

SECTION 6

FAILURES IN QUALITY CONTROL

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6.1 Introduction

Note: I use the terms '*over-cladding package*' and '*over-cladding work*' extensively throughout this section. In this context I am referring to all work involved in upgrading the exterior of the building: all facades (fourth floor to Crown), preparation, insulation, new windows and fixed panels, internal window linings to head, jambs and sills, cavity barriers, all supports and fixings, and the rainscreen cladding.

- 6.1.1 Consideration of the causes of the spread of the fire at Grenfell Tower raise questions in respect of quality in all aspects of design, statutory controls and guidance, inspection, product testing and certification, manufacturing and construction. In this section I examine the quality management processes, as adopted and applied by Studio E, in relation to the preparation of the over-cladding package. I do this because failures in quality control go to the heart of the issues investigated and reported upon within this report.
- 6.1.2 In this section, I examine the performance of Studio E in terms of its managing of its own work with respect to quality. This section complements the content of Sections 4 and 5 which examined:
- a) Whether the documentation, as produced by Studio E and Harley, met the requirements of the Building Regulations and complied with the guidance of, respectively, Approved Document L1B (ADL1B) and B2 (ADB2).
 - b) Whether the processes of dialogue and formal application for approval under Building Regulations, and thereafter of assessment, inspection and 'sign-off' as carried out by Building Control, were conducted in a proper and satisfactory manner.
- 6.1.3 This section focuses mainly on Studio E's work in relation to the over-cladding. Whilst some aspects of the firm's poor quality work that I report on relate to wider issues, for example the Full Plans submission for Building Regulation approval covered the entire project scope, it is notable that much of the work produced by Studio E for other parts of the 2012-16 Work appear to have been of a very good standard. It seems, for reasons I do not understand, that the work for the over-cladding, in all its aspects, fell very far short of the work carried out by Studio E on other parts of the project.

- 6.1.4 As set out in Section 5, the scope of Studio E's work was established under its appointment terms, firstly to KCTMO and then to Rydon. The standards of quality were defined pre-novation by the appointment's reference to, amongst other documents, the RIBA '*Plan of Work*' and the RIBA's Job Book (2008 Edition). Post-novation, the standards of quality were defined by the Rydon Deed of Appointment {RYD00094228}. Whilst no specific reference was made to any of the RIBA documentation within the Rydon Deed of Appointment, Studio E were bound to perform, and would have been expected by Rydon to perform, to the standard of a reasonably competent architect.
- 6.1.5 This section is not concerned per se with the quality of Studio E's work, but instead with:
- a) What processes and systems the office had set up to ensure a quality of service that complied with the standard of practice expected of a UK registered architects' office?
 - b) How Studio E managed those processes and systems and whether it did so in a satisfactory way?
- 6.1.6 It is inevitable that I will use examples of failure in both the way in which Studio E carried out its work and the product of that work. The point of this section is, however, to build on the work of the previous two sections by examining why the quality that was reasonably expected of Studio E was not achieved in terms of both process and product and, in this respect, was not achieved in such serious a manner across such a widespread agenda of issues and over such an extended period of time.
- 6.1.7 As I have concluded in Sections 4 and 5 of my report, Studio E's services in respect of the over-cladding work were seriously wanting. The quality of the services provided with respect to the over-cladding work against the obligations owed to KCTMO and thereafter to Rydon, as set out in the appointment documentation, fell far short of the standard of reasonable competence.
- 6.1.8 In terms of the over-cladding work, Studio E failed to do much of the work required of them under the terms of their appointment. My criticism is not, however, limited to the poor quality of the work carried out by Studio E. I am also critical that much of the work which was instructed by the KCTMO and by Rydon, and which was expected given the terms of Studio E's appointment both pre and post novation, Studio E simply did not do. Likewise, there was work which was anticipated under the RIBA Plan of Work, but which Studio E simply did not do. An example of this is the 1:5 scale external wall over-cladding drawings required under Rydon's appointment document but not provided by Studio E.
- 6.1.9 In summary, with respect to quality, the failings of Studio E across the pre-novation and post-novation appointment stages can be summed up under the following headings (listed in no particular order with respect to importance):

- a) **Failure in documentation control:** e.g. errors in ascribed drawing numbers, failures to list drawing revisions, failures to describe drawing revisions, failures in maintenance of accurate and properly informed 'As Built' drawing register.
- b) **Mistakes in information provided in drawings:** e.g. referencing wrong materials: zinc cladding in lieu of ACP.
- c) **Design and specification errors:** e.g. failures in meeting requirements of Building Regulations, failures to comply with ADB2.

6.1.10 It is my opinion that had Studio E applied the protocols of a properly prepared ISO 9001 Quality Management System (defined below), the work and service that was provided would have been of an appropriate quality in terms of design, specification, and statutory compliance. Information would have been submitted to the appropriate standard and in a timely fashion to Building Control. Specialist sub-contractors (e.g. Harley), sub-contract drawings and specifications, and construction work would have been properly checked during the course of its preparation by Rydon, Building Control and others as appropriate, for compliance with properly prepared and quality assured Studio E documentation. Against such checking being competently carried out and any irregularities being remedied, the over-cladding work would have been fully compliant with the requirements of ADB2.

6.2 What is ISO 9001?

- 6.2.1 It is essential for any architectural practice to have a system in place to ensure the consistency of its outputs, for example drawings and documents. BS EN ISO 9001 is a standard against which any quality management system can be measured via third party accreditation.
- 6.2.2 At the time of the fire at Grenfell Tower, Studio E's practice information stated that it was an ISO 9001:2008 and ISO 14001:2004 registered practice.

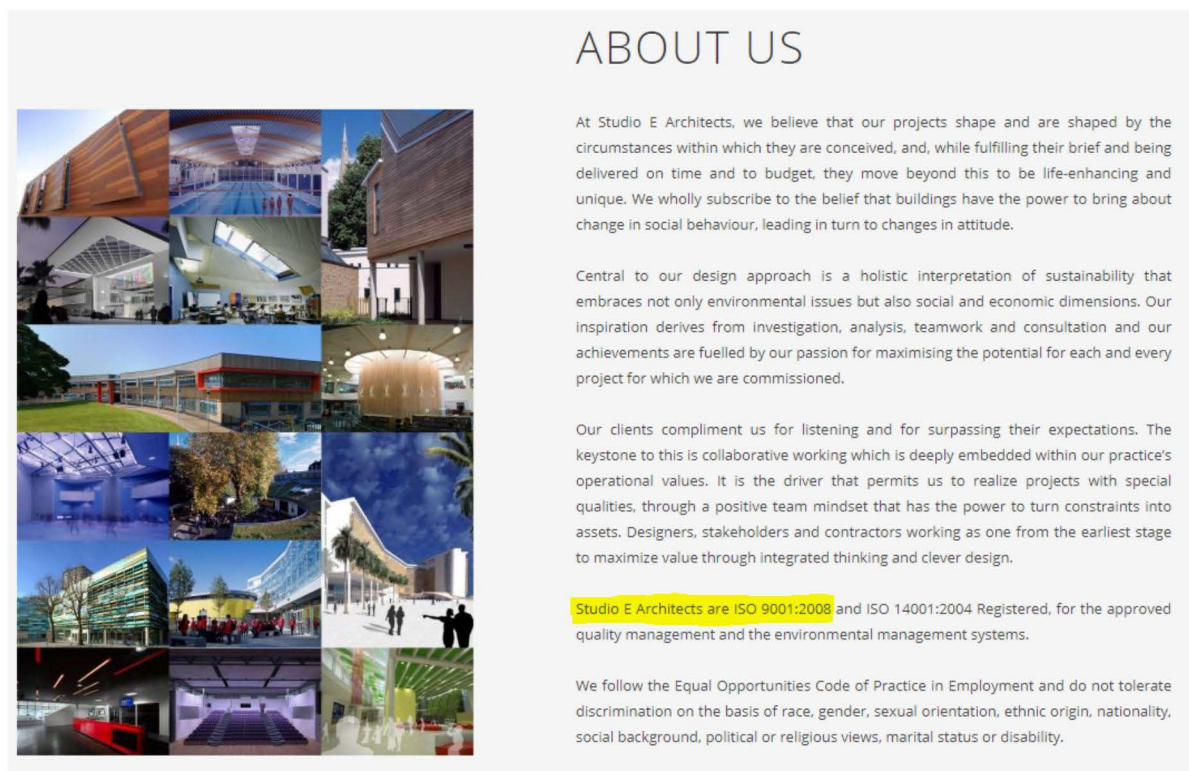


Figure 6.1: Extract from the Studio E website that states the practice is ISO 9001 Registered

- 6.2.3. ISO stands for 'International Organisation for Standardisation'. Its headquarters are located in Geneva, Switzerland. It is an independent, non-governmental international organisation with a membership of 164 national standards bodies. Its web-site states that:

Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges'.

- 6.2.4 Studio E's web site stated that it was ISO 14001:2004 registered. ISO 14001:2004 is part of a family of standards related to environmental management. It was established to help organisations to act responsibly in terms of the ecological impact of their work. This aspect of the ISO registration is not relevant to my work for this Inquiry and I shall therefore not comment further in this respect.
- 6.2.5 Studio E's web site also stated that it was ISO 9001:2008 registered.
- 6.2.6 The ISO 9000 family of quality management systems (QMS), of which ISO 9001 is a part, is designed to help organisations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to a product or service. ISO 9000 deals with the fundamentals of quality management systems, including the seven quality management principles upon which the family of standards is based.
- 6.2.7 ISO 9001 deals with the requirements that organisations wishing to meet the standard must fulfill.
- 6.2.8 Third-party certification bodies provide independent confirmation that organisations meet the requirements of ISO 9001. Over one million organisations worldwide are independently certified.
- 6.2.9 I shall therefore assess the performance of Studio E in terms of the investigation scope of this report (that is the over-cladding work) against the performance expected of an ISO registered organisation.

6.3 The History of Studio E's ISO 9001 Registration

- 6.3.1 I have not at this stage been able to establish the facts relating to the history of Studio E's ISO 9001 registration. However, further enquiry is warranted against the following questions that arise in terms of the transfer of the appointment for architectural services relating to the 2012-16 Works from SELLP to SEAL. I make this observation because I doubt (albeit this has still to be checked) whether an ISO 9001 registration can be routinely transferable from one company to another.
- 6.3.2 This brings into question whether Studio E, as a newly formed company appointed by Rydon at the outset of its Design and Build contract was, at the time of its appointment, ISO 9001 registered. If Studio E was not so registered, then evidence is required as to when thereafter it did become ISO registered in order to be able to state within its practice information at the time of the fire in June 2014 that it was indeed so registered.
- 6.3.3 My own experience is that the process of initial ISO 9001 registration is demanding for any firm seeking that registration. I was marginally involved in the initial registration of my own practice, but even through that lesser role I am aware that such registration involved an extended investment of time from one of our senior team members who oversaw the setting up of our Quality Management System. Thereafter, we have had to participate in routine reviews of our systems operation which take place during ISO 9001 QA visits to our offices and regular internal audits as required by ISO 9001.
- 6.3.4 On the basis of my own experience I would be doubtful that any immediate and easy transition of SELLP's ISO 9001 registration status to SEAL took place, and I suspect that there was a significant period in the early life of Studio E (as SEAL) when it was not ISO 9001 registered. If Studio E was, as I suspect, not registered in its own right at the time of its appointment to Rydon, two questions arise:
- a) Did Rydon know that Studio E was not so registered?
 - b) Did KCTMO know that Studio E was not so registered?
- 6.3.5 It goes without saying that if Studio E were not so registered then they should have advised both Rydon and KCTMO accordingly.
- 6.3.6 Such circumstances would also bring into question the following:

- a) If Studio E were not ISO 9001 registered at the time of their post novation appointment by Rydon, did Artelia, as KCTMO's Employer's Agent, know whether Studio E were not so registered at the time of their appointment to Rydon? In the absence of any advice on the matter from Studio E should Artelia, who must have known of Studio E's change of name (from SELLP to SEAL) at the time of the novation to Rydon, have checked their status in relation to ISO 9001 registration?
- b) If Studio E were not ISO 9001 registered at the time of their post novation appointment by Rydon, would Rydon have appointed Studio E?
- c) If Studio E were not ISO 9001 registered at the time of their post novation appointment by Rydon, would KCTMO have been permitted under the standing rules of such appointments to have accepted Rydon's use of a non ISO 9001 registered company for the provision of such a substantial Design and Build service?

6.3.7 Given that the protocols of a properly prepared ISO 9001 should have been in place during Studio E's pre-novation phase of the work, Studio E (as SEAL) ought to have known how to apply those same protocols post-novation even in the absence of registration. In the event that Studio E were not so registered, and were known not to be so registered by Rydon, it brings into question whether Rydon and/or Artelia took any steps to ensure that the protocols of ISO 9001 were in any event applied by Studio E, and that they were applied diligently and with proper effect to ensure that appropriate quality reviews were carried out by Studio E on its own work as it progressed.

6.3.8 I raise these questions because the issues of quality in terms of the professional service provided by Studio E, both under its initial (SELLP) appointment to KCTMO and under its post-novation appointment to Rydon, go to the heart of this Inquiry.

Commentary on Studio E's performance in relation to the BS EN ISO 9001 Standard with respect to Statutory Compliances, Quality and Document Control

6.3.9 As an ISO 9001 registered organisation, Studio E would have been required to set up a Quality Management System appropriate to its operation. The general requirements for such a system are set out in the exhibit below:

Quality management systems — Requirements

1 Scope

1.1 General

This International Standard specifies requirements for a quality management system where an organization

- a) needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements, and
- b) aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

NOTE 1 In this International Standard, the term "product" only applies to

- a) product intended for, or required by, a customer,
- b) any intended output resulting from the product realization processes.

NOTE 2 Statutory and regulatory requirements can be expressed as legal requirements.

Figure 6.2: Item 1.1 of the BS EN ISO 9001 Standard sets out the General requirements

6.3.10 This International Standard promotes the adoption of a 'process approach' when developing, implementing and improving the effectiveness of a quality system to enhance customer satisfaction by meeting customer requirements. An independent third party is required to periodically audit the registered organisation's own quality management system and outputs against the ISO 9001 standard. In so doing it provides any necessary certification, non-conformance notices, or recommendations for improvements. A third-party audit should be carried out at least once annually as a basis for maintaining accreditation. Many clients now require that their designers/consultants are ISO 9001 accredited.

6.3.11 At paragraph 130 of his statement {SEA00014273} Mr Sounes makes the following statement:

"I should also note that Studio E has an internal technical review process, which involves a design review and a technical review by Studio E employees not otherwise involved in the Project. Internal reviews are part of our ISO 9001 Quality Assurance process. They are conducted at key stages in the project and are intended to be a peer review of the work in process, to share thoughts and cross check that all relevant issues are being considered. I carried out a technical review for the Project after Neil became involved. This is discussed further below".

6.3.12 Unfortunately, Studio E's 'internal technical review process' was ineffective in terms of assuring the quality of the firm's work with respect generally to its application process for Building Regulations approval for the project and specifically with respect to the design of the over-cladding.

6.3.13 The remainder of this section sets out a series of examples which are typical of Studio E's poor implementation of Quality Management processes in terms of a diverse range of issues including mistakes and inconsistencies and discrepancies within drawings, correspondence, document control, and internal reviews.

These examples are dealt with under the following headings:

- Studio E Fire Strategy Plans
- Studio E External Communication
- Studio E Document Control
- Studio E Internal Review Processes

6.4 Studio E Fire Strategy Plans

6.4.1 The first two issues of the Studio E Fire Strategy Plans contain errors and anomalies. The two drawings exhibited below, as prepared by Studio E, have been annotated to show examples in this respect:

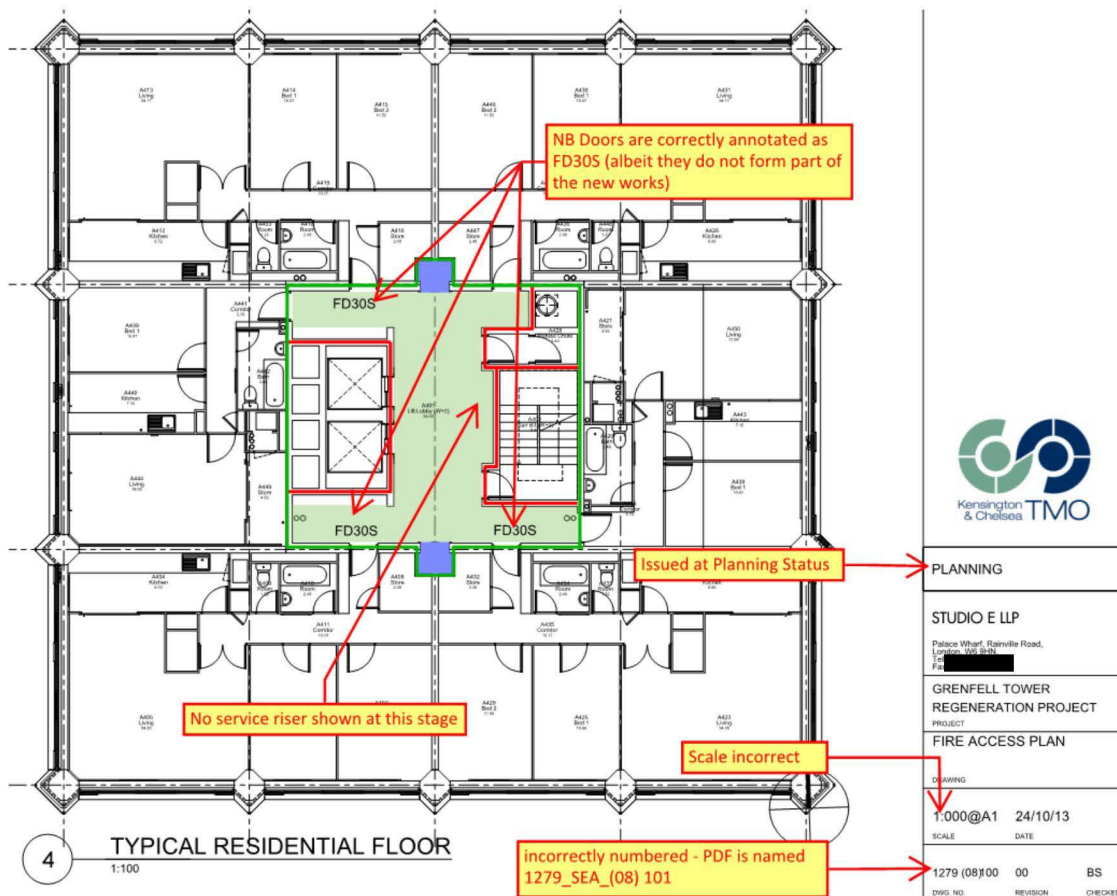


Figure 6.3: Extract from the drawing 1279 (08) 100 Rev 00 'Fire Access Plan' {EXO00000428} contained within the email correspondence between Studio E and Building Control 25.10.2013 {EXO00000427}

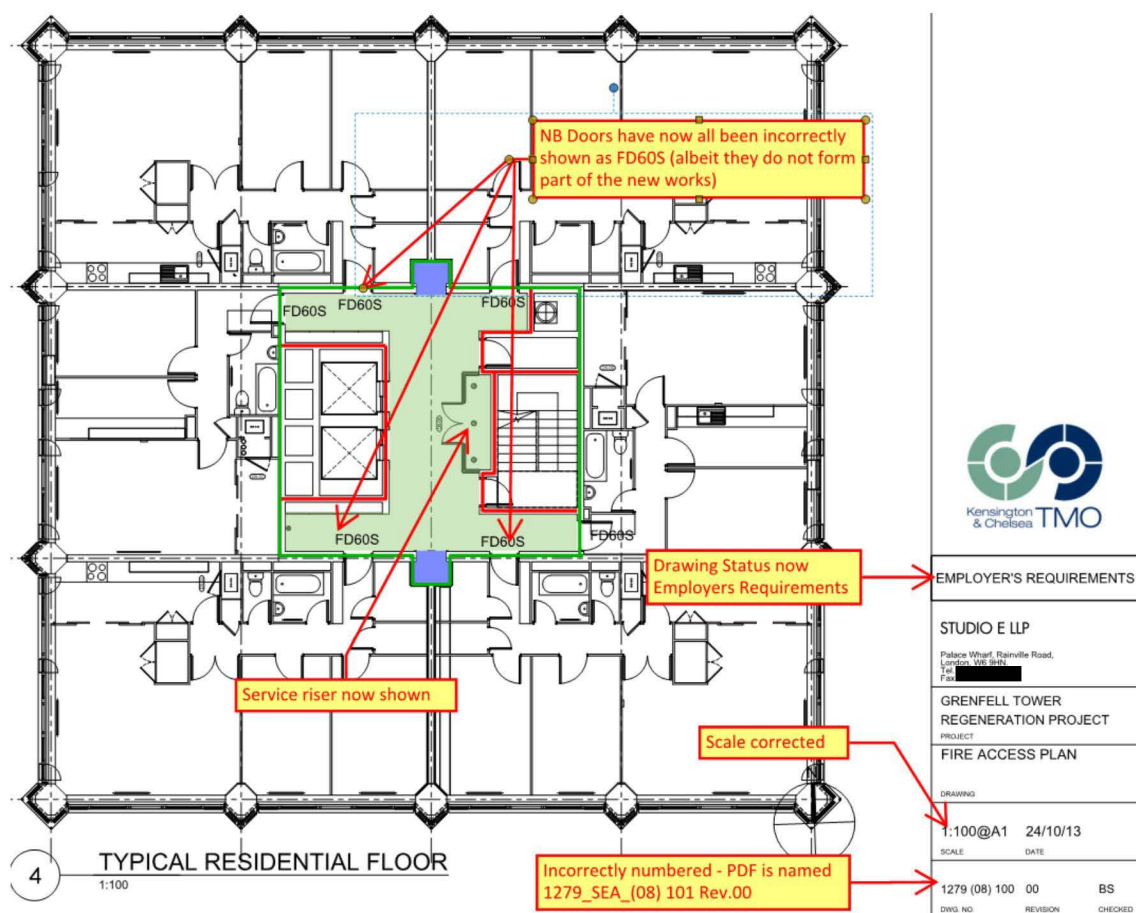


Figure 6.4: Extract from the drawing 1279 (08) 100 Rev 00 'Fire Access Plan' {SEA00002497}

6.4.2 The next two issues of the Studio E Fire Strategy Plans, as exhibited below, contain a series of corrections but also introduce some further errors and omissions which have been highlighted in yellow. These errors and omissions continue unamended through to the Issue 5 'As Built' version of the drawings.

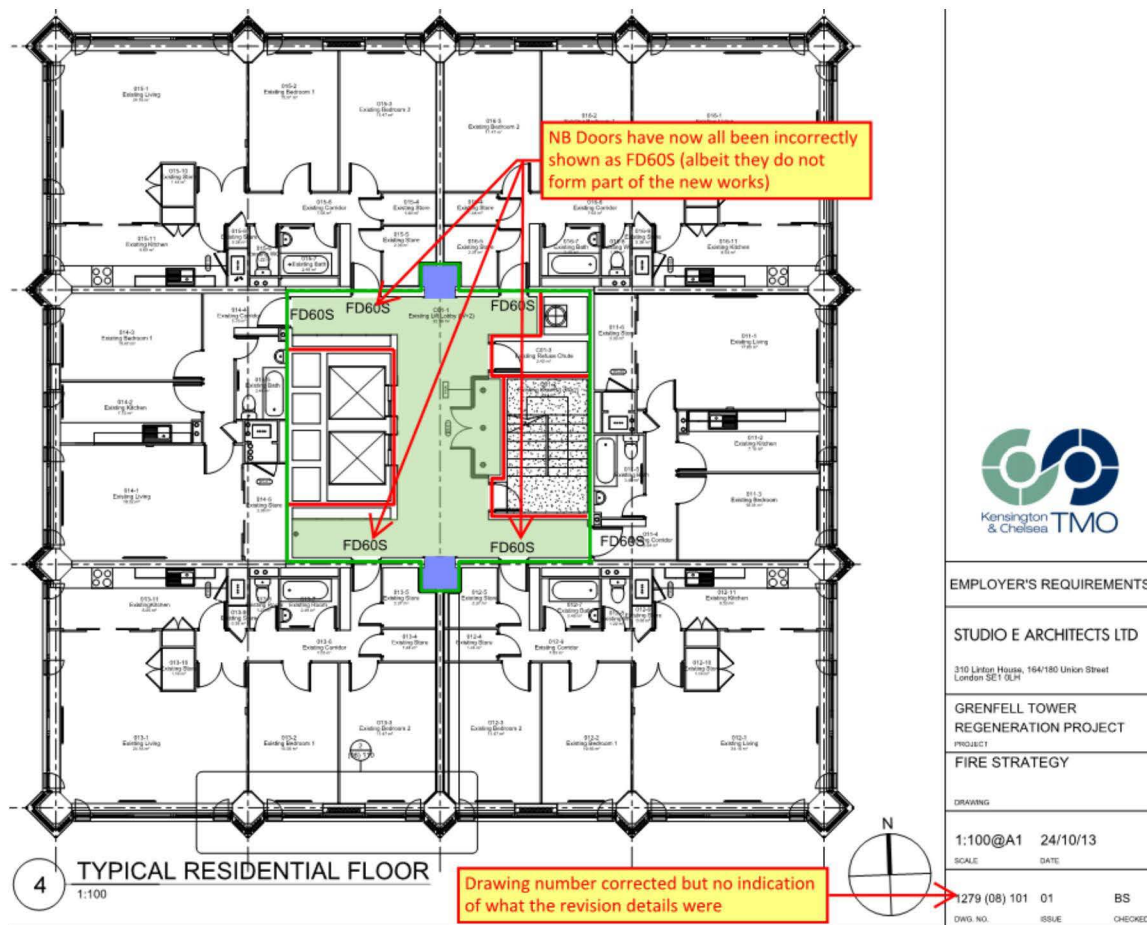


Figure 6.5: Extract from the drawing 1279 (08) 101 Rev 01 'Fire Strategy' {RYD00018761}

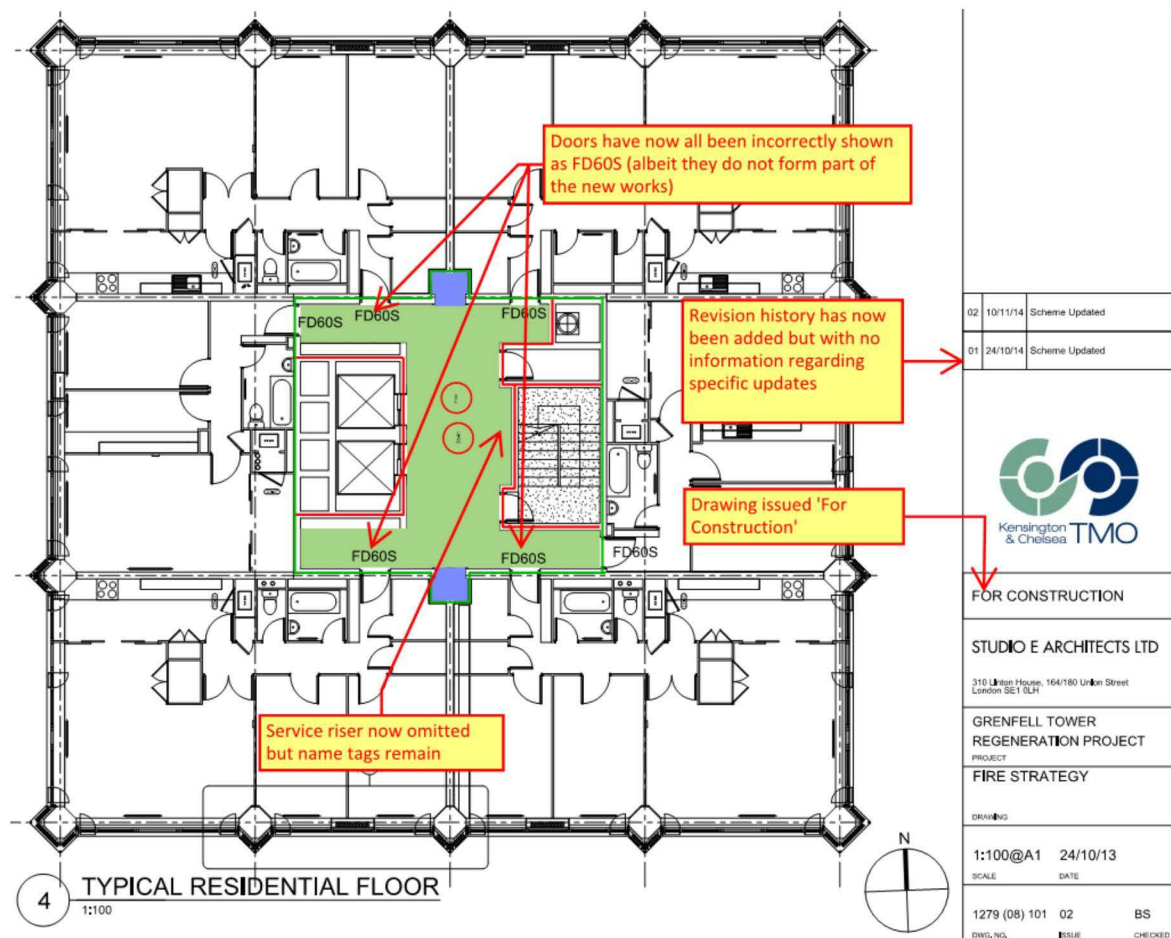


Figure 6.6: Extract from the drawing 1279 (08) 101 Rev 02 'Fire Strategy' {RYD00023253}

- 6.4.3 It is also notable that within Figure 6.6 although the revision note has been included (see above drawing title box), the changes that have been made under that revision have not been recorded. The revision description merely states '*Scheme Updated*'. Normal protocols with respect to revisions are for the revision to be described, albeit briefly, in the space adjoining the revision number above the title box, and for the drawing for that issue only to be annotated with a '*balloon*' around the revision or revisions that clearly highlights the amendment. This simple and widely adopted protocol was not generally adopted for the over-cladding drawings, albeit Studio E did adopt it extensively elsewhere for the 2012-16 Works. As a result, there was usually no indication and/or location to notify recipients of the drawings as to what specific changes had been made.

6.5 Studio E Communication

- 6.5.1 As a routine part of the correspondence and consultation with Building Control, the Fire Strategy drawings were emailed to Building Control with an invitation for comment. One such example dated 25 October 2013 is exhibited below {SEA00000121}. This exchange highlights lapses within the document control processes whereby electronic copies are named and numbered incorrectly and do not match the drawing title or number on the plan. In this example, the PDF title on two drawings within the same series which should carry a consistent title within the title block are variously listed as: 1279_SEA_(08) 101 Fire Strategy and 1279 SEA (08) 100 Fire Access Plan.

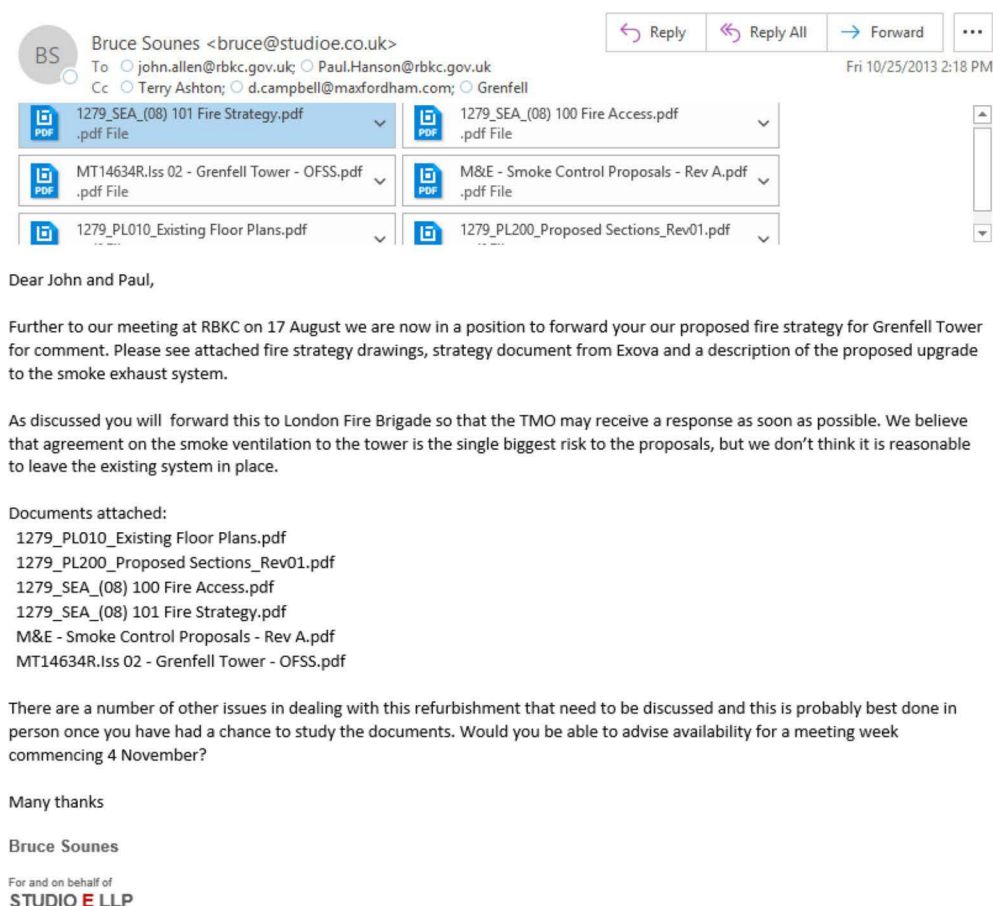


Figure 6.7: E-mail from Mr Soules to Building Control dated 25 October 2013 {SEA00000121}

6.5.2 As well as being evident in routine daily correspondence throughout, at least, the over-cladding element of the project (as shown in the example exhibited above), the poor levels of Quality Management in terms of documentation and information flow is also evident at critical milestones where important documentation submissions were formally made. As an example, I exhibit below Studio E's email dated 24 September 2014 that accompanied the 'pack', as forwarded electronically, of drawings that were formally issued to Building Control in support of the Full Plans application that had been issued some six weeks earlier without any drawings being attached. I then provide commentary on that issue.



John

Following our conversation on site looking whilst looking at the Academy on Tuesday, I am forwarding a pack of drawings for the Grenfell Tower Project as mentioned.
I believe yourself and Paul Hanson sat down earlier in the year and did an initial appraisal of the proposed layout changes to the lower levels with Bruce Sounes from our office. I have included Pauls initial mark-ups of the fire strategy from this time as well as a new set which shows that there has been some simplification to the arrangement on these floors. I know you like to go through the drawings on an agreed process of release rather than just being swamped with everything at once so I am just sending the following drawings to start with;

- Fire strategy drawings from previous meeting with Paul Hanson's mark up
1279 SEA (08) 100 - Fire Access
1279 SEA (08) 101 - Fire Strategy
- New fire strategy drawings that show modifications to office area and omission on internal office stair
1279 SEA (08) 100b - Fire Access-A1-000
1279 SEA (08) 101b - Fire Strategy-A1-000
- Basic Plans sections and elevations GA set
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (05) 100 - Proposed South Elevation Rev01
1279 SEA (05) 101 - Proposed North Elevation Rev01
1279 SEA (05) 102 - Proposed East Elevation Rev01
1279 SEA (05) 103 - Proposed West Elevation Rev01
1279 SEA (04) 100 - Proposed Basement Plan
1279 SEA (04) 101 Rev01 - Proposed Ground Floor Plan
1279 SEA (04) 102 Rev01- Proposed Mezzanine Plan.pdf
1279 SEA (04) 103 Rev01 - Proposed Walkway Plan.pdf
1279 SEA (04) 105 - Proposed Residential Plan (W+2)
1279 SEA (04) 108 - Proposed Roof Plant Plan
1279 SEA (04) 109 - Proposed Roof Plan

Regards

Neil

Neil Crawford
Associate

For and on behalf of
STUDIO E LTD

Figure 6.8: Email correspondence between Studio E and Building Control dated 24.09.2014 {SEA00000194} that includes a zip file with drawings as listed.

6.5.3 The drawings that were contained within the '*zip folder*', as referred to and listed within the email sent to Building Control on 24 September 2014, contained multiple errors with respect to drawing numbering, drawing naming and version control. Highlighted below are those listed drawings with the errors individually explained as follows:

- a) Four fire strategy drawings were referred to in the email under the headings '*Fire strategy drawings from previous meeting with Paul Hanson's mark up*' and '*New fire strategy drawings that show modifications to office area and omission on internal office stair*' but only three electronic files were sent.
- b) Of those four drawings two (listed as follows) were referred to in the email under the heading '*Fire strategy drawings from previous meeting with Paul Hanson's mark up*':
1279 SEA (08) 100 - Fire Access / 1279 SEA (08) 101 - Fire Strategy.
- c) The two remaining drawings (listed as follows) were referred to in the email under the heading '*New fire strategy drawings that show modifications to office area and omission on internal office stair*' 1279 SEA (08) 100b - Fire Access-A1-000 / 1279 SEA (08) 101b - Fire Strategy-A1-000

6.5.4 However, only three drawings were sent within the electronic files:



1279 SEA (08) 100b - Fire Access-A1-000
1279 SEA (08) 101 - Fire Strategy
1279 SEA (08) 101b - Fire Strategy-A1-000

Figure 6.9: Email correspondence between Studio E and Building Control dated 24.09.2014 that includes a zip file with extract of drawings as listed.

- 6.5.5 Neither of the electronic drawings that were listed in the typed drawing list with the suffix 'b' actually carried that suffix.
- 6.5.6 Contained within the same email of 24 September 2014 were drawings that were incorrectly listed and which did not correlate with the electronic files that were within the zip folder.
- 6.5.7 Five of the drawings were listed with the reference '1279 SEA (06) 100 – Section A'. Of those, four were wrongly listed. As indicated in the extract from the zip folder these should have been listed as different drawings: probably 1279 SEA (06) 101 Section B, 1279 SEA (06) 103 Section E, 1279 SEA (06) 104 Section F, and 1279 SEA (06) 105 Section G.
- 6.5.8 This error may have been caused by careless '*copying & pasting*' of drawing titles into the email. However, poor quality of referencing represents a lapse in document control which appears to have been a common failing of Studio E throughout the project. I highlight these errors below after which I exhibit the Zip folder listings:

Basic Plans sections and elevations GA set:

1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A
1279 SEA (06) 100 - Section A






 1279 SEA (06) 100 - Section A
 1279 SEA (06) 101 - Section B
 1279 SEA (06) 103 - Section E
 1279 SEA (06) 104 - Section F
 1279 SEA (06) 105 - Section G

Figure 6.10 : Extract from the email Correspondence between Studio E and Building Control dated 24.09.2014 {SEA00000194} and zip file with drawings as listed.

6.6 Studio E Document Control

- 6.6.1 Throughout the life of any project, all documentation issued to Clients, Consultants and Statutory Authorities should be recorded on a '*Drawing Issue Register*'.
- 6.6.2 This register should typically contain information including document name, number, version, date of issue. In addition, distribution listings should be maintained, accurately recording the recipient's name, date sent and the drawing revision.
- 6.6.3 Confirmation as to whether the document was issued electronically, as a hard copy, or both electronically and hard copy should in each instance also be included on the register.
- 6.6.4 On reviewing the Studio E Drawing Issue Register {SEA00013512} contained in an email from Studio E to Rydon dated 30 October 2015 {SEA00013511}, it is noticeable that whilst a distribution list was maintained, and document distribution to such parties as Appleyards, Max Fordham and KCTMO was recorded, there is paradoxically no record on the Issue Register of any information issue being made to Building Control at any time throughout the contract.
- 6.6.5 The drawing issue sheet extract below should have recorded key milestone document issues, such as those that followed the Building Regulations Full Application submission to Building Control on 24 September 2014.

[illegible]

6.6.6 When an architect issues drawings they should be '*dispatched*' under a record sheet which lists the drawings included in that '*dispatch*'. Such listings must accurately record drawing number, revision, title etc.

6.6.7 As an indication of Studio E's poor discipline in terms of such record sheets I exhibit below an example of the '*As Built*' record drawings. Note: many architects refuse to issue '*as built*' record drawings as they consider that they cannot have adequate records as required to inform that process. Some will offer to compile a '*Last issue for construction set*' which will constitute a pack of their latest drawings. Studio E however undertook to provide this service under clause 19 of their Deed of Appointment with Rydon. The '*As Built*' record set is a very important '*package*' which may well be distributed electronically and in hard copy versions. Accurate recording of the drawings and any other documentation that forms part of this distribution is of obvious importance: such information has many uses, for example inclusion in the O&M Manuals (Operation and Maintenance) and the Health and Safety File as required under CDM legislation. Review of the Studio E '*As Built and Issue Advice*' register including the '*As Built*' drawings that were attached, reveals numerous errors and omissions {RYD00000345}. Examples are highlighted below with a commentary (in red).

AS BUILT REGISTER AND ISSUE ADVICEProject: **GRENELL TOWER REFURBISHMENT PROJECT**

AS BUILT DRAWINGS		Day	23
		Month	05
Number	Drawing Title	Year	16

		Scale	
Site Drawings			
(00)012	Proposed Site Plan	1:1000@A1	X
Proposed Plans			
(04)101	Proposed Ground Floor Plan	1:50@A1	X
(04)102	Proposed Mezzanine Plan	1:50@A1	X
(04)103	Proposed Walkway Plan	1:50@A1	X
(04)104	Proposed Walkway +1 Plan	1:50@A1	X
(04)120	Demolition - Basement	1:50@A1	X
(04)121	Demolition - Ground Floor	1:50@A1	X
(04)122	Demolition - Mezzanine	1:50@A1	X
(04)123	Demolition - Walkway	1:50@A1	X
(04)124	Demolition - Walkway +1	1:50@A1	X
(04)202	Flat Type 3 - Mezz 1 Bed	1:20@A1	X
(04)203	Flat Type 4 - Mezz 2 Bed	1:20@A1	X
(04)204	Flat Type 5 - Wheelchair	1:20@A1	X
(04)205	Flat Type 6 - 4 Bed	1:20@A1	X
Proposed Elevations			
(05)109	Community WC Kitchen	1:20@A1	X
(05)111	Boxing Changing	1:20@A1	X
(05)113	Resi Toilets	1:20@A1	X
(05)114	Resi Wheelchair Toilet	1:20@A1	X
(05)115	Resi WheelChair Elevations	1:20@A1	X
(05)116	Resi 4 Bed Elevations	1:20@A1	X
(05)117	Boxing Accessible Shower	1:20@A1	X
Proposed Sections			
(06)100	Proposed Section A	1:50@A1	X
(06)101	Proposed Section B	1:50@A1	X
(06)103	Proposed Section E - Drainage	1:50@A1	X
(06)104	Proposed Section F - Drainage	1:50@A1	X
(06)105	Proposed Section G - Drainage	1:50@A1	X
(06)110	Proposed Typical Bay	1:20@A1	X
(06)111	Alternative Crown Detail	1:20@A1	X
(06)112	Detail Main Entrance	1:20@A1	X
(06)120	Detail Sections Sheet 1	1:20@A1	X
(06)121	Detail Sections Sheet 2	1:20@A1	X
(06)122	Detail Sections Sheet 3	1:20@A1	X
Fire Strategy			
(08)100	Fire Access Strategy	1:100@A1	X
(08)101	Fire Escape Strategy	1:100@A1	X
Internal Walls			
(22)100	Partition Types	1:10@A1	X
(22)101	Setting Out Plan Ground Plan	1:50@A1	X
(22)102	Setting Out Plan Mezzanine Plan	1:50@A1	X
(22)103	Setting Out Plan Walkway Plan	1:50@A1	X
(22)104	Setting Out Plan Walkway Plan +1	1:50@A1	X
Doors			
(32)100	Door Types - Internal	1:20@A1	X
(32)102	Glazed Screen Schedule	1:20@A1	X
(32)	Door Schedule		X
(32)	Ironmongery Schedule		X
Ceilings			
(35)101	Ground Floor RCP	1:50@A1	X
(35)102	Mezzanine RCP	1:50@A1	X
(35)103	Walkway RCP	1:50@A1	X
(35)104	Walkway+1 RCP	1:50@A1	X
Wall Finishes			
(42)100	Proposed wall finishes	1:100@A1	X
Floor Finishes			
(43)100	Floor Finish Plans	1:100@A1	X
(43)110	Floor type details	1:10@A1	X
FFE			
(72)100	Reception Desk	1:20@A1	X
(72)101	Nursery Kitchen & Office	1:20@A1	X
(72)104	Modifications to refuse chute		X
(74)	Sanitaryware Schedule		X
A2	External Finishes Schedule		X
SK110	Elevations	1:200@A1	X
PL312	Proposed West Elevation	1:50@A1	X
PL313	Proposed East Elevation	1:50@A1	X
PL314	Proposed South Elevation	1:50@A1	X
PL315	Proposed North Elevation	1:50@A1	X
PL320	Proposed Detail Section 1	1:20@A1	X
PL321	Proposed Detail Section 2	1:20@A1	X
PL322	Proposed West Elevation	1:50@A1	X
PL323	Proposed East Elevation	1:50@A1	X
PL324	Proposed South Elevation	1:50@A1	X
PL325	Proposed North Elevation	1:50@A1	X

It is noted that these drawings do not contain any Revision Information

Drawing pack contains a duplicate numbered 202 but Revision A and not dated
Drawing pack contains a duplicate numbered 203 but Revision A and not dated
Drawing missing from pack
Drawing pack contains a duplicate numbered 205 but Revision A and not dated

Drawing 1279(04)301 Issue 02 included in pack but does not appear on the register

These drawings do not appear to be included within the pack of drawings issued.

Drawing includes references to zinc composite cladding

Errors & omissions on Typical Residential Floor Plan, refer to previous paragraphs and fire strategy drawing extracts

Drawing 1279(23)101 and 103 are included in pack but neither appear on the register

Drawing 1279(70)100 (checked by initials missing) is included in the pack but not shown on the register

This drawing does not appear to be included in the pack

Drawing 1279(70)012 is included in the pack but does not appear on the register

Drawings 9646/979/01 and Kompan drawing included in pack but not shown on the Register

This drawing not included in the pack

These drawings do not appear to be included within the pack of drawings issued.

Figure 6.12: Extracts from the Studio E 'As Built' Drawing Register and Issue Advice dated 23rd May 2016 with Plans Annexed (including fire access and fire strategy plans) {RYD00000435}

6.6.8 I offer below a series of five further examples of Studio E's poor document control and management, in each case illustrated by an extract from the drawing referenced.

Example 1: Confusion in numbering of drawings

6.6.9 This example, exhibited in the two drawings below, reveals confusion in drawing numbering: two completely different drawings have been registered and issued with the same drawing number.

6.6.10 The first exhibit, Figure 6.13, (title '*Flat Type 3 – Mezz 1 Bed*') is referenced drawing number '*(04) 202 Revision A*', as is the second exhibit, Figure 6.14, which carries the same title ('*Flat Type 3 – Mezzanine 1 Bed*') and the same drawing number albeit with a '*1279*' prefix and carries '*revision 04*'

6.6.11 Scrutiny of these drawings reveals that they contain entirely different images and information: despite carrying the same number they are different drawings which, it seems, existed concurrently albeit providing information on quite separate subject matter.

6.6.12 Such confusion around drawing numbers and identity is, for obvious reasons, completely untenable: these drawings were in currency from, respectively, the 12 November 2013 and 18 June 2014 – and were concurrent for the period 18 June 2014 onwards. At their point of issue under the '*As Built*' release on the 23 May 2016 that concurrency had extended to some 23 months.

6.6.13 Particularly noteworthy is the fact that as well as providing the obvious problems of confusion around duplication of numbering during the contract, the incorporation of two quite separate drawings with the same identity under their numbering system within the '*As Built*' record set laid the platform for the exponential expansion of the problem.

6.6.14 Mistakes of course occur in all building contracts but that an error of this kind was not spotted and corrected during that extended period is quite extraordinary.

6.6.15 The following irregularities are also notable on the exhibits below:

- a) There is no initial in the '*checked*' part of the drawing title block for either drawing – a frequent failing across Studio E drawings.
- b) The revision section of the first exhibit – as highlighted - carries no date or description of whatever constituted revision A.

The revision section of the second exhibit shows some four revisions listed in orderly fashion across a timespan of four months, which means that those on the distribution list each had opportunity to identify the concurrency issue upon receipt albeit I would not necessarily expect the recipient to spot the error.

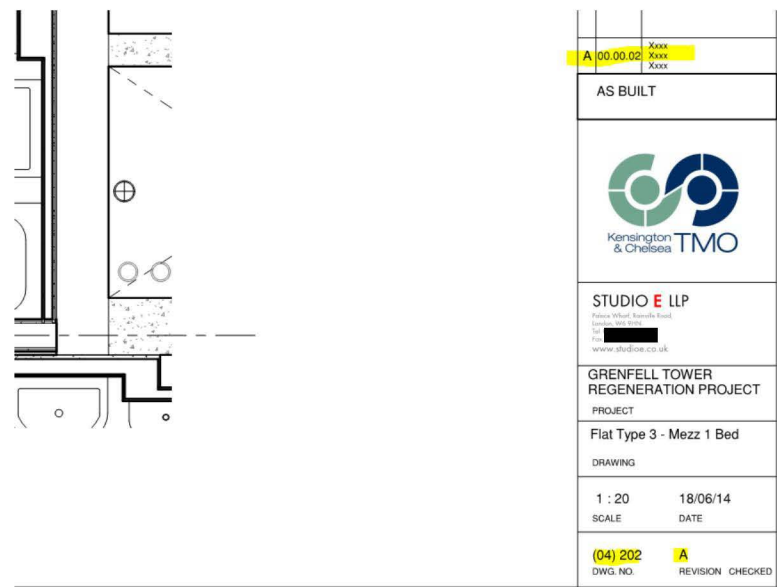


Figure 6.13: ‘As Built’ drawing (04) 202 Revision A {RYD00000435} (page 13 of document) and at {SEA00003419}

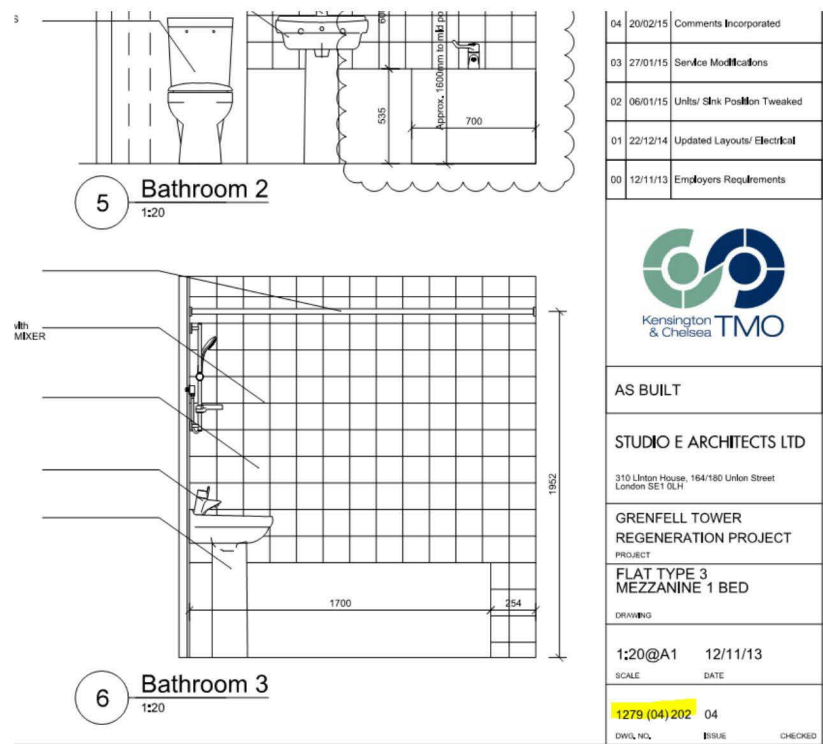


Figure 6.14: ‘As Built’ drawing (04) 202 Revision 04 {RYD00000435} (page 12 of document) and at {SEA00003457}

Example 2: Errors in specification referencing

- 6.6.16 This example reveals errors in specification referencing. It relates to incorrect referencing of the rainscreen cladding material. There are numerous instances where the rainscreen cladding has been identified as zinc composite as highlighted in the exhibit below (when of course, as has been shown throughout Sections 4 and 5 of this report, the zinc proposition was abandoned in favour for ACP).
- 6.6.17 That an error of this kind, in respect of a component as major as the cladding material of the entire building could be misdescribed over such a sustained period in the development of the production information is clear evidence that routine Quality Assurance checking and review procedures, as required under ISO 9001 registration, were either not carried out at all, or in the alternative, were not carried with reasonable competence.
- 6.6.18 The drawing exhibited below began its *'life'* as one of the *'Employer's Requirements'* set (Snap-Shot 2 stage) and is still current as part of the *'As Built'* record.
- 6.6.19 During the life of the project Quality Assurance reviews should have routinely taken place at key milestones. However, aside from the formal project review process at key stages of the project, each drawing should also have been individually checked prior to its issue. That this particular drawing could have been issued on so many occasions without this fundamental, most serious, and most obvious of mistakes ever having been identified illustrates the complete inadequacies of the Studio E operation with respect to Quality Assurance on this project over this period.

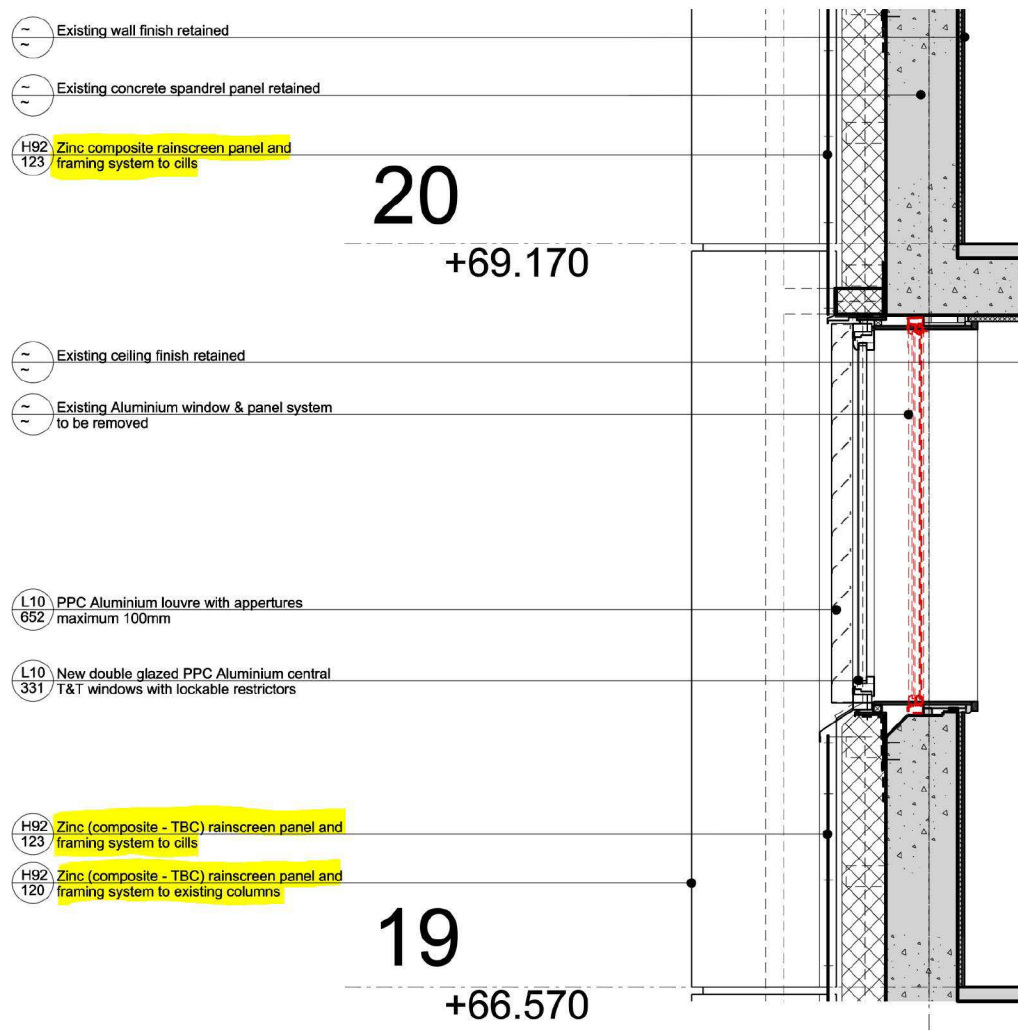


Figure 6.15: Drawing 1279 (06) 120 Rev 00 – ‘Detail Section Sheet 1’ {RYD00000435} (page 27 of document) and at {SEA00003436}

Example 3: Misinformation with respect to fire safety strategy

6.6.20 This example illustrates a series of problems relating to misinformation on the fire strategy plans as developed by Studio E. Such drawings are of critical importance and should be prepared with the greatest of care. The information that they carry is of significant importance because they quite literally form a physical representation of the application of Part B of the Building Regulations.

6.6.21 High-rise residential is a particularly high-risk building type and old buildings undergoing retro fit must be treated with the utmost care. As has been noted earlier the Regulatory Reform (Fire Safety) Order applied at Grenfell Tower and the exhibit below is one of a series of drawings which inform the Risk Assessment that must take place in buildings that come under that Order.

6.6.22 It is a legal requirement that a fire risk assessment must be carried out by a responsible person for the common areas of blocks of flats. Key to that process is the provision of reliable drawings amongst which the fire strategy drawings are essential. Such drawings are used initially by Building Control Officers and Fire Officers when considering the Full Plans Application in terms of Building Regulation Approval. Thereafter, they are used in the preparation of the Fire Risk Assessment, which is required for lawful occupation. Finally, they form part of the O&M manual, which is a live document.

6.6.23 I list below a series of serious and fundamental errors that are manifest within the drawing exhibited at Figure 6.16 {RYD00000435}:

- a) The front doors to the flats are denoted as being FD60S. This stands for '*fire door 60 minutes with smoke seal*' which means that the door will perform against set standards in terms of providing a level of protection to the public areas from fire and smoke arising from a fire incident within a flat.
- b) In this instance these doors (that is front doors from the 4th – 20th floor) did not form part of the 2012 – 2016 Works.
- c) Furthermore, most of these doors had been upgraded under a separate contract (in which Studio E had no involvement) that had been carried out shortly before the 2012 – 2016 Works were carried out. In order to comply with the guidance in ADB2 these front doors were only required to achieve FD30S standard.
- d) There are serious questions (fully addressed in Dr Lane's report) as to whether the replacement doors installed before the 2012- 2016 Works actually achieved compliance in all cases with the FD30S standard. That is not a matter for this report, but it is relevant to this review because Studio E are seen here to be providing misinformation of the most serious kind. The drawings imply at the least that the ADB2 guidance had been significantly improved upon in relation to the fire performance of the front doors but they could also be misinterpreted by Building Control Officers and the Fire Department to be an indication that new upgraded doors were to be installed under the 2012-2016 Works.
- e) In circumstances where the recently replaced front doors were of questionable quality in terms of compliance with the minimum standard set by guidance, which as Dr Lane's report reveals was indeed the case, any drawings which carry information implying that front doors have been or are to be upgraded to FD60S potentially generate serious confusion around an issue that should never be subjected to any confusion whatsoever.

- f) I have used yellow circle on Figure 6.15 to highlight an area opposite the lift which denotes that under its process of amendment Studio E, obviously inadvertently, deleted the enclosure of the service riser duct; that is, the partition and doors that formed it against the wall adjoining the fire escape stair. This is a serious omission/mistake: service ducts are high-risk areas as they enclose area where services are passing through compartment floors.
- g) Whilst there are strict requirements in terms of sealing around the services as they pass through floor it is an important part of any fire safety strategy that the riser enclosure, that is the '*cupboard*' through which they pass, is itself constructed of materials and components (wall and doors) which combine to provide the level of fire protection set out as guidance in ADB2. This enclosure was missing in the fire strategy drawings.
- h) Here we have an example of '*sloppy*' drafting omitting the entire services '*cupboard*' enclosure. The significance of such an error can hardly be overstated. As stated earlier, errors are inevitably made, but that such an error could remain on a drawing over such a long period and indeed even be carried into the '*As Built*' record set and O&M manual is unacceptably lax.
- i) It is also to be noted in the revision box that revisions are recorded as '*Scheme Updated*'. Normal convention is to provide at least a simple narrative that is indicative of change and I am critical of Studio for failing to do this because such information is useful to those involved in quality checking as it guides them swiftly to the point of change.

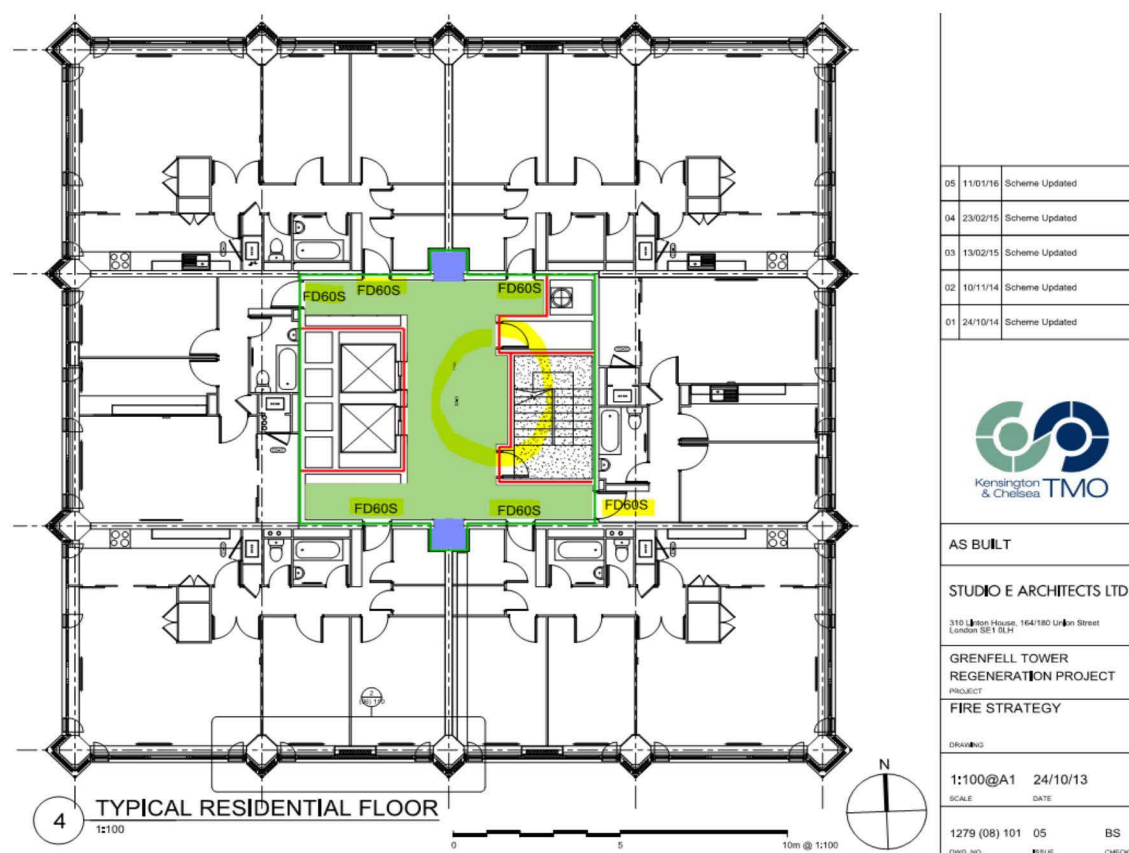


Figure 6.16: Extract from Drawing 1279 (70) 100 Rev 05 – 'Fire Strategy' (Typical Residential Floor) {RYD00000435} (page 31 of document)

Example 4: Failure to register drawings that were issued and were in currency

6.6.24 This example relates to another failure in the maintenance of the Drawing Register. In this instance a drawing has been prepared and issued, on this occasion as part of the 'As Built' record set, but the drawing is simply not recorded on the register.

6.6.25 Drawing Registers are very important for every project. They provide the essential overview of all drawings ever issued, the history of their reissue in the context of revisions, the record of drawings withdrawn from currency and ultimately the 'As Built' record set and O&M manuals.

6.6.26 My overall impression is that there was a 'sloppiness' in the way in which the 'As Built' register was compiled and maintained.

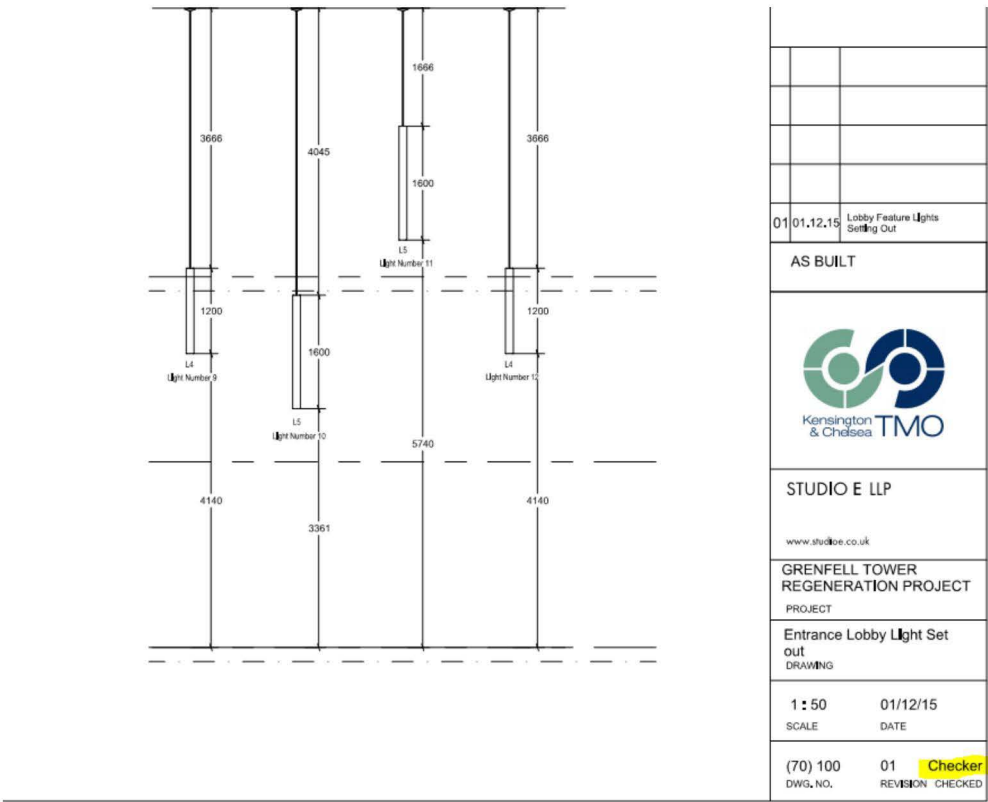


Figure 6.17: Drawing 1279 (70) 100 – ‘Entrance Lobby Light Set out’ {RYD00000435} (page 54 of document) and at {SEA00003434}

Example 5: Extraneous Information

6.6.27 This is rather an extraordinary example. The 'As Built' record set contains *only* Studio E drawings, no other consultants' drawings were incorporated.

6.6.28 However, the exhibit below at Figure 6.17 shows a drawing from another project by another firm.

6.6.29 I have no idea how a drawing for another project by another consultant could ever get into the Studio E 'As Built' record set that represents the Grenfell Tower project. That said, little turns on this drawing, which relates to trees and landscaping somewhere else but again, it is indicative of poor checking processes.

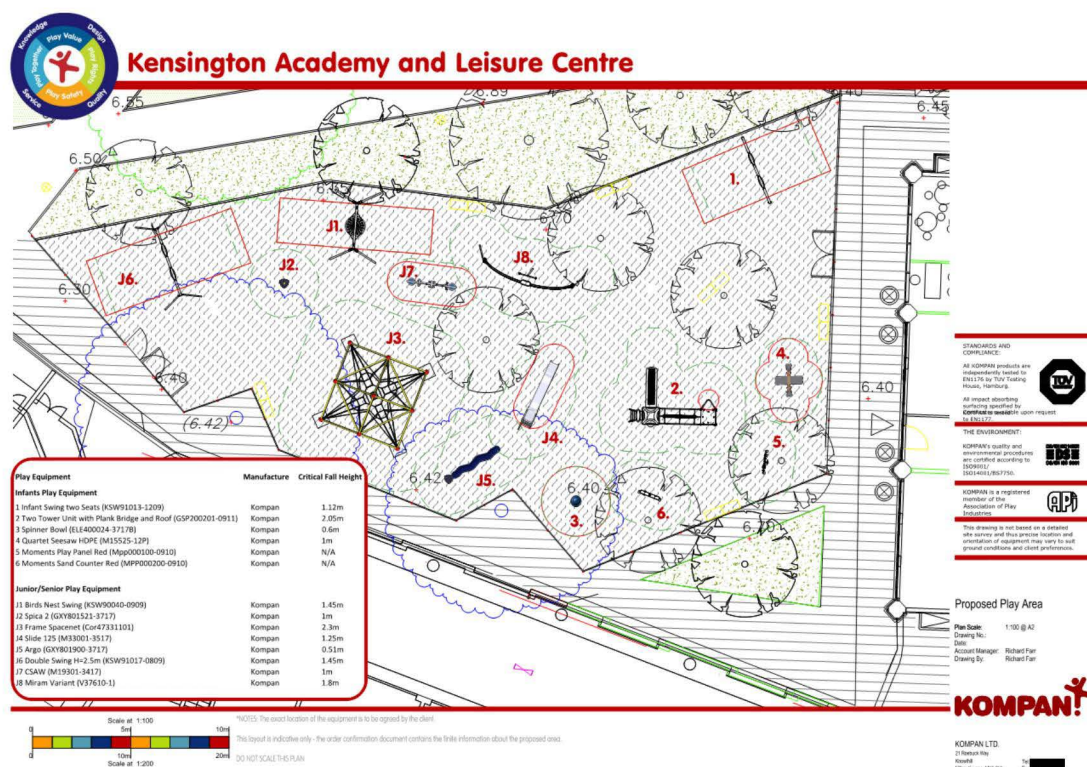


Figure 6.18: Kompan Kensington Academy and Leisure Centre ‘Proposed Play Area’
 {RYD00000435} (page 62 of document)

6.6.30 Each of the above examples reveal serious problems with information quality and with the administration of information issue and registration.

6.7 Studio E Internal Review Process

- 6.7.1 It is generally accepted as good practice within an architects' office for two types of project reviews to be routinely conducted on projects as they proceed.
- 6.7.2 The first are general design reviews which tend to be orientated towards the response of the proposal to the requirements of the design brief and therefore focus principally on the organisation of the building in terms of special planning and aesthetics.
- 6.7.3 It is of key importance that designs are developed in a way that complies with building legislation insofar as the Building Regulations impact on the organisation of a building (position of fire escapes, widths of corridors etc.). In that sense general design reviews of course do involve some technical and code considerations.
- 6.7.4 Most offices operate a system of technical reviews to complement the general design review process. Such reviews focus deliberately and exclusively on technical considerations such as the choice and arrangements of materials and components to achieve performance objectives such as thermal insulation, weather protection and fire safety. As would be expected these reviews seek to ensure that the construction documentation (drawings, schedules and specifications) are in all respects functional, fit for purpose, and fully compliant with relevant standards and statutory requirements.
- 6.7.5 The failings of the 2012 –16 Works relate principally to technical failures in design and specification (albeit there are some failures of construction) and in this respect the quality of the technical review process, both formal and informal, as carried out within Studio E's office has been brought into serious question.
- 6.7.6 By '*formal*' and '*informal*' review I mean the following:
- a) Informal Reviews: These take place on an ad-hoc basis usually between small groups of team members who will gather together at short notice to examine and discuss a particular issue or aspect of the work.
 - b) Formal Reviews: These are set events which should be recorded and documented. Sometimes they may be organised around particular calendar dates (for example an office may choose to have Design Reviews on Mondays and Technical Reviews on Fridays and projects may be '*fed in*' to the review process when they have reached a stage appropriate for that review). Alternatively, an office may decide reviews should be set to occur at particular milestones: for example, prior to a Full Plans Building Regulations submission but sufficiently in advance of that target date to enable any issues that arise to be dealt with effectively.

6.7.7 I am concerned here principally with Technical Reviews because it is technical failures that lie at the heart of this Inquiry. Without any formal Technical Review process there is simply no way of monitoring the quality of work produced by and within any team on a project as it proceeds. As stated earlier the RIBA Architects' Job Book offers a robust checklist of inputs and outputs which can be used to inform the agenda of formal Technical Reviews. Technical Reviews should be set at key milestones (concept design, detailed design and tender issue, as well as statutory approval submission points such as Planning and Building Regulations) to suit the rhythm and running of the project throughout its life and they play a critically important role in Quality Assurance.

6.7.8 At paragraph 130 of his statement Mr Sounes describes the internal review process that Studio E operated. The quote below {SEA00014273} attests to Mr Sounes' opinion with respect to the thoroughness of the review process.

'I should also note that Studio E has an internal technical review process, which involves a design review and a technical review by Studio E employees not otherwise involved in the Project. Internal reviews are part of our ISO 9001 Quality Assurance process. They are conducted at key stages in the project and are intended to be a peer review of the work in progress, to share thoughts and cross check that all relevant issues are being considered. I carried out a technical review for the Project after Neil became involved.'

6.7.9 The witness Statement of Mr Sounes {SEA00014273} at paragraph 131, refers to Studio E's initial and technical reviews of the February 2013 and October 2015. However, I have only seen evidence of the technical review dated 28 October 2015, titled '*Technical Review Stage 4/5 (F/GHJK)*'.

6.7.10 I have five comments on this particular review which I set out below:

Comment 1

6.7.11 The Technical Review Document {SEA00013508} is dated 28 October 2015. When set against the backdrop of the Rydon Progress Report dated October 2015 {RYD00056956} which records the external façade works 60% complete, this appears (if this is indeed the first formal technical review to have been carried out) to be woefully late. As such it would fail to achieve compliance with the standards expected under a Quality Management Plan as compliant with ISO 9001.

STUDIO E ARCHITECTS

TECHNICAL REVIEW STAGE 4/5 (F/GHJK)Project title: Grenfell Tower
Refurbishment

Assessor : Bruce Sounes, Associate

File Ref: 1279/A11

Meeting Date: 28 October 15

Issued: 29 October 15

Project Architect : Neil
Crawford

Figure 6.19: Extract from the Studio E 'Technical Review Stage 4/5 (F/GHJK)' {SEA00013508}

**Site Progress Report**

SITE PROGRESS REPORT

BOARD MEETING – October 15

Site	Grenfell Tower	N _e	3482	Date	October 15
Financial					
Cont Sum	£9,094,219				
Gross Val	No. 17 £7,810,996.18 9 issued and awaited				
Budget	No 5 - £673,000 – 8%				
Budget w/c	14	30	38	46	54
				62	
Progress					
Contract Period	(9)66(+Eot)				
Target	75				
Prelims	(9)66				
Programme Week	71				
Progress Week	61				
Budgeted Completion	75 (+Eot)				

Financial

Current Month	Gross Cost Forecast	Gross Cost Achieved	Difference	Comment
Oct 15		£5,810k		

Orders

Subcontractor Name	Trade	Order Cost	Gain/loss £	Gain/loss %	Variance to Budget

- 1) Backup to external works VO has been submitted, client has omitted D&B contingency making this item re-measurable
- 2) Budget has been completed, if all EOT claims are agreed and paid budget will hold, and may increase in margin by approx. £35k
- 3) Signage information received from client, queries to be raised as some information missing, once queries answered we will send our quote to the client for the VO to be issued

Activity (against revised programme dated 21.1.15)	Planned Progress	Actual Progress	+ or - weeks
External façade works	100%	60%	-10wks
1. fix mechanical within existing flats (HIU install)	100%	65%	-10wks
Communal boxing works	100%	70%	-10wks
Remodelling of lower floors	100%	70%	-10wks
Communal boiler plant	100%	95%	-10wks

Figure 6.20: Extract from the Rydon Progress Report (Board Meeting) October 2015 that indicates (where highlighted) that the façade works were 60% complete at the time of the Studio E Technical Review {RYD00056956}

Comment 2

6.7.12 The Technical Review refers to a review of project documents and states that *'Building Control sign-off drawings have been issued and incrementally signed off'*. However, I have seen no evidence that there was any formal 'sign off' drawings by Building Control. The seriousness of such misinformation and misunderstanding in this context can hardly be overstated.

PROJECT DOCUMENTS	
Drawing Register	Comment: Completed
	Action:
Building Regulations Assessment	Comment: Building Control sign off-drawings have been issued and incrementally signed off /agreed on site
	Action:

Figure 6.21: Extract from the Studio E 'Technical Review Stage 4/5 (F/GHJK)' {SEA00013508}

Comment 3

6.7.13 As indicated in the exhibit below the Technical Review implies that the project documents were designed to meet the requirements of the Building Regulations with the guidance in the Approved Documents. Evidently on the basis of the investigation carried out under this Inquiry with respect Approved Document B Volume 2 this is evidently not the case and therefore calls into question the integrity of the Studio E internal review process. This suggests that either Studio E were either unaware of the requirements of Approved Document B and that their design was not fully compliant or the review of the Project Documents at this stage was not adequate.

Design Standards	Comment: Designed to current Housing, Approved Document Building Regulations and British Standards where applicable.
	Action:

Figure 6.22: Extract from the Studio E 'Technical Review Stage 4/5 (F/GHJK)' {SEA00013508}

Comment 4

6.7.14 In the exhibit below '*Fire Detailing*' of the Technical Performance section of the Technical Review is commented on as being '*Completed*'. It is not clear what this comment refers to. It certainly would not appear to have applied to the façade based, for example, on my assessment in Section 4 of this report on the work to cavity barriers as carried out by Studio E.

TECHNICAL PERFORMANCE	
Materials	Comment: Appear appropriate
	Action:
Assembly	Comment: Interfaces with existing building require specialist input
	Action: Managed through production drawing approval
Relationships	Comment: Interface details approved through production drawing process
	Action: Ongoing
Durability	Comment: Appropriate to location/ public realm interface
	Action: Completed
Fire Detailing	Comment: Completed
	Action:

Figure 6.23: Extract from the Studio E '*Technical Review Stage 4/5 (F/GHJK)*' {SEA00013508}

Comment 5

6.7.15 The exhibit below merely records under the word 'addressed' that some type of discussion/ review has allegedly taken place. I cannot know whether that review was thorough or what it covered and expect the record sheet to record the drawings under consideration for example, '*drawing titles, numbers and review*'.

DRAWING CONTENT	
Scope	Comment: Addressed
	Action:

**Figure 6.24: Extract from the Studio E 'Technical Review Stage 4/5 (F/GHJK)'
{SEA00013508}**

6.8 Conclusion

- 6.8.1 Prior to the development of modern quality assurance methodologies quality control was based totally on 100% inspection at the point of completion.
- 6.8.2 Modern Quality Assurance methods incorporate quality control processes so that errors are identified and remedied early as part of an ongoing process. Quality Assurance management systems therefore focus on preventing defects.
- 6.8.3 In order to design and produce defect free products and services, Quality Assurance has to be implemented at the beginning of development and throughout all divisions of the organisation.
- 6.8.4 ISO 9001 is recognised throughout the world. Many organisations will not buy from a company unless it is ISO 9001 certified.
- 6.8.5 The ISO 9000 standards are based on the idea that a well designed Quality Assurance program will provide confidence in a company's products, services and management *team* because quality is assured through a disciplined approach to quality review and checking throughout the process of delivery.
- 6.8.6 Unfortunately, despite Studio E's apparent claims to have been ISO 90001 registered at the outset and throughout the project, and the claims of Mr Sounes within his witness statement that rigorous QA procedures were in place, the evidence that I have seen is that quality control was woefully lacking in all Studio E's work with respect to the over-cladding. Quality control was also widely lacking in terms of Studio E's general communication and documentation processes as they related to other aspects of their service such as the Full Plans Building Regulations submission and ongoing dialogue with Building Control.