Will Marshall

Fire engineer

A decade of learning, more to come

Key words
engineering
consultancy
construction
career

It's been almost a decade since I graduated from a Masters in Mechanical Engineering from Brunel University in west London. Very shortly after I finished, I started work as a fire engineering graduate fresh to the specialist field of fire engineering consultancy. A decade on, I am managing a team of fire engineers, code consultants and modelling specialists as well as one of the largest and most complex fire engineering projects in Australia. Reflecting on this I want to explain where I have got to and, just as importantly, where I have to go in the future.

My current project is the Darling Harbour Live project, a 20 hectare site at Darling Harbour. This will include a conference centre, theatre, housing and commercial buildings, all of which must be designed for fire safety. But first I should explain just what someone called a 'fire engineer' does.

An architect's impression of the Sydney Convention Centre

What is fire engineering?

Fire engineers work on major construction projects. We have to think about many aspects of engineering, but we must also think about human behaviour.

At the start of a project, fire engineers will consider where and when a fire may occur and identify a credible worst case scenario. A fire occurring in an unoccupied area may grow to a larger size before it is discovered than a fire in an occupied space, but the fire in the unoccupied space may not have an impact on so many people so a smaller fire in an occupied space may be the worst case to consider.

We consider how the smoke generated from this fire could impact on building occupants and on the fire fighters sent to deal with it. The movement of smoke through spaces is a complex flow problem and can require detailed analysis to accurately predict the performance of the building when there is a fire. On the simplest end this might be using calculations on spreadsheets, but at the other extreme detailed Computational Fluid Dynamic (CFD) modelling to visualise smoke movement throughout the spaces may be used. With all this information it is possible to determine how long the occupants will have to escape from the building.

We must also take into account how the occupants are likely to react in a fire. This analysis includes determining the number of occupants, as well as the demographic characteristics of these occupants, such as age, gender, social or family groups etc.

and how we can use staff to control crowds of occupants and to ensure that they escape. Knowing how the fire might spread and how people will move we can check that they will be able get out before it is too late. Ultimately the aim is to demonstrate that occupants can escape and fire fighters can effectively carry out fire fighting operations.

Building design must take into account the safety of fire fighters who may have to tackle a blaze.

How do we assess how a building will work in practice? We will study architectural drawings, 3D models, technical input specifications from other engineering disciplines as well as architects and clients visions for the project. This information is collected through 2D and 3D drawings, meetings, telephone conversations, technical documents, codes, standards and promotional material.

The level of complexity involved in this analysis depends on the complexity of the project. The Darling Harbour project discussed in this article has involved multiple analyses following the process above for several worst case scenarios. In the design of the buildings the aim for the fire engineer is to optimise the building efficiency and flexibility, while still meeting the requirements of the code.

Once the analysis has been carried out, we prepare documentation reporting on the results. These documents must be concise and written in a language that the audience can understand. They include both technical results (such as calculations and research findings) and advice on what design features are necessary in the project.

The project

The Darling Harbour Live project involves the redevelopment of the existing facility in Sydney to provide a world-class convention, exhibition and entertainment facility. A consortium has been formed to develop and manage the precinct for the next 25 years. The company that I work with, AECOM, are providing the majority of the technical engineering consultancy services, including fire engineering on this project.

The design and construction phase of the project, where our advice relates primarily to, started in 2012 and will be completed in 2016. A project of this scale has more than 100 consultants working across the various teams on the project. Any way you look at this project, it is large and complex.

An aerial view of the Darling Harbour Live site as it will look after redevelopment

The team

The overall AECOM team comprises of over 50 staff and includes the following disciplines:

Mechanical Engineering
Electrical Engineering
Fire Services
Fire Engineering
Specialist Lighting
Communications
Security
Dangerous Goods
Vertical Transportation
Pedestrian modelling
Environmental
Sustainability
Blast Engineering

An overall AECOM project manager is responsible for coordinating all of these services. However, individuals from each of the disciplines interact directly with the rest of the design team.

My role

My role on this project, which marks my current level after a decade, is to lead the fire engineering aspects of the design. This includes several aspects such as providing technical advice to the design team and acting as the interface with them, attending meetings regularly and corresponding by email and phone daily. I am also responsible for verifying fire engineering documentation, responding to queries and making decisions on the fire engineering strategy.

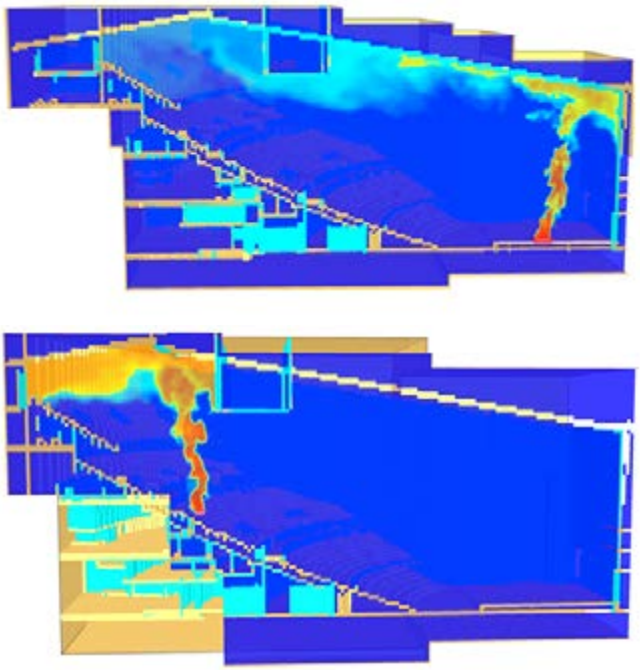
I manage the input of the other fire engineers on the project. I rarely get involved in calculations (other than particularly challenging areas) or any of the advanced computer modelling and I rarely write reports or memos, but I will often check these to ensure the consistency of advice and quality of information provided.

I am the registered Fire Safety Engineer on this project. To become registered one of the prerequisites is to achieve Chartered Engineering status, which in itself is a major milestone with an involved process (see my previous article in CATALYST).

All this happens while responding to the aspirations, constraints and challenges from each of the other disciplines within the design team.

The team's role

With a project of this scale it's not possible for all the fire engineering advice to be provided by a single person. I have been fortunate enough to have the assistance of several other very good engineers on this project. For example, a senior fire engineer managed all the advanced modelling. I was involved in setting the key parameters for the modelling, but not involved in any of the models, or their checking. The models were used to validate our earlier calculations and demonstrated that the strategy had been robustly developed.



Smoke movement within the theatre can be modelled using Computational Fluid Dynamic (CFD) computer simulation; a fire breaks out on the stage (top) or in the audience seating area (bottom).

The theatre at Darling Harbour

The fire engineering team in Sydney

The roles of the other fire engineers within the team reflect the level of experience that they have, which is how it has been for me through my career progression. It's crucial to have put in the time learning the calculations and modelling techniques so that I can effectively oversee others carrying out these tasks and can manage them effectively. Skimping on building a strong technical base will only weaken your ability to manage and control others carrying out those tasks in the future.

The next decade and beyond

I see myself as a member of Generation Y, with great ambitions and high expectations. So far, my career progression expectations have been met to this point where I am leading the fire engineering input on this significant project.

One possible direction for my own career is to manage the engineering input for multiple disciplines, not just fire engineering. I am already doing this, but only on relatively modest projects. To do this on larger and more complex projects requires me to continue to expand my knowledge of the other engineering disciplines and therefore my ability to manage multi-disciplinary projects. Whatever way I choose to progress my career will involve continuing to learn more and continually build on my skills.

Will Marshall is Australia and New Zealand Fire & Risk Group Leader, AECOM

Look here!

The Sydney International Convention, Exhibition and Entertainment Precinct:
www.siceep.com

More about the engineering project Darling Harbour Live:
www.darlingharbourlive.com.au

Will Marshall describes how he became a chartered engineer:
http://www.catalyststudent.org.uk/cs/article/83