Case Study: Door Design, Procurement and Installation

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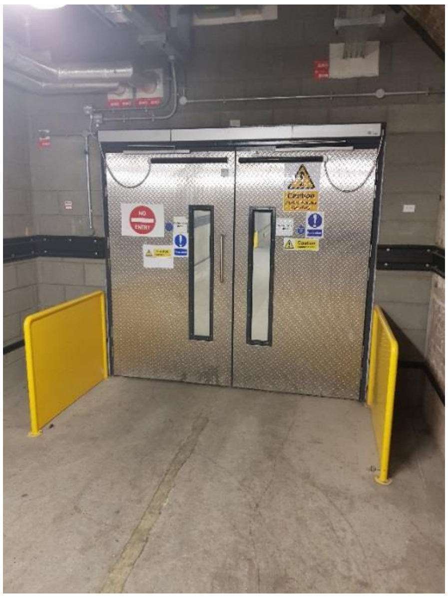
London Bridge Station Redevelopment

The Challenges of Design, Procurement & Installation of Doors in a Large Operational Project



Doors may look simple. We use them daily, from waking up, using the bathroom, leaving our homes and arriving at the office, swiping our building passes to go through them, locking or unlocking them etc.

However, when you have a complex project like the London Bridge station redevelopment with over 1100 doors in different locations, changing end user expectations, different sizes, diverse locking mechanisms, access control, fire rating, security requirements and lead time for manufacturing them etc, the reality of doors become more challenging than the simple functionality like opening and closing.

This case study captures and documents the "door" experiences with the challenge of meeting several delivery milestones on the London Bridge station redevelopment project. It bears in mind that there are different structural or steel works, mechanical and electrical as well as stakeholder interface elements that must be considered as part of the scope, design, procurement, installation, handback, key suiting/access control and future maintenance of the doors for successful delivery to be accomplished.

1. Door Schedule - Scope and Requirement

Doors are tied up to security and design specification must be driven by end user requirements. Changes in end user requirements affected the early design specification and procurement. As the rooms kept changing, it impacted on the specification for locks, fire and security levels as well as other features which should have been agreed before the works started.

There were also issues about the size or type of wall the doors were going to be fixed to. For instance, jamb depth was not specific in the door schedule. Also, where kick plates were requested to be installed on one side it was not clear which.

The door schedules were initially defined by area. Each architect had their own schedule which did not necessarily align to any other. Areas were grouped into packages; station west package door type X wasn't necessarily the same as station east package door type X. Coordination was almost impossible; the project team eventually realised that its site-wide approach should be applied to the door schedule. The door schedule N420-COT-SCH-AR-000117 should have been created during the GRIP 4 stage to assist in the development of detailed design of the project with *all* the doors to be installed in the station. Also, inconsistency between doors of the same type (retail unit doors, meter cupboard door, escape doors) caused too many errors regarding the information provided in the door schedule.

It would also have been advantageous for the drawing plan references to be all referenced in the door schedule, to enable each door on the project to be easily located. Instead, a hidden column made it difficult for everyone, especially subcontractors, to find the correct drawing showing the door. It would have been better to invest time in creating a folder or system with all the drawings divided by tiles number. With hindsight, this was the approach used later in the project; it became easier to find a door once implemented.

2. Door Design

In the design process, too many door references were used twice. This resulted in STQs (subcontractor technical query) being issued to change the door references which could have saved time and money. Though adopting the door numbering was effective, it was difficult to get consistent commonality on sizes of doors when they were being retrofitting on an existing or old structure.

The other issue was that structural openings were inconsistent with the expected dimensions creating measurement variances between what (square and true) was on site and what was designed, thereby affecting frame/door procurement and production. As well as the structural openings not being consistent, on occasion doors that opened out onto the service trench clashed with obstruction (like the metal decking) meaning that the door could not open once installed. Standardising of door sizes would have enabled use of a template for forming consistent structural openings.

Another design challenge was that the level of design for MEP works did not align with the rest of the other activities. If each of the doors had its own IDR/IDC, some of the issues would have been captured. Door interface with the floor and other structures is a solution that can be captured during IDC/IDR.

3. Procurement

There were too many size errors due to either the floor not being finished, opening not ready or the survey not being correctly undertaken before sending the door for manufacture. Ideally, there should be a three-month buffer between the confirmation of fabric and the ordering of the doors. However, the rush to meet milestone deadlines meant that the project proceeded without vital information being there.

When there are discrepancies on the scope, design and ordering of door components, it adds consequential costs and unwanted delays to a project. The cost range for the doors used at London Bridge Station was between £800 - £12,000 depending on the type and there was no flexibility of reusing them elsewhere on the project due to inconsistent sizes. Standardising the size would have made it easier to fit and reuse.

The situation was compounded by the fact that different suppliers were providing door frames, doors, and access control components. Each supplier had its own approach to design coordination. Hence, the project was forced to resort to 'back fitting' the communications aspect later.

The project also did not anticipate the acquisition of a major door supplier, which caused substantial issues in the procurement process. Contractors should protect against suppliers being taken over by another company as this can have a negative impact on cost, timescale and other terms.

4. Installation

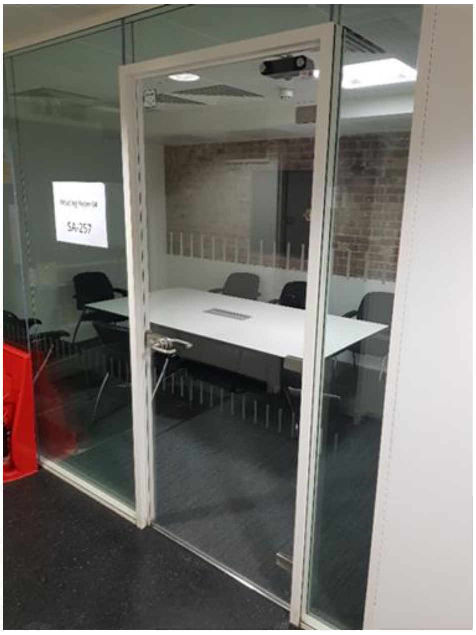
Good communication between the design and delivery teams is essential. An example of what can happen when communication is not effective resulted in doors being painted while construction activities continued within areas that had been handed back. This led to lots of scratches and damages.

Also, doors were installed to structural openings before the works within the room were complete. This led to doors being propped open to allow MEWPs and materials to be transported within the room. It also resulted in doors being hit and damaged due to the high level of traffic, sometimes causing the door to be replaced at a cost. This is mainly in respect to the metal doors within the BoH areas.

In an ideal world the doors would be the last thing to be installed when all the major works are completed and no longer require daily access to complete works. This, however, would have a large influence on the programme of works. Certain rooms required the doors installed prior to certain works for security and health and safety issues such as the electrical rooms.

There is value in retaining protection to doors once installed to minimise damage or the need for magic man repairs. This was especially true where complex doors (including hold open / automatic / EACS) were installed and brought into use before Elec / Comms elements were available – resulting in significant damage to doors. A lot of this can be self-inflicted by the workforce bumping plant into doors or wedging them open, which damages drop seals. On occasions they did not have the MEP installation for access control or the link to fire systems.

5. Handback, Entry into Service (EIS) and Maintenance



Once EIS takes place, doors are open to abuse. This was a problem when the project team was delivering and handing back the station in phases. Continuous work by the project team and subcontractors contributed to the damages experienced. Between four and six doors were lost by pulling against the mechanisms of fire doors during the interim periods before they were finally commissioned.

Due to the unique operational need of the station, doors were being EIS'd before being completed and the interface between systems commissioned (i.e. hold open fire doors). This in turn resulted in a high level of faults being reported via the station fault control which lead to false reporting on the performance of the doors.

Sometimes, due to lack of clear recordable handover process between trades and subcontractors, EIS of complex doors did not progress fast enough. Because of incomplete documentation, the accuracy of information that was handed over to the project maintenance team was poor and meant that time was wasted looking for the relevant information. This increased the time it took to repair any faults and plan maintenance.

Ideally the following information should have been provided:

- Installation/commissioning date
- Door ID and location
- O&M's for the different type of doors
- Door make up and ironmongery detail (make and manufacturer of products used)
- Details on the door (fire rating and security rating).

If this information was handed over prior to the areas containing the doors being EIS'd it would have given the maintenance team time to procure spares, schedule PPMs and set up maintenance contracts (if required) with specialist contractors. All of this could have resulted in a more efficient and timely door maintenance.

6. Key Suiting and Access Control

As mentioned above, one of the early lessons learned by the project team was the lack of consistency of approach in the electrical power supply to access control, door contacts, maglocks etc. Initially, when access control was designed 'sitewide', the project had a standard set of door designs that were imparted to architects. This approach was not successful because some architects were more accepting of the requirements than others. Also, access controls were not installed on time, leading to additional costs being incurred for employing security personnel to guard some of the rooms.

In the earlier stages, the keys to some of the rooms were not properly handed back to the station team in a manner that would assist them to run the operations without the project getting involved. The project had to rely on its personnel at the permit office to sift through the keys and organise a system/process of access permit that enabled both the project work activities and the station operations to coexist.

7. Future Maintenance

Difficulties were experienced with encouraging suppliers to complete maintenance on the metal doors they supplied, leading to slow response time to faults. This meant that door faults were not able to be closed out early and did not meet the required repair times agreed. To overcome this it is recommend that a separate contract be put in place for maintenance with the specific supplier. Alternatively, a maintenance contract could be set up with an external locksmith before doors are handed over.

Because of the issues surrounding faults, one question that continued to arise from the station and route maintenance teams was: "who is going to maintain the doors in the future, especially the glazed doors or other doors with specialist features?" One of the suggestions was to retain the contractor used for installation, including figures of the repairs carried out already in the O&Ms to assist them make decision on who to use.

8. Conclusion and Recommendations

Key points to consider when managing door installation on a complex project:

- Early agreement of full design scope following end user specification
- Where, or if possible, use fewer suppliers for all doors, frames and other components
- Standardising the types of doors to minimum of types and specification will provide flexibility for inevitable programme / priority shifts throughout delivery programme
- Where possible avoid bespoke doors to avoid risk of long lead times to replace them
- Only remove protection and hand back when all construction activities in the area are completed to avoid damages to already installed doors
- Where there more than one designer, a coordinated design approach and mechanisms (like the internal quality check process, the IDC, the assurance review and change control e.g. STQ on site) to identify clashes and discrepancies and enable these to be resolved prior to installation
- Ensure all structural openings are checked at point of completion and confirmed within tolerance prior to acceptance
- Complete tolerance build-up / compatibility for structural opening and door installation
- For a project of this size (circa 1100 doors) have a maintenance team on site during the warranty period to address faults/quality issues. *The maintenance team will need to be able to respond in accordance with required times*
- Ensure clear handover process where multiple sub-contractors are required to complete works on a door. *The sequence of install is not always aligned to functional systems requirements*
- Where significant quantities of doors are being procured it would be advantageous to include the requirement of tracking for any door through manufacture to delivery on site.

About the author

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Further information

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