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To:

Re: Professional Opinion
Date: 30 Dec 2025

Professional Opinion

Helical Steel Staircase – Condition Assessment & Structural Adequacy Review (Non-Design)

Project: Residential Development – Helical Staircase

Location: UAE,

Prepared by:

Evgeny Chernikov, MSc Eng

For and on behalf of CAworks

Role: Specialist Staircase Subcontractor

Revision: A – Condition-Based Opinion (Non-Intrusive)

1. Scope & Basis of Opinion

This professional opinion has been prepared following a **non-intrusive visual and functional inspection** of the installed helical steel staircase structure currently supported by **temporary scaffolding and auxiliary props**.

The purpose of this document is to:

- Assess the **observable structural behaviour and condition** of the staircase;
- Identify **structural risks and deficiencies** based on site observations;
- Comment on **structural adequacy in principle**, **without undertaking structural design or calculations**;
- Propose **conceptual reinforcement strategies** to enable a safe, compliant, and **visually appealing** permanent solution.

⚠️ **This report does not constitute structural certification, design validation, or compliance approval.**

No intrusive investigations, material testing, anchor testing, or structural calculations were performed.

2. Reference Standards (Indicative)

The following standards are referenced **for guidance and benchmarking only**, noting that compliance has **not** been verified:

- BS EN 1991 – Actions on Structures
- BS EN 1993 – Design of Steel Structures
- BS 5950 – Structural Use of Steelwork (legacy reference)
- BS 5395 – Stairs, Ladders and Walkways
- UAE local authority requirements (Dubai Municipality / relevant authority)

3. Description of the Structure (As Observed)

- **Configuration:** Helical staircase spanning multiple levels
- **Total vertical height:** approx. **13,210 mm**, comprising:
    - Basement to Ground: ~3,620 mm

    - Ground to First: ~5,160 mm
    - First to Second: ~4,430 mm
- **Plan geometry:**
    - Outer diameter: ~4,800 mm
    - Inner diameter: ~2,000 mm
- **Structural system:**
    - Dual **inner and outer side stringers**, fabricated from **20 mm thick steel plate**
    - **No central column** or spine
    - Stair assembled from **multiple segments welded on site**
- **Risers:**
    - Intended nominal riser: ~199 mm
    - **Observed to be inconsistent across the flights**
- **Finish intent:**
    - TBC
    - Glass balustrades (additional dead load anticipated)

4. Observed Structural Behaviour

During site inspection and controlled use (walking tests), the following were observed:

- **Global structural vibration**, noticeable under:
    - Single pedestrian loading
    - Two persons
    - Light dynamic movement
- **Perceptible torsional flexibility** of the overall structure, even while temporary supports remain in place

- **Audible noise** during movement, indicative of joint movement and/or insufficient stiffness
- Behaviour assessed as **unacceptable for a permanent residential staircase**

Based on professional judgement, the staircase **does not currently exhibit adequate stiffness, rigidity, or load path clarity** to perform safely once temporary works are removed.

5. Load Path & Structural Stability Assessment

5.1 Load Transfer Mechanism

- The staircase lacks a **clear, continuous, and verified primary load path**
- With no central column and no permanent suspension system, the structure relies on:
    - End fixings to slabs
    - Side fixings to concrete platforms
    - Composite behaviour of segmented stringers

In its current condition, the staircase **cannot be considered a monolithic or torsionally stable structure**.

5.2 Temporary Works Dependency

- Scaffolding and temporary supports are currently:
    - Carrying vertical load
    - Restricting torsional rotation
    - Preventing cantilever action from developing

Once removed, the structure is expected to:

- Experience **significant torsional rotation**
- Impose **excessive forces on anchor bolts**

- Risk **progressive connection failure**, potentially leading to partial or full collapse

⚠️ **Professional opinion:**

The staircase, in its current configuration, is structurally unstable without temporary supports.

6. Connections & Substrate Uncertainty

The following critical information was **not available or verified**:

- Anchor bolt:
  - Diameter
  - Embedment depth
  - Grade
  - Spacing and quantity
- Substrate:
  - Structural capacity of the reinforced concrete slabs
  - Presence of post-tensioning
  - Reinforcement layout
- No anchor pull-out tests or proof loading have been carried out

As a result:

The adequacy of all connections cannot be verified, particularly at locations resisting cantilever and torsional forces.

7. Welding & Fabrication Observations

- Site welding observed throughout the assembly
- No WPS, PQR, or welder qualifications provided
- Visual inspection identified:
    - Variable workmanship quality
- No NDT (visual beyond cursory, dye penetrant, UT) performed

Weld quality TO BE ASSESSED separately, particularly for fatigue, torsion, and dynamic loading.

8. Structural Risk Classification

Based on observed behaviour, configuration, and unknowns:

Overall Structural Risk Rating: HIGH

Primary risks include:

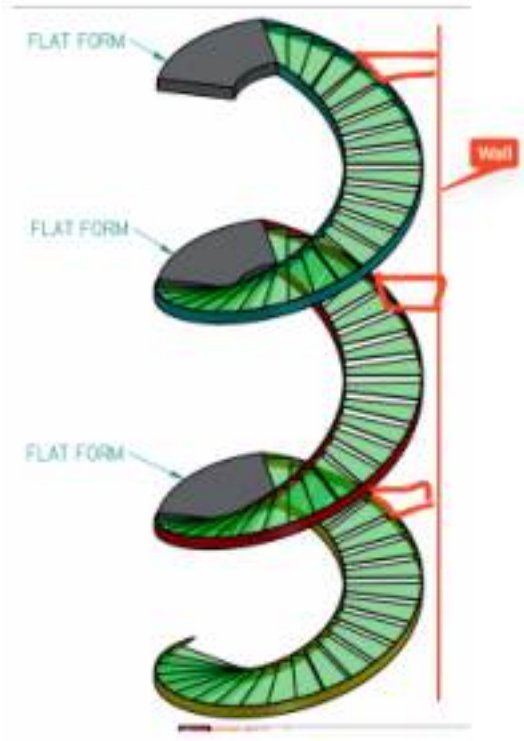
- Loss of torsional stability
- Anchor bolt failure
- Progressive structural collapse once temporary supports are removed
- Inadequate performance under serviceability and ultimate limit states

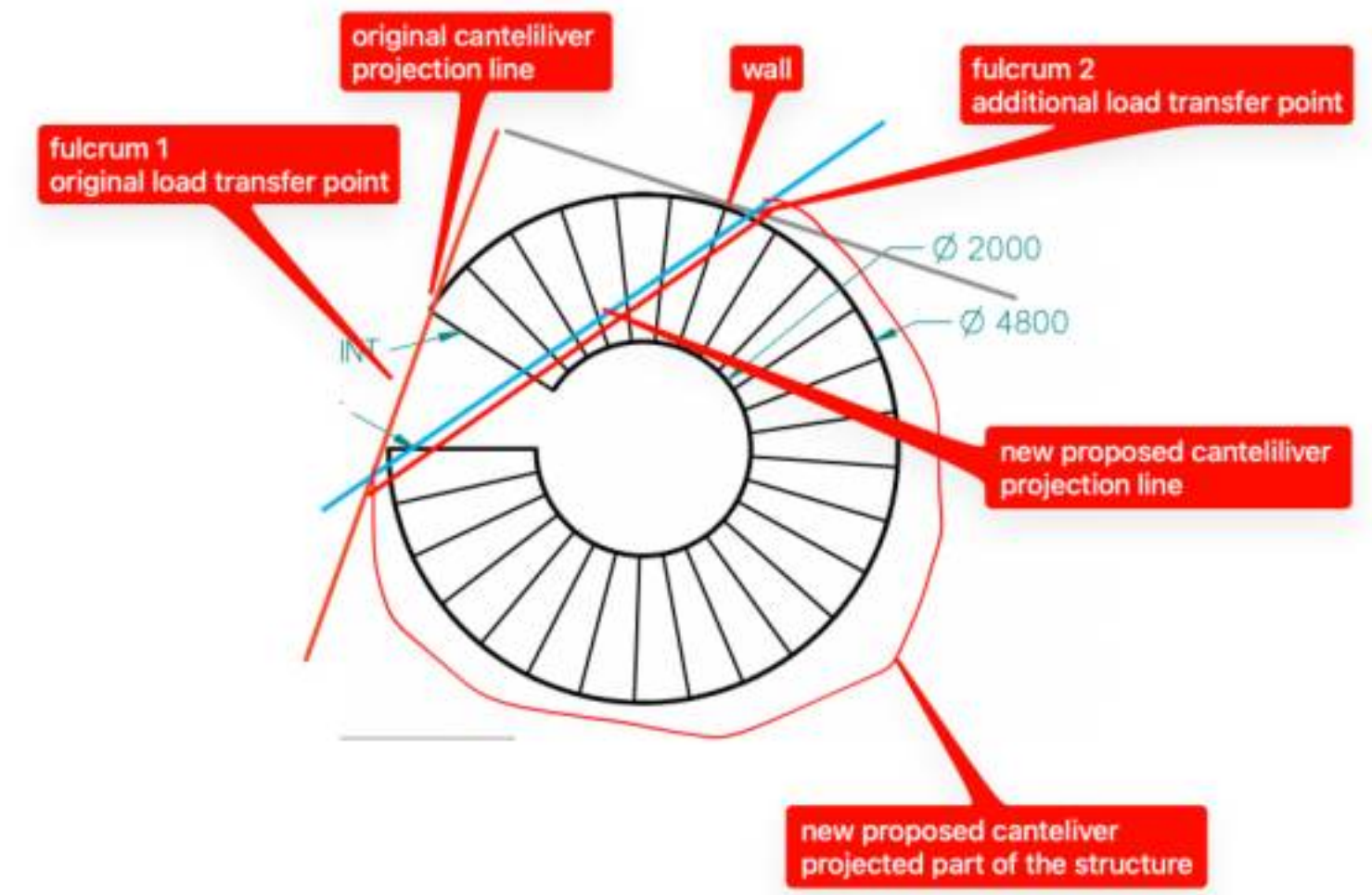
9. Conceptual Reinforcement Options (Non-Design)

The following **conceptual options** are presented for discussion only.
Each option would require **full structural design, calculations, and approvals** prior to execution.

Option A – Lateral Fixing to Structural Walls

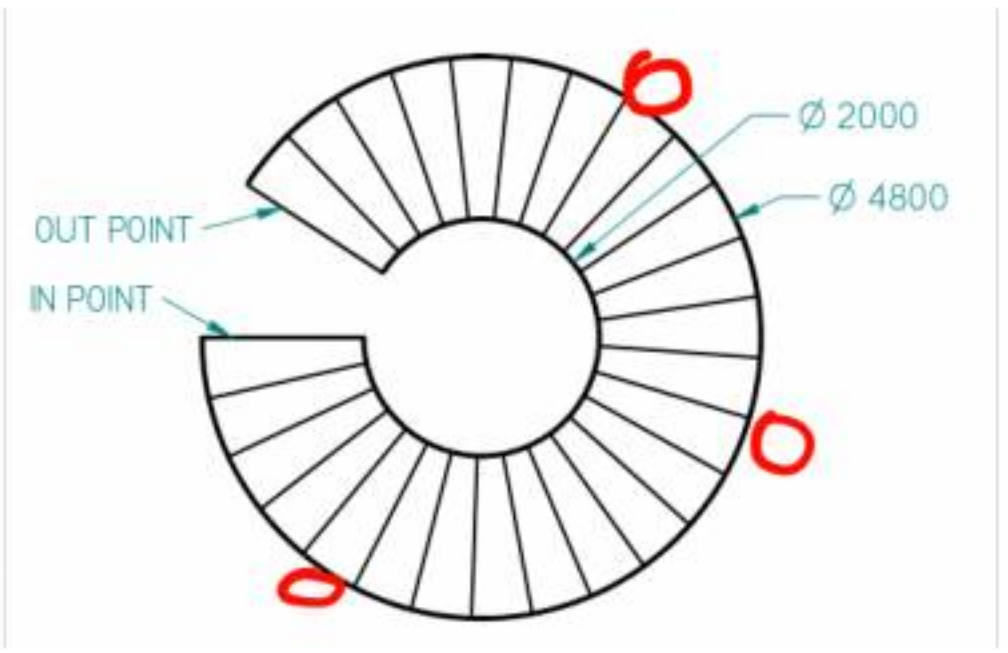
- Introduce continuous or decorative rigid connections from stringers to RC walls
- Improves torsional restraint and lateral stability
- Decrease the cantilever projected part of the structure (see sketch)
- Lateral fixing to cladded or decorated to agree with the design intent





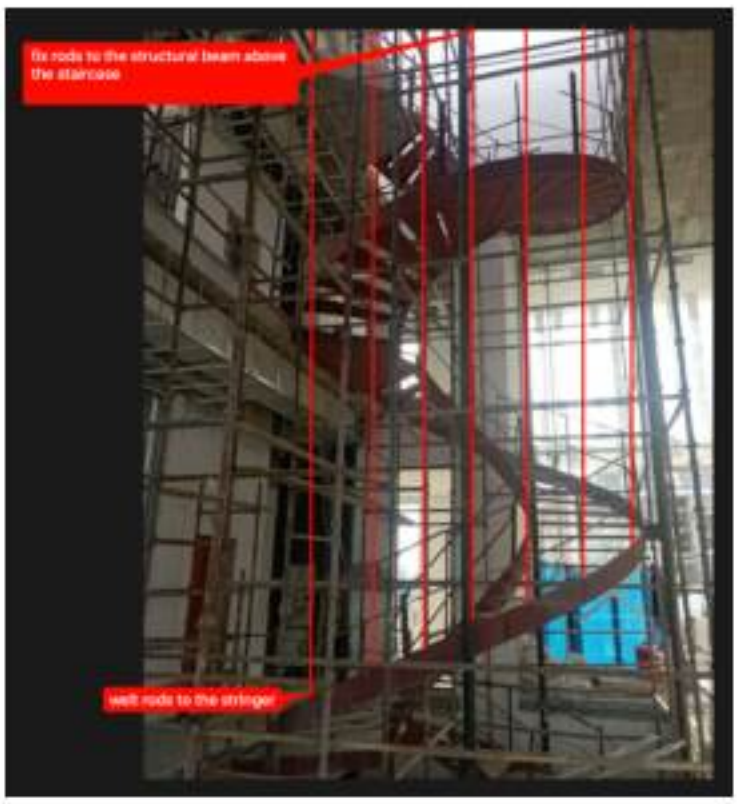
Option B – Introduction of Vertical Support Column(s)

- Install one or more steel columns adjacent to the staircase
- Significantly reduces or completely elimintaes the cantilever effects and global deflection
- Support pillars to be cladded or decorated to agree with the design intent



Option C – Suspended Support Rods from Above

- Introduce steel tension rods fixed to newly installed structural beams
- Transfers vertical and torsional loads upward
- Requires new beam installation and structural verification

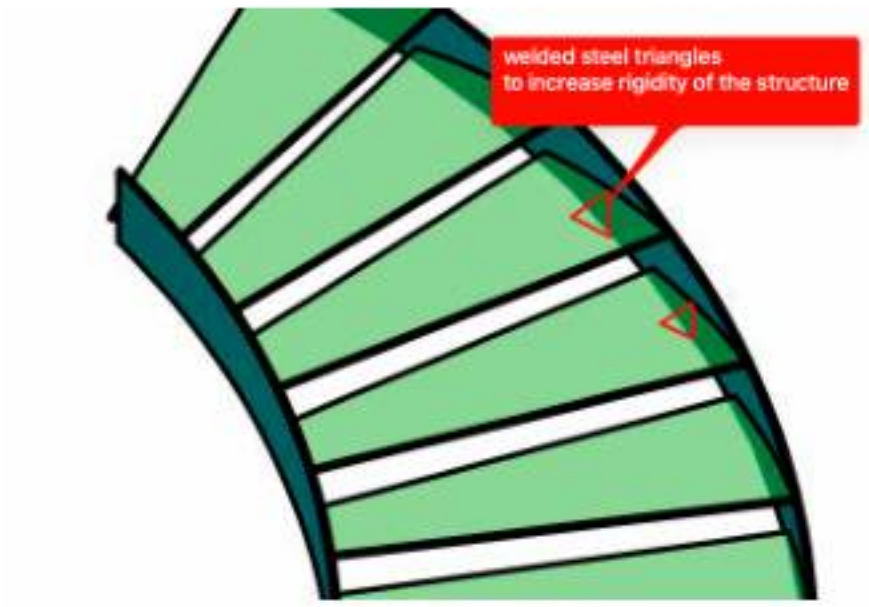


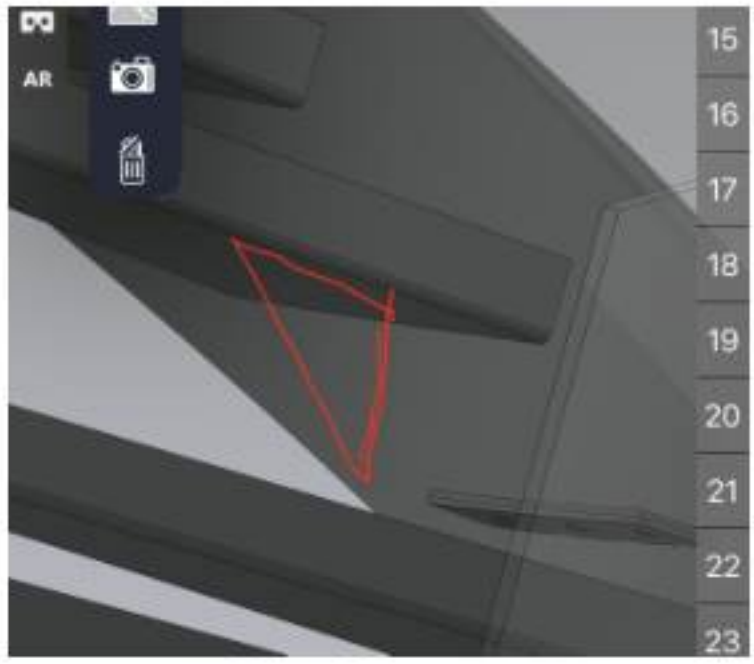
Option D – Reposition Staircase to Engage Wall Support

- Shift staircase laterally to bear against a structural wall
- Allows direct load transfer and improved redundancy
- Same effect as option B, however without lateral fixing which might not agree with the design intent

Option E – Local Step-to-Stringer Stiffening Triangles (complimantary and recommended with all of the above)

- Current structure lack vertial sitffeners thus torsion stability is inficient
- Add welded steel triangular stiffeners beneath each tread
- Improves local stiffness but **does not resolve global instability on its own**
- Suitable only as a supplementary measure

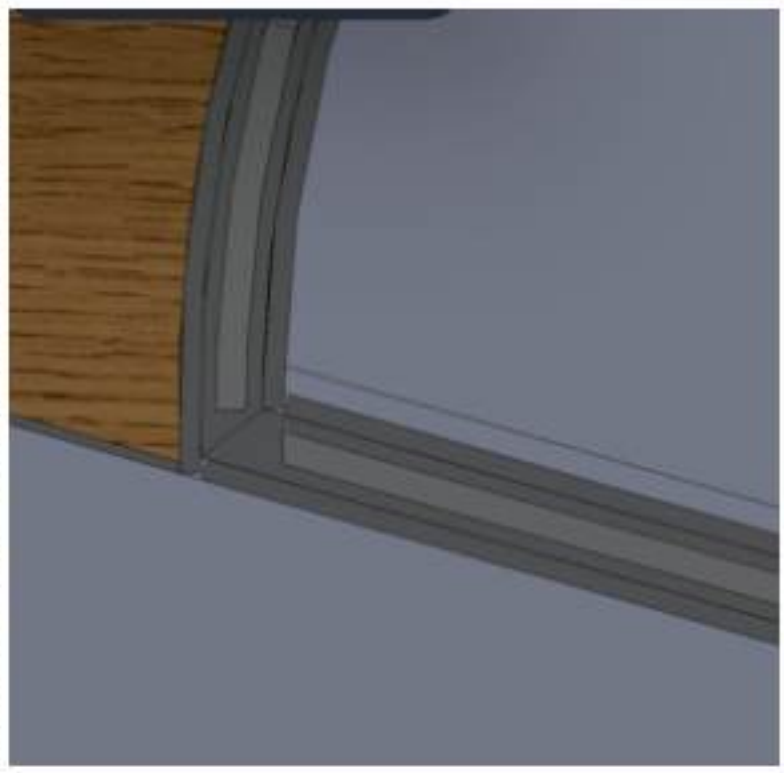




Option E – additional outer stringer (to be justified by the calculation or glass fixing requirment)

- Add additional outer stringer along the line of the existing stringer
- Educted opinion is that combitnation of the steps enforsements and either of the structure enforcement with provide sufficient rigidity to the overal structure, however if practical execution or structural calculations will prove otherwise, additional stringer could become another viable option
- Additional stringer will also anable “sunk-into-channel” ballustrade fixing method for the external glass ballustrade


dX: 1527.423mm
Dist: 3315.845mm
dY: 2941.445mm
dZ: 98.546mm




Helical Sheen Lane 3d.E...
AR
X: 127.514mm
Y: 3241mm
Z: 60mm

Option D – use glass as a load bearing structure

- Use structural toughened laminated glass as a load bearing structure to transfer load steel stringer to >> galss to >> to floor slab
- Bold existing steel strucure to the glass and lean it onto strucgtural glass
- Most visually appealing option, however also most expensive complicated to execute

10. Recommendatoins

1. **Do not remove temporary supports** under any circumstances at this stage

2. Appoint a licensed structural engineer to:
    - Perform full structural analysis
    - Define permanent load paths
    - Design reinforcement measures

3. Carry out:
    - Anchor testing
    - Weld inspection (minimum visual + selective NDT)
    - Verification of substrate capacity

4. Select reinforcement strategy balancing:

- Structural safety
- Architectural intent
- Long-term serviceability

📍 CAworks is ready to assist with the optimal solution and 3d visualisation should you choose to engage further.

5. Issue a **fully engineered remedial design** prior to any permanent works

6.

11. Limitations & Disclaimer

This opinion is based solely on:

- Visual inspection
- Observed behaviour
- Professional engineering judgement

No responsibility is accepted for:

- Hidden defects
- As-yet unobserved structural deficiencies
- Performance once temporary supports are removed without further works

12. Staircase design & decoration suggestions

Please refer to our brochure for the desing ideas.

CURVED BALUSTRADES

FOR SPACES THAT TWIST AND TURN

Curved glass can be fitted with bolts or within channels to provide a beautiful lining to the side of a staircase or landing. The glass is bent to precision ahead of its installation so that it can be fitted directly to the designated space. Given that glass can be curved to any bend within physical reason, the possibilities of what can be achieved with the use of these balustrades is truly breathtaking.

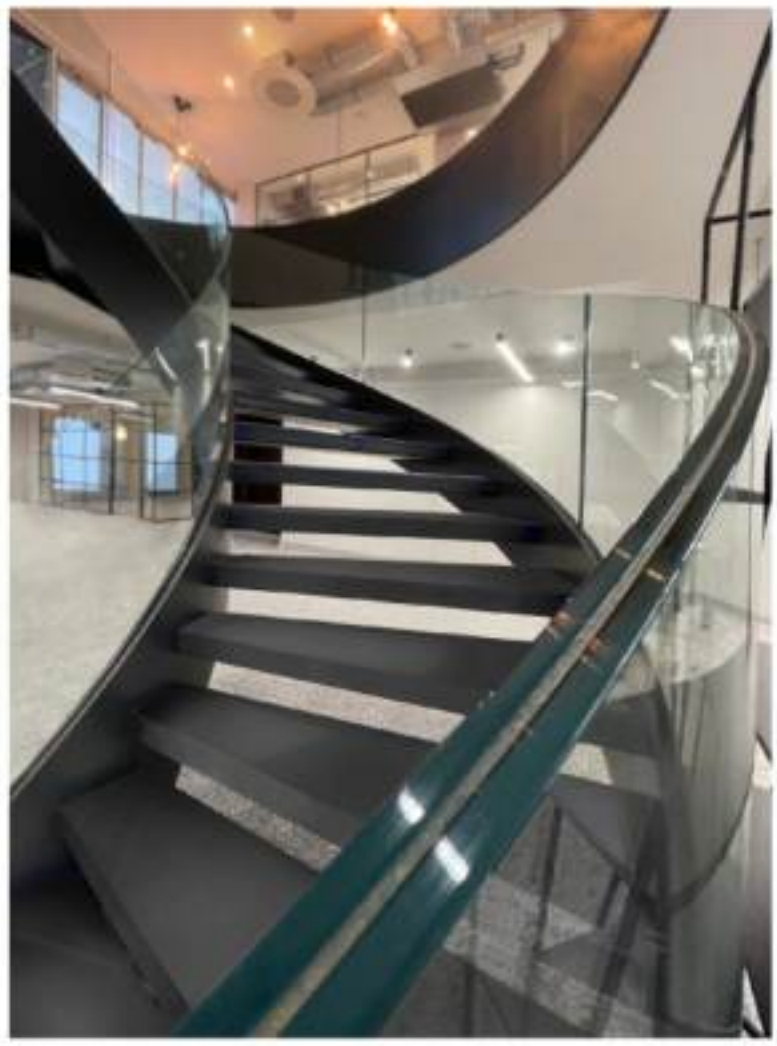
GLASS SELECTION

thickness	type	process
10mm	clear	laminated
12mm	low-iron	toughened
13.5mm	frosted	non-toughened
17.5mm	tinted	
21.5mm	one-way switchable	

If you would like to source any type of glass outside of the above list, please get in touch with us and make a custom request.

HANDRAIL AND POSTS

material	shape	form
oak	round	handrail
pine	square	post
steel	top-fixed	spindle
		rod system



CLADDING

FASCIA

STRINGER

SIDE

GROOVE

EXISTING STRUCTURE

BESPOKE WOOD CLADDING

With a joinery facility located within our Factory, we fabricate our wood materials, inclusive of boxes, handrails and side cladding, to-house to be in-line with client specifications, inclusive of finish, before delivering it for installation.

RISER RODS

Conforming to building regulations on the allowed height of a riser, we offer steel horizontal rods between the riser gap of each step so as to fulfil increased height requirements towards a limited space.

13. Conclusion

CAworks proposes to finalise the staircase visual design intent first and amend the staircase structure with the final architectural design and budget constraints in mind.