

GRENFELL TOWER FIRE = A LOOK INTO THE ASPECTS OF “MINIMUM REQUIREMENTS” “RISK” AND “MODERN TECHNOLOGY” (BIM)

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ABSTRACT

The Grenfell Tower fire resulted in the loss of 72 people. The series of events that led to this tragedy must be scrutinised by the construction industry beyond the level of the currently ongoing public inquiry

The tower had recently undergone a £8.700.000 ‘revamp,’ with the addition of a new cladding system, which, at our current understanding, seems to have allowed the fire to spread with such catastrophic consequences.

A proper Disaster Risk Management framework was, and still is, nonexistent in respect to Grenfell Tower and possible many other tall Tennant’s buildings with similar vulnerabilities.

The de-centralisation and privatisation of key aspects of control and supervision of safety in buildings has been implemented by the neo-liberal policies by both Labour and Conservative governments over the past 30 to 40 years. Due to this event, a series of questions have been raised regarding the choice of materials, the detailing, the certification, the policies and regulations within the industry. It will start by exploring and contrast aspects of the established “**minimum requirement**” strategy employed by many Developers and designers, the **Risk** aspects encountered in the process of design, construction and use of the buildings and infrastructure; plus the possibilities of using **modern digital technology** to aid the design, construction and occupation process from a **Risk management framework** perspective.

What lessons can be learnt in terms of professional development and ethics for such a tragic chain of circumstances to be avoided in the future?

Keywords: BIM, Construction Industry, Digital technology, Minimal requirements, profits, risk,

INTRODUCTION

This essay aims to start the process of finding answers to the challenging aspects of **Ethics in Construction** that are posed by the Grenfell Tower Disaster (14 June 2017). Three aspects of the Design and Construction Process that encounter Ethical challenges. That is, a look into the aspects of “minimum requirements” “risk” and “modern technology”. The aim of the research is to use the Grenfell Tower fire as a case study to examine and highlight ethical issues that arise from a tragedy of this scale that could have been avoided. The complex nature of the construction process and the crossover between the disciplines makes it difficult to allocate direct professional liability.

Therefore, this tragic event must be viewed as “the before and after” of a chapter in the serious study of the conflict between public interest and profitable enterprise.

Minimal requirements

The Hackitt's Report includes a serious criticism (indictment) to the past and present "culture issue across the sector" caused by Ignorance, Indifference, Lack of clarity on roles and responsibilities and inadequate regulatory oversight and enforcement tools. (A personal View from Dame Judith Hackitt. Forewords to **Building a Safer Future- Independent Review of Building Regulations and Fire Safety. Final Report**. 23 May 2018 Published by Ministry of Housing Communities & Local government. Quoted from here as "**Hackitt Report 2018**")

The Police technical report* catalogue and the expert witnesses reports by **Dr Barbara Lane** and **Jose Torero** reconstructed the most likely way in which the fire spread through the building, and presents a series of damning shortcomings in the choice of design, materials, detailing, installations, system, etc.. (**Dr Barbara Lane's Expert Report. April 12, 2018**).

The initial fire in the kitchen of flat 16, 4th floor most likely affected the uPVC jamb and sills of the kitchen window and fire leaked out into the new combustible cladding installed two years earlier. (**Professor José L. Torero Expert Report. May 23, 2018**).

Risk Management

Aspects of risk were not fully understood by the different actors involved with the Grenfell Tower project, or perhaps they simply chose to flaunt and ignore those risks in pursuit of profit as the Hackitt Report 2018 indicate. (**Hackitt Report 2018, p3**).

So appalling was the response by the authorities to the post-disaster phase of the Grenfell Tower Fire, that Kensington and Chelsea council was relieved of responsibility for taking care of the survivors of the Grenfell Tower on 19 June 2017, and then the **Kensington and Chelsea Tenant Management Organization** was also dismissed on 27 September 2017. (Harriet Agerholm, The Independent, 27 September 2017).

In term of urban resilience, a Disaster Risk Management framework was nonexistent at Grenfell Tower. **Mitigation** and **Preparedness** were foreign concepts to the Council Authorities and the **Kensington and Chelsea Tenant Management Organization**, who repeatedly dismissed both important technical and social concern, by the local occupants of Grenfell Tower. (**Hackitt Report 2018, p8**).

A formal **Risk Management Framework** as post disaster strategy indicates the need of a coordinated **Response Phase** followed by a **Recovery Phase** and a **Reconstruction Phase**. (Abbas, et al 2013, p3). Most worryingly in this case, the lack of awareness by local and governmental authorities of the scope and seriousness of the tragedy was not apparent during and immediately after the tragedy.

THE TECHNOLOGY ASPECTS

The **Hackitt Report 2018** refers to the ways in which modern technology can be used in construction and criticizes the construction industry for its lack of effort in adopting it. In addition, the report calls on the construction sector to adopt the rapid development of digital tools in the new projects during the design, construction and occupation phases of developments, to improve the robustness of the Fire and Emergency response when needed.

The Hackitt Report request the need of a compulsory **Digital record and a Fire and Emergency File** (Hackitt Report 2018, P36, Table 3, Chapter 2).

The Building life cycle is further assured by the recommendations suggested to Occupation and Maintenance aspects, *“to strengthen resident collaboration and partnership with duty holders in order to resolve issues”*. ((Hackitt report 2018. Page 51, 3.8, Chapter 3).

Developers have been encouraged to operate by doing the absolute minimum to meet regulation standards in their projects, by monetary pressure and/or the government re-writing or the abolishing of regulations.

Using advanced Design and Management tools, this trend can be reverse and a positive outcome by incorporating a **Risk Management Framework** within the system can help the Procurement, Design, Construction and Occupation of buildings and infrastructural projects. The Digital record and the Fire and Emergency File can be part of this process.

Our Proposal is of integrating Risk and safety to BIM-like tools used in design and construction of projects.

RESEARCH AIMS & METHODOLOGY

To understand the competing interest in Land Use when building urban resilience.

The purpose of this section is to clarify the methodological framework used to conduct this research.

The questions that this research will attempt to examine relate to what went wrong with the procurement procedure and initiate a critical view to issues of Risk, redundancy, and application of modern Digital technology to a Risk Management framework.

It asks if the current state of Building Regulations, the testing of standards, the use of Design and Build and other types of contract are up to the job they were design to accomplish.

How could a £8.7m public sector refurbishment have resulted in the building becoming more unsafe and unfit for purpose?

What lessons can be learn in terms of professional development and ethics for such a disaster to be avoided in the future?

Do any of the above questions imply unethical construction practices in the name of profit are endemic in the UK construction Industry? What impact do Government decisions and policies on the quality of private and social housing have? To what extent does the government have a duty of care about these issues? If Yes, How this can be reconcile with the Neo-liberal policies government of last 40 years are pursuing?

To what extent have the neo-liberal thinking made our work more dangerous and “fracture critically designed “as put by Thomas Fisher in his book “Designing to Avoid Disasters” (Fisher, T. 2013). Should the emphasis be placed on designing to avoid disasters?

All this led to the initial question: What lessons can be learnt in terms of professional development and ethics for such a tragic event (Grenfell Tower Fire) to be avoided in the future?

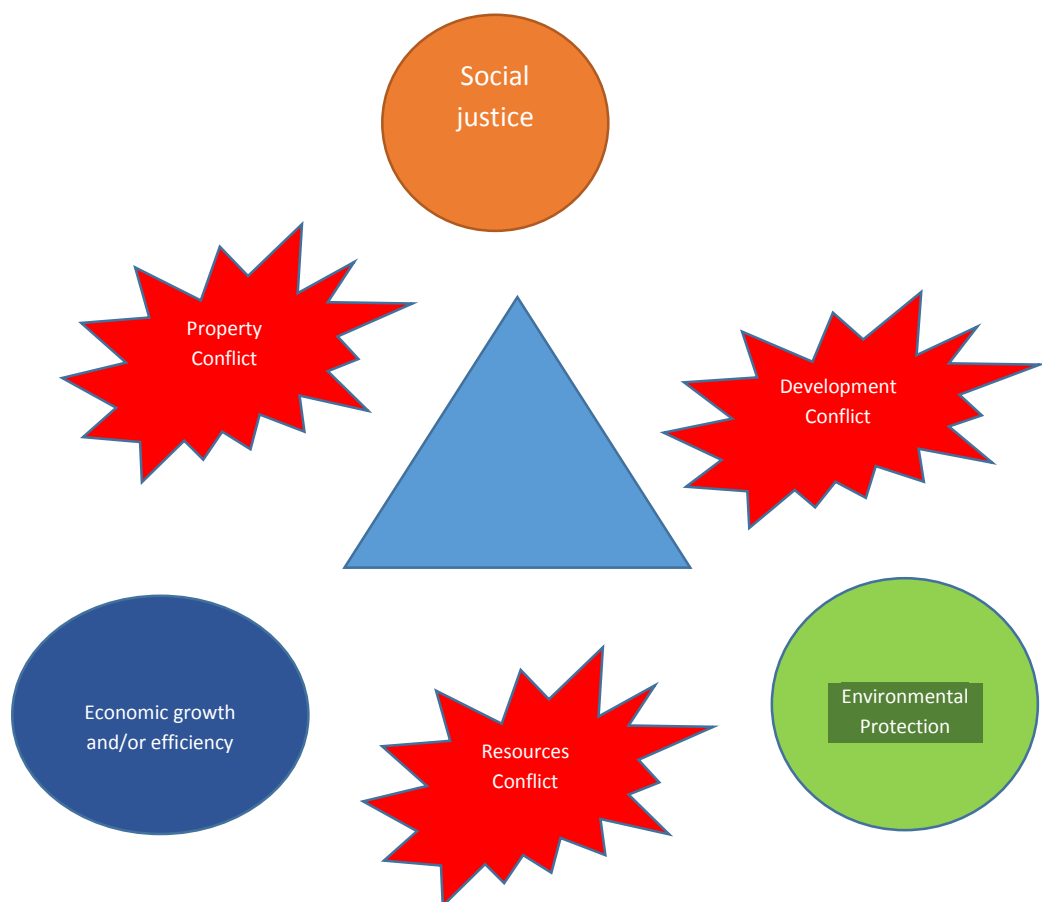
This methodology approach will examine on the one hand how the competing interests in land (resources) use process intrinsically contain the seed of conflict (see Infogram 1).

The construction industry is out of touch with the safe provision of risk and liability, by flaunting the use of building standards. The use of the regulations as "minimal requirement" as the investigation into the causes of the fire at Grenfell Tower is demonstrating. .

How systems should be tested and certified to guarantee quality and safety? Professional consultants and contractors are expected to behave with integrity and reasonable care, the liability in terms of quality will depend on the procurement method.

In one hand, as the Grenfell Tower procurement process is scrutinized, and new hard answers are found; the construction industry will change in important ways. On the other hand, it is key to also examine the UK government decisions and policies on housing and building regulations and look at how privatization of certifying bodies may have had an impact on the unfit for purpose delivery of the project.

Once this process of investigation is applied to the Grenfell Tower renovation works, the ethical consequences and conclusions can be analyzed, and technological suggestions can be presented that could potentially help to prevent another tragedy occurring. A new set of robust set of guidance will see the light to critically benefit the production of good and safe buildings.



Infogram 1; Competing interests in land use. Used to shows the Economic, Social and Environmental factors at play in governance approach to urban policy development and planning. (Jha, Abhas Kumar, Zuzana Stanton-Geddes, and Todd W. Miner. 2013. *Building Urban Resilience: Principles, Tools and Practice*. Washington, D.C.: World Bank.p33)

COMPETING INTERESTS IN LAND USE

It is recognized that in the case of Grenfell Tower, a conflict has existed between Grenfell Tower residents and The Borough of Kensington and Chelsea and its **Kensington and Chelsea Tenant Management Organization** for several years. The underpinning of this conflict is the Local community finding itself unable to participate in Local decisions regarding modernization of their homes and area, plus the competing pressure of Modern gentrification of sectors neighboring the Estate. These factors put the local inhabitants in a situation of great disfranchisement.

The complains of local activists regarding health and safety issues were disregarded. The new additions to the building were felt by many to be a cheap dressing up of the building to produce the beautification of the area in benefit of richer adjacent neighborhoods. The non-existent checks of fire and emergency safety indicate a conflict between in one hand the social and environmental aspects and on the other hand the economic aspects seen by the local authority as primordial.

ETHICS AND MINIMAL REQUIREMENTS IN PRACTICE

“Every aspect of fire safety in Grenfell Tower failed long before 14 June 2017, the leader of the Fire Brigades Union (FBU) told delegates at the annual TUC conference in Manchester ...” (TUC 18: Fire Safety 10 Sept 2018).

THE HACKITT REPORT 2018: The Hackitt report include a serious criticism to the past and present “culture issue across the sector” caused by Ignorance, Indifference, Lack of clarity on roles and responsibilities and Inadequate regulatory oversight and enforcement tools. (A personal View from Dame Judith Hackitt. Forewords to **Building a Safer Future-Independent Review of Building Regulations and Fire Safety. Final Report.** May 2018 Published by Ministry of Housing Communities & Local government. Quoted from here as **“Hackitt Report 2018”**). There is an unhealthy relationship between the Construction Industry and the establishment, in encouraging a culture of “minimum requirements” to permeate the construction process and avoiding dealing with the issues of Risk, uncertainty and redundancy, rather than committing all effort to an optimal construction and engineering design.



1. Figure1. Window internal new uPVC elements



Figure 2: The origin of the fire in Flat 16, 4th floor + fast vertical spread of the flames

The Police technical report* catalogue and the expert witnesses reports by **Dr Barbara Lane** and **Professor Jose Torero** reconstructed the most likely form in which the fire spread through the building and presents a series of damning shortcomings in the choice of design, materials, detailing, etc. of the refurbishment work performed at Grenfell Tower.

(* The police technical report disappeared from public view some months ago, but its findings are being used by other witnesses' reports)

Most of materials used in the new work carried out were combustible, (figure 1) therefore the egress and ingress of fire were facilitated by the removal of old windows, the installation of new windows shifted out some 185mm from the center-position of the old windows and the use of uPVC materials elements to fill the gaps produced by the new installations. (**Dr Barbara Lane's Expert Report. April 12, 2018**). The initial fire in the kitchen of flat 16, 4th floor affected the jamb and cills of the kitchen window and flames leaked out to the new combustible cladding. The fire rapidly spread vertically aided by the cavity between the insulation (Celotex RS5000) attached to the old concrete structure and the aluminum and polyethylene core composite material (ACM) Rainobond PE rainscreen. (**Prof. Jose Torero's Expert Report. May 23, 2018**).

Omnis Exteriors Director declared to The Guardian Newspaper that the company that refurbished the Grenfell tower asked them to supply Rainobond PE which is £2 per sq metre cheaper than Rainobond FR, a fire-retardant alternative panel which contains a mineral core. (Davies, Rob, Kate Connolly, and Ian Sample. 2017. "Cladding for Grenfell Tower Was Cheaper, More Flammable Option." (The Guardian. June 16, 2017.) The material originally requested by 4Architects submission to the council was Rainobond FR, the fire-proof variety.

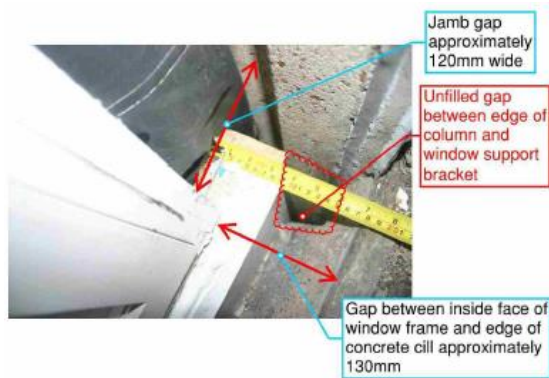


Figure 3: Gaps filled with Insulation and uPVC elements

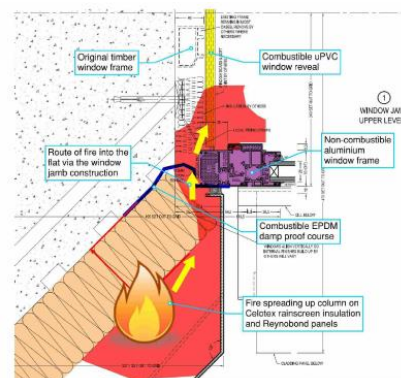


Figure 4: Ingress of fire to apartments

CLADDING AND WINDOWS DETAILS; as seen in Figures 3 & 4 details, the design and workmanship of the installation of the new windows attached this time to the external cladding rather than to the old concrete fabric of the building was to create the combustible gap filled with combustible uPVC elements (Figures 1 & 5). These gaps in the fabric of the building, plus the design and materials of the curtain walling provides ideal conditions for fire and smoke to egress into the cladding and ingress back into de cellular spaces (flats) many times until most of the building was consumed killing 72 tenants.

FIREDOORS DETAILS: One of the unresolved mysteries is the fast spread of smoke and flames through the building bypassing two or three fire barriers; the exterior windows, the fire-rated entrance flat doors and the stairs fire doors.

EXITS AND ESCAPE ROUTES: One line of enquiry in the investigation process of Grenfell Tower fire is related to the two central aspects of cellular containment to the spread of fire that did not performed as envisage. Namely the failure of windows and fire doors to contain the spread of fire, inability to contain the toxic gases produced by combustion. The stair well was provide with positive air pressure to avoid smoke entering the space even when a fire door to stairs remained open. The work for that smoke extraction system was done before the refurbishment.

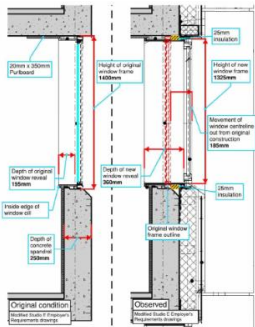


Figure 5 Window installation, old in Black & New in Red, shifted 185mm on to the new Cladding.



Figure 6: Damaged or missing flat door

RESCUE EFFORTS: The inability for people to escape due to the inexplicable rapid spread of smoke and flames through 2 or 3 fire doors. The “stay put” instructions that at first were the right strategy in normal conditions, where fire-walls and fire doors would have performed as intended. The narrowness of stair wells of about 900mm width, and the non-existent rescue plan for disabled people from top floors conspired to create a “CASCADE” disaster, one which is compounded by several failures in chain (figures 7 & 8). According with test performed after the tragedy, the Grenfell Tower apartment main doors proved not to comply with the 30 minutes fire rating. The doors were replaces few years before. As consequence of this test, many thousands of door of similar characteristics will need to be remove for high-rise building elsewhere in the Country.

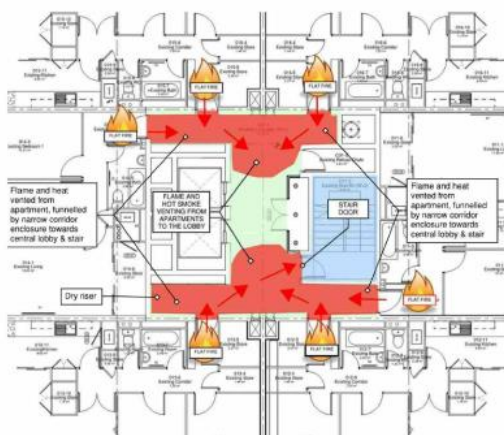


Figure 7 Compartmentation failure of the central corridor, stair well and lifts

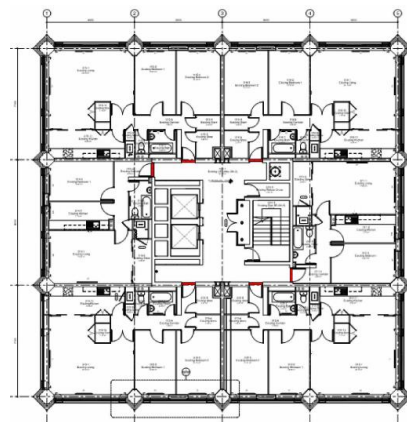


Figure 8 : Entrance to flats fire-doors in red

ETHICS AND RISK

RISK, UNCERTAINTY AND REDUNDANCY

QUALITY, RISK MANAGEMENT AND SAFETY, SOCIAL INCLUSION: In the case of Grenfell Tower, contractual aspects are discussed in the other Twin Paper (Grenfell Tower fire: the importance of ethics and professionalism for the procurement of safe buildings and infrastructure in the construction industry. Voutsadakis. Gonzalez 2018). As urban Planning in poor areas set minimum critical needs as objectives of any project, there is always the need for redundancy and alternatives. These redundancies are increase by the size and complexity of big project. The most worryingly aspect is the lack of understanding of the tragedy shown by local and governmental authorities, as it was apparent during and immediately after the tragedy. A normal **Risk Management Framework** a post disaster strategy indicates the need of a coordinated Response Phase followed by a Recovery Phase and a Reconstruction Phase. Kensington and Chelsea council was relieve of responsibility for taking care of the survivors of the Grenfell Tower disaster on 18 June 2017 after severe incompetence in their planning of remedial assistance to survivors of the disaster.(MacAskill, The Guardian 18 June 2017).

Soon after Robert Black Chief executive of **Kensington and Chelsea Tenant Management Organization** was forced to resign to “concentrate on assisting with the investigation and inquiry” (**Grierson, Jamie, and Haroon Siddique**, The Guardian 30 June 2017). Then the management team itself , the **Kensington and Chelsea Tenant Management Organization** was also dismissed on 27 September 2017.(Harriet Agerholm, The Independent, 27 September 2017).

INDUSTRIALIST’ LOBBY: The fact that the Construction industry and principally manufacturers of materials used in new buildings has been actively lobbying to reduce the impact of new legislation restricting or banning the type of material used at Grenfell Tower. Press reports indicate that Director of Kingspan, Manufacturers of part of the insulation used at Grenfell Tower, gave speech opposing plans by government to ban combustible products from new tower blocks. (Gerad Tubb, Sky News, 19 June 2018)

SILENCING VICTIMS – A COMMON OCCURRENCE: Famously for example, Barratt Homes has for long time, incorporated all minimal requisites and conform to BRs to their house design processes. Where regulations do not exist, the quality of materials and craftsmanship dropped to the lowest level permitted. Most cases of bad workmanship and materials are silenced by gaging orders and contractual obligations imposed to new buyers. “Silencing those who have reason to complain will make it more likely to push down standards in the industry rather than pushing them up” (Ruddick, Graham. 2017 The Guardian. February 16, 2017.)

We need to add that the phenomena mentioned by the “Introduction and personal view of the Author of Hackitt Report” support the view that some of the corporate actions regarding Quality, Risk Management and Safety, Social Inclusion (as they are acting on behalf of the community at large) has been replaced by greed, criminal negligence, and corruption.

ETHICS AND TECHNOLOGY

DEVELOPMENT OF BIM: Developing of BIM–like technology and Risk clash- detection system build-in the new digital era is viable way forward in developing robust new safety framework. BIM as a system to design construct and use of buildings and infrastructure should incorporate a Disaster Risk Management Frame work tools to deal with Uncertainty from day one of the project.

As developers are technically able to incorporate calculation of minimal requirements to some projects (mainly housing) there is the opportunity to reverse the trend. The application can be reversed to a more positive use or outcome building up redundancy as a good approach to the equation of Risk against uncertainty.

The incorporation of a standard Fire and Emergency File to be integral part of the BIM process and initiated by Client, Principal Designer, Principal contractor and finally by the building owner. For an outline of the content of the File, please refer to Appendix D ; Outline of the Fire an Emergency File in Hackitt Report, p132

Conclusion

This essay is an attempt to start the process of finding answers to the challenging aspects of **Ethics in Construction**. It begins by exploring and contrasting aspects of the established “**minimum requirement**” strategy of many Developers and designers, the **Risk** aspects encountered in the process of design, construction and use of the buildings and infrastructure; plus the possibilities of using **modern digital technology** to aid the design, construction and occupation process from a **Risk management framework** perspective.

There is the need to support all effort towards a more robust solution to uncertainty and risk not previously encountered. It is needed of a more flexible approach to the solution of constructional problems, not committing large efforts to an infrastructure that could become soon obsolete.

The risk of disasters or crisis is highly uncertain, therefore, there exists a need to build in some redundancy, to help the difficulties of not knowing the entire unknown risk not yet encountered. To better manage these unknowns, the use of digital technology widely available and in constant development could provide an affordable, robust and safe solution.

The assurances that after the long process of proposal, design construction and occupancy, it will be possible to plot the history of the development with all the aspects of risk, fire and emergency or other risk factors be available to the users, being them the tenants, owners or members of the Public services (Fire, Police, ambulance).

The incorporation of a standard Fire and Emergency File to be integral part of the BIM process and initiated by Client, Principal Designer, Principal contractor and finally by the building owner would be an acceptable route to take after Grenfell Tower disaster.

The Hackitt Report ask in Appendix E (p134) aspect of competence, continuing Professional Development etc. to be taken by Professional Bodies within the Construction Industry. In particular ask Professional institutions, Engineering, Architecture, Building Control Inspections and many others to collaborate with improved competence;

The fact that the repercussions and changes within the Construction Industry will also affect the academic world. Aspect of superior quality testing, risk management and its contents of mitigation, preparedness etc. need to be included at Technical institutions. They will need to be studied in the context of the new ethics of a flexible and dynamic outlook to build resilience further than the mere “minimum requirement”.

END

REFERENCES; BOOKS

Fisher, Thomas. 2013. *Designing to Avoid Disaster: The Nature of Fracture-Critical Design*. Routledge.

Jha, Abhas Kumar, Zuzana Stanton-Geddes, and Todd W. Miner. 2013. *Building Urban Resilience: Principles, Tools and Practice*. Washington, D.C.: World Bank.

Aldrich, D 2012. *Building Resilience: social capital in post-disaster recovery*. The University of Chicago Press. Chicago London

REFERENCES; WEB

"Professor Luke Bisby's Expert Report." April 2, 2018. Accessed October 21, 2018. <https://www.grenfelltowerinquiry.org.uk/evidence/professor-luke-bisbys-expert-report>.

"Professor Jose Torero's Expert Report." May 23, 2018. Accessed October 21, 2018. <https://www.grenfelltowerinquiry.org.uk/evidence/professor-jose-torero-expert-report>.

"Dr Barbara Lane's Expert Report." April 12, 2018. Accessed October 21, 2018. <https://www.grenfelltowerinquiry.org.uk/evidence/dr-barbara-lanes-expert-report>.

Ministry of Housing, and J. Hackitt. "Independent Review of Building Regulations and Fire Safety: Final Report." GOV.UK. May 17, 2018. Accessed October 21, 2018. <https://www.gov.uk/government/publications/independent-review-of-building-regulations-and-fire-safety-final-report>.

MacAskill, Ewen. "Council Sidelined in Grenfell Tower Response as Leader Refuses to Quit." The Guardian. June 18, 2017. Accessed October 21, 2018. <https://www.theguardian.com/uk-news/2017/jun/18/council-leader-nick-paget-brown-grenfell-tower-response>.

Harriet Agerholm @HarrietAgerholm. "Kensington and Chelsea Council Has Just Terminated Its Contract with Grenfell Tower's Landlord." The Independent. September 27, 2017. Accessed October 21, 2018. <https://www.independent.co.uk/news/uk/home-news/grenfell-tower-council-ends-contract-landlord-chelsea-tenant-management-a7971001.html>.

Grierson, Jamie, and Haroon Siddique. "Grenfell Tower Management Company Chief Quits 'to Focus on Inquiry'." The Guardian. June 30, 2017. Accessed October 21, 2018. <https://www.theguardian.com/uk-news/2017/jun/30/grenfell-tower-management-chief-quits-to-focus-on-inquiry-robert-black-kensington>.

Davies, Rob, Kate Connolly, and Ian Sample. 2017. "Cladding for Grenfell Tower Was Cheaper, More Flammable Option." The Guardian. Guardian News and Media. June 16, 2017. <https://www.theguardian.com/uk-news/2017/jun/16/manufacture-of-cladding-on-grenfell-tower-identified-as-omnis-exterior>.

MacAskill, Ewen. "Council Sidelined in Grenfell Tower Response as Leader Refuses to Quit." The Guardian. June 18, 2017. Accessed October 21, 2018. <https://www.theguardian.com/uk-news/2017/jun/18/council-leader-nick-paget-brown-grenfell-tower-response>.

Ruddick, Graham. 2017. "New Home Owners Gagged over Poor Build and Compensation Claims." The Guardian. Guardian News and Media. February 16, 2017. <https://www.theguardian.com/business/2017/feb/16/new-home-owners-gagged-over-poor-build-and-compensation-claims>.

"TUC 18: Fire Safety Failed at Grenfell Tower Long before Fire Broke Out." n.d. TUC 18: Fire Safety Failed at Grenfell Tower Long before Fire Broke out | Fire Brigades Union. Accessed October 21, 2018. <https://www.fbu.org.uk/news/2018/09/10/tuc-18-fire-safety-failed-grenfell-tower-long-before-fire-broke-out>.

MacHarriet Agerholm @HarrietAgerholm. "Kensington and Chelsea Council Has Just Terminated Its Contract with Grenfell Tower's Landlord." The Independent. September 27, 2017. Accessed October 21, 2018.

<https://www.independent.co.uk/news/uk/home-news/grenfell-tower-council-ends-contract-landlord-chelsea-tenant-management-a7971001.html>

<http://documents.worldbank.org/curated/en/320741468036883799/Building-urban-resilience-principles-tools-and-practice>

<https://www.centreforsocialjustice.org.uk/core/wp-content/uploads/2018/07/CSJ6364-Social-Housing-and-Employment-Report-180706-WEB.pdf>

Tubb, Gerard. 2018. "Warning against Combustible Insulation Ban." Sky News. June 19, 2018. <https://news.sky.com/story/warning-against-combustible-insulation-ban-11410241>.

"Grenfell Tower fire: the importance of ethics and professionalism for the procurement of safe buildings and infrastructure in the construction industry". Voutsadakis. Gonzalez 2018

The thoughts and ideas put here in this essay are part of a twin papers effort by E Voutsadakis and C Gonzalez, in which there are parallels areas and alternated areas within the issues of ethics in the Construction industry. CPG + EV