

Learning Lessons from Historical Case Studies: Information Sources & Higher Education

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Access to Information is the Key

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Historical case studies to construction failures **MUST** be in the curriculum because of the lessons to be learnt from them.

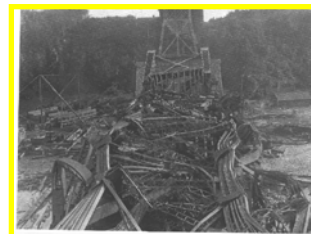
Number of modules with teaching on historical failures remain low. Why should this be so?

Could it be because of the quantity, availability and quality of source information?

The case is made for the community (how large?) to resource the set-up, the maintenance and the running of an e-library resource.



Knickerbocker theatre roof collapse, 1922



First Quebec bridge, 1907

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Warwick Module and 50+ Case Studies

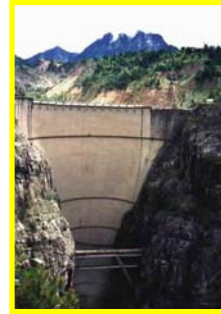
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100 year 2 students take our Forensic Engineering module (materials and structures themed).

Assignment work for 50% credit (15 CATS) is carried out in teams of five. They research to:

- write a trade magazine article in Term 1 (for 16.7% credit).
- give both oral and poster presentations in Term 2 (for 33.3% credit).

Information on >50 case studies is needed for the learning provision.



Vaiont dam, Italy 1963



Schoharie Bridge, USA 1987

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Warwick Module and 50+ Case Studies

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To deliver the 'new' module 600 hours were given to its preparation and assessment.

Majority of effort was spent (still is!) on finding and assessing information for the case studies.

But such endeavours are not commensurate with the research drivers in our Universities!

Given very positive feedback from 300 students it as been very rewarding teaching; so no regrets!



Ronan Point tower, 1968



Hyatt Regency Hotel, Kansas, 1981

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Warwick Module and 50+ Case Studies

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Presented in lectures

Case study, country (Year)	Inquiry Report	Internet (report)	Chapter in book(s)	Journal paper(s), from 1969
Comet aircraft, UK (1952-1954)	x	✓ (✓)	✓	✓
Vaiont Dam, Italy (1963)	x	x	✓	✓
Point Pleasant Bridge, USA (1966)	x	x	✓	✓
Ronan Point tower, UK (1968)	✓ ✓	x	✓	✓ (1)
Hyatt Regency Hotel, USA (1981)	✓ x	✓ (x)	✓	✓
Oil rig platform, the Alexander Kielland, Norway (1980)	x	✓ (x)	✓	✓
Thruway Bridge, USA (1987)	x	✓ (x)	✓	✓
Twin Towers (WTC), USA (2001)	✓ ✓	✓ (✓)	✓	✓

Key: ✓ for to be available & x for not known, the second symbol in a column is for when it can, ✓, or cannot, x, be obtained .

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Case study, country (Year) * civil engineering	Inquiry Report	Internet (report)	Chapter(s) in book(s)	Journal paper(s) from 1969	Case study, country (Year) * civil engineering	Inquiry Report	Internet (report)	Chapter(s) in book(s)	Journal paper(s) from 1969
Tay bridge, Scotland (1879) *	✓ x	x	✓	✓	Hartford Arena, USA (1978) *	x	x	✓	✓
San Francisco Earthquake, USA (1906) *	x	x	✓	✓	Kemper Arena, USA (1979) *	x	x	✓	✓
Quebec Bridges, Canada (1st) 1907 & (2nd) (1916) *	✓ x (1 st)	✓ (x)	✓	✓	Ocean Ranger drilling rig, Newfoundland (1982)			✓	✓
S.S Schenectady ship, USA (1943)	x	x	✓		Abbeystead valve house, UK (1984)	✓ ✓	x	✓	x
King's Bridge, Melbourne, Australia (1962) *	x	x	✓	✓	Carsington dam, UK (1984) *	x	x	✓	✓
Ferrybridge cooling towers, UK (1965) *	x	x	x	✓	Herald of Free Enterprise, Belgium (1987)	✓ ✓		✓	✓
Apollo 1 (1967)	✓ ✓	✓ (✓)	✓	✓	Clapham Junction rail crash, UK (1988) *	✓ ✓	x		
West Gate Bridge, Australia (1970) *	✓ x	✓ (x)	✓		Piper Alpha oil platform, UK (1988)	✓ ✓	✓ (x)	✓	✓
20th Commonwealth Ave., Boston, USA (1971) *	✓ x	x	✓	✓	British Midlands 737 airplane, UK (1989)	✓ ✓	✓ (✓)	✓	
Skyline Plaza apartment, USA (1973) *			✓	✓	Exxon Valdez oil tanker, Alaska (1989)	x		✓	✓
Brown's Ferry nuclear power station, USA (1975)		✓	✓	x	Marchioness sinking, London, UK (1989)	✓ ✓	✓ (✓)		x
Love Canal toxic waste, Canada (1978) *		✓ (✓)		✓	For trade magazine assignment				

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Case study, country (Year) * civil engineering	Inquiry Report	Internet (report)	Chapter(s) in book(s)	Journal paper(s) from 1969	Case study, country (Year) * civil engineering	Inquiry Report	Internet (report)	Chapter(s) in book(s)	Journal paper(s) from 1969	7
Leaning tower of Pisa, Italy (1173 to present) *		✓	✓	✓	Murrah building, USA (1995) *	✓ ✓	✓ (x)	✓	✓	✓
Flixborough chemical plant, UK, (1974)	✓ ✓	✓ (x)	✓	✓	TWA 880 airplane, USA (1996)	✓ ✓	(✓)	✓		x
Cooling tower, Willow Is., USA (1978) *	✓ ✓	✓ (✓)	✓	✓	UK railway safety and privatisation (1997 to date)	✓ ✓	✓ (✓)	✓		✓
Three Mile Island (Nuclear), USA (1979)	✓	✓ (x)	✓	✓	Concorde 203, F-BTSC, France (2000)	✓ ✓	✓ (✓)	✓		x
MV-Derbyshire bulk carrier, Sea of Japan (1980)	✓ x	✓ (✓) re-opened			International airplane safety (from 2000)	x	✓	✓ ✓		✓ ✓
Harbor Cay Condos, Florida, USA (1981) *	✓ ✓	✓ (x)		x	Millennium Bridge, London, UK (2000) *	x	✓			✓
Bhopal gas leak, India (1984)	✓ ✓	✓ (✓)	✓	✓	Columbia space shuttle, USA (2003)	✓ ✓	✓ (✓)	✓		✓
Chernobyl (also Chernobyl) (Nuclear), Ukraine (1986) *		✓	✓	✓	Boscattle flash flooding, UK (2004) *	✓ ✓	✓ (✓)			✓
Challenger space shuttle, USA (1986)	✓ ✓	✓ (✓)	✓	✓	Katrina hurricane and flooding of New Orleans, USA (2005) *		✓			✓
M/A Estonia ferry (RORO), Baltic Sea (1994)	✓ ✓	✓ (✓)	✓	✓	Buncefield oil storage depot, UK (2005)	✓ ✓	✓ (✓)	✓		
Port of Ramsgate walkway, UK (1994) *	✓ ✓	x	✓	✓	I-35W road bridge, Minneapolis, USA (2007) *	✓ to appear	✓ to appear			
Kobe earthquake, Japan (1995) *		✓	✓	✓	For oral and poster assignment					

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Need for e-library Resource

Majority of 46 case studies have an inquiry report obtained from a library. 14 are mounted on Internet, **but for how long? The report on MV-Derbyshire bulk tanker has already gone.**


If inquiry report is 'scarce' it was prepared before mid-1980s. **Is this a moving year?**

Wikipedia often has an entry; with good background information. **But not good for the engineering information we require.**

There is rapid open-access to engineering information to prominent recent failures. **Good news, and shows a policy change to satisfy public expectation. But for how long will the Internet sites be live?**



I-35W Bridge, USA, 2007
www.dot.state.mn.us/i35wbridge



Buncefield oil depot, 2005
www.buncefieldinvestigation.gov.uk



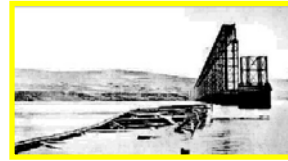
Need for e-library Resource

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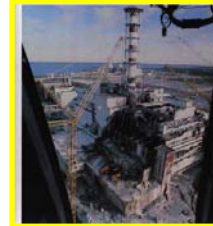
Nearly all cases have a chapter in a book, some have whole books devoted to them (including those illustrated). **Good for background, less so for educating engineers.**

Using the Engineering Village search engine the least number of publications are for cases classified as civil engineering. **Many sources are for immediate thoughts, well before the forensic engineering investigation reports. Without reading everything, it is difficult to “separate the wheat from the chaff”.**

Key publications (like the Merrison report and ICE publication *Recommendations for the inspection, maintenance and management of car park structures*) are out of print. **How long before they are forgotten?**



Tay Bridge, Scotland, 1897



Chernobyl, Ukraine, 1986

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Concluding Remarks

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Quantity, quality and accessibility of historical case study information greatly varies from one engineering sector to the next.

Possibly the weakness engineering sector is civil (**bad news!**).

We should aim to have, in five years, an e-library to store ALL forms of forensic engineering information. **Without the Internet, building a person library for teaching would be prohibitive on time.**

Such an e-resource will facilitate growth in teaching in HEIs and provide an essential information source for professionals whose work requires them to minimise the risk of mistakes being made.

Thank you for attention, and don't ever forget that **complacency** is the Achilles heel to every action a professional engineer takes.

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