Fire safety engineering in the third world – challenges to acceptance and growth

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The 'Third World' is a cold war-era term, representing countries which were not aligned to either the USA or USSR blocs. Today the term is used to represent relatively undeveloped and developing countries of Asia and Africa. The opinions and views expressed in this article are based on my experience in South Asia, but should, in general, be applicable to most of the 'third world' as the situation and the factors associated with fire safety engineering (FSE) are largely similar.

In 1999, Meacham[1] observed that performance-based design (PBD) or FSE was a young, growing discipline and compared it to a 'healthy adolescent'. By that analogy, it should now have grown to a fully-fledged, mature adult with a lively, vibrant family; the second generation getting ready to step out into world. We see today that FSE has gained more acceptability in the developed world over this period of time. It is also a fact that it is yet to find a foothold in most developing countries.

In a recent post[2] on a professional networking site, I compared the practice of FSE to the sport of cricket. For the benefit of those outside the Commonwealth sphere, cricket is a 'bat and ball' sport played in the UK, Australia, New Zealand, India and a handful of other commonwealth countries, which were part of the erstwhile British Empire. In spite of its limited popularity globally, as compared to a global sport like football, it has its own international tournaments (including two 'world' cups), generates tremendous revenue for its governing bodies and has its own stars and superstars, some of whom have a following and an income comparable to the best sportspersons in the world. To me, these were striking similarities with the present practice of FSE and its current sphere of influence (though I learnt later that cricket has a fan following five times that of baseball; maybe a comparison with baseball would have been more appropriate).

Well, the truth is that since its introduction approximately three decades back, FSE has gained acceptance in two, maybe three handful of countries, which include the USA, Canada, UK, Australia, New Zealand and some European countries. Practitioners of FSE are much sought after in the above countries (and outside), and are monetarily in the top bracket amongst practitioners of fire safety. A few other countries accept 'performance based' alternatives for deviations in an otherwise code based approach, typically to justify non-compliant egress designs. The rest of the world follows the prescriptive, code based approach to fire safety design.

A Fair Comparison?

It is not fair to compare a sport played for entertainment with a practice concerned with safety of people. However, the fact remains that outside the few countries where it is accepted, FSE is mostly unheard of. In the period since its inception, the scattered and feeble attempts at introducing this approach to countries outside the developed world have been met with scepticism and resistance. The reasons for this are varied, but primary among them is a strong feeling of insecurity amongst stakeholders, mainly the authorities and real estate sector, and a feeling that the knowledge and competence to apply this design approach is not available presently. There is also a belief that the FSE approach results in more expensive designs, while following code based designs is simpler and faster.

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FSE Roots

Fire safety engineering has its roots in scientific principles and fire research, while prescriptive codes are based mainly on experience. For countries which do not have the depth of scientific knowledge, and the infrastructure (and funding) to carry out fire research, it would be acceptable to base their principles of fire safety on existing codes, and modify them as required based on incidents and experiences. Change is painful and it is certainly easier to accept something which has practiced and experienced over a period of time. Especially if society feels that the practice provides a tolerable level of risk, and is willing to accept it. It must be noted for society to accept and adapt to new fire safety practices requires changing it's perception of fire risk; this occurs, unfortunately, at great cost, where nations realise that fire losses are significant enough to affect a country's economy. Fire research and development in the USA began only after the *America Burning* report was tabled. However, as long as nations feel that the fire problem is not significant, or an area of priority, no change will ever occur – which is presently the case with most third world nations.

Another important fact is that fire research is expensive, and it is no coincidence that most of the fire research is carried out in a handful of developed, affluent countries. In the past three to four decades, all research and development in areas of fire dynamics, suppression, material and people behaviour in fire (which forms the core of the FSE approach), has taken place in these countries. It is almost unthinkable for third world countries to invest in fire research, as they grapple with more pressing issues which demand urgent attention (and funds).

Most of the FSE knowledge comes in the form of graduate or post-graduate studies (or specialised short term courses) offered, again, in the same few countries mentioned earlier. Very few graduates from the third world are fortunate enough to get the opportunity (and funds) to gain knowledge through these courses. However, once they do, they are hard-pressed to find acceptance of their knowledge and skills in their native lands. Most opt to move to developed countries where FSE is accepted, and where their knowledge can get just returns. In effect, core FSE literacy does not spread beyond the present boundaries.

Fire safety engineering knowledge has deepened with new research and development, and its acceptance has increased in the countries where it was given a chance. Therefore, we can say that FSE roots now run deep, but unless the seeds scatter, and a healthy diaspora thrive, its influence and, more importantly, its benefits, will remain limited to these few countries.

Key Stakeholder Perspectives

Developers, fire services and engineering design houses are the key stakeholders in the fire safety design process and unless their perspectives and concerns are appreciated and addressed appropriately, acceptance of FSE is not possible. Construction projects being time sensitive, developers are comfortable with design teams and approval systems that are quick and well understood. At the present, the time, effort and cost required for an FSE design and approval are not clear. Also, the legislative framework in these countries does not encourage, and in many cases, does not allow an FSE approach.

As far as fire services in third world countries are concerned, the present reluctance to accept FSE stems from a lack of core fire engineering knowledge. The higher education/training system for the fire services in these countries were developed decades ago, in many cases by colonial rulers.

Unfortunately, issues related fire safety and fire services have been largely ignored by these countries and consequently, these courses have not evolved over time to reflect important changes and developments in fire behaviour, firefighting and fire engineering. Fire service training institutions, functioning directly under the government, are generally poorly funded, and have in fact depreciated due to a lack of support over the years.

Basic fire engineering knowledge, important for fire services to understand concepts and practices related to FSE, is therefore missing from fire service courses. This leads to a feeling of scepticism and wariness when faced with an FSE option. More often than not, the reaction is to recommend a prescriptive based approach, with which they feel confident about.

On the design and engineering side too, the vast majority of professionals involved are exposed to and experienced with code-based design. The concept of CPD is not yet prevalent in such countries, and even when the few opportunities to upgrade their FSE knowledge do materialise in the form of short-term specialised courses, they are prohibitively expensive. As mentioned earlier, a lucky few who have obtained fire engineering qualification in developed countries have the knowledge necessary for performance based design. But there are no opportunities to apply this in a code based environment and they remain largely an ineffective minority. Many developing

countries being reservoirs for IT workers, there are also people who have the skills and resources required for modelling services to support FSE, however they are forced to seek business overseas in view of the limited opportunities available in such countries.

A Silver Lining?

Even with the present situation, there is reason for some hope. In the past two decades, developing countries, considered insignificant, have become important drivers of the global economy now while the developed world has struggled to come out of financially sluggish scenario. This has been possible due to a large (and young) workforce, a varied economy (comprising both service and manufacturing sectors) and large internal consumption capacity. It also resulted in major changes in these countries – rapid urbanisation and industrialisation being key features (not all of it well planned though)[4].

Ambitious plans have therefore been put forward to make these cities better, more efficient and 'smarter' in all ways possible. This huge infrastructure growth requires fire safety inputs, and provides an opportunity for FSE to gain a foothold.

This is especially true where new building designs may be unique and not strictly meet code requirements; hence some engineering analysis may be required to prove their equivalence to codes. These typically apply to smoke control systems or egress arrangements provided in large buildings, places of assembly, etc, where code provisions may not be entirely met; it provides a window of opportunity to FSE to provide equivalence and prove its utility. This is already visible in places like the Middle East, which typically have code-based regimes, but do accept engineering analysis for the above mentioned aspects of design. Even within developing countries, certain jurisdictions do have knowledgeable and forward looking officials who agree to look at and understand FSE alternatives. This acceptance means that authorities do agree on its relevance and functionality. Further growth and acceptance of FSE, however, depends on how legislation and competence related to FSE are developed here.

Way Forward…

The fundamental knowledge underlying FSE is critical, life-saving knowledge, accumulated and systematised over the past two to three decades. The fact is, however, that its tenets also find application in a code-based environment; it helps to understand and appreciate the underlying concepts behind many code provisions, which are mostly not known in developing countries. Therefore, it is only fair that critical aspects of FSE knowledge be passed on in suitable form to the developing and underdeveloped world.

Raising Fire Safety Awareness

It must be understood that for FSE to gain acceptance in the third world, the basic issue of fire safety itself must be sufficiently highlighted for these societies and countries to appreciate the severe level of risk posed by fire. In spite of fire death rates as high as four to five deaths per 100,000 population[6] (most developing countries having a comparable figure of <1.0), and tremendous loss of property (amongst the top ten risks identified for industries), the issue of fire safety itself is never discussed or deliberated upon in these countries. This could be an 'out of sight, out of mind' phenomenon, because fire incidents do not get adequate media coverage or other factors such as an 'optimism bias' (it will not happen to me) or even a belief in 'karma'.

Changing public perception of fire risk requires altering the normal human response to circumstances that pose the potential for harm, with the intention of altering some aspects of their knowledge, attitudes, and/or behaviour in a beneficial way. While the state has the primary responsibility, the media, and specifically, professional bodies and industry organisations (related to fire safety) and NGOs, can play an important role as well. Bodies such as the IFE and SFPE have the professional reach and respect to influence key stakeholders, and bring about this change. It may not be immediately possible, but the efforts need to be made right away.

Positioning Fire Safety Engineering

Resistance to FSE acceptance is borne out of the feeling that it is a highly technical and complicated process (true to an extent), compared to a traditional prescriptive approach. Feeling amongst fire service professionals is that it challenges their practical wisdom with theoretical calculations and research data. Seasoned fire officers are reluctant to interact with young FSE/modelling professionals who are armed with new fire-related knowledge and skills, which show their own experience in a poor light.

It has to be conveyed that homes and buildings and the fires that affect them have not remained the same since the introduction of building codes, and new materials and changes in design and construction techniques are posing new challenges to firefighters and fire safety professionals, while codes cannot be reviewed and revised quickly

enough to reflect incidents and experiences. Fire safety engineering allows tapping into the now substantial body of knowledge and data acquired from fire research to bring about much required changes in codes and provide solutions where codes fail to do so. This has been aptly brought out by Bullock, Monaghan [7] in their article where they also point out the need for fire engineers 'to understand what codes are saying effectively in engineering terms and to understand flaws that are not scientifically based'.

For FSE to find acceptance, therefore, it needs to be projected as a more friendly practice. Wisdom lies in convincing other nations that FSE is not a threat to their existing fire safety wisdom, but important complementary knowledge that can help better understand, support and improve their own fire safety codes. For it to find acceptance, FSE needs to be positioned not as an adversary, but as a knowledgeable partner to code-based design.

Developing Competence

Fire services and engineering/design professionals are two key stakeholders who need to be introduced to FSE fundamentals. As pointed out in the referred article [7], Law and Beever summarised 'that code provisions are considered biblical (without any need for justification), while FSE based solutions need to undergo a high level of scrutiny for consideration'. This arises due to the lack of knowledge and confidence on FSE concepts and practices, as compared to an established comfort with codes. While there is inherent resistance to change, fire services in all developed countries have gone through this metamorphosis. For e.g., in the UK, legislation in the 90s introduced a risk-based approach to fire safety, which required fire service personnel to necessarily upgrade their knowledge beyond firefighting and building codes. This led to many fire officers undertaking specific training and even higher education related fire engineering courses to meet new professional demands, and FPE graduates getting employed by the fire services[2].

Fire safety engineering fundamentals can be passed on through targeted training of such professionals. Tailoring training courses to local educational and competence level is important, as also is the need to make this training affordable. It must be noted that professional organisations charge lower membership fees from developing and underdeveloped countries, the same principle should also be applied to training. Leading educational institutions offering fire engineering courses need to build bridges with third world countries, and look at the possibility of offering relevant higher education courses in these countries.

Research organisations related to fire safety could consider opening facilities in such countries to foster local talent, and develop interest in this field[2].

Contributing to Legislation

In most third world countries, legislation does not allow a FSE approach; this can be attributed to the various factors cited earlier. While the factors need to be addressed, legislation needs to change to give FSE a chance. This can only be achieved by a combined effort of competent fire professionals within the respective country and professional organisations such as the IFE. Political will is driven by society's perception of issues, and addressing the above factors should pave the way for future change.

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