



**6-8 Bishopsgate / 150 Leadenhall Street –
Structural ‘Lessons Learned / Observations’**

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1.0 Interpretation

- “Project” meaning 6-8 Bishopsgate / 150 Leadenhall Street.
- “Keltbray Structures” meaning Keltbray Structures Limited who were responsible for undertaking works associated with A2600.
- “William Hare” meaning William Hare Limited who were responsible for undertaking works associated with A2400.
- “Wolffkran” meaning Wolffkran Limited who were responsible for undertaking works associated with H1500.
- “Arup” meaning Ove Arup & Partners Limited who were the Structural Engineer on the Project.
- “Alinea” meaning Alinea Consulting LLP who were the Cost Consultant on the Project.
- “Scope of Work” refers to the document attached as part of Appendix 1.
- “Normal Working Hours” refers to 08:00-13:00 Monday to Friday and 08:00-13:00 Saturday.

2.0 Structural Steelwork

2.1 People / Management

Following the Critical Incident in January 2021, William Hare terminated the sub-contract for the company responsible for their steel erection on the Site. As consequence, William Hare decided to then employ labour directly and manage the erection themselves with their own supervision. This resulted in the ‘erection’ labour was being paid on ‘price’. William Hare’s own supervision faced significant problems with managing the erection themselves, and the fact labour was being paid on ‘price’ also influenced the safety-culture. Prior to this, William Hare’s own management which was directly employed were effectively back-to-back with their sub-contractor.

2.2 Edge Protection (CellShield)

The Scope of Work required William Hare to provide 1800mm of edge protection to the perimeter of the structure and around unprotected openings. William Hare’s system consisted of two panels, comprising one 1200mm panel, and another 600mm panel. There was an option for William Hare to reduce this to 1200mm once the Tower Façade Trade Contractor commenced.

The consensus by the Project was that William Hare’s proposals for 1800mm panels were not “user-friendly” and were not designed to be specific to the Site. This was because by removing one risk, additional risks were being added by doing so.

Firstly, this system does not consider the tolerances of the concrete structure.

It was also found that William Hare had not considered the gaps that would exist beneath the panels. This should not have been an afterthought but should have been an integral part of said panels. William Hare had to make subsequent amendments to the design using ArmaFlex (foam) to seal these gaps.

Additionally, there were concerns over whether the handrail pots themselves were sufficient to withstand the movement of the 1800mm panels.

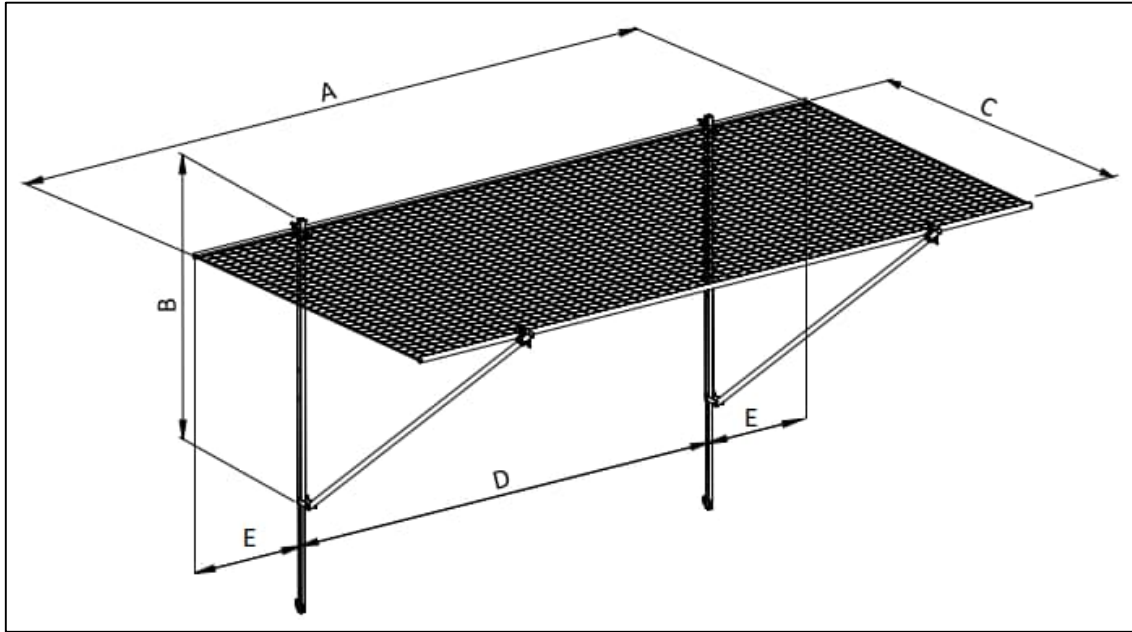
William Hare's system is based on ease and simplicity whereby the posts are simply positioned within the handrail pots without any mechanical locking system. It was found that during slinging operations, there was risk that the handrails could be dislodged when caught. It should be noted that other systems such as K-Guard, are locked into position.

An exercise was completed by Paul Martyn that outlines the advantages and disadvantages of William Hare's system, versus other systems available on the market.

2.3 Safety Fans

During November 2021, the Project experienced adverse weather. Specifically, there were high winds which resulted in damaged Vertemax fans. On further review, the Construction Manager discovered that the fans did not have a suitable base design, incorrect bolts were installed on a significant number of arms (one bolt had no nut which we can only assume fell into either the Pit Lane or Bishopsgate) and there was not a designed restraint mechanism for the top of the fans. It took well into December 2021 before the design and practical issues around the fans were fully resolved.

The design of the Vertemax fans is based on a simply supported system. Where the fan rests on the upper metal deck and relies on the “leg” pushing against the beam underneath to provide support, when the fans are deployed / erected. However, this design was only suitable for wind speeds up to 30mph, which was stated on William Hare's own documentation. The Project was experiencing wind speeds significantly more than 30mph which highlighted issues with the design. Additionally, William Hare had no strategy and/or methodology to overcome this. To overcome this, William Hare and Lendlease co-ordinated, to design a system whereby the fans could be fixed onto a bracket at deck level, to ensure that they remained in position during high winds, with the top of the fans tied back to the studs.



Construction to manufacturers manuals??

Below should be related to fans...

Due to the nature and sequencing of the works, William Hare were obligated to both supply and fit the safety fans. The edge protection should be flush with the ‘Comflor’ metal decking, to ensure that there were no gaps present under the edge protection, however, when Keltbray Structures accessed the unconcreted floor to fix reinforcement and then pour concrete, these works could not be completed until the edge protection was raised. There were various claims received from Keltbray Structures associated with the non-productivity of their steel-fixing resource when William Hare had failed to raise their fans to required levels. This exposure should have been managed within the Scope of Work for both Keltbray Structures and William Hare. For example, an addition to Keltbray Structures’ Scope of Work may be, “... the Trade Contractor shall also be responsible for co-ordinating and completing amendments to the edge protection to ensure the continuity of their Works”.

Note that Keltbray need to install their nappies.

Steel frame needs to be four floors ahead of where we are pouring (based on maxi fan system).

Standard v Maxi Fans = What are the pros and cons (look at EDR’s).

Standard 3m from edge of protection / maxi fans are 4.2m

Standard allows you to do 2 floor jump

Maxi allows you to do 4

EDR's say 3 floors

For each of the brackets on the floors for hare's, there were 8 loose elements that had to be installed (what drawings??)

Strip netting???? What detail was this for edge of building???

2.4 MEWP Track Checking / Sign-Off (Temporary Load Out of Steel / Decking)

This evolved throughout the Project as consequence of the Critical Incident in January 2021. There was no thorough “*Shake-Out*” plan prior to the Critical Incident. This plan empowered William Hare’s operatives to properly consider the works ahead of erection.

The Critical Incident in January 2021 resulted in an overhaul of William Hare’s temporary works design and series of “*standard*” layouts (which covered several levels) and zones showed how loading occurred. This also resulted in William Hare using the “Deck Ryder” system for spreading the loads on the metal decking.

What was the shake out plan??? Load out plan?? Examples??

West Elevation / Public Interface

- 1) The Western elevation of the structure cantilevered across Bishopsgate and therefore the public. To adhere to the Work at Height Regulations 2005, to complete works to this elevation, particularly to the North-West corner, William Hare was required to prevent materials and/or objects from falling firstly, before any further measures are undertaken to prevent any falling material and/or objects striking any person. This meant that both primary and secondary means of protection were required.

At tender stage, William Hare had committed at the start of the Project to develop and use bolt and nut tethers as primary means of protection, an engineered control. This was unsuccessful, rendering the fans as the primary means of protection – no other engineering control has been proposed. As stated, as part of the ‘Safety Fans’ section, the fans had been incorrectly deployed on numerous occasions and therefore could not alone be relied on upon to provide suitable protection to the public during Normal Working Hours.

The secondary means of protection was the exclusion zone (crash deck) setup directly below the Western elevation on Bishopsgate.

Exclusion Zones

- 1) The exclusion zones need to be considered, with respect to 8bg being a highrise job...

- Do EDR's cover this???

Deckers found to be working directly below steel erection...

Lifting

Controlling lifting zones...

Temporary works, loading out plans???

Repetition is easy, but due to differing nature of phases, William hare didn't keep p with – each section had different layouts and needed to be managed differently.

Prior to incident Originally, whl would bring materials, they would balance them on beams / junctions of beams – i.e. sitting across beams. They need temp works for this.

Same applies to steel.

Go to drops prevention in steelwork folders and look at means and methods!!!

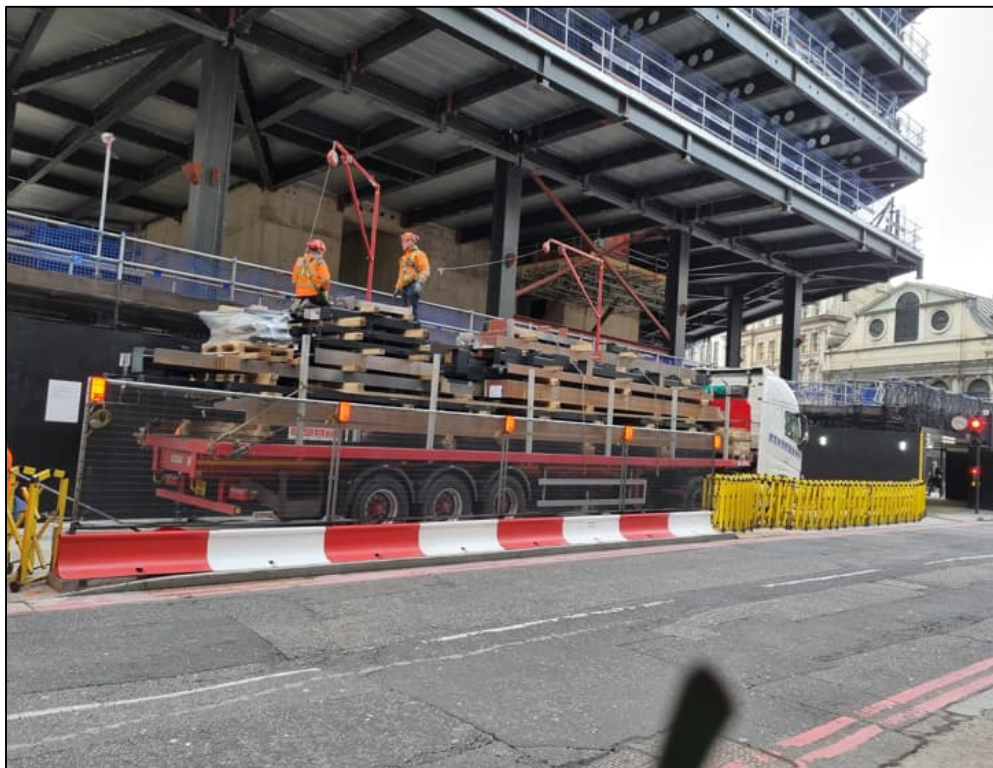
Deliveries

6-8 Bishopsgate / 150 Leadenhall Street – Structural ‘Lessons Learned’

- 1) William Hare’s proposal post-contract was to load up to 25te of steel onto HGVs, but the edge protection to the perimeter of the HGVs flatbed was not sufficient. Notwithstanding this, the Site did not have the space for William Hare to load-out and laydown material thereafter.

The below photograph of offloading operations at 1 Leadenhall Street (Brookfield Multiplex) shows how William Hare had intended to offload material from the outset of the Project.

- Steel could become destabilised and ‘*topple*’ over the side of the HGV due to the loading of the steel being stacked higher than the steel king posts.
- There are no handrails to prevent the operatives from falling.



- It also seemed that William Hare relied too heavily on Tekla to calculate their deliveries and did not take account of the Site’s constraints, logistically. As noted, there was nowhere on the Site to store 25te of material.

- 2) The Project’s Pit Lane, also on Bishopsgate, was logistically constrained. The Contract Documents and specifically the Logistics Plans showed this constraint.

Nylon banding v steel banding on decking – due strength / sharp edges

Nylon was stronger in tension, but did not deter sharp edges???

William ahre believed it was stronger. Tata steel!!

Comflor Metal Decking

- 1) The Comflor metal decking had to be slung using chains, but this could not be done outside of Normal Working Hours (i.e., 08:00-18:00) due to City of London’s restrictions on noise. Were the Comflor metal decking to arrive pre-slung, then this could have been loaded onto the required floor straight away (avoids removing chains outside of Normal Working Hours).
- 2) After they were no longer required, the temporary beams that were required to support the Comflor metal decking caused problems, as were left “*stuck*” on floors, even after the floor structure had been concreted. This needs to be considered as part of the Programme also. This prevents MEP Trade Contractors from visiting areas on occasion.
- 3) William Hare used propping (when safe to do so) to prop the composite decking. This caused interruption to MEP Trade Contractors, when the propping was not removed timely.
- 4) Load-out of metal decking being loaded out incorrectly onto beams.

[See Oxford House Lesson Learned and Critical Incident at Triton Street]

Materials

- 1) The Project's hoists could only serve concreted floors. This restricted the load-out of materials earlier, thus preventing the early build of shaft-related works by Keltbray Structures for example, who were responsible for constructing Working Decks and Protection Decks. Opportunities should be explored as to whether the Project's hoists could be amended to serve unconcreted floors, i.e., Only those with only the Comflor metal decking.

Kone used metal

Does this add risk into programme??

Kone had those grated flooring systems???

- 2) With respect to the Programme, Trade Contractor's programmes should be queried as to whether there is enough time to load away materials for removal from the Site.
- 3) William Hare also continually failed to achieve their piece-count.

PIECE COUNT???? DATA (SEE DATA AFTER INCIDENT).

Painting

- 1) William Hare were not permitted to complete painting to steel members outside of the perimeter netting. This resulted in return visits.

PAINTING OUTSIDE OF NETTING = RETURN VISITS???

If job necessitates, because you cannot put no person zone in.

Or William ahre can come up with painting before concrete is done (when they have fan).

Fire / Intumescent Paint

- 1) The issue of placing attachments onto and through structural steelwork protected with an intumescent coating was raised on the Project. There was concern that when areas of the intumescent coating are unable to expand and perform their function in a fire, that a conduction path for heat transfer would be created which could lead to the primary structural steel member becoming hot in localised points and therefore damaging the integrity/stability of the steel member. The subsequent outcome of this was to achieve what is known as a “coat-back”. This purpose of this coat-back is to prevent heat transfer to the primary steel.

2.2.Larger Attachments – 30-90 Minutes Protection
NOT USED, ALL ATTACHMENTS TREATED AS INDICATED IN SECTION 2.3

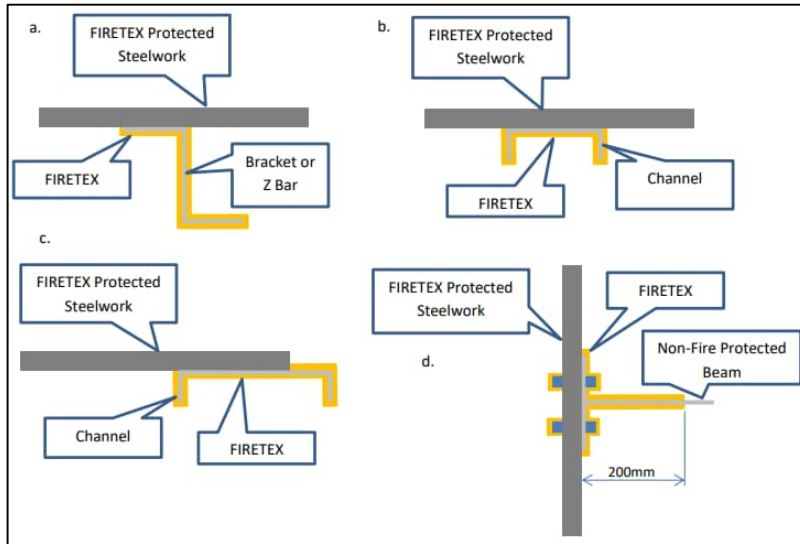
2.3.Larger Attachments – 120 Minutes Protection
At protection periods of 120 minutes or longer the FIRETEX applied to the attachment should extend for a minimum of 200mm (“coatback”) from the point of connection. A fin plate, toe plate or similar which is not connecting an item that requires fire protection should be protected with FIRETEX for a minimum of 200mm from the point of connection to the primary structural element.

Please Refer to Extraordinary Use of FIRETEX Intumescent TAD for illustration of above scenarios

* Macropoxy 400 has been rebranded from Macropoxy C400V3

William Hare’s ‘Behaviour of Intumescent Steelwork’ (260906-WHL-XX-XX-TS-X-0001) document explained, from Sherwin William’s (FIRETEX) perspective, how the treatment of attachments to primary steel should be designed.

The below illustration from the ‘Behaviour of Intumescent Steelwork’ (260906-WHL-XX-XX-TS-X-0001) document provides examples of how secondary attachment could be treated.



- 2) Item 1, above, generally applies to façade-related bracketry, however, there may be other Trade Contractors whose own works interface with the primary steel and therefore require coat-backs where they are connecting onto the permanent steel structure. For example, there were brackets that supported the glass bridge in the reception area that required coat-backs. This has been shown on the screenshot of the model below, circled.

Where these coat-backs are required, William Hare, or similar, should remain responsible for the co-ordination and application of these coat-backs to ensure that intumescent to the permanent steel structure can be warranted by William Hare, and then Sherwin Williams. Where design is being developed, following the execution of the Steelwork Trade Contract, then Orders Not Placed should be allowed for, to cover where William Hare are required to provide additional protection extra over from their Contract Documents.

- 3) Check that the specification correctly calls for corrosion protection (galvanising) in external areas. This may be required to areas with high condensation or dampness, such as plant areas.

Regarding corrosivity, the Project should ensure that correct paint is specified for areas working in C3 to C5 corrosion environments. The below extract from the Structural Steelwork Specification (260906-ARP-XX-ZZ-SP-S-0006) was amended post execution of the Trade Contract to confirm that plant space at Level 49 and Level 50 were considered external steelwork.

- (v) The cladding support frame along the North and East of the pavilion roof structure and level 49 and 50 plant space (columns and beams) is the only external steelwork. Typically, these members will not be insulated or clad

260906-ARP-XX-ZZ-SP-S-0006 | 03 | 12 November 2019

IGLOBAL\LONDON\BELL\065200000233700233716-00 PRUSSIAN BLUE\4 INTERNAL DATA\06 SPECIFICATIONS\07 STRUCTURAL\5-SPC-06 STEELWORK SPECIFICATION\260906-ARP-XX-ZZ-SP-S-0006_03.DOCX

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MEC Property London & Stanhope PLC

8 Bishopsgate
Structural Steelwork Specification

and will be subject to thermal variations and an external C3 to C5 corrosion environment. The required paint specification for these items is E-1. No other part of the structure is external and where the steelwork is present outside the building envelope but will be insulated to perform as it would internally.

- (vi) No part of the structure may be manufactured to Execution Class 1.

To provide context, BS EN ISO 12944-2 provides categories for corrosivity environments, below (from https://www.steelconstruction.info/Standard_corrosion_protection_systems_for_buildings).

Atmospheric corrosivity categories and examples of typical environments (BS EN ISO 12944-2 ^[1])			
Corrosivity category	Low-carbon steel Thickness loss (µm) ^a	Examples of typical environments (informative only)	
		Exterior	Interior
C1 very low	≤ 1.3	-	Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels
C2 low	> 1.3 to 25	Atmospheres with low level of pollution: mostly rural areas	Unheated buildings where condensation can occur, e.g. depots, sports halls
C3 medium	> 25 to 50	Urban and industrial atmospheres, moderate sulphur dioxide pollution; coastal area with low salinity	Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundries, breweries, dairies
C4 high	> 50 to 80	Industrial areas and coastal areas with moderate salinity	Chemical plants, swimming pools, coastal ship and boatyards
C5 very high	> 80 to 200	Industrial areas with high humidity and aggressive atmosphere and coastal areas with high salinity	Buildings or areas with almost permanent condensation and high pollution
CX extreme	> 200 to 700	Offshore areas with high salinity and industrial areas with extreme humidity and aggressive atmosphere and sub-tropical and tropical atmospheres	Industrial areas with extreme humidity and aggressive atmosphere

- 4) At tender stage, tenderers should be queried on what has been allowed for with regard intumescent paint. For example, has the tenderer priced for the painting of the top flange? Tenderers may use this as opportunity to value engineer post-execution of the Trade Contract, as the top flange is not exposed where the metal decking sits on this area of the steel member. This query should however be checked with the Structural Engineer beforehand (as part of the tender process).

- 5) The behaviour of other building components also came into question regarding their interface with the structure and specifically the steel. William Hare

Steel to Concrete Connections

- 1) William Hare was asked to model steel-to-concrete connections pre-execution of the Trade Contract. This enabled the Structural Engineer to identify clashes and update their design accordingly. This proved to be highly beneficial and cost effective. It is perhaps something that could be delivered as part of PCSAs.
- 2) Grouting of steel members was bought directly from William Hare (who sub-contracted this to Keltbray Structures). This was based on a ‘Lesson Learned’ from Google whereby

Pricing Schedule

- 1) The addition of the 'Average Steel Rate' to the Trade Contract proved beneficial when valuing variations post-contract.

Measured Works - Average Steel Rate			
Description	Unit	Rate £	%
Average Steel Rate			
Material Cost	t	£1,228.11	47.18%
Engineering	t	£210.01	8.07%
Fabrication	t	£807.08	31.01%
Transport	t	£72.77	2.80%
Erection	t	£285.03	10.95%
Total		£2,603.00	100.00%

Additional wording should be added to the Schedule of Rates to the

- 2) William Hare submitted Daywork rates which were significantly high at tender stage, and these were not inserted into the Trade Contract’s Schedule of Rates for obvious reasons. Greater emphasis should be placed on securing fair and reasonable Daywork rates with Trade Contractors

such as William Hare at tender stage. The rates that William Hare were charging post-contract were extortionate and were difficult to negotiate due to rates being agreed on another Project – these were also too high.

Post execution of the Trade Contract, benchmark rates of circa £69.69/hour were obtained from previous projects such as Oxford House and Triton Street. However, even these rates were too high – greater emphasis should be placed on securing reasonable rates at tender stage and adding them to the Schedule of Rates.

Procurement

- 1) Alinea were not aligned with Arup when producing the Cost Plan. Need to understand whether castellations are accounted for in Arup's tonnage estimate before finalising Cost Plan.

3.0 Substructure, Cores & Superstructure Concrete

People / Management

- 1) Keltbray Structures' safety culture was concerning. Even greater focus and emphasis should be placed on their 'People' at forthcoming tender stages.

Shafts

- 1) Following various examples of poor safety performance by Keltbray Structures directly employed scaffolding resource, there should be greater focus on the supply chain employing competent labour for works that are considered high-risk. This should be queries at tender stage.

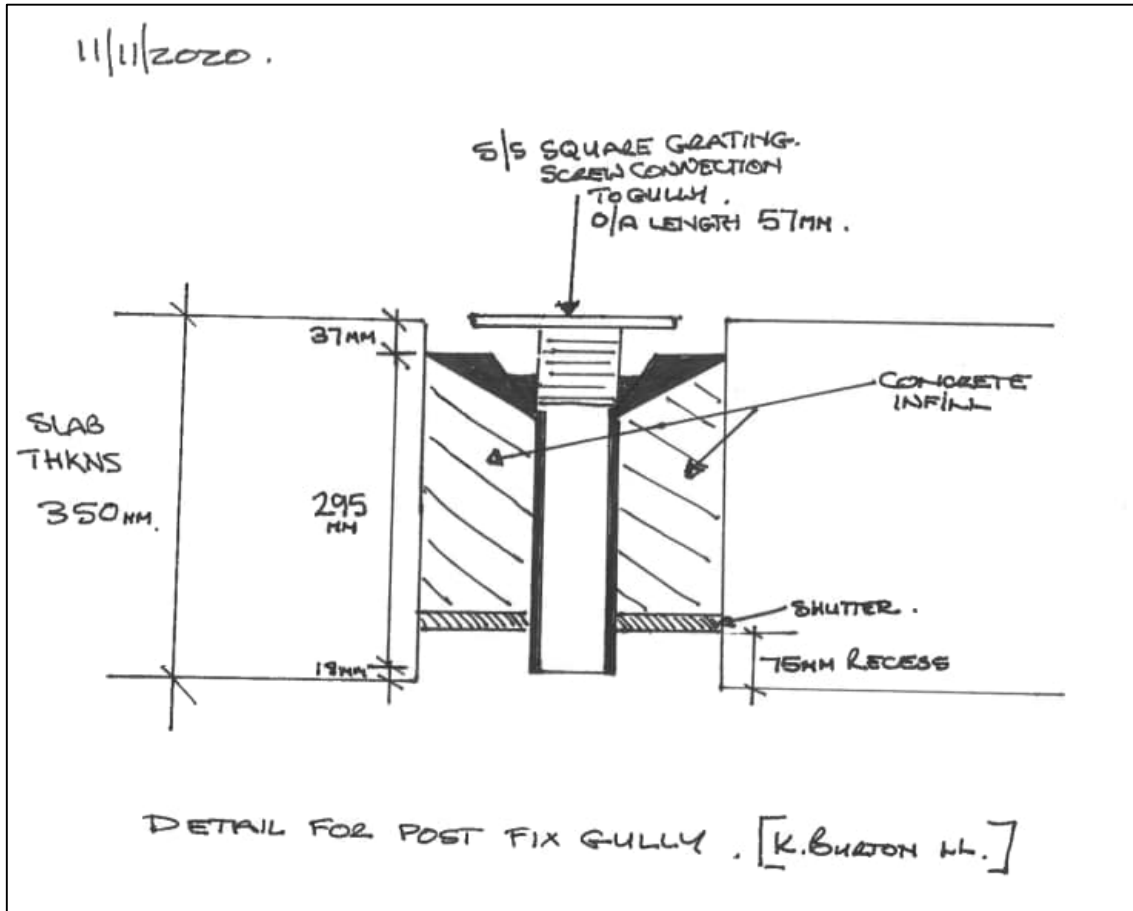
Exclusion Zones

- 1) Exclusion zones were required for steel/concrete frame, which meant that TC1a was put out-of-service. This was not considered at tender stage.

- 2) The top deck of the composite decking was also a ‘No Person Zone’.

Leading Edges

Gullies



Lifting

- 1) Keltbray Structures' supplier for reinforcement, F Brazil Reinforcement Limited, were not bundling reinforcement correctly. They were mixing different lengths, configurations, and sizes of reinforcement bar. These unsafe practices ultimately resulted in the Critical Incident that occurred in November 2020, whereby...

Temporary Core Stability

- 1) Fortunately, the behaviour of the core during the construction phase was well understood by the Project.

Formwork Hoists (Temporary Works)

- 1) Keltbray Structures' own formwork hoists were situated within various shafts. There were two hoists situated within PA & FF and HR of the North Core, and one hoist situated in SL 02 of the South Core. Once the North Core's structure had progressed far enough, Keltbray Structures had planned to re-construct “*flying*” hoist bases / platforms at intermediate levels of the North Core. This was to ensure that their operatives could get access to the rig. Note that the Project's Metal Stairs also provided secondary means of access.

Keltbray Structures subsequently submitted RAMS to reflect their proposal for the “*flying*” hoist base / platform.

The Designer’s Risk Assessment stated that other Trade Contractor’s Works could not continue below this platform / base. This also contradicted 3.23 of the Scope of Works which stated that “... *No access to the lift shafts will be permitted after handover*”.

In addition, the removal of these formwork hoists from the shafts caused delays to other Trade Contractor’s Works, namely, the Lifts Trade Contractor, who could not commence their Works until these temporary formwork hoists were removed from the shafts.

- 2) When in operation, Keltbray Structures’ formwork hoist had insufficient lighting. Keltbray Structures claimed that this was a “*safety feature*”. Lendlease’s framework agreements should be back-to-back with the supply chain and whatever sub-contractors and/or suppliers, the supply chain propose for use on any construction site being operated by Lendlease.
- 3) Three Lift Shafts were always planned to be used for beneficial builder’s use; however, as noted, Keltbray Structures positioned their ‘formwork’ hoists into two Lift Shafts and TC1a was positioned in SL 01. This added risk into the Programme, particularly from the perspective of Lift Trade Contractor, Kone Plc.

Rig Activities

- 1) The Programme should have separated the normal vertical and horizontal construction of the North Core and South Core (e.g., Separating Lobby Slabs from North Core) respectively, from the period required by Keltbray Structures to remove the rig. This activity caused significant disruption to other Trade Contractor’s on the Project due to the exclusion zones required and the fact that Keltbray Structures required William Hare’s craneage allocation between 08:00-18:00.

[illegible]

- 2) When the rig was being jumped between cycles, this required exclusion zones to be setup around the Site. This prevented William Hare from working within specific areas. This also meant William Hare could not carry out their steel erection within these zones on occasion. William Hare used this as opportunity to make claims associated with “*disruption*” to their Works.

Whilst the Trade Contract was clear on the requirement for Trade Contractor's to ensure continuity of their Works where re-sequencing is required. This prevented William Hare from using TC1a for 1-3h once per week. This "*disruption*" needs to be considered at tender stage.

In addition, wording should be added to Keltbray Structures' Scope of Work to the effect...

- 3) The Scope of Work should have added an obligation on the Trade Contractor to maintain materials such as reinforcement and formwork on the rig to ensure continuity Works can continue for period of 48h in the event of adverse weather preventing the lifting of reinforcement to the rig. However, the Scope of Work should be clear so as not to contradict Lendlease's own procedures regarding Just-In-Time deliveries. In addition, the Trade Contractor must also ensure that they do not overload the rig beyond the allowances in their temporary works design.

The loading plan for the rig limited the weight of reinforcement (or material, generally) that could be loaded – specifically, only 28te could be loaded onto the rig, when some floor levels required c. 50te of reinforcement.

- 4) Due to changes in geometry of the core walls, adaptations were required at various stages of during construction of the South Core and from Level 47 upwards of the North Core. These adaptations meant removing and adapting formwork at height, thus adding additional risk. In addition, the adaptations add 'time' onto the Programme. This needs greater consideration at tender stage, as neither Keltbray Structures or the Programme.

Reinforcement

- 1) Keltbray Structures raised a Technical Submittal prior to commencing on the Site, proposing the use of Dextra Rolltec couplers in lieu of the lapping of reinforcement. These couplers however only have technical approval by CARES for static applications in tension only, but no approval for compression applications. The Technical Submittal was subsequently recommended Status C.

Fortunately, the ‘Concrete Specification’ was clear on requirements for couplers to work in both tension and compression. It was also clear on the requirement for relevant technical approval by CARES. For tension-compression applications, the coupler should be CARES approved for both tension and compression. Additionally, the Concrete Specification also stated that reinforcement detailing should be carried out to BS EN 1992 (Eurocode EC2) and highlights that this may be different to previous British Standards.

- 2) At tender stage,
- 3) Following a Critical Incident in November 2020,

[Insert File Note on lifting procedures and drawing showing Belgrano]

Lift Shafts

- 1) The document that outlined the scope associated with the Working Decks and Protection Decks should have had a caveat relating to building the shaft at the highest level possible, based on the progress of the structure.

Waterproofing

- 1) Ground Floor slab should have been designed to be waterproof, with for example water-bars to create a watertight seal. Alternatively, the Scope of Work should be very clear on the Trade Contractor’s (e.g., Keltbray Structures) responsibility to ensure that basement areas are maintained as watertight following casting of the Ground Floor slab.

An example addition to the Scope of Work could be, “... *The Trade Contractor shall also ensure that the basement shall remain watertight up to Practical Completion of the Project*”.

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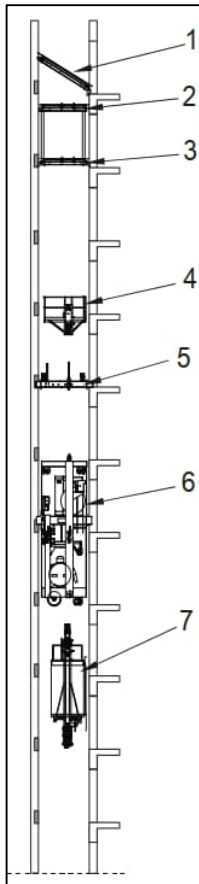
There were numerous issues associated with the temporary waterproofing of the Ground Floor slab. Although the temporary waterproofing of this area was bought from Keltbray Structures, this was only bought to the extent that was shown on the Contract Documents, therefore, where additional builder's work was requested, these were considered variations. As such, rates should be added to the Schedule of Rates to cater for this.

- 2) Where there are temporary openings through concrete slabs and there are subsequent construction joints, the Scope of Work should be clear on the requirement for the Trade Contractor to waterproof said construction joints.
- 3) The Contract Documents and the design intent within need to be clear on where the waterproofing membrane (i.e., Preprufe was specified on the Project) terminates vertically. This applies specifically where there are multiple interfacing Trade Contractors.
- 4) The Scope of Work should have been clearer regarding who was responsible for the provision of puddle flanges, or similar, to the secant wall, or other vertical areas of the basement.
- 5) The Scope of Work should have been clearer on the party responsible for casting sleeves into the secant wall for services, along with the requirement for waterproofing for said sleeves.

- 6) Kone's JumpLift required weather protection to protect activities taking place below from water ingress. Keltbray Structures Limited failed to properly weatherproof the Working / Protection Decks.

In Lift Shafts with the JumpLift, only the Crash / Weather Deck would be required as the JumpLift system provides the Working Deck.

1. Deflection Deck (provided by Construction Manager via Keltbray Structures). It should be noted that Kone recommend in their JumpLift '*Installation Instruction*' that the Deflection Deck is attached to the core form.
2. Waterproof Crash Deck (provided by Construction Manager via Keltbray Structures)
3. Crash Deck (provided by Construction Manager via Keltbray Structures)
4. Installation 'Time' Platform (provided by Kone)
5. Cathead Hoisting Beam (provided by Kone)
6. Cathead (provided by Kone)
7. Car (provided by Kone)



Liner Walls

- 1) In October 2020, Keltbray Structures poured concrete into the Site’s lateral sewer (which exits into Bishopsgate). This came as consequence of Keltbray Structures engineer failing to check that the cap was solid enough - Keltbray Structures had used ‘duck’ tape to seal the opening. It should have been cast iron.

Metal Stairs

- 2) The conversation around damage and protection to Metal Stairs was frequently discussed.

There should be greater emphasis, driven by milestones on the Programme and corresponding wording in the Scope of Work, to ensure that stairs are handed over timely. Where Trade Contractors are required to carry out repairs to their...

- 3) PAD Contracts Limited (sub-contractor for Keltbray Structures) advised post-contract that paying an additional amount for applying and then maintaining protection to handrails and balustrades outweighs the cost of retrospectively repairing damage to balustrades. Tenderers should be asked to price this ‘below-the-line’ at tender stage; under the Trade Contract, this could be added as an ‘Alternate’ in the Trade Contract. The cost associated with maintaining protection can be significant. This was bought successfully.

13.2 Protection

The Trade Contractor shall protect the Works to prevent damage to them as required by Appendix 2 and shall maintain such protection until Practical Completion of the Project or Practical Completion of any Section in which the part of the Works to be so protected is comprised. The Trade Contractor shall take all reasonable steps to prevent loss or damage to all work executed or in the course of execution and any goods and materials on the Site. The Trade Contractor shall also protect occupiers of adjacent properties and the public from danger, discomfort, disturbance, trespass or nuisance caused by the Works.

8. Protection of the Works (Clause 13.2):

The Trade Contractor shall provide protection to the Works as required prior to practical completion of the works.

Specific requirements for protection shall be as follows:

- The Trade Contractor shall provide protection as required by the Contract Documents.
- The Trade Contractor shall provide suitable protection of architecturally finished concrete finishes (Including protection from construction activities and weathering).
- The Trade Contractor shall provide suitable protection to all completed work elements including stairs, handrails, gullies and any other architecturally finished concrete surfaces.
- The compatibility of the protection material with any other adjacent material shall be tested and guaranteed.
- Stairs protected with anti-slip surfacing during construction phase

- 4) The Scope of Work should have been clearer regarding the responsibility of who was to provide fixings for the handrail to the stairs.

During the construction phase, Keltbray Structures argued that the “stem” bracket which allowed for the external balustrade to be fixed onto, did not form part of their Trade Contract. The Scope of Work was not entirely clear on this element of scoping.



3.16 of the Scope of Work stated, “... Steel stairs inside cores shall include the flights, landings, and internal permanent handrails (factory) finished to base and first coats only. Final finishes and the associated external permanent handrail will be completed by following trades”.

The Scope of Work’s wording could be amended to, “... Metal Stairs on the Project shall include the flights, landings, half-landings, and internal permanent handrails, and associated fixtures and fittings. The Metal Stairs should be (factory) finished to base and first coats only. Final finishes and the associated external permanent handrails fixed to concrete will be completed by follow-on trades.

Where fixtures and fittings are welded and therefore form part of the structure of the Metal Stair, these should also be allowed for by the Trade Contractor”.

There were two Wilkinson Eyre documents, namely, 260906-WEA-XX-XX-SP-A-Section L30 - ‘Stairs Specification’ and 260906-WEA-XX-XX-SP-A-Section L32 - ‘Balustrades / Handrails’.

The ‘Stairs Specification’ and specifically L30.1207(c) refers you to L32 of the specification for ‘Balustrades / Handrails’.

- c) Integrated balustrades and handrails:
 - i) Type BAL-114, balustrading to be welded to stair treads (Refer to Section L32).
 - ii) Balustrading types to give visually seamless continuation/ appearance from top floor to basement level.

Regarding L32.1215 of ‘Balustrades / Handrails’ states the below.

- | | |
|----------|--|
| L32.1215 | Type BAL-305 External Metal Balustrade |
| | External metal balustrade system, configured as indicated on the Design Drawings, comprising: |
| | a) Balusters: |
| | <ul style="list-style-type: none">i) Galvanised mild steel flat rectangular balusters to sizes and profiles configured as indicated on the Design Drawings.ii) The balusters shall be welded to mild steel base plates. |
| | b) 40mm diameter stainless steel handrail bolt fixed to stainless steel circular section bracket, welded to baluster. |

Note that the “stainless steel circular section bracket” (stem) is to be welded to the balustrade, as per ‘b’ above. Therefore, the Project could argue that the intent had always been that this bracket has formed part of the structure of the balustrade.

Riser Protection

Riser protection was bought from two Trade Contractors, namely, Keltbray Structures (Substructure, Cores & Superstructure Concrete and William Hare (Structural Steelwork). Keltbray Structures were responsible for the supply and fitting of RiserSafe to any opening, greater than 300x300mm, within the concrete structure, whilst William Hare were responsible for fitting free-issued RiserSafe to any opening that was supported on at least one side by metal decking.

- 1) This generally applies to the Project,

Had the

Access platform in Im01-Im3

Current design

MJL's contract didn't have craneage /
Hare's and Keltbray weren't using it

46 nights = 10h – 460 hours of lifting – wasn't factored into MJL
1 HOUR EQUATES TO 460 DAYS

William Hare and Keltbray Structures were allocated 90% of the craneage throughout the duration of the structure during Normal Working Hours, whilst Keltbray Structures Limited had 90% allocation to craneage during backshift hours of 18:00-23:00 Monday to Friday. This means Michael J Lonsdale's Trade Contract had craneage allowance of 1h per day.

<https://youtu.be/H2ELBYrKbUA>

Miscellaneous

- 1) Wording should be added to the Scope of Work that protects the Project from claims associated with activities carried out by UK Power Networks (or similar) for example, that would mean the Site could be potentially closed during Normal Working Hours.
- 2) The Trade Contract was not clear on the Construction Manager’s entitlement to stop Trade Contractor’s Works on safety grounds and/or safety stand-downs, such as those that following Critical Incidents. Trade Contractor’s should not be able to claim ‘time’ associated with these events. This is an area that should be checked with Macfarlanes. Below is an example of wording that was added to the Sub-Contract at Deptford, Plot 4.

“2.19A	<p>For the avoidance of doubt the following do not constitute a Variation or Relevant Sub-Contract Event and no extension of time or loss and expense will be given:</p> <ol style="list-style-type: none">.1 in respect of weather delays, including winding-off of craneage;.2 in respect of logistical issues, lack of craneage, Site access, Site interface, design co-ordination and/or design development of
<hr/>	
Scope ID: BB692388-52FD-4965-82B1-C8C7BF85C95E	
	<p>items to complete the Sub-Contract Works which are the responsibility or fault of the Sub-Contractor; or</p> <ol style="list-style-type: none">.3 in respect of any delays arising in connection with: (a) site-wide stand-downs for to health and safety reasons; or (b) ‘topping-out’ ceremonies for the Project (or part of the Project) in respect of which the Contractor has given the Sub-Contractor reasonable advance notice; or.4 where the Sub-Contractor has failed to comply with clause 2.3A.”

4.0 H1500 Tower Cranes

Lendlease European Delivery Requirements / Global Minimum Requirements

- 1) Careful consideration must be given when placing an order to the Lendlease’s European Delivery Requirements, as they are not clear on requirements.
- 2) Crane Supervisors were not bought as part of the Hire Contract. The European Delivery Requirements do not clearly stipulate the requirements for this role, as they only say this requirement is dependent on the degree of risk. These requirements also state that the “Appointed Person” can act as the “Crane Supervisor”.

An Appointed Person was bought, along with supervision and resource downstream from Trade Contractors.

Project Lifting Profile	Lend Lease Personnel		Contractor's Personnel	
	Lifting Manager	Appointed Person	Competent/Appointed Person	Competent/Lifting Supervisor
Profile 1 - projects with: <ul style="list-style-type: none"> ■ 1 tower crane and high risk. ■ 1 tower crane + 1 or more mobile cranes not including 'compact cranes'. ■ Multiple tower cranes. ■ Mobile cranes only and high risk operations. High risk includes: <ul style="list-style-type: none"> ■ Lifting in close proximity to the public or railways. ■ Complex lifting operations or lifting in close proximity to other operations. 	Required If work load permits may be combined with other roles.	Required Must be a Lend Lease appointment may be a Lend Lease employee or a non-Lend Lease employee (on secondment or under contract). Must be resident on site.	Required Dependent on the lifting profile for the contractor (number and nature of lifts) this may be a resident or visiting role. This must be agreed before placing contracts. Can act as crane supervisor.	Required Must be on site all times a lift is taking place. Dependent on work load and degree of risk may be combined with other roles.

Once the craneage scheme had commenced on the Site, with more than one tower crane, the Project decided that two Crane Supervisors were required, in addition to the Appointed Person and the resource already bought downstream from Trade Contractors on the Project.

- 3) JR Crane Services Limited were appointed on the Project to provide independent third-party attendance to oversee crane activities such as erections, dismantles and climbs. Currently, the business only has one person that can provide this attendance. This was not bought as part of the Hire Contract. This requirement is also not clear in Lendlease’s European Delivery Requirements.

Other Lendlease projects within the business had previously set this up as a Simple Purchase Order. However, this does not provide appropriate insurance coverage, that is back-to-back with other Trade Contracts and/or Hire Contracts on the Project.

Orders Not Placed

- 1) Ensure that the requirement and quantity of 'Independent Category 3 Design Checks' are firstly understood and scheduled out at tender stage. These should be either allowed for as an Orders Not Placed, or bought with one of the other Trade Contractors, e.g., Keltbray Structures. The allowance of £50,000.00 was not enough for the number of these checks required on the Project.

It should be noted that there are approved sub-consultants that the business considers to be acceptable. These sub-consultants are vetted by Lendlease's Temporary Works Department.

Most of these checks for the craneage scheme were bought with Keltbray Structures. It would be beneficial to add rates to the Trade Contract's Schedule of Rates...

- 2) An Orders Not Placed should be allowed for within Temporary Services for out of hours working where attendance is required for climbing of craneage. This was not bought, but this was required every weekend where the crane was climbing.

Communication

Communication between Crane Operators (from Wolffkran) and William Hare's workforce was the potential cause of two Critical Incidents on the Project. Crane Operators could not understand William Hare's operatives' accents, with many of them coming from Northern areas of the country. There were workshops held to better the communication between the two parties

Culture??

William Hare became poor in communication with Wolffkran.

Certain crane drivers couldn't understand different slingers (because they were Northern).

Communication not clear

There was workshop on communication to better the communication

We took hares signers up the crane to understand what the crane drivers were ‘seeing’

British standard says that you need to establish common means of communication!!!

Transient workforce!!!

There needs to be groundrules – they also talk to each other day, but never see each other.

General Notes

- 1) Scope of Work covers the time allowed for associated with the submittal of Method Statements, however, this should also add that “... *the Construction Manager is allowed to revisit the contents of the Method Statement as and when required, to reflect the current state of progress on the Site*”.
- 2) The “Facilities” provided by the Construction Manager and specifically stated in Appendix 2 need to be clearer regarding the power and lighting requirements that are going to be provided to Trade Contractors. For example,
- 3) Percentage for overheads and profit should be agreed at tender stage and added to the Schedule of Rates (where necessary). An appropriate rate of profit is often taken from a Trade Contractor’s audited accounts for the previous three financial years, whilst the percentage for overheads can be arrived at

- 4) Trade Contractor's should be obligated to provide their yearly audited management accounts to Lendlease regularly.