

EXPLANATION OF CAUSE AND EFFECT PROGRAMME

Introduction

The original contract for Grenfell Tower included the following sections of works:

- External cladding and installation of new windows
- New communal heating and hot water system
- New boosted cold water mains
- New mechanical smoke extraction and ventilation system
- Remodelling of its lower floors four floors to provide:-
 - o Improved accommodation for a nursery,
 - o Improved accommodation for the Dale Youth boxing club,
 - o Offices and concierge desk
 - o New main entrance lobby
 - o 7 new residential flats
- Soft and hard landscaping works surrounding the Tower.

Rydon started work at Grenfell Tower on the 2nd June 2014 and the original programme duration was 66 weeks

On 28th November 2014, EAI 5.2 was issued in which the double storey office was omitted and an additional two new flats added – one on the first floor and one on the second floor. Planning approval for change of use was received in January 2015 and EAI 9.1 issued instructing Rydon to proceed.

On 27th March 2014, Extension of Time No1 was granted for an additional seven weeks following 'Client changes to window design and installation works'. This extended the contract period to 73 weeks with a new completion date of Friday 23rd October 2015. To reflect the changes, 'Revised Contract Programme 22/01/15' was issued to the client.

During the course of the contract there were two further significant changes (delays 1 & 2) that prolonged the contract period and a number of contemporaneous events (delays 3,4,5 & 6) which in aggregate extended the completion date to 4th July 2016

Please note that the this assessment of causes of delay does not consider the design development changes in respect of door entry access equipment as a primary reason for programme prolongation

The following explanations and summaries refer to the 'Grenfell Tower – Extension of Time Claim – Cause and Effect Programme – Ref 3482/EOT/DH' dated 26/7/16

Delay No 1 - HIU's in the kitchen's

Originally, the intended location for the HIU's was to be in the kitchen cupboards where the old hot water tanks were located.

However early in the design period, it was agreed with the client to locate the HIU's in the hallways of the existing 120no residential flats. This decision was based on the need to keep the old system running at the same as bringing the new system into operation. This was because it wasn't possible to isolate individual flats from the old system; it was only possible to isolate each riser which served 20no properties at a time.

The mains distribution pipework was fitted and the changeovers were originally scheduled to start on 4th May 2015. This was initially delayed by a 6 weeks due to the client's decision to extend the winter heating period.

During the changeover period, there were a number of residents who refused to have the HIU put in the hallway and complained to the TMO and local council. The TMO made a decision to further investigate the issues and implications involved in moving the HIU's back to the kitchen

On 7th September, the Employers Agent issued EAI 24 which covered the additional works involved in locating the HIU in the kitchens of 36no flats.

On the 15th October, Rydon issued a delay notice estimating that the EAI caused a 10 week delay to the project

The changeover works started again on the 19th October and were completed on the 23rd December meaning all existing flats were connected to the new system before Christmas 2015

TOTAL DELAY = 22 Weeks (see programme line 72)

Delay No 2 - Revised AOV System

The tender equipment schedule Z [--]500 Mechanical Equipment specified AOV fans which could perform at the following duties:

0.42m³/sec at 70Pa at roof level

0.42m³/sec at 184Pa at lobby level

In October 2014, it was established by Max Fordham (see Max Fordham Smoke ventilation Analysis – Rev B – 13th May 2014) that the equipment schedule was incorrect and the new AOV fans should be capable of extracting 5m³/sec.

Following the accommodation changes to the lower four floors, in November 2014 the local Building Control fire officer stated that the AOV system would have to cover all floors from Ground to the 23rd at the increased extraction rate of 5m³/sec

From November 2014 to September 2015, the design team worked together towards designing a system that would be capable of extracting 5m³/sec, be compliant with regulations and accepted by Building Control, compatible with the agreed flat layouts, and which would not adversely affect the structure of the building and be capable of installation with the residents remaining in situ.

The Employers Agent issued a number of client instructions during this design period covering the necessary variations to the tendered/contracted works, these were:

EAI 20 - 26th June 2015 - Design change to AOV to achieve 5m³/secs

EAI 25 – 7th September 2015 - BWIC to the AOV system

On the 18th September 2015, the structural engineer confirmed that the proposed route was structurally acceptable, which was the last confirmation needed for the revised system and for the builders works to commence.

On the 22nd September 2015, the necessary building works started with the core drilling of new apertures through the RC walls and floors.

On the 15th October, Rydon issued a delay notice with an estimated delay period of 20 weeks

TOTAL DELAY = 34 Weeks (see programme line 39)

Delay No 3 - Communal decorations to lift lobbies

In October 2015, EAI 33.1 was issued instructing Rydon to carry out communal decorations to the existing lift lobbies (4th to 23rd floors).

The communal decorations were done from 2nd November 2015 to 23rd December 2015

TOTAL DELAY = 8 Weeks (see programme line 46)

Delay No 4 - Repair blocked drain to TMO office

On 11th June 2015, EAI 19.1 was issued instructing Rydon to carry out repairs to the blocked drained outside the TMO estate office.

The TMO office was refurbished by Rydon as part of a pre-start agreement and the estate team relocated there prior to the contract start date.

Within the first month, the foul drain backed up and had to be cleared by an effluent tanker. It was discovered that the drain was blocked about 13m from the TMO estate office just outside the Rydon site boundary.

On the 3rd December 2015, Metrorod jetted the drain run and did a CCTV survey and report. The report was analysed and compared with the drainage drawings from the KALC project. An assumption was made and agreed with KCTMO that Bouygues had dug through the drainage run to lay a new storm drain. It was agreed to investigate the possibility of diverting the drain into another part of the estate foul drainage.

Rydon carried out a drainage invert and level survey in January 2016. It was determined from this survey that it was possible to divert the drain run into the foul drainage in the underground garage area.

Rydon instructed Fife Belcher to design the drainage diversion and drawing 9646/979/01 was received in February

Rydon instructed HPS groundworks to dig a trial hole on 15th March to investigate the boundary wall foundations as the drainage run had to pass under the wall and there was minimal tolerance on the invert levels.

The drainage diversion works were carried out from 14th April 2016 to 24th April 2016

TOTAL DELAY = 15 Weeks (see programme line 94)

Delay No 5 - Flooring remedials over existing floors

On 9th March 2016 EAI 38.4 was issued instructing Rydon to carry out remedial works to the existing floors in the four flats on the 3rd floor (flats 7, 8, 9+ 10)

The works were instructed because the existing floors were a combination of old cracked screed which bounced, and the base of old blockwork walls. Rydon were only contracted to repair the floors where vinyl was to be laid in the kitchens, bathrooms, shower rooms and WC's.

The instructed remedial works consisted of repairing screed when absolutely necessary and then installing one layer 6mm plywood with suitable glue. Suitable threshold strips were provided at junctions with the vinyl areas and adjustment to all internal doors.

Until these works were completed, it was not possible to complete and handover the four flats on the third floor

The works were carried out from 14th March 2016 to 24th March 2016

TOTAL DELAY = 2 Weeks (See programme line 12)

Delay No 6 - Additional landscaping

On 5th November 2015, EAI 34 was issued instructing Rydon to carry out landscaping to additional areas around Grenfell. Some of these works were originally due to be done by Bouygues as part of the KALC project.

The works included:

Remove hoarding from around play area (erected by Bouygues)

Removing excess fill from play area

Installation of play equipment

Installation of rubber crumb play surface

Carrier drain to supplement the new acodrains

DPM to basement slab

Additional top soil and grading of bank on east elevation

Pavement repairs to Grenfell Road

The additional landscaping was 16 weeks from 14th March 2016 to 4th July 2016

TOTAL DELAY – 16 Weeks (see programme line 104)

Critical Path Analysis

Following EAI 20, the design & build of the AOV route became the critical path for the project as it would affect the ability to construct and complete the nine new flats on the bottom four floors.

Below is an explanation of the original critical path shown on 'Revised Contract Programme 22/01/15'

<i>Line 51 - AOV System</i>	- W42 to W56
<i>Line 52 - Phase 1 – upgrade to passive section of AOV system</i>	- W42 to W49
<i>Line 53 - Phase 2 – upgrade to mechanical section of AOV system</i>	- W49 to W56

The intake mechanical fans and ductwork for smoke extract and ventilation system are located in the void above the main entrance lobby ceiling about 8m above floor level. Until these were designed, installed, connected and tested it would not be possible to strike out the access scaffold which would delay the completion of the main entrance lobby.

<i>Line 30 – New entrance lobby area after AOV complete</i>	- W56 to W63
<i>Line 33 – Open new public entrance at Ground Floor level</i>	- 10 th August 2015

Once the AOV was completed, there was 7 weeks allowance on the programme until the new public entrance would be opened on 10th August. This would allow time for the access scaffold to be struck, completion of drylining and plastering, installation of glass screen, new screed including drying time, floor tiling, decoration and handover.

<i>Line 35 - Walkway – Flat E – phase 2 completion works</i>	- W63 to W73
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Until the new entrance was opened, it would be impossible to build the last flat on the 2nd floor because it formed part of the temporary residents' entrance route from the walkway. Once the residents ceased using the temporary route, there was 11 weeks allowance shown on the programme to construct flat E

As Built Critical Path Analysis

Line 55 - Design change to AOV to achieve 5m³/sec - 26th June 2015

Following EAI 20, there was a large amount of necessary design work done to allow for the larger fans and extension of the AOV system to the lower three floors.

Line 56 - BWIC to the AOV system - 7th September 2015

Once the design was nearing conclusion, EAI 25 was instructed which covered the 'Builders Work in Connection' works to the AOV extension.

Line 57 – Curtins – Structural confirmation of new AOV route - 18th September 2015

This design work was concluded with the Structural Engineers confirmation on the 18th September following submission and subsequent revision of the proposed route

Line 58 - Upgrade works to revised AOV system (inc. BWIC) - W69 to W84

Line 59 - Installing high level ductwork & fans in entrance lobby - W84 to W87

Line 60- Upgrade works to revised AOV system - W87 to W100
(inc. Commissioning & Witnessing)

The building works started on the 22nd September 2015 with the first diamond drilling of the required structural openings. This builders' works continued through October, November, December and January. From the 6th to the 28th January 2016 the installation, connection and commissioning of the high level ductwork and two new fans was carried out.

NOTE: One of the shafts and dampers on the 2nd floor was directly over the temporary entrance route for the residents. This section of shaft could not be built and the last damper fitted until the new entrance lobby was opened. This meant that the system was only partially commissioned on the 17th March 2016, which was a prerequisite from the client to the opening of the new entrance lobby. The contracted AOV works were not completed until the 28th April 2016 when the full system was commissioned and witnessed by Matt Smith of Max Fordham.

Line 31 - Completion of Entrance Lobby - W87 to W94

Line 34 - Open new public entrance at Ground Floor level - 17th March 2016

On the original critical path, it showed 7 weeks from completion of the AOV to the opening of the public entrance. This matches the time taken from the completion of the high level AOV fans and ductwork to the actual opening date of the new entrance lobby on the 17th March 2016

Line 36 - Dismantle hoarding, deactivate door entry system etc. - W94 to W95

Line 37 – Install metsec walls and new windows - W96 to W96

The above is the time period taken to dismantle the temporary walkway entrance and get flat E (

Line 38 - Walkway – Flat E – Phase 2 completion works - W96 to W107

This line demonstrates the entitlement of 11 weeks to complete flat E which matches the 11 weeks shown on 'Revised Contract Programme 22/01/15'.

Summary of Delays

Line 72 - Delay No1 Installation of HIU's in Kitchens - 22 weeks

The 2nd fix mechanical changeover to new system was originally programmed to be completed on the 24th July 2015. Following the issuing of EAI 24 (a-d) on the 7th September 2015, the installation of the HIU's in the kitchens of 36no flats was completed on 23rd December 2015. This is a delay of 22 weeks

Line 39 - Delay No 2 Revised AOV system - 34 weeks

As explained in the critical path analysis, the instructed alterations to the AOV system impacted on the completion of the flat E (flat 6). On 'Revised Contract Programme 22/01/15', flat E was scheduled to be completed on Friday 23rd October 2015. It should have been completed on 17th June 2016 (it actually was handed over on 19th July 2016). This is a delay of 34 weeks

Line 46 - Delay No3 - Communal decorations to lift lobbies - 8 Weeks

The communal boxing works were due to be completed on 22nd May 2015. Following the client instruction (EAI 33.1) to carry out communal decorations to the upper lift lobbies, the works were done from 2nd November 2015 to 23rd December 2015. This is a delay of 8 weeks.

Line 94 - Delay No 4 – Drainage diversion to the TMO office - 15 Weeks

The design works for the drainage diversion started on the 4th January 2016 following analysis of the CCTV report. Included in the design were a level and drain survey, drainage design from Fife Belcher and a trial hole. The actual works were started on the 4th April and completed on the 15th April. This is a delay of 15 weeks

Line 12 - Delay No 5 Flooring remedials over existing floors - 2 weeks

Flat D was scheduled to be completed on 3rd July 2015 on 'Revised Contract Programme 22/01/15'. Due to the extension to the AOV detailed above and EAI 38.4 the floors to the 3rd floor flats were not completed until 25th March 2016.

Line 104 – Delay No 6 Additional Landscaping - 16 weeks

Following the client instruction (EAI 34) to carry out the additional works, the landscaping works started on the 14th March and completed on the 4th July taking a total of 16 weeks.