

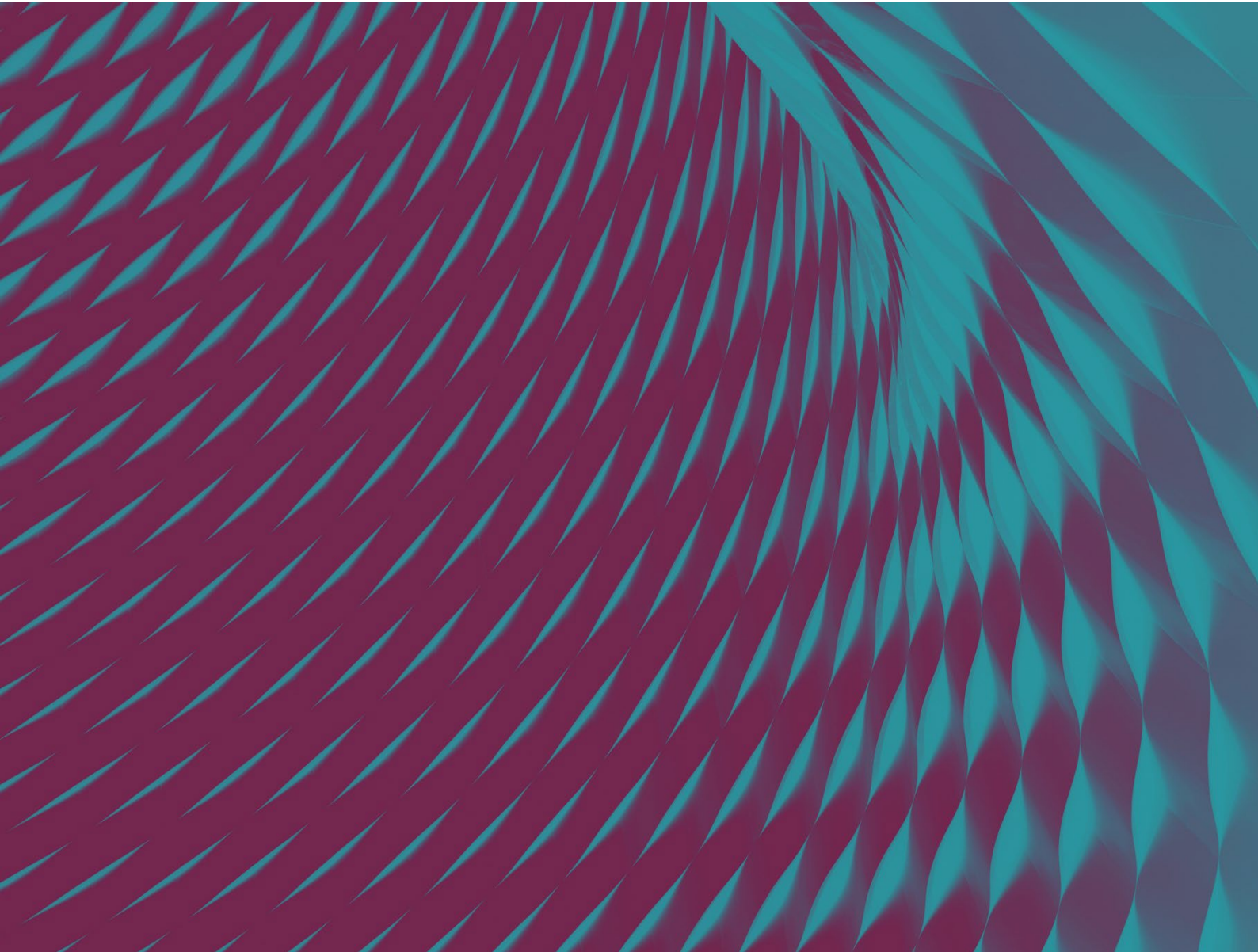
Examiner Report – July 2025

Chartered Membership Exam – July 2025

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Notes on the reports

The Examinations Panel, on behalf of The Institution of Structural Engineers, continues to review all aspects relating to the Chartered Membership, Incorporated-Membership and Chartered Supplementary Examinations and their relevance and role in assisting structural engineers to gain Chartered and Incorporated status within a worldwide professional structural engineering organisation.

Comments from the Examination and PRI Manager

All candidate exam papers were received back from the exam centres in good time and all scripts and pages were accounted for.

Candidates should make sure that they are aware of their candidate number and the location of the exam in advance of the day. The Institution sends out a reminder prior to the exam to check this information by signing in to the website and looking in the 'My Exams' section.

Candidates continue to leave page numbers blank on scripts which results in Marking Examiners not always being able to follow an answer script logically. Candidates are reminded that the final 5-10 minutes of the exam should be used to ensure that their papers are in order and ready for collection at the end by the invigilators.

A general observation from examiners is that many candidates continue to adopt a formulaic approach in their responses to Section 1B, 2D and 2E, using 'standard' wording and generic sketches possibly taken from an exam preparation course. Candidates should note that examiners are looking for bespoke solutions which address the specific requirements of the brief and marks will not be awarded for generic answers.

The Examinations Panel has created and made available a preparation guidance document that all candidates are encouraged to download and use as part of the revision, as well as taking a copy into the exam for any last-minute reminders.

Question 1 – Multi-storey law court

The brief in this question was based on an existing building that features a series of cantilevering glazed pods at either end. The question included two significant challenges; specifically, the 15m wide column-free space for the law courts and the 5.5m long cantilevering pods that act as consultation rooms.

The brief specified a number of constraints regarding the positioning of bracing. It stated, “*Bracing is not permitted to the glazed north elevation of the atrium or internally within the building. Feature bracing is permitted in elevations of the meeting room pods.*” Some candidates appeared to misinterpret this and failed to take full advantage of using bracing in those locations where it was allowed. The complexity of the building’s geometry led to many candidates struggling to develop viable schemes that were structurally sound. Many featured 5.5m long cantilevering elements that lacked sufficient back-span which demonstrated that those candidates did not understand simple framing actions. The more successful candidates recognised that external feature bracing was permitted and incorporated this into their schemes.

The brief included a two-storey atrium space at the front of the building. This was intended to provide candidates with an opportunity to demonstrate their knowledge of creating such spaces using lightweight framing elements; however few candidates developed schemes that addressed this, and some even ignored the atrium’s presence completely.

The column-free space for the law courts did not prove much of an issue for candidates; however few referenced the need to consider vibrations within this space of the building.

The soil conditions afforded candidates the opportunity to explore a number of substructure forms, but few managed to develop their designs to a sufficient level of detail. Those that adopted a raft, for example, did not consider the localised bending of the structure due to the spacing of the columns. This omission would have resulted in differential settlement and/or cracking of the raft. The challenge of creating two distinct schemes for this question was too difficult for many candidates, with impractical designs being presented to create schemes that were significantly different.

The letter was generally well addressed, with the better candidates making reasonable alterations to the brief to reduce the quantity of materials present in the structure; however, many candidates presented changes to the scheme that without altering the brief, implying that their original designs were inefficient. The calculations generally lacked narrative structure and did not design key components of the structure. A lot of time was spent on deriving loads, especially wind induced actions, at the expense of designing the elements within the structure itself. This was a common problem and implies that greater attention is paid to loading analysis than element design in practice. Outside of element design and loading analysis, structural analysis was lacking, with many candidates treating cantilevering elements as having no back-span. This resulted in inaccurate applied bending stresses and deflected shapes being arrived at.

Drawings were often poor, with many candidates choosing not to use a straight edge at all in their sketches. The details provided were often not critical with many candidates choosing to present generic reinforcement details. There was also a lack of overall cross sections through the building, which for this brief was critical due to the challenging nature of its geometry. This made it difficult to determine if the candidate understood the stacking requirements of the building.

Method statements suffered from being overly generic. Most candidates did not describe how the cantilevering and long span elements were to be put into place whilst maintaining stability of the structure as it was being built.

In summary, this question was a challenging one that required candidates to look at the entire building as a system rather than a small kit of parts. The stability of the cantilevering pods could have been dealt with via external bracing, as was implied by the text in the brief, but many candidates failed to pick up on this.

Question 2 – City centre office

The challenges in the question were generally based on three aspects, the support for the floors above the step-back below Level 4, the lateral stability of the structure (in the absence of core walls) and, to a lesser extent, the restrictions placed on internal columns.

The ground conditions should not have provided a major challenge in proposing suitable solutions.

Section 1a

Suitable solutions for the step-back at Level 4 included using raking columns under level 4, a transfer floor at level 4, or a truss within the plant room at Level 6 with hanging columns. Stability could be provided by moment frames making use of the allowed internal column or perimeter bracing which required consideration of the continuity of bracing above and below level 4.

A lot of candidates did not utilise the available number of columns above level 4 in an efficient way resulting in uneconomically large span beams.

Candidates rarely produced a second viable solution entirely different from the first solution. In a lot of cases it was almost a copy of the first solution but with a different material. Candidates' ability to produce two distinct solutions remains a big hurdle.

Suitable foundation solutions were piled or pad/strip foundations. Some candidates suggested an uneconomical raft which was not very appropriate given the layout of columns.

Section 1b

Some candidates found the presentation and technical aspects of the letter difficult. Good candidates expanded on their proposed options to explain how they would save on material usage.

Section 2c

Candidates need to focus on identifying the key elements for the scheme and avoid repetitive design of similar elements. Time was often wasted on over-elaborate wind loading calculations. The question needed detailed consideration of stability for the full height of the building but discontinuity of perimeter bracing at Level 4 was generally overlooked.

Carbon calculations have generally improved but some candidates still do not submit any.

Section 2d

Candidates need to remember that the question asks for general arrangement drawings for the whole structure for estimating purpose; however many candidates do not provide enough information to fulfil this requirement. Drawings including split floor plans were often difficult to understand and did not include sufficient information.

Critical details are generally poorly attempted and many of the details provided are not critical.

Section 2e

Method Statements often showed a lack of construction experience with candidates struggling to demonstrate an understanding of the specific construction sequence required for the project. Typically, candidates provided a well-prepared preliminary sequence of works for setting up site and placing foundations; however, the information provided for the superstructure was typically lacking in detail specific to the building such as stability during construction and temporary works/sequence for the overhang at Level 4.

Conclusion

Understanding the requirements of the brief, and in particular any restrictions, is critical in producing a satisfactory script.

While this appeared to be a simple question, it was not, and it was easy to identify the candidates that had a good understanding of functional framing and stability options. Candidates often failed to appreciate that time lost in providing generic responses to sections of the paper meant they often failed to demonstrate a clear understanding or knowledge of structural design, particularly at concept stage.

Candidates should ensure that their time management allows sufficient time to give satisfactory responses to all parts of Section 2 as a pass in both Sections 1 and 2 is required.

Question 3 – Replacement footbridge

The question involves raising and widening an existing truss footbridge and requires the existing trusses and foundations to be retained as far as possible.

The loading is very high for a footbridge so it was expected that the main trusses would need strengthening and that the cross beams would be replaced by longer ones. Options to change the level include raising the whole bridge or raising the deck between the widened trusses. The latter allows cross bracing below the deck to provide transverse stability but retains some elements below high water level. Possible approach solutions include the following:

- ▶ Install additional simply supported approach spans. A continuous structure with short end spans is less suitable as it has a significant risk of uplift at the ends so would need holding down bearings. The benefit of reducing the midspan permanent load moment would not be significant.
- ▶ Increase the span and construct new foundations. This would need extensive strengthening and no re-use of the existing substructure so would be less sustainable.
- ▶ Raising the approach on embankments with new wing walls and earthworks slopes. Reinforced soil construction would minimise load on the abutments which would need to be modified. The approach may need edge protection.
- ▶ Widening the existing foundation by direct widening of the concrete, adding a crosshead or installing a transfer beam.

Truss strengthening options include adding a framework to increase the overall height of the truss, adding prestress below the bottom chord or increasing the size of top and bottom members by welding on steelwork plates or sections. The top flange stability could be by U frame action, or a bracing system to the vertical elements.

The site is sensitive, so access on land should be minimised by using the water for heavy construction machinery and equipment. It is desirable that the work can be carried out at the bridge site rather than to relocate the whole. The use of pontoons or a barge would provide a safe working space as well as support to the work. It is not expected that the candidate will know capacities and detailed use of the specialist equipment, but some information on warning times for flooding was provided. The candidates were expected to consider:

- ▶ Temporary support to isolate the two trusses and allow the deck to be removed and the trusses moved apart.
- ▶ Raising the structure or moving it away to allow access to modify foundations.
- ▶ Use of compound and floating access for heavy materials.

Section 1a

Many candidates failed to conduct capacity checks on the existing structure. They proceeded directly to modifying the existing trusses or proposed entirely new structural systems ignoring the client's intention to retain and reuse the original trusses.

Candidates often failed to identify straightforward strengthening strategies and some proposed increasing the depth of the existing truss without appreciating that the vertical and inclined members would be too short so could not be re-used without complete disassembly of the trusses and separate modifications of each before reassembly. This is a complex and labour-intensive process. One candidate proposed melting down the existing truss to fabricate new steel elements which is recycling not re-use. Complete replacement structures were marked down as they disregarded the client's brief. The addition of a pier in the water is less sustainable than other options.

A common alternative suggested was a steel-concrete composite structure, which typically has a significant structural depth below the deck level. This increased depth would result in the bearings and parts of the steel beams being submerged at high water. These candidates did not identify any mitigation measures to deal with long-term durability and maintenance.

Most assumed, without justification, that the existing foundations would be sufficient.

Section 1b

Material reduction options proposed by most of the candidates lacked clarity and detail. Some did suggest reducing the width or loading requirements.

Section 2c

Some candidates could not complete the calculations due to poor time management.

Missing key structural elements and incorrect calculations led to losing marks significantly in this section. Few candidates looked at the structural capacities of the existing truss. Most of the candidates did not estimate the bearing sizes.

Candidates were not always able to demonstrate a clear understanding of the specific structural behaviour of half-through trusses. (out-of-plane buckling- U-frame action, and in-plane buckling - Euler buckling). Mistakes such as using live load as a beneficial effect and numerical errors were marked down.

All candidates disregarded live load surcharge and potential eccentric loading from the superstructure when evaluating foundation overturning stability.

Only a very few candidates estimated the difference in loads to support reusing the substructure and foundations and very few checked the stability of existing foundation.

Several candidates failed to complete the carbon calculations for key structural elements.

Section 2d

Only a few candidates provided a set of scaled drawings. Others produced a set of free hand sketches which lacked details and were very rough. Common issues include lack of dimensions, lack of details like bearing articulation, plan, cross section, typical details of truss etc. Often they were missing notes with material information, reinforcement ratios etc.

Candidates proposing reusing the existing truss with modifications often simply presented the structure as if it were entirely new. The design intent and scope of work involved, particularly in cases involving complex modifications to the Warren Truss, were not shown. Many candidates indicated that abutments and foundations would require modification, but few provided any details to clarify what these changes would entail.

Many submissions included generic details, such as bearings and movement joints without tailoring them to the proposed design or site conditions. These details often fail to contribute meaningfully to the design intent and can introduce confusion rather than clarity.

Section 2e

The method statements were generally presented as a sequence of work with headline tasks without any actual description of the construction method or health and safety risks/ mitigation. The plant and equipment required to execute the works together with the likely temporary works involved were often not mentioned. The temporary works should be clearly illustrated with the aid of sketches.

Question 4 – Seaside hotel

This question involved the design of a 4-storey hotel, with bar/restaurant and reception facilities on level 1 and three levels of bedrooms above. The hotel is located on an infill site, with an adjoining 4-storey building to the west, a vacant site to the east and a road to the south, where the main front entrance of the hotel is situated. The building, which has an irregular shape on plan, is to be clad in masonry, with windows on the northern and southern elevations. The southern elevation is fully glazed at level 1, as are the bedroom windows of the suites at each floor level. There are two circulation cores, one located on the western elevation and one in the north-east corner.

The key challenges associated with the question were:

- ▶ An adjoining building on one side and a site boundary on the other requiring the use of balanced or cantilevered foundations.
- ▶ Consideration of the differing floor layouts between Level 1 and the upper floors, with the potential requirement for transfer structure.
- ▶ An open plan bar/restaurant area, with only 2No. internal columns permitted.

- ▶ A significant amount of glazing to the front elevation with no visible bracing permitted.

Section 1a

The building size permitted a wide range of materials to be considered, including steel or concrete framed or a hybrid structure comprising a transfer structure at Level 2 with a masonry or timber structure above. For the upper floors, a lightweight form of construction could have been considered as an alternative concept to the more traditional concrete solution.

The column spacing rules allowed for a variety of grid spacings, with 4 to 9m being a suitable range. A significant number of candidates utilised the same (or very similar) grid for both schemes and simply changed the material from steel to concrete, resulting in two schemes that were not sufficiently distinct.

Clear and unambiguous sketches are required to illustrate the proposed structural concept for each option; however, for this question, too many candidates presented poor quality sketches, some to the extent it was difficult to understand the nature of the proposed concept.

From a stability perspective, there were several options which could have been used to brace the building, including the use of the 2No. well placed circulation cores or alternatively, utilising shear walls or vertical diagonal bracing set within the masonry panels of the perimeter walls. The front elevation required special consideration, and some form of frame action was required to provide the necessary stability.

The building superstructure could either have been supported on piles or pad foundations. Where piled foundations were proposed, 300-450mm diameter, taken to rock level, would have been considered an appropriate size for a building of this nature. Driven piles were considered inappropriate due to the proximity to the adjoining building. Many candidates failed to adequately address the complication of building immediately adjacent to an existing building and the potential impact on foundations. Cantilevered foundations were necessary to avoid interfering with the zone of influence of the adjoining building. Due to the nature of the ground conditions a ground bearing floor slab was a potential option, although many candidates opted for a suspended slab in conjunction with a piled foundation solution, which was perfectly acceptable.

The scheme comparison continues to see too many candidates provide very generic responses with little or no reference to sustainability, a key criterion to be considered when critically appraising the schemes. Consideration of local practices or availability of materials were not considered acceptable reasons for choosing one scheme over another.

Section 1b

The communication was in general reasonably well attempted. The question was looking for candidates to suggest what changes could be made to the brief in order to reduce material usage while maintaining the number of bedrooms. Importantly, an explanation of the effect on the design was required. Potential options included:

- ▶ Reducing the imposed loading for the bedrooms and at roof level.
- ▶ Relaxing the rule concerning the number of permitted columns within the open plan bar/restaurant area.
- ▶ Aligning the corridor exiting to the northern elevation with the bedroom walls above to simplify the structural layout and potentially remove the need for transfer structure.

- ▶ Reducing the width of the building by approximately 500mm in the east west direction, while maintaining the minimum bedroom area, in order to avoid the need to cantilever foundations along the eastern elevation.
- ▶ Permitting discrete vertical diagonal bracing on the southern elevation at ground floor level.

Section 2c

Calculations were generally well attempted with most candidates providing an introduction which included information such as a note of the design codes adopted, loadings, a list of the elements designed and assumptions.

Some candidates tended to focus on the easier calculations such as beams, slabs and columns, while avoiding the more complex calculations for stability and transfer structure. Calculations also often lacked a clear narrative and would have been enhanced by including simple sketches showing span/loading information or output, e.g. RC beam reinforcement.

The carbon calculations were generally well attempted.

Section 2d

The drawings provided varied in their presentation and quality and most of the candidates that failed were unable to produce adequate drawings and/or critical details. The structural concept for this building was best represented by full plans at foundation level, level two and an upper floor & roof as well as a full building section. Some candidates produced only part floor plans in order to save time; however, given the irregular shape of the building, this approach did not adequately convey the full structural concept.

Details continue to be an issue, with too many producing reinforcement details, which are not considered critical and would in reality, be better placed as a summary to a calculation for the particular element. Many candidates failed to sketch the key section through the foundations along the western elevation showing the interaction with the foundations of the adjoining building, perhaps indicating a lack of experience in dealing with such challenges.

In preparing for the exam candidates should review concept schemes produced by Chartered Engineers within their office or the resources available on the IStructE website to become familiar with an acceptable standard.

Section 2e

Many candidates provided brief generic method statements that could apply to any building and accordingly lost marks. Good candidates were able to:

- ▶ Provide a detailed sequence of work for both the substructure and superstructure elements including specifics on the particular challenge of installing foundations along the length of the adjacent building on the western elevation;
- ▶ Discuss proposed crane positions with respect to the constrained site;
- ▶ Highlight significant Health & Safety issues including, but not limited to, making recommendations for condition surveys prior to commencement and ongoing monitoring of the adjoining building during substructure works;

- ▶ Consider the requirements for any temporary works for stability to facilitate the safe erection of the superstructure.

Question 5 – Country park visitors centre

Introduction

The question is relatively straightforward with the main challenges relating to the stability and interconnectivity of the octagons making up the building, particularly at first floor level. The wooded area under active management and the workshop is intended to steer candidates to consider using timber to reduce the need to import material and to potentially reduce costs and project time.

Section 1a

Superstructure options could include braced steel frames, portal frames, or three-pin arches with different load paths for stability. Options include a clear 20m span, a single central support, or internal columns at sensible spacings. For materials, timber from the managed wooded area could be used subject to availability and specification, glulam would be appropriate for long spans, or alternatively, steelwork and/ or concrete is feasible for the columns and beams.

Two predominant structural schemes emerged from candidates; a conventional steel frame comprising simple beams and columns, and a portal frame arrangement. Both were widely adopted, with layout variations introduced through the inclusion of one or more internal columns. A 3-pin timber frame was also successfully used.

Schemes needed to address both lateral and torsional stability; however, schemes often lacked sufficient detail and candidates often proceeded with designs that lacked sufficient structural stability undermining the overall viability of their solutions. Some candidates proposed vertical bracing to external elevations but failed to accommodate door and window openings.

For foundations, a notable number of candidates proposed piled foundations, despite the presence of favourable near-surface ground conditions. This suggests a lack of site-specific appraisal or an overreliance on generic foundation solutions. Feasible options include:

- ▶ Pad foundations to columns with perimeter ground beams (either ground bearing or spanning across column pad footings).
- ▶ A perimeter strip footing with local thickenings at columns and a ground-bearing slab with pad footings to internal columns.
- ▶ A raft may be acceptable as long as candidates deal effectively with the different loadings between the perimeter and the internal floor slab. A thin uniform concrete raft without any local thickening at columns and perimeter would be difficult to justify.

Section 1b

The purpose of 1b is to reduce embodied carbon by reducing material usage where possible whilst still satisfying key aspects of the brief.

Most candidates produced brief letters that addressed only one or two issues, despite the opportunity to engage with a broader range of relevant concerns. Possible changes to the brief could include:

- ▶ Removal of the canopy

- ▶ Relaxing the 'no bracing' constraint to external elevations
- ▶ A reduction in floor to ceiling height as 6m appears generous
- ▶ A reduction in roof loading from 1kN/m² to 0.75kN/m²
- ▶ Consideration of alternative plan layouts/section profiles whilst still accommodating the specified areas

Section 2c

Calculations, while generally well presented were often incomplete. Many scripts omitted key structural elements or provided overly brief calculations. The majority of candidates restricted their calculations to basic beam and column elements, often overlooking the structural complexity inherent in their proposed arrangements. This simplification suggests a limited engagement with the full structural behaviour of the scheme. In contrast, the better candidates, particularly those adopting timber solutions, tended to produce more comprehensive and context-sensitive calculations. These submissions demonstrated a stronger grasp of material-specific design considerations and a more rigorous approach to structural analysis.

Most candidates provided embodied carbon calculations, many in some detail.

Section 2d

Drawings varied in quality. While some were excellent, others appeared rushed or incomplete. A significant number of candidates failed to provide sectional or elevational views. For this type of question, such drawings are essential to demonstrate how bracing integrates within the structural arrangement and to convey critical height information. These omissions impact the clarity and completeness of the submission. Overall, drawing quality remains a persistent issue. Candidates who did not meet expectations often displayed limited understanding of the drawing requirements, producing outputs that were poorly annotated, difficult to interpret, and insufficient for cost estimation or construction feasibility.

Section 2e

A method statement should provide a construction sequence for substructure and superstructure reflecting the design methodology and building shape. Candidates should consider temporary stability and would be expected to propose working from braced bays with temporary propping as required.

This section continues to pose challenges for many candidates. A proportion failed to attempt it altogether, likely due to poor time management or prioritisation during the exam. Among those who did respond, many defaulted to listing construction operations without addressing the core requirement: explaining how the building can be assembled safely and in a logical sequence. This omission reflects a limited understanding of buildability and site safety integration within structural design.

Conclusions

Despite the relative simplicity of the question, many candidates gave insufficient attention to structural stability, the distribution of bracing, and the load path to braced bays. The issue of lateral spread, particularly in schemes relying on simple beam and column arrangements without ceiling ties was poorly addressed by many.

Drawing standards remain a concern. The majority of candidates submitted basic plan views with non-critical details, omitting sections and elevations. This omission significantly hindered the ability to interpret the proposed structural intent and assess buildability.

Calculation quality requires improvement. Many submissions were limited to rudimentary beam and column checks, failing to reflect the structural configuration and complexity of the proposed schemes. A more holistic and material-sensitive approach to analysis is expected at this level.

Finally, candidates are encouraged to adopt a more holistic approach to structural design, integrating stability, material-specific analysis, and clear communication. Greater attention to drawing standards, load paths, and construction sequencing is essential. Future submissions should reflect not only technical competence but also the ability to communicate structural intent effectively and defensibly.

Time management emerges as a critical issue. Many candidates appear to have allocated disproportionate effort to early sections of the script, leaving later parts underdeveloped. This imbalance often resulted in incomplete discussions, brief calculations, and insufficient drawing detail. In borderline cases, the lack of depth across multiple areas rather than any single error is what prevented a script from achieving a pass.

Examination Statistics

The following section provides some general statistics to provide an overview of candidate performance during the exam. A total of 336 candidates attempted the exam.

Pass rates by question

Question	Pass rate
1: Multi storey law court	32.38%
2: City centre office	32.67%
3: Replacement footbridge	28.57%
4: Seaside hotel	13.64%
5: Country park visitors centre	44.44%
Total	31.85%

Pass rates by exam attempt

Exam attempt	Pass rate
1 st Attempt	47.66%
2 nd Attempt	22.43%
3 rd Attempt	17.76%
4 th Attempt +	12.15%

This table does not include the total number of candidates in each attempt number, only those that passed.