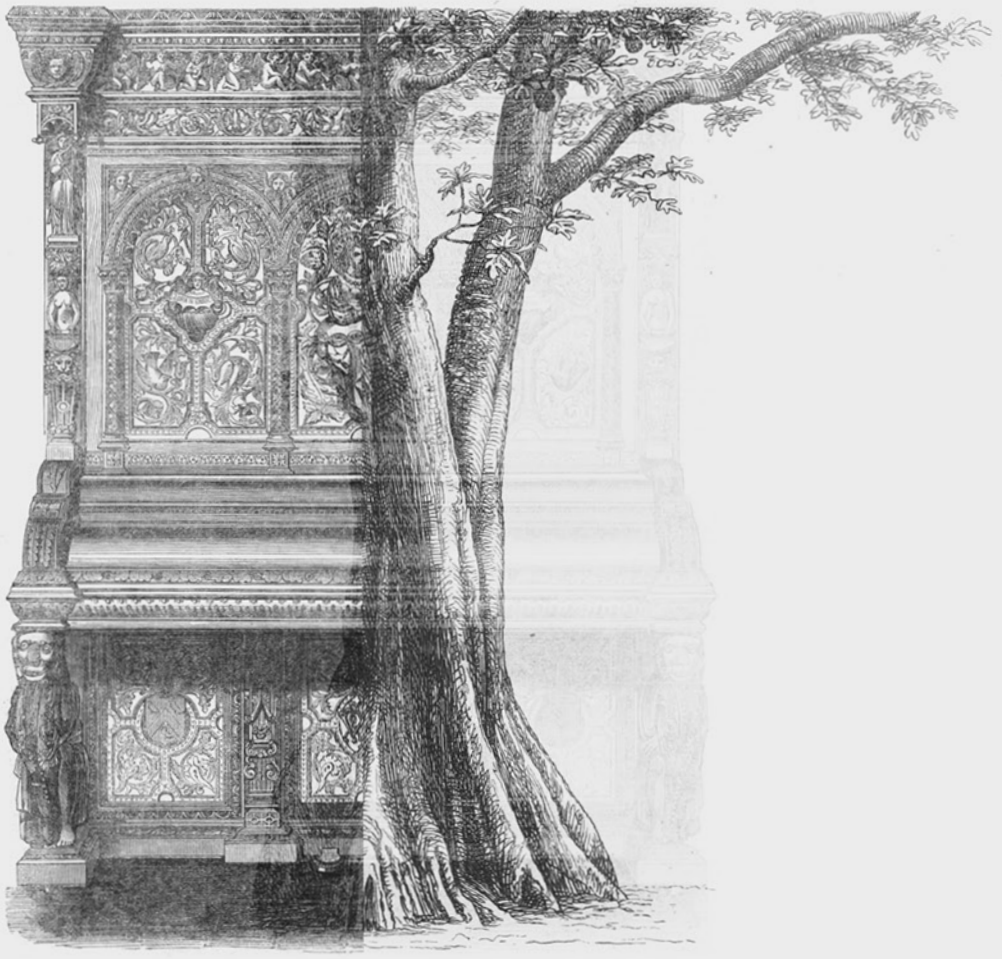


Reform

James Burkhalter

Design Studio 4.2

Grade: 73 (1st)

Acknowledgements

My Tutors

Nigel Bedford
Architecture

Aoife Wiberg
Environmental

Tim Mander
Structures

Tim Osborn
Landscaping

John Griffiths
Tectonics

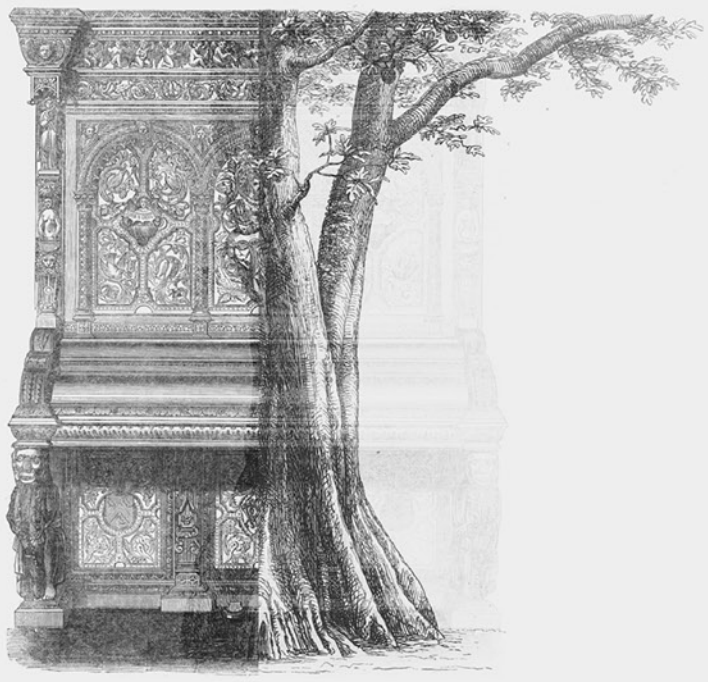
Act 1

I met a traveller from an antique land

An Introduction to Craft, Client and King's Cross

Foreword

To *Reform*



Interpretations of Craft are burdened by definition, process and personal perspectives. It is a 'word to start an argument with' (p.20), as recognised by David Pye (1968) in *The Nature and Art of Workmanship*. Regardless, Pye's contemporaries and academic "apprentices"[1] have perpetuated this debate, insecure to the undefinable act of (their own) making.

Craft mutates under observation; ***intangible-tangible***, ***process-product***, ***man-machine***; there is a duality to it. To 'distinguish' between these states, such as in the case of man and machine, is 'meaningless' (Pye, 1968, p.24) — it purely isolates the state of a Craft, subjecting it to: prejudice, historicism and idealisation.

In summary Craft is practiced and tested (Adamson, 2018) through the ***repetitive*** act (***craftsmanship***) of making and ***remaking*** (i.e. to ***re-form***), resulting in generations of both the ***object*** (***Craft***) and the ***maker*** (***craftsman*** or ***machine***). Process ***embodied*** in ***material*** (form or surface) and ***memory*** (virtual or of the mind).

These remnants of making are ubiquitous to civilisations (Risatti, 2007). A primitive act of survival, the act is 'not localised…[it] transcends [societal] boundaries' (ibid., p.59). Yet, there is an ***intangible cultural heritage*** (UNESCO, 2003) of a place — a ***genius loci*** (Adamson, 2018) — a tacit knowledge of making, inherited through proximity and time.

James Burkhalter

Key Terms:
intangible-tangible, *process-product*, *man-machine*, *repetitive*, *craftsmanship*, *remaking*, *re-form*, *object*, *Craft*, *maker*, *craftsman*, *machine*, *embodied*, *material*, *memory*, *intangible cultural heritage*, *genius loci*

[1]Pye (1968), Risatti (2007), Langlands (2017), Adamson (2018)

Decline

Reason and Rationale

Figure 1.1

The reasons for a craft's decline are vast and greatly depend on the discipline. To summarise, the following information has been derived from the *HCA's* and other researcher's work (Association, 2021a, unless otherwise indicated) and put into three categories:

Inheritance

- Craft and business education (qualification standards, course availability, cost and quality at all levels of academia)
- Time — ageing professionals and mastery of a craft
- 'Loss of traditional methods of skills transmission; apprenticeships and intra-family'
- Repair and conservation over making
- Perceived as simple peoples producing arbitrary goods (Adamson, 2018)

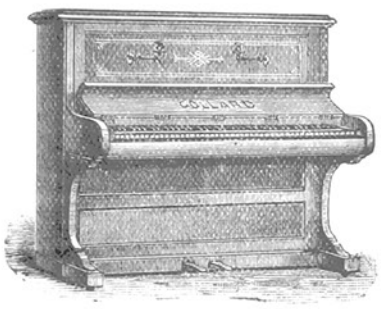
Trade and Transport

- Material shortages and increasing costs (of product and material)
- Workshop and equipment availability (in cost and production)
- Recruitment of apprentices (career paths, skills and earning potential)
- Ephemerality and niche of a craft (demand and awareness)
- Traditional trade is unsustainable (demand) (Adamson, 2018)
- Divisive in cost — an upper-class only experience (Langlands, 2017)

Technology

- Congested digital markets (international competitions, lack of skilled work)
- Mechanisation of Techniques (in process and materials)
- Incompatible Craft-Technology e.g. in Architectural details (Pye, 1968)
- Mass manufacturing of products (competitive pricing, 'customer impatience')
- 'Lack of [recorded] data' on the craft
- Inexperience with technology and luditism (Adamson, 2018)

Initially published in 2017, *The Red List of Endangered Crafts*, was created by the *Heritage Crafts Association* (*HCA*); the first *UNESCO*-accredited *NGO* for *intangible cultural heritage* (Association, 2021a). Surveying the status of traditional crafts across the UK, the HCA monitors the viability of trade practices and promotes their sustainable preservation (Association, 2021b; see Carpenter, 2021).



Instruments

Pianos (A Camden Craft)

CRITICALLY ENDANGERED

11 (+1)

Woodwork

Basketwork

CRITICALLY ENDANGERED

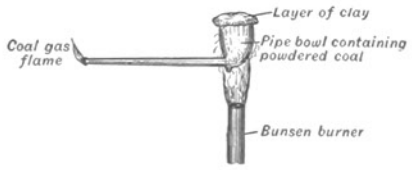
1 (+2)

Tools and Equipment

Scissors

CRITICALLY ENDANGERED

10 (+5)



Ceramics

Clay Pipes

CRITICALLY ENDANGERED

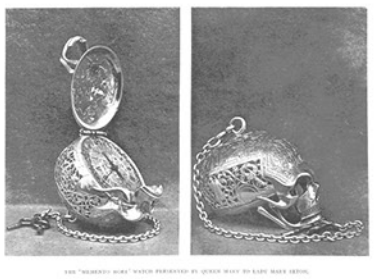
3 (+1)

Sports Equipment

Cricket Bats

CRITICALLY ENDANGERED

20



Timepieces

Watchmaking

ENDANGERED

20 (+10)

Hunting

Arrow Smithing

ENDANGERED

5

Fig. 21. *Mediæval Book-Binding.*
(From Jost Amman.)

Papercraft

Fore Edge Painting

CRITICALLY ENDANGERED

1

Metallurgy

Bell Founding

CRITICALLY ENDANGERED

24 (+5)

Instruments

Woodwind

ENDANGERED

50 (+5)

Ewen Macpherson of Cluny Macpherson
Chief of Clan Chattan C.B.

Textiles

Kilt Making

ENDANGERED

20(+25)

Metallurgy

Gold Beating

EXTING

0

Construction

Bricks

ENDANGERED

16 (+50)

Papercraft

Fore Edge Painting

CRITICALLY ENDANGERED

1

Sports Equipment

Cricket Balls

EXTINCT

0

Figure 1.2, A collection of British Library etchings

The Red List of Endangered Crafts

Many traditional British crafts are endangered or at risk of becoming extinct.
Above are some examples, detailing the remaining **Practicing Craftsman** (and **Apprentices**)

I met a traveller from an antique land,
Who said—"Two vast and trunkless legs of stone
Stand in the desert. . . . Near them, on the sand,
Half sunk a shattered visage lies, whose frown,
And wrinkled lip, and sneer of cold command,
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them, and the heart that fed;
And on the pedestal, these words appear:
My name is Ozymandias, King of Kings;
Look on my Works, ye Mighty, and despair!
Nothing beside remains. Round the decay
Of that colossal Wreck, boundless and bare
The lone and level sands stretch far away."

Percy Shelley, *Ozymandias (Shelley, 1977)*

The Brief

Client, Cost and Stakeholder Summary

The following proposal has been put forward:

A *Research and Development Centre for the Preservation of Traditional Crafts* (*RDC-PTC*) as part of a course-led extension to the internationally renowned arts and crafts college of *Central St Martins* (*CSM*), in collaboration between the *University of the Arts London* (*UAL*) and the *Crafts Council* (*CC*) as advisors.

As part of the project, the architectural intent is expected to reflect the syllabus and even to ***Reform*** it; to be read as a palimpsest of craft and education, tightly interwoven from and into the genus loci of the site, as if it were tapestry. Examples include the site's Grade II listed Waterpoint and Lock Cottage and even CSM's own Granary Square.

Client

ual: central saint martins

Figure 1.3

Previously the S*t Martin's School of Art and the Central School of Art and Crafts*, CSM provides a range of design and research-based courses.

A project of the *King's Cross Central* (*KXC*) development, the college moved into a retrofitted granary in 2011; which opened out onto *Granary Square* and neighbored the *Coal Drops Yard* (retail by *Heatherwick*) and *Gasholders* (flats).

Committed to resolving local issues through 'creative collaboration', their CSM Public scheme actively engages with the KX community while 'working with a variety of academic, corporate, non-profit, citizen-led and government organisations' such as the *Crafts Council* (Till, 2022).

Advisors

Figure 1.4

A national charity responsible for the: organisation, promotion and development of the UK's Crafts sector; and hosts of *Craft UK*, a free membership network including other charities such as the HCA, practicing artisans and many Universities — now including the UAL (see Council, 2022).

Funding

Supported using public funding by ARTS COUNCIL ENGLAND

LOTTERY FUNDED

Figure 1.5

Funding from the *Arts Council England* is provided to the *University of the Arts London* as a result of their new partnership with the *Crafts Council*.

Stakeholder Requirements

There are a wide range of associated stakeholders as a result of the *Craft Council's* national and international network.

The following list is a summary of the most prominent stakeholders and Camden-specific.

- ***Canal and River Trust***
  Body for the protection of British waterways
- ***Camden Council***
  Borough representative, agreed to provide a connecting bridge to CDY
- ***St Pancras Cruising Club***
  Former owners of the site and residents of the *St Pancras Basin* and *Waterpoint*. Must be consulted and provided for within the programme e.g. access
- ***London Wildlife Trust***
  Neighbouring site and will be providing landscaping for their new centre. Need to consider the biodiversity and boundaries of this space to the industrial centre
- ***Heritage Crafts Association***
  Creators of the endangered crafts list and a collection of active practitioners. Can deliver information regarding possible tutors and sourcing of traditional craft techniques
- ***Network Rail***
  Operating within canal tunnel boundaries (see p. 12)

Budgeting

Construction (2530 m²)	**£6,971,150**
Medium: £2755/sqm	
(Based off Ruthin Craft Centre)	
Landscaping (1850 m²)	**£185,000**
£100 /sqm	
Fees (rel. to constructio costs)	**£1,254,627**
18%	

The Course

Central St Martin and its Lecturers

Retrofitted by *Stanton Williams* in 2011, the CSM building was formerly used as granary storage. Previously it faced out onto an open canal basin that transported materials to the store by barge, which has since been built over to create *Granary Square*, a privately-owned public space (POPs) managed by *Argent*.

Central St Martins and Granary Square, Image by Author

Workshop	Area (sqm)
Textiles	600
Printing	650
Digital Art	650
Weaving	700
Knitting	800
Modelmaking	850
Jewellery/Plastic	850
Metal and Timber	880
Ceramics	900

Studio	Area (sqm)
Project Specific	3400
Graphic Design	1300
Fashion	1100
Theatre	1000
Performance	900
Art	880
Film	580
Product Design	580
Flexible	540
Photography	250

Education	Area (sqm)
Lecture Hall	640

Proposal	Area (sqm)
Research buildings, specialist craft facilities, performance spaces and **Reform** *of local industries.*	2530

Existing Typology vs. **New Proposal**

Figure 1.6, Anthony Quinn

Anthony Quinn — **Department Head | Head of BA (Hons) Ceramic Design**

"Project co-ordinator (2010-13) on Firing Up, the Crafts Council's national programme to re-introduce ceramics into the School Curriculum [and the Erasmus+ project CRAFT: Activating Pedagogy for Ceramic Education Futures (IOM3, 2021)], my work for the Crafts Council was [to] build a national network that encouraged the transferring of craft skills from practicing artists to teachers and in turn to their pupils".

Figure 1.7, Carole Collet

Carole Collet — **Regenerative Design Course Founder and Leader**

"Working with the Crafts Council on the Biosalon, Professor Carole Collet described their investigations into 'bio-mimicry/fabrication', 'future design' and 'disruptive (living) technologies' (Council, 2015, pp.2,7). In coordination with other designers and specialists to create a 'new toolkit for sustainable design and manufacture'" (ibid., p.7).

Despite a strong Craft economy (£3.4 billion), Craft education is in decline (46% decrease in Higher Education) and so the preservation of techniques, quality and industrial loci is at risk (Council, 2014). This brief provides a unique opportunity to *Reform* the anachronistic and often 'circumscribed' nature of 'traditional craft education' (Pye, 1968, p.131) through a 'new school model' (Council, 2014) — how will Architecture respond?

Headed by Anthony Quinn and led by professors from the University's currently online-only *MA Regenerative Design* course; the *Research and Development Centre for the Preservation of Traditional Crafts* should provide a platform to explore the genus loci of the *London Borough of Camden* through a new in-person syllabus centred around the history of piano making in the borough.

The Course

From Syllabus to Space

Developed from the client's *MA Regenerative Design* course (Martins, 2022), the *Research and Development Centre for the Preservation of Traditional Crafts* (*RDC-PTC*) comprises of an extension to the *Central St Martins* school focusing on a localised, highly collaborative and multi-disciplinary programme.

At the start of the course, each student is placed into a group of eight that is assigned to one of four permanent tutor that will advise them across the two year course.

Initial Occupancy **shared between years*

User	Year 1	Year 2
Tutors	8*	
Visting Tutors	16	16
Students	32	32

General Public	> 20,000 per day
SPCC Residents	120 (60 moorings, 2 people per boat)

Year 1

Unit 1 (6 months)
Place-based Action Research

Field research of the current state of the chosen Camden craft and the process, parts and techniques required to make it. In parallel, students will be undertaking four modules, each from these tutors specialised in their respective crafts of: woodwork, metallurgy, ceramics/polymers and textiles. These disciplines are combined into a final product prototype chosen by the student.

Unit 2 (2 + 4 months)
Permaculture Principles

A. Learning about the commerce of craft, students are expected to learn on how to advertise and sell their product, with the expectation that their work is exhibited within their tutor's retail gallery spaces at the end of a 2-month period.

B. Each group will then start preparing for the second year of the course (Units 3 and 4) by developing what they have learnt in Unit 1 by: modelling functioning parts of the piano at 1:1 scale, assigning group members to these parts, assessing the time required, and the quality control processes. Collaboration and learning with second year students and visiting specialists are expected and forms part of this transition to second year.

Year 2

Unit 3 (9 months)
Crafting the Piano

An intensive module that sees each group create a functioning 1:1 piano, following what they have studied and prepared in year 1 (Units 1 and 2). They will continue with their previous tutors as hands-on guides but will be aided by visiting specialists and first year students at key points, such as: stringing, making the action and tuning. Each drawing, manufacturing stage and constructed element will be digitally recorded (e.g. photogrammetry, diaries and photographs) so that in preparation for Unit 4, a digital twin is formed.

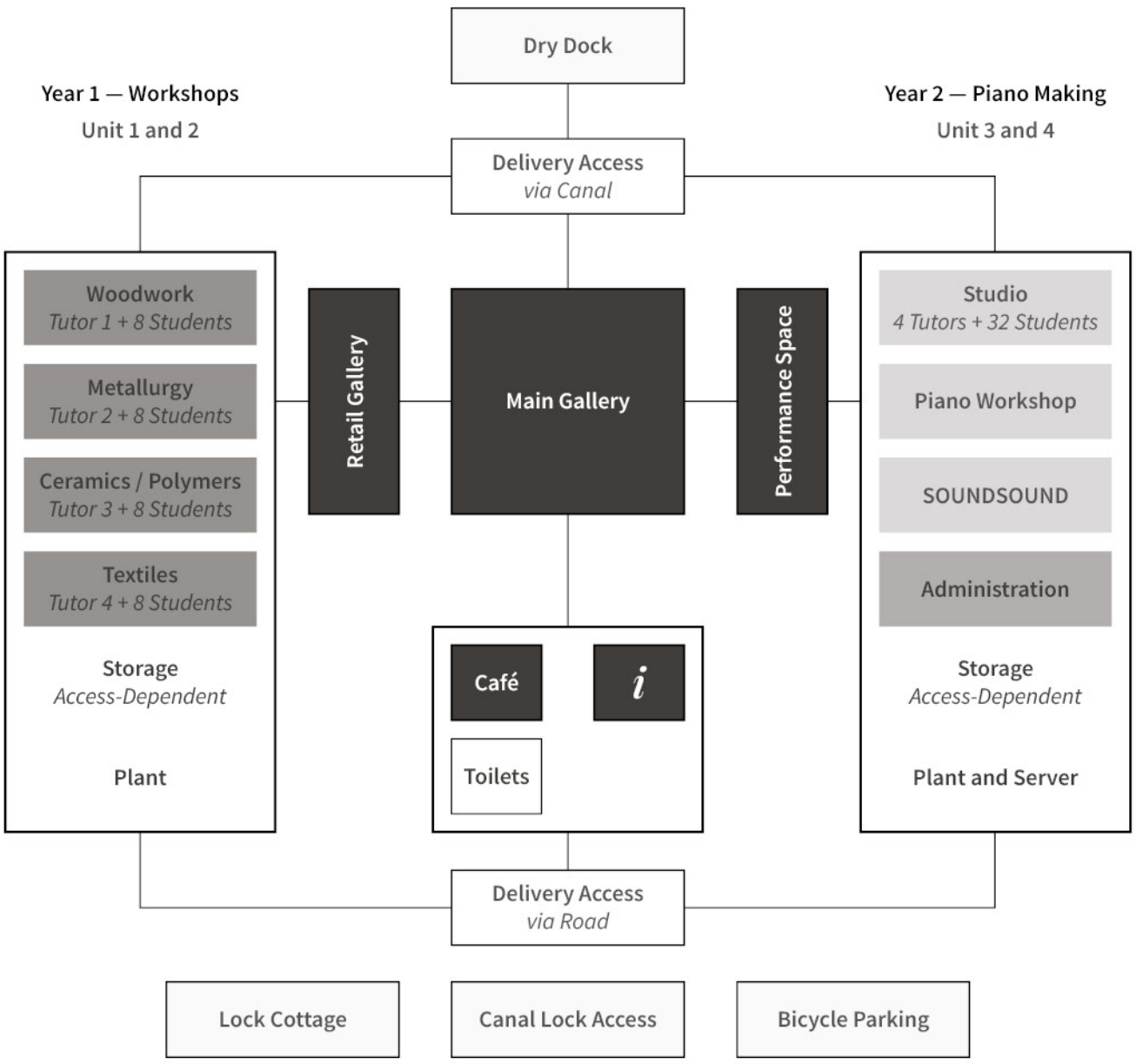
Unit 4 (3 months)
***Reform* and Regenerative Futures**

The archive preserves the piano making process, the hand of the craftsman is logged dimensionally, their memory captured. From the pressure of a pen stroke or grain and of chosen wood to the prose of the maker's logs, the embodiment of craft extends its life. At the end of the course, students will take this digital copy and create an evolved form, that continues to generate variations of functionable models that can be played within a virtual environment. These will be celebrated alongside the other piano at an end of course show. Real and virtual mirrored against each other.

The R&D Program

A Flexible Campus

Piano making is the foci of the centre as it's the most resource-intensive, space-specific and space-intensive practice, and so the building programme should reflect this. However, there will be alternative modules and course alterations over the building's design life — which aims to rival the site's neighbours through the act of *Reform*. Overall, lending the design to flexible units within a typical campus-course arrangement.



The *RDC-PTC* Campus

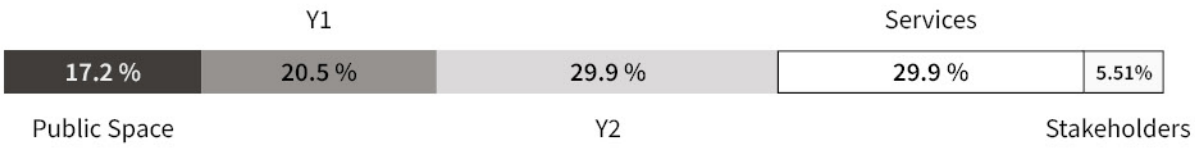
Category	**Area sqm** (A1–A5 tkgCO2e)
Public Space	**437.5** (131.25)
Information Point	12.5
Small Café and Kitchen	105
Main Gallery	200
Retail Gallery	90 (+250 ext.)
Performance Space	30
Y1/ Tutor Workshops	**520** (182)
Timber*	130
Metallurgy*	130
Ceramics and Polymers*	130
Textiles*	130
Y2/ Piano Making	**760** (228)
Studio	320
Piano Workshops	320
Tuning Rooms	120

Category	**Area sqm** (A1–A5 tkgCO2e)
Services	**682** (204.6)
Circulation	~250
Toilets	24
Plant	>150
Digital Archive (Server)	7.5
Delivery Access (via Canal)	200
Delivery Access (via Road)	50
Administration	
Offices	(see TW)
Stakeholder Requirements	**140** (TBC)
Lock Cottage Retrofit	~100
Canal Lock Access	TBC
Biclycle Parking	40
Canal Bridge	TBC

* Includes Makers Yard and Storage

Total (not incl. stakeholders)	**2400** (746)
A1–A5 Total (kgCO2e/m²)	**310**
B1–C4 Total (kgCO2e/m²)	**~200**

Typology and Areas



Typology Proportions

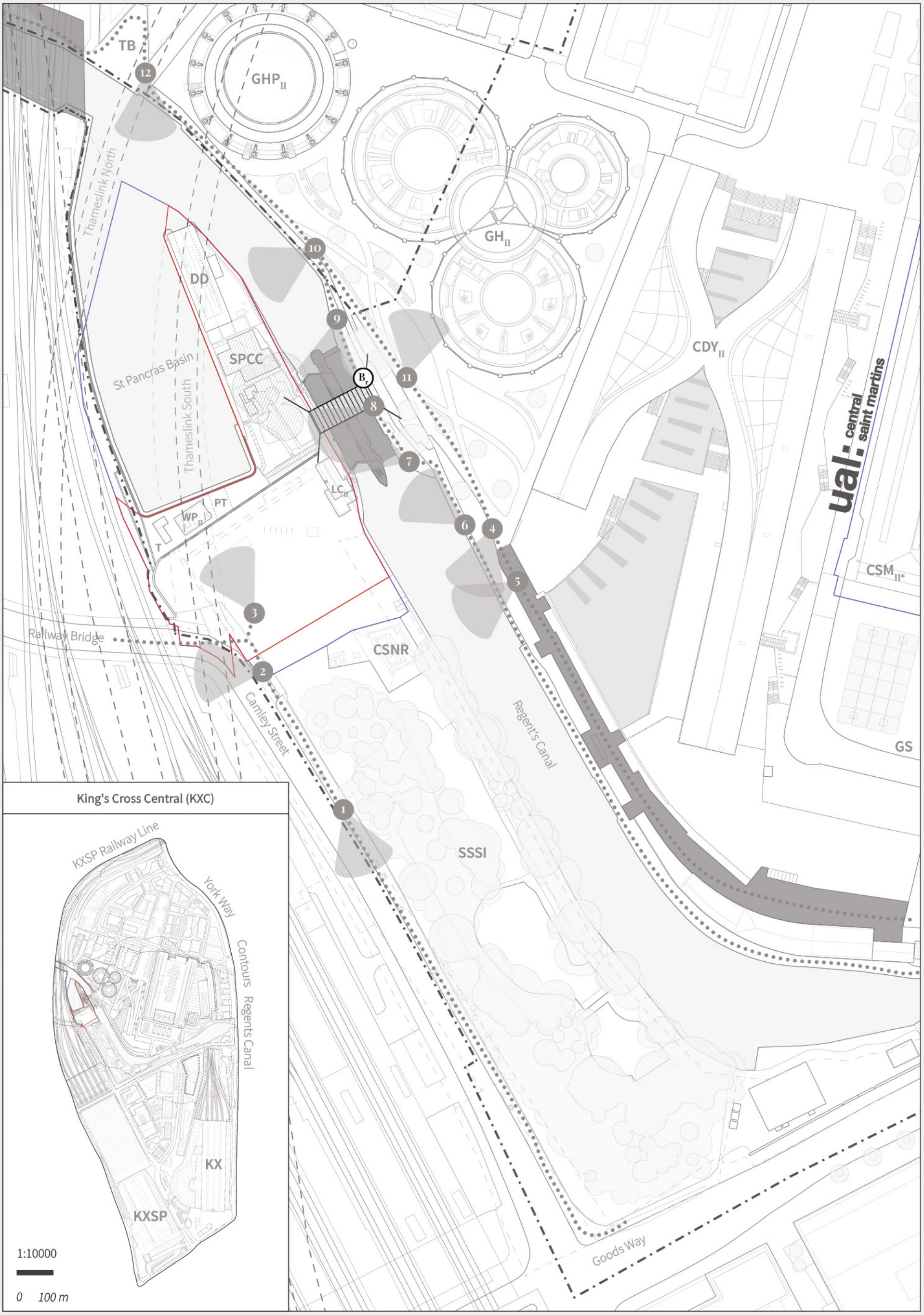
Setting Early Sustainability Targets

LETI 2030 Design Target A1–A5 (kgCO2e/m²)			
Class	Office (Y1 TW)	Education (Y2)	Retail (Public)
A++	100	100	100
A+	225	200	200
A	350	300	300
B	475	400	425

RIBA 2030 Design Target A1–A5, B1–B5, C1–C4 (kgCO2e/m²)			
Class	Office (Y1 TW)	Education (Y2)	Retail (Public)
A++	150	125	125
A+	345	260	250
A	530	400	380
B	750	540	535

Tables A and B

Based on the LETI and overall RIBA targets and example projects, each area is given a carbon limit to work to (LETI, 2020).



The Island of King's Cross

Bounded by railway, road and the Regent's Canal — King's Cross is overlooked by the peninsula comprising of Camley Street Nature Resere, Waterpoint, Dry Dock and a disused Clubhouse.

1:1000 A3

0 10 20 40 m

View 1 — Camley Street South

Camley Street south forms immediate access to the north of KX via the underpass by motor vehicle. However for the pedestrian it is merely a tertiary street to York Way, with minimal footfall — except to the fairly inconspicuous CSNR.

View 2 — South-East Underpass

Plated steel warren trusses span between pillars of stone-capped brick to create an underpass below the railway line, providing access beyond KX island to south-west Camden. The frequent trains of KX St Pancras pass beneath OHLE suspenxded between similarly plated trusses.

View 3 — Entrance to St Pancras Basin

Provides security in the form of cameras, controlled gates, etc. to boats moored in the canal basin. There are sometimes limited access on guided tour open-days to the WP.

Site Walkthrough

An Initial Promenade

I visited the site on many ocassions, each time developing a greater understanding of its opportunities and constraints. Notably, the same feeling welcomed me during each of my visits — isolation.

A tall, 6 metre high wall of weathered bricks of various shades, painted edges and climbing plants continues from the railway station to the basin and beyond.

The Waterpoint, peaking beyond the ruined wall, stands as this statuesque monument to the railway industry; and somehow you can tell that it has been moved there. It does not yet belong to the site.

In *Reform*ing the site, I am aiming to restore it and so enhance the fundamental character by blending together the vast layers of historical textures of typology, topology and topography.

View 4 — Regent's Canal Towpath South

Vegetation spills into the Regent's Canal, contrasting against the hard landscaping of the towpath that still moores many canal boats along it.

View 5 — CSNR from Coal Drops Yard

Pyramid roof with 'hopper' skylights, inspired by the site's former coal drops (Architecture, 2017). The same inspiration is used in the project, see pages 56 and 120 for more info.

View 6 — Ascent to St Pancras Lock

The contrast in scale is immediate noticeable looking up towards Lock no. 4. New industry dwarfs the old at King's Cross and Camley Street.

Label	Name
TB	Tapestry Building
$GH[P]_{II}$	Gasholders [Park]
DD	(St Pancras) Dry Dock
SPCC	St Pancras Cruising Club
PT	Plimsoll Tunnel
WP_{II}	St Pancras Waterpoint
T	Waterpoint Toilet
LC_{II}	Lock (Keeper's) Cottage
CDY_{II}	Coal Drops Yard
CSM_{II}	Central St Martins
CSNR	Camley Street Nature Reserve
GS	Granary Square
KX	King's Cross
KXSP	KX St Pancras

Listed $Buildings_{Grade}$

Key	Information
• • •	Walking Path and Viewpoints
	Site Ownership Boundary
3800	Site Area (sqm)
	Client-Owned Land
	Land Ownership Boundaries
	Regents Canal Area Contours (KXC)
	Regent's Canal Conservation Area (RCCA)
	Positive Buildings
SSSI	Site of Special Scientific Interest (SSSI)
	Thameslink Tunnels
	Demolished Buildings / Planting

View 7 — Lock Cottage and Lock no. 4

Distant high-rise apartments stand out against the 1–3 storeys of the site and notably the lock's lower levels.

View 8 — SPCC Access to WP and Planting

Steep ramped access from car park to lock. Lack of disabled provisions to WP from this point.

View 9 — Private Lock and Basin Access

An existing and secure footbridge. A canal boat stops at this point then descends through the lock.

View 10 — Former Club House and DD

Canal boats frequently passed through, mooring along the site's edge or using Lock no.4.

View 11 — GH, GH Park and TB

Similar to the WP, the Gasholders have been implanted to the site and repainted, their structure forming a soulless non-structural skeleton.

View 12 — St Pancras Basin and Dry Dock

The WP dwarfs the DD, and even the wall from this point — perspective makes the chimney appear as if it's reaching to the height of context behind.

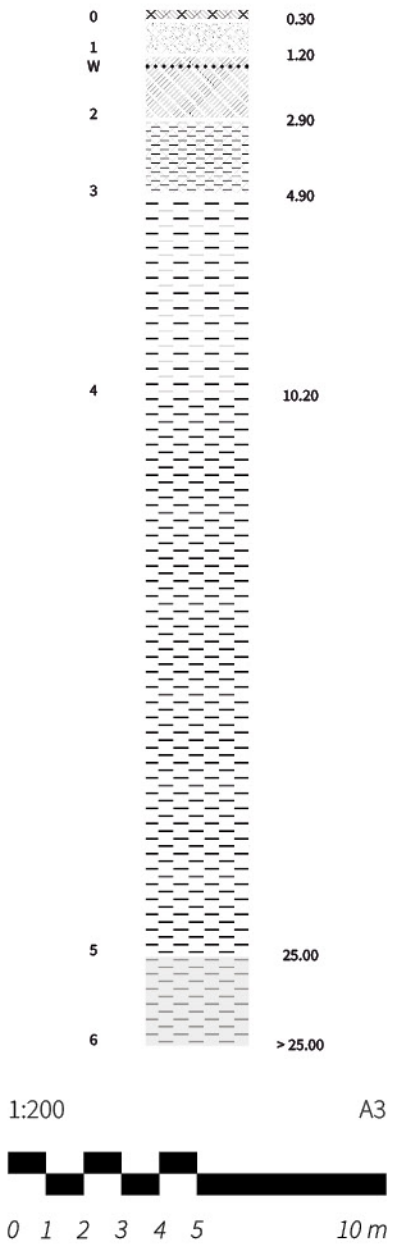
Proposed Canal Bridge

A new canal bridge has been proposed by the author to connect the island and peninsula together, providing access by both RDC-PTC students and the general public on foot and by bike. Due to the complexity of this element, it is considered a separate workstream to the main project and so will only be mentioned or indicated where needed in the report.

The Dry Dock

Feasibility Study

As the Dry Dock's management is going to be in partnership with the SPCC, a feasibility study was undertaken regarding possible expansions of the site for the greater handling of construction and workshop materials.
To briefly conclude, for the purpose of sustainability, the existing Dry Dock would be used for a trial period during the RDC-PTC construction, and if required, later retrofitted or replaced.



0: Top Soil (and landscaping)

1: Made Ground
- ⇧ Fine-Coarse Sand (silty/gravelly)
- ⇧ Fine-Coarse Gravel (brick/flint/slate)

W: High Water Table (1.5 m)

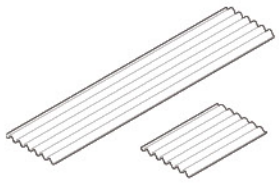
2: Made Ground
- ⇧ Silt (ashy/sandy/gravelly)
- ⇧ Fine-Coarse Gravel (brick/flint)

3: Made Ground
- ⇧ Firm Clay (gleying i.e. waterlogged)
- ⇧ Timber fragments

4: Weathered London Clay (firm, blue gleying)

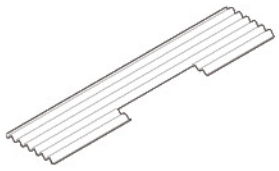
5: London Clay (firm to stiff)

6: Borehole End-point — assumed that it continues as London Clay (firm to stiff)



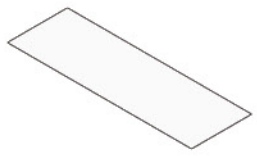
Corrugated Sheets

Mat.: Steel (Powder Coated)
Dim.: (4000/1400) x 900 x 75 mm
Volume: 0.03 / 0.01 m³
Total Quantity: 64 /14
Source: BIM, Images



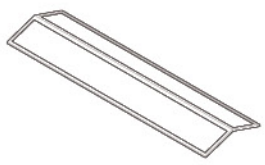
Corrugated S. (NS)

Mat.: Steel (Powder Coated)
Dim.: 4000x 900 x 75 mm
Volume: 0.026 m³
Total Quantity: 16
Source: BIM, Images



Roof Window

Mat.: Extruded Translucent PVC
Dim.: 4300 x 1400 x 6 mm
Volume: 0.036 m³
Total Quantity: 8
Source: BIM

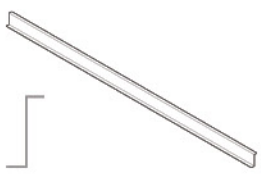


Eave Finishes

Mat.: Steel (Powder Coated)
Dim.: N/A
Volume: 2 m³
Total Quantity: 1
Source: BIM, Images

Portal Frame

Mat.: Steel (Intumescent)
Dim.: 7200 x 220 x 3350 mm
Volume: 0.25 m³
Total Quantity: 7
Source: BIM

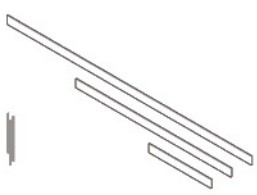


S-Shaped Purlins

Mat.: Steel (Intumescent)
Dim.: 4600 x 190 x 100 mm
Volume: 0.0065 m³
Total Quantity: 24
Source: BIM

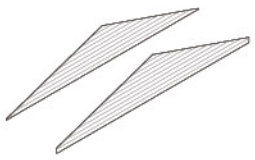
Ridge Purlins

Mat.: Steel (Intumescent)
Dim.: 4600 x 200 x 95 ,,
Volume: 0.0067 m³
Total Quantity: 6
Source: BIM



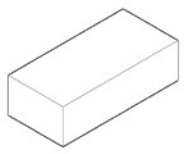
Shiplap Boards

Mat.: Timber (Preserved/Paint)
Dim.: (4600/2900/1170) x 140 x 18 mm
Volume: 0.012/0.0073/0.0029 m³
Total Quantity: 180 / 28 / 30
Source: BIM, Images



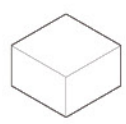
Shiplap Boards

Mat.: Timber (Preserved/Paint)
Dim.: N/A
Volume: 0.18 m³ (Total)
Total Quantity: 19
Source: BIM



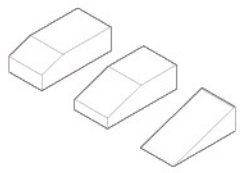
Brick

Mat.: London Stock
Dim.: 215 x 102.5 x 65 mm
Volume: 0.0014 m³
Total Quantity: 1025
Source: BIM



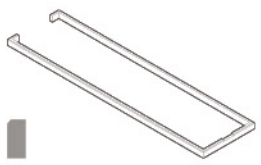
Brick (Half Bat)

Mat.: London Stock
Dim.: 102.5 x 102.5 x 65 mm
Volume: 0.00068 m³
Total Quantity: 97
Source: BIM, Images



Brick (NS)

Mat.: London Stock
Dim.: N/A mm
Volume: 0.067 m³ (Total)
Total Quantity: 97
Source: BIM



Plinth

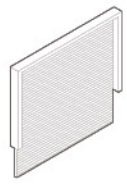
Mat.: Concrete
Dim.: 28200 x 7400 x 1300 mm
Volume: 18 m³
Total Quantity: 1
Source: BIM

Balustrade (Stands)

Mat.: Steel (Tubular)
Dim.: 1100 x 75 x 75 mm
Volume: 0.0005 m³
Total Quantity: 39
Source: BIM, Images

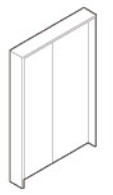
Balustrade(Rail)

Mat.: Steel (Tubular)
Dim.: 13600 x 75 x 75 mm
Volume: 0.025 m³
Total Quantity: N/A
Source: BIM, Images



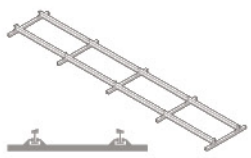
"Garage" Door

Mat.: Steel
Dim.: ~ 4900 x 3500 (Opening)
Volume: N/A m³
Total Quantity: 1
Source: BIM



Doors

Mat.: Timber (Preserved/Paint)
Dim.: 2000 x 690 x 25 mm (per door)
Volume: 0.034 m³
Total Quantity: 2
Source: BIM, Images



Overhead Gantry

Mat.: Mixed
Dim.: N/A
Volume: N/A
Total Quantity: 1
Source: BIM

1 Dry Dock

2 Retaining Wall

Constructed in 1832, the retaining walls consist of earth banks lined with ragstone walls or brickwork — contemporary replacements would include "steel sheeting with concrete copings" (Camden, 2008).

3 Regent's Canal / Basin

4 Exclusion Zone

Future foundations should not encroach this zone, mitigating adverse risk to the tunnel. It is important to note that the *Infrastructure Act* will apply (Engineers, 2022).

5 Tolerance Zone

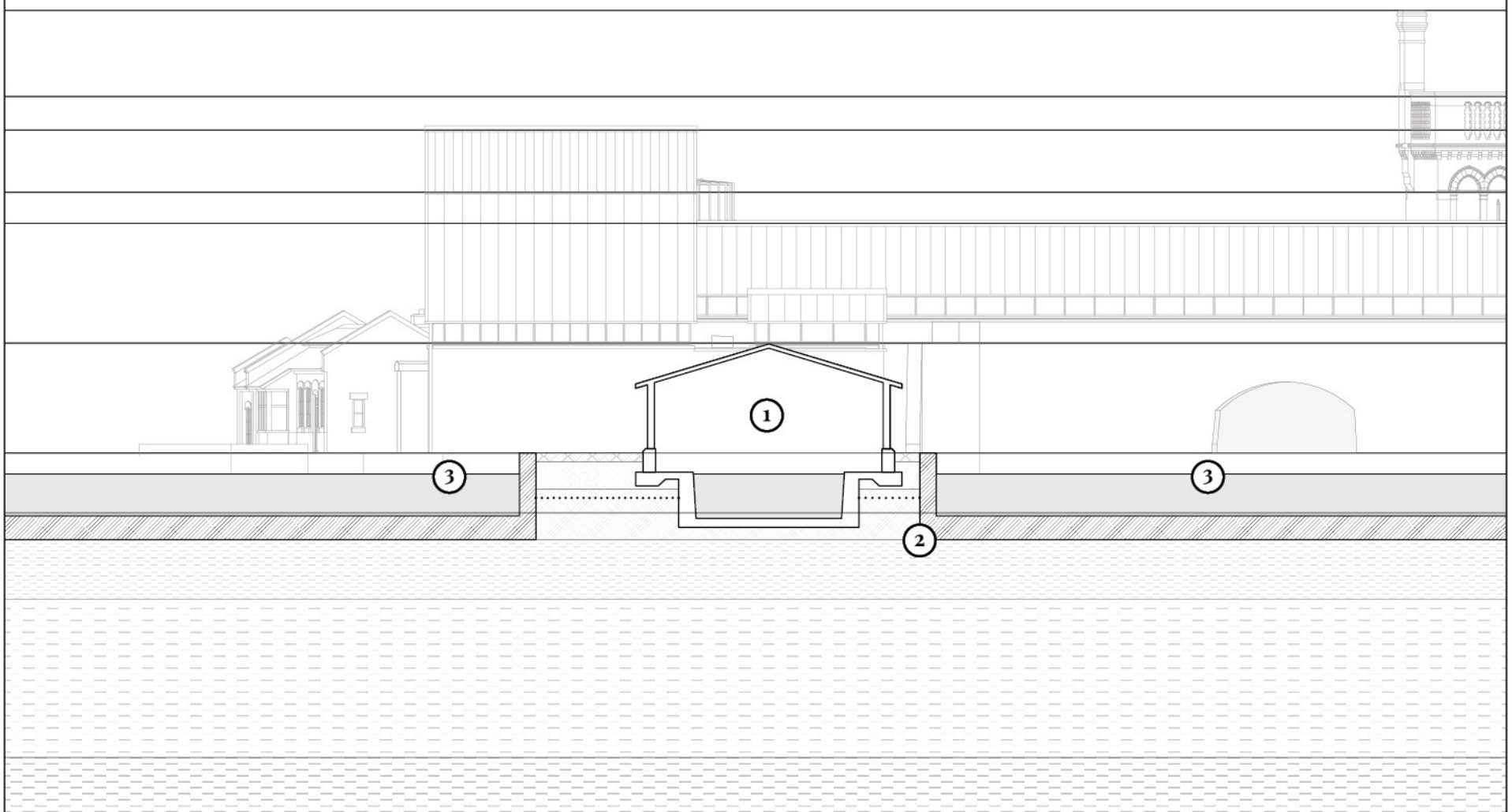
Stricter zoning (including for tolerance) was applied based on more recent *Cross Rail 2* information. This reduces the risk of future foundations from directly impacting the tunnel such as in the case when piles are constructed beyond the *Exclusion Zone* (Johnson, 2022).

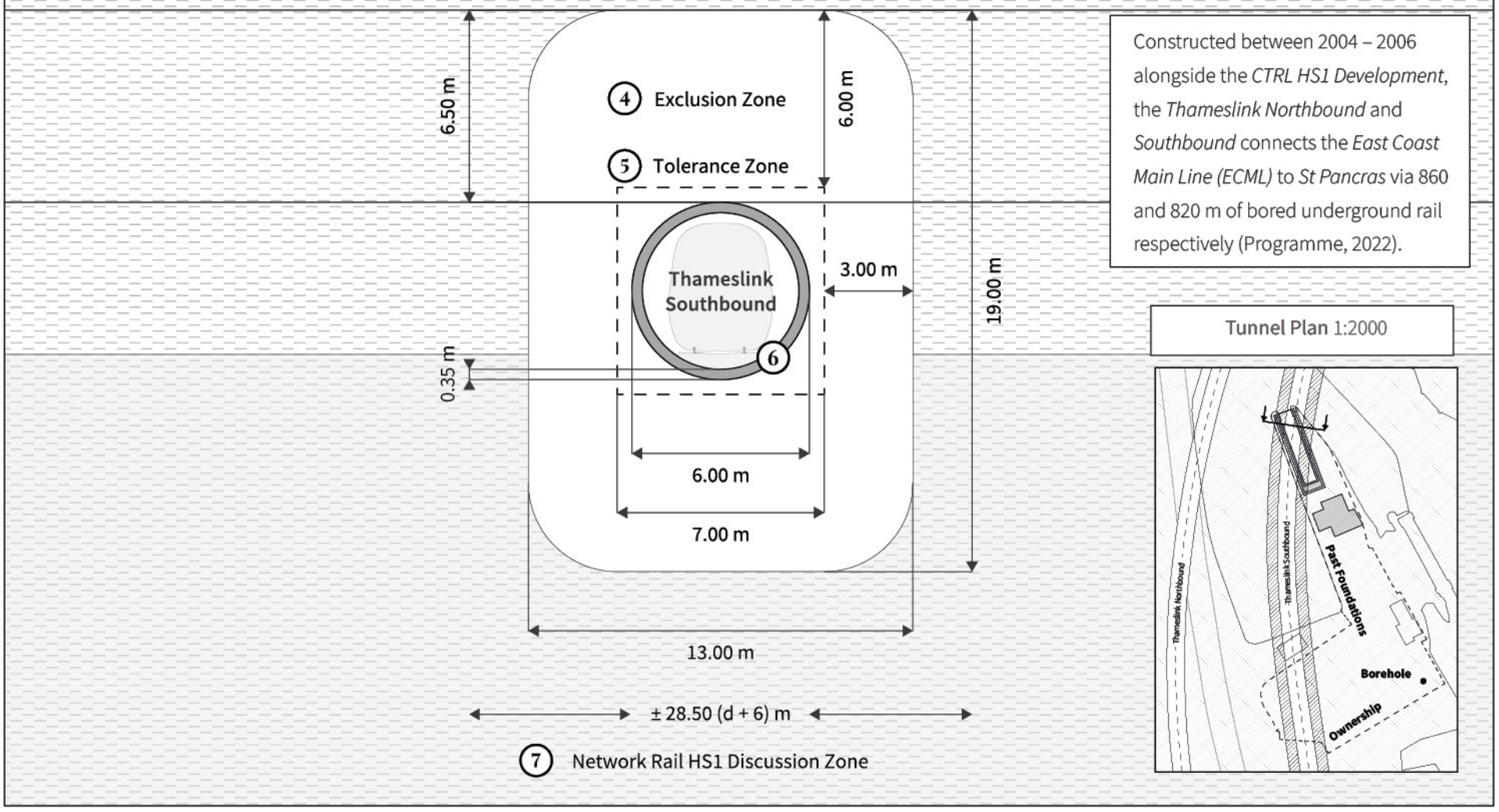
6 Thameslink Southbound

The tunnel is lined with "350 mm thick fibre-reinforced precast concrete segments" (Milgate, 2020, p.2).

7 Network Rail HS1 Zone

As set out in the *Network Rail Developer's Handbook* (Milgate, 2020), the zone for *Architect-Network Rail* dialogue goes far beyond the ownership boundaries of the *Exclusion Zone*.





Constructed between 2004 – 2006 alongside the *CTRL HS1 Development*, the *Thameslink Northbound* and *Southbound* connects the *East Coast Main Line (ECML)* to *St Pancras* via 860 and 820 m of bored underground rail respectively (Programme, 2022).

Tunnel Plan 1:2000

The Thameslink Tunnel

Possibly restricting the depth, typology and constructibility of foundations below the site, the Thameslink tunnel's constraints were identified.

1:1000 A3

0 10 20 40 m

1.5

Act 2

Tell that its sculptor well those passions read

Historicism, a Piano's Home and the Maker's Hand

Lost Works

Locating Former Factories

Piano manufacturing migrated along *Tottenham Court Road* from *Soho* and the *West End* to the *London Borough of Camden* (Oliver, 1975). Settling throughout the wards of *Bloomsbury* and *Fitzrovia* by the mid-19th Century before being 'drawn North' (ibid.; Hayes, 2012) towards *Camden Town* and *Kentish Town*.

Camden's British furniture industry had already established trade routes for material supplies and the transport of bulky products in the North of the Borough; operating along *Regent's Canal* (see p.55) from the East and centering to the railway infrastructure of *St Pancras*, *King's Cross*, and smaller stations (Ball and Sunderland, 2001; Hayes, 2012; Kent, 2015).

Forming distinct 'enclaves' within the Borough, nearly every street of Camden Town had a factory (Hayes, 2012), as if mirroring the '[now] substantial suburban Churches' that they furnished for; both provided prominent building typologies and leisure for the mid-to-upper classes of *Fitzrovia* and *Bloomsbury* (Ball and Sunderland, 2001, p.163).

Figure 2.1, Camden, 1896

The site is located in the industrial centre of *King's Cross* and away from the majority of piano works and so can form a distinct emulation of this vernacular.

1:30000 A3

0 600 1200 m

10. Collard & Collard

Oval Road,
Camden Town

Typology: Offices
Building/Mew: 400/>4000 sqm
GIA: 1440 sqm

The Piano Factories

Today, the firms listed and over a hundred more *Camden* piano-makers no longer exist. *Cavendish Pianos* in *Yorkshire* are the last remaining practitioners.

1. T.G. Payne

28–34, Fortress Roard,
Kentish Town

2. Arthur Allison & Co.

Apollo Works, Leighton Road,
Kentish Town

3. S. Weston & Co.

73 Malden Road,
Kentish Town

5. Steward & Lamberd

St Paul's Road,
Camden Town

6. Rich Schaw & Co.

138 Camden Road,
Camden Town

7. Burling & Burling

Ferdinand Place,
Camden Town

8. Chappell & Co.

10a Belmont Street,
Camden Town

9. J & J Hopkinson

Fitzroy Road,
Regents Park

11. Joseph Shaw

9a Georgiana Street,
Camden Town

12. Square & Longson

Arlington Road,
Camden Town

13. Heckscher & Co

Ferdinand Place,
Camden Town

14. William Squire

Bayham Place,
Camden Town

15. Monk & Schuppisser

Greenland Place,
King's Street

16. Sandon & Steedman

54 Queen Street,
Camden Town

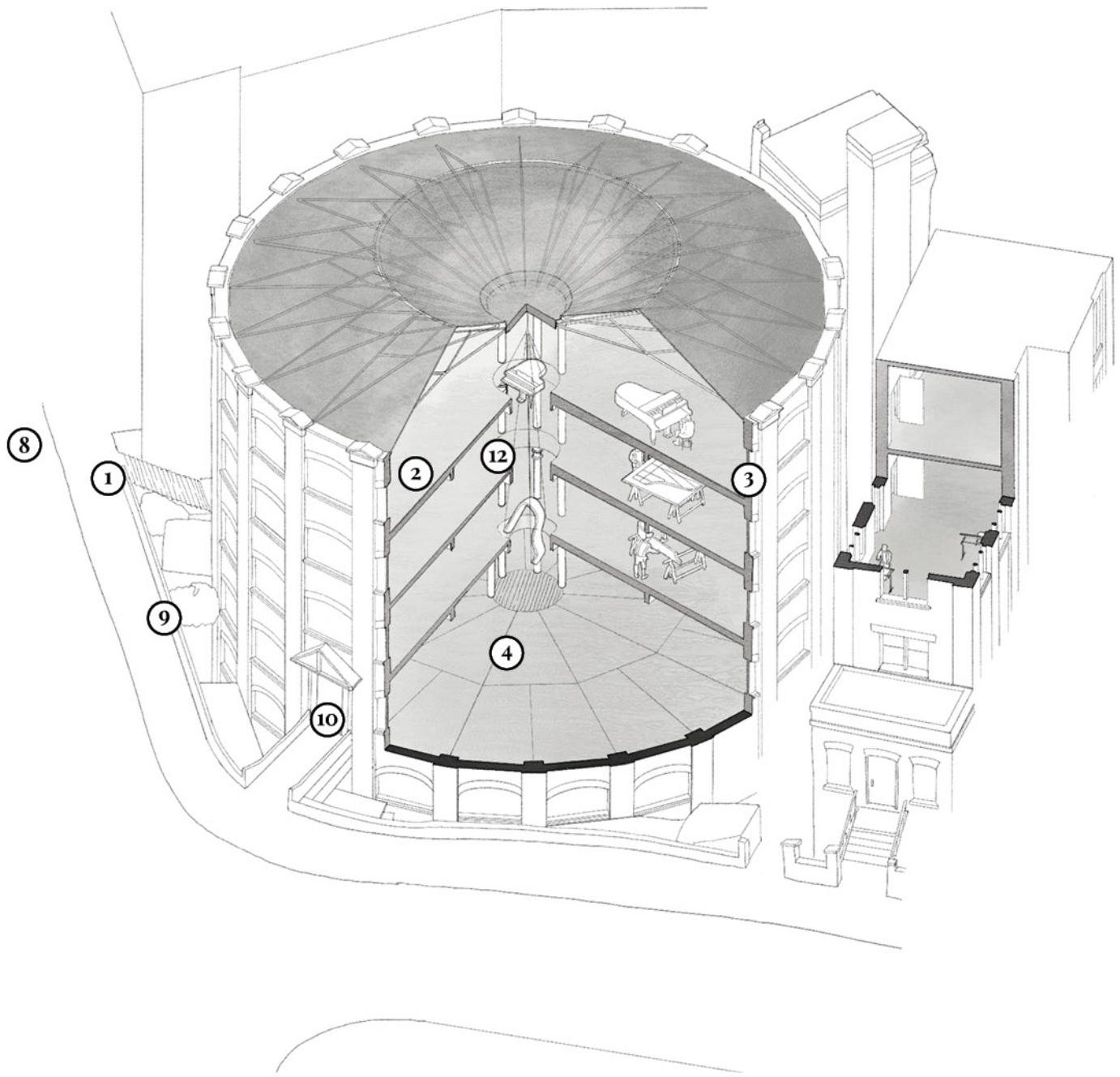
17. F. H. Saffell

288 York Way,
Kings Cross

A Unique Typology

Collard & Collard

An analysis of the former pianoforte manufactory, now known as *The Rotunda*.



The Rotunda, Camden. Formerly Collard & Collard, now Max Fordham Engineers. Illustration by Author

1 Level Change

The factory continues below the road level, expanding out into the mew and the import/ export access to the North.

2 Material in Motion

Corresponding to its assembly, piano materials move upwards while the completed piano is moved down from the top floor via a central oculus (Ø 2.4 m)

3 Spatial Organisation

The Rotunda and adjoining block are separated, with a bridge connecting the two. Effectively dividing craftmanship and admin / design respectively.

4 Ground Floor

5 Floors 1 – 2

6 Top Floor

7 Panoramic Rhythm

Each segment shares equal prominence up to the entrance which changes to a triangular (non-segmented) opening. The panoramic buttressed walls emphasise the building's verticality and structure as you orbit it.

8 Navigating the Mew

The condition of circular-to-rectilinear forms create a diverse urban response where you can go below the street, under/over bridges and through the mew cluster.

9 Wide Segmented Arches

London Yellow stock brick. Designed to flood the workshops with natural light.

10 Expressed Hybrid Details

Steel Columns
(two-forms shown)
Timber Beams
Load-bearing Masonry
(vaults, buttresses, arches)

11 Vaulted Ceilings

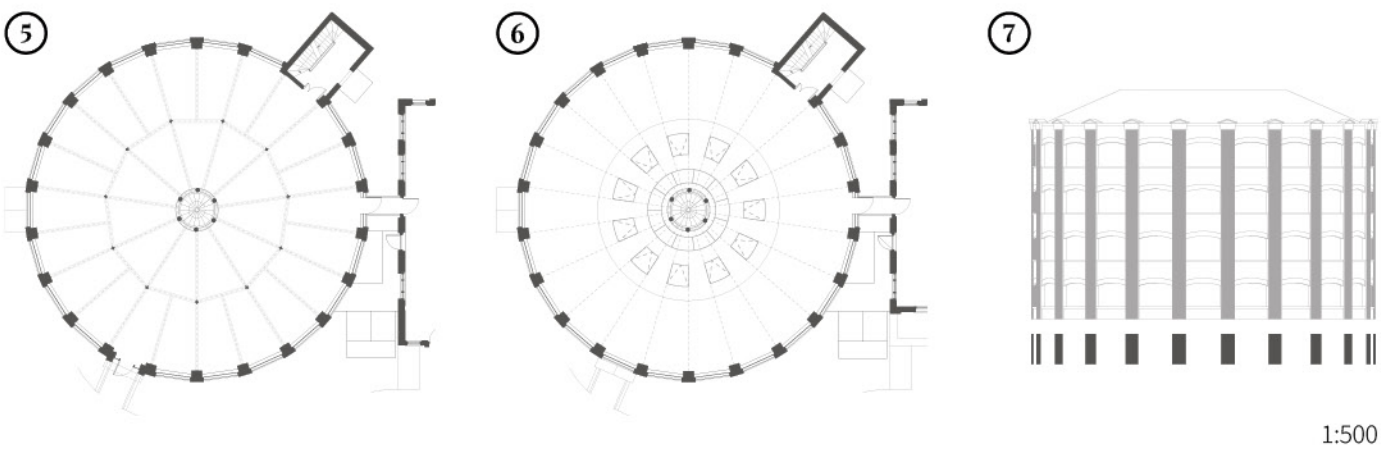
Improved internal heights.

12 Structure-Use

Production is also sequenced radially in the structural layout.

13 Corner Condition

A pivot that connects the adjoining linear streets.



Parts-whole — Elements of the piano factory, aka. the "Churches" of Camden (Hayes, 2012)

"'In this instrument," says Thalberg, “the object is to convey from the point where the finger acts upon the string, all the delicacy of action of the finger, so that the piano may participate to a certain extent in the sensibility of touch which is observable in the harp, and which is in consequence of the finger acting immediately on the string, in that instrument without the intervention of any other mechanism.

The power of the piano depending on the quantity of matter brought into vibration; the resonance or the perfection of that vibration depending on the correct proportion of its parts; and the accuracy of intonation depending on the nature of the bridging, the proportions of the strings, and their arrangement with regard to the blow of the hammer which are all most admirable; while the action of depending on the peculiar — mechanism employed far surpasses everything else of the kind, for it enables the player to communicate to the strings all that the finest-formed and most skilful hand can express; and becomes as it were apart of himself, reflecting every shade of his feelings, from the most powerful to the softest and most delicate sounds.

This action is indeed so perfect, particularly in its power of delicate repetition, that if any note is missed in execution it is the fault of the player and not of the instrument.”'

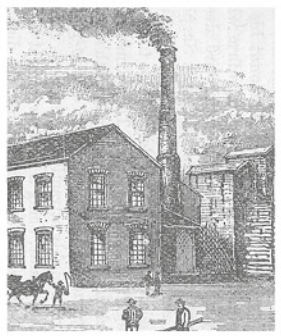
Thalberg quoted by Joseph Hatton (1891)

4. J. Brinsmead & Sons

Imperial / Brinsmead Works,
Kentish Town

Typology: Residential (Premium flats)
Building/Mew: 400/>7000 sqm
GIA: 1800 sqm

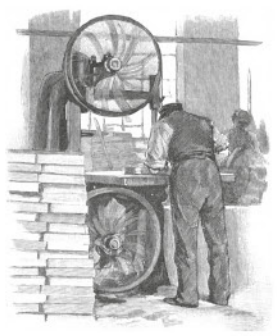
Initially 'draw[ing] from the vast substratum of carpentering skills' (Samuel, 1977, p.89), *Camden's* piano works were made up of *Mews* or *Clusters* of different artisans and their apprentices, their 'specialist [workshops]' each contributing to the 'assembly-line' of the Piano (Ball and Sunderland, 2001, p.164; Kent, 2015, p.95).



Timber Drying Stores and Engine House

Timber is stored both internally and externally on the ground and roofs of the factory. The Engine House produces heat and vapour for the workshops.

Floor G



Sawmill and Veneer Store Room

'Full of a fascinating variety of mechanical music' (p.404)

Strengthening a sounding board using gobars

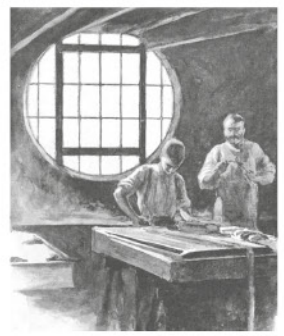
'Bent between a false roof...a level pressure...force of twelve tons upon the board' (p.406) in the 'grand sounding — board shop' (p.407)

3, 4

Preparing the Iron Frame for Enamelling (Japanning)

'Elbow grease... not by any means all the work of machinery...the hand is a great factor' (p.403)

G



Stringing

'First tuning at the hands of apprentices [and] by nine or ten different tuners before it goes to its final operator and it begins considerably above concert pitch' (p.407)

4

Clamping the Grand Piano Case

'Final screw and cramp pressure, the last piece of coercion to which it is necessary to subject the beautifully rounded structure' (p.408)

2

Fitting Action to Grand

'A quiet corner', where the 'fine art [of the] painter, carver and artist...beautify the piano' (p.409)

1

Special Fitting Room And Finishing

'The grand fitting shop. We enter it literally through a tunnel of grand pianos' (p.407)

1

A Tuneful corner

Tuners and canaries respond to the subtle changes in tone; 'the more the men tuned the more energetically they sang' (p.409)

1

Figure 2.2, How Pianos are Made

How Pianos [were] Made

John Brinsmead & Sons

Beautifully narrated by Joseph Hatton (1891), How Pianos are Made, guides us through the Brinsmead Works of John Brinsmead & Sons from a first-person perspective. A precedent of vernacular space, as well as tools and machinery.

Each of the sequential illustrations show an intimate relationship between material, maker and space. Where architecture forms a helping hand through false ceilings and natural light.

Figure 2.3, Each floor was defined by the process

An Education *Reform*

A Manifesto

Figure 2.4

The *Craft Council's* education manifesto outlines 5 acts to ***Reform*** current education — based off interviews with Craft students (see England, L. (2014) and Council (2014)):

1. Put Craft and making at the heart of education
2. Build more routes into Craft careers
3. Bring Craft enterprise into education
4. Invest in skills throughout careers
5. Promote world class higher education and research in Craft

Coinciding with recent developments of rural *Craft Towns* (Brown, 2014) or redefined urban *Mews*, Craft is slowly undergoing a revival. While their former industrial shells are migrated and retrofitted into new and typically commercially driven typologies, we ask: where is Craft to go?

The following architectural aspirations are derived from it:

The *RDC-PTC* should become a case study (5) — as *John Brinsmead & Sons* factory was — for local, innovative and sustainable Craft preservation in a time where specialist courses are in decline (4). Architecturally, it should aspire to reflect the syllabus. To be formed from the vernacular and to conversely ***Reform*** it (1); intertwined with the genus loci of *Camden* and the site. The Piano, the Centre and the Craft as interchangeable elements.

For example, society has become complacent with the availability of energy (fossil fuels and electricity), material (timber and metals) and manufacturing (rapid prototyping and mass-production) at the flick of a switch/click of a button (Langlands, 2017). The project should aim to be sustainably powered through interpretations of traditional systems. These include 'wind, water, animal [and] human' (Pye, 1968, p.26; Risatti, 2007, p.53; Langlands, 2017).

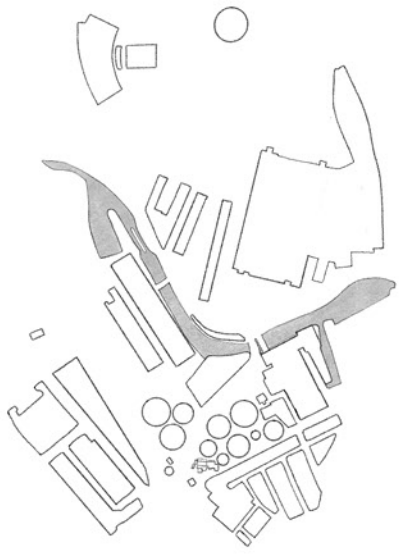
Part of an educational and enterprise cluster with *Central St Martins*, the centre will provide an interdisciplinary environment (1) and permanent workshops with retail-frontage (3) for tutors. Transmitting techniques through high quality education and apprenticeship (2) opportunities. Providing business management education, as well as through facilitating the recording of the Craft (5) process.

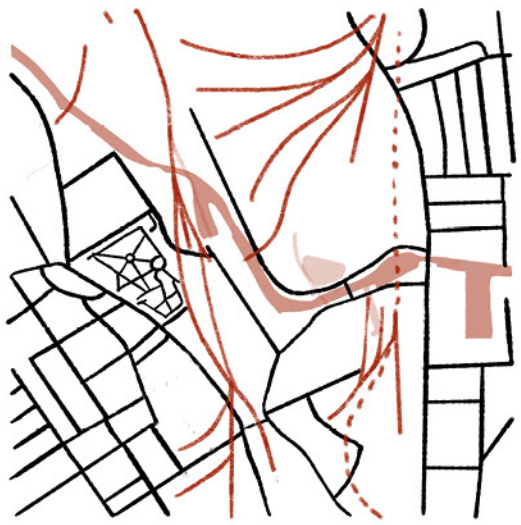
Act 3

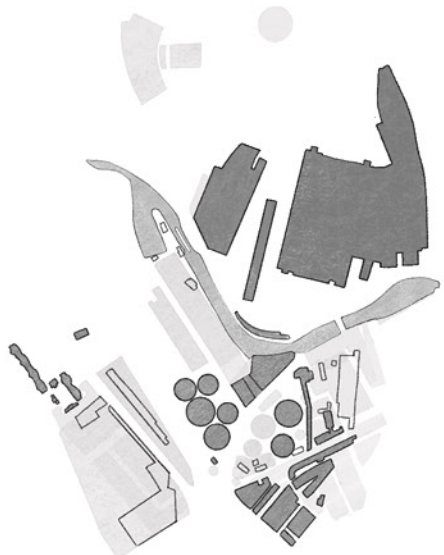
Which yet survive

Thoughts, Tapestry and Time

Industrial Revolution







20th Century

The Urban Fabric

The In-Between (Circulation)

Relocated Monuments

Change in King's Cross

How the movement of product and people has shaped its streets

Figure-on-Ground

Tracing Textures

During my site walkthrough, my feet traced through lines of stone, a density that went beyond only materiality.
A sense of time, overlaid as tapestries of material, I began to form not a Nolli plan but a true figure-on-ground.

Hard Landscaping

What appears as a patchwork of pavement finishes reveals a narrative to the urban grain through the: weathered depth of stone and joint (smooth, coarse or roughly cut), the variations of colour and size, and the response to climate (discolouration and permeability).

Canal Palette

CONCRETE CANAL CAP

GRANITE STONE SETTS
Spec.: Naturally Weathered
Colour: Blue-Grey-Pink
Dim.: 100 x 100 x 200–300 mm
Mortar: 10–15 mm

BRICK PAVERS Figure 3.1
Colour: Red
Dim.: 65 x 102.5 x 215mm
Mortar: 6 mm

CONCRETE PAVING
Spec.: Protects the HV Line
Colour: Grey
Dim.: 80 x 200 x 300 mm
Mortar: 6 mm

Other Surface Materials

Made Ground
Sand and Gravel

Plinth Floor
Concrete and Gravel

Dry Dock Slabs
Exposed Concrete

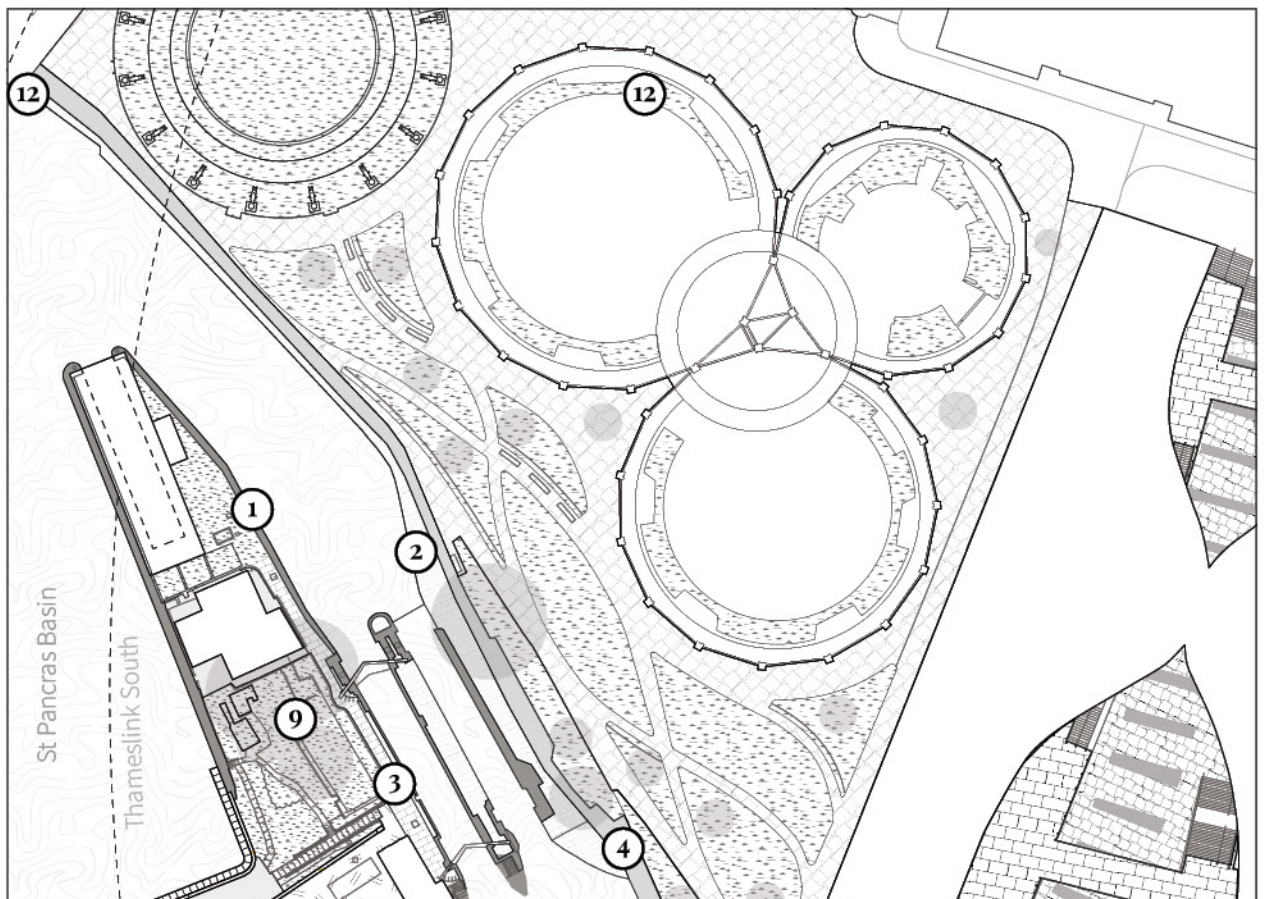
Soft Landscaping

Details regarding the species of flora and fauna around the site were sourced from an *Ecological Assessment* (Trent, 2014) and information regarding Green Roof build-ups were sourced from *Camden's Biodiversity Action Plan* (Camden, 2013) and the *Green Roof Code* (Harris, 2021).

SYCAMORE TREES (3)
Canopy Spread: 14 m
Trunk Diameter: 1100 mm
Root Spread (Max): 21 m
To be excavated from site

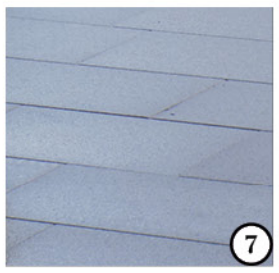
Removed before site visit

GOAT WILLOW TREE
Canopy Spread: 9.9 m
Trunk Diameter: 800 mm
Root Spread (Max): 15 m



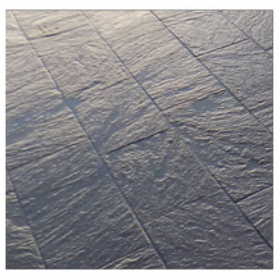
GH and CDY Palette

GRANITE STONE SETTS
Spec.: Bush Hammered
Colour: Pink and Mixed (Blue-Grey)
Dim.: 100 x 100 x 200–300 mm
Mortar: 10 mm



LARGE PAVERS
Spec.: Bespoke to CDY
Colour: Blue-Grey
Dim.: 70 x 200 x 400–600 mm
Mortar: 6 mm

Granary Square Palette



PORPHYRY PAVING
Spec.: Riven
Dim.: 70 x 200 x 400–600 mm
Mortar: 6 mm

YORK STONE PAVING
Dim.: 80 x 200 x 300 mm
Mortar: 6 mm

CANAL-SIDE PLANTING
Type:
Variety of trees, shrubs, bushes and grasses as part of SUDs around King's Cross

REGENTS CANAL
Type: Sanding Eutrophic
Plants:
Canadian Pondweed
Gipsyword

GREEN ROOFS Figure 3.2
Precedent Specification:
Semi-Intensive
150–200 mm Substrate
15–20 species /sqm

BIRDS
Species:
King Fishers / Swans / Moorhens (pictured) / Herons / Mute / Mallards

Other Flora and Fauna

FISH
Species:
Red Swamp Crayfish
Coarse Fish

BATS
Additional Information:
Important to mitigate the impact of development to neighbouring bats at the CSNR

Site Strata

Regent's Canal bisects the island of King's Cross from the peninsula of our site, creating a 'unique [corridor]' of industrial-era architecture, a biodiverse habitat, and contemporary retail and accommodation (Camden, 2008). Towards Granary Square, the raised plinth — formed from a hard landscaped edge of brick and concrete towpaths/horse slips – provided security to the yard, with cast iron gates sitting beneath arches that housed horses used for towing barges. Unusual level changes, former tunnels (closed and open), and underground infrastructure (e.g. 400k volt cables, rail tunnels and basins) exemplify the distinct strata of the site.

Plimsoll Coal Drops

Four railway tracks lead from the goods yard in the East then along the *Plimsoll Viaduct* and bridge, and into their bays. The carts are then discharged through mezzanine-levelled hoppers into storage bins or further carts which lead to the St Pancras railway line.

Figure 3.4, Basin Trade, **1930s**

Figure 3.5, Coal Drop Short Section

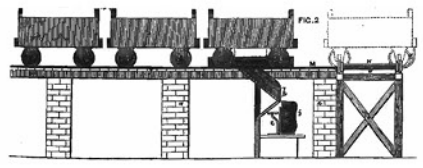
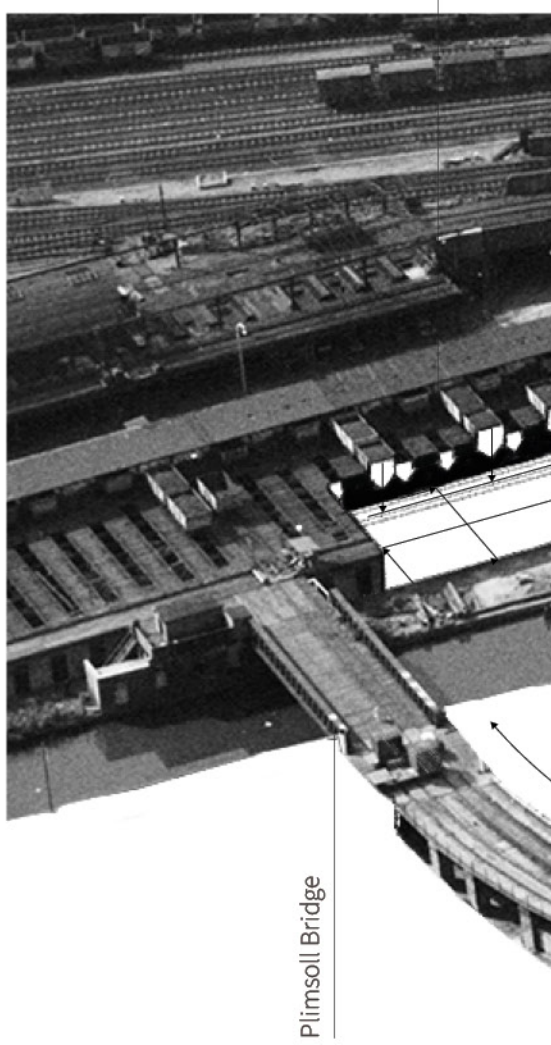
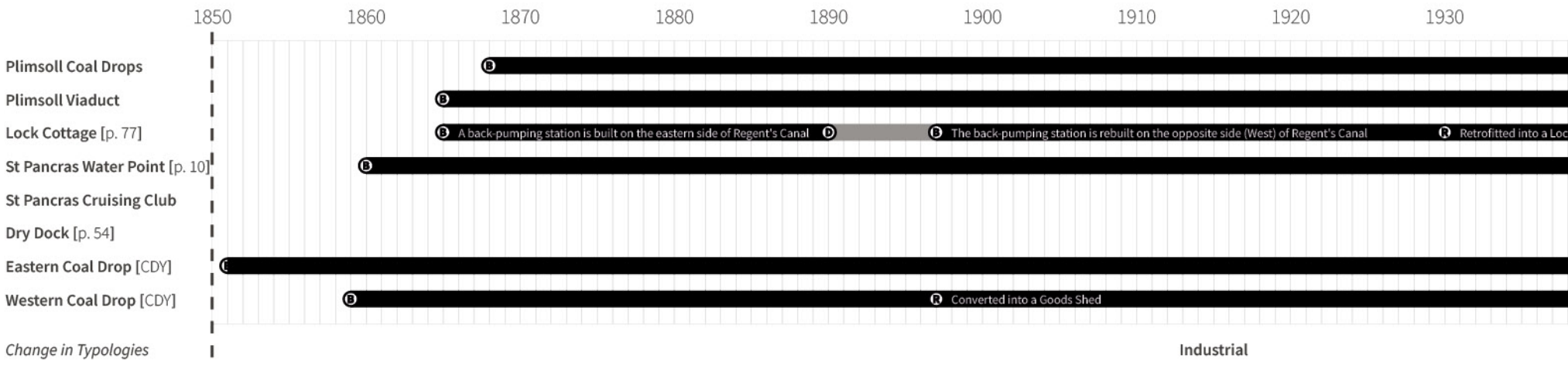


Figure 3.3, Adapted from Google Earth



Uncovering the Site 1960s

Reimagining the Plims



The Hidden Rail Tunnel

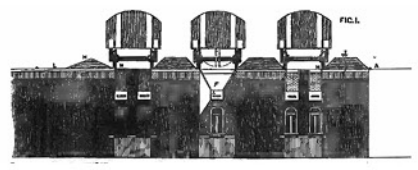
Consisting of a cast iron and cellular brick structure, the coal drops abut the hill-like retaining mass adjacent to the St Pancras Basin. A tunnel leading through this allows for coal to be transported to the railway lines or into barges below.

Palimpsest

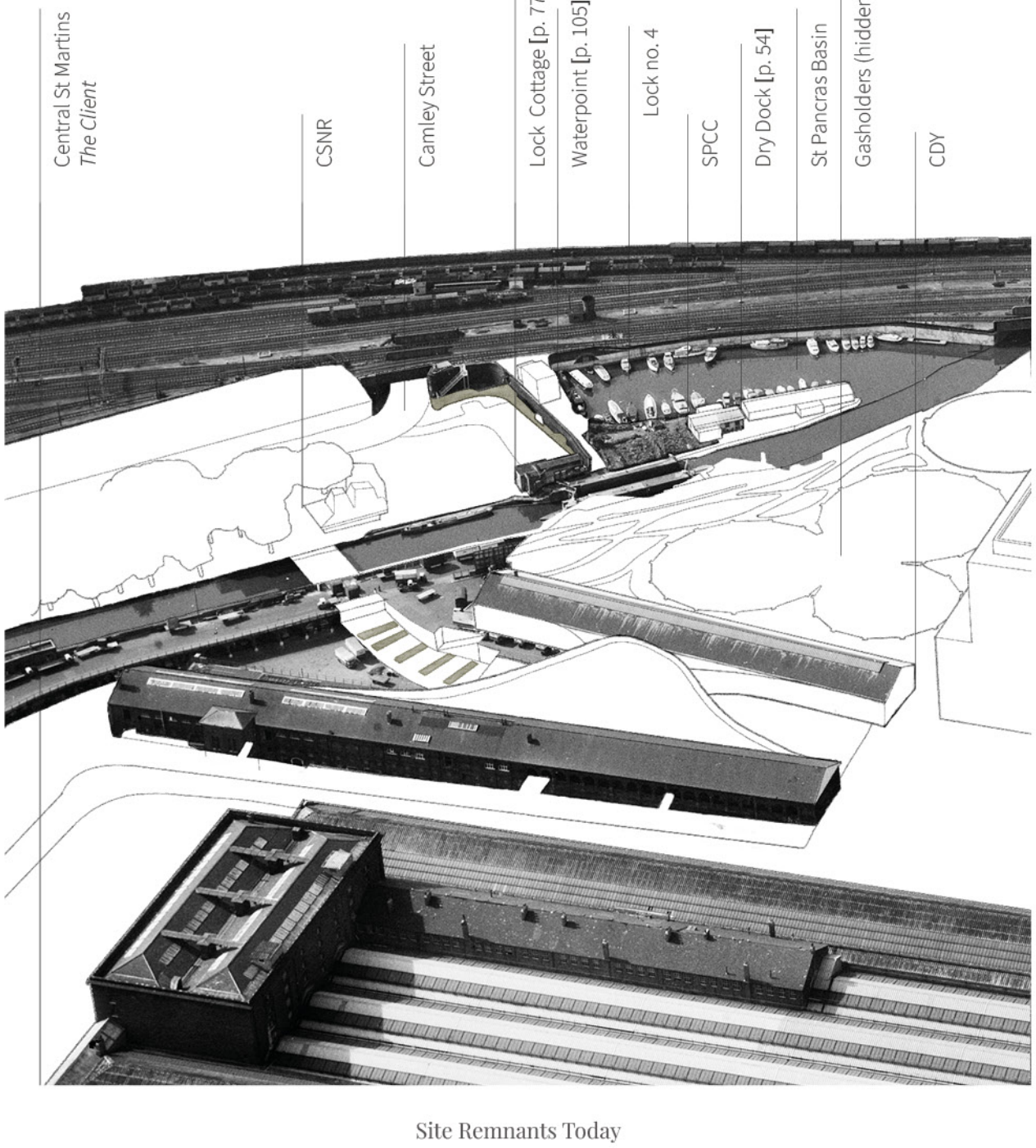
Tracing the sites industrial grain through plans, photos, accounts, diagrams and remnants such as the half-bricked up tunnel (see p. 112), viaduct outline (see p. 22) and the former Plimsoll bridge (below); these layers began to be navigated through an act of ***Reform***.

Beginning by reimagining and excavating the site's narrative moments, the overlaying of contemporary design could be explored as palimpsest.

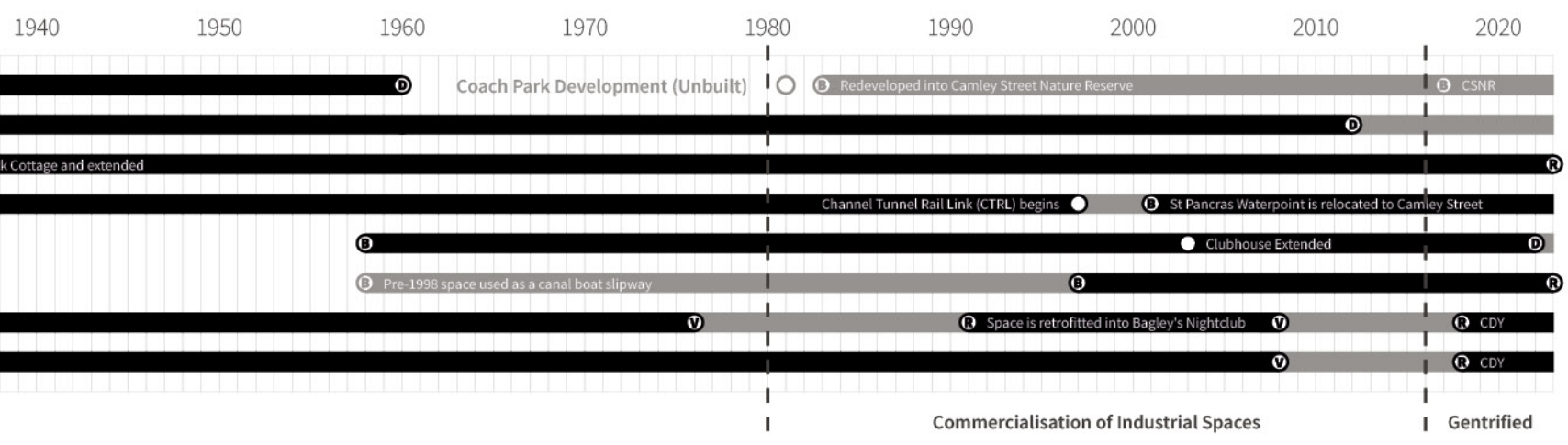
Figure 3.6, Coal Drop Long Section



Plimsoll Coal Drops Industrial Revolution



Site Remnants Today



Changes in King's Cross' typology through gentrification were previously explored in the study in Burkhalter (2020). Highlighting the re-introduction of the "creative classes" and commercialisation of industry post-1980s e.g. in the CDY.

Ⓑ Built **Ⓓ Demolished**
Ⓡ Re-used **Ⓥ Vacant**
New Vernacular

Repair as an Act of *Reform*

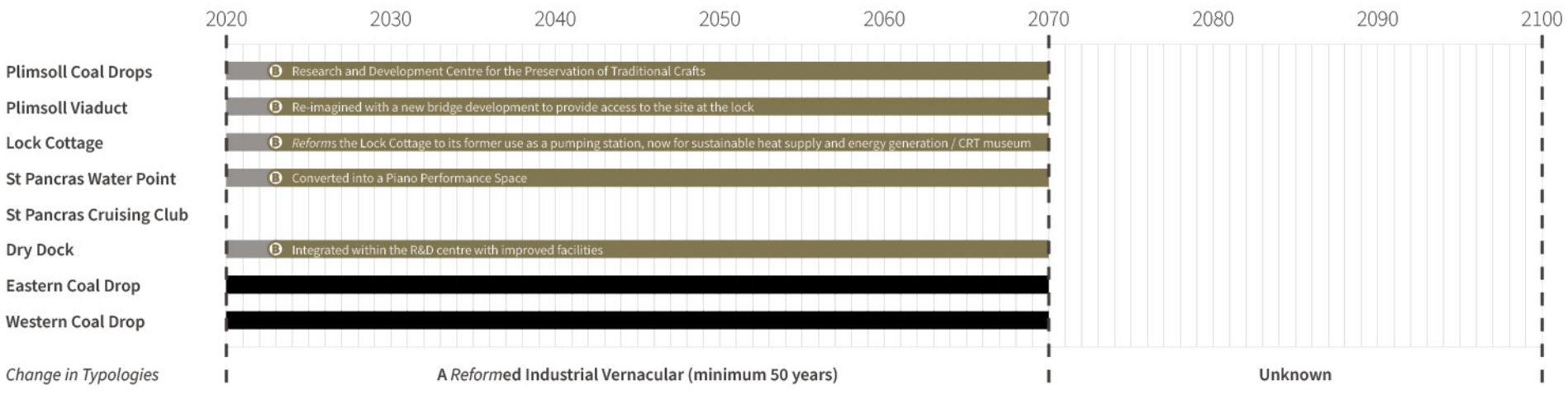
The remains of industrial archaeology is often, as this research attests to, the unseen layers of history that become the quotidian pavements treaded on throughout the year. Nevertheless, the genus loci of King's Cross — the poverty, hard labour and homelessness; has permeated every slab, brick and sheet of steel like coal dust.

Gentrification has attempted to clean the context into a generic privately-owned-public (POP) retail space, first displacing the working class and then the creative class of pop-up artists and nightclub scenes (Bagley's at the CDY) in favour of the luxury consumer (see Burkhalter, 2020). King's Cross is a centre of industry, not retail — the creative class, a "new" sustainability-spearheaded industry, can prevail at the RDC-PTC by being of this place, at this time.

Figure 3.3, Adapted from Google Earth

Industrial Archaeology

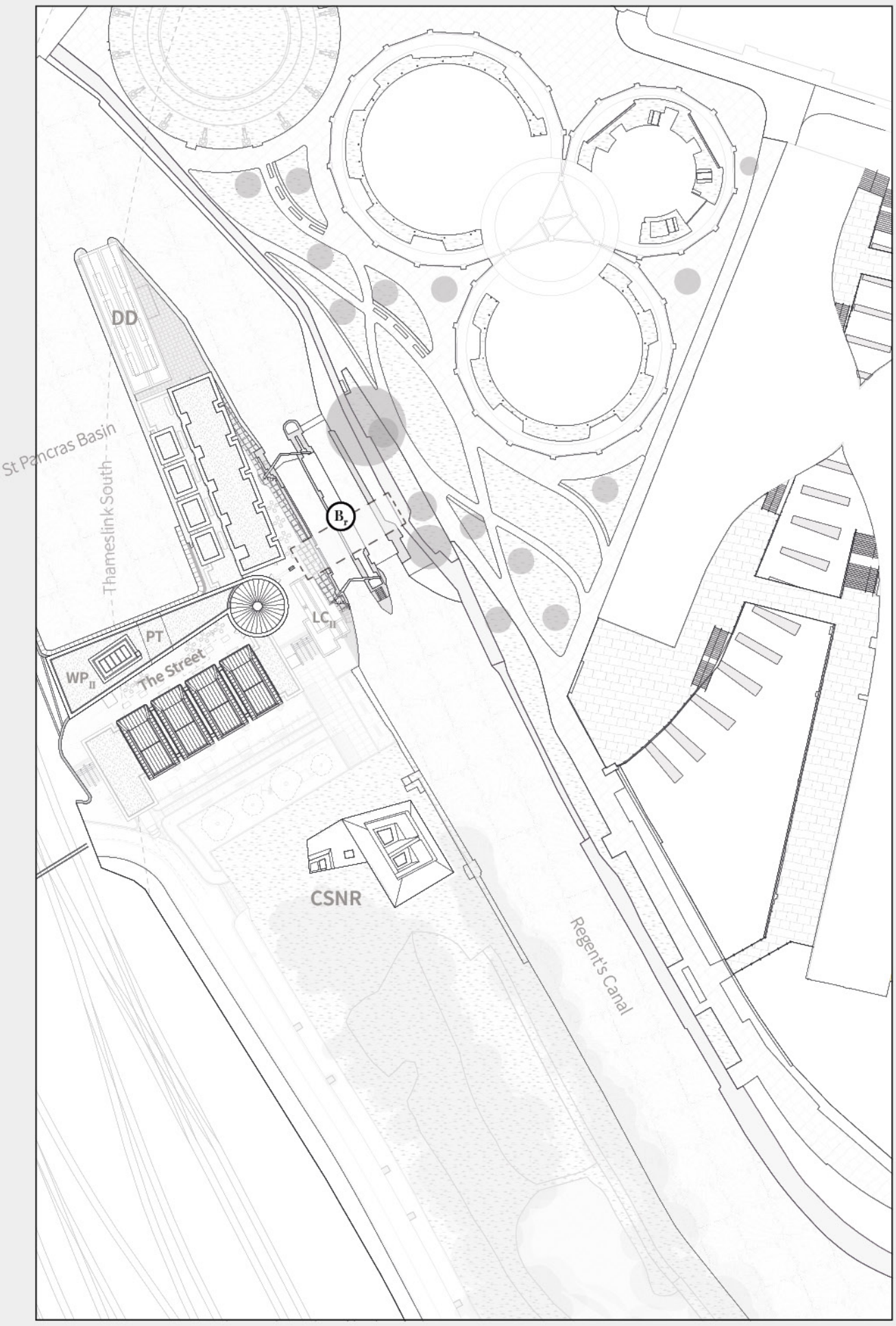
The RDC-PTC



Act 4

Look on my Works, ye Mighty

Process, Proposals and Plans



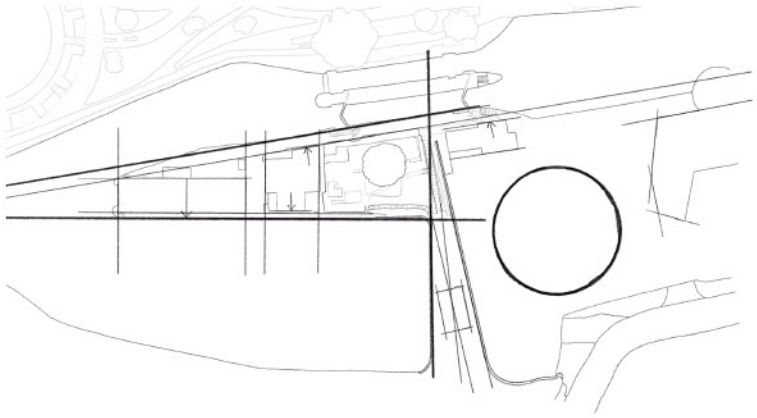
The RDC-PTC

A context plan illustrating the diversity of building forms and roof typologies that constitute King's Cross Central and the peninsula of the RDC-PTC

N

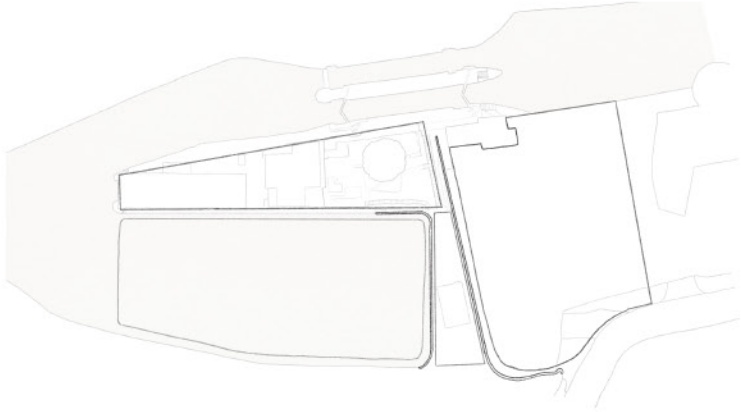
1:1000 A3

0 10 20 40 m



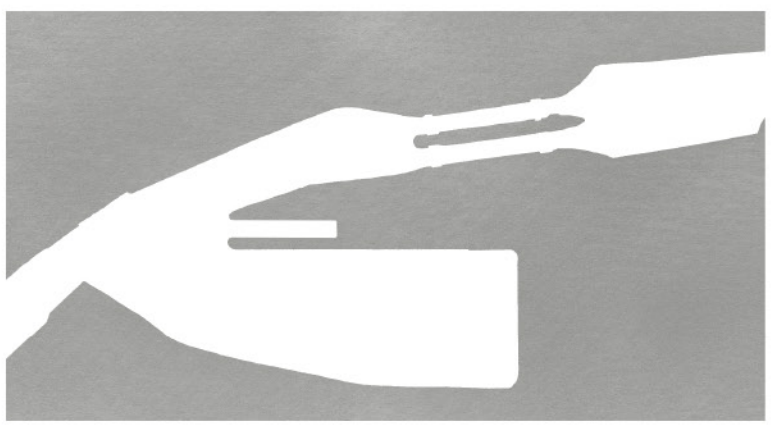
1. Edge Conditions

Regent's Canal converges towards the end of the peninsula at the Dry Dock and as illustrated by the demolished SPCC Clubhouse and the Lock Cottage, the form will follow the closest face to the canal edge. The space between the old Coal Drops wall and CSNR has an undefined edge, a circle.



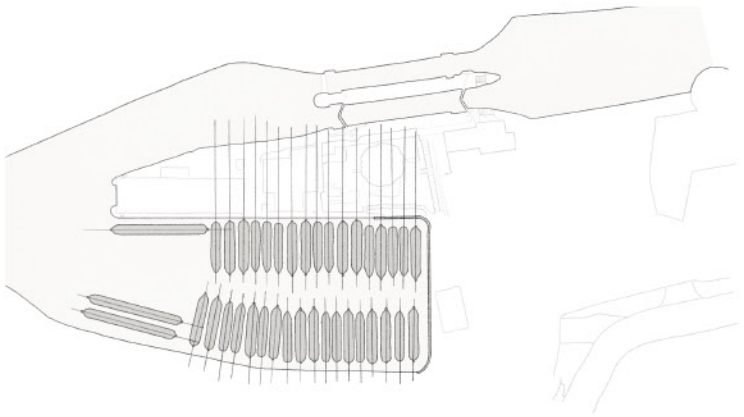
2. Zoning the Site

The site is composed of 3 clear zones and the St Pancras Basin that have been divided by the canal, ruined wall and a level change from the North and South of the site.



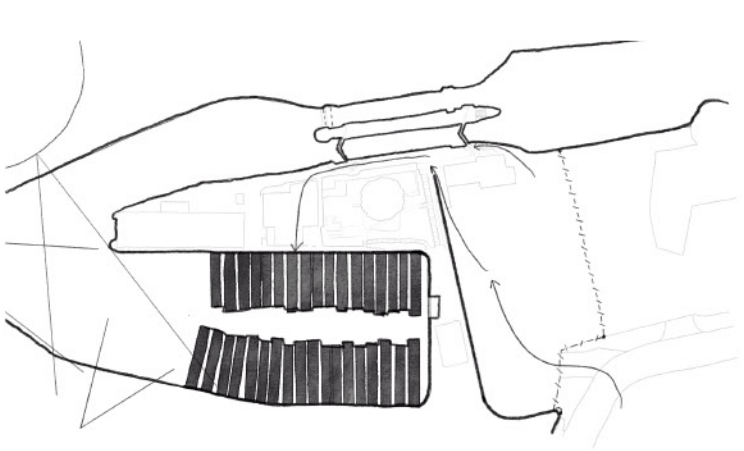
3. Regent's Canal, King's Cross Island and the Peninsula

The land mass that currently houses the Dry Dock, derelict Clubhouse and vegetation, projects outwards to form the St Pancras Basin. If the same mass was off the coast of Croatia or Italy, it would be considered a land-mark — except it has declined into an isolated post-industrial "thing" that purely exists.



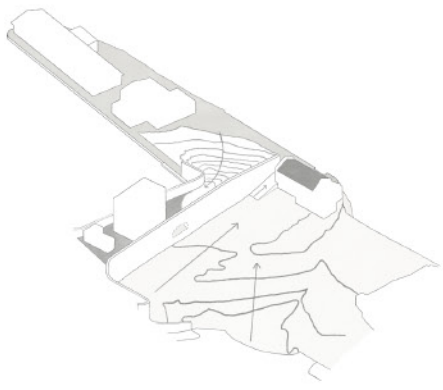
4. A Floating Village

The canal basin is a unique typology not typically experienced in architecture projects. To see how the boats, aligned to the jetty and so the canal edge, varied in size, shape, fittings and colour — it would be difficult to not compare it to a floating village. Each boat moors like one of the multi-coloured houses of Bristol or Lyme Regis.



5. Improving the Public Realm — Existing Basin Access

A public-realm first approach to site access and landscaping was part of a dedication to improve facilities for the many users and stakeholders of the site. This included improving elderly/disabled access (currently only a steep ramp is available) to the basin and direct bridging from the King's Cross Centre (and so CSM) to the site.

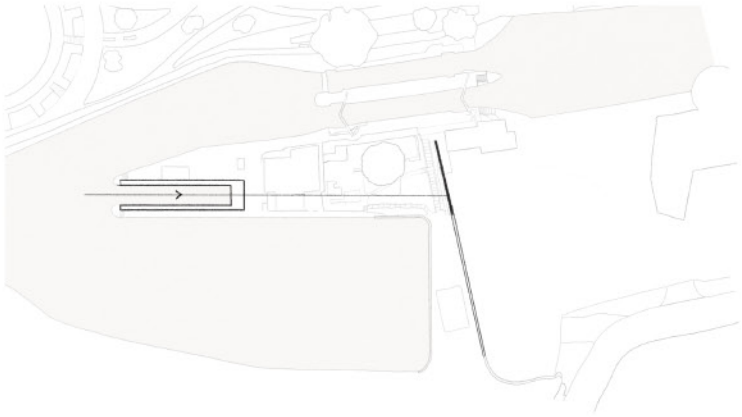


6. Navigating the Level Changes

A small (for a lock) but significant level change of around 1.8 metres separates the North and South of the site. Understanding how to resolve this was challenging but navigated through physical and digital modelling (see p. 135), and most importantly to the project's principles of ***Reform***; historical research. This resulted in finding the exact location, historical significance and dimensions of the covered coal tunnel.

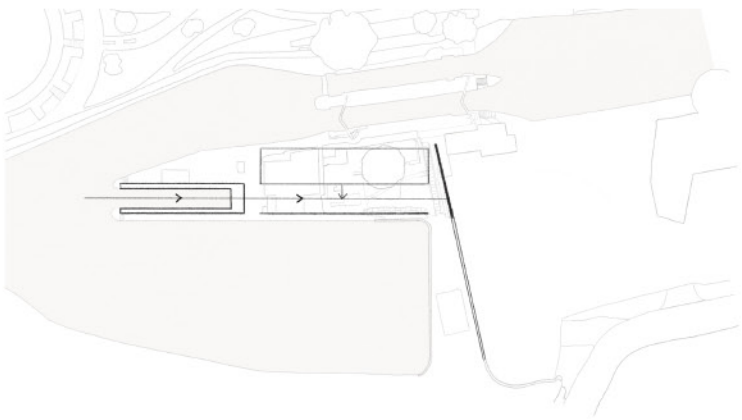
Design Strategy Overview

A summary of key observations, decisions and processes



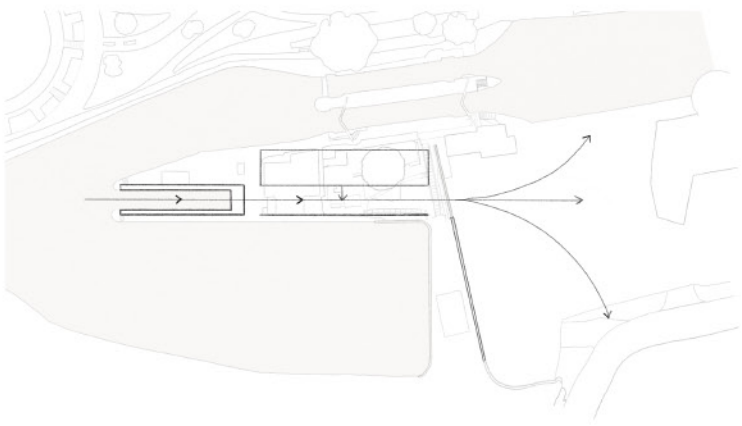
7. Defining the Datum

Integration of the Dry Dock to facilitate the canal network (see p. 53) as an initial concept of ***Reform*** rationalised it as the main axis to anchor the movement of construction materials, workshop materials and people.



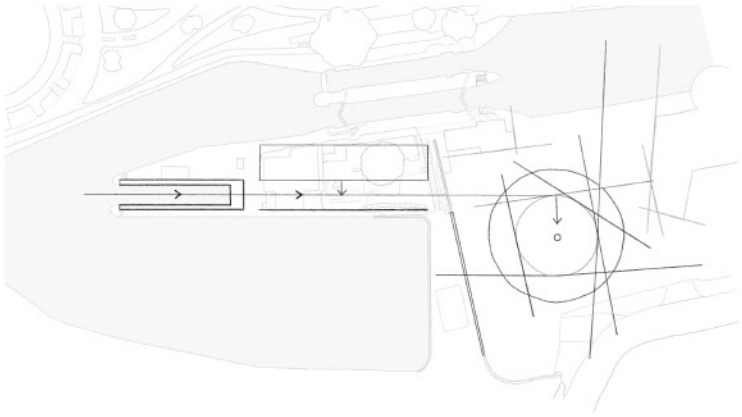
8. Adding to the Axis

A workshop block feeds off this movement of product and people, creating the first corridor. Variations of this alignment (i.e. through the block and to the East of it was also explored). However the corridor is stopped in each iteration by the wall's remains and the changes in level — breaking the circulation from North–South of the site.



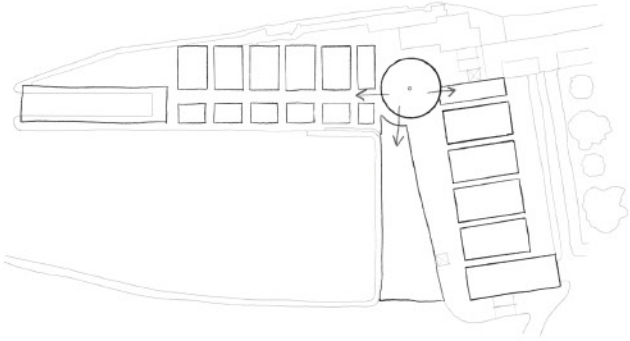
9. Partially Removing the Wall

Upon removing the walls, the datum meets the undefined space created by the Wall, Lock Cottage and Camley Street Nature Reserve. At this stage I began exploring how the campus could grow beyond this axis. Whether it enveloped or sat adjacent to the wall, if it integrated the Waterpoint or not, and how it interacted with the Lock Cottage — is the RDC-PTC its new neighbour?



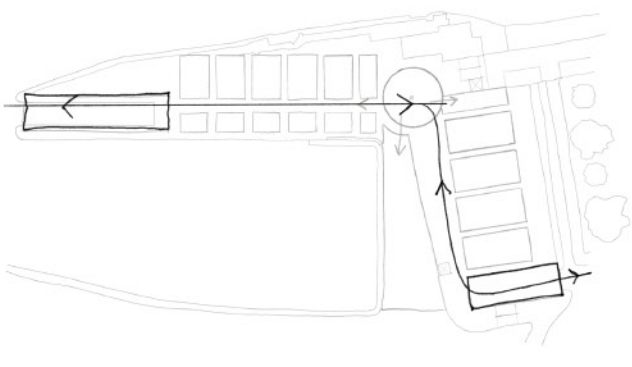
10. Creating a Focal Point

In its abundance of possible parallel faces, it is best resolved by having none — and so the location of The Centre was rationalised and the precedent for circular heritage buildings in Camden was equally motivational in this decision e.g. The Rotunda (p. 16), Roundhouse (a performance space) and the Gasholders opposite the site.



11. A Radial Plan

Pivoting from The Centre, the course programme (p. 7) defined the groups and units of the modules in Year 1 and Year 2; as well as the need for individual tutor workshops which permanently house the work of these craftspeople. Each unit became defined by streets and corridors, and the existing wall and new bridge fed into this mew.



12. Process as Plan – Plan as Process

The functionality of the RDC-PTC was essential from the beginning at all levels of design (e.g. from equipment spacing, p. 122; to ventilation systems p.124). At a macroscopic level, the induction of the Dry Dock became the starting point of the piano making process and the R&D centre management as a whole.

While the change in levels illustrated that the site was still somewhat divided, it could be re-utilised to improve the operational performance of the site. By having two delivery points from two separate sources of transport (canal and road), the site became increasingly flexible in managing the import and export of materials — in addition to immediately supplying the two separate Y1 and Y2 blocks with material storage (and plant).

Design Strategy Overview

A summary of key observations, decisions and processes

RDC-PTC Overview

Processes in Parallel

The movement of product and people is consistent throughout the history of King's Cross — shaped by their changing demands over time, and so this continues to be reflected in the RDC-PTC.

The Piano

1 Dry Dock
Material Supply

2 Solar Kiln and
Lumber Yard

3 Piano Workshops

G Piano Workshop Access
(limited)

F The Waterpoint

See Figure 3.3 (altered)

4 Y2 Studios

5 Tuning Rooms

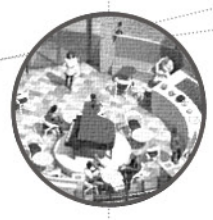
6 The Piano Corridor

7

8 The Scale del Pianoforte

9 The Waterpoint

10



E The Scale del Pianoforte

D Workshop / Gallery Balcony

C The Street

B The Centre

A CRT Museum

The Public

Plan oF

Y1/ Tutor Workshops and Landscaping

The lowest floor of the scheme is defined by the Y1 module facilities and the landscaped boundary between the RDC-PTC, Camley Street Nature Reserve and lower Regent's Canal.

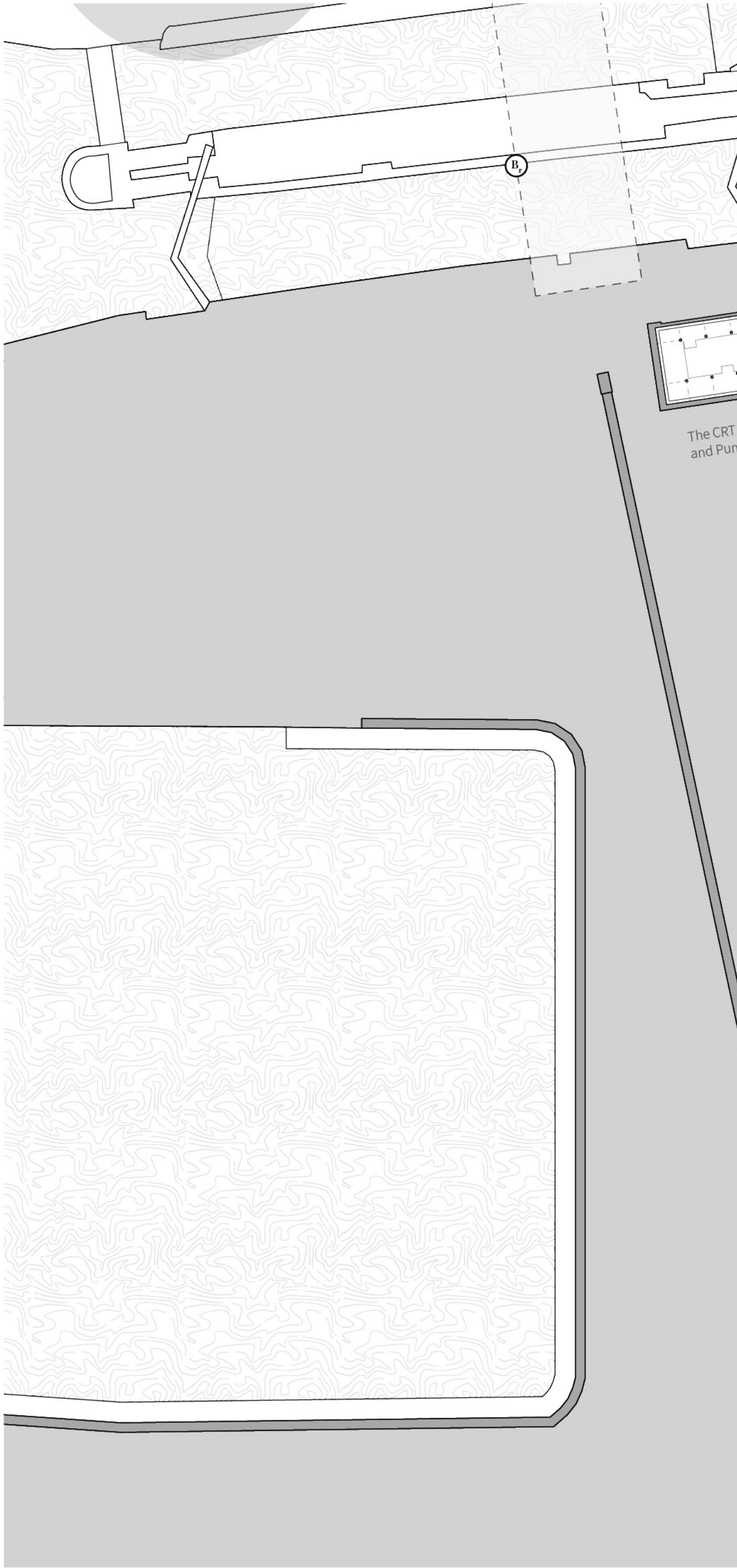
V. A visiting tutor returns to her bike

Key

1. Water Source Heatpump
2. Water Storage (all types)
3. Museum Floor
4. Goods Lift
5. Year 1 Workshop Yard
6. Preparation and Deliveries Room
7. Below-Street Piping Access
8. Lift Shaft
9. Bicycle Storage (Covered and Uncovered)
10. Wayfinding
11. The Third Street — seat access designed for disabled people
12. Public Park (shared with CSNR)
13. Stair and lift access to the retail street

1:200 A3

0 1 2 3 4 5 10 m




Museum
np House
Textiles
Ceramics and Polymers
Metallurgy
Timber Workshop
CSNR
Camley Street
36
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13
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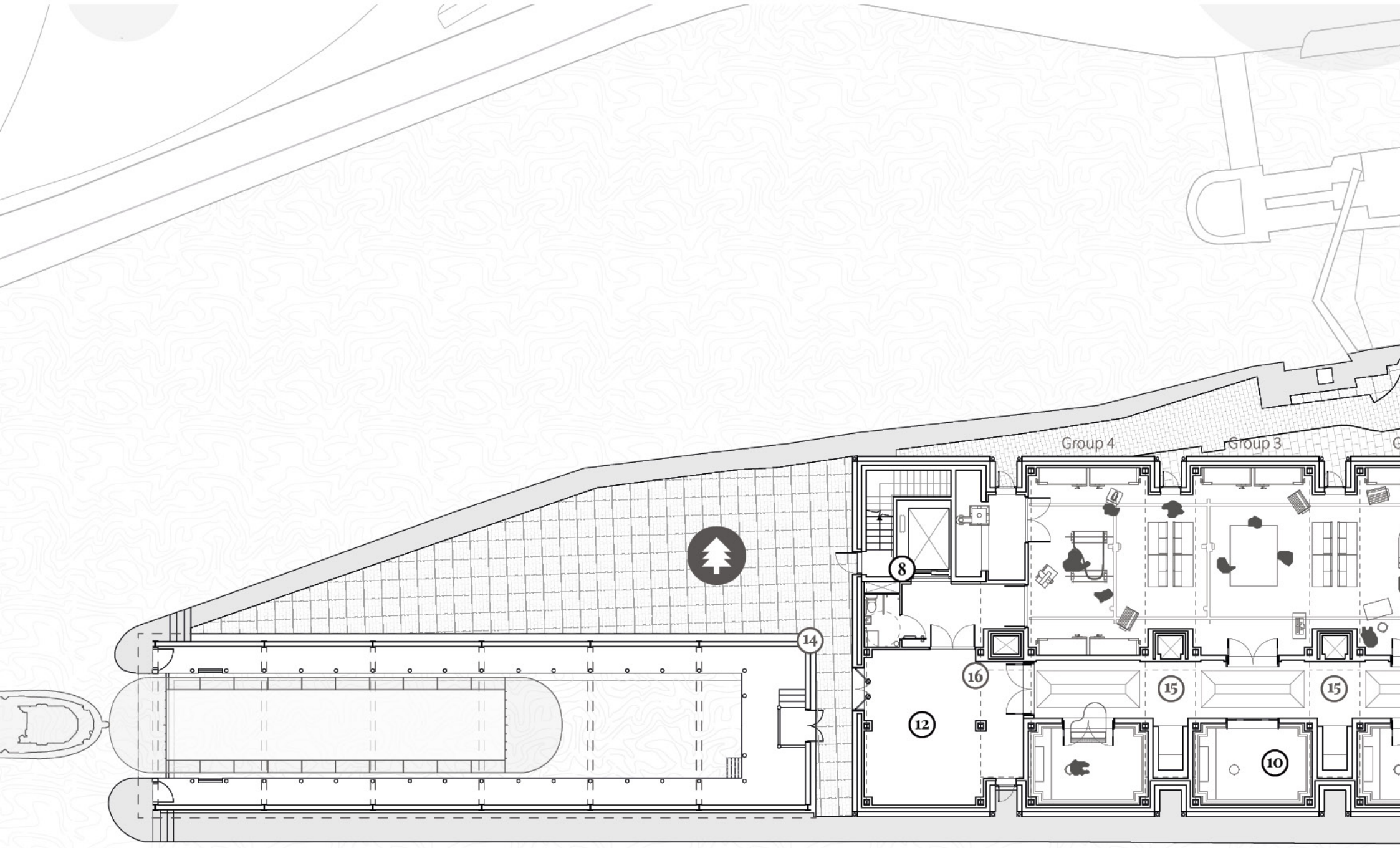


The Year 2 Block

Plan 1F

Y2 / Workshops and Public Realm

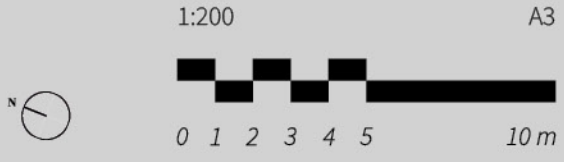
Plan 1F is the primary access floor for the RDC-PTC, with it providing direct access from Central St Martins. The sprawling site has a diverse range of typologies, and notably the existing Dry Dock and Lock Cottage (now retrofitted into a CRT museum, as indicated by the dark grey fill).

Key

1. The CRT Museum Display Balcony
2. The Centre Café
3. The Scale del Pianoforte (The Piano Stairs Gallery)
4. Security Access for Students/Tutors
5. Reception and Security
6. The Retail Street / Industrial Mew — the weekend displays have a dedicated space for each tutor.
7. The Tunnel / Secure Basin Access
8. Goods Lift
9. Retail Gallery Balcony
10. Tuning Rooms
11. Year 2 Piano Workshops
12. Plant and Delivery Storage
13. Lift to Waterpoint
14. The Dry Dock
15. Naturally Ventilated Chimney
16. Mechanical Chimney

The Lumber Yard and Solar Kiln

B_r The New Bridge (a separate project workstream)




Br
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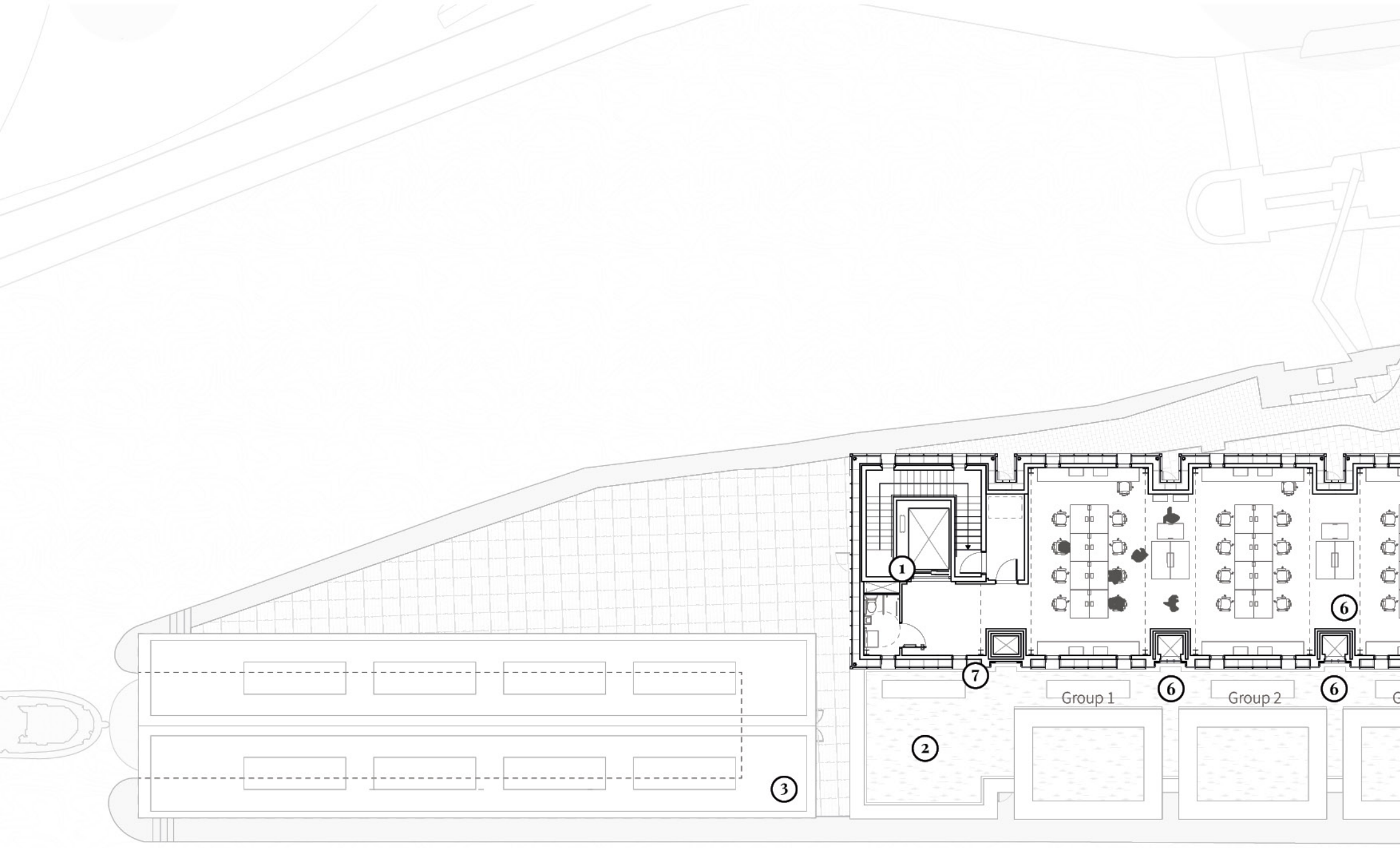
13
15
Group 2
Group 1
The Centre
The Year 1 Block
Textiles
Ceramics and Polymers
Metallurgy
Timber Workshop
38



The Year 2 Block

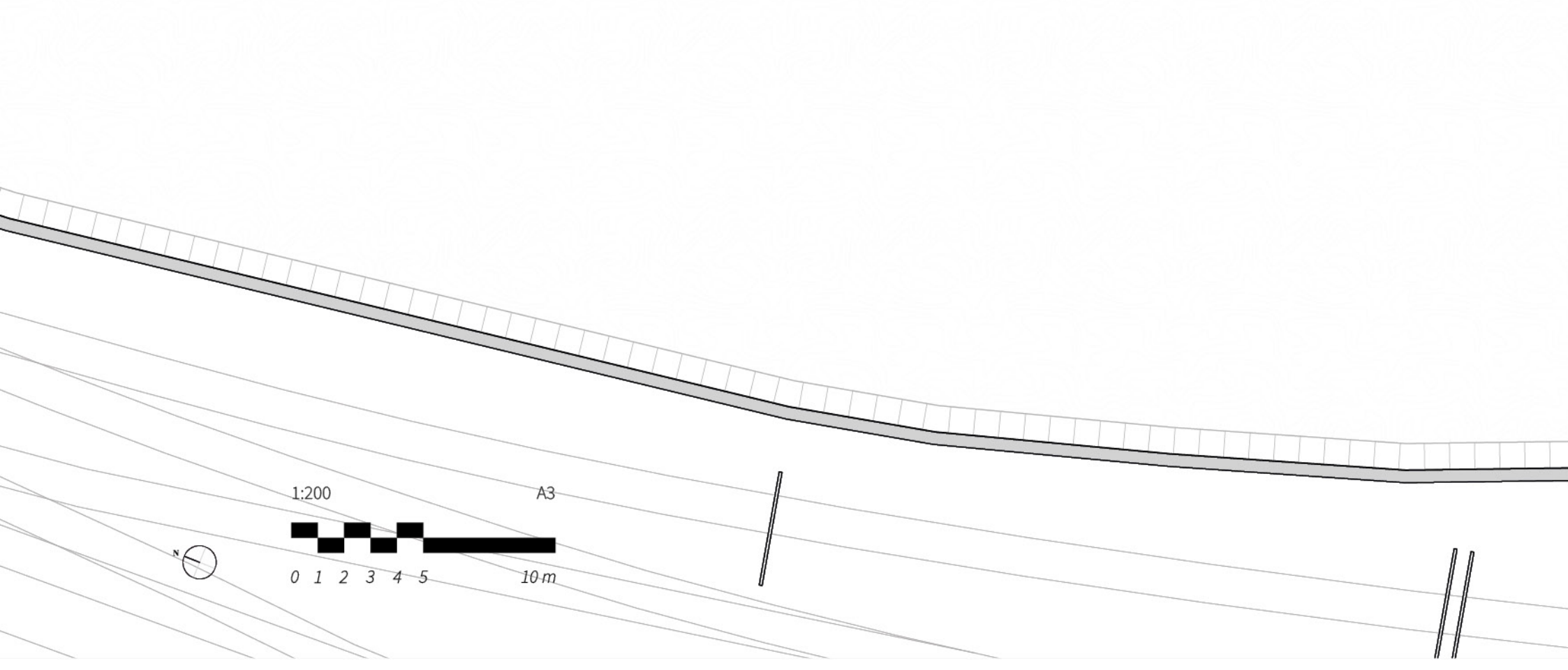
Plan 2F

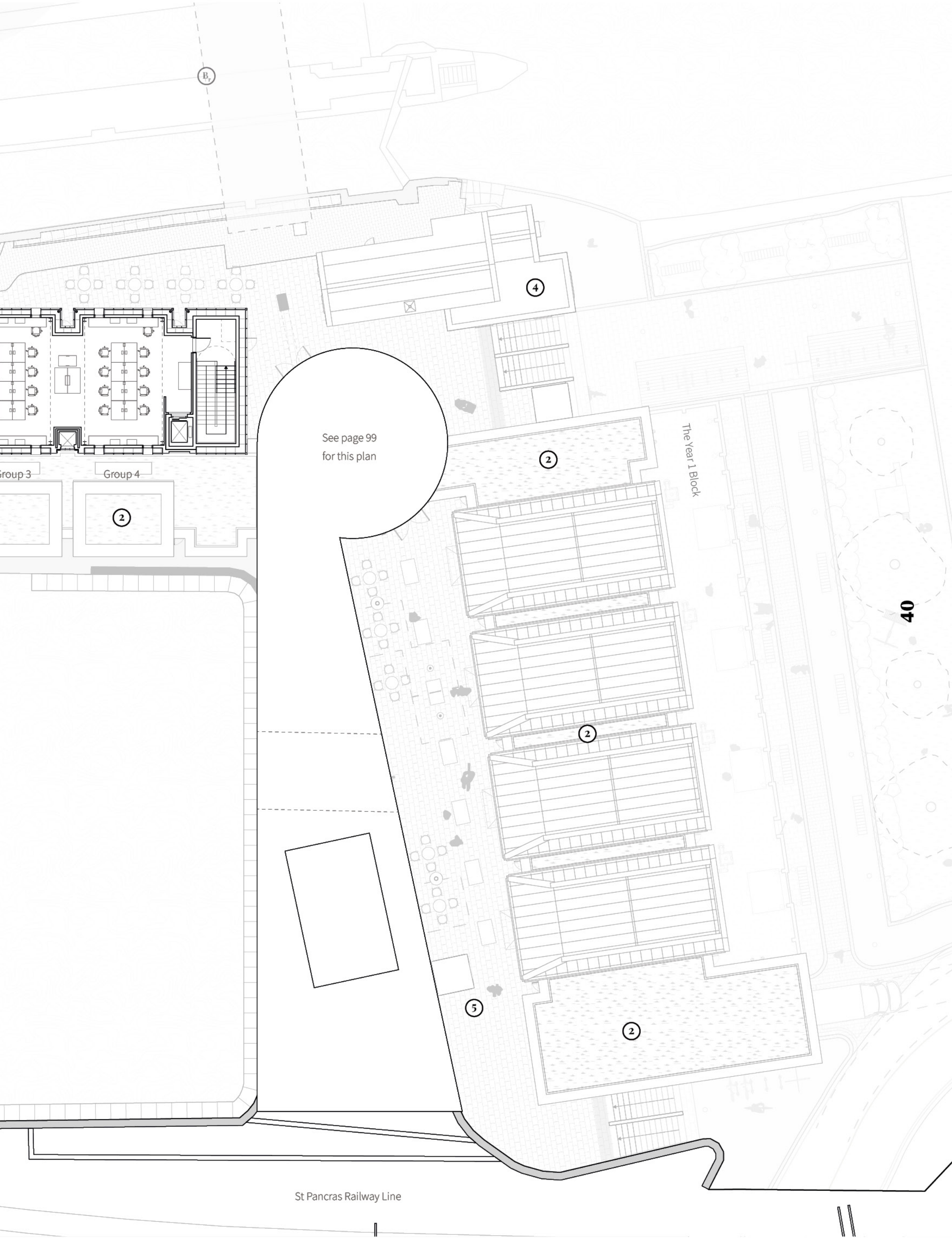
Y2 / Studios

The Year 2 studios provide vistas across King's Cross Central, while being isolated from the noisy St Pancras Railway Line, the workshops below and the retail opposite. The RDC-PTC's green roof provides the students with a light biodiverse scene that compliments the CSNR and improves wellbeing.

Key

1. Goods Lift
2. Green Roofs
3. Dry Dock Roof
4. Lock Cottage Roof
5. Lift Top
6. Naturally Ventilated Chimney
7. Mechanical Chimney



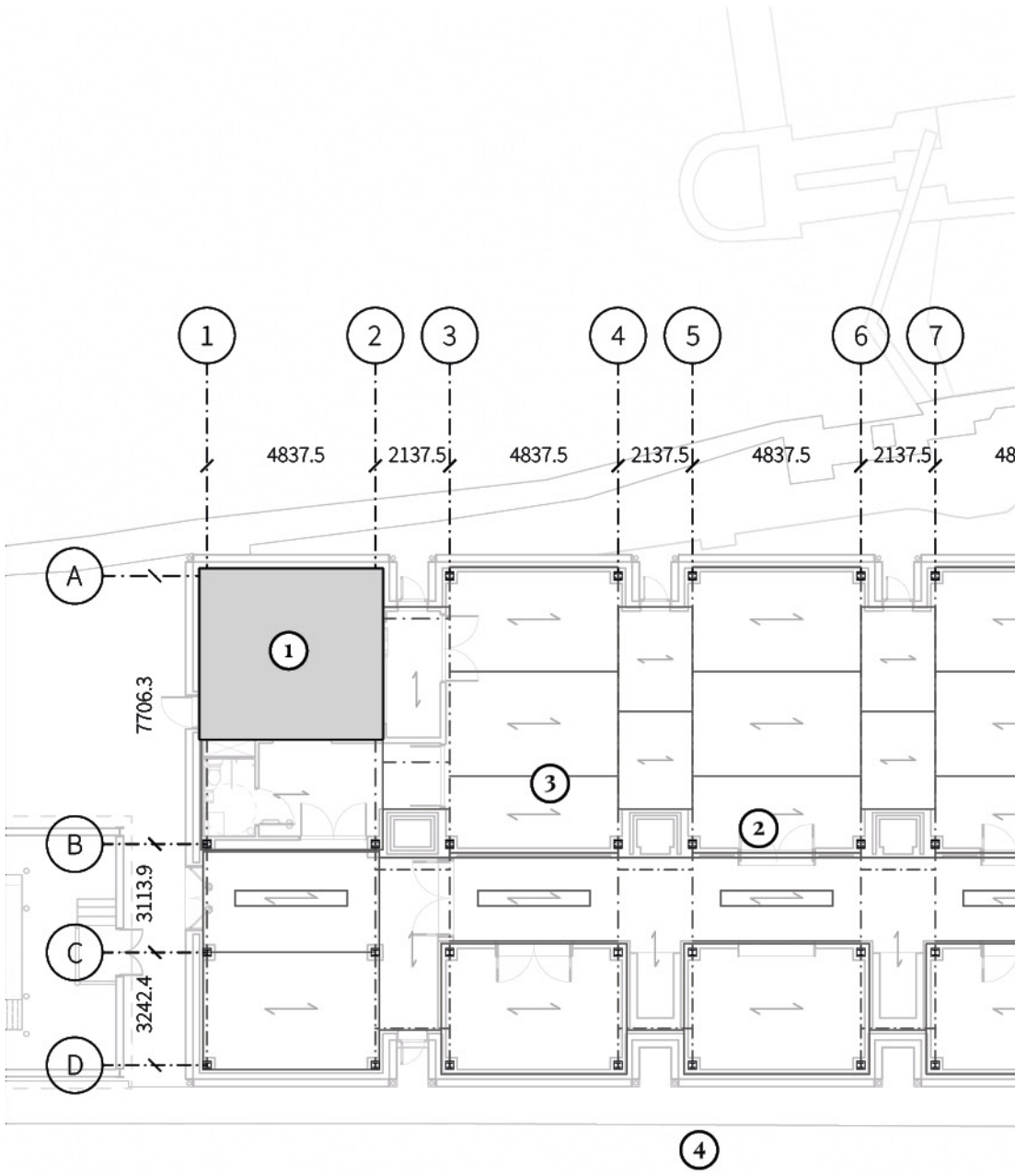

B$_r$
4
Group 3
Group 4
2
See page 99
for this plan
2
The Year 1 Block
40
2
5
2
St Pancras Railway Line

Act 5

An Interlude

The Sonority of Structure

Looking up at the Spoke Wheel Ceiling



Structural Plan

Overview of Structure, Spans and Systems

A variety of steel frame systems are utilised throughout the building. This includes the following:

1. Year 2 Piano Workshops, Studios and Tuning Rooms

A series of individual primary steel frames (similar to a portal frame) that are tied together by a CLT diaphragm and cores (in grey).

2. The Centre

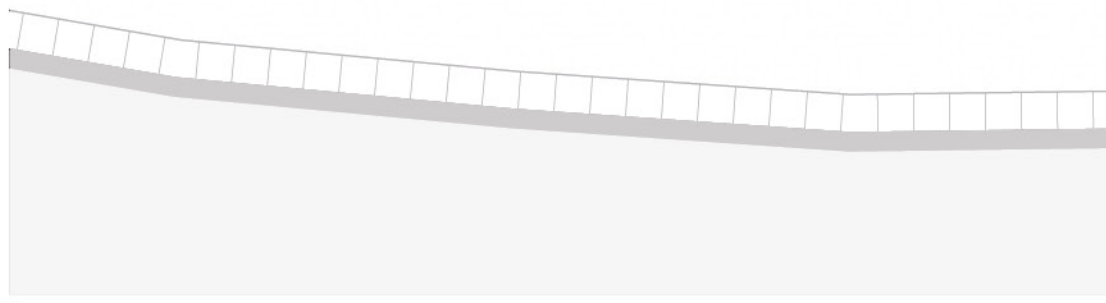
A spoke wheel radial plan comprising of an array of CHS steel columns with EA plated beam elements tied together with cross bracing, and an outer tension ring and inner compression ring (see above render).
This was greatly inspired by *David Mellor's Cutlery Factory.*

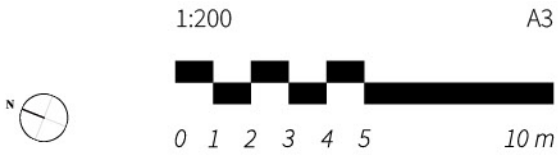
3. Year 1 Tutor Workshops

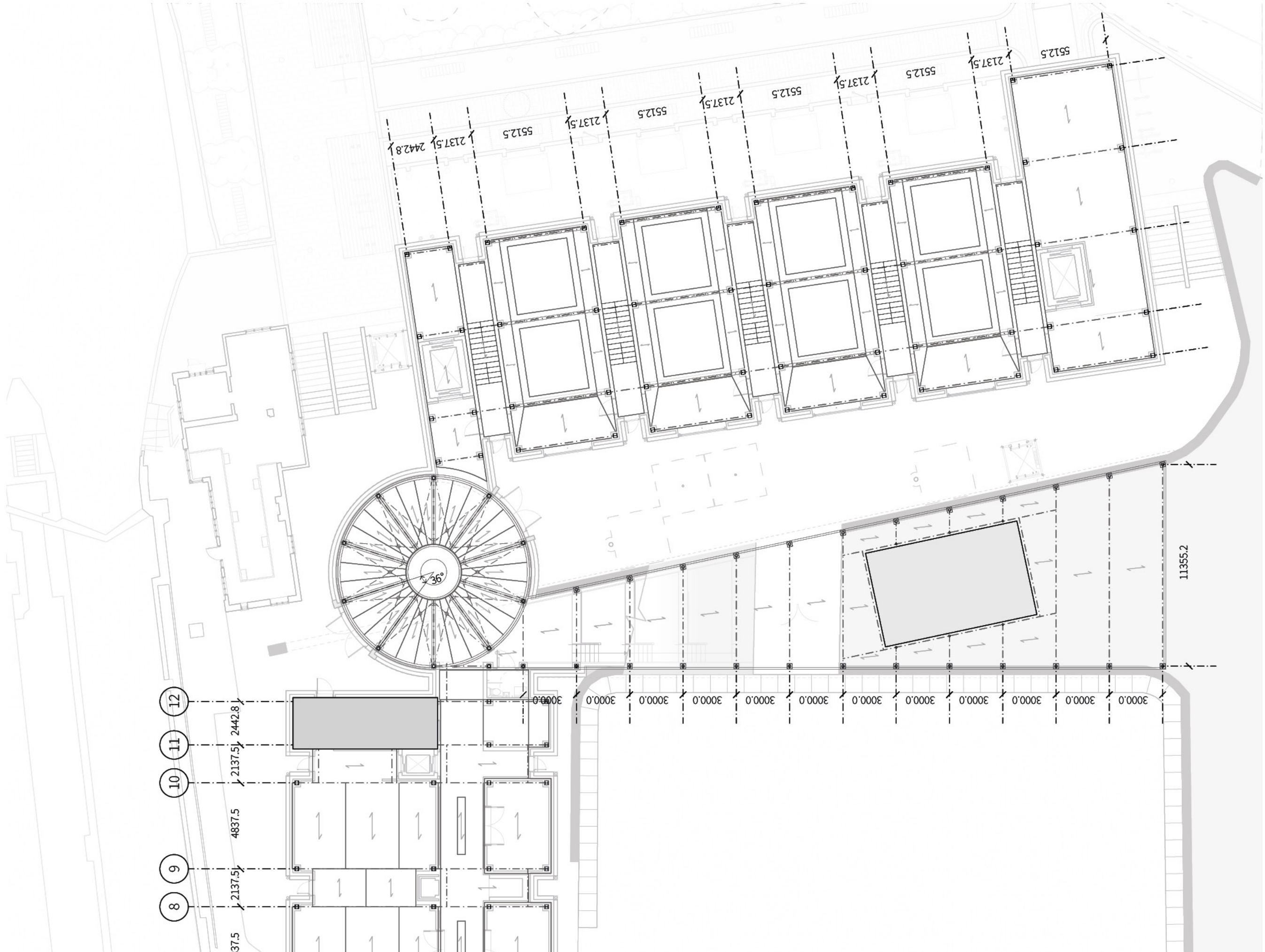
Mansard-esq Pratt trusses run along the shortened length of the tutor workshops and with CLT-boxed upstands to create the unique roof form and skylight.

4. The Scale del Pianoforte (Gallery)

CHS columns sit between the retrofitted weathered wall, with I-beams running along its varying widths at equally varying depths. Minimising steel to only its structurally-efficient depth, reducing embodied carbon.



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2442.8
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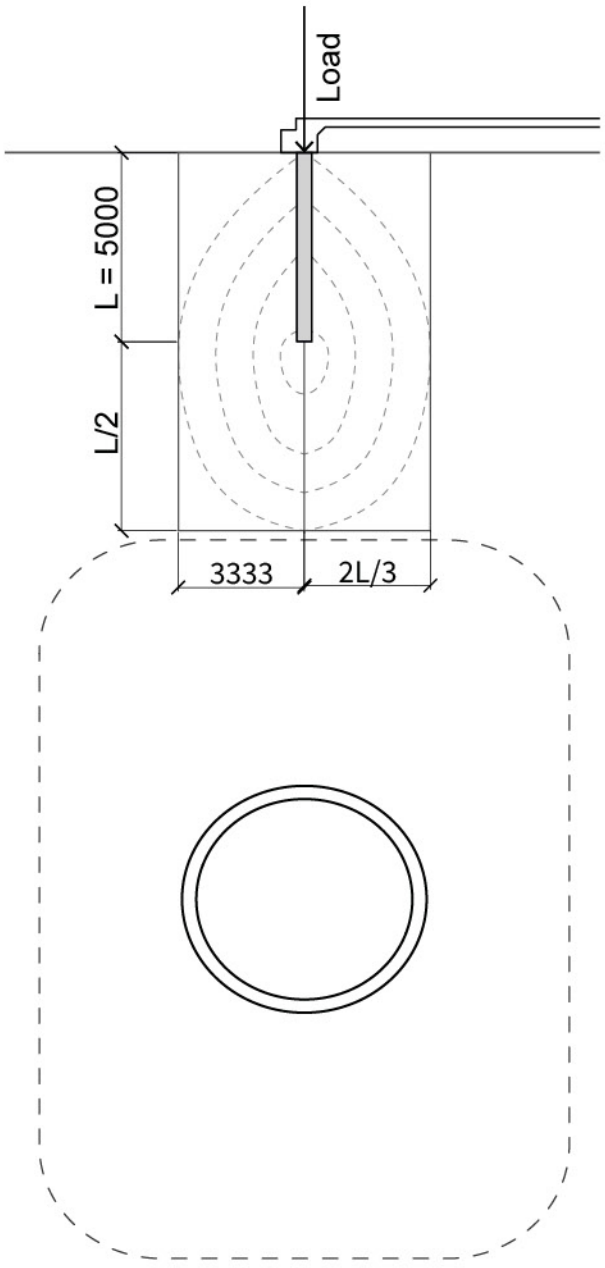
4837.5
2137.5
2137.5
36°
11355.2
3000.0
512.5
2137.5
244.8

Foundation Type
Rafts and CFA Piles (continuous flight auger)
Build-up / Max. No. Storeys
2
Justification
Low noise-levels — reduced impact to neighbouring canal boats, reduced disturbance to wildlife at CSNR
Quick construction vs. bored piles — better facilitating material supply during construction and for workshops
Suitable for the silt-gravel-sand-clay conditions
Suitable for high water table areas
References
See Piling (2023)



Pressure bulb for CFA (friction-based) piles and their proximity to the Thameslink Southbound at A

$$S = 3.5d + 0.02L$$

Pile Spacing = 3.5*Diameter + 0.02 Pile Length

$$S = 1520 = 3.5(400) + 0.02(6000)$$

Pile Spacing — based on maximum length at the Y2 Workshops

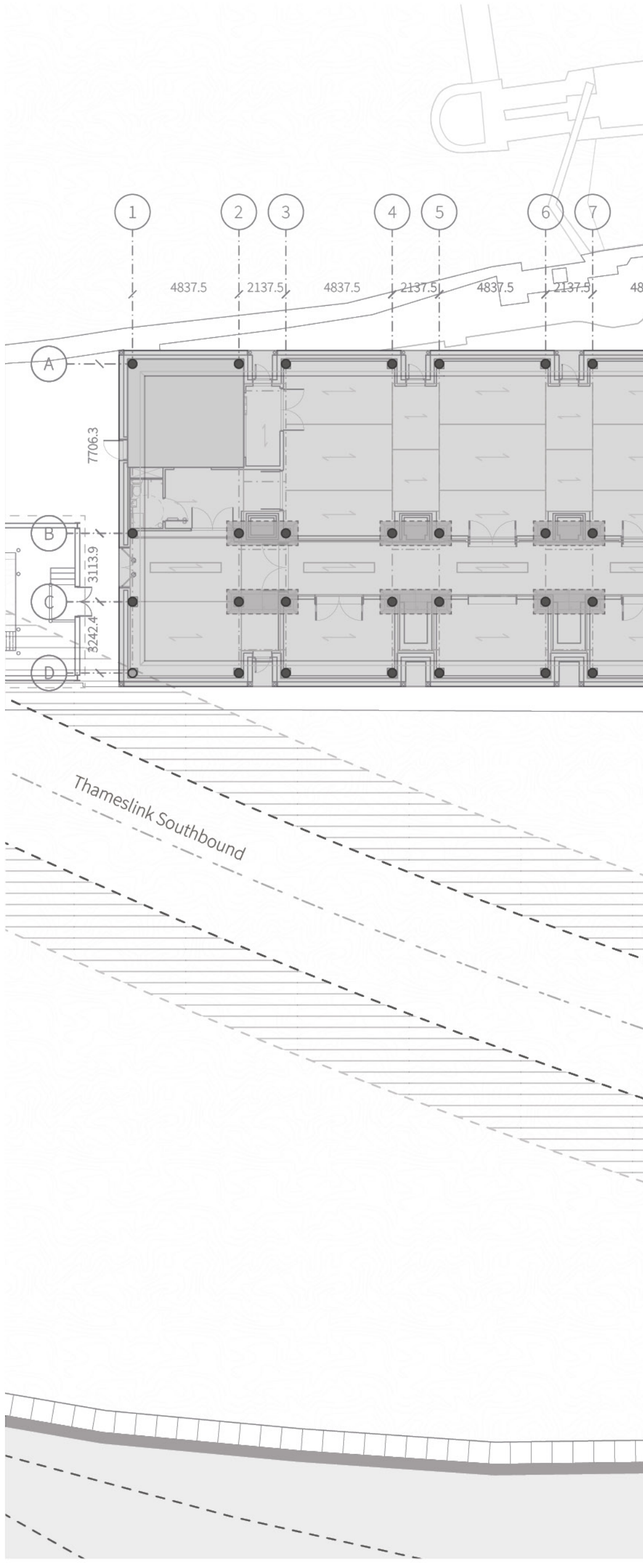
Plan FF

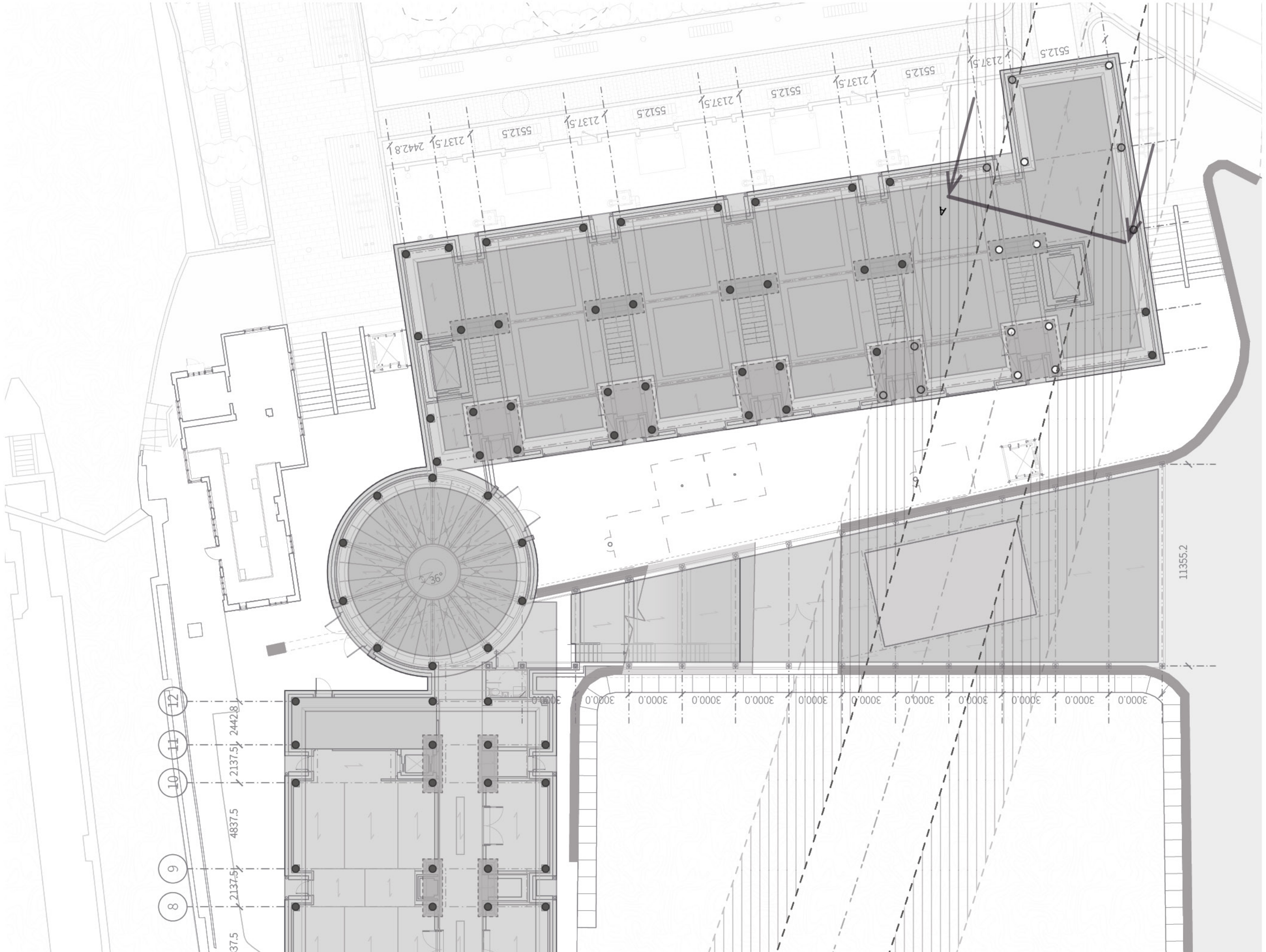
Foundation Design and the Thameslink Tunnel

The foundations have been thought through in-depth due to the complexity of above-tunnel design and their significant contribution to embodied carbon in research-based buildings.

1:200 A3

0 1 2 3 4 5 10 m




A
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3000.0
2137.5
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4837.5
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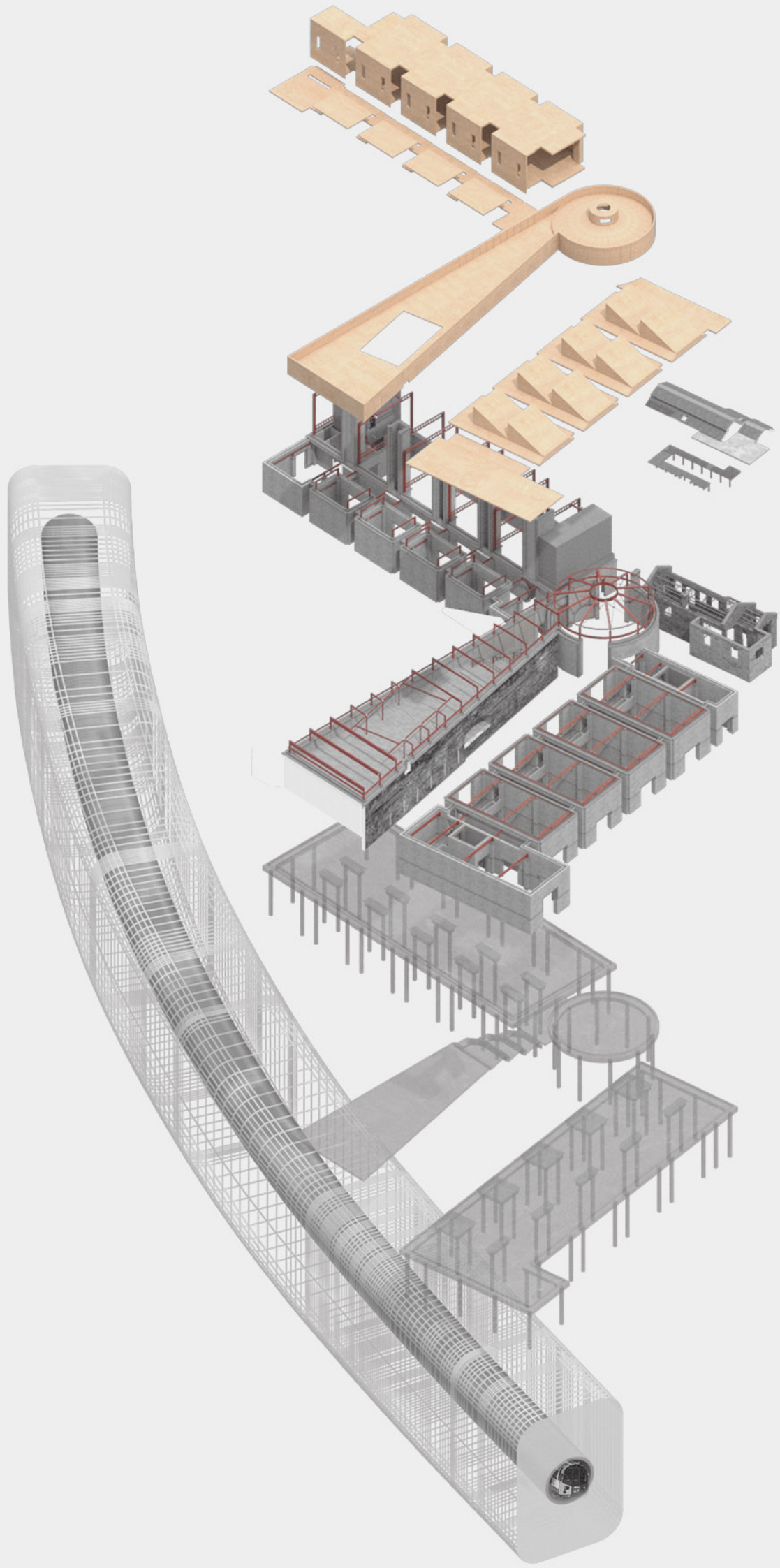
8

Construction Summary

Primary and Secondary Structure



CLT System
Primary and Secondary

CLT Cores
Primary

Westok Beams*
Primary

Fink Truss
(existing)
Foundations

Inverted Steel Spoke Wheel*
Primary

Steel Pratt Truss*
Primary

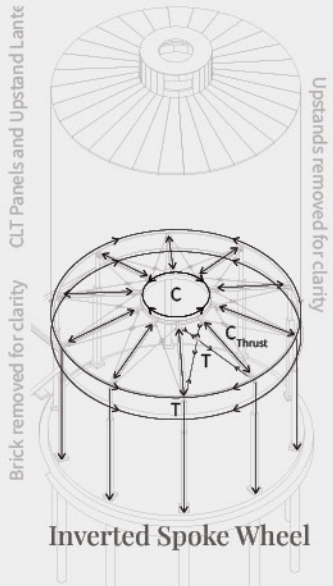
*Secondary steel systems are minimised and replaced with CLT

Simple Lightweight Slab
(retrofit)
Foundations

Piled CFA Raft
(main)
Foundations

Thameslink Southbound and Exclusion Zone
Foundations

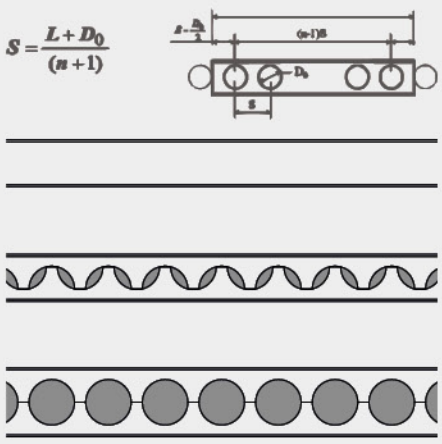
A hybrid steel-based structure that integrates both CLT and brick into its construction, as inspired by *The Rotunda* (see pt. 10 on page 16.) and the use of steel within the context, i.e. the Gasholders, St Pancras Railway Line and the Coal Drops Yard.



Inverted Spoke Wheel

An inner compression ring supports a CLT lantern which contains ventilation grilles and a central skylight positioned to direct light around The Centre's central display.

Two tension rings are formed from equal angles that follow the perimeter. These provide further support to the CLT upstands and roof panels.



Westok Beams

The formula shown above was used to design the beams in the RDC-PTC.

Westok beams are used to aid the complex ceiling system that supports the piano workshops.

In conjunction with the CLT slabs, they support the following:

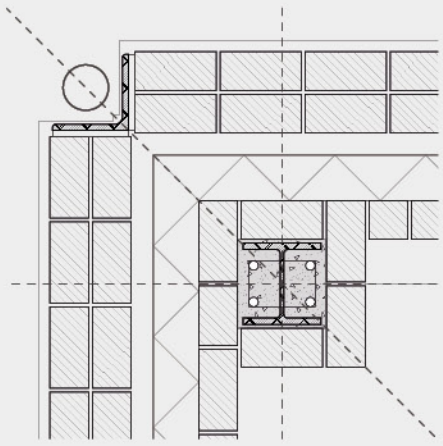
A. Gantry
B. Lighting
C. Hoists
D. Sprinkler System
E. LEV
F. Fresh Air Supply

CLT System

The CLT floor acts as a primary spanning diaphragm, transferring lateral loads (mainly wind) directly to the columns and via the Westok beams.

It is designed to withstand substantial live load from suspended elements (e.g. gantry, piano parts, LEV, sprinkler system, lighting etc.) and as described in detail on page 130, further oversized to act as a compartment floor.

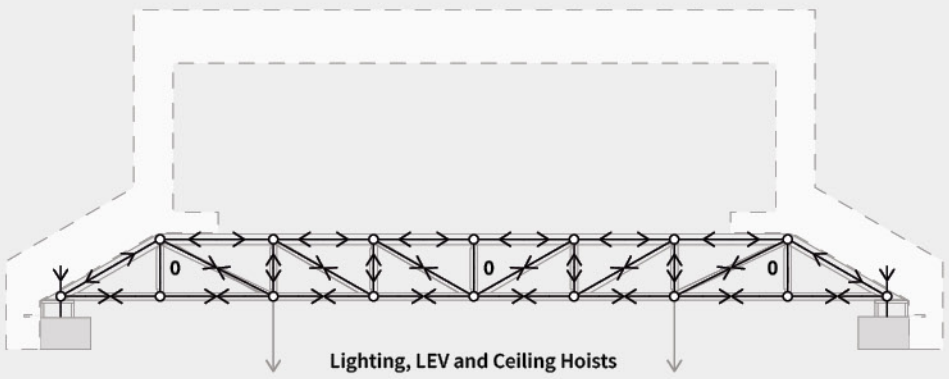
Each panel is dimensioned according to HGV logistics on page 56 i.e. a maximum CLT panel height of 3 m and length of 15 m (n.b. no panel is this long).



Steel Columns 1:20

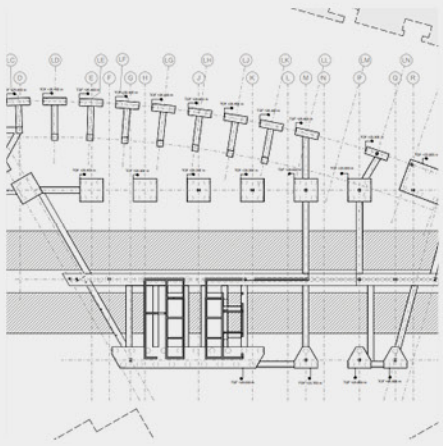
Columns are designed to be smaller by being reinforced with concrete and rebar, which is then capped off.

Lower grade, recycled steel can therefore be utilised to a much higher load bearing capacity — reducing the embodied carbon per load.



Steel Pratt Truss 1:50

A simple girder-styled Pratt truss spans between the workshops, supporting the LEV system, lighting and any hoists – emulating the St Pancras Railway girders (used to suspend OHLE) that run adjacent to the site.



Local Precedent Figure 5.1

King's Cross Central S3—S5

Developments S3–S5 in King's Cross are built on top of the Thameslink Tunnels. In building S3 (see above) by AHMM, they use pile foundations and ground beams that cross over the existing tunnel. Discussions with engineers on these projects highlighted the complexity of above-tunnel construction e.g. use of jacked piles, mini-piles, etc.

Local Precedent

Railway Trusses and OHLE Catenary

Heavily plated trusses are seen throughout the site and in British railway architecture more generally. Their proximity to and visibility from the Y1/Tutor Workshop's skylights rationalised their use for its structure.

Local Precedent Figure 5.2

The Lost Viaduct 1800s

Plimsoll's

The former Plimsoll Coal Drops that existed on the site was connected to the (today's) Coal Drops Yard via a plated double-intersection Pratt truss which has since been demolished (pictured).

Working Values

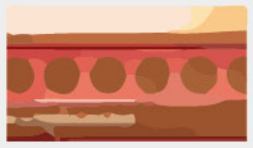
Concrete	0.12
(ρ, kg/m³)	2380
CLT	-1.2
(ρ, kg/m³)	480
SlimDek-type flooring	-
(kgCO2e/m2)	~150
Brick	0.25
(ρ, kg/m³)	1900
Reclaimed Brick	0.0027
(ρ, kg/m³)	1900
Rebar	1.99
(ρ, kg/m³)	7800
Recycled Steel	0.8
(ρ, kg/m³)	7800
Virgin Steel (worst-case)	2.8
(ρ, kg/m³)	7800

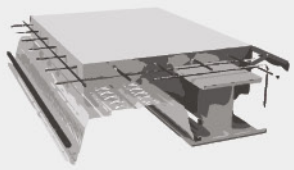
Figure 5.3

Typology Precedent
Glyndebourne Production Hub

Nicholas Hare

A hybrid CLT and Steel structure that achieved a BREEAM rating of Excellent as a low-carbon workshop and research-based facility.





(Per Bay) CLT Primary Diaphragm vs. Secondary Steel System

Calculated relative to the primary steel frame system shown and with the same floor build-up

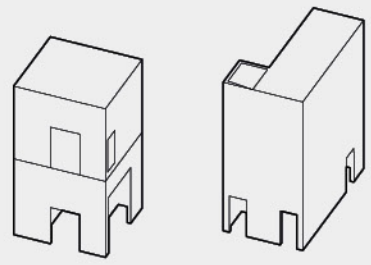
CLT Primary Diaphragm

Volume (m³)	20
CLT Quantity (t)	250
Total CLT EC (tkgCO2e)	30

SlimDek-Styled Concrete-Steel Floor

Area (m²)	82
Total EC (tkgCO2e)	12.3
Relative Carbon Reduction (tkgCO2e, incl. seq.)	24

The use of CLT flooring for a primary structural solution helps reduce the carbon impact of the total steel frame.



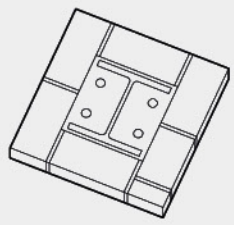
Concrete Core vs. CLT Cores

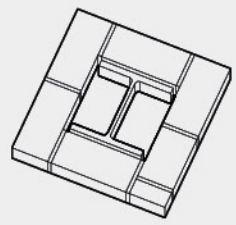
Volume (m³)	105
Concrete Quantity (t)	250
Total Concrete EC (tkgCO2e)	30
CLT Quantity (t)	50
Total CLT EC (tkgCO2e)	-61
Relative Carbon Reduction (tkgCO2e, incl. seq.)	91

Additionally, by eliminating any monolithic concrete construction beyond the foundations, the concrete contractor has minimal involvement / will not need to return later on.

Sequestered carbon via the CLT cores can account for a 30% increase in the A1–A5 allowance in the service spaces (see page 8).

These cores provide cross bracing to the steel structure at either end of the piano workshops, transferring lateral forces from the frame to the foundation.





Reinforced Recycled Steel Columns w/ 20% Reclaimed Brick vs. New Steel Columns w/ No Rebar or Concrete

Calculated per metre of bricked column, see the diagram above

Brick Volume (m³) (1 brick height used, 65 mm)	0.0089	*Brick Volume (m³) (1 brick height used, 65 mm)*	0.0089
Steel Volume (m³)	0.00013	*Steel Volume (m³) (assumes the same volume for this calculation though will likely be greater)*	0.00013
Steel Rebar Volume (m³)	0.0028		
Concrete Volume (m³)	0.00059		
Total EC (kgCO2e)	9.89	*Total EC (kgCO2e)*	16.3
Area (m²)	0.19	*Area (m²)*	0.19
Total EC/m (kgCO2e/m)	52	*Total EC/m (kgCO2e/m)*	86

Overall resulting in at least a 60% embodied carbon reduction for each column /m.
By being cast into the masonry column, the brick walls can provide some additional lateral stability to the frame — acting as a bracing.

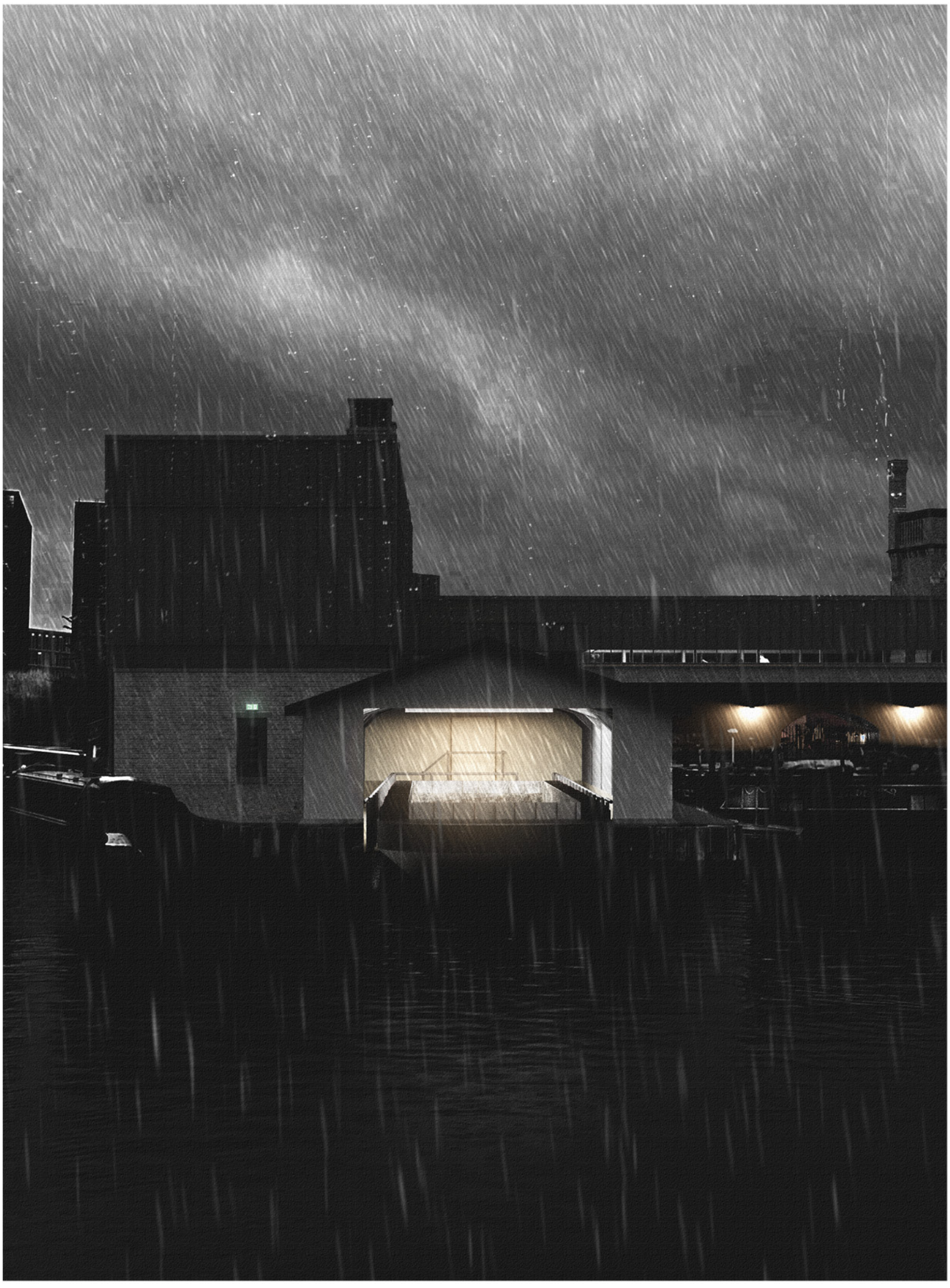
Hybrid structures can allow for greater flexibility in material-choices, and so the assignment of low-to-high embodied carbon materials optimally in order to reduce the building's footprint. These are some structure-based examples.

To compare with the data used in these calculations, please look at the following source, Bath (2019), and any branching sources recommended within its spreadsheet.

Act 6

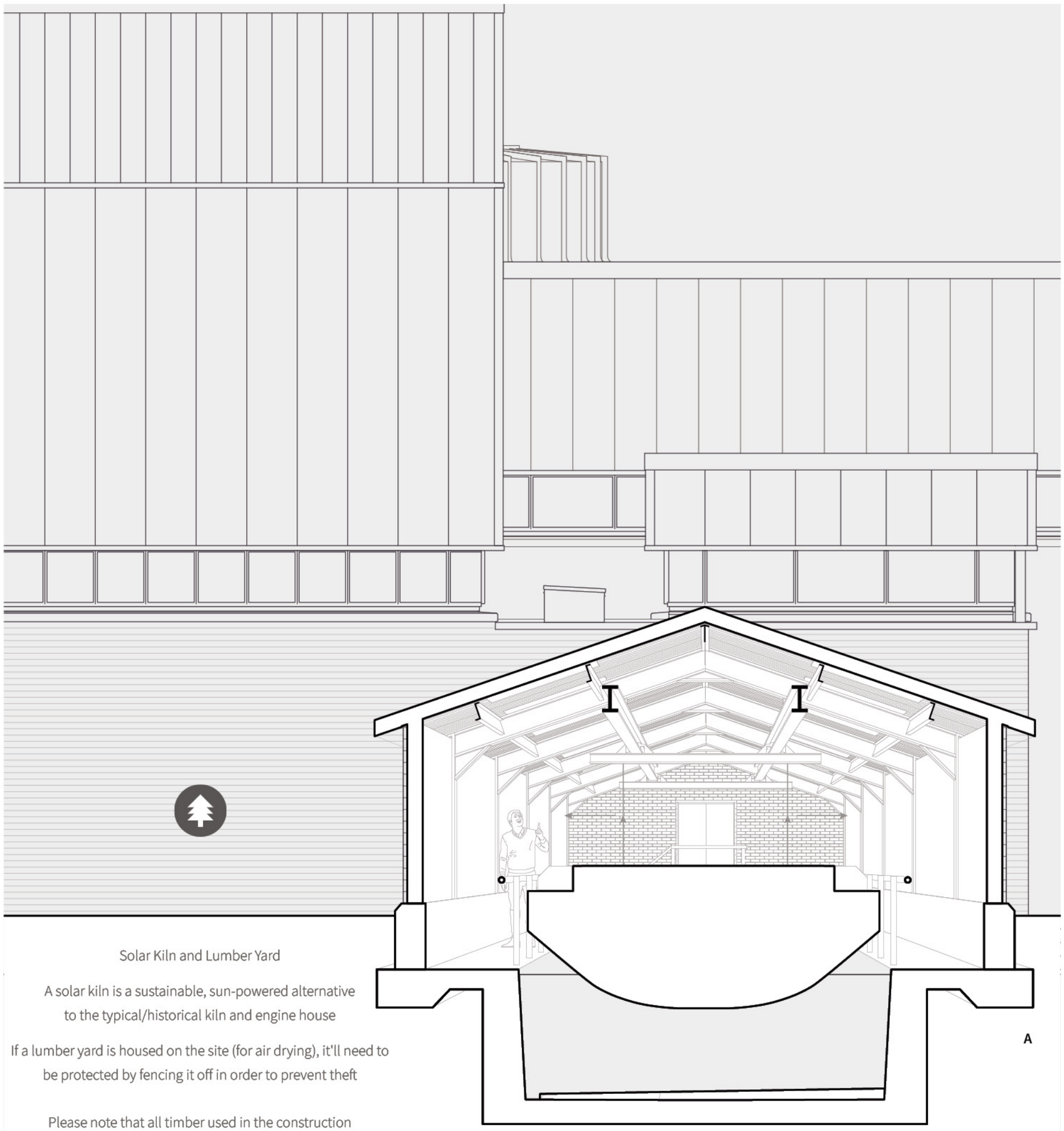
The Overture

The Dry Dock



Delivery to the Dry Dock

A late order of supplies arrive at the CSM's / SPCC's during a
wet and cold Tuesday night in King's Cross (a view from Tapestry Building)



Solar Kiln and Lumber Yard

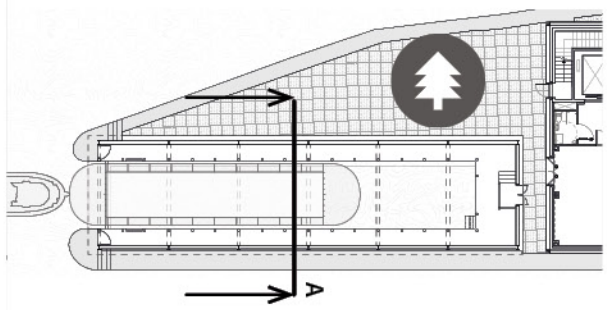
A solar kiln is a sustainable, sun-powered alternative to the typical/historical kiln and engine house

If a lumber yard is housed on the site (for air drying), it'll need to be protected by fencing it off in order to prevent theft

Please note that all timber used in the construction of the RDC-PTC and stored for the workshops will be Forestry Stewardship Council (FSC) certified

St Pancras Dry Dock

Retaining existing infrastructure and re-using it in an act of ***Reform***ing the Regent Canal's material supply network



1:500 A3

5 10 15 20 25 m

1:50 A3

0 0.5 1.0 2.0 m

New and Existing Infrastructure

The Solar Kiln, Lumber Yard and St Pancras Dry Dock

Regent's Canal *Reform*ed

The Canal Network

Pianos, piano parts and building materials such as bricks, timber and steel were once transported via London's inland waterways — as enabled by the many Wharves, Docks and Basins constituting the distinctive canal-side industrial grain, for example: *Dingwall's Wharf's* softwood stores (see plans below) (Camden, 2008).

Figure 6.1, Coal Barges to Horses at St Pancras Basin

Period	Trade (t/yr)
1830	0.5 m
1850	1.0 m
1870	1.4 m
– WW1	1.0 m
– WW2	-
1960s	Ends

Canal Trade

Figure 6.2

A greater dependency on rail freight (ibid.), post-industrial change and Two World Wars (see figure 6.2) saw the canal fall into 'dereliction and decline' (Parry, 2021), shifting from transport network to public cruising.

See figure 6.3, Towpath In-Use (site peninsula to right of picture)

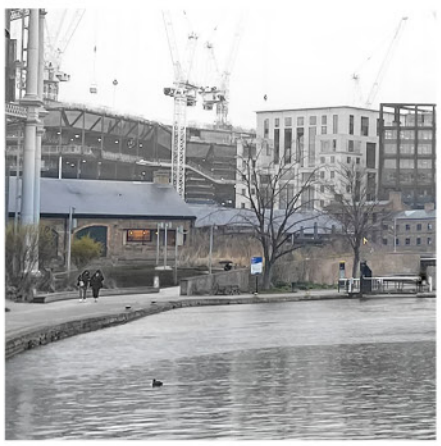
And figure 6.4, Towpath Today (CDY, Coal and Fish Offices, and underpass remain)

Local Precedent

Figure 6.3

A Unique Opportunity

Although there are significantly fewer operational transport facilities, the site's pre-existing (and only city-wide) dry dock, basin and tunnel, as well as an uninterrupted canal-edge offers a unique opportunity to ***Reform*** the network as we enter what Parry (2021) terms a "Green Industrial Revolution" for London's canals. Utilising canal freight to supply materials for both construction and R&D projects.

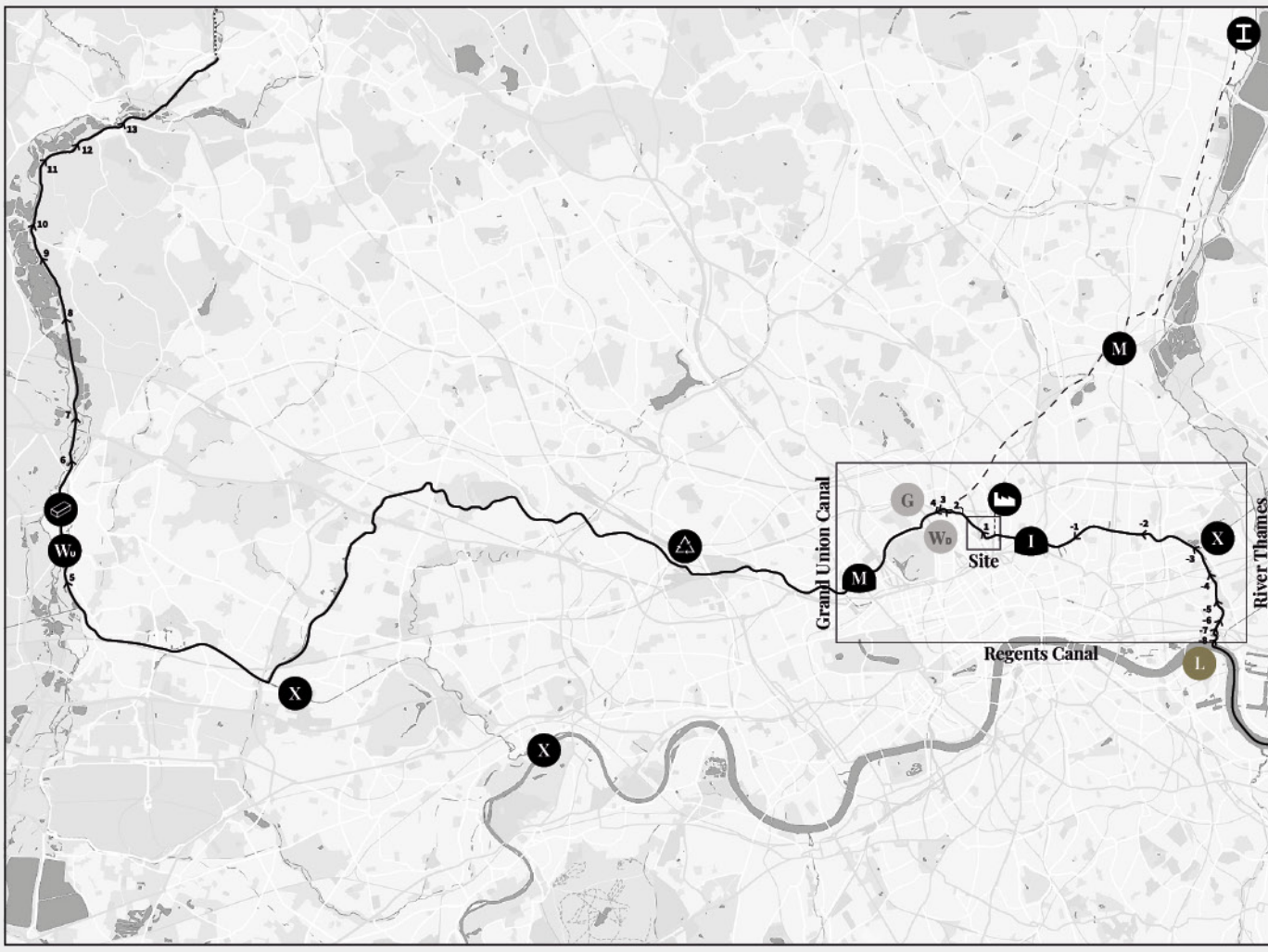


A4 Reduction

Canal freight contributes to only 25% of CO2 emissions (CBOA, 2022b) of the equivalent road haulage, while offering greater storage capacities (in many cases 3–4 times) (CRT, 2022) and the ability to be used as additional storage space on-site where access is limited e.g. at the Dry-Dock end.

For each journey of an 80 t canal barge, a saving of 706 kgCO2e is made.

Logistics Study



National Waterways

N

A3 (Scaled)

Grand Union Canal

River Thames

Local Waterways (*Reformed* / *Historical*)

N

Ww Winkwell Wharf

L Limehouse Basin

DT Tilbury Dock

Wu Uxbridge Wharf

Wd Dingwall's Wharf

G Camden Goods Yard

A Readily Available Network

Adjacent to the *Regent's Canal*, the site is connected to a 3,000 mile long transport network in the form of the *Grand Union Canal (GUC)*.

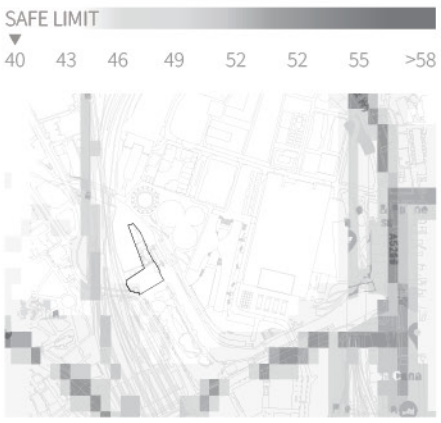
Categorised as *Broad Waterways*, the *GUC* is still authorised for commercial freight due to the minimum width of 4.4 m and the minimal number of locks along the canals (R). The number of locks and tunnels have been noted for each route.

Material Sourcing

Resource	●	<	⬬	Canal Distance to Site (km)	HGV Distance to Site (km)	A4 (kgCO2e)	Reduced /80t Journey	e. HGV Distance to Site (km)
Powerday Waste Reprocess.	△	4	1	10.2	-	25.7	49.0	10.9
H.G. Matthews Brick Maker	▰	33	1	63.6	13.7	191	199	58.4
London Reclaimed Brick	▰	6	1	33.8	2.09	89.9	313	60.4
Robinson Timber Manu.	▲	9	1	41.0	15.3	138	199	59.5
Metalcroft Metalworks	M	-	-	-	7.40	16.8	-	7.40
Cannon Steels	I	-	-	-	18.0	41.0	-	18.0
Cemex Concrete	▬	-	-	-	1.12	2.56	-	1.12
Total Reduction (kgCO2e)							706*	
Conv. Factor (kgCO2e/tkm)				0.028	0.65			

*Minimal savings initially but will increase per journey

Annual NO_2 (µg/m³) Figure 6.4



Air Quality Commitment

KX (an *Urban Island*) is congested with traffic from *Euston Road* and *York Way*. Road transport is 20% of the UK's GHG emissions (CRT, 2022) and the LBC is in an Air Quality Management Area (AQMA) committed to reducing NO_2 and $PM_{10/2.5}$ from vehicles/construction. As freight burns 25% of the amount of diesel (CBOA, 2022a) and can operate with biofuels, it supports a significant step in improving the air quality.

Local Precedent Figure 6.5

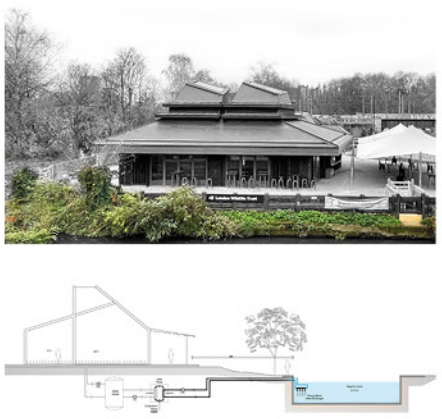
Supplying Building Materials

The Woodhall & Heward fleet was used in the construction of the King's Place cultural centre in King's Cross by transporting stone cladding and other building materials. A local precedent that further demonstrates the logistical capabilities of canal ***Reform*** in the construction of the RDC-PTC.

Local Precedent Figure 6.6

Providing Maintenance

The Woodhall & Heward fleet and the Powerday Waste Reprocessing have set a precedent for the use of canal freight in the transport of operational waste from the site on behalf of the St Pancras Cruising Club. A relationship that should be maintained and furthered in the Research and Development Centre.

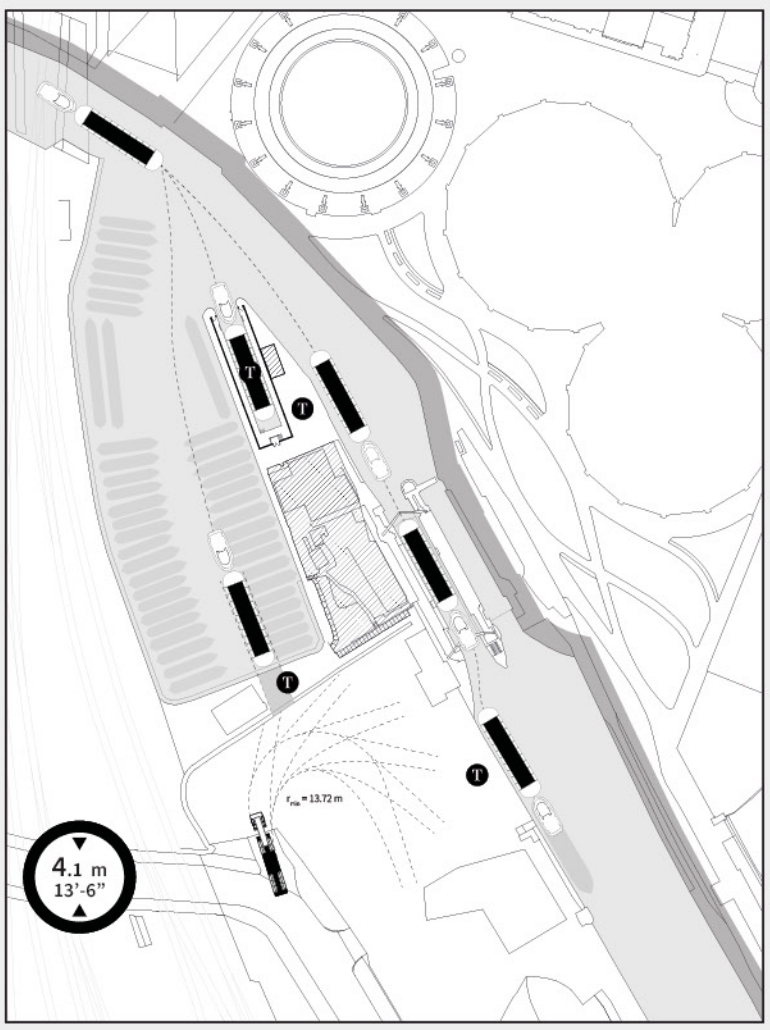


Local Precedent Figure 6.7

Expanding the Canal's Use

Erect Architecture

A closed-loop WSHP, specifically a 4.0 Coefficient of Performance (COP) 3000 x 500 mm *Nuenta Energy Blade*, is installed along the banks of the Regent's Canal at a depth of 1 m. This provides underfloor heating and cooling to the CSNR (Architecture, 2017). Their energy strategy follows the principles of : *Be Lean* (reduce), *Be Clean* (efficient) and *Be Green* (renewable) (ibid.).



Delivery Access (construction and workshop supply)

A3 (Scaled) 0 15 30 60 m 1:1500 A3 (Scaled)

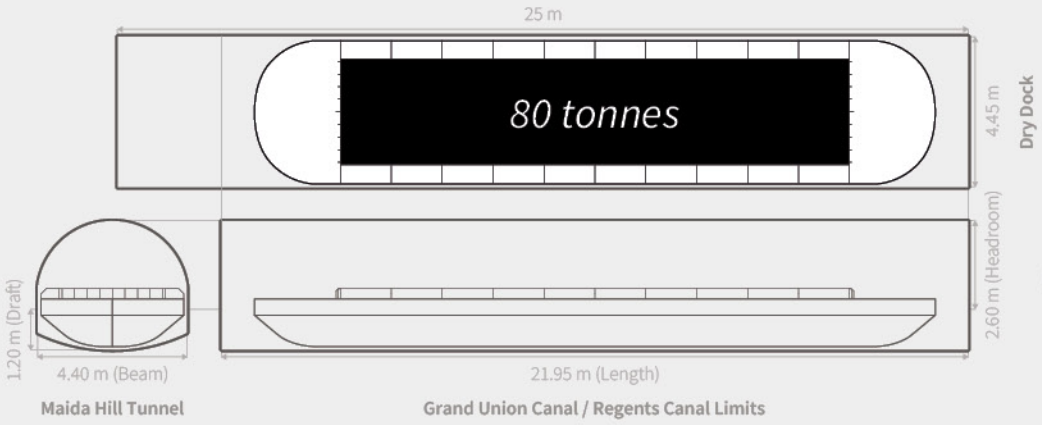
M Maida Hill Tunnel I Maida Hill Tunnel X Slow Routes (X-X)

Tug Boat Barge 80t HGV 44t (28t Load)

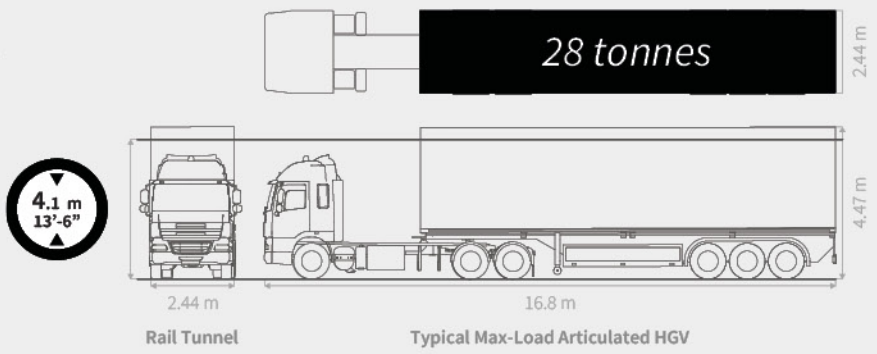
T Transfer Point Existing Mooring Demolition / Landscaping

CRT Ownership

Vehicle Limits



1:200 (A3, scaled 90% for diagrammatic purposes)

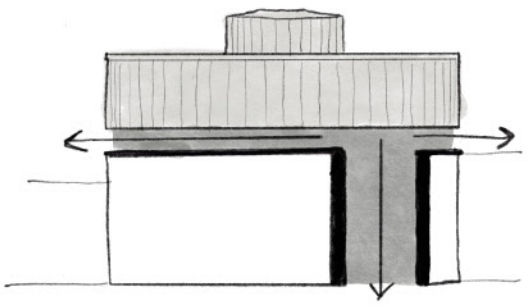


Re-route or use a smaller vehicle due to St Pancras railway underpass (if applicable)

Act 7

An Exposition

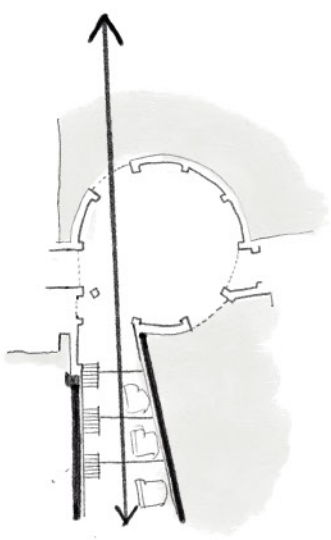
Entering the RDC-PTC



Defining the Primary Entrance

The horizontal bands of curtain walling expand and push down to the ground. Glazing becomes threshold as it breaks apart the continuous stained concrete cill causing it to also fall towards the ground; defining the entrance. Moreover, the primary entrance is emphasised by facing the bridge and CSM.

This is mirrored on the other side for the secondary Retail Street/Industrial Mew entrance.



A Permeable Threshold

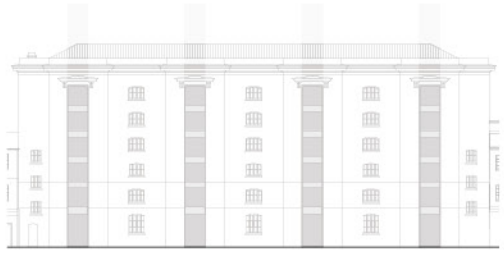
A continuous view up and towards the Grade II listed Waterpoint (now a performance space) is maintained by this grand entrance. As you enter perpendicularly to the threshold, the view changes, bringing the café start-point and street into focus (and *vice versa* from the retail street behind).

All that remains of the industrial wall at the front of the RDC-PTC is the large brick pier that originally concluded the wall. Now forming part of the wayfinding, a sign for the centre will be attached to it's front face or on top e.g. a flag.

The Centre of the RDC-PTC

A Welcoming

Under, over, in-between, through — the interweaving between old and new.



A3 1:100 — 0 1 2 5 m

Local Precedent Grade II
No.5 Grand Union Walk 1988

Grimshaw

As a Camden-based project, it greatly influenced my response to a similarly tight site constrained by the GUC, main roads and limited area. In addition to demonstrating a contemporary re-interpretation of the GUC's unique industrial character. As observed in the stratified façade of concrete, clerestory glazing and aluminium; the rhythm of solid (units) and void (shadow / glazing), and distinct vertical circulation.

Local Precedent
CSM / Granary Building — Vertical Rhythm

Stanton Williams / Lewis Cubitt

The vertical rhythm is created by the original set back faces that would have housed the multi-level cranes. It has now been replaced with continuous glazing that is subtly broken up by these old divisions.

NV = Natural Ventilation Chimney
MV = Mechanical Ventilation Chimney/Flue

Figure 7.1 (adapted)
Roof / Materiality Scaled Diagram

A mansard roof-styled lantern with skylights protrudes from the top of the CSM — which is visible on entering Granary Square because of the significant open space in front of it.

Reforming the Factory

East-facing Canal Frontage

The Waterpoint
\The Centre
\The Lock Cottage

Circulation

Less wide form in comparison to the workshops, as with the circulation of the tutor workshops, to denote its use.

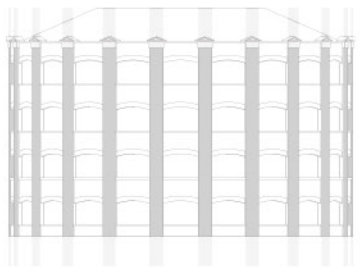
Group 4

Positioned to be closest to the Piano Stairs as they are the furthest away on these levels (see p. 100)

Lift

NV

Lock no. 4



Local Precedent
The Rotunda — Circular Rhythm

Collard & Collard Piano Factory

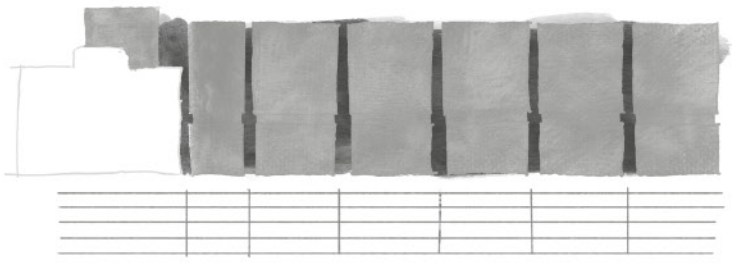
A continuous vertical rhythm runs around the 22-faced oval and as with the Granary Building, it is broken up by fenestration — which the PWS learns from and adapts to create these deeply recessed glass 'T' shapes that denote the (shadow) thresholds for each group's space.

Roof / Materiality

1:50

Similarly to the CSM, a tiled double-roof form continues beyond the façade in order to create a central oculus for the space.

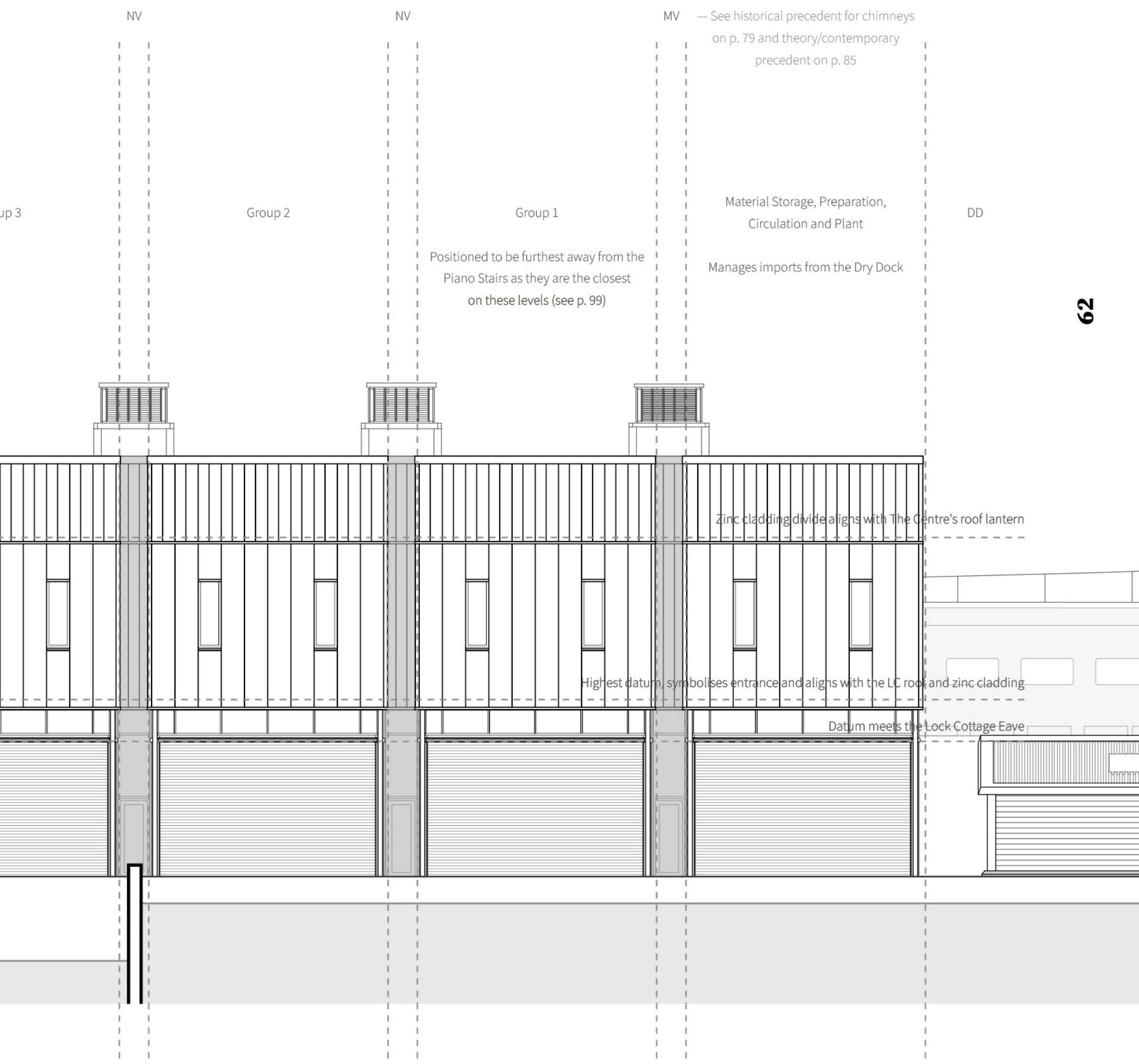
The same design rationale has been emulated for The Centre.



Music in Elevation

There is a great similarity between staves to lines of mortar and bars to the (shadow) thresholds between the workshops. A concept that was explored throughout the façades composition.

The proposed Y2 block continues the Waterpoint in harmony — no longer an isolated monument.



Façade Composition

Detailed Elevation

Zinc Cladding Panel

Oxide Red
RAL 3009

The zinc panels, square profiled corners and horizontal divisions are made of 80 mm deep standing steams. This produces rich shadow profiles and when combined with the slightly reflective/speckled coating.

Resulting in a diverse, ever-changing building façade.

Painted Steel

Ruby Red
RAL 3003

Contrasting against the "oxide red" of the zinc cladding, the ruby red intrumescent painted steel highlights the strong industrial aesthetic.

Aluminium Frame

Mouse Grey
RAL 7005

Deep and thin glazing bars minimise glare and direct sunlight through vertical shading and by creating a continuous light shelf for each of the bays.

The aluminium frame provides an element of syncopation to the rhythm of the Waterpoint by producing a further set of divides (1.2 metres) that break at the coners through continuous glazing.

Stained Cast Concrete

Terracotta Red Brown
RAL 0305020

Stained concrete breaks up the two levels of cladding, brick and zinc, and so forming three datum lines for their respective building (Y1/Tutor Workshops, The Centre and the Y2 Piano Workshops). As also shown on page 61.

Luton Grey Brick

H.G. Matthews
Buckinghamshire

As sourced on page 55, the Luton Grey Brick's are a form of fletton bricks, with dark kiss marks from where they have been in contact in the kiln. Process, as with the building form or workshop ceiling, is marked on the surface. The rich pink-red-orange and grey tones with the beige mortar complements the diverse textures of the site — from the orange of the tapestry building and the red-beige of the Waterpoint to the yellow and red stock mixed brick of the Lock Cottage and canal edge.

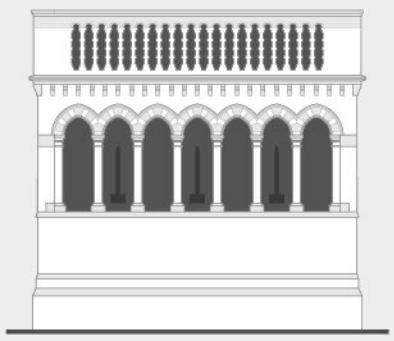
Scaled to Fit A3

0 *1* *2 m*

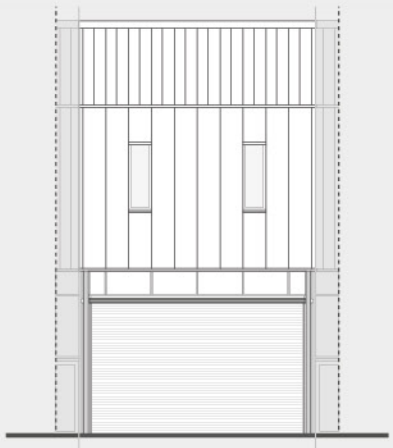
Façade Composition

Translating the Waterpoint

Architectural patterns have a distinct musical quality. Rhythm can be visualised through the proportions, repetition and overall composition of a cladding. Though the RDC-PTC will not always serve as a site for piano-making, the tuneful similarities of these two subjects are inescapable.

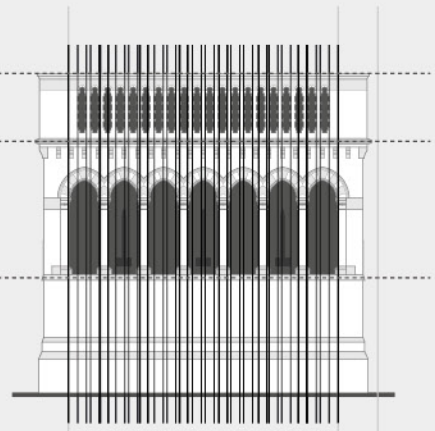


Solid and Void



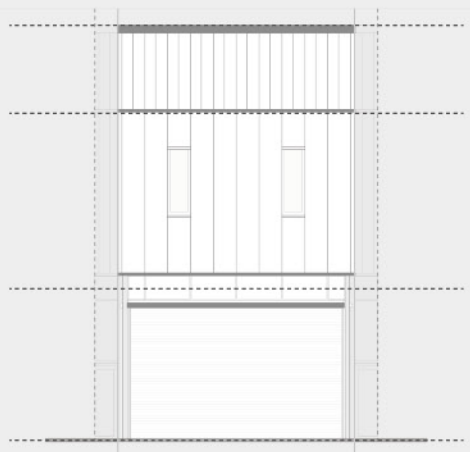
Proposed Elevation

A sense of scale can be easily lost within the dense urban architecture of London, however King's Cross and the site is a rare moment of openness. Panoramically, the large Granary Square, St Pancras Basin and Nature Reserve, allow each building to breathe — scale and its prominence is not lost but emphasised.



Extracting a Rhythm

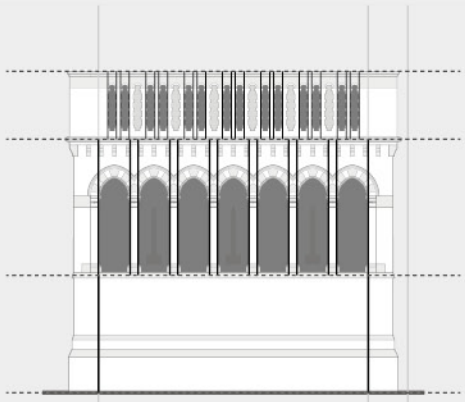
129 %



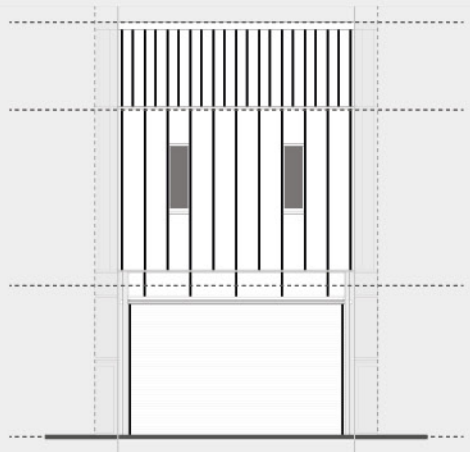
Superposing Proportions

Thin horizontal bands of beige stone break apart the visually massive red brick walls of the Waterpoint into 3 divisions (and a chimney — not pictured). An echo that is repeated practically in the RDC-PTC.

As with the Waterpoint, an English cross bond course is used — made up of alternating headers and stretchers with king and queen closers.

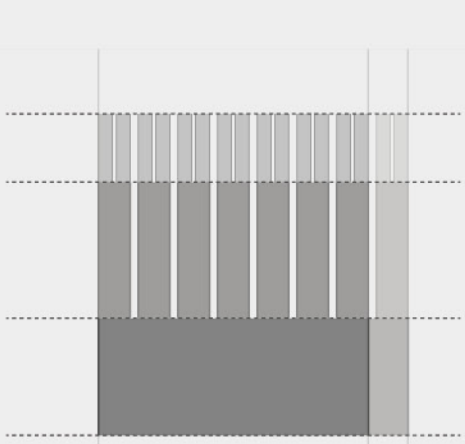


Removing Noise

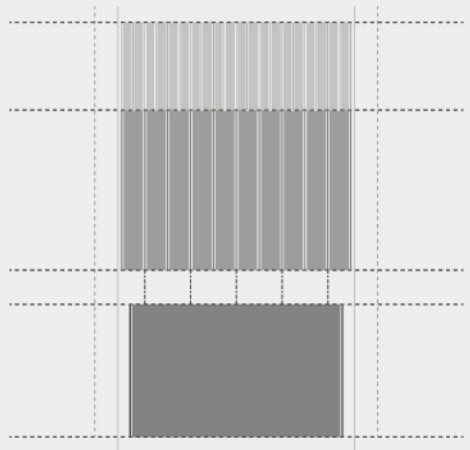


An Echo

The sizing of zinc cladding panels initially determined the division of each tier. At a maximum size of 600 mm, the possible next sub-division was either 100, 200 or 300 mm. Recommendations from my tutor regarding the difficult constructibility of panels smaller than 200 mm narrowed down my initial options, and the Waterpoints melody confirmed it at a 2:1 (600:300 mm) composition.

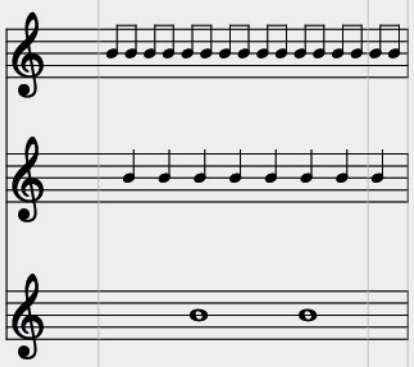


Visualising the Melody

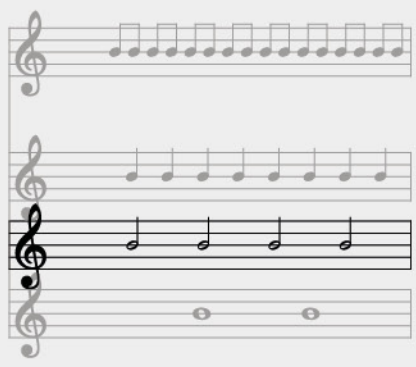


Visualising the Echo

Strongly inspired by Niall Mclauglin's Jesus College façade (see Mclauglin, 2019) and earlier work during a music-based project in first year — the translation of architectural patterns to notation or sound waves has been well developed.



The Melody of the Waterpoint



A New Ensemble

1:200 A3

0 1 2 3 4 5 10 m

The Tectonics of Rhythm

Military Axonometric

Local Precedent

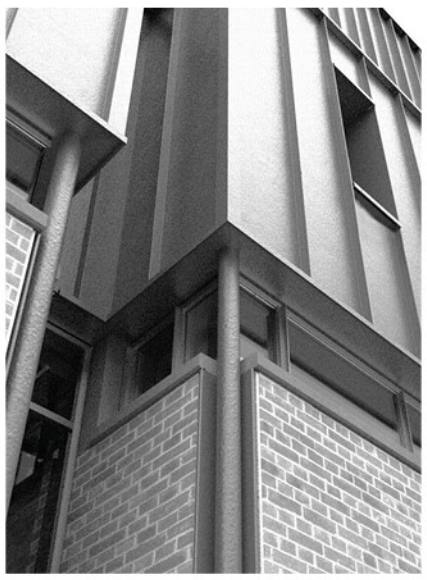
The Tapestry Building

Níall McLaughlin Architects

The Tapestry building is clad with Techcrete's terracotta-coloured (G171 R12000) GRC panels (Techcrete, 2019), a reddish-orange colouring alike to KX St Pancras and WP, while contrasting CDY's yellow stock London Brick.
Each panel is ornamented with recesses and flower-like motifs emulating patterns from Assyrian textiles at the British Museum (Burton, 2014).
A stylistic application with similarities to the Art Deco movement's and Egyptian geometry.

Niall Mclaughlin was inspired by Louis Sullivan's Guaranty Building (as confirmed in Mclauglin (2014), a case study for the application of Semper's theories relating but not limited to craft, tectonics, textiles and polychromy.

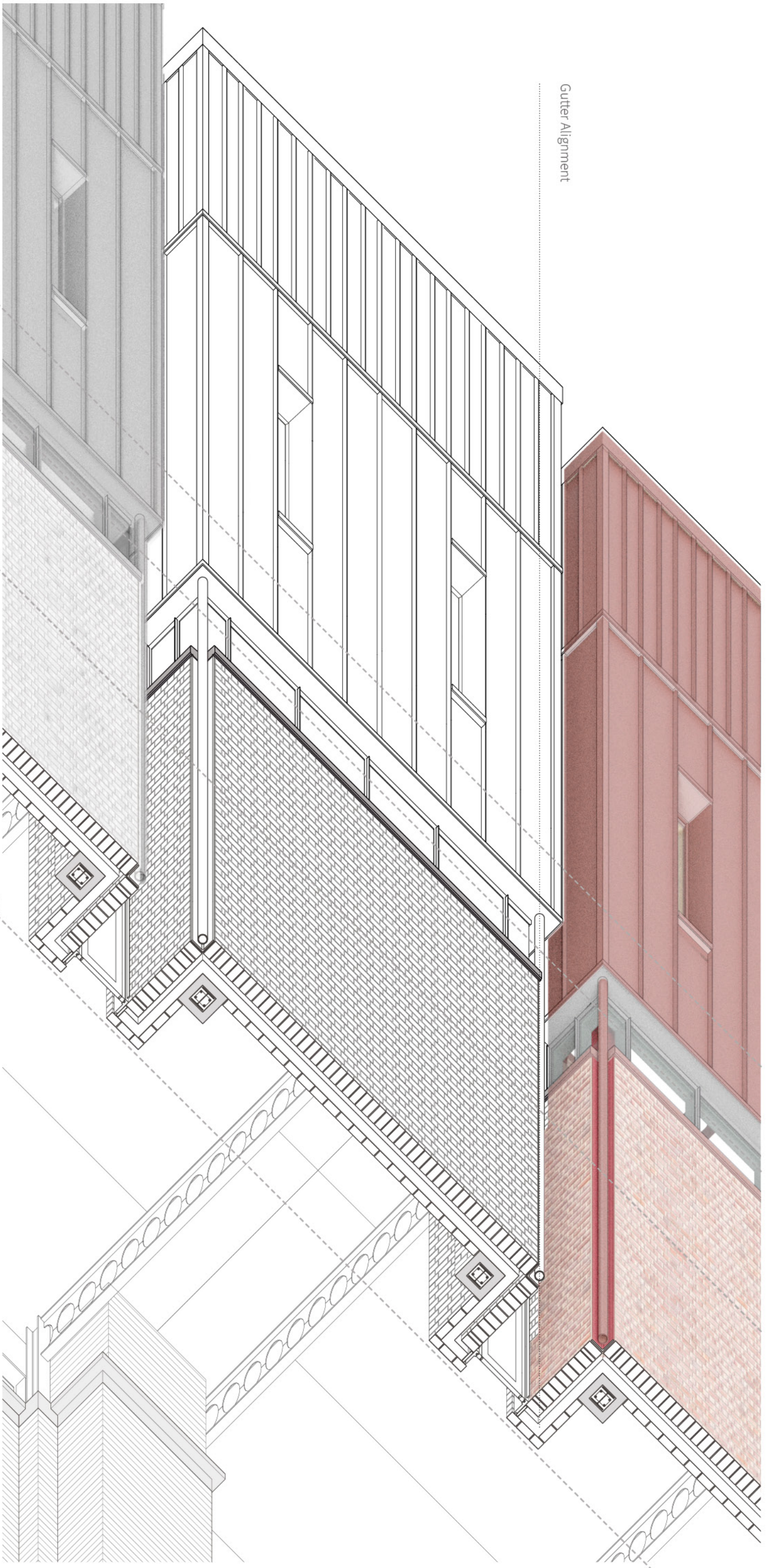
As described on the opposite page, cladding and cladded rhythm continues upwards from the brick wall — with the curtain wall glazing and rainscreen zinc panels being aligned, coloured and patterned as if an item of clothing.

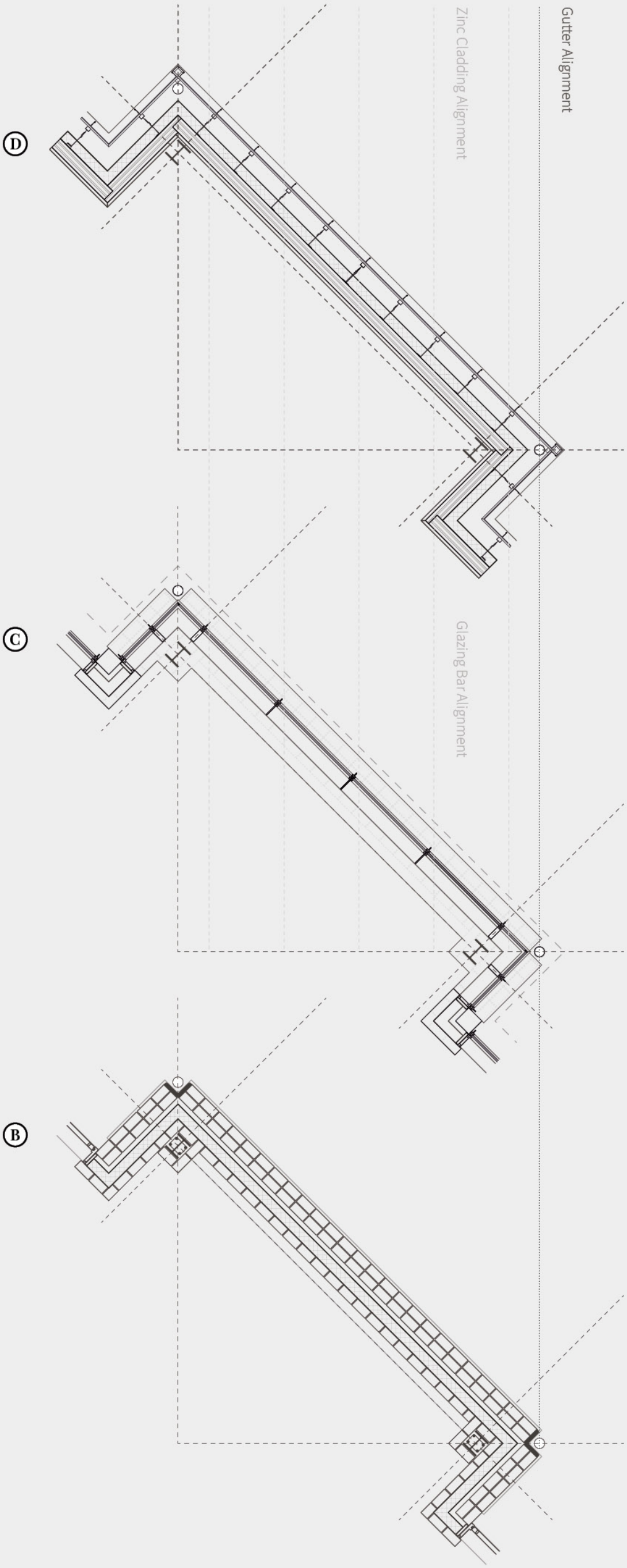


Looking up at the corner

1:50 A3

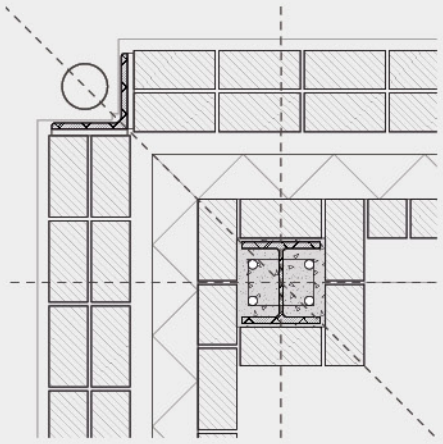
0 0.5 1.0 2.0 m





Constructing the Corner

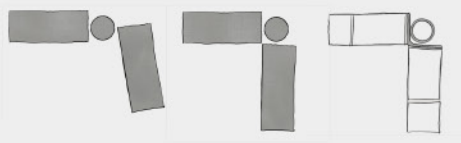
Expressing the "Mundane"



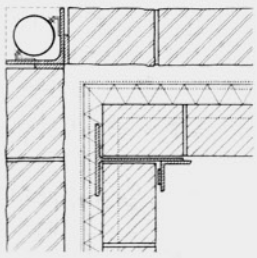
A negative corner, created by the use of equal-angle steel plates accentuate the disconnected wall — with the outer façade acting as a piece of woven textile that has been hung between; suspended like the piano elements within the workshops.

Guttering then rests within this negative space, emphasising the verticality of the façade — following the movement of water under gravity and meeting the ground.

As the circular gutter inhabits the square profile of the equal-angled columns, it becomes a radial point to the linear walls; translating the building's relationship from site-to-building / macro-micro at the tectonic level.



Macro to Micro Tectonics (Plan–Corner)



Typology Precedent Figure 7.2
Shoe Factory 1995

Haworth Tompkins

Originally seen in Birkhauser's Masonry Construction Manual (Pfeifer et al., 2001), I have been obsessed with the use of an equal angle to break-up what can be perceived as monolithic walls of masonry. Tompkins took this one step further with the inclusion of a gutter in his design for a series of workshops for shoes.

Music is liquid architecture;

Architecture is frozen music.

Goethe (1749–1832),
as seen in Mclauglin (2019)

Year 2 Modules

Unit 3 (9 months)

Crafting the Piano

An intensive module that sees each group create a functioning 1:1 piano, following what they have studied and prepared in year 1 (Units 1 and 2). They will continue with their previous tutors as hands-on guides but will be aided by visiting specialists and first year students at key points, such as: stringing, making the action and tuning. Each drawing, manufacturing stage and constructed element will be digitally recorded (e.g. photogrammetry, diaries and photographs) so that in preparation for Unit 4, a digital twin is formed.

Group 2 are hard at work, the masters students of the RDC-PTC begin fitting the action to the piano, as their final year project draws to a close.

Unit 4 (3 months)

Reform and Regenerative Futures

The archive preserves the piano making process, the hand of the craftsman is logged dimensionally, their memory captured. From the pressure of a pen stroke or grain and of chosen wood to the prose of the maker's logs, the embodiment of craft extends its life. At the end of the course, students will take this digital copy and create an evolved form, that continues to generate variations of functionable models that can be played within a virtual environment. These will be celebrated alongside the other piano at an end of course show. Real and virtual mirrored against each other.

The rest of Group 2 are helped by their tutor during a late evening of digital modelling and report writing for Unit 4.

How Pianos [are] Made

The Piano Workshops

3 Bending the Rim

No. Craftspeople: **5**

Comprising of 16 layers of planed maple that are glued together, the rim is clamped in place on sawhorses and then left to be conditioned for two months.

4 Casting and Enamelling the Piano Plate

No. Craftspeople: **3**

Grey cast iron is monolithically formed to withstand 40k pounds of force from the strings. This can be produced off-site and transported in via canal or van from a foundry or produced on-site using the Y1 Workshop's Metallurgy facilities. Typically the plate is sand cast and then sanded and primed to be painted bronze by hand.

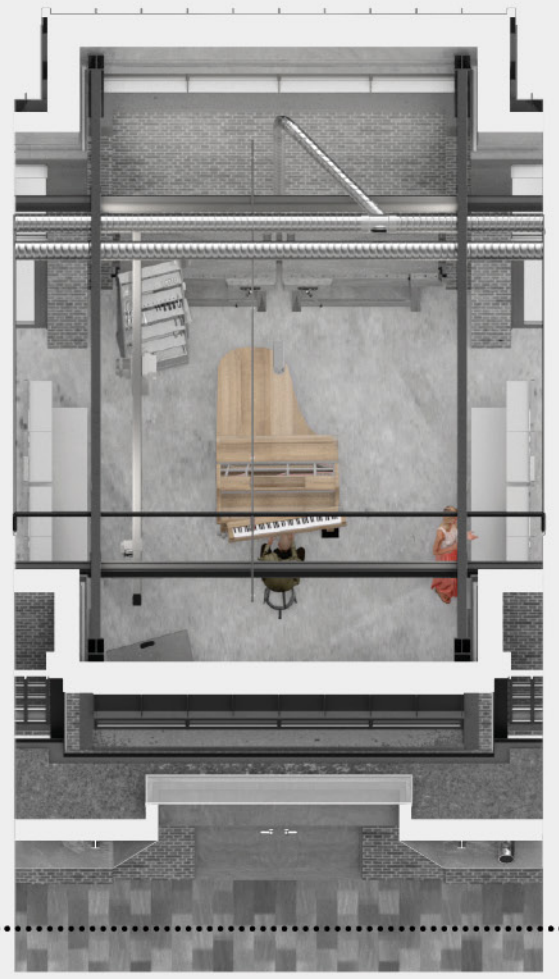
1	2	3	4	5	6
Material Delivery (see p.53)	Air and Kiln Drying Timber (see p.54)	Bending the Rim	Casting and Enamelling the Piano Plate	Fitting the Braces and Plate Structure	Making/Strengthening the Sounding Board
	1–2 years	2.5 months	0.5 months	1 month	1 month

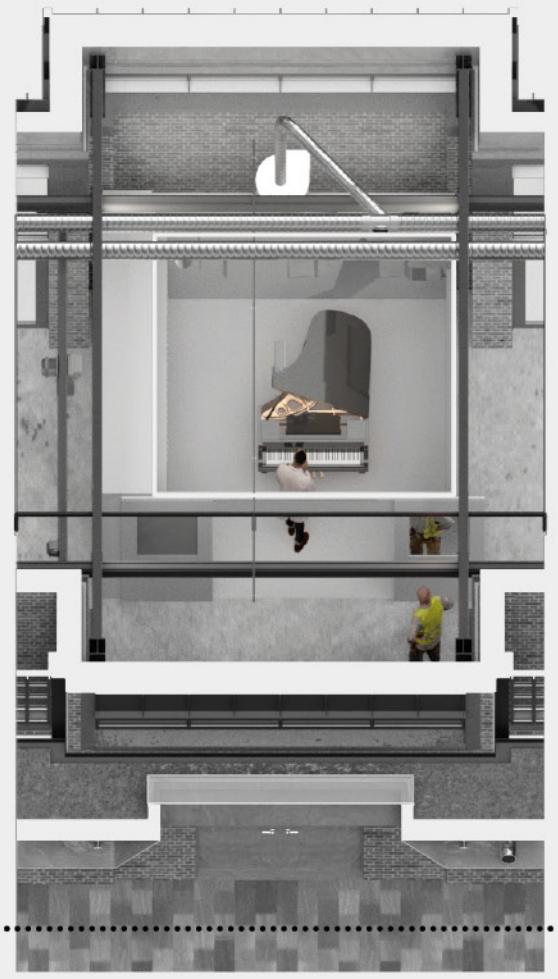
Steinway Precedent Figure 7.3

8 Bellyman Installation

Steinway Precedent Figure 7.4

5 Fitting the Braces and Plate





12 Fitting and Checking the Action to Grand

No. Craftspeople: **1**

As previously described on p.18, fitting the action to grand is a quiet conclusion to the piano making process and can be either carried out in the Y2 Workshops or the group-dedicated Tuning Rooms. **N.B.** Each space is appropriately dimensioned to allow for additional room-in-room construction e.g. high ceilings, flexible LEV provision and sufficient area.

13 (Optional) Special Fitting / Finishing

No. Craftspeople: **2**

Portable industrial-sized spray booths can be built inside of the workshop space and connected to the extract system. Sanding, varnishing, painting and so on can all be applied in this space. Typically this constitutes around 3 weeks of painting, and of drying. In addition to a 3 month finishing period if needed (e.g. japanning).

7	8	9	10	12	13	Total
Making the Bridge	Bellyman Installation	Crafting a Pin Block and Stringing the Board	Making and Installing the Hammers	Fitting and Checking the Action to Grand	(Optional) Special Fitting / Finishing	9 months for Unit 3
1–2 weeks	1 week	1 month	1 week	2–3 weeks	4 months	

Steinway Precedent Figure 7.5

8 Bellyman Installation

Steinway Precedent Figure 7.6

10 Making and Installing the Hammers

Y2 Workshop and Studio

Detailed Section (STF)

Detail Key

Externally–Internally / Up–Down

Typical 1F Wall / Detail A

Luton Grey Brick	215 mm
Cavity	58.75 mm
Insulation	120 mm
Luton Grey Brick	102.5 mm

Typical Window / Detail B

Double Glazing w/ Low-e Coating	24 mm
Aluminium Frame	70 mm

Compartment Floor / Detail C

Wooden Floorboards	20 mm
Heated Screed	60 mm
Protective Membrane	
Acoustic Insulation (impact)	60 mm
Chipping Infill	30 mm
Emergency Membrane	
CLT (protected, see p. 130)	245 mm

Typical 2F Wall / Detail D / Rainscreen

Zinc Panel	0.8 mm
Plywood	18 mm
Timber Batten	120 mm
(and metal fixing)	102.5 mm
Ventilated Cavity	>150 mm
Insulation	120 mm
Breathable Membrane	
CLT	139 mm
Acoustic Plasterboard	36 mm

Typical "Flat" Green Roof / Detail E

Sedum / Planting	20 mm (min)
Soil Substrate	100 mm
Filter Fleece	
Drainage Board	20 mm
Protection Mat	
Protective Membrane	
Insulation	200 mm
Breather Membrane	
CLT	245 mm
Suspended Ceiling	

Typical Ground Floor / Detail F

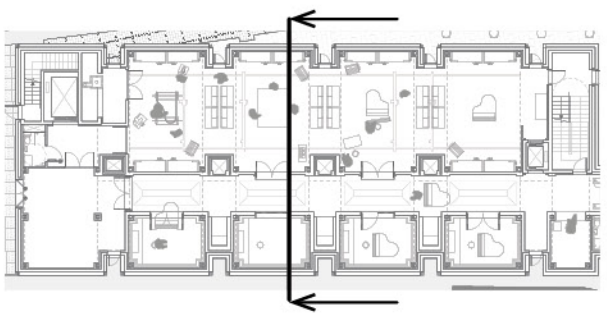
Stone Tiles (smaller but matches landscaping)	30 mm
Mortar	10 mm
Heated Screed	90mm
Protective Membrane	
Insulation	150 mm
Raft-Pile Foundation	>225 mm

Typical Ground Floor / Detail Fw

Resin Coating	5 mm
Wearing Screed (to manage significant loads)	100 mm
Protective Membrane	
Insulation	150 mm
Raft-Pile Foundation	>225 mm

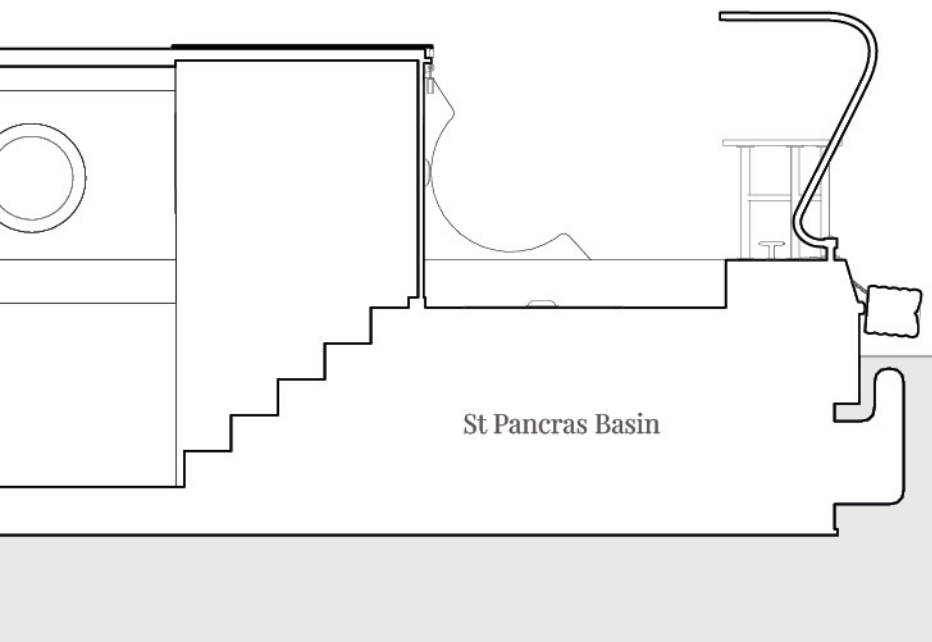
Gutter Alignment

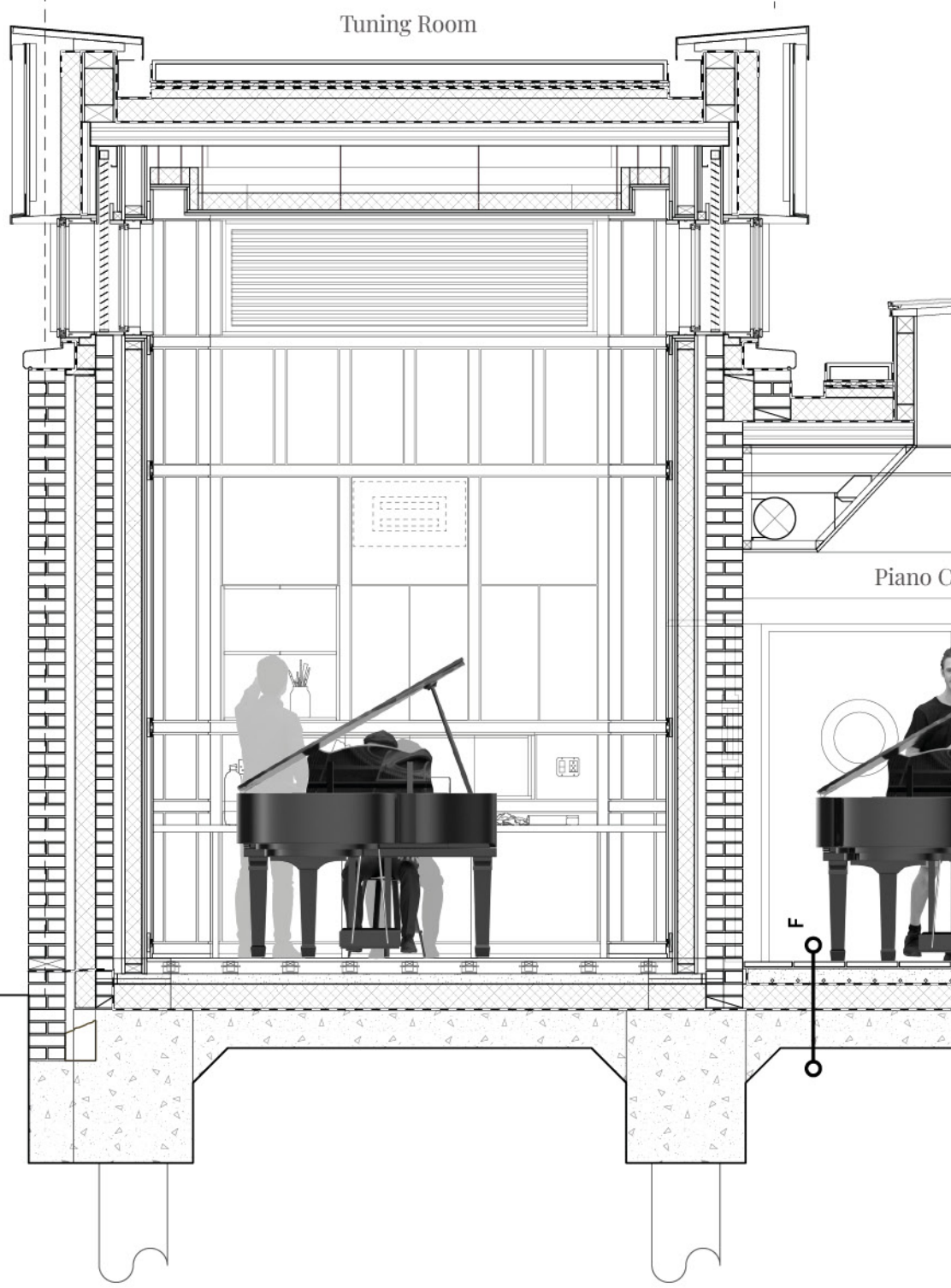
Increases in height away from the St Pancras Basin — to not dominate in scale, overshadow the boats and minimising the Urban Canyon effect



Scaled to Fit A3

0 1 m





Reform

Natural Ventilation Chimney

Zinc parapet, similar in style to the parapet of the existing Waterpoint (copper from the former tank)

Green Roof (Accessible)

E

D

Year 2 Studios

G

B

A

Piano Workshop

Casting and Enamelling the Piano Plate

Corridor

FW

72

LETI Climate Emergency Design Guide

Element	Target U-Value (W/m²K)
Walls	0.13 – 0.15
Floor	0.09 – 0.12
Roof	0.10 – 0.12
Windows	1.2 (double)
Doors	1.2

Part L2 — Limiting U-Values

Element	Target U-Value (W/m²K)
Walls	0.26
Floor	0.18
Roof	0.18 (0.16, p)
Windows	1.6
Doors	1.6

Project Target

Element	Target U-Value (W/m²K)
Walls	0.16
Floor	0.12
Roof	0.12
Windows	1.6 (double)
Doors	1.2

For references relating to building regulations and standards, please see page 128.

Typical 1F Wall / Detail A

Material Layer	Conductivity (λ, W/mK)	Thickness (m)	R-Value (m²K/W)
External Surface Resistance (R_{so})	-	-	0.06
Brick	0.62	0.3075	0.50
Mortar	-	0.01	Negligible
Ventilated Cavity	-	>0.05	0.12
Insulation	0.022	0.12	5.50
Internal Surface Resistance (R_{si})	-	-	0.12
Total R-Values (m²K/W)	6.25		
U-Value (W/m²K)	0.16		

Typical Window / Detail B

Material Layer	U-Value (W/m²K)
Double Glazing w/ Low-e Coating	0.96
Aluminium Frame	1.9

Typical 2F Wall / Detail D

Material Layer	Conductivity (λ, W/mK)	Thickness (m)	R-Value (m²K/W)
External Surface Resistance (R_{so})	-	-	0.06
Zinc	110	0.08	Negligible
Ventilated Cavity	-	0.05 (min)	0.12
Insulation	0.022	0.12	5.50
CLT	0.12	0.139	1.16
Plasterboard	0.25	0.036	0.144
Internal Surface Resistance (R_{si})	-	-	0.12
Total R-Values (m²K/W)	7.05		
U-Value (W/m²K)	0.14		

Typical "Flat" Green Roof / Detail E

Material Layer	Conductivity (λ, W/mK)	Thickness (m)	R-Value (m²K/W)
External Surface Resistance (R_{so})	-	-	0.06
Green Roof	0.95	0.1	0.11
Insulation	0.022	0.2	9.10
CLT	0.12	0.25	2.04
Internal Surface Resistance (R_{si})	-	-	0.12
Total R-Values (m²K/W)	11.4		
U-Value (W/m²K)	0.10		

Typical Ground Floor / Detail F

Material Layer	Conductivity (λ, W/mK)	Thickness (m)	R-Value (m²K/W)
External Surface Resistance (R_{so})	-	-	N/A
Stone Tiles	1.73	0.03	0.02
Mortar	-	0.01	Negligible
Screed (varies)	1.1	0.1	0.09
Insulation	0.022	0.15	6.82
Foundation	2.3s	0.225	0.10
Internal Surface Resistance (R_{si})	-	-	0.12
Total R-Values (m²K/W)	7.14		
U-Value (W/m²K)	0.14		

Typical Pitched Zinc Roof / Detail G (Warm Ventilated Roof, see p. 112)

Material Layer	Conductivity (λ, W/mK)	Thickness (m)	R-Value (m²K/W)
External Surface Resistance (R_{so})	-	-	0.06
Zinc	110	0.08	Negligible
Ventilated Cavity	-	0.05 (min)	0.12
Insulation	0.022	0.2	9.10
Internal Surface Resistance (R_{si})	-	-	0.12
Total R-Values (m²K/W)	9.39		
U-Value (W/m²K)	0.11		

Typical U-Values

Meeting Regulation and Sustainability Targets

Act 8

Intonation

Crafting the Canal Cottage

The Lock Cottage(s)

Originally situated on the opposite side of the canal as a *Back-Pumping Station* and *Cottage*, it was migrated adjacent to the *Lock no.4* and *St Pancras Basin* due to increased demands resulting from a series of dry summers at the end of the 1890s (GLIAS, 1995).
Upon the merger of the Regent's Canal and Grand Junction Canal companies into the GUC in 1929, the building was extended and converted into primarily a *Lock Keeper's Cottage*.

Grade: II (1974)

Architect (known for)
Sir John Wolfe Barry
(Tower Bridge)

Year: 1898 (Replacement)

Owners:
Canal and River Trust

Users
Residential

Figure 8.1 and 8.2, The Lock Cottage(s) (Original vs. Today)

Figure 8.3, 1895

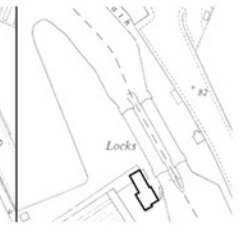


Figure 8.4, 1953

1. Chimney

Provided draught to the *Boiler Room*. There was not sufficient material except the image on page 79 to show the location and size of the *Chimney*, therefore the diagram is purely indicative but based on other pumping stations (e.g. Claverton pumping Station).

2. Pump Well

Housed the "Centrifugal Pump" (GLIAS, 1995) to help maintain the Regent Canal's minimum water levels.

3. Canal Culvert

Water access from the bottom of Lock no. 4 to the Pump.

4. Engine House / Boiler Room

Based on historical precedent, the double-height space would have provided an enclosure for the *Engine*, *Boiler* and any other equipment necessary for powering the *Centrifugal Pump* (5).

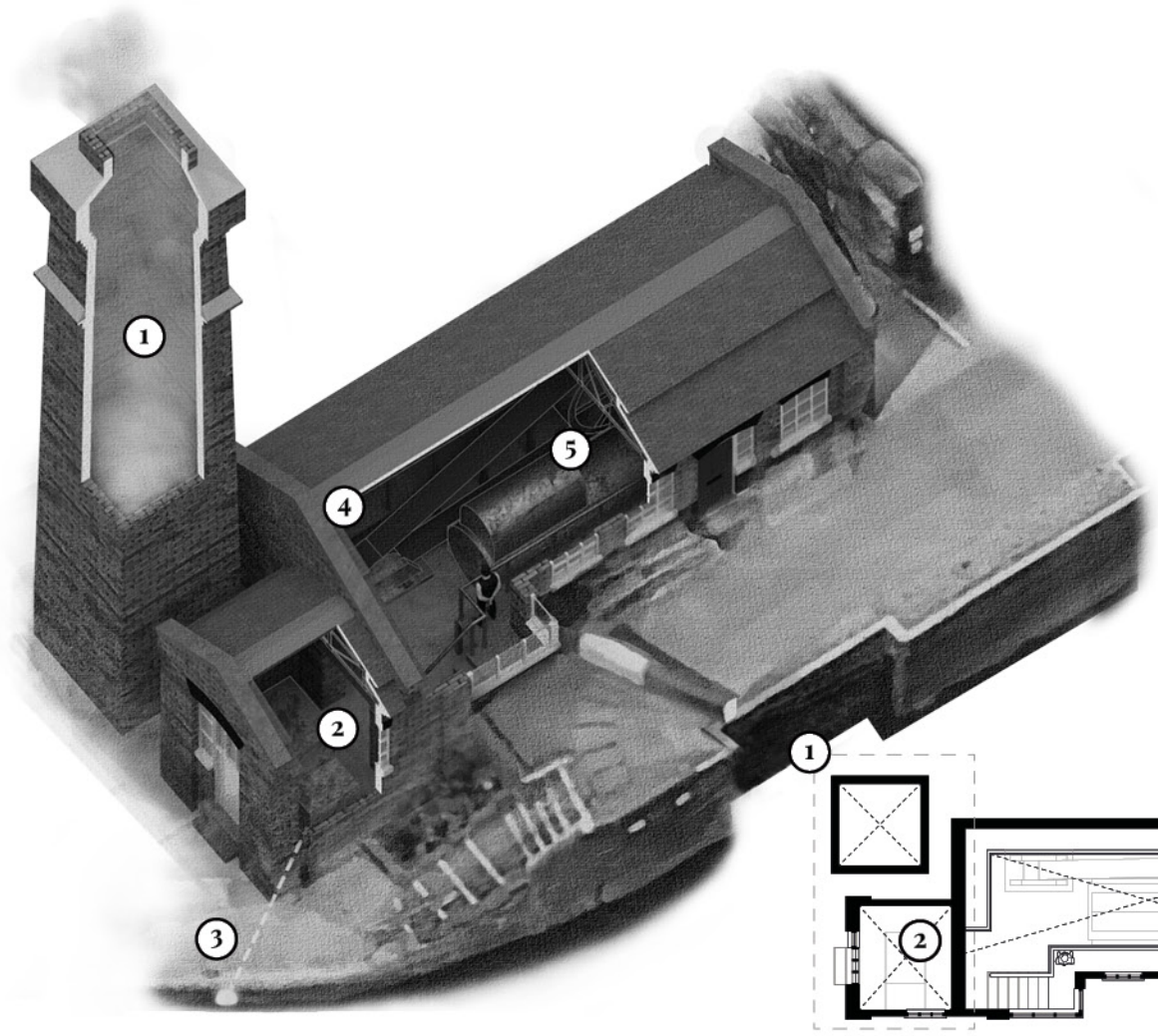


Figure 8.5, 1897: The Rebuilt Back-Pumping Station

Figure 8.6, 1897 Floor Plans (assumed)

6. Bedrooms

Part of the Lock Cottage extension.

7. Bathrooms

A suspended timber floor has been added to level-off the Lock Cottage so that it is all one floor — covering the *Pump Well* and making the door obsolete.

8. Hallway

9. Living Room and Kitchen

As with the bathroom, the 1.5*height space has been levelled off with a suspended timber floor and a chimney (10) has been installed into the space. The chimney would have provided wood-fired heating in the 1930s.

The existing steel truss and roof lanterns have been covered up by a beige plasterboard ceiling.

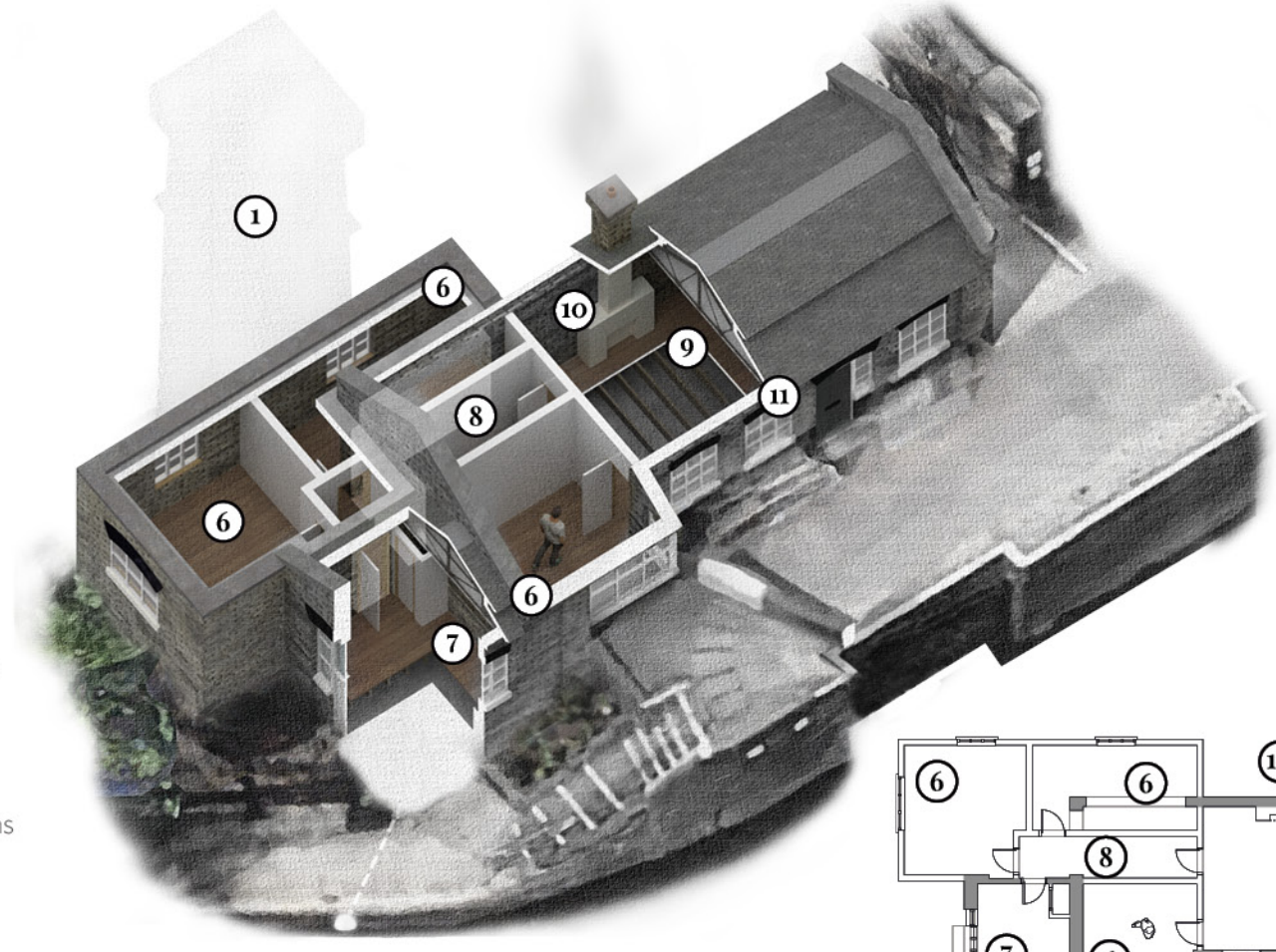


Figure 8.7, 1930 / Today: Converted into a Lock Cottage and Extended

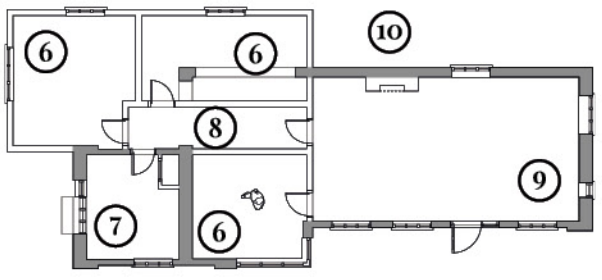


Figure 8.8, 1930 / Today's Floor Plans (adapted)

The Lock Cottage

The CRT Museum and Pump House

Society has become complacent with the availability of energy (fossil fuels and electricity), material (timber and metals) and manufacturing (rapid prototyping and mass-production) at the flick of a switch/click of a button (Langlands, 2017).

As a museum space, the interpretation of traditional systems for sustainable power should be visual, interactive/educational and celebrated. Traditional systems will include the use of 'wind, water, animal [and] human' (Pye, 1968, p.26; Risatti, 2007, p.53; Langlands, 2017).

11. Internal Balcony Display

The suspended floor should be removed, with any structural elements and flooring material (e.g. floorboards, carpeting etc.) re-used for the internal balcony. ***Reform***ing the original balcony arrangement of the 1897 Back-Pumping Station.

12. The CRT Museum

It is unlikey that an original pump and engine can be returned to the museum as this will require the removal of roof or wall elements to install it.

Alternatively, the *Canal and River Trust* can display many artefacts relating to the site and the Regent's Canal. Examples of this could include: water-powered drills, hammers and other workshop equipment in functioning condition — emphasising the sustainable power-production from historical methods.

13. Water Source Heat Pump

Beyond the principle of ***Reform***ing the pump house, the Lock Cottage's well and culvert is re-used to provide heating and cooling throughout the RDC-PTC.

14. Water Storage

Grey water, rainwater, hot water and cold water are all stored within the Lock Cottage – with rainwater being sourced from green roofs and permeable paving (SUDs) around the site (see p. 112/113).

15. Exposed Structure

All internal structure should be exposed and protected with the same red intrumescent paint as used in the RDC-PTC's steel frames.

16. Solar Renewables

Potential locations for discrete solar renewables (e.g. solar water heating and photovoltaics). Do not fix any on the 1897 roof.

The Lock Cottage's retrofit further exemplifies (as with the Waterpoint and Wall) the attitude to minimal design intervention and the ***Reform***ing of historically-significant spaces in the built-environment. A principle of both design and sustainability that is seen throughout the project.

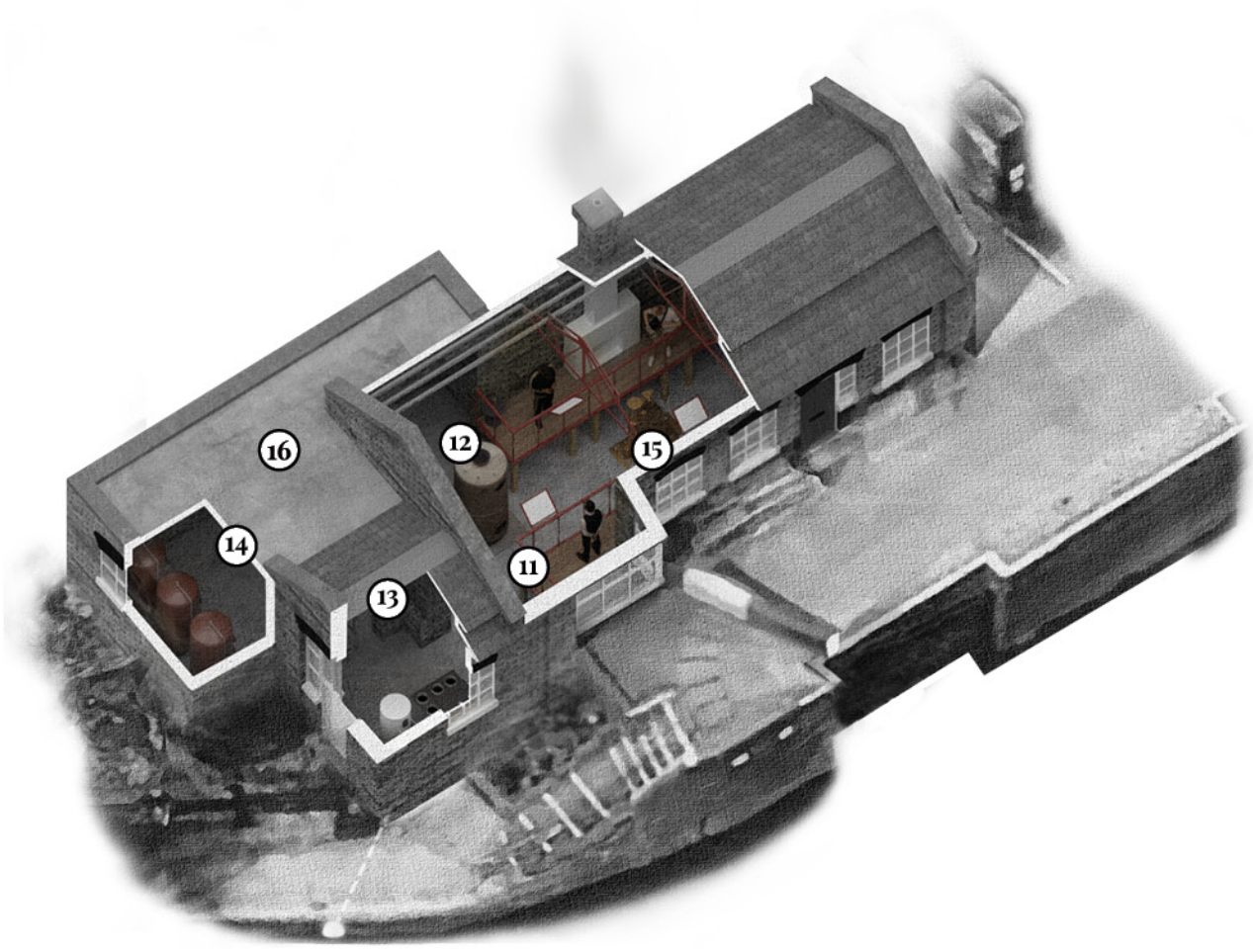


Figure 8.9, The CRT Museum and Water Source Heat Pump Supply and Storage

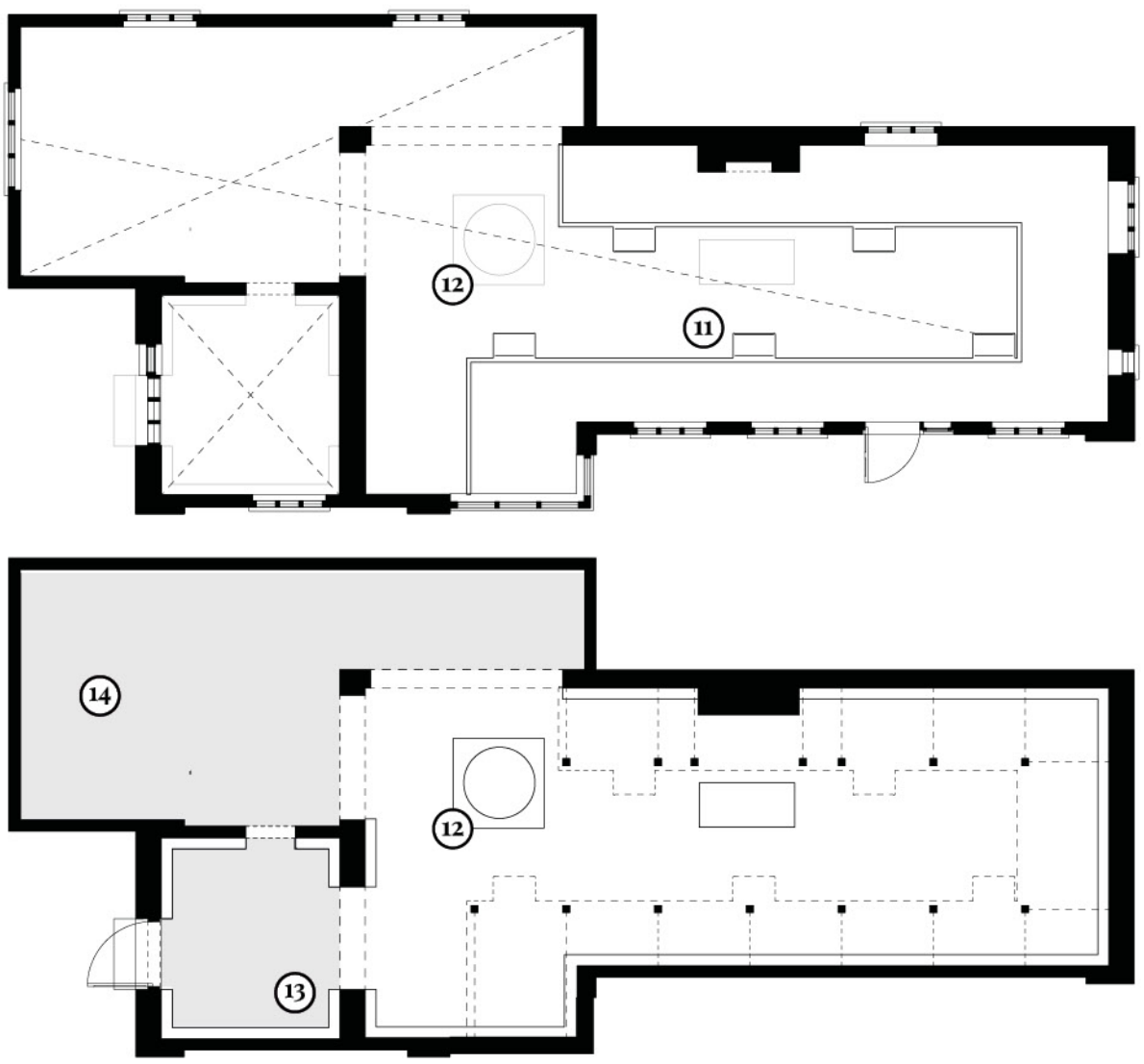
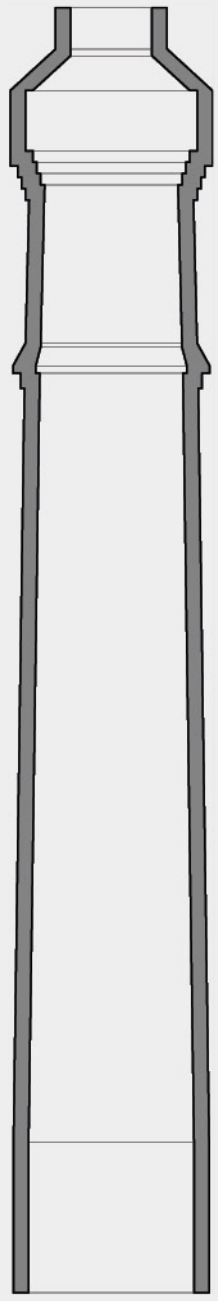


Figure 8.10, Retrofitted Floor Plans

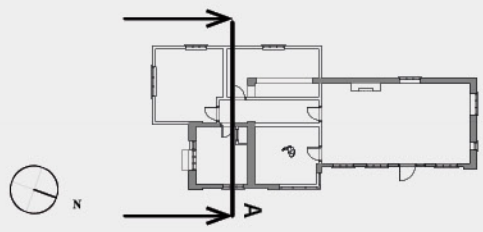
Local Precedent Figure 8.11
The Forgotten Chimney 1897

A barge possibly supplying coal to the Pumping Station looks out onto the peninsula and the (now) re-located Gasholders.



Approximated Form

A



Time and Tectonics

Tracing the life of the Lock Cottage in section illustrated the alterations of its form over time, and a hidden tectonic character that could be celebrated.

1:50 A3

0 0.5 1.0 2.0 m

Regent's Canal *Reform*ed

The New Pump House

Integrating a Water Source Heat Pump (WSHP) into the existing pump house and lock cottage infrastructure.

Local Planning Guidance (Camden, 2021)

> ***4.25*** *Any development within 200 metres of the Regent's or Grand Union Canal to prioritise water source heat pumps*

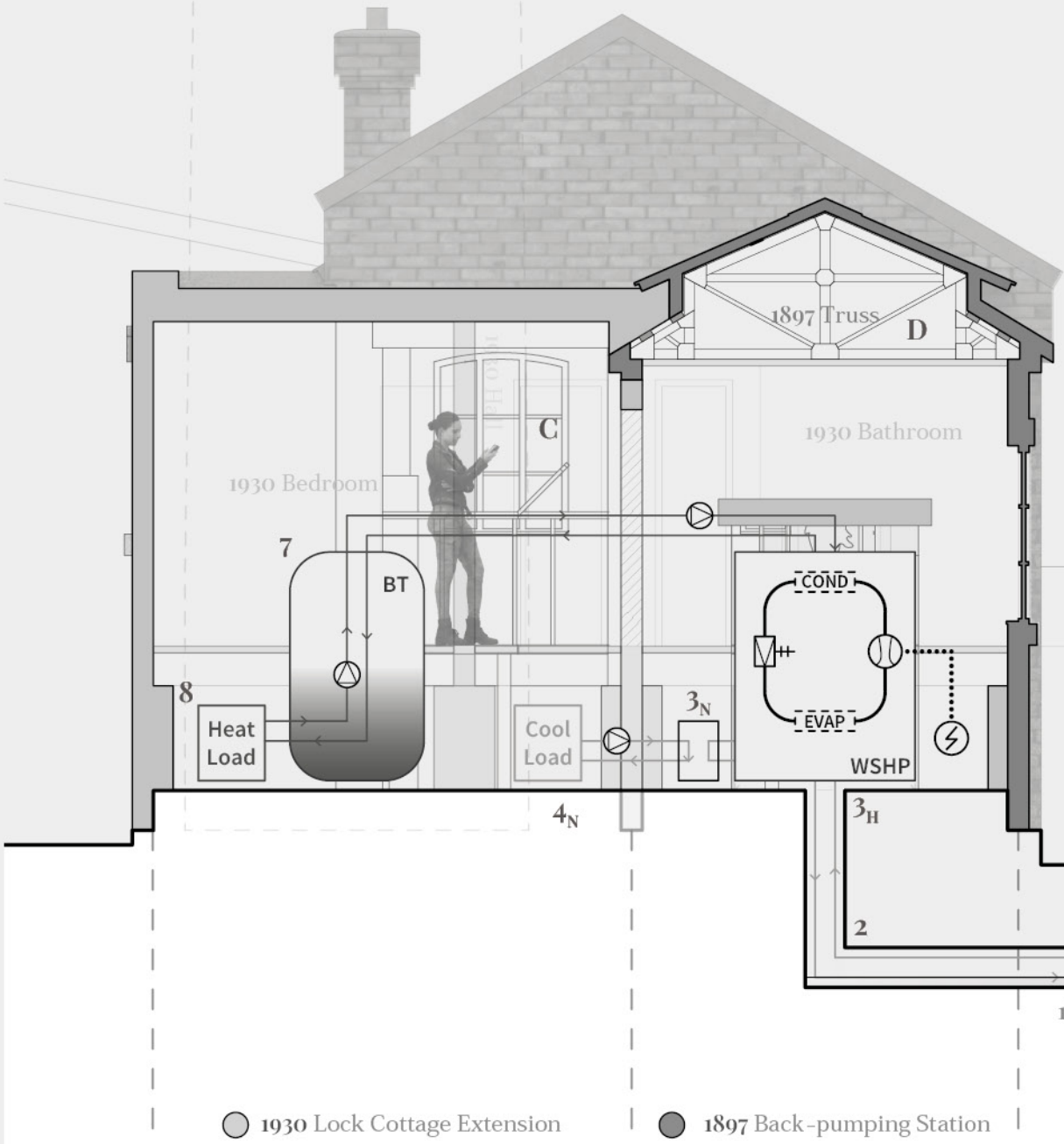
> ***4.9*** *Major developments in close proximity (< 500m) to existing DENs should prioritise immediate connection to them and fully test the feasibility of doing so*

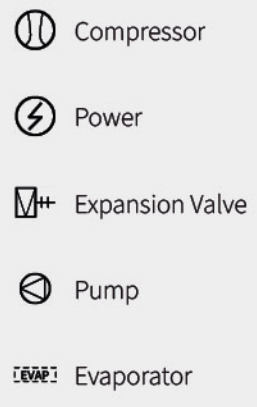
WSHP vs. the KX CHP DEN

Considerations were made to connect to the KX District Energy Network (DEN), however the following points proved it untenable in comparison to a WSHP:

- The WSHP has a renewable and sustainable source of heating and cooling that is readily available locally. The biomass pellets for the CHP are sourced from Scotland.
- Does not locally produce greenhouse gasses or particulates (e.g. NO_2 or $PM_{10/2.5}$) that contravene the AQMA requirements of the LBC, unlike the CHP system.
- As the "carbon benefit[s] of CHP will cease by 2032", less than ten years post-construction and is one third into a "15 year" life cycle (Camden, 2021), attempts to connect to the DEN will have minimal carbon savings before a new system is required.
- Adjacent to the RC vs. difficulty in connecting over it, and so will require a bespoke (high carbon / cost) solution.

Logistics Study



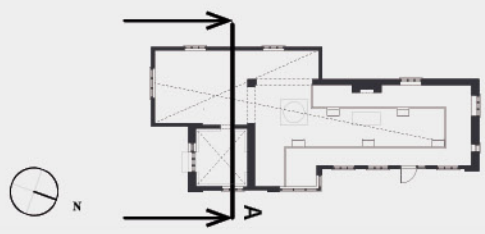


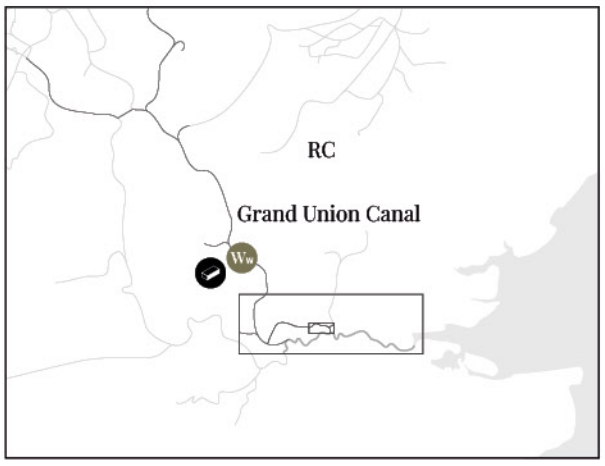
The Regent's Canal Battery

Property	Winter – Summer*
Temperature (ºC)	8 – 14
Flow Rate (m^3s^{-1})	4 – 13
Heat Capacity (MW)	1 – 5

**Average*

A



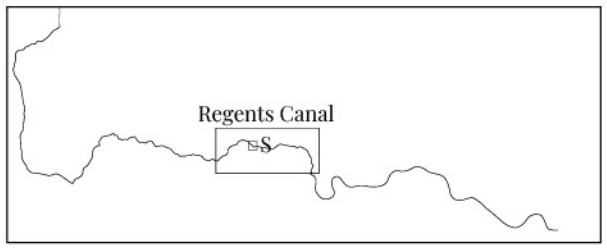


Total Heat Capacity of UK Canals Figure 8.12

N

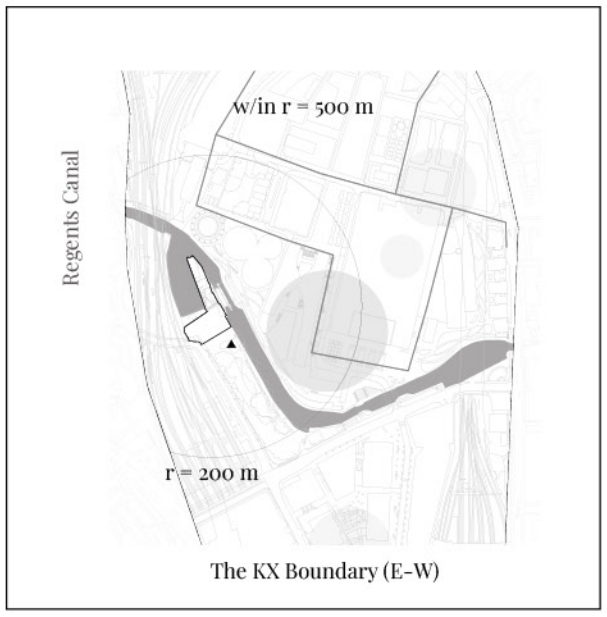
0 / No data | 0 – 1 MW | 1 – 5 MW | 5 – 10 MW | 10 – 22 MW

A3 (Scaled)



Grand Union Canal — Regent's Canal — Site

Figure 8.13



The KX Boundary (E–W)

KX's Heating Opportunities (R)

N

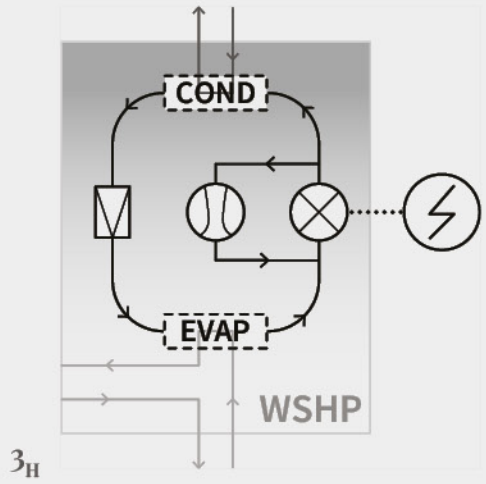
0 200 400 m

A3 1:10000

Existing DH
WSHP
GSHP
BCS

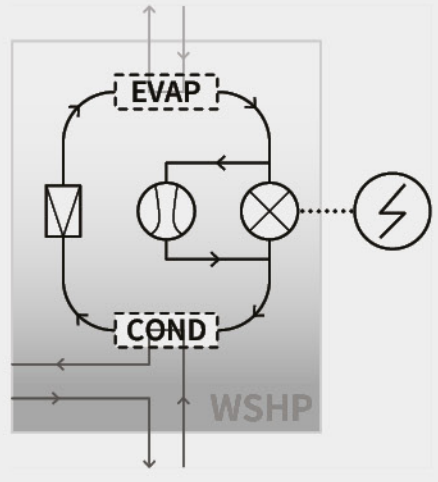
Figure 8.14

Annual Use



3_H

Figure 8.15



6_C

Figure 8.16

Natural Cooling (Example)

Other system arrangements are possible depending on loads and the space available, notably: combined WSHPs, cold water storage and low-loss tanks. Depending on consultation with M&E engineers.

1 A thermal transfer fluid (TTF) is pumped through the closed-loop heat exchanger. Low grade heat is then extracted from the *RC* via the fluid

2 The fluid is then pumped to the WSHP through the existing canal culvert (1897)

3_N TTF from the evaporator is transferred to a heat exchanger

4_N Then cold water provides comfort cooling for spaces requiring controllable conditioning all year round i.e. the Café, Tuning Rooms, and Y2 Studios

Heating Mode / Winter Operation

Figure 8.15's diagram depicts the WSHP in heating mode

1 A thermal transfer fluid (TTF) is pumped through the closed-loop heat exchanger. Low grade heat is then extracted from the *RC* via the fluid

2 The fluid is then pumped to the WSHP through the existing canal culvert (1897)

3_H Water Source Heat Pump (WSHP)

4_H Heat is absorbed by a refrigerant, where it then evaporates and is transferred as a low-temperature gas to the compressor

5_H The refrigerant vapor is then compressed, increasing its temperature to 45 – 65 °C

6_H Energy from the high-temperature vapor is exchanged via the condenser to heat water

7 Hot water is then stored in a buffer tank (minimises cycles)

8 A combination of underfloor heating and MVHR then conditions spaces

Cooling Mode / Summer Operation

Figure 8.16 is the reverse of Figure 8.15, the WSHP in cooling mode

8 Any excess heat from load sources (e.g. occupancy and equipment) is:

a. absorbed by cooler fluid passing underfloor

b. recovered by the MVHR system

7 Heat can be stored and recycled for the building's hot water supply (if needed)

6_C Reversed WSHP

5_C A reverse valve re-directs the refrigerant flow, switching the roles of the evaporator and condenser around

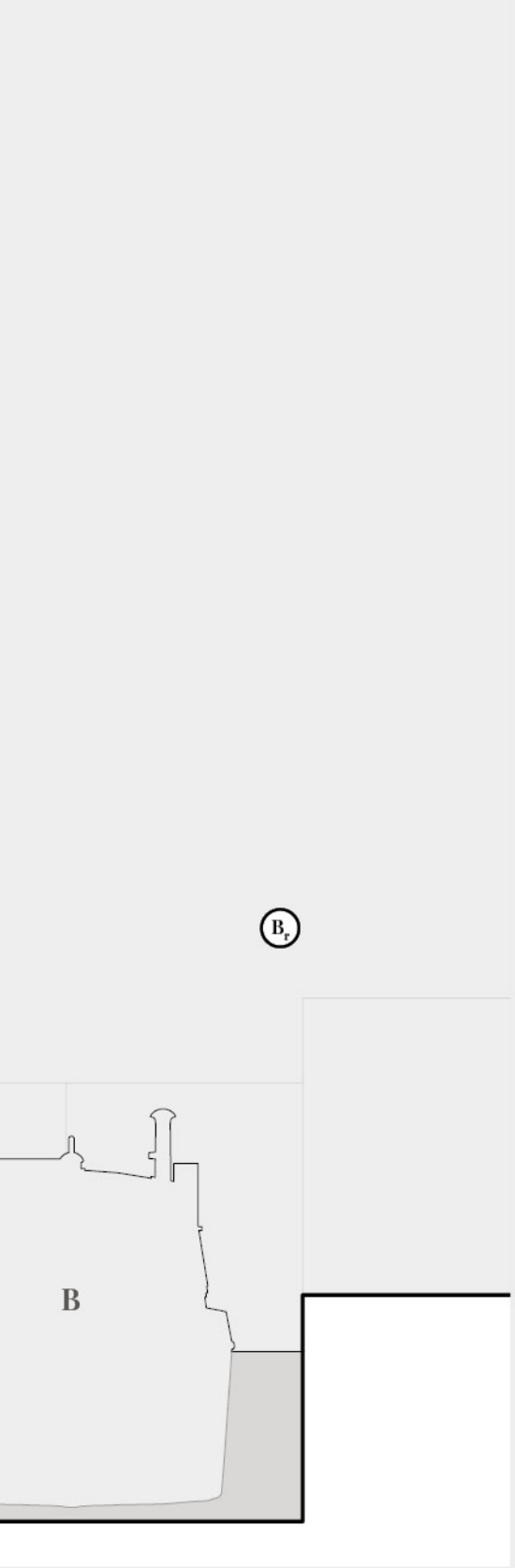
4_C Heat is absorbed by a refrigerant, where it then evaporates and is transferred as a low-temperature gas to the compressor, which increases its temperature

3_C Energy from the high-temperature vapor is rejected via the condenser to the cooler canal-side refrigerant

2 A TTF is then pumped from the WSHP through the existing canal culvert (1897)…

1 … and to the closed-loop heat exchanger. Low grade heat is then extracted to the *RC* via the fluid.

B_r



1:50 A3

0 0.5 1.0 2.0 m

Regent's Canal *Reformed*

The New Pump House

All-Round Constraints

- Canal Boats
- Fish (e.g. Red Swamp Crayfish)
- Vandalism

Design Solutions

- Canal boats within the area will need to be temporarily moved while being installed.
- A closed-loop system prevents possible canal contamination of aquatic habitats unlike open-loop WSHP.

Stakeholders

Canal and River Trust
Requires a license for the movement, discharge and changing the temperature of its canal.

- As opposed to a surface WSHP, the coils will be submerged at a > 1.2 m depth to prevent contact with canal boats.

Winter Constraints

- Cold weather reduces the canal's flow rate, temperature and subsequently its heat capacity

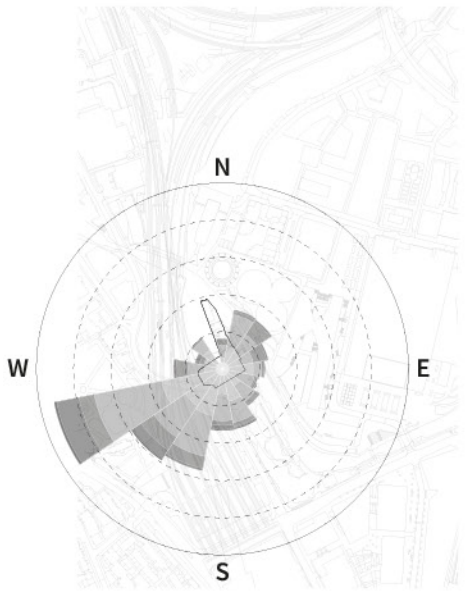
Design Solutions

- Fortunately, the canal's flow rate is of a "similar order of magnitude to [a river's] winter Q95" i.e. exceeding the minimum flow requirements 95% of the time.
- In winter, canal temperatures are typically around 2 °C and in extreme cases <0 °C. As 4 °C is the minimum feasible temperature before the exchanger will freeze-up in an open-loop WSHP, it is not suitable for a multivalent system. Antifreeze passed through a closed loop-heat exchanger's TTF allows for the WSHP to operate at much lower temperatures in aquatic habitats unlike open-loop WSHP (see CIBSE, 2016).

Total Building System

Overview of Spaces and Connections

Figure 8.17 (adapted)



Wind Rose (5 Years Avg.) Figure 8.18

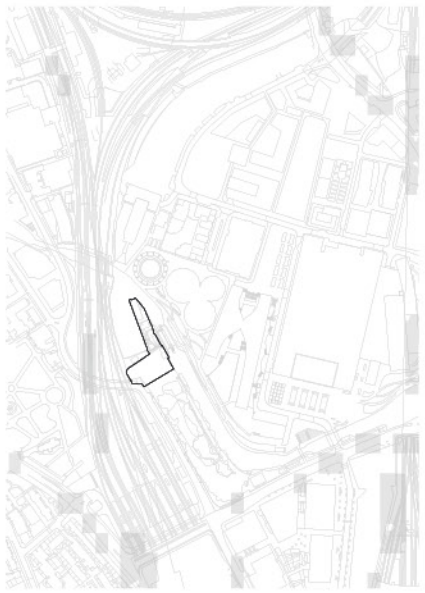
Wind Speed	Occurrences
Calm: 0 – 0.7 mph	11.4 %
Light: 0.7 – 7.8 mph	40.5 %
Gentle: 0.7 – 12.3 mph	34 %
Calm: 0 – 0.7 mph	9.6%
Light: 0.7 – 7.8 mph	3.7%
Gentle: 0.7 – 12.3 mph	0.8%

Annual NO_2 (µg/m³) 2016 Figure 8.19

LEGAL LIMIT*
40 43 46 49 52 52 55 >58

Annual PM_{10} (µg/m³) 2016 Figure 8.19

LIMIT
22 25 28 31 34 37 40



Annual $PM_{2.5}$ (µg/m³) 2016 Figure 8.20

LIMIT
14 15 16 <25

*Refers to UK government limits based off of WHO guidelines

1:10000 A3

N

0 200 400 m

Systems Typology

MVHR is used in most spaces in order to improve whole-system efficiency and to utilise excess heat gain from space-use e.g. in the workshops.

Mechanical Ventilation

Displacement Ventilation

Ceiling displacement ventilation is provided in the piano workshops due to the large volume/area that it has to supply. This can be controlled by the BMS in combination with the chimneys (hence their layout, see left).

Mixed Mode Ventilation

Chimneys and MVHR

The chimneys are mechanically controlled based on a building management system (BMS) that assesses the wind-direction, temperature, noise and pollution levels. By being South/South-West facing they are in an optimum location.

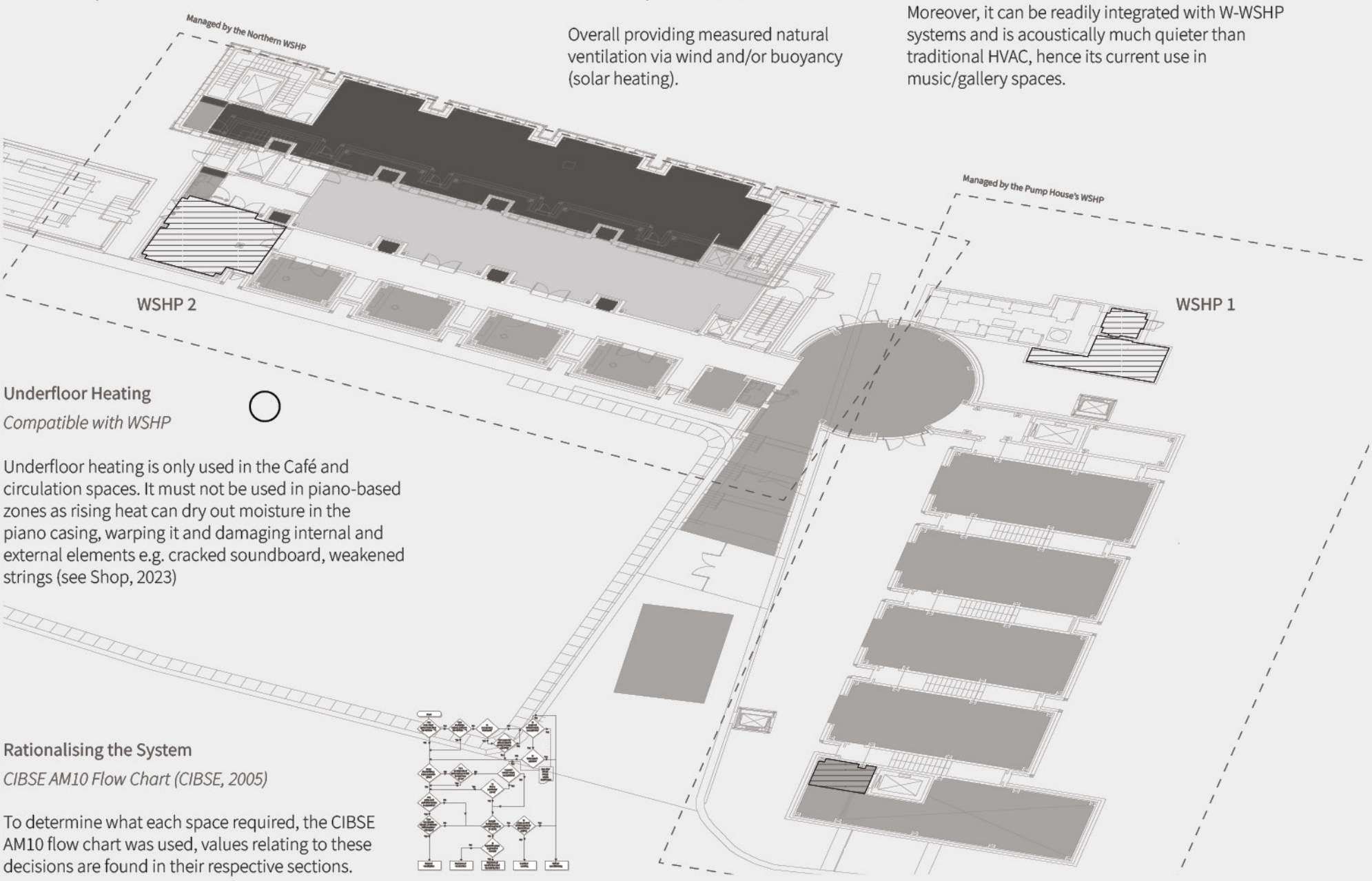
Overall providing measured natural ventilation via wind and/or buoyancy (solar heating).

Mechanical Ventilation

VRF and MVHR Hybrid

VRF (Variable Refrigerant Flow) operates similarly to a 'multi-split system', allowing each space (the tuning rooms, piano stairs, lock cottage, and Waterpoint) to be individually controlled — meeting the highly dependent conditions (humidity/temperature) of these spaces (see Daikin, 2023).

Moreover, it can be readily integrated with W-WSHP systems and is acoustically much quieter than traditional HVAC, hence its current use in music/gallery spaces.



Underfloor Heating

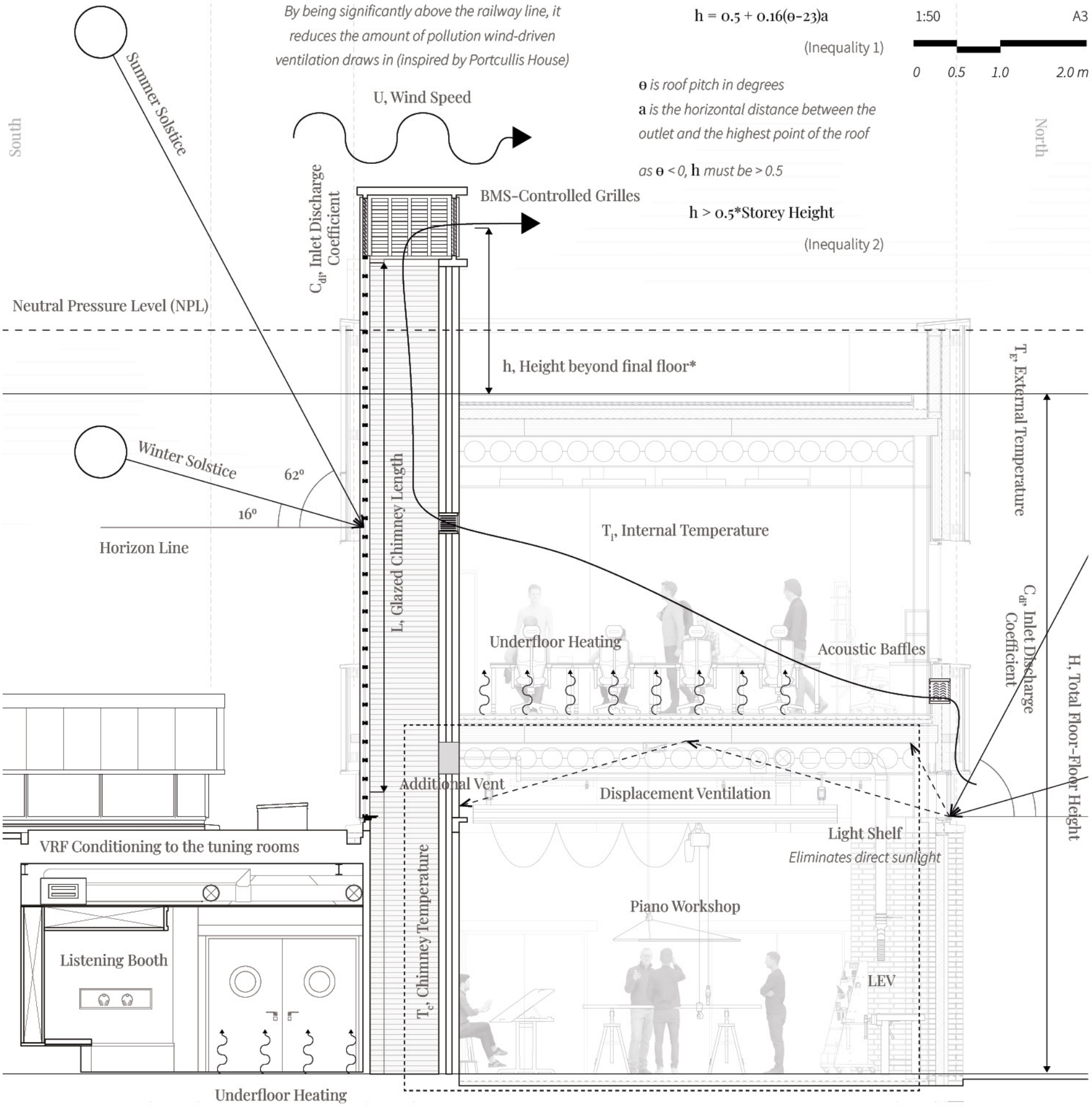
Compatible with WSHP

Underfloor heating is only used in the Café and circulation spaces. It must not be used in piano-based zones as rising heat can dry out moisture in the piano casing, warping it and damaging internal and external elements e.g. cracked soundboard, weakened strings (see Shop, 2023)

Rationalising the System

CIBSE AM10 Flow Chart (CIBSE, 2005)

To determine what each space required, the CIBSE AM10 flow chart was used, values relating to these decisions are found in their respective sections.



Calculations Reference Diagram

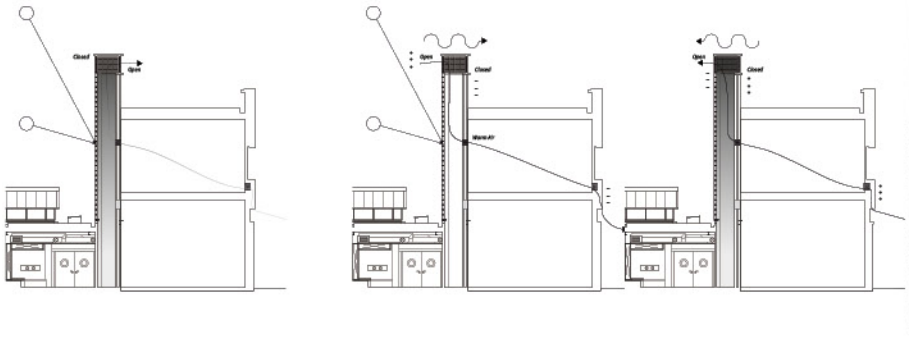
The chimneys are positioned to draw in cooler, cleaner air from the North East (the shaded side) of the RC as a result of the stack ventilation effect — driven by either wind or irradiation from the south-facing glazing.

As outlined on the previous page, pollution and noise from the adjacent railway has to be avoided as it can adversely affect the health of the users.

The glazing will likely need to be rotated upwards to avoid possible glare impacting the adjacent railway line and the moored boats.

Needing to be quite prominent vertical structures, the Chimneys have to have a greater internal temperature than the adjacent Piano Workshop and Studio that they supply.

Subsequently, a large area of glazing and a high thermal of mass brick is used (the chimney is insulated separately to prevent overheating to adjacent spaces and heat loss from it).



Summer
Cooling Mode (Buoyancy Example)

Lower wind-velocity, reducing wind-driven stack ventilation, fans can be fitted within the chimneys to aid this. Cooler air is sourced from the North.

Winter and Non-Summer
Heating Mode (Wind > Buoyancy)

Greater wind velocity and fewer sunlight hours. Grille control prevents flow changes due to pressure differences reversing.

Precedent
BRE Offices
1996
Feilden Clegg Bradley Studio

Figure 8.21

The Year 2 Block

How the Year 2 block works, focusing on one NV Chimney

Change in Density

Ventilation Inlets

Change in internal pressure ΔP *for the final inlet opening (i) and the chimney (c) are opposite and equal.*

$$\Delta P_c = \Delta P_o - \Delta p_E g (H + h) + p_E g (H + h - L) + p_c g L$$

(Equation 1)

$$\Delta P_c = \Delta P_o - \Delta p_o g (H + h) - \Delta p_c g L$$

(Equation 2)

Change in internal pressure ΔP *for the final inlet opening (i) and the chimney (c) are opposite and equal.*

$$\Delta P_i = - \Delta P_C$$

(Equation 3 = - Equation 2)

$$\Delta P_o - \Delta p_o g z_{2F} = -(\Delta P_o - \Delta p_o g (H + h) - \Delta p_c g L)$$

$$2\Delta P_o = \Delta p_o g z_{2F} + \Delta p_o g (H + h) + \Delta p_c g L$$

ΔP_o = 1.56 Pa

Chimney Outlet

H= 9.9 m T_i= 25 °C p_o = 1.2 kgm^{-2}

L= 8.2 m T_e= 28 °C C_{di}= 0.61

h= 2.5 m $T_{(=e-i)}$= 3 K C_{dc}= 0.8

g= 9.81 ms^{-2} T_c= 28 °C

U= 0 ms^{-1} $T_{(=c-i)}$= 3 K

Calculating the area of the chimney outlet

$$\Delta p_o / p_o = (T_I - T_E)/(TE+273)$$

(Equation 6)

Δp_o = 0.01

$$\Delta p_c / p_o = (Tc - TE)/(TE+273)$$

(Equation 7)

Δp_c = 0.01

Change in Pressure

ΔP_o *is substituted into equation 3i to find* ΔP_i

$$\Delta P_i = \Delta P_o - \Delta p_o g z_i + 0.5 p_o U_2 C_{pi}$$

(Equation 3i)

ΔP_o *is substituted into equation 3c to find* ΔP_c

$$\Delta P_c = \Delta P_o - \Delta p_o g z_n + 0.5 p_o U_2 C_{pc}$$

(Equation 3c)

buoyancy-driven condition, so U= *0*

$0.5 p_o U_2 C_{pi/c}$ = 0

ΔP_i = 0.89 Pa

ΔP_c = 0.89 Pa

Opening Areas

Calculating the area of the inlet opening

$$C_{di} A_i = (q_i / S_i) . (p_o / 2|\Delta P_i|)^{0.5}$$

(Equation 4i)

$$A_i = ((q_i / S_i) . (p_o / 2|\Delta P_i|)^{0.5}) / C_{di}$$

(Equation 5i)

A_i = 0.969 m²

Calculating the area of the chimney outlet

$$C_{dc} A_c = (q_c / S_c) . (p_o / 2|\Delta P_c|)^{0.5}$$

(Equation 4c)

$$A_c = ((q_c / S_c) . (p_o / 2|\Delta P_c|)^{0.5}) / C_{dc}$$

(Equation 5c)

A_c = 2.95 m²

Key Values

Openings	z / m	qi / m³s⁻¹	Flow Pattern	Si	ΔP_i / Pa	C_{di}	$A_{i\,or\,c/4}$/m²
2F	*5.6*	*0.72 (*4)*	*Inward*	*+1*	*2F*	*0.61*	*0.24*
Chimney (c)	*5.6 (NPL)*	*-2.88*	*Outward*	*-1*	*Chimney*	*0.8*	*0.98*

A sophisticated spreadsheet was created by the author that utilised these calculations, and so can be re-used for different/future floors, changing conditions and any building alterations

Chimney Calculations

Inlet and outlet sizing calculations for the buoyancy-driven ventilation conditioning the Year 2 Studio Space

Act 9

Tuning

Non-absolute Acoustics

Without atmosphere a painting is nothing.

Rembrandt

A Man seated reading at a Table (?)
in a Lofty Room

Follower of Rembrandt
Figure 9.1

The Tuning Room

In-Use

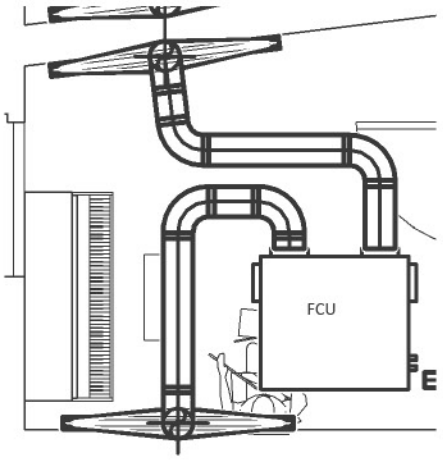
Considered an individual practice room, as per BS ISO 23591:2021, The *Tuning Room* is designed for individuals or pairs (teacher and student) for the practicing and tuning of musical instruments and so can become very loud (BSI, 2021).

Precedent Figure 9.2

Hallé Music Facility 1:50

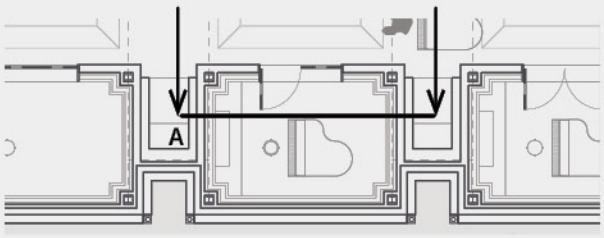
Stephenson Studio

Inspired by Max Fordham Engineer's response to a diverse range of room typologies. Notably the 'small practice rooms' which consist of fixed-windowed box-in-box constructions that are climatically controlled by individual VRF units. Each of these have been 'located in [adjacent underfloor-heated corridors] to [minimise breakout noise]' (Engineers, M.F., 2023).



+. A Tuneful Corner **14.** Tuning Room **A** *Designed for All*

A Man seated playing a Piano in a Lofty Room



1:50 A3

N

0 0.5 1.0 2.0 m

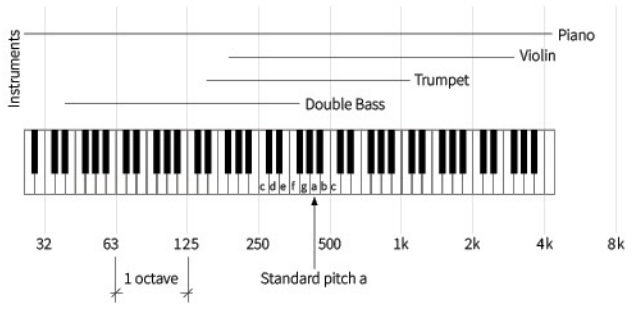
Detail key

1. Timber Floor
2. Floor Spring System
3. Acoustic Seal (Cat. C)
4. Upstand Insulation
5. Thermal Block
6. Acoustic Panel (various)
7. Soundbloc Plasterboard
8. Acoustic Mineral Wool (Cat. C)
9. Plywood
10. Min. 50 mm Void
11. Floating Screed
12. Glazing with Blinds
13. Rigid Insulation (Cat. C)
14. Underfloor Heating

CA = Ceiling Absorbers *WA = Wall Absorbers* *BA = Bass*

Rw = Sound Reduction Index *L'nT,w = Normalised Reduction Index*

Figure 9.3, Instrument Frequency Ranges



Piano Dynamics

Dynamic Range of a Piano	Sound Power Level (SPL), L_{WA}
Pianissimo pp	<60 dB
Piano p	>60 dB
Mezzoforte mf	>70 dB
Forte f	>90 dB
Fortissimo ff	100 – **115 dB**

Table A

Table B, Key Noise Values and Targets

Criteria and Level Difference Targets	Value	Authoratitive Source
Background Noise in Schools	35 dB(A)	WHO
Imission in Villages / Mixed-use Zones	60/45 dB(A)	Day / Night. TA Lärm, Technical Instructions on Noise Abatement, Germany.
Imission in General Residential Areas	55/40 dB(A)	
Imission in Purely Residential Areas	50/35 dB(A)	
Railway, L_{Aeq16h}	55–70 dB(A)	Extrium
UK Permitted Noise Level from Neighbours	34 dB(A)	UK GOV
Daily / Weekly Exposure	87 dB(A)	HSE Noise Regulations
Maximum Peak Noise Exposure	140 dB(C)	

Formula for Acoustic Details

$$R = L_1 - L_2 + \log_{10}(S/A_2)$$

S/A_2 *is often* ~ 1, *therefore* $\log_{10}(S/A_2) = 0$

$$R = L_1 - L_2$$

(Equation 1)

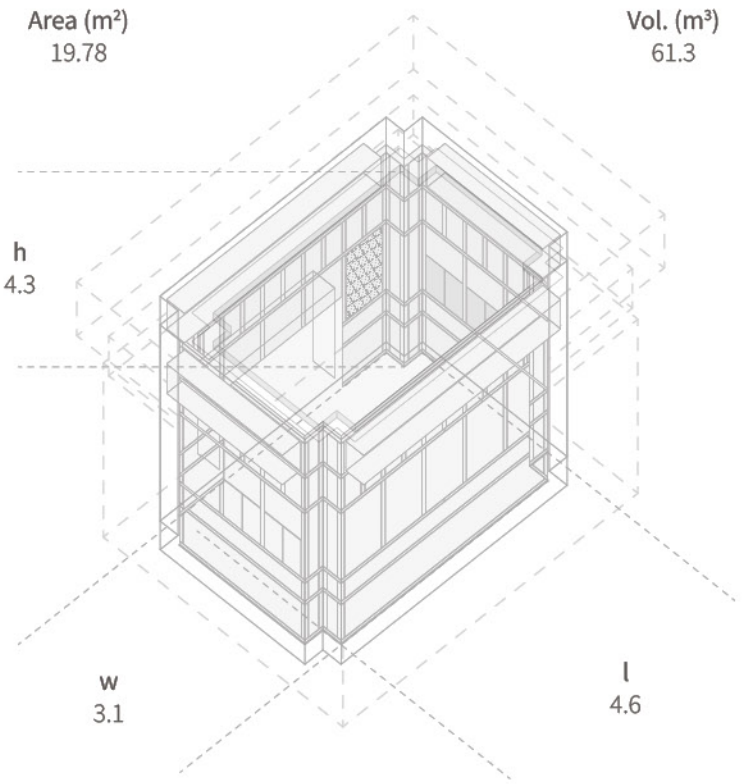
R= Level Difference (see targets)

S= Area of the Transmitting Wall

$L_{1/2}$= Sound Pres. (Room 1/2)

A_2= Absorption Surface Area of Wall

X-Ray View of Tuning Room



Room Proportions

Small tuning rooms have fewer room modes than typical rehearsal rooms and so dissimilar proportions are needed to produce low frequencies (20 – 200 Hz) and to minimise unwanted superposition /audible resonance events.

Initially, it is assumed that l ≥ w ≥ h, however as h > w, h and w switch in these inequalities (Rindel, 2021)

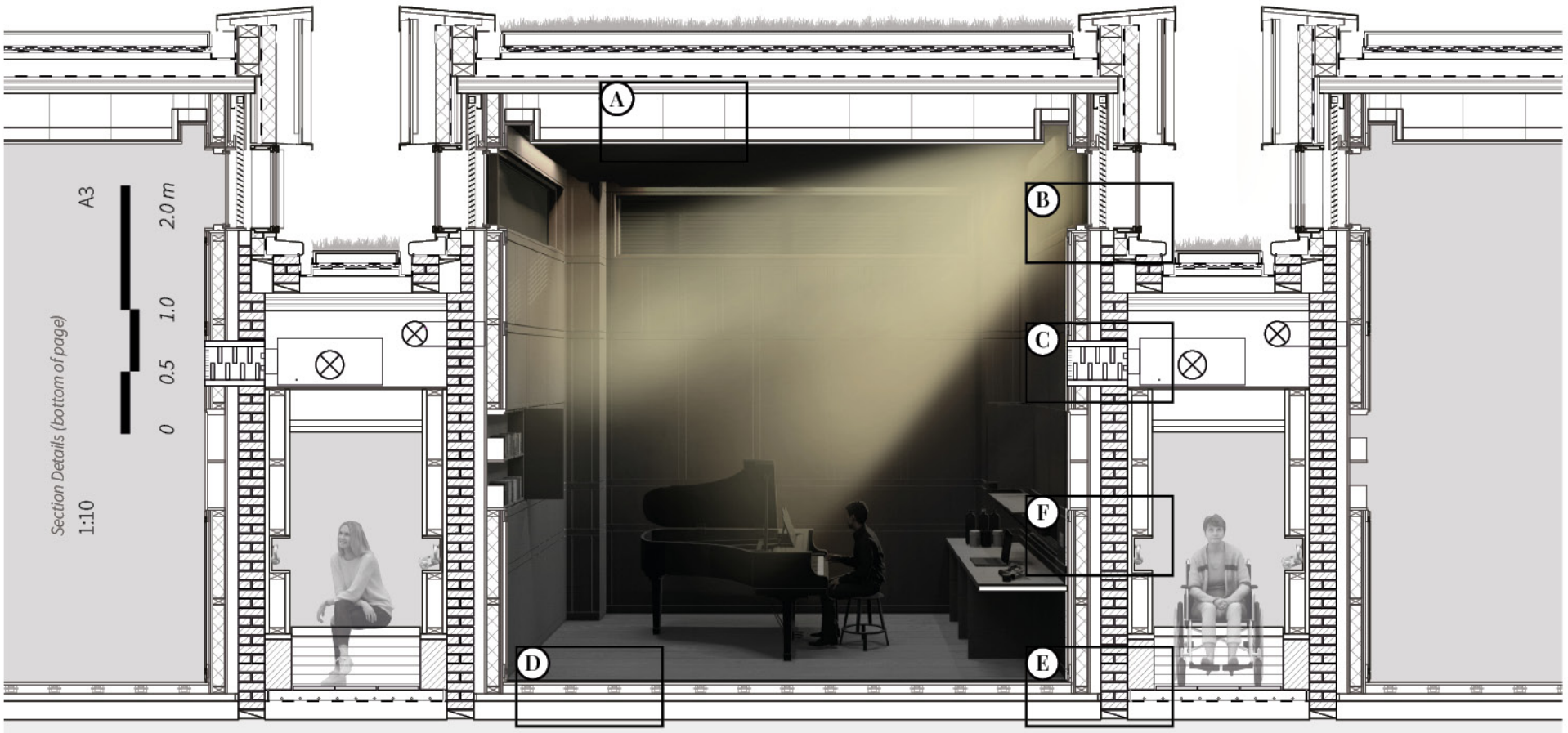
l/w= 1.48 1:1.44:1.2[A]

h/w= 1.38 l/h= 1.1 1:1.38:1.48

1:w/h:l/h (Proportion 1a)	1:h/w:l/w X (Proportion 1b)
w/h > 1.1 (Inequality 1a)	h/w > 1.1 ✓ (Inequality 1b)
1.1 < l/w <1.6 (Inequality 2a)	1.1 < l/h <1.6 ✓ (Inequality 2b)

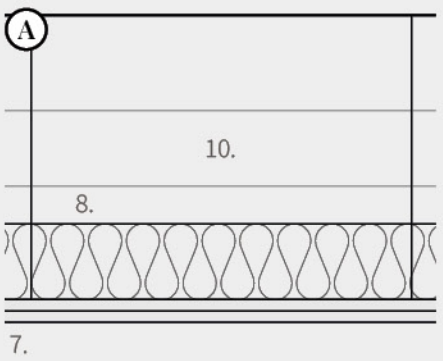
Unfortunately, due to the constrained site and programme, the optimum ratio (A) is not met but each of the inequalities are.

This can be compensated through the small tuning rooms design.



The Tuning Room

Acoustic Details and Flanking Paths



Suspended Acoustic Ceiling (CA)

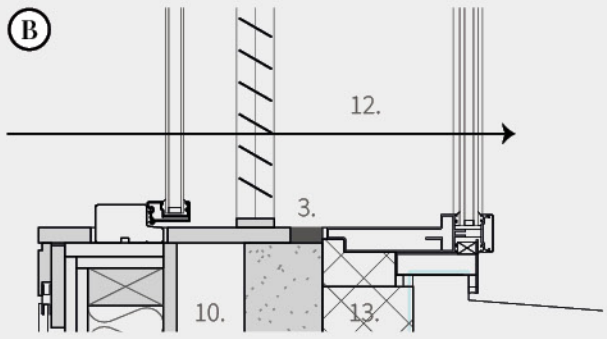
Standard Windows

Rw + (C;Ctr)[1], dB	**53**

Double Windows

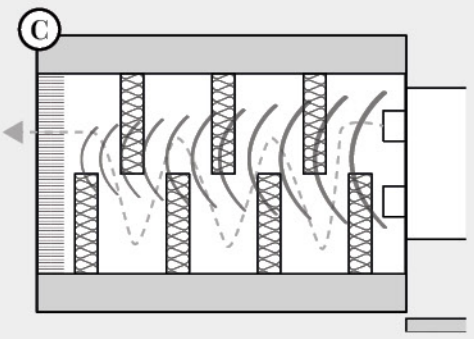
Rw + (C;Ctr)[1], dB	**>~58**

1. *Assumes a +8dB conservative difference N.B. On a grounded floor so will contribute much less to airborne noise than walls*



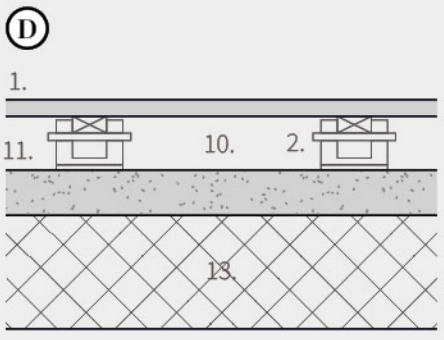
Primary and Secondary Glazing

3/12. Electrical blinds are stored within the window void in order to minimise their mechanical noise.
A double-double glazing studio system is used as part of the *box-in-box* construction. Acoustic seals (e.g. 3) are used to minimise the *Deep Niche Effect* of light shelves and so transmission loss in the glazing via 'interreflections' (Egan, 2007).



Acoustic Baffle Box for VRF Ventilation

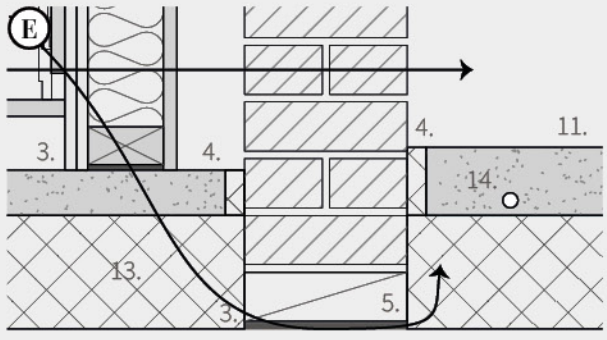
Provides damping for the VRF fresh air supply, totally eliminating any possible mechanical noise (~ 20 – 35 dB(A)).
All build-ups are designed to subtract from the **115 dB** maximum SPL from a piano playing fortissimo. Target values are shown on the adjacent page.



Floating Timber Floor on Screed

Airborne DnT,w dB	**58**	T[3]
Airborne DnT,w + Ctr dB	**53**	
Rw + Ctr[1], dB	**61**	72
Impact L'nT,w dB	**50**	28

1. *Assumes a +8dB conservative difference N.B. On a grounded floor so will contribute much less to airborne noise than walls*

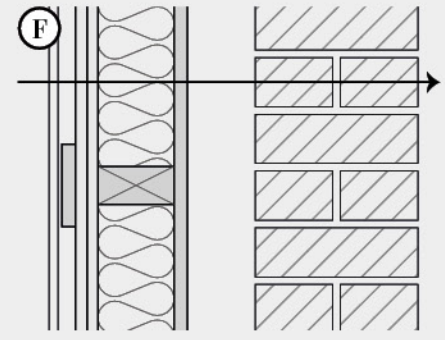


Corner Junction

2/3/11. A combination of acoustic seals and floating floors (both timber and screed) minimise flanking transmission from airborne and impact noise.

5. Thermal blocks provide a continuous thermal envelope.

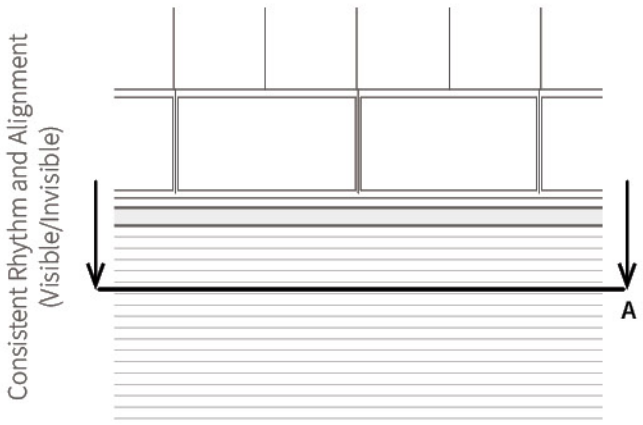
3. *Target for a Category C music room*

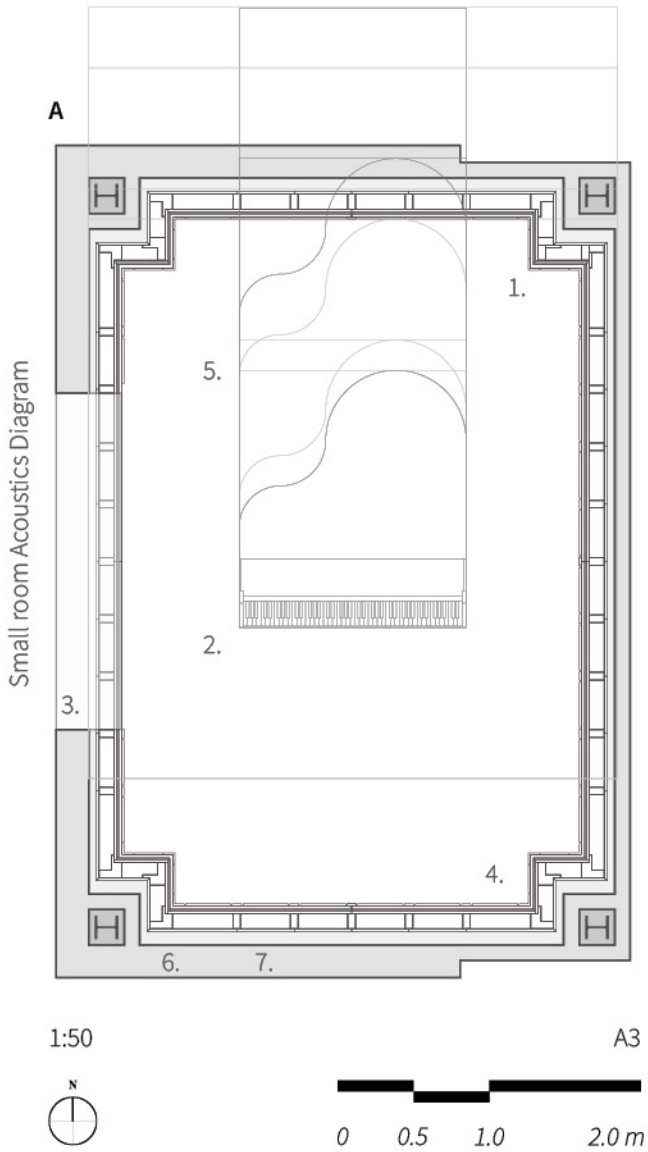


Internal Timber Frame (WA/BA)

Airborne DnT,w dB	**64**	T
Airborne DnT,w + Ctr dB	**60**	
Rw + Ctr (Single-Brick)[1], dB	**68**	
Rw + Ctr (Double-Brick)[2], dB	**73**	72

1. *Assumes a +8dB conservative difference*
2. *Mass Law — Double mass, +5 dB*





Small room Acoustics Diagram

Small Room Acoustics

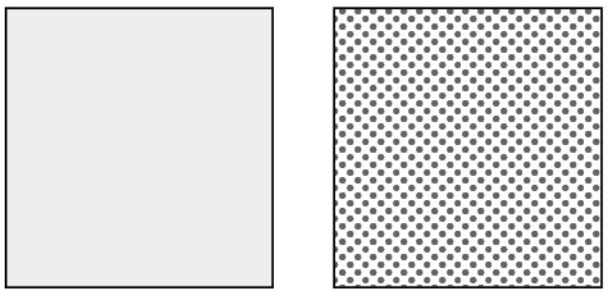
Careful consideration was undertaken regarding the tuning room in regards to: how it functioned, connected with the piano-making process and its future-use — continuing this theory of constant holistic ***Reform***.

1. Non-fully rectangular space with the use of the inward corner
2. Designed to the piano's dimensions and frequency requirements (sized to baby–parlour room pianos)
3. Self-closing Studio Doors (increased thickness and sound reduction)
4. Sound Absorption / Reflection Panels (based off *Gustafs*) — absorption (α) varies depending on surface finish e.g. perforations, solid, thickness etc.
5. The inward corners create a space for a built-in desk and storage, as inspired by SALT's Steinway Showroom.
6. 50 mm minimum air gap increases 'low-frequency absorption' from the small room proportions, 'reducing boominess' (Foley, 2020) and eliminating any transmission bridging across a solid build-up.
7. Box-in-box construction, offers a loose fit and acoustically resilient construction (with levelled access being enabled by differing floating screed levels) that allows these spaces to be changed in the future e.g. if a different small work environment is needed, more offices, more gallery space, etc..

Small room Acoustics Diagram

Criteria and Level Difference Targets	a	b	T_{mid}
Loud Acoustic Music, Upper Limit	0.6	0.5	0.6
Loud Acoustic Music, Lower Limit	0.4	0.3	0.4
Quiet Acoustic Music, Upper Limit	0.75	0.65	0.7
Quiet Acoustic Music, Lower Limit	0.55	0.45	0.5
T_{mid}	≤ 0.8 ✓		
Legislation (Practice Room, V > 30 m³)	BB93		
R_{T60}	0.6 – 0.8		

Acoustic Panels



Solid Panel
$\alpha_w = 0.85$

5 mm Perforations
$\alpha_w = 0.25$

Reverb Time

Small rooms are ideal for practice and tuning room, with them provider shorter reverb time than typical performance spaces. The following calculations and considerations were made:

$$T_{mid} = a\log_{10}(V) - b$$

(Equation 2)

T_{mid} = Average value of reverberation times at the octave bands from 500 – 1 kHz —'where the human ear is most sensitive' (BSI, 2021)

$$R_{T60} = 0.161V / S\alpha$$

(Sabine Equation [3])

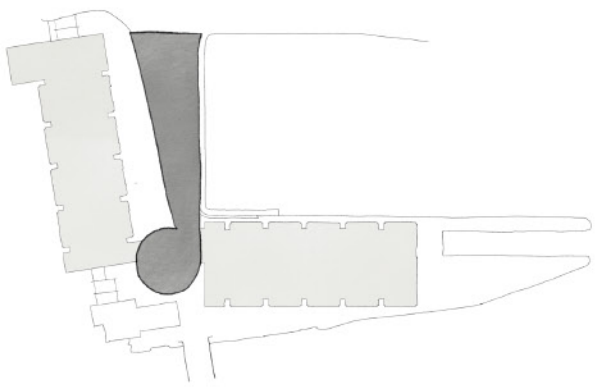
R_{T60} = 'Time (in seconds) for the average sound in a room to decrease by 60 decibels after a source stops generating sound' (AcousticComfort, 2023)

Act 10

The Anti-Cappella

The Public and the Piano

Through the Piano Corridor



Form finds Function in a music note

The Café

A Meeting Point

As a centre point the café is able to serve the many users from CSM, the Camley Street Nature Reserve and the general public throughout the week. As well as the St Pancras Cruising Club, of which this constitutes as replacement to their clubhouse space — eliminating the divide that the existing site had between canal enthusiasts and King's Cross.

Through the Piano Stairs

1:100 A3

0 1 2 5 m

Reform

The Centre Café

Group 1

Group 2

Group 3

Increases in height towards the Waterpoint

A

The Copper Tank

Remains within the wall

up 4

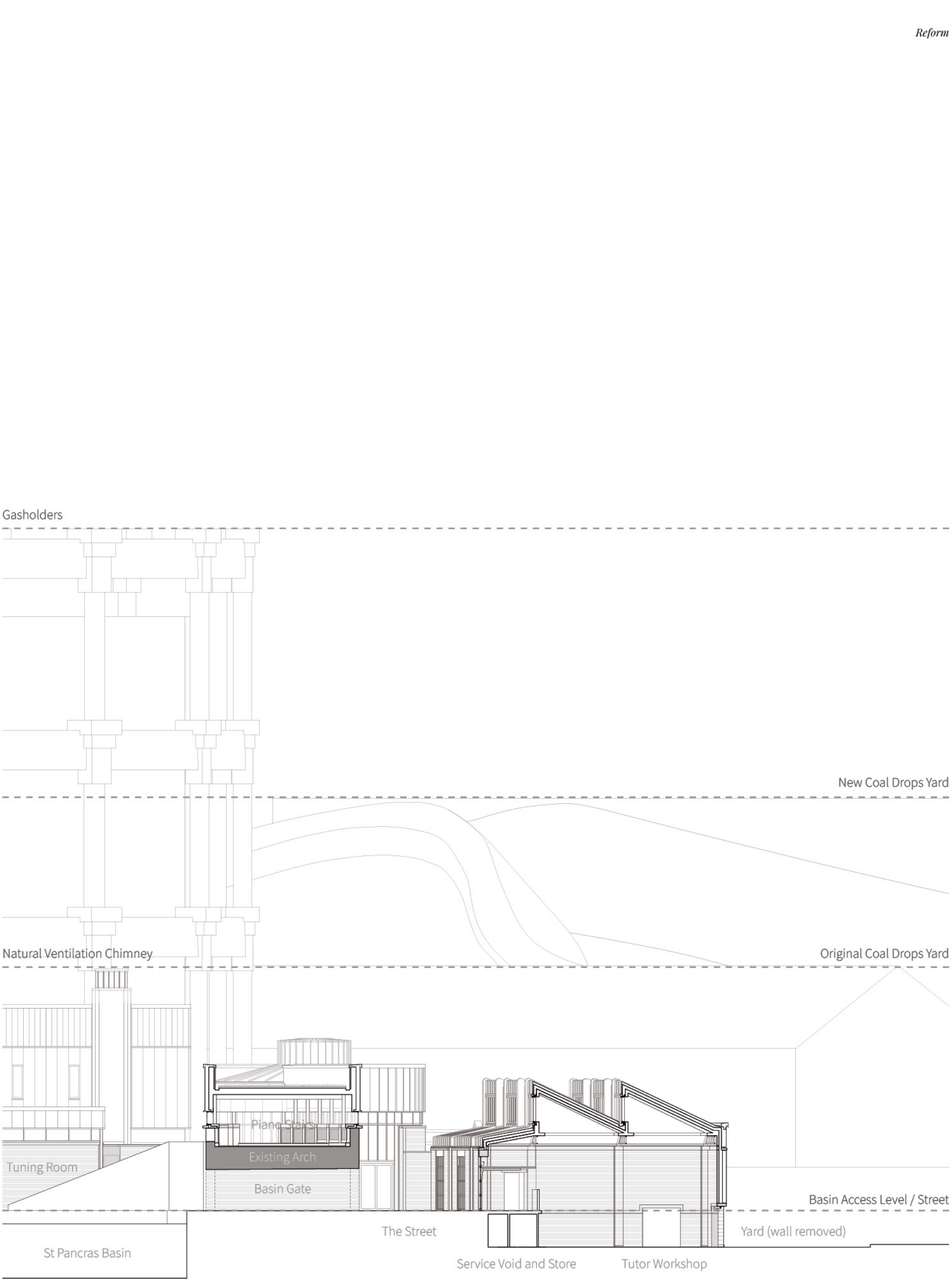
The Basin Gate

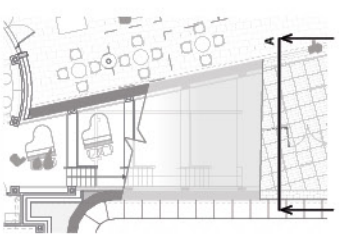
The Waterpoint Performance Space

Toilet Space — Existing but not modelled

The Scale del Pianoforte

The Piano Stairs/Scales — a noisy corridor filled with finished pianos and an enthusiastic public ascending the steps towards the Waterpoint's performance space. The crescendo of the piano-making process.





1:200 A3

N

0 1 2 3 4 5 10 m

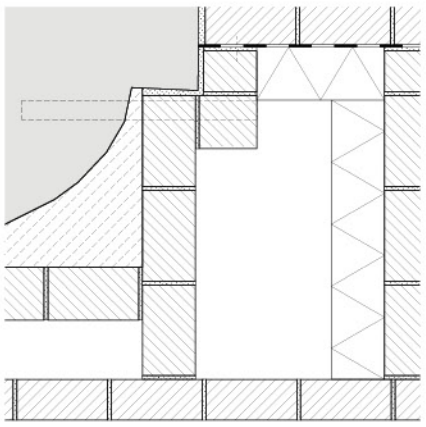
A New Mew

A modest addition in comparison to the Gasholders and retrofitted Coal Drops roof but it continues to follow the industrial grain of the original Coal Drops and so when viewed from the Eurostar or the Regent's Canal corridor it meets the scale of the context.

Inhabiting the Wall

Retrofit Details

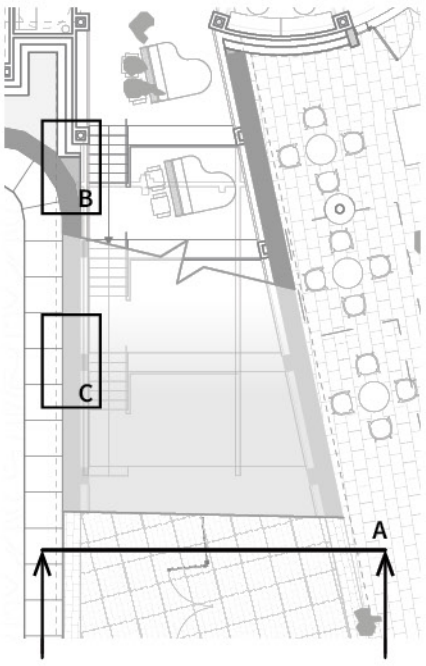
New and old brick overlap and are defined by the stained cill and zinc "cap" (see p. 63), and internally by ribbed timber panels (and shadow gaps) that provide acoustic absorption and reverb balance for the piano at each level.

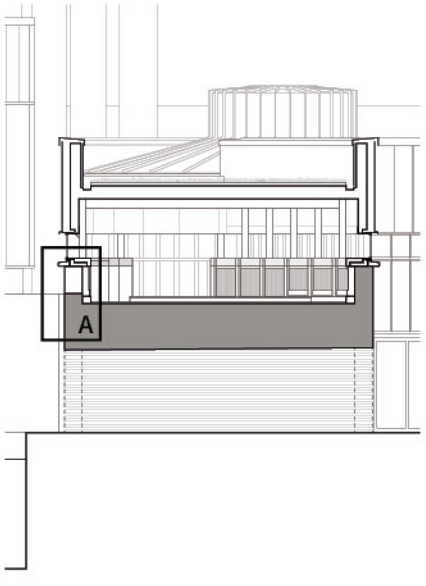


Retrofit Precedent — Figure 10.1
Astley Castle — Grade II*

Witherford Watson Mann

Use of a concrete infill to create a primer when building against existing masonry structures. Unlike WWM's detail, I've decided to leave the concrete exposed so that this transition is visible.

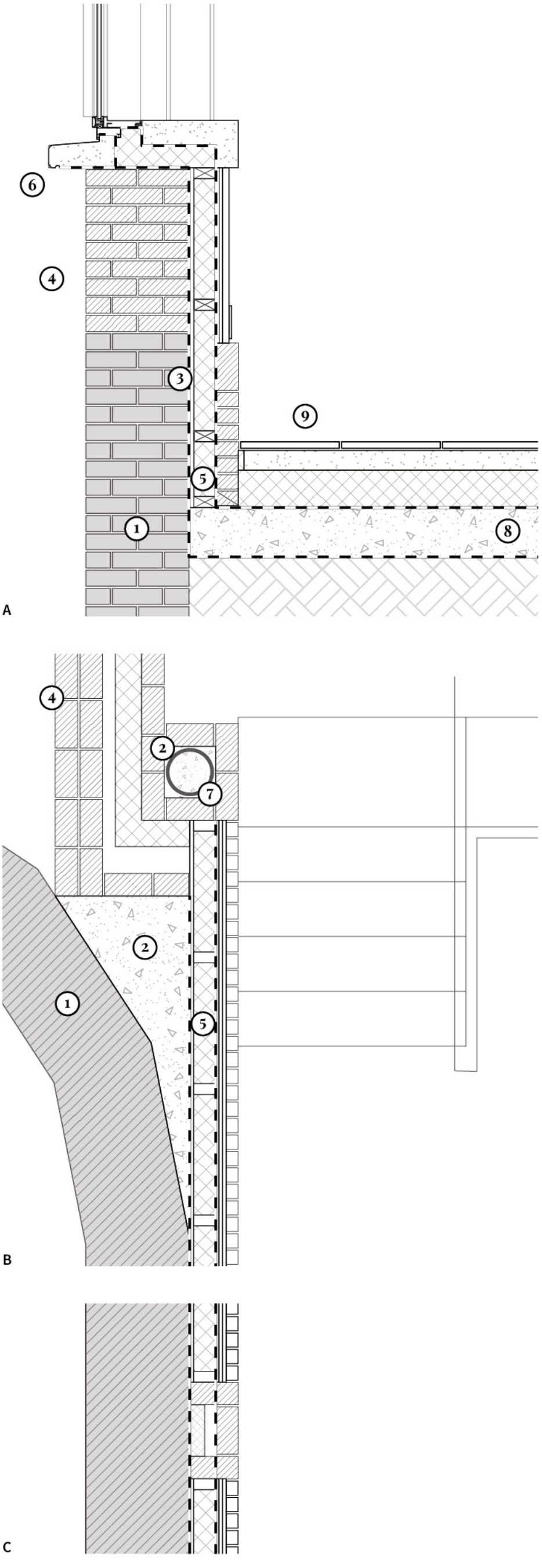




1:200 A3

0 1 2 3 4 5 10 m

1. Existing Brick
2. Concrete Infill
3. Protective Membrane
4. Luton Grey Brick (New)
5. Stud Wall Insert
6. Concrete Cill
7. CHS
8. Ground-bearing Slab
9. Stone Tiles



St Pancras Waterpoint

A Relocated Monument

A steam locomotive Wateroint for St Pancras Station. Relocated over 700 metres from 'Barlow's train shed' to Camley Street to accommodate the Channel Tunnel Rail Link (HS1); it is now refurbished and used by the St Pancras Cruising Club for social functions (Abrehart, 2022). Only remaining waterpoint of seven for St Pancras' steam trains (Camden, 2008).

Grade: II (1974)

Architect (known for)
Sir Gilbert Scott (St Pancras Station)

Year: 1860s

Owners / Leased to
London Historic Buildings Trust / British Waterways

Users
St Pancras Cruising Club

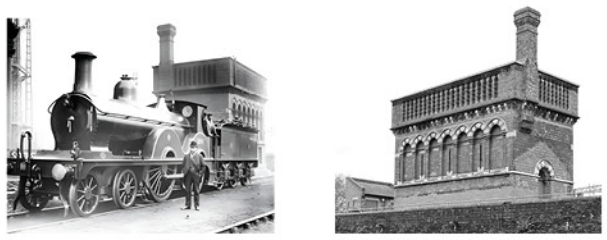


Figure 10.2, St Pancras Waterpoint (Then vs. Now)

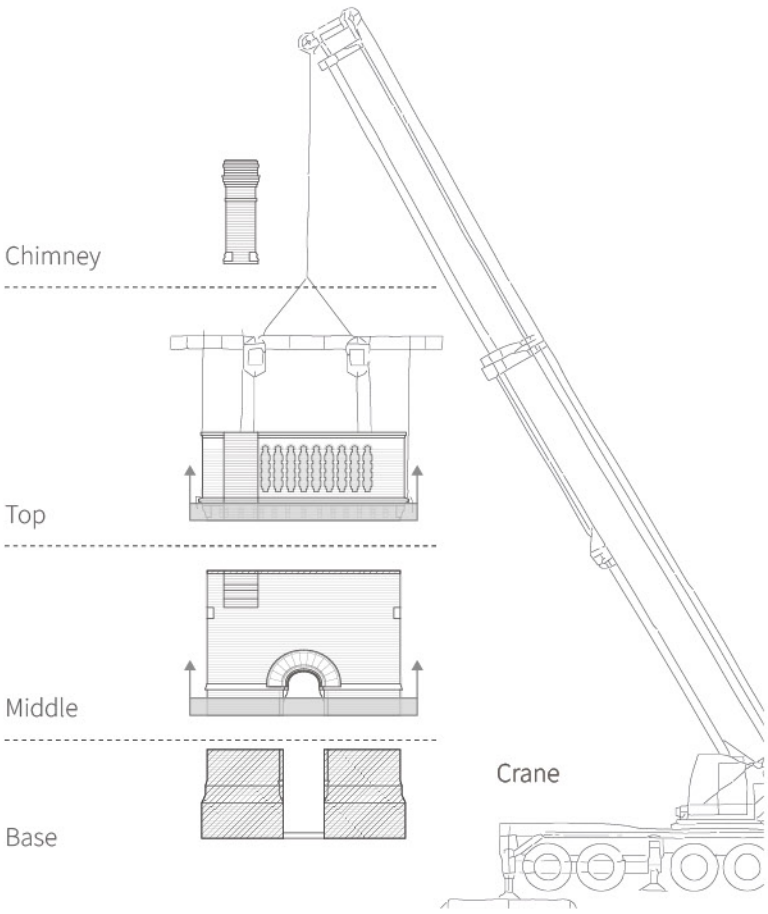


Figure 10.3, Moving the Monument (adapted)

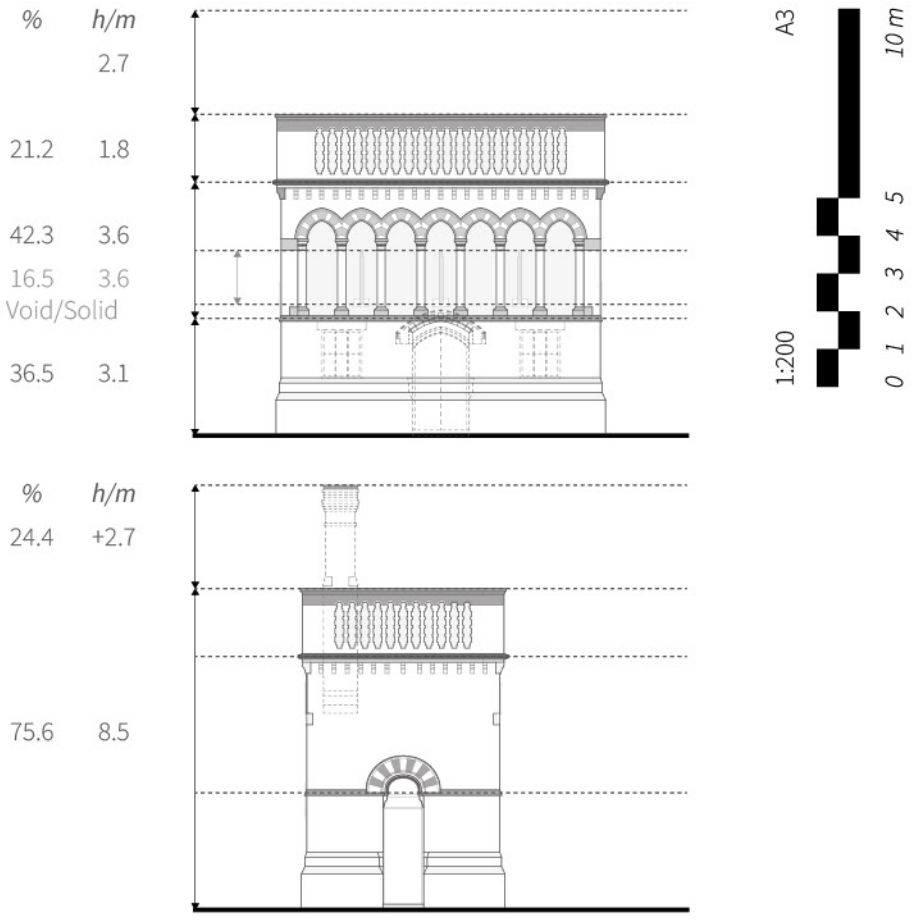


Figure 10.4 (adapted elevations)

Old Brick New Brick Lifting Beams

1:50 A3

0 0.5 1.0 2.0 m

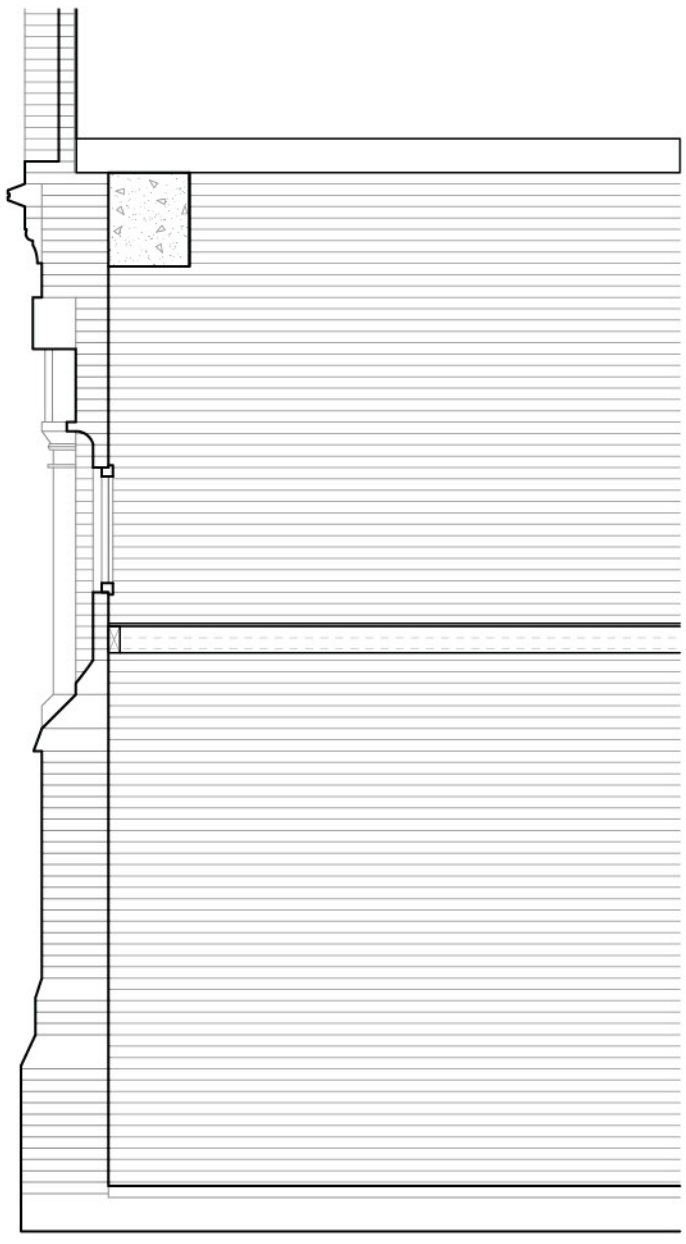
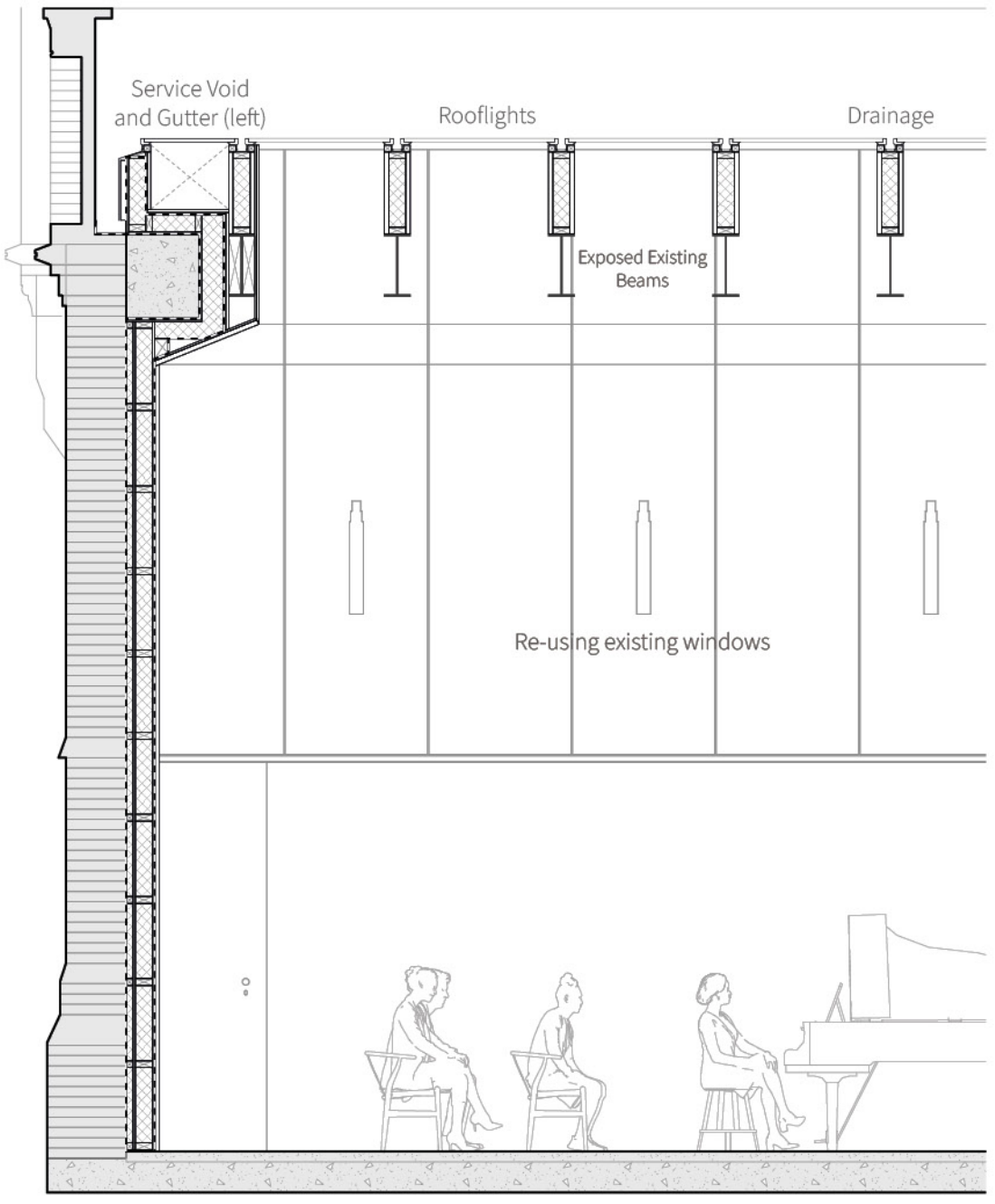


Figure 10.4, Existing Structure



Proposed Retrofit — Up to Performance (see tuning room / wall retrofit for similar details)

St Pancras Waterpoint — Up to Performance

The Waterpoint offers a unique venue for the end of year show, with a retrofitted acoustically-controlled interior similar to the small tuning rooms of the RDC-PTC

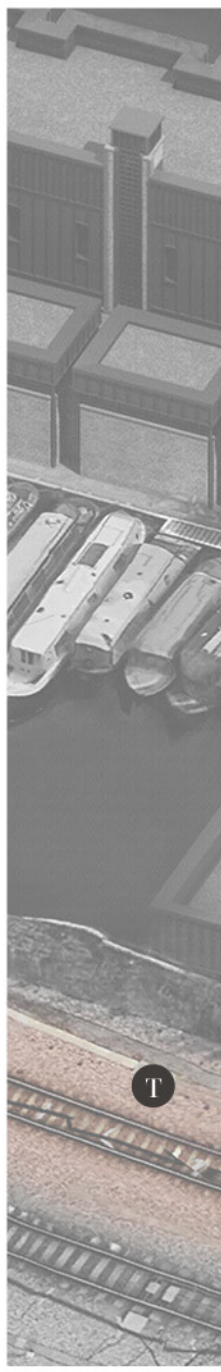
Act 11

After the Cappella

Site, Sights and Safety

1. A Tributary of Camley Street (top)

2. The Industrial Mew / Retail Street (bottom)



Large Pavers
/ York Stone

E. External elevators provide disabled, elderly, and bike access to the upper levels of both the main entrance and the Waterpoint performance space.

Y. A maker's yard minimises the demands on extract ventilation e.g. when using paints or adhesives. Moreover it increases the workshop area and provides secure external storage if required. It is unlikely that noise from this space will have any impact.

Br. A new bridge will span over the lock, extending in line with the axis of the piano stairs.

W. Clear, well-lit maps and signs are essential to navigating this campus. The existing style of mapping used on opposite of the canal has been adapted at the site.

D. All bench seating is disabled friendly, with a space of at least 1000 x 2000 being provided besides them. Additionally the benches are homeless-friendly, with no exposed metal or handrails that could prevent sleeping.

T. The acoustic impact of the St Pancras Railway has been assessed (p. 92).

B. Parking for at least 16 bikes is provided to restore the 5 used car park spaces removed during the building's construction. A shift from road vehicles to cycling is needed in King's Cross, as inspired by the many urban Scandinavian street models and with AQMA in London (see p. 82).

P. The boundary park is between the RDC-PTC and the CSNR has been designed by the author but it will be managed by the nature reserve due to their specialisation in habitat management.

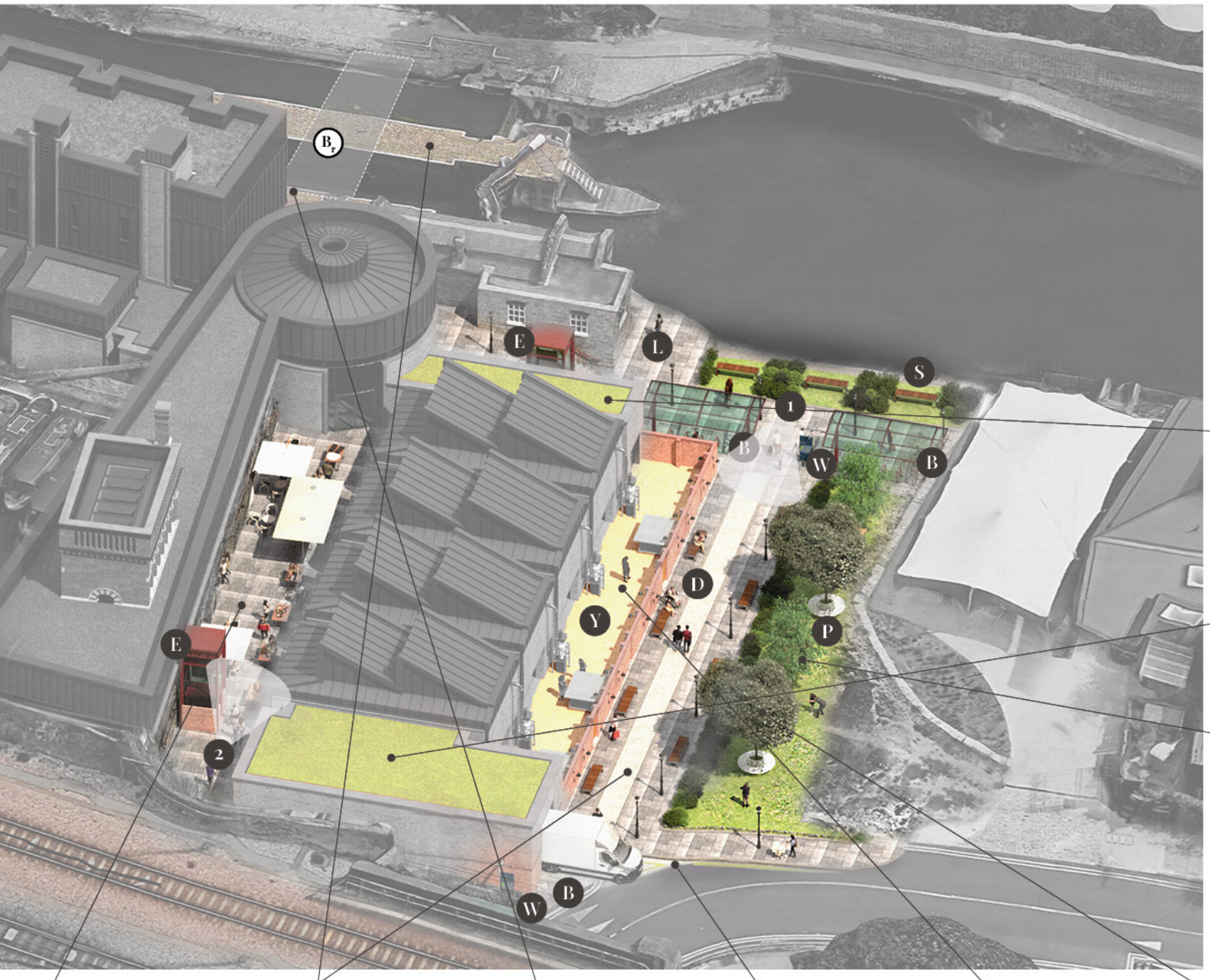
L. Measured street lighting is essential in this area for many reasons, examples include:

Safety
Most notably for women and girls coming to and from the retail of CDY.

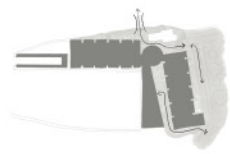
Bats (at CSNR)
Light pollution disturbs their hunting.

St Pancras Basin
Neighbouring canal boats should not be affected by light pollution. Solutions to this include low-level light modes for the gallery and tuning rooms can not be used beyond 20:00.

Figure 11.1 (adapted)

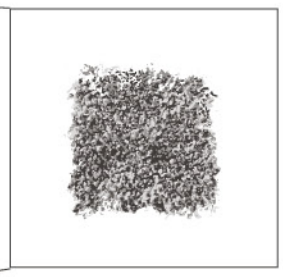


Balancing Hard-Soft



Closed Building Access

A Series of Streets



Light Sedum Planting and Gravel

Goat Willow Tree

New Granite Setts
Permeable as part of the SUDs

Existing Granite Setts
Permeable as part of the SUDs

Brick Pavers
Permeable as part of the SUDs

Concrete Capping

Bonded Sand / Gravel
Easy to replace and maintain

Sycamore Tree
Based on existing flora at the site

Material Palette

The Industrial Mew

Opening the Street

Reforming the multi-level industrial mew, as seen at the: Coal Drops Yard, Granary Square, The Rotunda and the Ruthin Crafts Centre. A contemporary craft village with a retail frontage.

Fortnightly Timetable

Term Time

M	T	W	T	F	S	S
○	○	○	○	○	◎	●

Summer

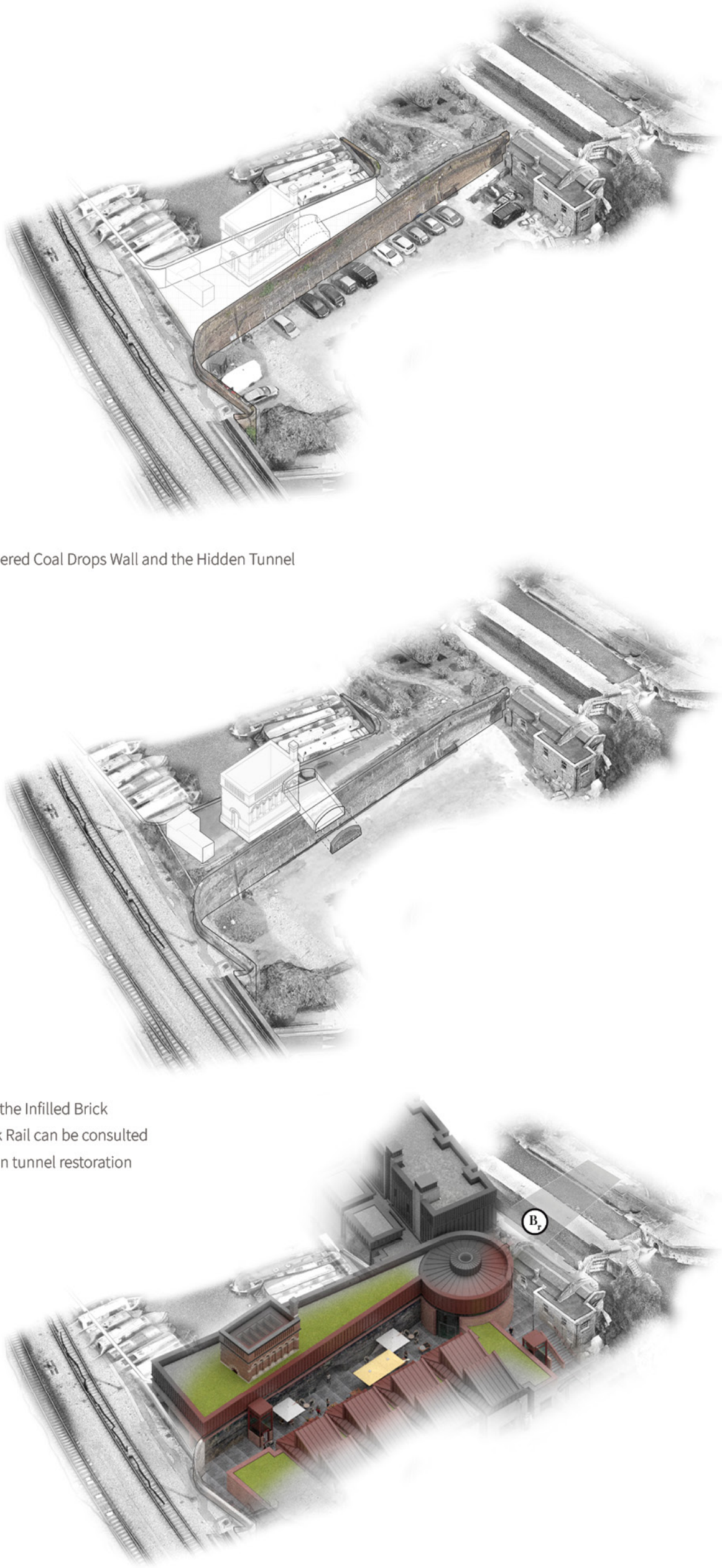
M	T	W	T	F	S	S
○	○	○	○	◎	●	●

Winter (weather-depending)

M	T	W	T	F	S	S
○	○	○	○	○	◎	●

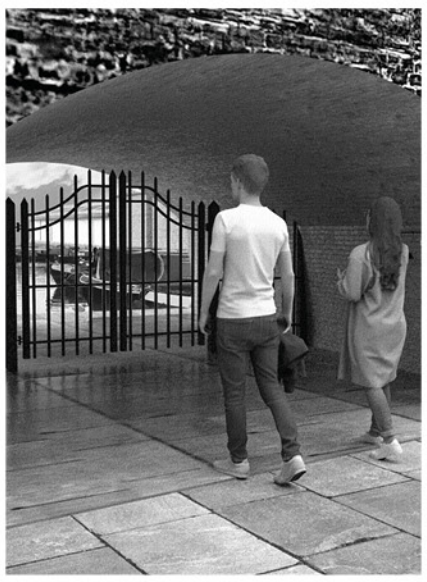
● Retail ○ Street ◎ Prep.

Access to the street varies throughout the week and term times and is fortnightly to give tutors time for their own projects. Most notably are the retail gallery days, where tutors are able to exhibit their workshop space and sellable products either externally or internally (climate-depending). Preperation days are provided so that the working tutors have time to set-up their display. Otherwise on all days, the street and café/piano stairs (except during maintenance or other special days e.g. total school closure) are totally accessible to the public. The basin is only accessible to members of the SPCC or in the case of a fire. See page 131 for more information on access.



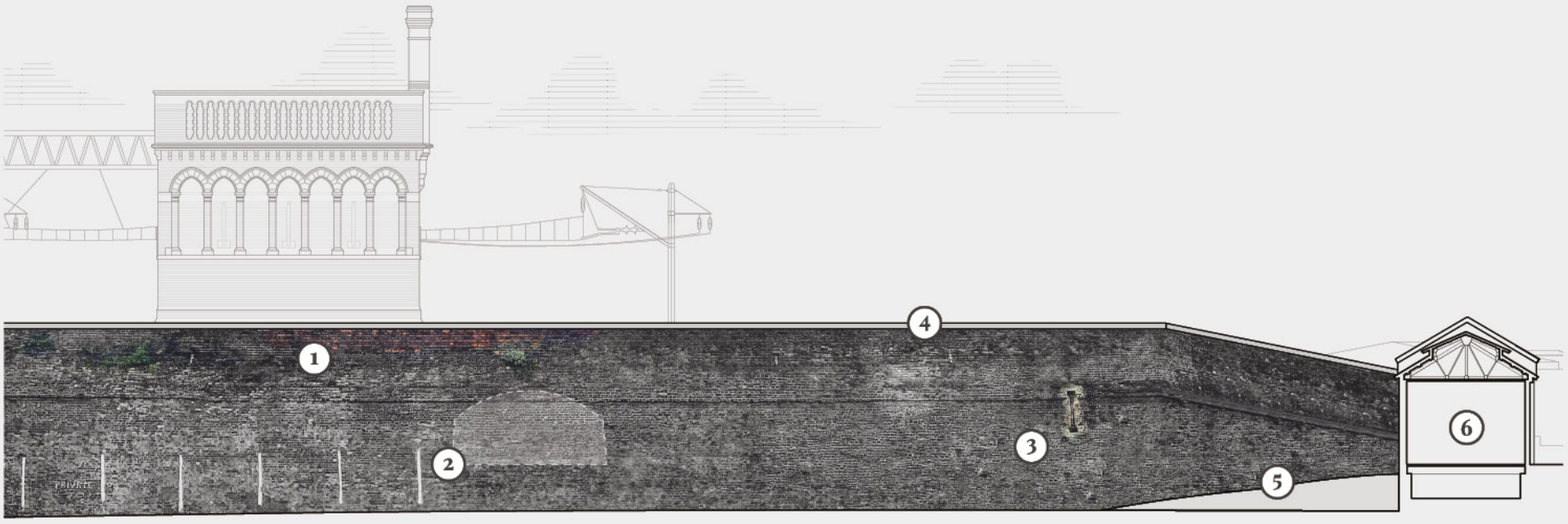
The Weathered Coal Drops Wall and the Hidden Tunnel

Removing the Infilled Brick — Network Rail can be consulted on Victorian tunnel restoration



Accessing the St Pancras Basin

The Fortnightly Weekend Retail Gallery



The Existing Wall

1. Red stock infills the brickwork of the weathered wall. A theme that is consistent throughout the site, from the Waterpoint's façade, doors and frames to Niall McLaughlin's stained-concrete tapestry building, red equates to new.

2. Vegetation, pollution, rain and the patina of age hides the former tunnel. A passerby would never know that it was there.

3. A small slit, like that of an embrasure or archer's loophole, it is not clear why it features along the wall.

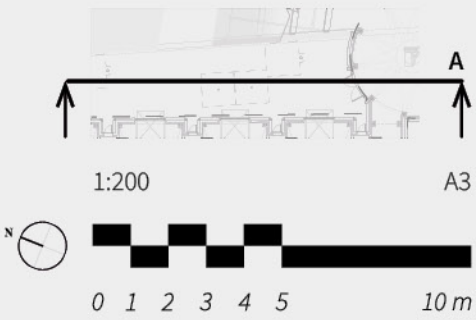
4. Victorian industrial walls — as seen abutting the British railway network — have a distinctive semicircular capping that runs along it.

5. A steep ramp provides the only disabled access to the elevated clubhouse (disused) , DD and LC.

6. See page 105 for details on the existing lock cottage and how it has been retrofitted

The Centre Café

The Mew



1. The Waterpoint breaks through the gallery roof, no longer an isolated monument but a connected performance space within a Grade II listed piece of industrial architecture.

2. The piano stairs form a second street that runs in parallel to the retail gallery and which can look beyond towards the basin, nature reserve, railway line and even St Pancras Gardens.

3. A lift provides disability access to the piano gallery and performance space. The Waterpoint was previously inaccessible to wheelchair users. See page 131 for more.

4. Security is keycard-based in order to protect the basin — improving the current security of a single manually operated fence.

5. As with the permeable gallery entrance, the street-access provides visibility to the the publicly accessible central café.

6. The CRT-managed museum space will be open to the public on a permanent basis and managed by volunteers. While the heat pump that supplies the site is operated by the university.

The Street Section — Before and After

Integrating the wall within the RDC-PTC and the wider landscaping

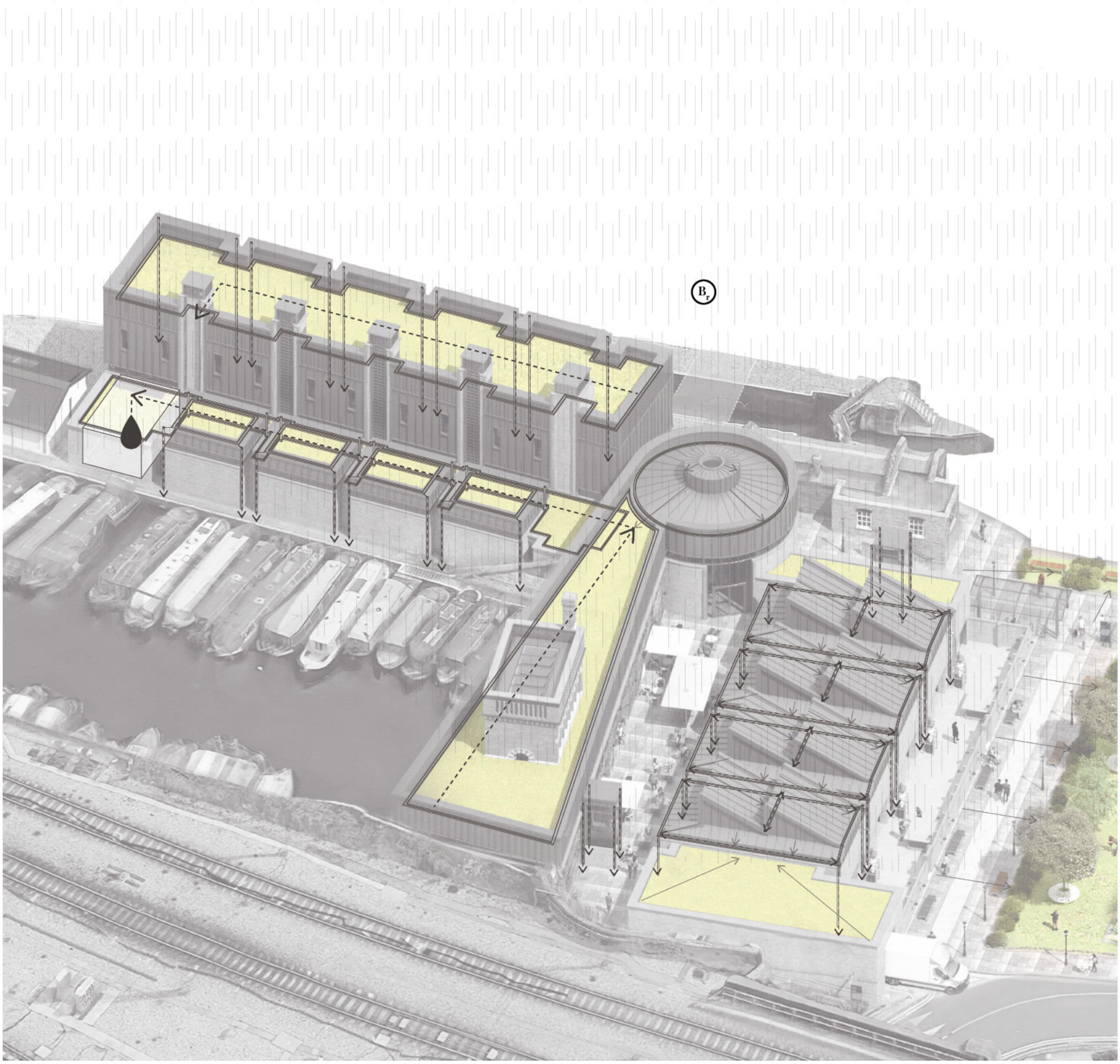


Figure 11.1 (adapted)

Green Roofs

Makes up part of the water-management strategy which has been integrated into the landscaping and tectonic design of the RDC-PCT e.g. with SUDs.

Act 12

Legato

Tutors, Teachers and Traders

The Street Front

Detailed Elevation

Typology Precedent Figure 12.1
Shoe Factory 1995

Haworth Tompkins

After reading up on Haworth Tompkin's Shoe Factory, I began testing the same form on my site, with the same orientation as my tutor workshops. In identical conditions, as the opposite page shows, there is a significant amount of glare due to the clerestory glazing and the diffusing skylight filter having minimal effect.

Typology Precedent Figure 12.2
Oxbow School 1998

Stanley Saitowitz

A similar typology to the RDC-PTC, the Oxbow School provides a mixed-media one-semester programme for students of all ages and qualifications(e.g. secondary school, foundation and graduates). A series of workshop units open out onto a dense Californian habitat — the large glazed garage-like doors blends the internal and external spaces together.

Similarly, large partially-glazed doors open on either side of the tutor workshops — to the North, the industrial mew and to the South the Camley Street Nature Reserve. Due to the UK's juxtaposing environment, the opening of these doors would be more controlled but still benefit the movement of materials and for the retail galleries.

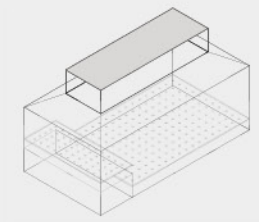
1:50 A3

0 0.5 1.0 2.0 m

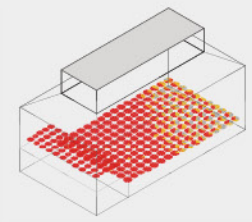
Version A

Version B

Generation 1

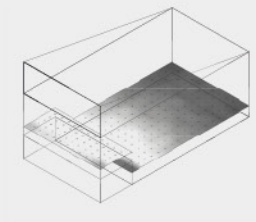


avg. DF (%): 9.67/8.18
min. DF (%): 5.41/5.98

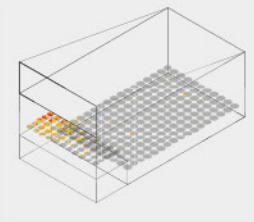


Uniformity: 0.56/0.73
sDG-5 (%): 100/70.12

Haworth Tompkin's Shoe Factory



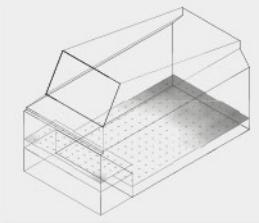
avg. DF (%): 3.55/8.04
min. DF (%): 1.73/3.66



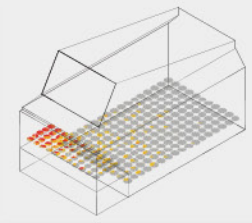
Uniformity: 0.49/0.46
sDG-5 (%): 0/0.23

Standard Saw Tooth Roof

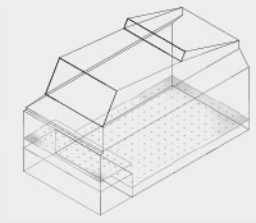
Generation 2



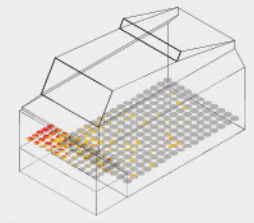
avg. DF (%): 5.98/9.41
min. DF (%): 2.78/4.24



Uniformity: 0.46/0.45
sDG-5 (%): 0/12.05

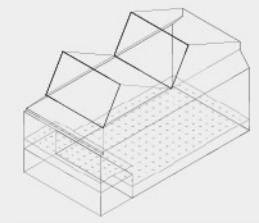


avg. DF (%): 6.6/8.89
min. DF (%): 4.27/4

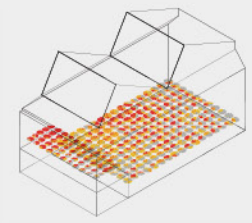


Uniformity: 0.65/0.45
sDG-5: 0/11.14

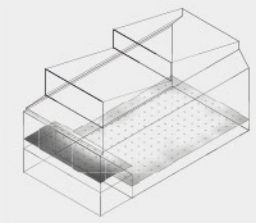
Generation 3



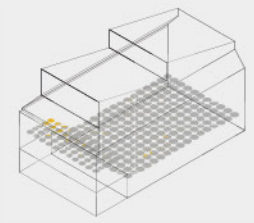
avg. DF (%): 12.87/10.91
min. DF (%): 9.04/5.54



Uniformity: 0.7/0.51
sDG-5 (%): 9.69/31.14

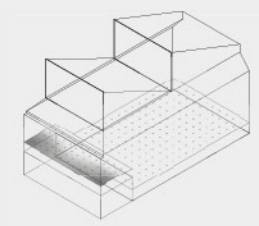


avg. DF (%): 5.03/3.4
min. DF (%): 3.57/1.86

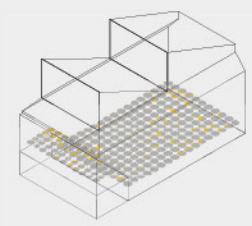


Uniformity: 0.71/0.55
sDG-5: 0/0

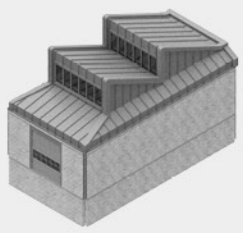
Final Generation



avg. DF (%): 7.91/4.7
min. DF (%): 5.08/2.69



Uniformity: 0.64/0.57
sDG-5 (%): 0/0



avg.: Average
DF (%): Daylight Factor
Uniformity: min:avg. D.F.

sDG-5 (%):
Spatial Disturbing Glare,
% of views that experience
disturbing glare

Material	Maintained Illuminance (lx)	Average D.F.*	Minimum Uniformity	Source	Glare (sDG-5)
Timber	300 (General) – 750 (Intricate)	6 – 15	0.6 – 0.7	CIBSE LG1: The Industrial Environment *Working Plane — 0.85 / 0.7 m*	0
Metallurgy	300 (General) – 750 (Intricate)	6 – 15	0.4 – 0.7		
Ceramics	50 (Drying) – 1000 (Painting)	1 – 20	0.4 – 0.7		
Textiles	300 (Washing) – 750 (Sewing)	6 – 10	0.6		
Preparation	500	~10	0.6	CIBSE LG5: Lighting for Education	

**Design Sky Illuminance (85% of the time between 9–5) for London = 5000 lux*

***Aim to have no disturbing glare throughout the year as this will impact machine-use and therefore safety*

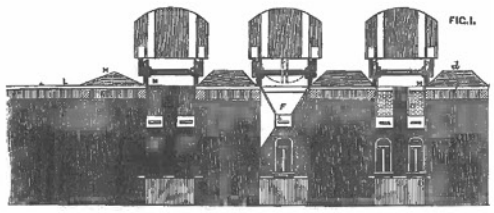
Sculpting with Light

Modelling daylight conditions with different roof typologies based on the vernacular architecture of the site.

Y1/ Tutor Workshops

Form and Function

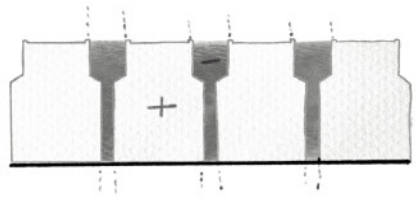
Tutor Workshop, Front Corner Detail



Local Precedent — Figure 12.3

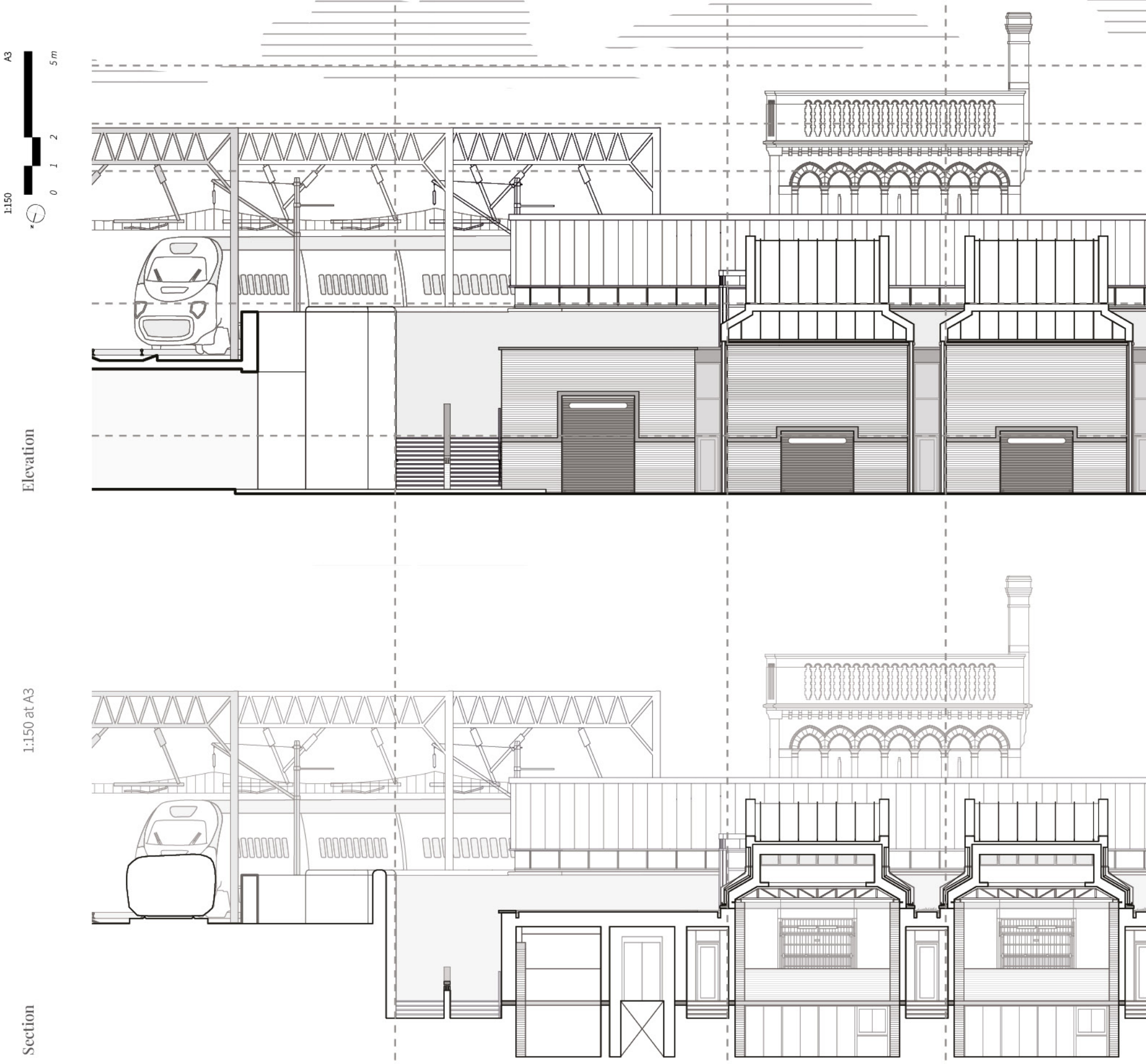
Plimsoll's Coal Drop Hoppers — 1:50

The historical coal drops, as shown on page 24, had strong vertical and horizontal openings that created a distinct rhythm of building and coal cart through y-profiled hoppers.



Creating the Hopper Form
Solid and Void

The gable end of the Lock Cottage initially led to the flat brick-filled face of the tutor workshops and as the form changed from pitched to sawtooth, the hopper-language could be found in the void.

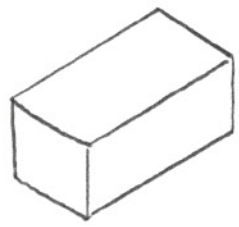


See page 122 for equipment

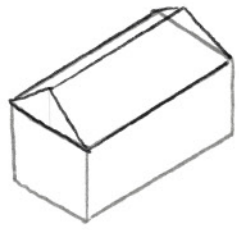
Local Precedent
CSNR's Vernacular

Erect Architecture

Similarly, the hopper form was rationalised by the neighbouring CSNR, with the positive profile of their skylight (Architecture, 2017).

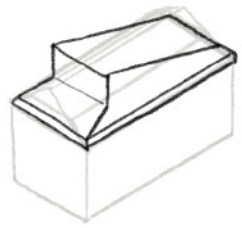


A Building Block



Gable Ended

Mansard Roof



Sawtoothed Mansard

Form-Finding

Each stair serves the dedicated workshop space. Providing security control for the tutors

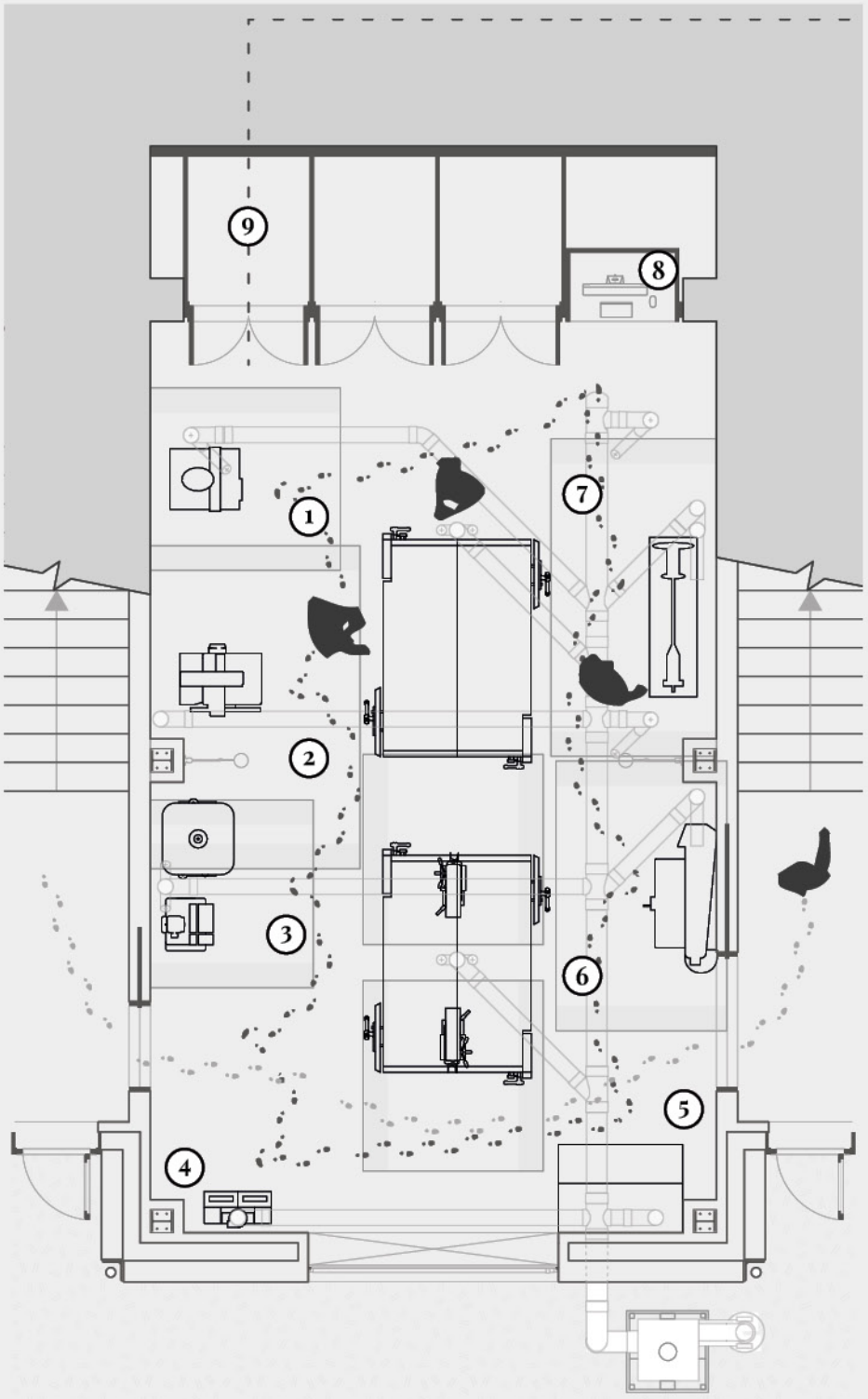
The Gallery Balcony

A member of the public looks out onto the workshop during an open day

Most of the equipment is easily portable (built on wheels) to provide flexible workshop layouts that can be altered based on different tutors or course / module demands.

Safe Area

Machine Overlap



BB81

Building Bulletin 81
Design and Technology
Accommodation in Secondary Schools

Each piece of machinery has a safe working area which in most practical cases overlap. However, from first principles it was essential that there was sufficient working room for the tutor and students. Layout options were defined by the safe area and the location of local exhaust ventilation (LEV), with similarly demanding equipment being positioned next to each other. In addition to being ordered by process (as with the RDC-PTC itself) e.g. positioning the drills in the middle of the space and having access to sanding equipment either side, and finishing equipment (spray booths/ downdraught) being at the end of the room.

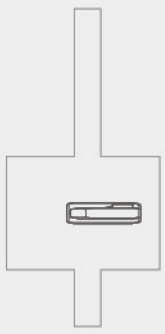
Timber Workshop Equipment

1. Morticer
2. Bandsaw
3. Gerbil and Disc Sander
4. Spray Booth
5. Downdraught Table
6. Belt Edge Sander
7. Lathe
8. Computer
9. Storage and HVAC Access

For references relating to building regulations and standards, please see page 128.

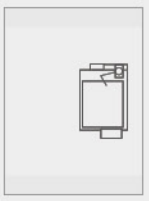
Preparation Equipment

Grindstone

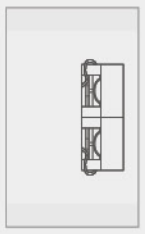


Metal Hacksaw

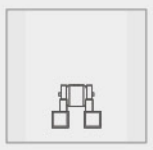
Metallurgy Equipment



Welding Bench



Brazing Hearth



Grinder

Textiles Equipment

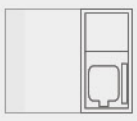
Sewing Machines

Industrial Printers

Polymer Equipment

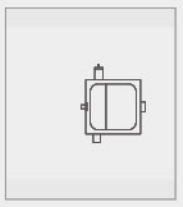
FDM Printers
Resin Printers
Vacuum Former

Sharpener

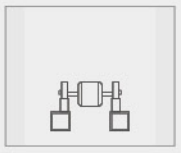


Moulding Bench

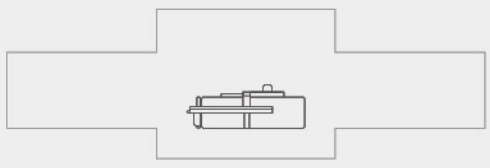
Crucible Furnace



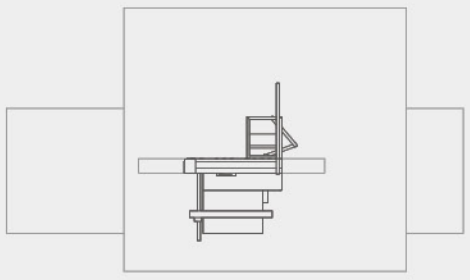
Milling Machine



Polisher



Planer



Circular Table Saw

Workbench

Workshop Equipment

Sizing, positioning, power and flexibility are just some of the demands a new workshop and its equipment needs.

Scaled to fit A3

0 10 20 40 m

The Timber Workshop

A tutor works on the lathe while two students begin crafting their timber module.
The ventilation grilles can be seen integrated above the storage.

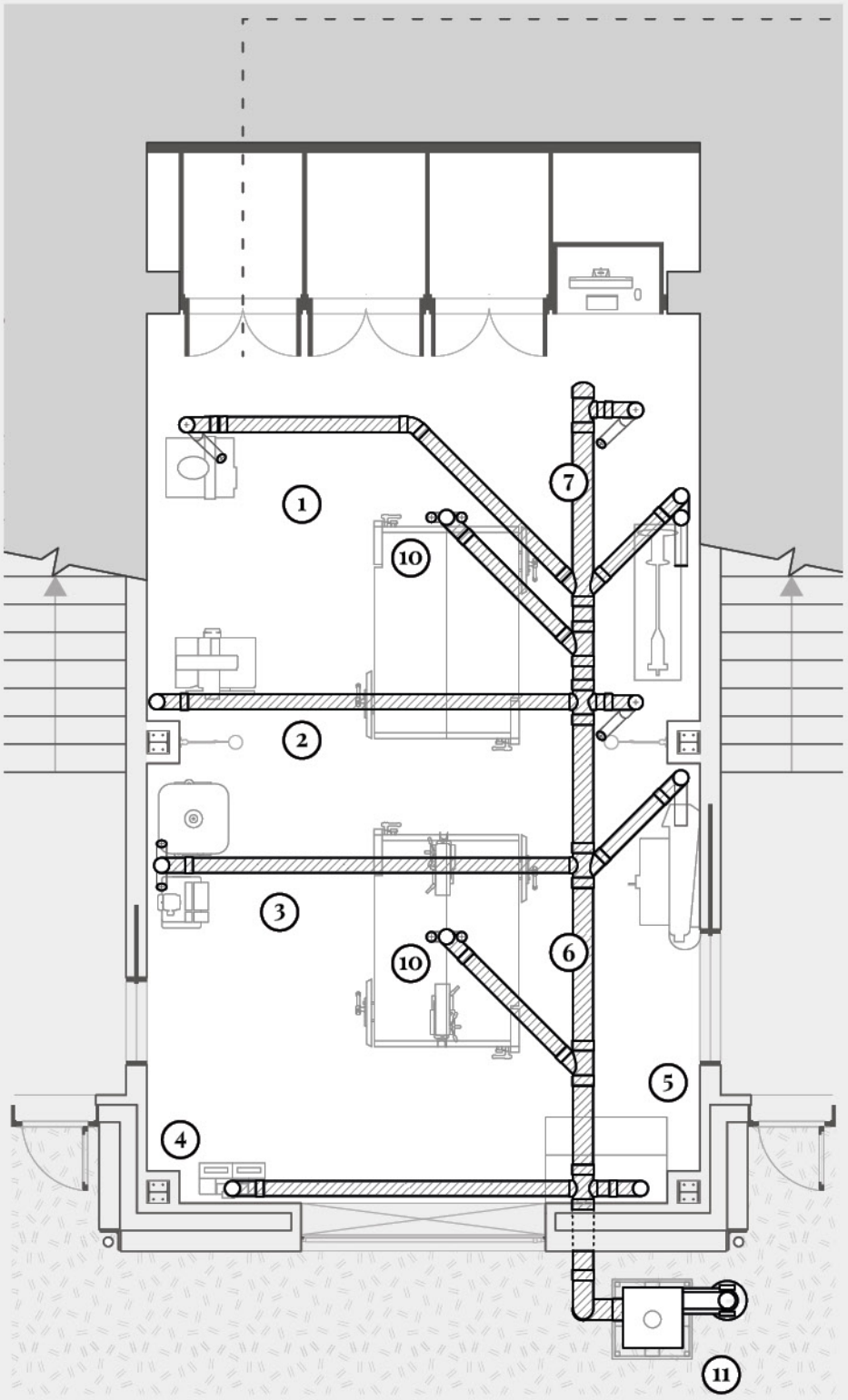
BB101 and ASHRAE 62.1

Building Bulletin 101
Guidelines on ventilation, thermal comfort and indoor air quality in schools

The BB101 recommends a minimum exhaust rate of 2.5 l/s/m², a minimum 3 m height for high pollutant emitting spaces and a secondary method for getting fresh air (e.g. the garage door/ glazing and adjacent yard doors) for general pollution control — as based off *ASHRAE 62.1 Ventilation and Acceptable Indoor Air Quality*.

The following calculations use formula from ASHRAE:

Variable	Value
Min. Suggested Air Supply Rate per person (p) from ASHRAE 62-1	20 (L/s.p)
	72 (m³/h.p)
	0.02 (m³/s.p)
Room Height	6 m
Room Area	60 m²
Volume	350 m³
ach /per person	0.21
Typical Occupancy	10
Max ach	2.1
Suggested Air Supply Rate	200 l/s
Suggested Air Exhaust Rate *over an area*	3.1* l/s/m²
* Meets minimum required by UK Government's BB guidance	



COSHH

Control of Substances Hazardous to Health

COSHH is a legislative requirement to 'adequately control exposure to [harmful substances]' (see HSE, 2023). Examples of this include: micro-organisms, liquids, gasses, powders, etc.

Workplace Exposure Limit (WEL, ibid.)

Hardwoods: 5mg/m3
Softwoods: 3mg/m3

Hazardous Substances

Hazardous substances within a timber workshop include:

Dusts
e.g. wood, MDF, laminates

Liquids
e.g. adhesives, paints, varnish

Risks

Carcinogens
Asthma
Skin Irritation

No.	Equipment	Approx. Dim. (m)	LEV-Type	Min. Airflow (CFM)	Prov. Airflow (CFM)	Minimum Branch Ø (m)	Contaminant	Duct Velocity (m/s)
1	Morticer	0.7 x 0.7 x 1.5	Receiving Hood	350	403	0.11	Process Dust	20
2	Bandsaw	0.8 x 0.8 x 1.9	Connected	350	403	0.11		
3	Disc Sander	0.7 x 0.5 x 1.0	Receiving Hood	195	213	0.08		
4	Spray Booth	0.7 x 0.5 x 0.6	Partial Enclosure	325	325	0.11	Condensing Vapours	
5	Draft Table	1.3 x 0.6 x 0.8	Partial Enclosure	~ 2000 m³/h		0.13	Process Dust	1.5 at surface
6	Belt Sander	1.5 x 0.5 x 1.2	Connected	550	550	0.13		20
7	Lathe	1.6 x 0.8 x 1.2	Receiving Hood	350	550	0.13		
10	Workbench	Varies	Hood / Sweeps	728	750	0.15		
11	Dust Extractor							
Note: The supply duct for the LEV will likely have a diameter of around 0.2 – 0.3 m								

Health and Safety in a Workshop

Beyond the safe operation of equipment, the need for fresh air and ways of extracting pollutants created by the making process is essential to user safety.

Scaled to fit A3

0 10 20 40 m

Act 13

Regulations

Rules, Requirements and Risk

Code	Building Regulations	Reference
Part A	Structure	(Gov, 2023a)
Part BV2	Fire Safety	(Gov, 2023b)
Part C	Site Preparation and Resistance to Contaminants and Moisture	(Gov, 2023c)
Part D	Toxic Substances	(Gov, 2023d)
Part E	Resistance to the Passage of Sound	(Gov, 2023e)
Part F2	Ventilation	(Gov, 2023f)
Part G	Sanitation, Hot Water Safety and Water Efficiency	(Gov, 2023g)
Part H	Drainage and Waste Disposal	(Gov, 2023h)
Part J	Combustion Appliances and Fuel Storage Systems	(Gov, 2023i)
Part K	Protection from Falling, Collision and Impact	(Gov, 2023j)
Part LV2	Conservation of Fuel and Power	(Gov, 2023k)
Part M1	Access to and Use of Buildings	(Gov, 2023l)
Code	**Building Bulletin**	**Reference**
BB81	Design and Technology Accommodation in Secondary Schools	Slightly outdated but useful re: equipment safe zones and typology, (Gov, 2004)
BB93	Acoustic Design of Schools — Performance Standards	(Gov, 2004)
BB100	Building Bulletin 100: Design for Fire Safety in Schools	(Gov, 2014)
BB101	Ventilation, Thermal Comfort and Indoor Air Quality 2018	(Gov, 2018)
Code	**British Standards**	**Reference**
BS ISO 23591:2021	Acoustic Quality Criteria for Music Rehearsal Rooms and Spaces	(BSI, 2021)
BS 9999:2017	Fire Safety in the Design, Management and Use of Buildings	(BSI, 2017)
BS EN 12845	Fixed Fire fighting Systems. Automatic sprinkler systems. Design, Installation and Maintenance	(BSI, 2015)
Code	**Chartered Institution of Building Services Engineers**	**Reference**
CIBSE Guide A	Environmental Design	(CIBSE, 2021)
CIBSE Guide B	Heating, Ventilating, Air Conditioning and Refrigeration	(CIBSE, 2005b)
CIBSE Guide B2	Ventilation and Ductwork	(CIBSE, 2016b)
CIBSE Guide B3	Air Conditioning and Refrigeration	(CIBSE, 2016c)
CIBSE Guide G	Public Health Engineering	(CIBSE, 2014)
CIBSE TM46	Energy Benchmarks	(CIBSE, 2008)
CIBSE AM10	Application Manual 10, Natural Ventilation in Non-Domestic Buildings	(CIBSE, 2005a)
CIBSE AM13	Application Manual 13, Mixed Mode Ventilation	(CIBSE, 2000)
CIBSE CP2	Surface water source heat pumps: Code of Practice for the UK	(CIBSE, 2016a)
Code	**Other Notable Regulations and Guides**	**Reference**
TA Lärm	Technical Instructions on Noise Abatement	(Lärm, 1998)
HSE COSHH	Control of Substances Hazardous to Health	(HSE, 2023)
HSE	Noise at Work	(HSE, 2022)
LETI CEDG	LETI Climate Emergency Design Guide	(LETI, 2023)
LETI ECP	LETI Embodied Carbon Primer	(LETI, 2020)
WHO	World Health Organisation	(WHO, 2023)
Extrium	England Noise and AIr Quality Viewer	(Extrium, 2023)
UK GOV	Noise Nuisance Guidance	(Gov, 2017)
ANSI/ASHRAE Standard 62.1-2022	Ventilation and Acceptable Indoor Air Quality	(ASHRAE, 2023)

Regulations, Legislation and Standards Database

A collection of references and notes

Building Regulations

Fire Strategy

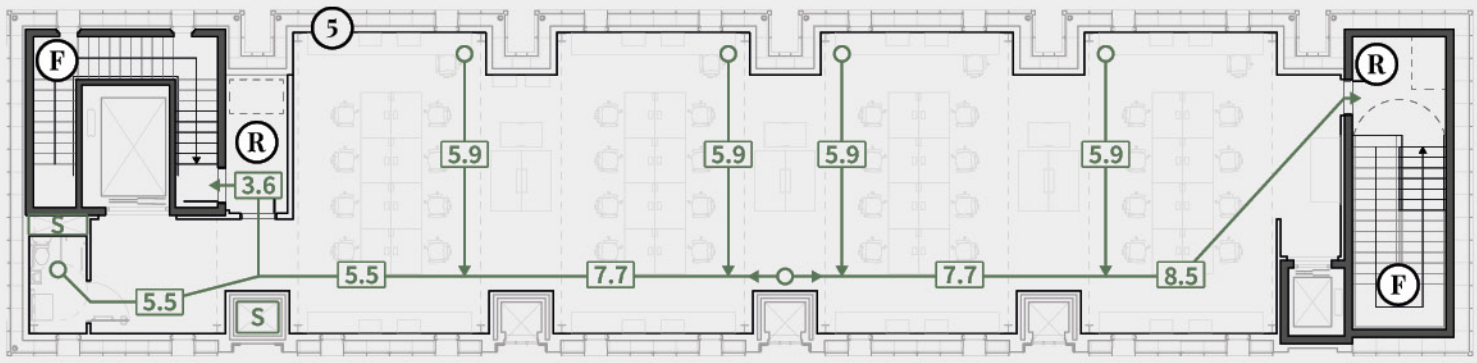
All of the following information is derived from the Approved Document Part B V2 and the Building Bulletin 100: Design for Fire Safety in Schools, unless otherwise stated, with the strictest limits taken from each.
See Table B for each of these limits and the previous page for reference locations.

Refuge areas (**R**, min. 9 x 1.4 m) are adjacent to the stairs in a protected enclosure (left) or directly within the staircase have been implemented (right).
These differ due to site size constraints and programme (i.e. plant and storage requirements).

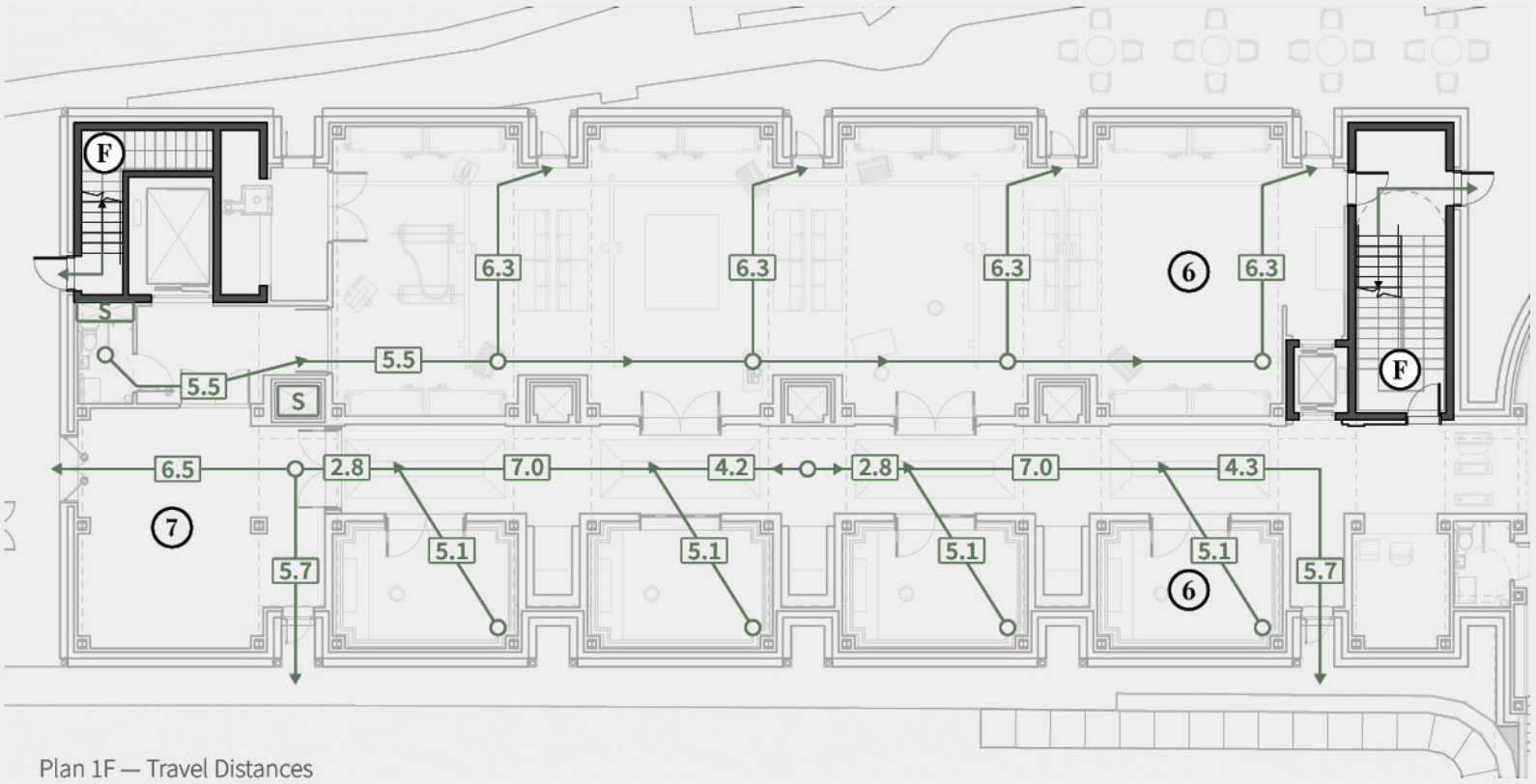
An emergency voice communication (EVC) system (BS 5839-9 compliant) is installed adjacent to a "fire detection and alarm panel" within the refuge areas. Moreover, each escape route is appropriately signed, as shown on page 53.

All escape routes are provided with doors that open in the direction of egress and fire stairs (**F**) meet minimum widths (>1100 mm).

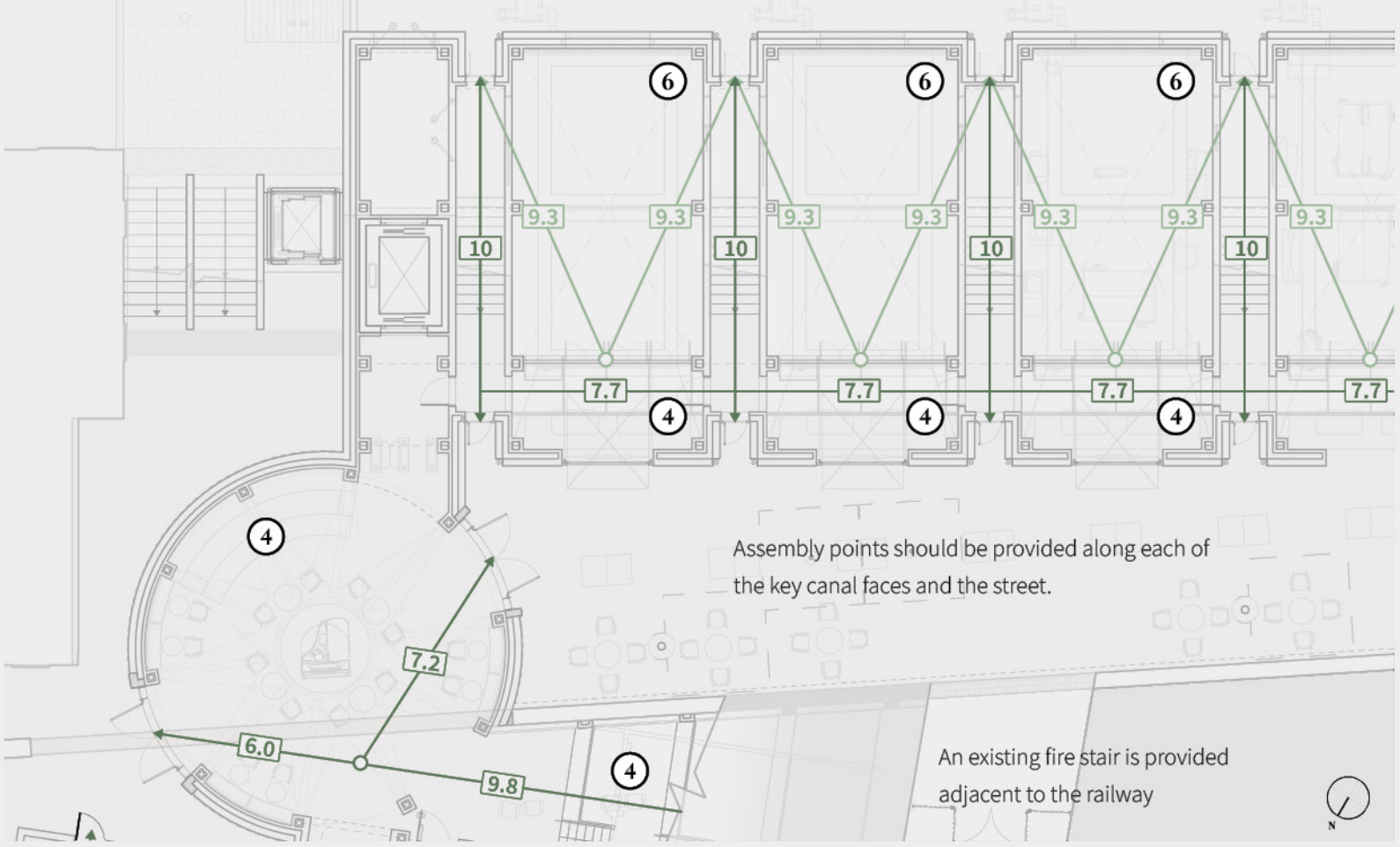
The final exit continues with the same width as the stairs, with self-closing fire doors in order to mitigate spread beyond higher risk spaces e.g. the workshops.



Plan 2F — Travel Distances



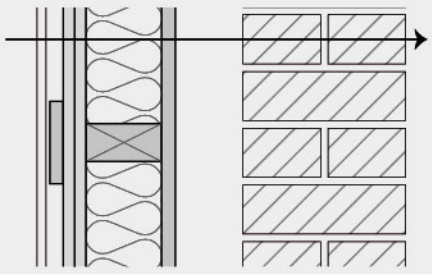
Plan 1F — Travel Distances



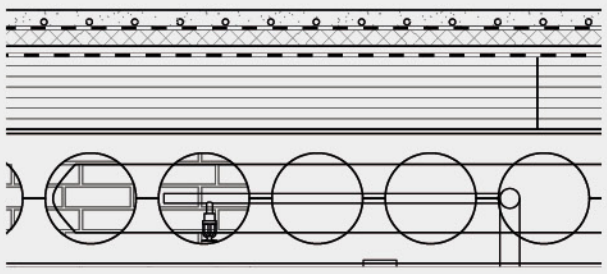
Plan 1F — Travel Distances

A3
1:200
0 1 2 3 4 5 10 m

B2/3: Internal Fire Spread (linings and structure)

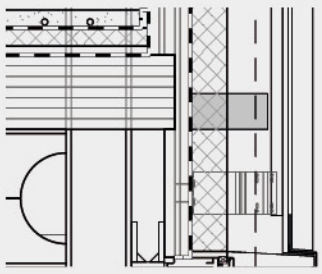


All internal linings will meet the required class rating as set out within the regulations and will otherwise be treated if not supplied to that standard. Examples of compliant material include the *Gustaf* styled acoustic panels used for the tuning room, which has a rating between B (perforated) and A2 (non-perforated) and soundproof plasterboard at A2-s1m d0 (left–right)



The required REI ratings for materials are provided in table B. Timber elements such as CLT, plywood, battens etc. can be coated in intrumescent paint to achieve high fire ratings of 90 mins. Most notably for the primary CLT *compartment* slab separating the first and second floor of the Y2 building, which requires an REI of 90 mins. The CLT has been oversized (245 mm) to enable structural stability and fire resistance e.g. 160 mm CLT provides REI 90 (Enso, 2019).

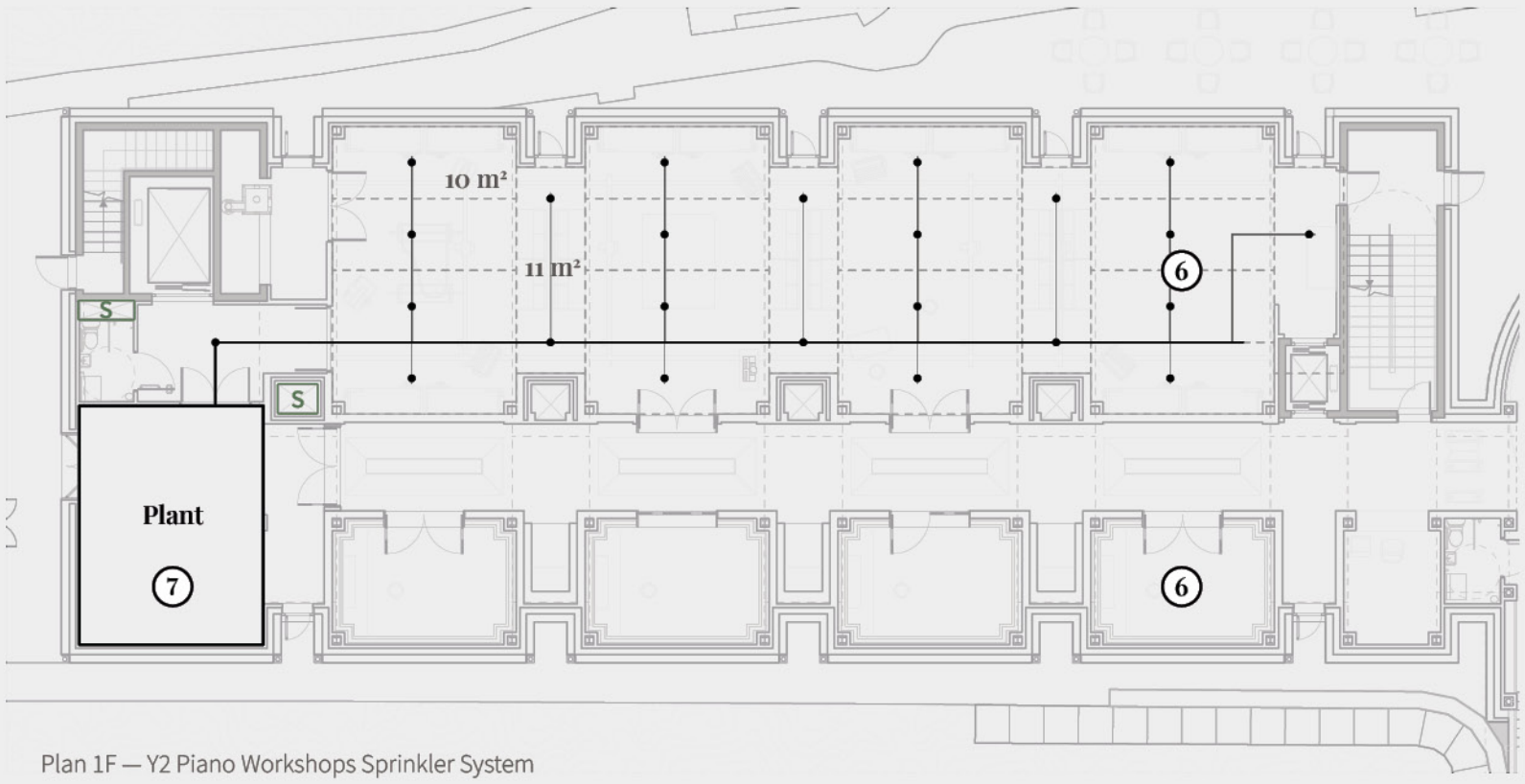
B4: External Fire Spread



Including but not limited to:

- Zinc cladding is rated beyond B-s3, d2, at A1 (for 0.8 mm thick zinc).
- A fire stop and non-combustible insulation (Euroclass A1) is installed within the rainscreen cladding to provide a maximum 44 mm gap. The location and appropriateness of the fire stop used should be coordinated with a fire safety specialist.

B3: Internal Fire Spread and BS EN 12845



Plan 1F — Y2 Piano Workshops Sprinkler System

Based off BS EN 12845, *Fixed fire fighting systems — Automatic sprinkler systems — Design, installation and maintenance*, the Piano Workshops are rated as an *Ordinary Hazard 3 (OH3)* class. Related examples to this class include: factories and mills for timber, textiles, polymers and so on. Each sprinkler supports a maximum area of 12 m² at this class and the required pipe diameters are shown.

No.	Occupancies	Travel Distance (One Direction)	Travel Distance (Two Direction)	Fire Rating w/ sprinklers (mins)	Fire Rating w/o sprinklers (mins)	Additional Fire Rating for Compartments b/n different occupancies
4	Shop and Commercial	18	45	60	60	+60[bc]
5[a]	Assembly and Recreational	15	32	60	60	
6	Industrial (Normal hazard)	25	45	90	60	
7	Storage (Normal Hazard)	25	45	90	60	
F	Fire Stair	-		30		
R	Refuge Area	-		30		
S	Sprinkler Riser	-		30		

[a] includes Schools as per both Part B and BB100

[b] For example: the compartment floor used between 1F and 2F of the Piano Workshops and Studios

[c] BB100 recommends a +60 minute increase for property protection regardless

Table B

Building Regulations

Site and Building Access

B5: Access and Facilities for the Fire Service

Due to the changes in level and difficult accessibility for fire services to the North of the peninsula, a number of options were explored:

- As the main volume of the RDC-PTC was considered to have an internal area less than 2000 m² and a top storey less than 11 m in height. This provided sufficient vehicle access to the Year 1 block and The Centre within 45 m. However this did not extend to the Dry Dock and Year 2 block.
- The Y2 Workshops and Studios are composed of a compartment floor system and sprinklers. As this is over an area greater than 280 (320) m², fire hydrants will be installed.
- Riser space for the installation of dry or wet risers have been designed into the plan — depending on feedback from a fire consultant in regards to appropriate access to the North of the site (hence the 18 m boundary).

Approved Document Part M1: Access and Use of Buildings (OTD)

1.33 800 mm deep 'corduroy' hazard warning surfaces have been used within a minimum 1200 mm deep landing at the top and bottom of all external stairs.

Where applicable, steps with projected nosings of 18 mm (< 25 mm) are used, e.g. the tiled staircases dividing the workshops.

1.37 Two contrasting styles of handrail are used for the internal and external circulation. Partly this is so that the stair width can be maintained without encroaching into it.

2. The entrance doors are out-swinging, self-closing and both manually and mechanically powered. Push buttons are provided at a suitable distance so that wheelchair users do not need to move out of the way to access the door.

2.21 The main entrance doors have been designed to not open into any circulation routes, with at least 1.5 m provided around it.

3. It was challenging to attempt to integrate a functional ramp that worked within the context, especially due to the 1.8 m level difference, and so external lifts for both disabled and bike access is provided.

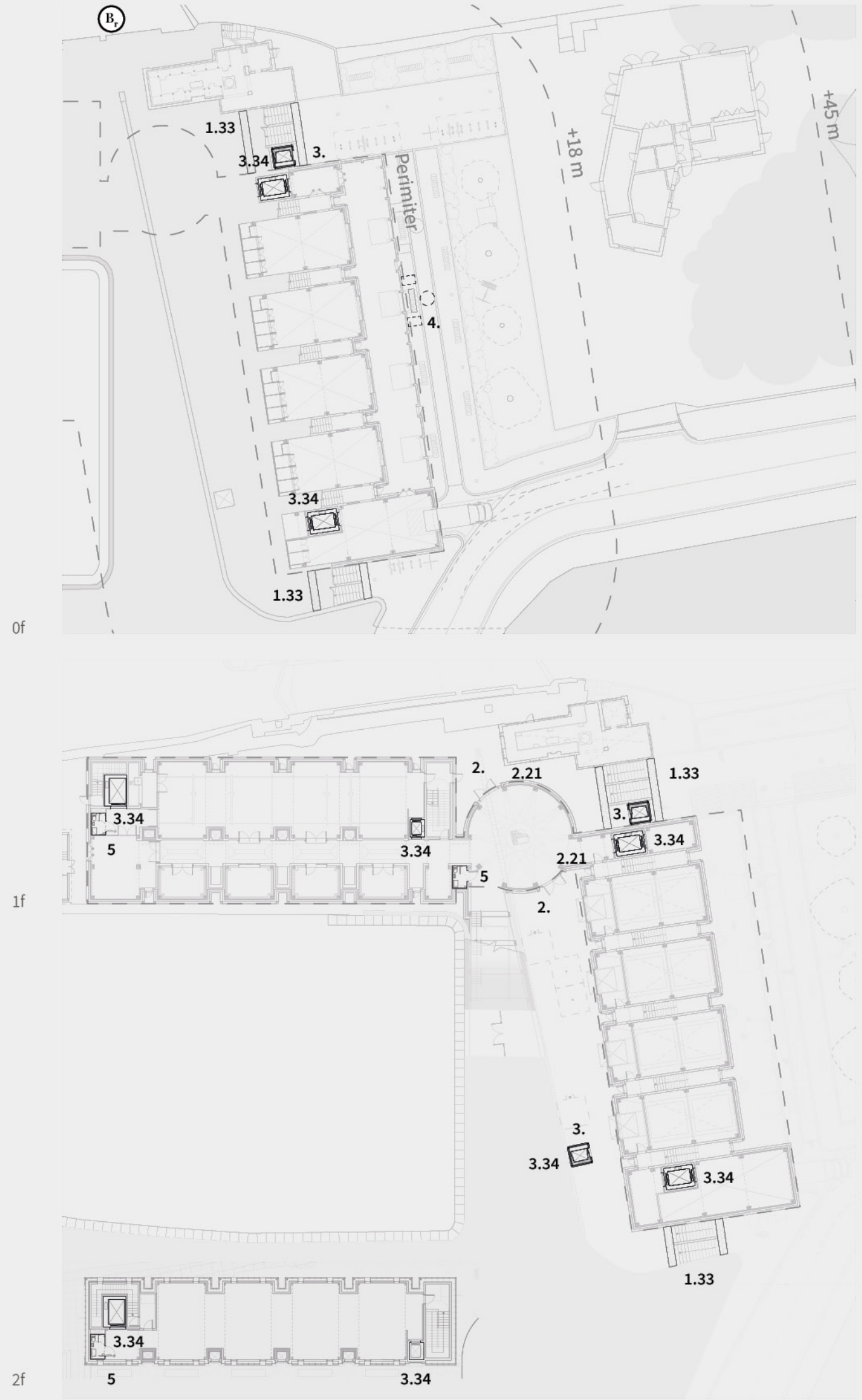
An external lift provides disabled access to the previously inaccessible Waterpoint (now a performance space), and the vista across the piano stairs.

3.34 All lifts have at least 1.5 x 1.5 metres of space in front of them for unobstructed wheelchair turning and all adhere to the 1100 x 1400 mm minimum car dimensions.

4. All external seating areas have been provided with at least 900 x 1400 mm of space beside them for wheelchair users, and the path between the yard and park is designed to at least a 1.5 m turning circle.

5. All toilets have been designed based on part M's specifications.

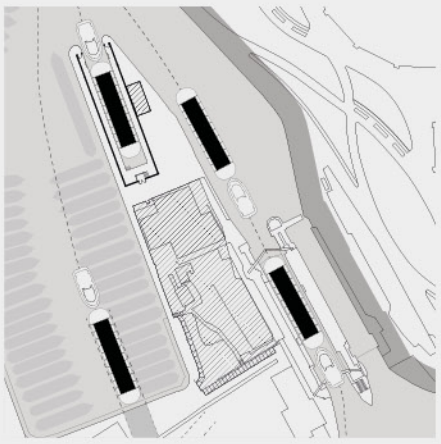
In addition to Part M1, all stairways have been designed to information set out in Approved Document Part K — Protection from Falling, Collision and Impact



Building Regulations

Construction, Design and Management

All information relating to the CDM 2015 regulations (see Gov (2015)) has been sourced directly from the UK Government's legislation website and relate to their respective sections as indicated in brackets. Compliance to the CDM 2015 includes but is not limited to the following considerations:

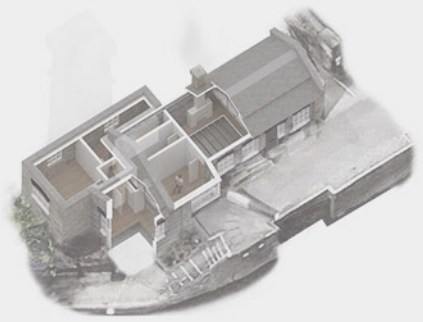


The Regent's Canal

Barges and tug-boats used for the transporting of construction material must not be 'overcrowded or overloaded' (26). The logistics concerning this are outlined on page 55.
The canal edge can be temporarily fenced off to minimize the risk of people or equipment (28) falling in.
However, access to and from the basin must be maintained, so a safe walking route will be established and altered throughout the course of the construction. Permanent rescue provisions will be provided along the edge as the site will be publicly accessible in the future.

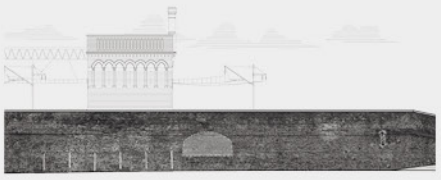
Site Boundaries

Existing hoarding surrounding the SPCC can be removed and a new perimeter fencing erected around the site with identifiable signage (18). Demolition of the SPCC has already been assessed prior to the project and should be carried out during the pre-construction phase as part of a separate workstream.



Retrofitting

On a separate note, work undertaken on the Grade II listed Waterpoint and Lock Cottage should be in coordination with Historic England, the The Historic Buildings and Monuments Commission and the GLIAS (Greater London Industrial Archaeological Society) – with approval from Camden Council. Architecturally-sensitive temporary support work is required in these spaces to prevent damage to existing structures.

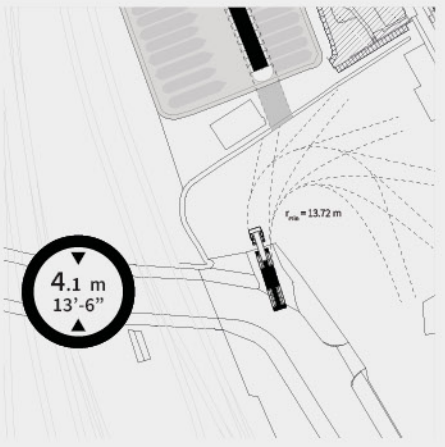


Excavating the Site

Detailed excavation (22) inspections will be carried out on the site as a result of the Thameslink Southbound running below it. Tunnel compressions and ground movement should be measured during additional borehole explorations and piling — in coordination with Network Rail, as outlined on page 12.
Removal of the existing wall for the basin tunnel and the excavation of earth and brickwork within the existing wall must be provided with 'support or battering' to prevent collapse.

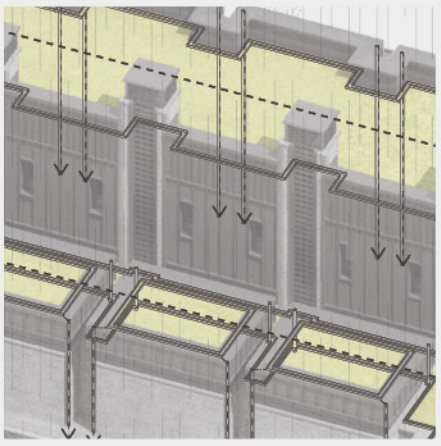
Neighbours

Noise and lighting (35) should not be an issue at the site, with construction only commencing during daylight hours and has been planned to be minimized through design e.g. CFA piles, supplying materials via barge (quieter than HGVs).



Site Traffic

The existing space in front of the basin wall provides sufficient pushed-back access for delivery and construction vehicles. No vehicles should be parked alongside Camley Street as this will adversely block traffic (27).



Cleaning and Maintenance

Cleaning and maintenance of the roof and its guttering has been thought out in detail with green roofs greatly minimising the impact of local forna and the blocking/overflowing of drainage.

CDM Co-Ordinator and the Health and Safety File

Please note that as the project will go beyond 30 working and have more than 20 workers on it simultaneously, a CDM co-ordinator will be appointed prior to the pre-construction phase. 'Appropriate information' relating to the maintenance, hazards, risks and controls throughout the site / RDC-PTC will be included in a health and safety file. This HS file will be reviewed throughout the construction process by both the principle designer and contractor before being passed onto the client.

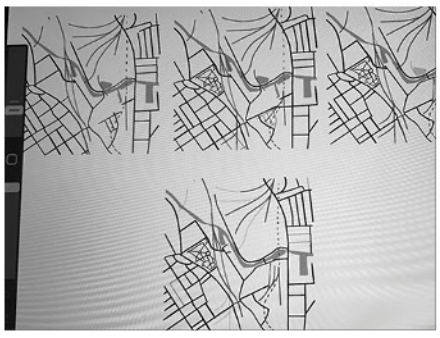
Act 14

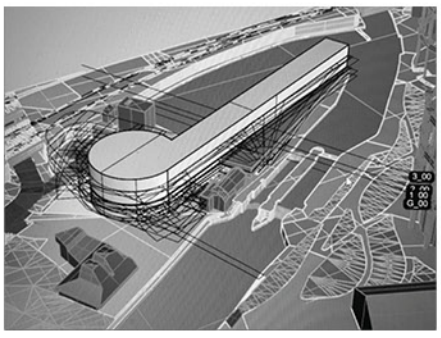
Nothing beside Remains

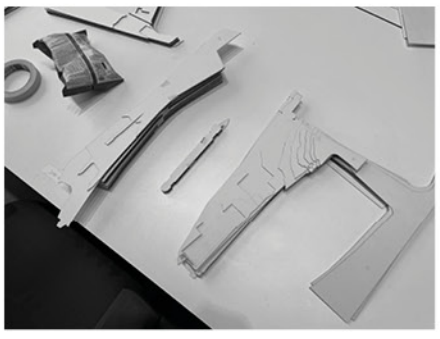
Reviews, Reflections and Relief

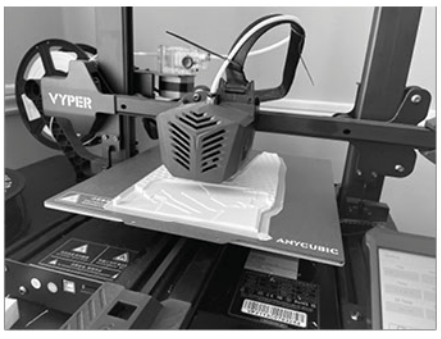
Design Diary

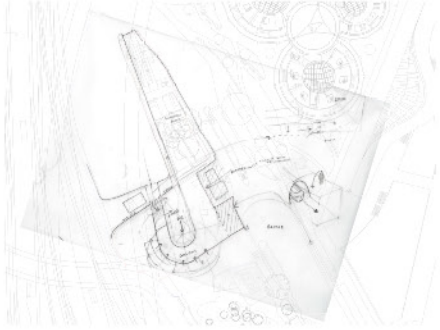
A Difficult Reflection

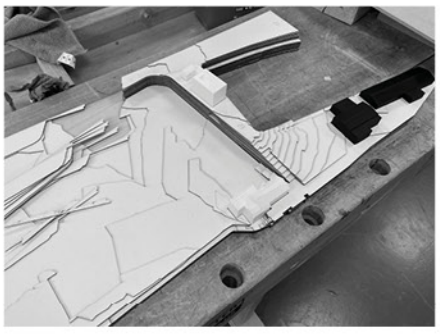


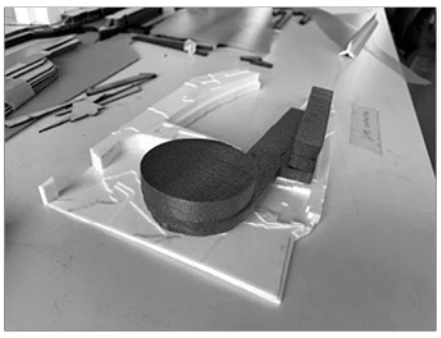


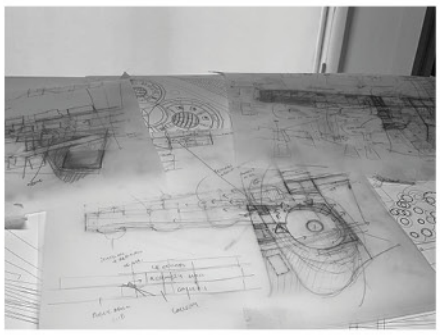


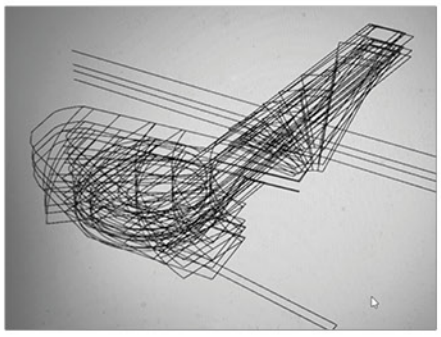












The Project Begins

Ideas were translated to stacks of A4 and A3 sheets, tracing and iterating the weird, the wacky and the wonderful through it all; to extend the Regent's Canal, to build over the St Pancras Basin and to build next to the railway line; these were just some of my immediate thoughts.

Purposefully labyrinthine, no thought of mine or tutor suggestion could go unexplored at any scale — this was a week to be creative. Beyond this, my own interests in archaeology, vernacular architecture and place-making (especially in KX's industrial past and gentrified present) led to a rabbit hole of GLIAS and emailing museums for plans. I slowly began to develop a new collage style that I've ever since enjoyed using when I can.

Experimenting

Spending too long in 2D, I shifted to begin modelling massing and exploring the more complicated elements of my site like distinct level changes, access, deliveries and retrofitting existing buildings (or not).

My historical research produced many questions, ideas and solutions to how I was to meet the demands of a very constrained site. Examples of this include finding the tunnel, the Lock Cottage's former use as a pumping station and what made up the Dry Dock.

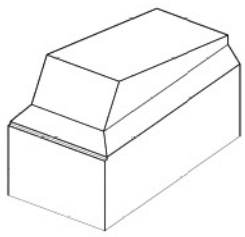
The significant level changes and tunnel meant that I needed to explore the site more in 3D, so two models — a 1:500 3D printed model and a 1:200 hand-made/ laser-cut model were made. Foam and paper models began to occupy them.

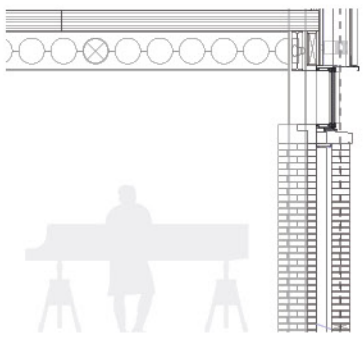
Pause

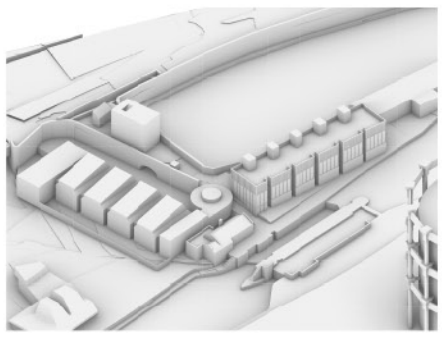
Many iterations of the massing were produced over the next couple of weeks at varying scales, layouts and orientations. In parallel to this, the project was now being rationalised to scale, the dimensions of everyday life were being seen in plan, section and elevation.

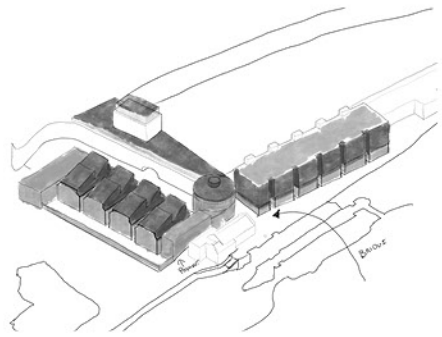
The first interim review, was very positive, with both tutors pleased by the very grounded context-driven approach to the scheme. In addition to the radial plan that appeared to reach out (as if fingers to a hand) into the context with the bridge and multi-level contact points with the wall.

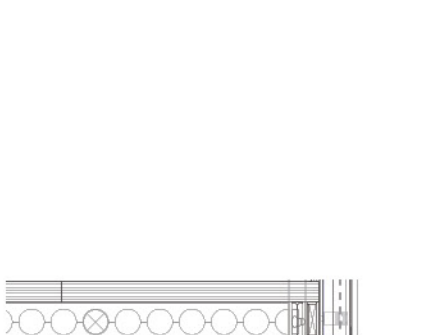
After this stage, following a family bereavement, I went into suspense. The Project was now on pause.

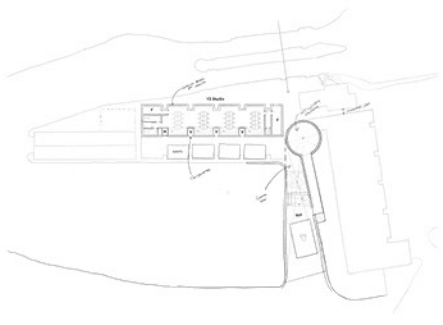


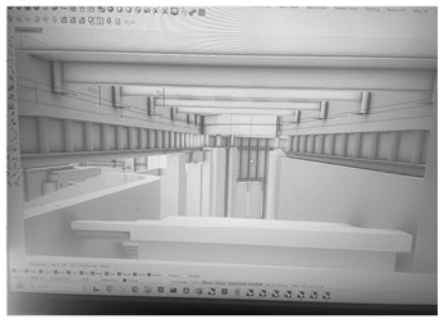












Return — "Tail Wagging Dog"

"It is more difficult to restart a project than to start a project from scratch"

Nigel Bedford (paraphrased)

After pausing the project, all of my work (and more I'm certain) had been lost to the pandora's box of drawings, models, digital folders and ideas soon to be lost to time. I endeavoured during my time out to retain what I could, so that I could return with a vast synopsis of my project so far — which included to-brick tectonic plans, with a totally load-bearing masonry system, at least 4-levels of building, multiple terraces and a not-yet retrofitted Waterpoint and Lock Cottage.

All I could ask myself was — What was I thinking a year ago?

How much does your piano weigh Mr Burkhalter?

It is impossible to go beyond this section without thanking my tutor, Nigel Bedford for the patience and commitment he showed to helping me get back into the rhythm of University life, despite now commuting once or twice per week from home (5 hours there and back) to make it to tutorials. Advancing from a single A1 tube to an A1 backpack.

I now began to recognise that the building (and the brief by extension) needed to go on a diet. To lose the weight of past decisions and to go back to first principles — a Piano Workshop, an industrial site and a way to ***Reform*** craft education. I could now see new, positive and motivational opportunities like retrofitting the wall and Waterpoint and how every space must be designed to the piano.

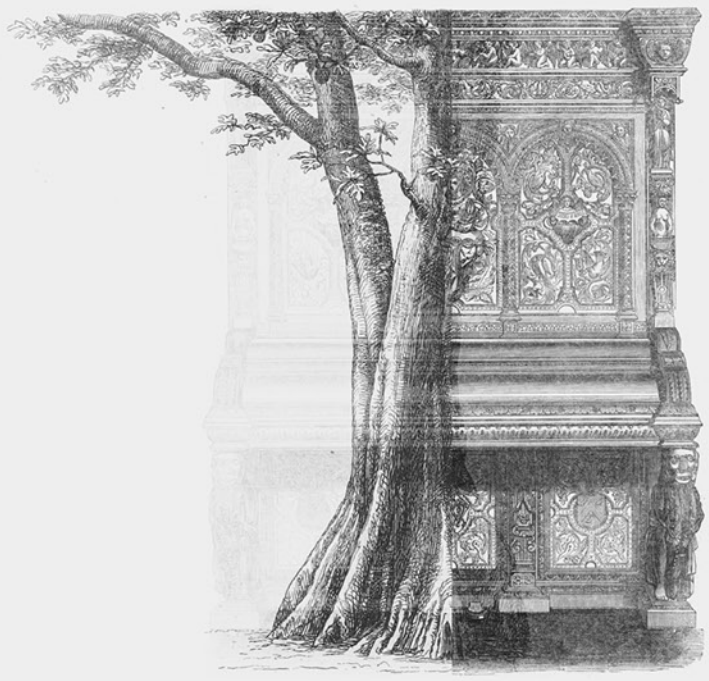
The Corner

So in answering, *How much does your piano weigh?* I can reply, around 500 to 650 kg, with a typical length and width of 1500-1700 mm for Baby Grand and Parlour Pianos. I can also reply that it takes nearly one year to build one, there are many roles (my favourite in name being the Bellyman), and a tuning room has very specific requirements (notably the lack of underfloor heating).

Following a one-year anniversary, the process of ***Reform*** began to go beyond just the project and into my personal life. I soon realised that I had developed a tectonic obsession with my building (beyond other things). I had to "perfect" the corner and then the section and then the... and so on.

Self-Reflection

An Echo



Reform, was as much a self-reflecting verb as any conceptual noun for my project or own architectural thoughts. There is no coincidence that the project related to improving design-led education — having taken at least four years to realise that any crit, regardless of tutor or audience, could never be as self-critical or obsessive as I could be with the RDC-PCT.

However, it was a fortunate coincidence to be based in King's Cross. An area that I was strongly passionate about, having written *King's Cross Central: A Critical Analysis on the Socio-Historical Outcome of its "Regeneration" from the Perspective of Vulnerable Groups* (Burkhalter, 2020). The 'creative-class', as termed in this essay, was just one of many peoples churned through the gentrification and formalisation of the site, and in this case the few who were given a home in Granary Square. Yet not going beyond just occupation when it came to inhabiting the context. So the RDC-PCT was proposed.

Inhabiting my imagination, I am walking towards the tutor workshops on a rainy April morning, a proverbial packhorse of art tubes, laptop, a small Wilko plastic box of foam models and my lunch stuffed in a multitude of coat and trouser pockets.
Later walking up echoing fire stairs towards a half-filled studio, I see tables of drawings, models and tired-eyes; tutors and students discuss projects and life – it's hard to differentiate. Setting down my box of models and draping my drenched coat over my chair (or has it been swapped with someone else's?), I look out over the studio and its beginning to empty.

The project is over and so when I ask myself, what would I do if I had more time?

I can simply reply:

I don't, I've had enough time — this is my project.

James Burkhalter

An Outro — Anthony's Song

Post-performance, the pianos are donated to where they can be best utilised in the local area for free (unless earmarked for special commendation)

B

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