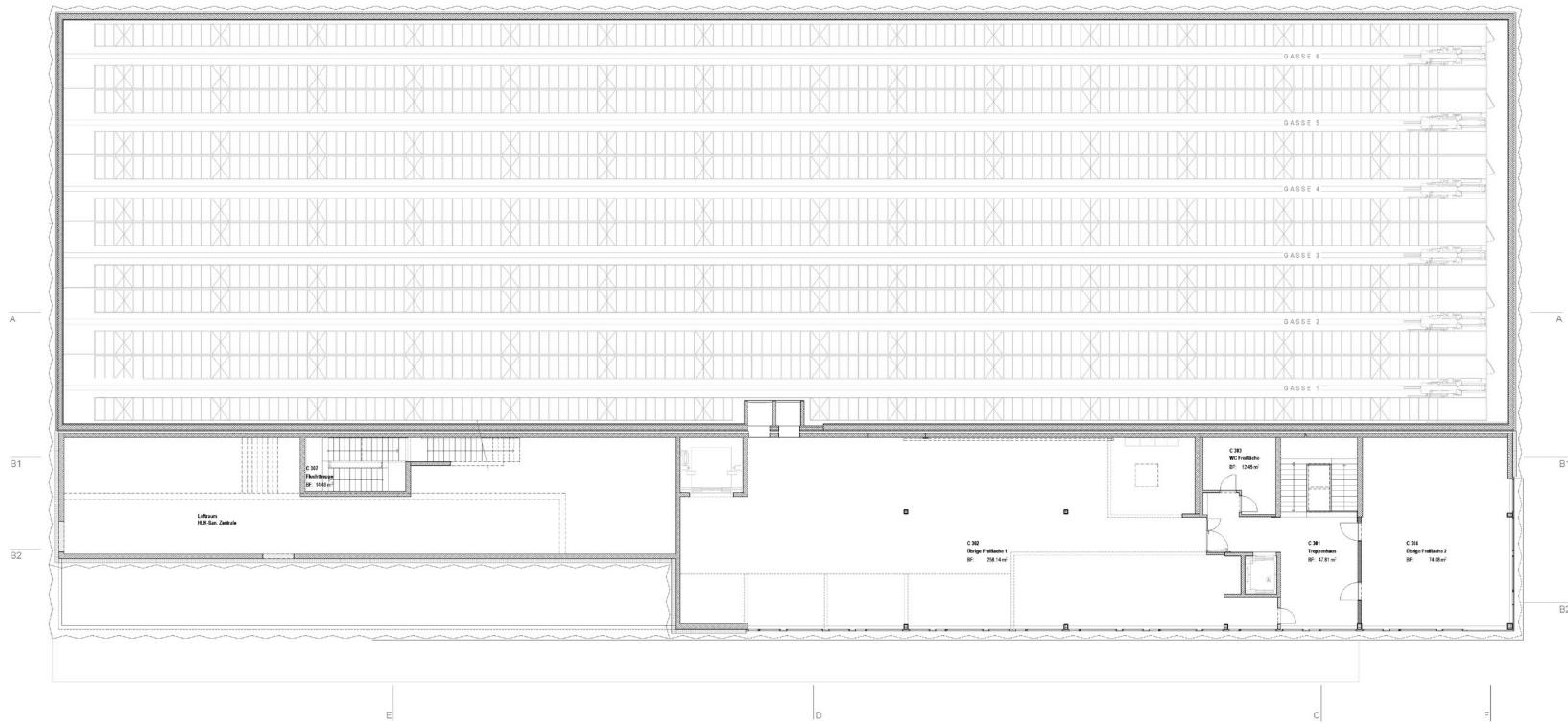
1st floor



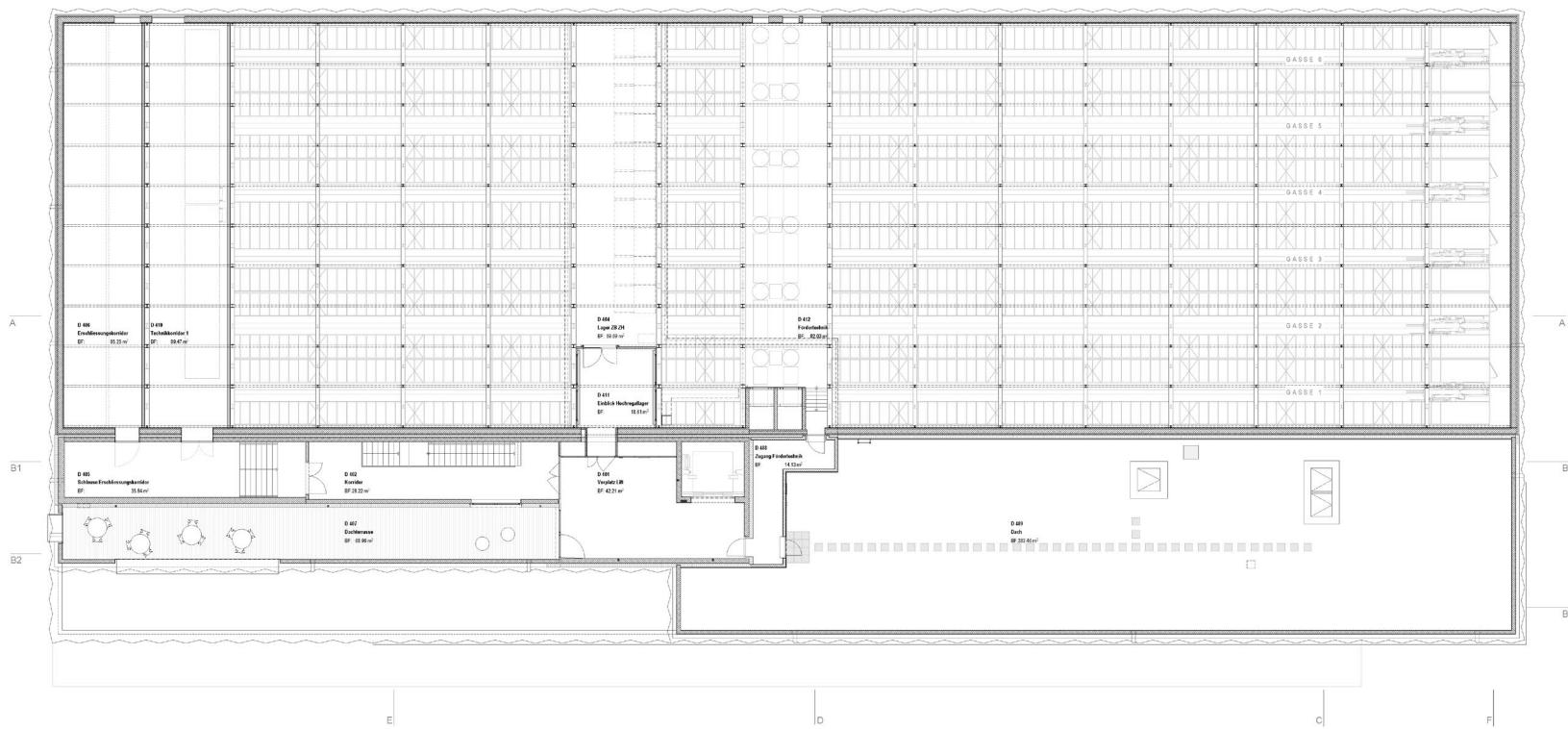
2nd floor



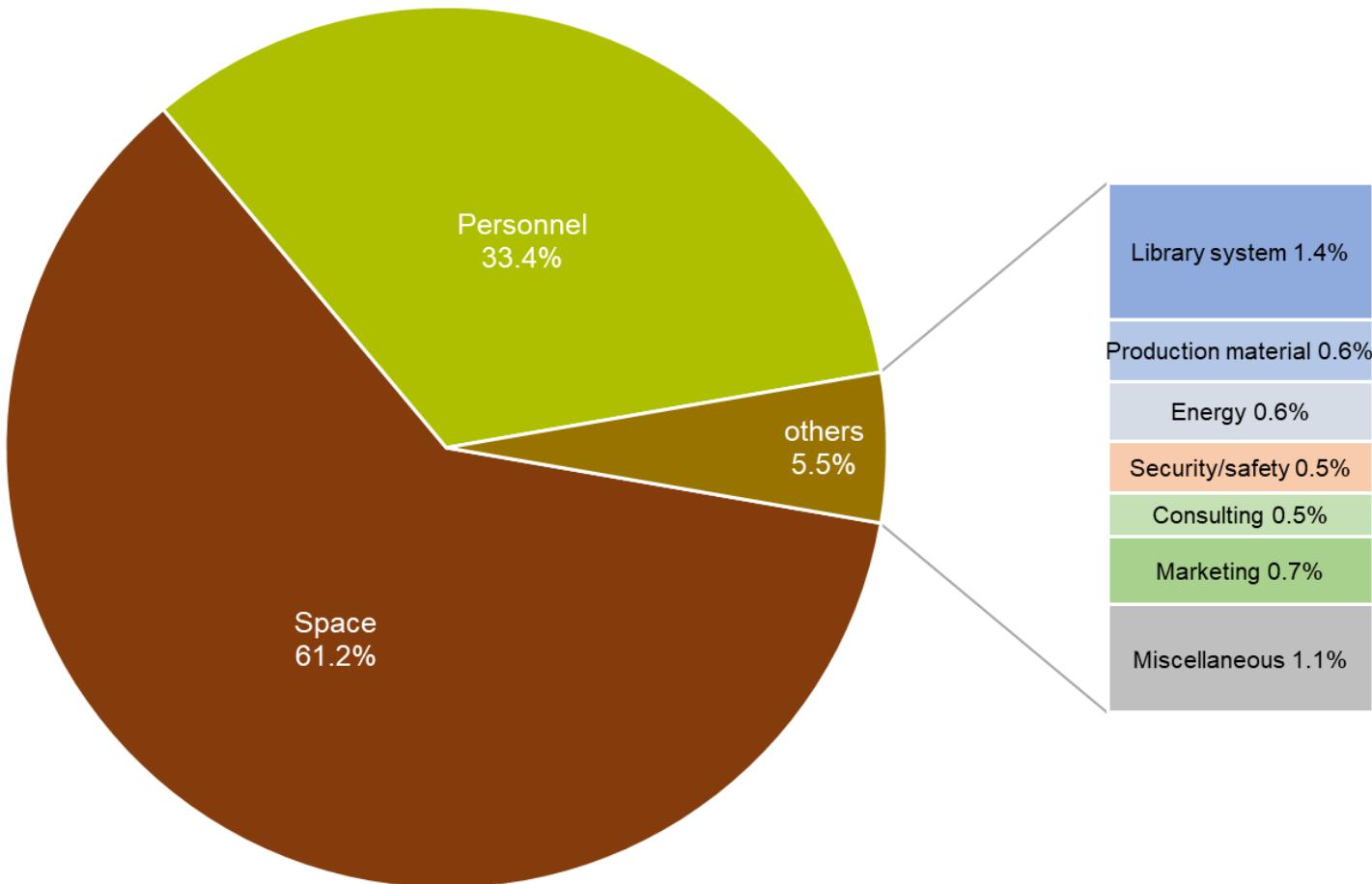
3rd floor



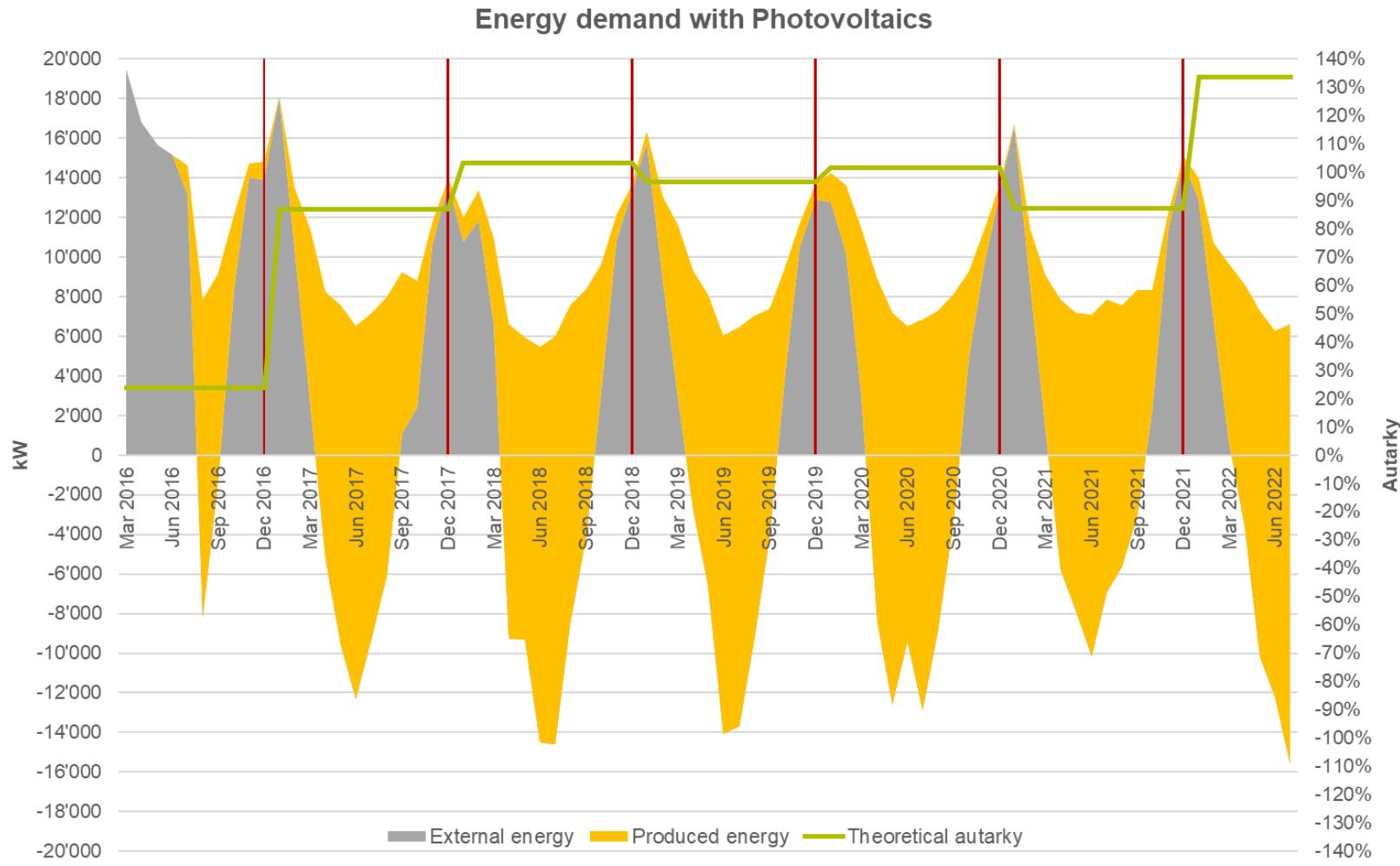
4th floor



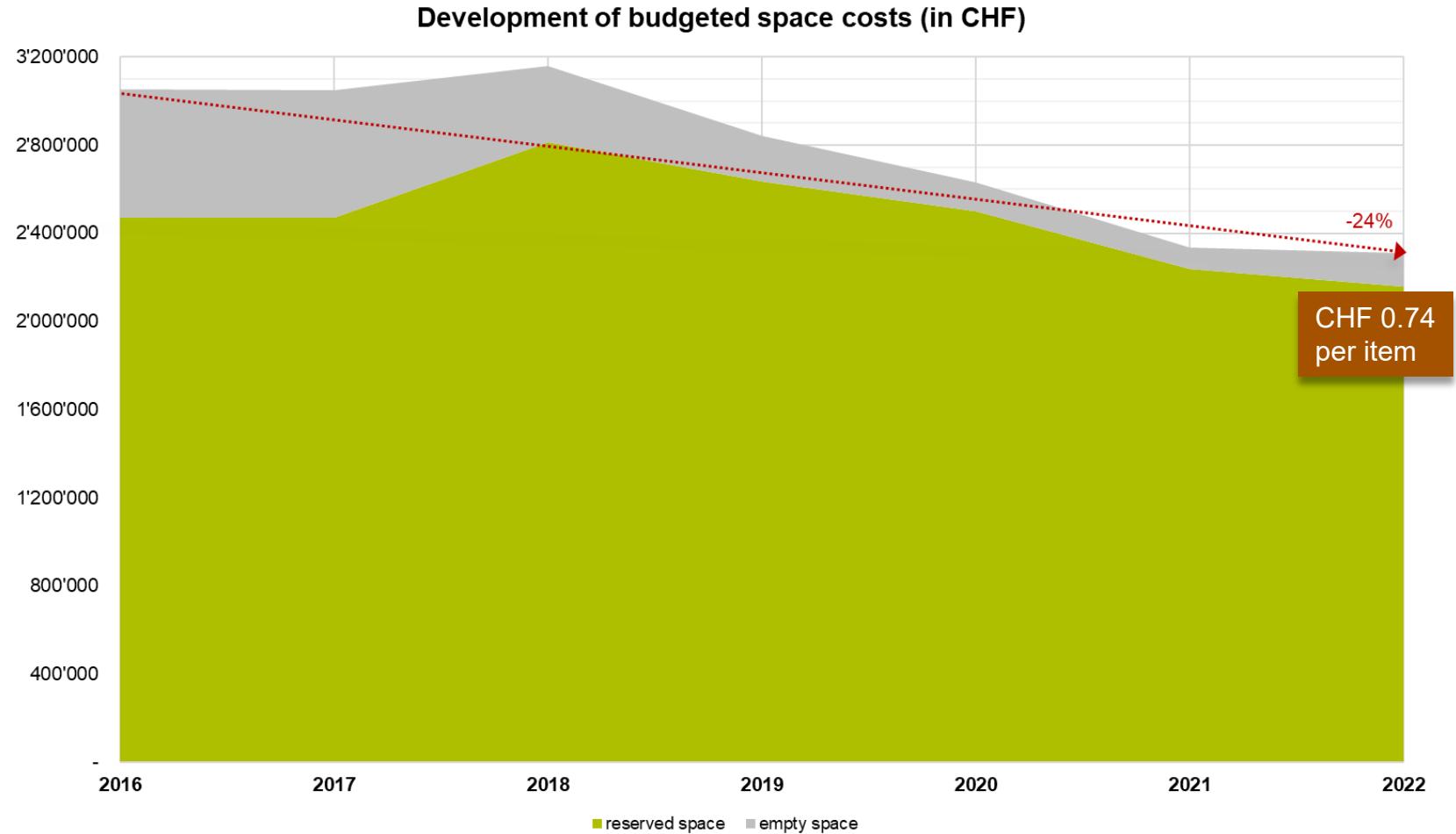
Our cost structure (Budget)



Photovoltaics



Development of space costs



Cost reduction through optimisation of maintenance costs and interest effects.

Challenges ...

- High fixed costs due to complex technology and upfront investments
- Decreasing process volume
- Low empty space leads to extension module with jump fixed cost
- Difficulties to fill vacancies

Bottlenecks in our logistics



6 Storage and retrieval cranes

↗ Error =
83% Delivery capacity

1 Conveyor System

↗ Error =
0% Delivery capacity

1 Outfeed lift
1 Infeed lift

↗ Error =
0% Delivery capacity
↗ Performance

4 picking stations on 2 floors

↗ Error =
100% Delivery capacity