

## Engineering Ethics: When Buildings Fail

*Overview, Background Resources and Materials Needed*

Key Stage / Year	KS4 (Years 10-11)
Subject Area	Design & Technology
Keywords	Engineering ethics, cladding, flammability, chimney effect, compartmentation, facade, duty of care, systemic failure, cost-cutting, regulatory failure
Duration	50 minutes

### EDJ Connection

Start with the engineering, not the horror	The lesson focuses on material properties, design decisions, and systemic failures before addressing human impact. The engineering analysis is the learning vehicle.
Honour lived experience	Residents warnings are presented as valid evidence that was ignored. Their knowledge of their own buildings is treated as legitimate and important.
Situate events in social and structural context	Both fires are examined as systemic failures shaped by cost-cutting, regulatory weakness, and power imbalances rather than isolated accidents.
Emphasise justice, not just memory	The ethical principles explored (duty of care, accountability, honesty) are linked to ongoing reforms and students own future professional practice.
Support emotional safety and dialogue	Sensitivity guidance is provided. Focus is on engineering lessons, not graphic detail. Students may opt out. Pastoral referral routes are signposted.

### Lesson Context

On 14<sup>th</sup> June 2017, a fire at Grenfell Tower in North Kensington, London, killed 72 people. The fire spread catastrophically due to combustibile ACM cladding fitted during a 2012-16 refurbishment. The Grenfell Tower Inquiry final report (published September 2024) found decades of failure by central government, regulators, and the construction industry, including systematic dishonesty by cladding and insulation manufacturers.

On 26<sup>th</sup> November 2025, fire engulfed seven of eight 31-storey towers at Wang Fuk Court in Tai Po, Hong Kong, killing 168 people. The buildings were undergoing facade renovation; non-compliant scaffolding netting and expanded polystyrene foam boards over windows acted as fuel, creating a chimney effect strikingly similar to Grenfell. Investigations have revealed cost-cutting, falsified safety certificates, and ignored resident warnings.

This lesson uses both fires as comparative case studies to explore engineering ethics: how material selection, cost-cutting, and regulatory failures can have fatal consequences, and what ethical responsibilities engineers, designers, manufacturers, and regulators bear.

## Lesson Overview

Students learn the key facts of both disasters, focusing on how flammable exterior materials, cost-cutting, and ignored warnings contributed to each. Through a brief comparison activity, they identify the pattern of failure common to both cases. The main focus of the lesson is on engineering ethics: students engage with core principles (duty of care, honesty, accountability, whistleblowing) and write an evaluative paragraph applying these to the evidence.

## Big Questions

- What ethical responsibilities do engineers and designers have when selecting materials for buildings?
- What structural and material similarities connect two fires separated by eight years and 9,600 kilometres?
- Who bears responsibility when systemic failures lead to loss of life: the manufacturer, the designer, the regulator, or the government?

## Learning Objectives

- Describe the key facts and timelines of the Grenfell Tower and Wang Fuk Court fires.
- Compare the common factors across both disasters: flammable exterior materials, cost-cutting, ignored warnings, and regulatory failures.
- Evaluate the ethical responsibilities of engineers, designers, manufacturers, and regulators, and apply this understanding to their own design practice.

## Background reading for teachers before lesson

- Grenfell Tower Inquiry – Phase 2 Report: Executive Summary (September 2024). The official final report of the public inquiry. Covers decades of government, regulatory and industry failure, and the "systematic dishonesty" of cladding and insulation manufacturers. <https://www.gov.uk/government/publications/publication-of-the-grenfell-tower-inquiry-phase-2-report>
- "How the products used in Grenfell Tower's cladding system were tested and sold", Inside Housing (2020). Detailed investigative journalism on the ACM panels and Celotex insulation — how internal warnings were suppressed, fire tests were manipulated, and cheaper combustible products were marketed for high-rise use. <https://www.insidehousing.co.uk/insight/how-the-products-used-in-grenfell-towers-cladding-system-were-tested-and-sold-70011>
- "Tai Po fire timeline: Wang Fuk Court's HK\$330 million renovation, ignored warnings and aftermath", Hong Kong Free Press (17 December 2025). Independent journalism tracing the renovation project from 2016 through to the fire, including alleged bid-rigging, resident complaints to multiple government departments, and the arrests of contractor and consultancy directors. <https://hongkongfp.com/2025/12/17/tai-po-fire-timeline-wang-fuk-courts-hk330-million-renovation-ignored-warnings-and-aftermath/>
- "Hong Kong's Wang Fuk Court fire and the global lessons for high-rise safety", International Fire & Safety Journal (5 December 2025). Technical analysis drawing on

NFPA's Fire & Life Safety Ecosystem framework. Compares the systemic failures at Wang Fuk Court with those at Grenfell and explains how multiple weaknesses aligned catastrophically. <https://internationalfireandsafetyjournal.com/wang-fuk-court-fire-lessons/>

- **Statement of Ethical Principles (2017 revision)**, Royal Academy of Engineering & Engineering Council. The UK profession's foundational ethical framework, organised around four principles: accuracy and rigour, honesty and integrity, respect for life/law/public good, and responsible leadership. Short, accessible, and directly relevant to a UK engineering or design curriculum. <https://www.engc.org.uk/resources-and-guidance/guidance-for-the-profession/ethical-principles>
- **Professional Code of Conduct for Designers (2020, revised 2022)**, International Council of Design (ICoD). The international standard for professional design ethics. Covers honesty, integrity, responsibility to humanity, advocacy and education, and the duty to consider the social, cultural, environmental and safety impacts of design decisions throughout a product's life cycle. <https://www.theicod.org/resources/Professional-Code-of-Conduct/professional-conduct>

## Safeguarding and trauma-informed approach

- Avoid graphic detail and distressing imagery; focus on engineering analysis, material properties, and ethical principles.
- Provide advance warning about lesson content. Allow students to step out if distressed.
- Be mindful of students who may live in tower blocks, social housing, or buildings undergoing renovation.
- Direct students to pastoral support where appropriate.

## Glossary

Engineering ethics	The moral principles that govern the professional conduct of engineers, including responsibility for public safety, honesty in testing, and accountability for design decisions.
Cladding	Material applied to the exterior of a building, typically for insulation and weatherproofing. ACM cladding has aluminium sheets sandwiching a core that may be combustible (e.g. polyethylene).
Compartmentation	A fire safety strategy that divides a building into enclosed sections (compartments) to prevent fire from spreading between them.
Chimney effect	The tendency of hot air and fire to rise rapidly through a vertical channel (e.g. an air cavity behind cladding, or scaffolding), drawing oxygen from below and accelerating flames.
Duty of care	A legal and ethical obligation to ensure that products and buildings do not pose an unreasonable risk of harm to users or occupants.
Systemic failure	A failure caused by multiple interconnected problems within a system (regulation, industry, management) rather than a single isolated error.

## Whistleblowing

Reporting unsafe or unethical practices to an authority or the public, often at personal risk, in order to prevent harm.

## Materials

- Lesson slide deck (PowerPoint): Engineering Ethics - When Buildings Fail (10 slides with speaker notes).
- Student Activity Sheet (printed A3 or A4): Case study summaries, comparison table, Venn diagram, evaluative writing task, and reflection (3 pages).
- Sticky notes or scrap paper for exit tickets.
- Highlighters and writing materials.

## Learning plan

### Opening (0-5 minutes)

Greet students and provide a brief sensitivity note: the lesson covers real events in which people lost their lives; the focus is on engineering analysis and ethics. Display the title slide. Ask the opening question: "What do you think an engineer's most important responsibility is?" Take 2-3 responses. Display Slide 2 and read through the learning objectives. [Slides 1-2]

### Case Studies: Grenfell Tower and Wang Fuk Court (5-17 minutes)

Present both case studies in sequence, keeping each to around 6 minutes of teacher input. For Grenfell (Slide 3), cover: 24-storey tower; combustible cladding added during refurbishment; fire spread via the chimney effect; 72 killed; cost-cutting on materials; warnings ignored. For Wang Fuk Court (Slide 4), cover: eight 31-storey towers wrapped in scaffolding; non-compliant netting and foam boards over windows; fire spread via the same chimney effect; 168 killed; cost-cutting on netting; residents demonstrated the danger months earlier and were dismissed.

The Activity Sheet provides a factual summary for each case so students can follow along without needing to copy down all details. Keep teacher narration focused on the what and why of material failure rather than graphic detail. Check for understanding: "Can you already see a similarity between the two?" [Slides 3-4; Activity Sheet, Task 1]

### Comparison (17-23 minutes)

Display Slide 5 (comparison table) and Slide 6 (five structural similarities). Walk through the key parallels briefly: flammable exterior materials, chimney effect, fire entering through windows, cost-cutting over safety, and ignored warnings. Ask: "Which similarity do you think is the most significant and why?" Students can begin completing Task 2 (comparison table) and Task 3 (Venn diagram) on their Activity Sheets, working in pairs. [Slides 5-6; Activity Sheet, Tasks 2-3]

### Engineering Ethics Discussion (23-33 minutes)

This is the core of the lesson. Display Slide 7 and introduce five ethical principles: duty of care, honesty and transparency, accountability, professional competence, and whistleblowing.

For each principle, give a concrete example from the case studies (e.g. manufacturers falsifying fire-safety test data as a breach of honesty; residents reporting flammable netting as attempted whistleblowing).

Facilitate a structured class discussion using the questions on the slide. Key prompts: "Who bears the most responsibility - the manufacturer, the designer, the contractor, or the regulator?" "Is following the law enough, or should engineers go beyond minimum standards?" "What would you do if your employer asked you to use a material you believed was unsafe?" Accept all reasoned answers and draw out the tension between profit, compliance, and safety. Connect to students own D&T coursework: "When you design products, what is your duty of care?" [Slide 7]

## Evaluative Writing (33-44 minutes)

Display Slide 8. Students work individually or in pairs to complete Task 4 on the Activity Sheet: an evaluative paragraph of 6-8 sentences answering the key question about engineering ethics and responsibility, drawing on evidence from both case studies. Sentence starters and connectives are provided on the sheet for scaffolding. Circulate, prompt, and differentiate: support students who need it with verbal prompts; challenge stronger students to consider multiple perspectives and link to their own coursework. [Slide 8; Activity Sheet, Task 4]

## Plenary (44-50 minutes)

Display Slide 9. Read through the key takeaways. Ask 2-3 students to share one sentence from their evaluative paragraph. Introduce the exit ticket: "If you were an engineer asked to use a material you believed was unsafe, what would you do and why?" Give students 2 minutes to write a response on a sticky note. Collect as formative assessment. End with a calm reflection and signpost pastoral support. [Slide 9]

## Extension Activities or Homework

- **Option 1 (15-20 mins):** Research the Lakanal House fire (2009) or the Lacrosse Building fire, Melbourne (2014). Write 200-300 words connecting it to the lessons from the Grenfell and Wang Fuk Court case studies.
- **Option 2 (15 mins):** Write a design specification for a hypothetical building renovation project that prioritises fire safety. Reference at least three lessons learned from the two case studies.
- **Option 3 (10 mins):** Read the Engineering Council UK Statement of Ethical Principles. Identify three principles and explain how each was violated in the Grenfell or Wang Fuk Court cases.

## Appendix. National Curriculum Connections

### Design & Technology (KS4) - selected connections

- AQA 3.1.1 Core technical principles: understanding the working properties of materials, including their response to fire.

- AQA 3.1.6 Specialist knowledge: ethical considerations in design; the impact of design decisions on end users and the wider world.
- AQA 3.2.1 Designing skills: investigation and analysis of existing products, systems, and failures.
- OCR J310 Section 1.5: Safe working practices, sustainability, and the impact of design decisions on the environment and society.
- Edexcel 1DT0 Topic 1.8: Investigation using primary and secondary sources; ethical, social, economic, and environmental issues.

## Cross-curricular connections

- **Science:** material properties, combustion, polymers, thermal conductivity.
- **Citizenship:** social responsibility, governance, the role of public inquiries, accountability.
- **Geography:** urbanisation, housing inequality, the built environment.

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