

MBSA 2014 CONGRESS 014

PORT ELIZABETH, 21-23 SEPTEMBER 2014

ACCIDENTS (PREVENTING) IN CONSTRUCTION

**PRESENTED BY PROF JOHN SMALLWOOD
PROFESSOR OF CONSTRUCTION MANAGEMENT, AND
HEAD, DEPT. OF CONSTRUCTION MANAGEMENT**

john.smallwood@nmmu.ac.za

COPYRIGHT 2003 & 2014

Introduction (1)

- **According to the Construction Industry Development (cidb) (2009), during visits to 1 415 construction sites by Department of Labour (DoL) inspectors:**
 - **1 388 notices were issued:**
 - **86 (6%) improvement notices**
 - **1 015 (73%) contravention notices**
 - **287 (21%) prohibition notices**
 - **Furthermore, 52.5% of contractors were non-compliant**
- **The disabling injury frequency rate (DIIR) is a rate, per 200 000 hours worked, of disabling injuries due to all causes i.e. per 100 workers x 2 000 hrs / yr:**
 - **0.98 (cidb, 2009)**
- **Fatality rate per 100 000 workers: 25.5 (cidb, 2009)**

Introduction (2)

The presentation is based upon:

- Preventing 'Accidents' in Construction, http://www.cbe.org.za/PDF/Health_and_Safety_Preventing_Accidents_Article.pdf (requested by the Council for the Built Environment)
- Articles such as:
 - Constructing reinforced concrete frames without injury and fatality: The relationship between health and safety and quality, *The Civil Engineering and Building Contractor*, March, 1997
 - Large-scale construction accidents Is there a trend? *ProjectPro*, September, 1998
 - Slab and structural collapses can be prevented, *SA Builder / Bouer*, March, 2002
 - Construction slab collapses: Could we prevent the next one? *Safety Management*, March, 2002

Introduction (3)

- **Slab, deck, roof and ceiling collapses: Can they be prevented?** *Building Africa*, May, 2003
- **Twelve ingredients for optimum construction H&S...incident prevention,** *Safety Management*, August, 2004
- **Collapsing decks and related failures of management,** *SA Builder / Bouer*, August, 2004
- **Accidents will continue to occur in construction until ,** *Specifier*, August, 2004
- **Helicopters in Construction Health & Safety,** *ProjectPro*, May 1999
- **Helicopters and construction,** *Construction World*, May 1999

Introduction (4)

Construction H&S occurs in a macro environment:

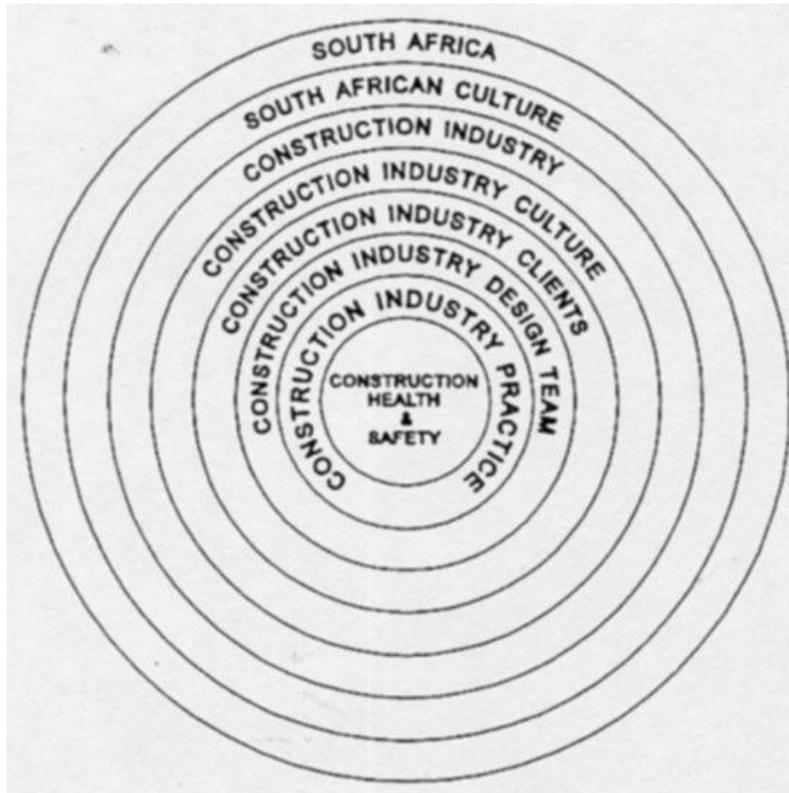
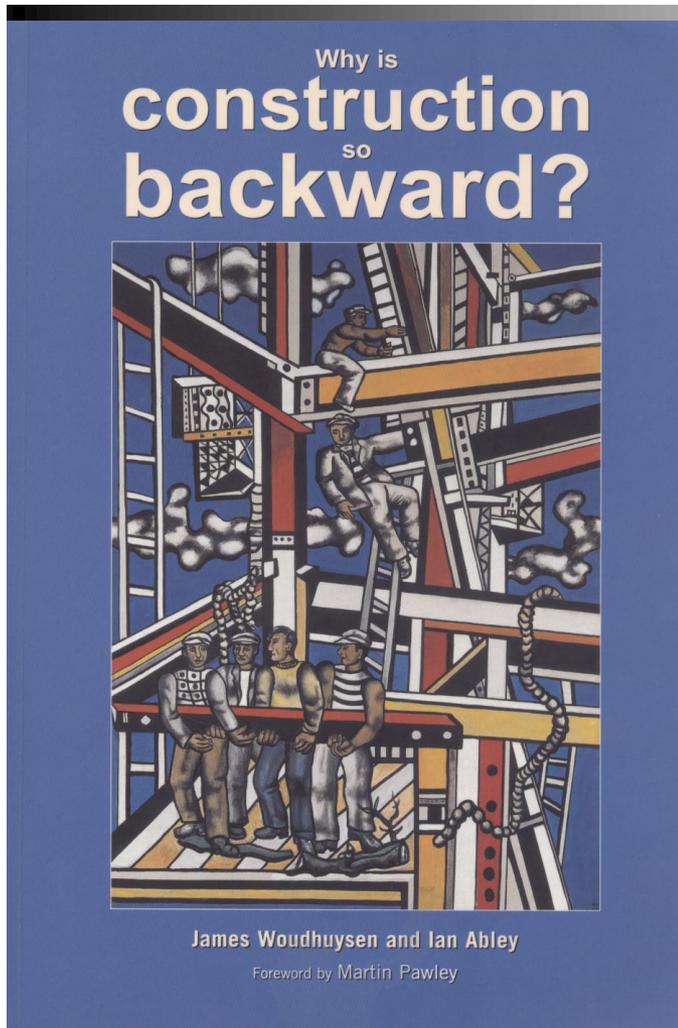


Figure 1: Construction H&S – the macro environment (Smallwood, 1995)

Why is construction so backward?



“So long as construction remains a backward industry, safety within it will be backward. So long as off-site manufacturing remains a footnote to general building, a lot of accidents are bound to happen in the hurly-burly rush to get on-site work completed on time .” (p. 43)

(Woudhuysen and Abley, 2004)

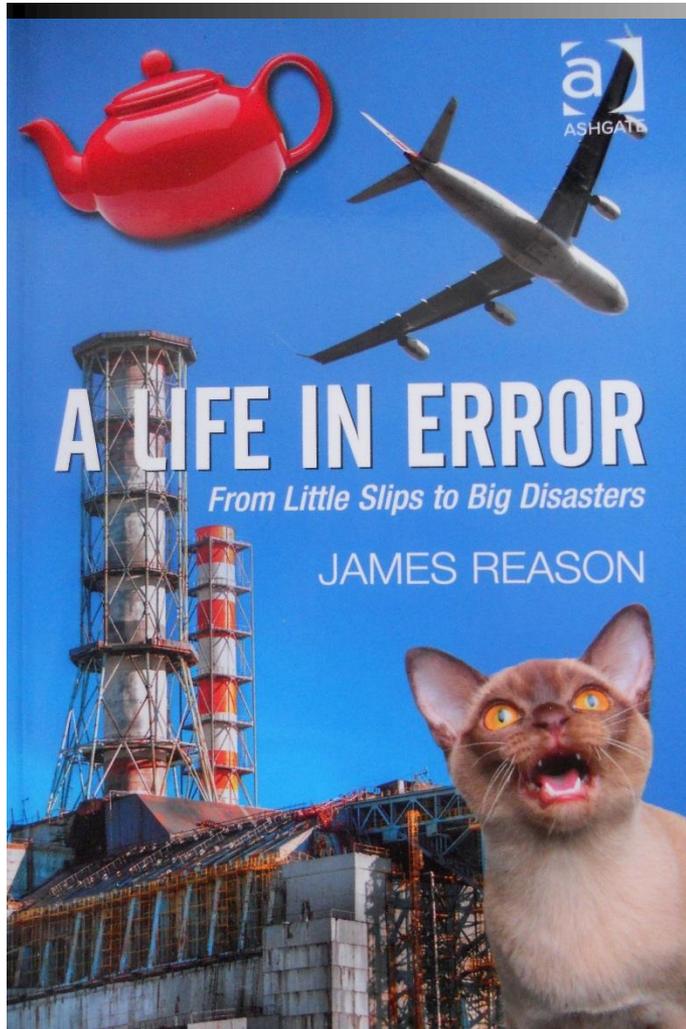
‘Failure of management’ versus ‘Accident’(1)

- **There is no such thing as an ‘accident’ (Myth)!**
- **Traditional definitions include, among other: ‘An unplanned event’**
- **Are ‘accidents’ unplanned?**
 - **Absolutely not!**
 - **Any review will indicate that they are meticulously planned by default i.e. through actions and or omissions**
- **Consequently, given that the five functions of management work are planning, organising, leading, controlling, and coordinating, then unplanned events such as ‘accidents’ = ‘failure of management’ (Reality)**
- **Philosophy and constitutes a state of mind**

‘Failure of management’ versus ‘Accident’(2)

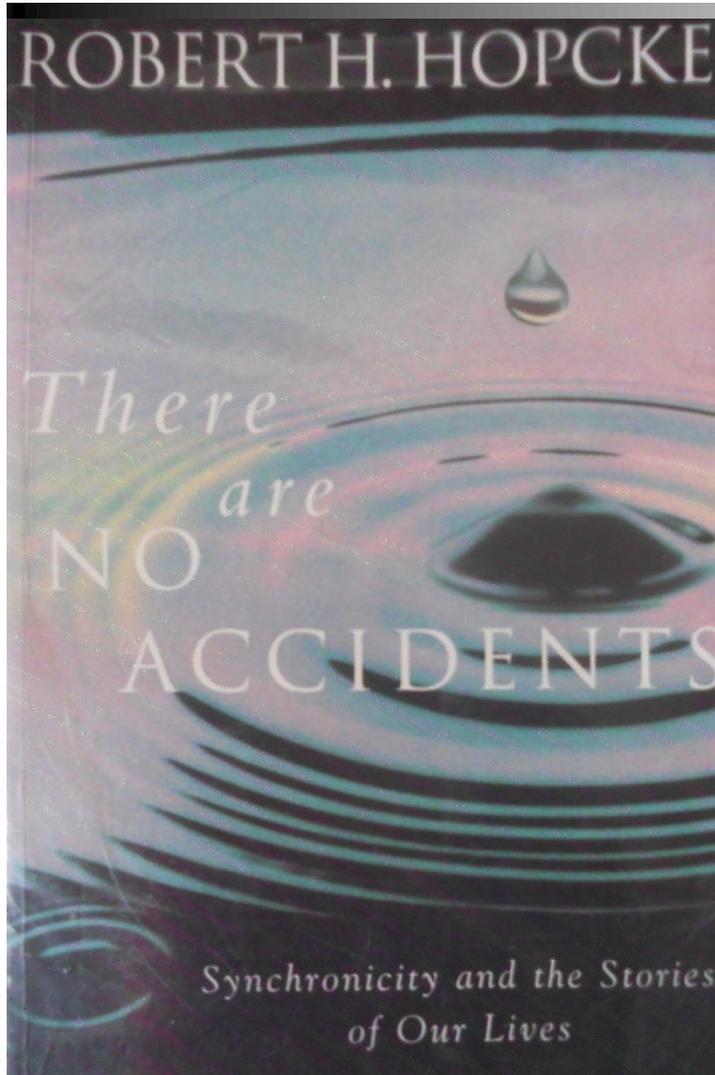
- **Management of all built environment stakeholder organisations, including client, project manager, designer, and quantity surveyor, not just contractors**

'Failure of management' versus 'Accident'(3)



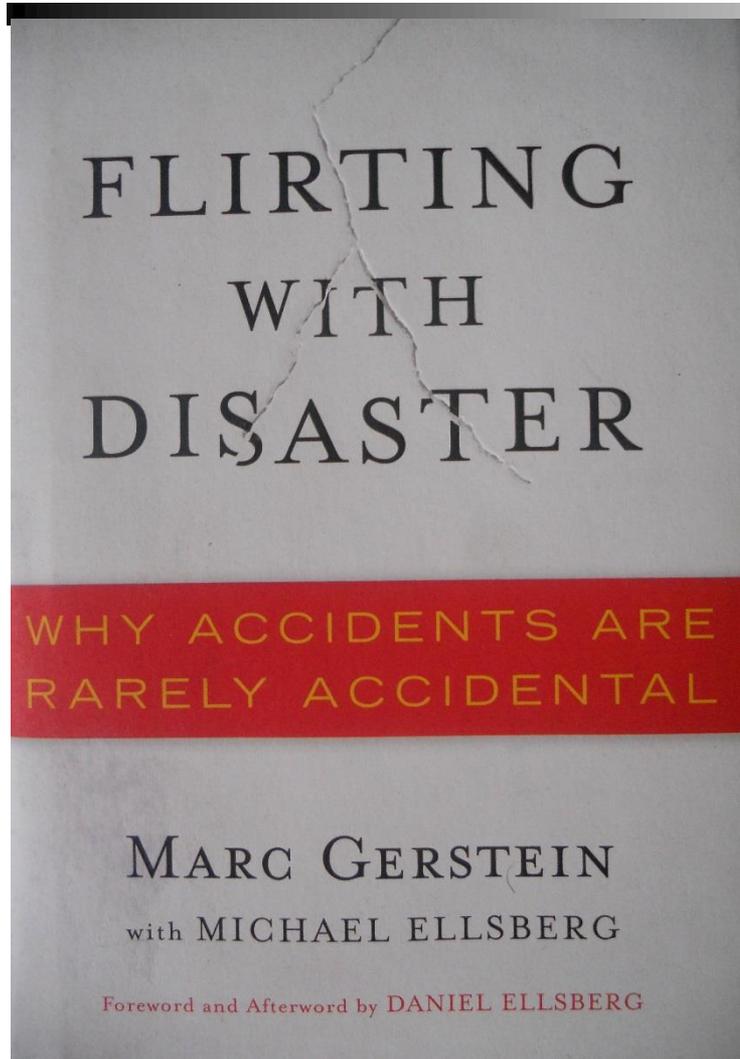
Chapter 8: Planning Failures

'Failure of management' versus 'Accident'(4)



A different kind of coincidence, a confluence of events that shakes us up. Can see and feel a significance in the randomness. Like pure chance, or just a coincidence. However, Jung refers to it as synchronicity. (p. 3)

'Failure of management' versus 'Accident'(5)



Construction is not inherently dangerous

- The myth that ‘construction is inherently dangerous’ or ‘accidents are part of the job’ implies that there is nothing that can be done to mitigate hazards and risk
- Strategies, systems, procedures, and protocol can mitigate or even eliminate hazards and risk

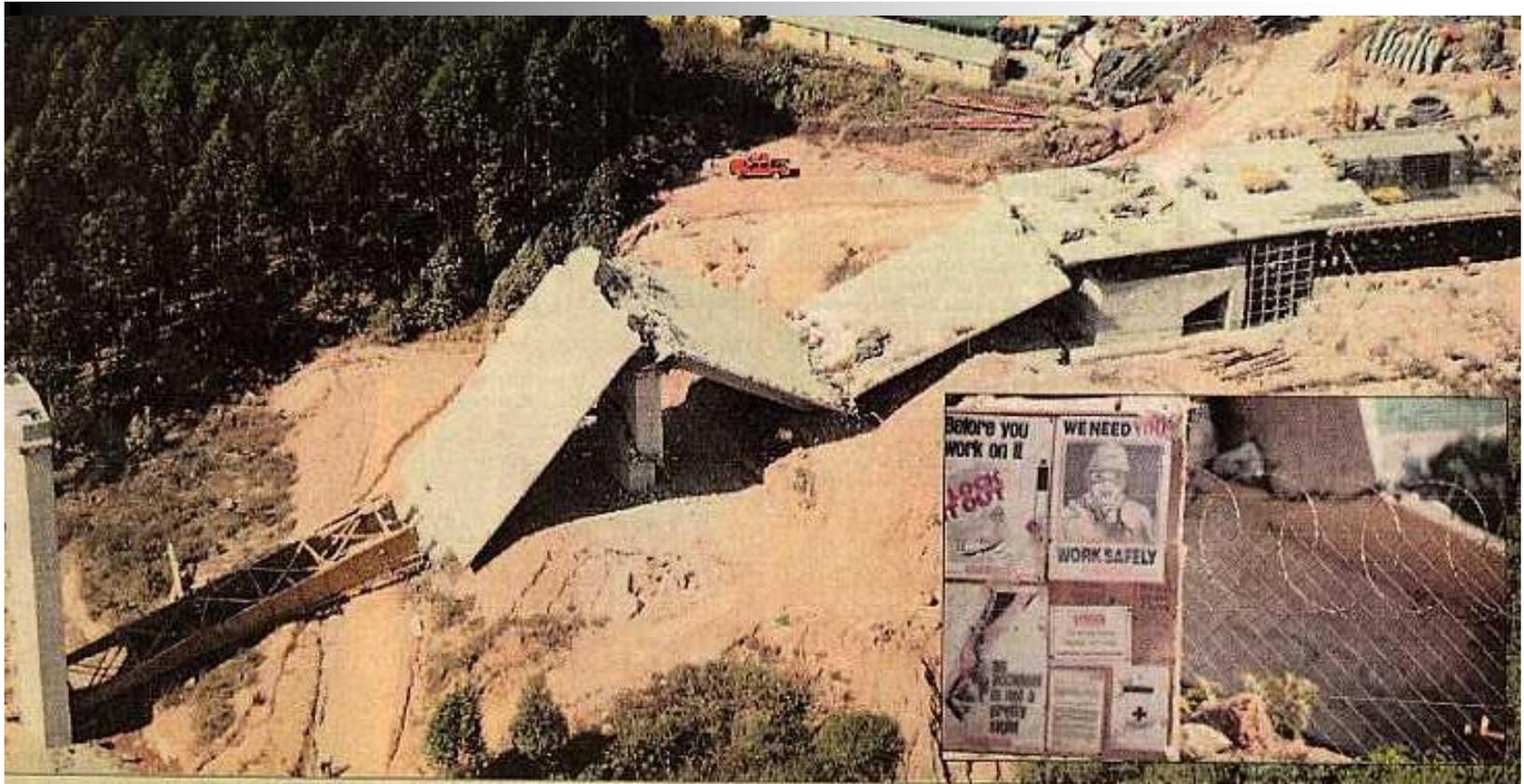
Risk management (1)

- Risk introduces potential variability in outcomes
- Risk is not complementary to the business of construction and projects
- Project risk management is 1 / 9 project management knowledge areas
- There are numerous risks in construction, H&S included
- Built environment is not renowned for risk management
- The lack of aversion to risk does not complement construction H&S
- Clients, project managers, principal agents, and construction managers especially should adopt a formal risk management process
- Quantify the risks, rank, and evolve appropriate responses where required

Risk management (2)

- Beware of 'low probability / high impact' risks e.g. Injaka Bridge

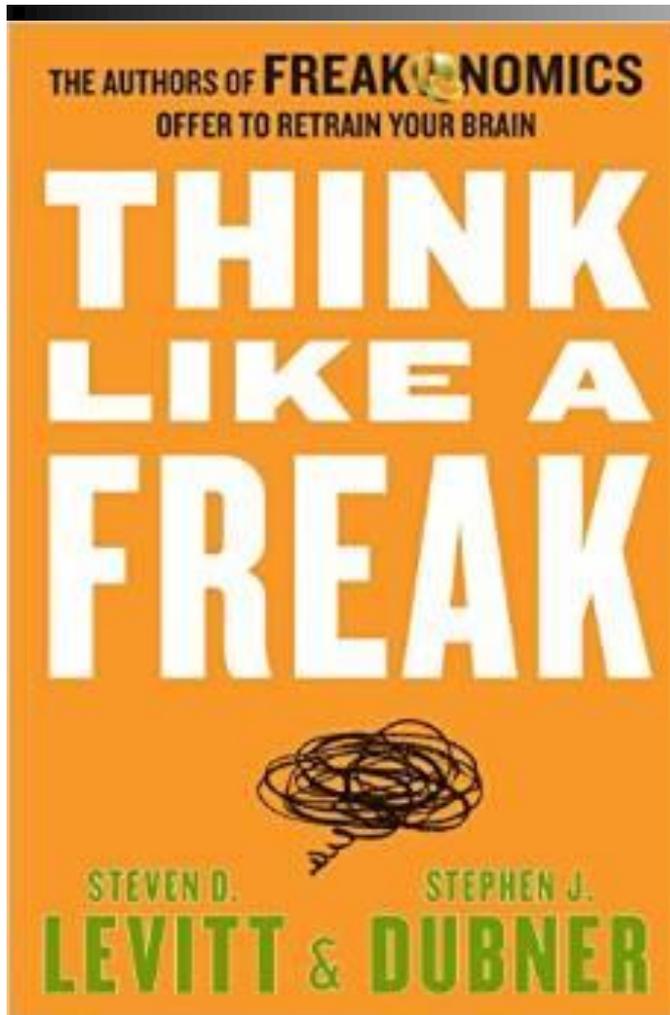
Risk management (3)



Disaster area: The construction of a road bridge near Injaka Dam turned into disaster when it collapsed, instantly killing 12 people and injuring 15. Two of the injured died later. Insert - A reminder to workers of the dangers of working on a construction site. Full update on page 2. Photographs by Raymond Travers.

Injaka Bridge collapse, Mpumalanga, July, 1998 (Travers, 1998)

Risk management (4)



Risk management (5)

Chapter 9, *Think like a freak* addresses the Challenger space shuttle (1986):

- Cold weather might damage the rubber O-rings that kept hot gases from escaping the shuttle boosters
- Morton Thiokol's senior engineer and others recommended the launch be postponed – over ruled by NASA
- Knowledgeable people forecast the exact cause of failure
- Levitt and Dubner advocate 'premortems' as opposed to 'postmortems' i.e. learn how you might fail without failing
- Premortem: Gather those involved and imagine that the project or an activity failed and require them to record the exact reasons for failure

Respect for people and ‘People are our most important resource’ (1)

- **Respect for people is the catalyst for the value ‘people are our most important resource’**
- **However, poor welfare facilities on site, among other, are not a manifestation of respect for people**
- **This value is critical as it is the catalyst for H&S culture**
- **Supervisors and workers that are exposed to hazards and risk are people that have a body, mind, and a soul. They invariably have a partner, a family and are derived from a community**
- **Such a value is the foundation for H&S and sustainability of an organisation**

Respect for people and 'People are our most important resource' (2)



**Workers change room, shower, and lockers, Max 4 project, Lund, Sweden
(Smallwood, August 2012)**

Respect for people and 'People are our most important resource' (3)



Workers' mess area, Max 4 project, Lund, Sweden (Smallwood, August 2012)

Respect for people and 'People are our most important resource' (4)



Mess facility, Sancti Spiritus, Cuba (Smallwood, 2007)

Respect for people and 'People are our most important resource' (5)



'Outdoor dining', SEP (Smallwood, 2007)

Respect for people and 'People are our most important resource' (6)



Lockers, SEP (Smallwood, 2007)

Optimum H&S culture

- **The catalyst for H&S culture is the value ‘people are our most important resource’**
- **Such a value will engender a vision of a ‘fatality, injury, and disease-free work place’**
- **Such a vision requires a complementary goal of ‘zero deviations’**
- **To realise a goal of ‘zero deviations’, requires ‘continual improvement’ – the mission**
- **A higher-level purpose is necessary for an optimum H&S culture:**
 - **‘Sustainability of the organisation’**
 - **‘Sustainability of the industry’**
 - **Needs to be a rationale for H&S endeavours when fatalities, injuries, and disease are no longer occurring**
 - **H&S is a means to the end, not an end in itself.**

Optimum status for H&S – H&S is a value not a priority

- **The passé paradigm of cost, quality, and time is a critical mind set yet to be dispensed with:**
 - Using these as the set of criteria by which projects' success is measured marginalises H&S
 - Confirms ignorance with respect to the synergistic role H&S plays in overall project performance
 - Also marginalises H&S culture
 - Reflects a lack of respect for people
- **H&S is often referred to as a priority:**
 - Priorities may change on a daily basis
 - Therefore, H&S should be a value
 - H&S must always be the first consideration and all activities must be 'structured around it'

Planning (1)

- A hallmark (should be) of the built environment and relevant to all built environment disciplines
- ‘Construction is 80% planning and 20% execution’
- ‘H&S does not happen by chance, it must be planned’
- However, many facets to ‘planning for construction H&S’:
 - Completeness of design facilitates construction planning for H&S
 - Client ‘baseline risk assessments’ [CR 5 (1) (a)]:
 - Prerequisite for preparing H&S Specifications [5 (1) (b)]
 - Design hazard identification and risk assessments (HIRAs):
 - Required to mitigate the use of hazardous materials and undertaking of hazardous processes
 - HIRAs are a prerequisite for preparing H&S Specifications and ‘designer reports for clients’ [CR 6(1) (c, d, & e), which should include residual hazards and risks i.e. those remaining after conducting HIRAs
 - Designers may also need to prepare ‘design and construction’ method statements - refer to temporary works and related interventions



Planning (2)

- Clients' requirements, a form of planning, should also be included in such H&S specification
- **Contractors' H&S Plans should respond to such H&S Specifications:**
 - Response should reflect in the tender documentation i.e. in the form of budgeting
 - Adequate financial and other resource budgeting is not facilitated by the competitive tendering system
 - Obvious solution being the inclusion of comprehensive 'H&S' preliminaries as opposed to provisional sums
- **Construction planning for H&S commences during the pre-tender stage:**
 - Followed by the pre-contract stage
 - Which provides the foundation for construction stage planning

Planning (3)

- **Pre-tender and pre-contract HIRAs, programmes, site layouts, generic method statements, and temporary works designs are obvious focus areas in terms of integrating construction H&S into the future construction process**
- **Following adjustments during the pre-contract phase the aforementioned need to translate into daily actions such as HIRAs, focused planning of construction activities, and coordination**

Planning (4)



Helicopter crash, Strand Street, Cape Town (Vosloo, 1999)

Planning (5)



Helicopter crash, Strand Street, Cape Town (Vosloo, 1999)

Planning (6)



Helicopter crash, Strand Street, Cape Town (Vosloo, 1999)

Planning (7)



FLAMES OF DEATH . . . The Russian Mi-8 helicopter crashes into the roof of Boston House in Cape Town's central business district early yesterday. A professional photographer, who had been photographing the helicopter as it loaded airconditioning equipment onto the building, ended up capturing these images of a horrific accident in which four people died. Pictures: AP

Helicopter crash, Strand Street, Cape Town (Amalgamated Press, 1999)

The six stages of projects and H&S (1)

- **Historically, construction H&S has been viewed as the contractor's problem**
- **Construction H&S is influenced during all six stages of projects by project stakeholders: project initiation and briefing; concept and feasibility; design development; tender documentation and procurement; construction documentation and management, and project close out**
 - **Project initiation and briefing - 100 storey office block**
 - **Concept - natural stone cladding**
 - **Design development - specification of materials that contain hazardous chemical substances**
 - **Tender documentation and procurement:**
 - **Facilitate financial provision for H&S?**
 - **Construction H&S is included as a criterion for selection of contractors?**

The six stages of projects and H&S (2)

- Construction documentation and management – exposure to hazardous activities including materials
- Project close out:
 - Handing over of the H&S File
 - Including as built and as laid drawings

The six stages of projects and H&S (3)



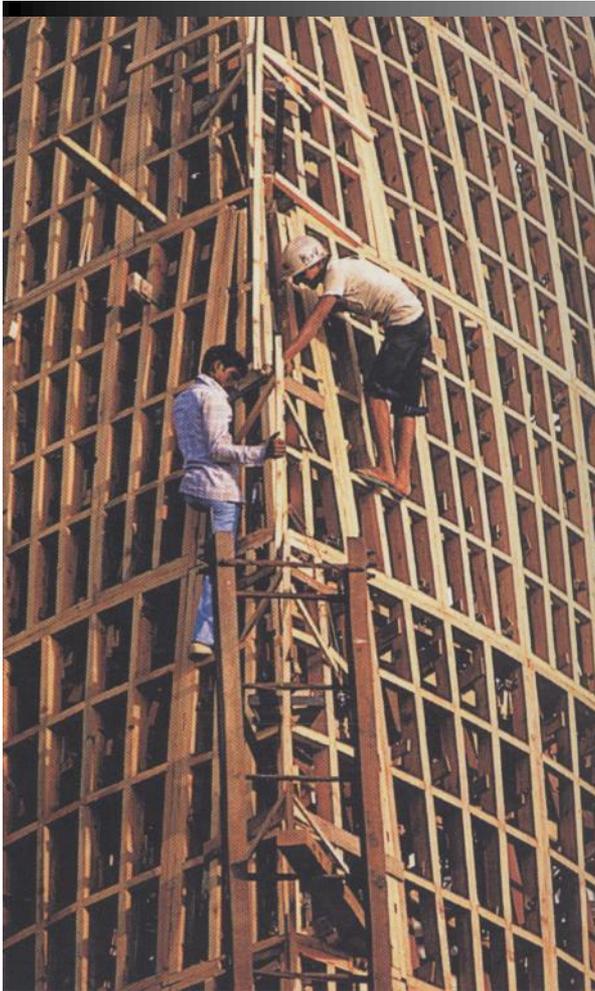
Bahia Temple, Delhi, India (Smallwood, 2005)

The six stages of projects and H&S (4)



Bahia Temple, Delhi, India (The National Spiritual Assembly of the Bahia'is of India, 2002)

The six stages of projects and H&S (5)



Bahia Temple, Delhi, India (The National Spiritual Assembly of the Bahia'is of India, 2002)

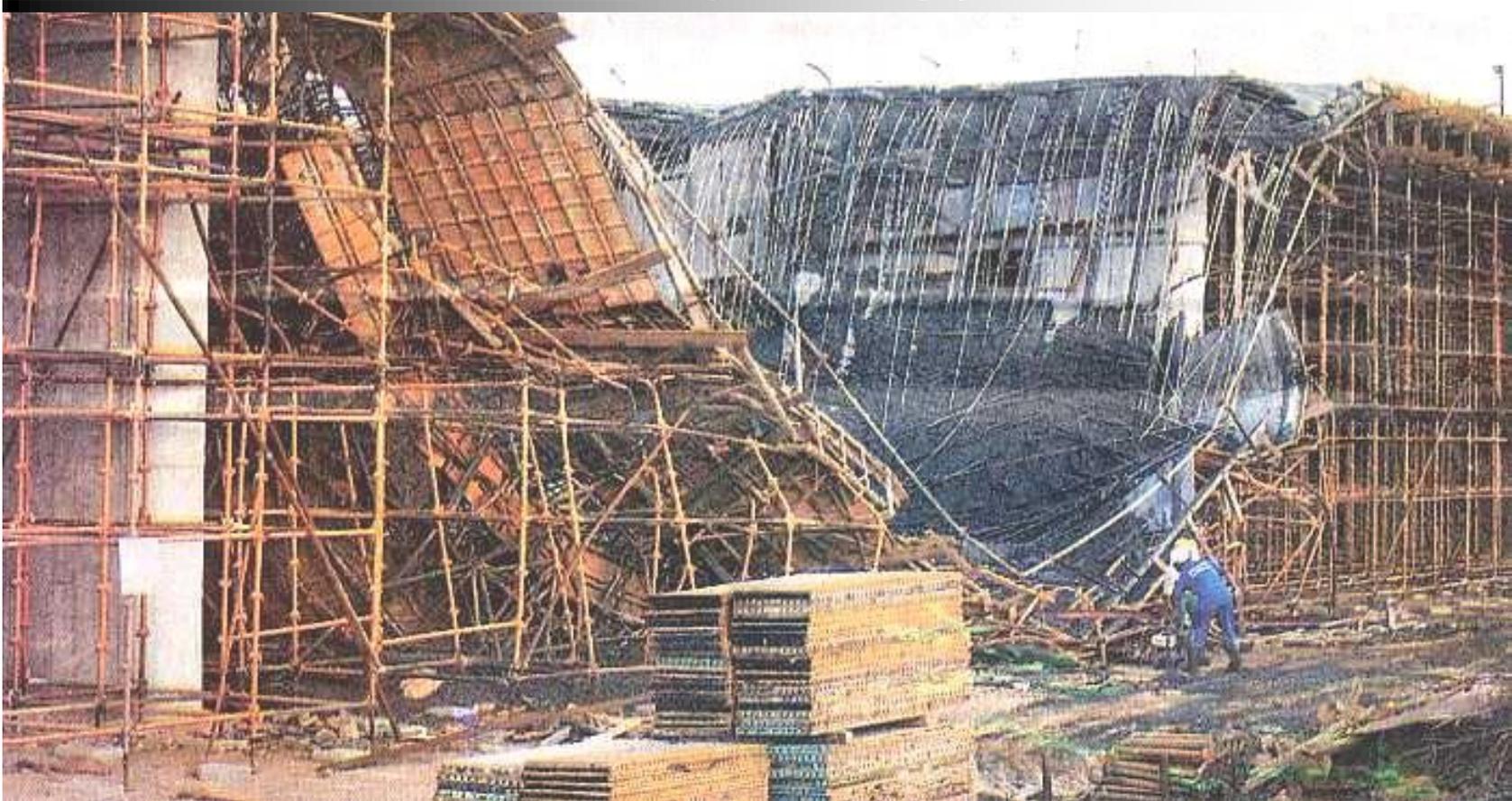
Construction is a Science, Art, and a Profession / Sound Construction Management (1)

- Management skills and the application thereof are a pre-requisite for optimum H&S
- The five functions of management work, namely planning, organising, leading, controlling, and coordinating are necessary to realise among other the development of objectives, strategies, systems, procedures, and protocol
- Management and integration of project resources (Smallwood, 2006) are also a pre-requisite for H&S
- One of the many challenges in terms of construction H&S is the limited 'barriers to entry' to the construction industry
- Construction Management programmes established at traditional universities in the 60's and 70's:
 - Result of an identified need therefore
 - The existing management with origins in other built environment disciplines and 'people from the tools' unable to effectively manage the business of construction and projects

Construction is a Science, Art, and a Profession / Sound Construction Management (1)

- Such programmes focus on three streams, namely economics, management, and science and technology - required to manage the business of construction and projects, construction H&S included
- **Every profession, including Construction Management, makes use of a common vocabulary:**
 - Not as per Slide 41 'Scaffolding Safe For Use'
 - It was allegedly support work not scaffolding

Construction is a Science, Art, and a Profession / Sound Construction Management (2)



Coega Bridge collapse, Port Elizabeth, November, 2003 (Markman, 2003)

Construction is a Science, Art, and a Profession / Sound Construction Management (3)



Coega Bridge collapse, Port Elizabeth, November, 2003 (Markman, 2003)

Construction is a Science, Art, and a Profession / Sound Construction Management (4)



Stellenbosch Collapse (Anonymous, June 2008)

Construction is a Science, Art, and a Profession / Sound Construction Management (5)



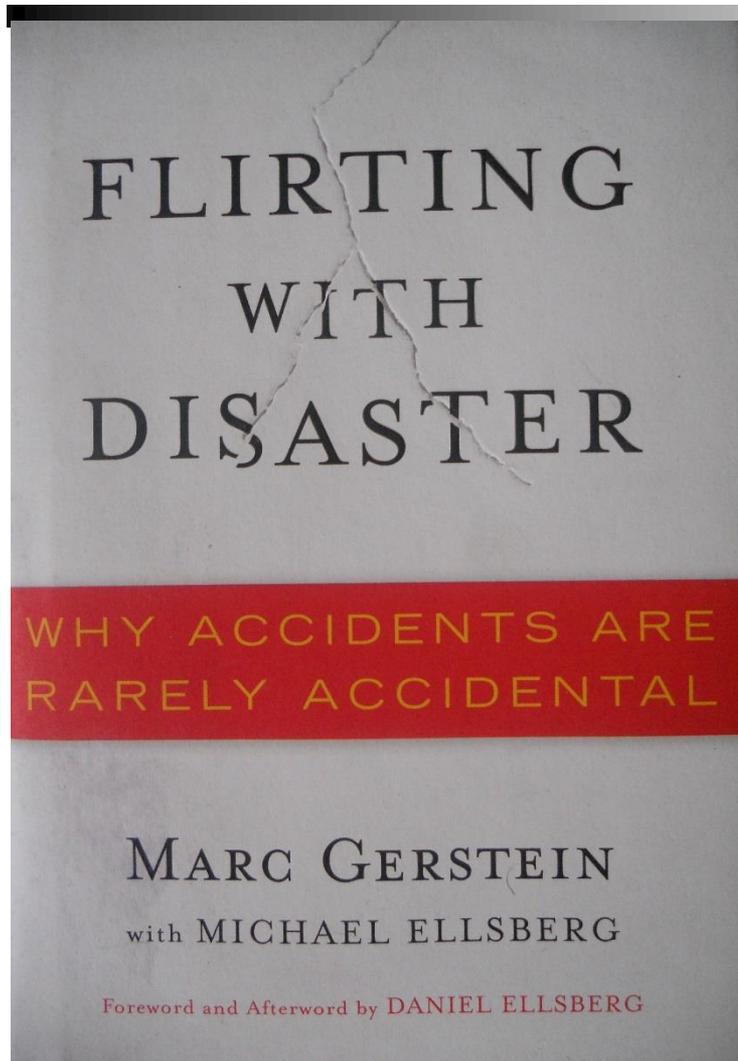
Stellenbosch Collapse (Anonymous, June 2008)

Construction is a Science, Art, and a Profession / Sound Construction Management (6)



Stellenbosch Collapse (Anonymous, June 2008)

Construction is a Science, Art, and a Profession / Sound Construction Management (6)



Construction is a Science, Art, and a Profession / Sound Construction Management (7)



Scaffolding, Bradford on Avon (Smallwood, August 2014)

Construction is a Science, Art, and a Profession / Sound Construction Management (8)



Scaffolding, Bradford on Avon (Smallwood, August 2014)

Tertiary Built Environment education that addresses construction H&S

- **A pre-requisite for optimum H&S / appropriate status, is the inclusion of H&S in the tertiary education of all built environment disciplines**
- **Education is a pre-requisite for awareness, sensitisation, commitment, and the development of an optimum H&S culture, and the required competencies to contribute to construction H&S**
- **With the exception of construction management programmes, which address construction H&S to varying degrees, tertiary built environment education addresses construction H&S to a limited extent, if at all**

Sound core and surface competencies

- **Competencies are divided into two categories (Sanghi, 2004):**
 - **Surface** - required to be at least effective
 - **Core** - distinguishes superior performance from average performance
- **The surface competencies are:**
 - **Knowledge** - information regarding content, and
 - **Skills** - ability to perform a task
- **The core competencies are:**
 - **Self-concept:** values; aptitude; attitude, and self-image
 - **Traits:** self-confidence; team player, and handles ambiguity
 - **Motives:** focus on client success, and preserves organisation / personal integrity
- **Surface competencies are important, but core competencies are critical in a dynamic environment - values, aptitude, ability to handle ambiguity, and preservation of integrity**
- **The DoL focus is on surface competencies**

Integration of design and construction (1)

- **Two issues - influence of design on construction H&S, and the type of procurement system**
- **Design influences construction directly and indirectly:**
 - **Directly, through design, choice of structural frame, details, method of fixing, constructability, and specification of materials and finishes**
 - **Indirectly, through choice of procurement system and conditions of contract, procurement, decision regarding project duration, and reference to H&S on various occasions**
- **Certain procurement systems such as design-build promote the integration of design and construction**
- **Optimum integration engenders and enhances H&S as it facilitates contractor contributions to the design process**
- **Designing for H&S is one of sixteen design for constructability principles – contractors can contribute**

Integration of design and construction (2)

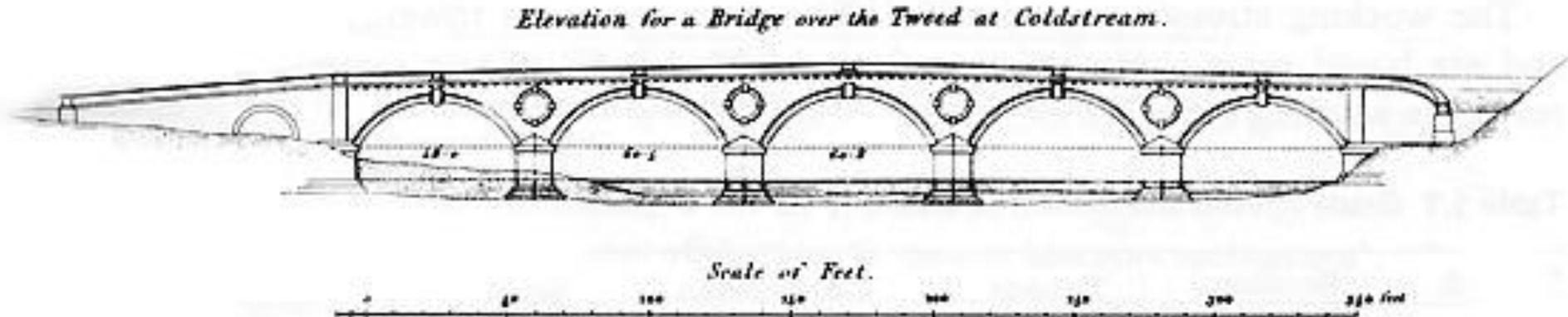


Figure 2: Elevation of masonry Bridge over the Tweed at Coldstream, 1866 (Irwin and Sibbald, 1983)

Integration of design and construction (3)

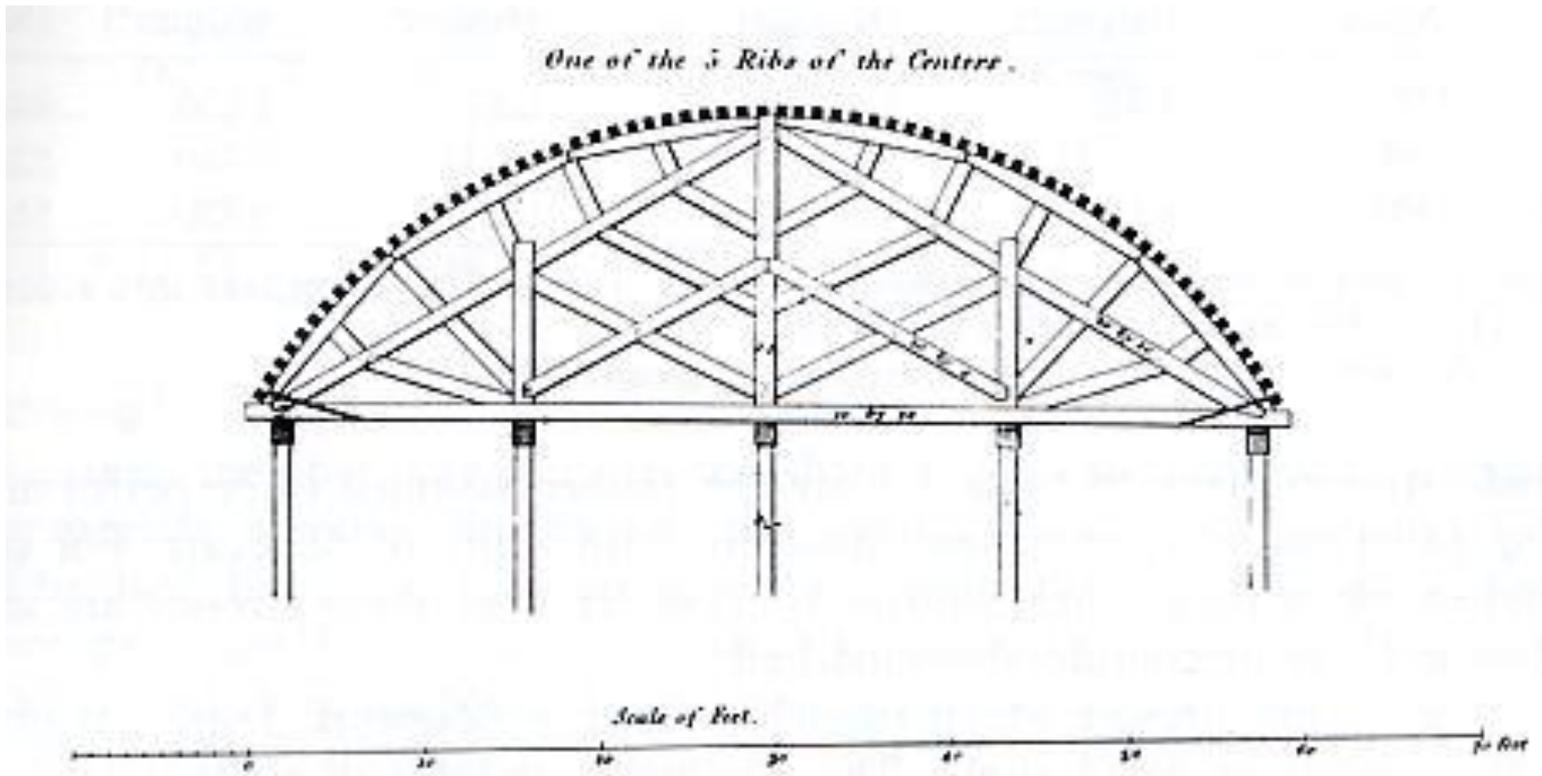


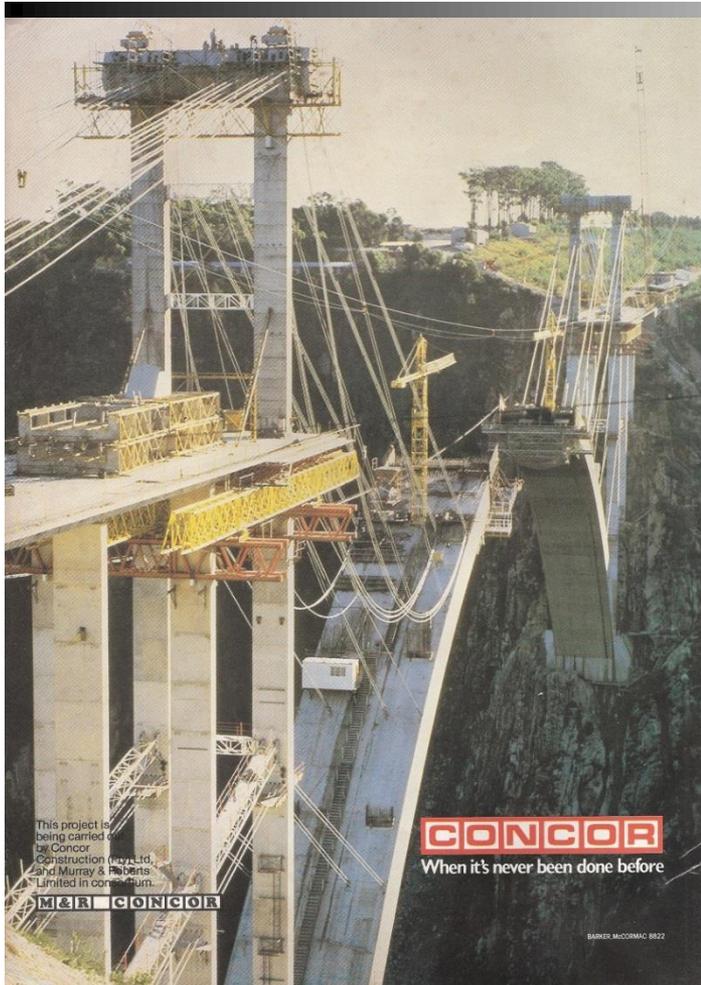
Figure 3: Centering for masonry Bridge over the Tweed at Coldstream, 1866 (Irwin and Sibbald, 1983)

Integration of design and construction (4)



Bloukrans Bridge (p. 11, Concrete Beton, 1983)

Integration of design and construction (5)



Bloukrans Bridge (Inside Front, Concrete Beton, 1983)

Integration of design and construction (6)

Bloukrans bridge project (Steele, 1983):

- “...notable for the close cooperation and team effort which were achieved by the consultant and contractor, and encouragement given by the client.”
- “... consulting engineers had clearly indicated in their design how the task should be tackled and worked closely with the contractors in converting the drawings they had supplied to reality...”

Quality and Quality Management Systems (1)

- **Four absolutes of quality (Crosby, 1979):**
 - Definition – conformance to requirements
 - Performance standard – zero defects
 - System – prevention
 - Measurement – price of non-conformance
- **Apply unequivocally to H&S:**
 - Numerous H&S requirements contained in, among other, legislation, standards, and H&S Specifications
 - Obvious performance standard relative to H&S is zero accidents – however, deviations create the opportunity for incidents and accidents
 - System is certainly prevention as opposed to appraisal or inspection
 - Cost of accidents (COA) is an ideal form of measurement:
 - All stakeholders can relate thereto
 - Can be expressed as a percentage of the cost or value of a project or the value of completed construction on a macro scale

Quality and Quality Management Systems (QMSs) (2)

- **Documented QMS complements H&S as it, among other, documents the systems, procedures, and protocol required relative to the design, procurement, and construction processes**

Health and Safety Management Systems (H&SMSs)

- The elements of an H&SMS provide the framework for the management of H&S, namely policy, planning, implementation and operation, checking and corrective action, and management review
- However, given the relationship between quality and H&S, the use of a documented QMS or an integrated management system, will complement H&S

‘H&S is a profit centre’

- **Given that the COA is estimated to be between 4.3% and 5.4% of the value of completed construction (Smallwood, 2004; cidb, 2009) whereas the cost of implementing H&S is estimated to be:**
 - **Between 0.5% and 3% of project costs (Smallwood, 2004)**
 - **1.6% of tender cost estimate and 1% of project cost (Smallwood, 2011)**
- **However, the synergy between construction H&S and the other eleven project parameters (Smallwood, 2006) results in further financial benefits: environment; cost; developmental criteria; environment; productivity; public H&S; quality; time; client satisfaction; design team satisfaction, and worker satisfaction**

Elimination / Mitigation of ‘excusitis’

- **Schwartz (1995) maintains unsuccessful people suffer from a mind deadening thought disease called ‘excusitis’**
- **Every failure has the disease in its advanced form**
- **The more successful the individual, the less inclined he / she is to make excuses**
- **Schwartz also cites a traffic engineer’s contention that there is no such a thing as a true accident. An accident is a result of human or mechanical failure, or a combination of both – nothing happens without a cause**
- **Consciousness and mindfulness will avert the development of ‘excusitis’ due to the lack of necessity**

Consciousness and mindfulness (1)

- **Consciousness (Payutto, 1999):**
 - “The perception and awareness of sensations, which will be related to particular intentions.”
 - “The awareness of sensations, namely seeing, hearing, smelling, tasting, touching and cognising; the basic climate of the mind from moment to moment.”
 - Fashioned into specific qualities by intention
- **Through self-observation a person can see, be aware, and in control of his / her own body or mind-mindfulness:**
 - This includes awareness of mind movement – thoughts
 - Awareness of the constant changes of all mental phenomena resulting in intuitive wisdom, which in turn averts clinging to conditioned phenomena that would lead to suffering (Tanphaichitr, 2001).

Consciousness and mindfulness (2)

- **Support work can be used to explain the role of optimum consciousness and mindfulness. The intention to realise optimum H&S will engender optimum observation and cognising relative to inadequate support work - consciousness. Mindfulness will result in, among other, intuitive wisdom, which will prevent clinging to the conditioned phenomenon of cost i.e. reducing the centres of standards or omitting bracing to reduce cost, which could result in a collapse and suffering of workers.**

Research findings (1)

- **Exploratory study**
- **2013 Master Builders South Africa (MBSA) National H&S Competition award winners**
- **Mean score (MS):**
 - **Between 1.00 (least) and 5.00 (very) in terms of importance**
 - **Where a MS ties, the related variable with the lower standard deviation is ranked higher**
 - **MSs > 3.00 (100%) more important as opposed to less important**
 - **MSs > 4.20 ≤ 5.00 (26 / 37) more than important to very / very important**
 - **MSs > 3.40 ≤ 4.20 (10 / 37) important to more than important / more than important**
 - **MSs > 2.60 ≤ 3.40 (1 / 37) less than important to important / important**
- **Unsure = U**

Research findings (2)

Action / Belief / Intervention / Practice / State	Response (%)						MS	Rank
	U	Least. Very						
		1	2	3	4	5		
Adequate financial provision for H&S	0.0	0.0	0.0	0.0	0.0	100.0	5.00	1=
H&S education	0.0	0.0	0.0	0.0	0.0	100.0	5.00	1=
H&S training	0.0	0.0	0.0	0.0	0.0	100.0	5.00	1=
Risk management	0.0	0.0	0.0	0.0	11.1	88.9	4.89	4=
Construction hazard identification and risk assessments	0.0	0.0	0.0	0.0	11.1	88.9	4.89	4=
Core competencies e.g. values, aptitude, and integrity	0.0	0.0	0.0	0.0	22.2	77.8	4.78	6
Construction Management competencies (knowledge & skills)	0.0	0.0	0.0	11.1	0.0	88.9	4.78	7
A mission of 'continual improvement'	0.0	0.0	0.0	0.0	33.3	66.7	4.67	8=
H&S management system	0.0	0.0	0.0	0.0	33.3	66.7	4.67	8=
Consciousness and mindfulness (see definitions below table)	0.0	0.0	0.0	0.0	33.3	66.7	4.67	8=
Respect for people	0.0	0.0	0.0	0.0	44.4	55.6	4.56	11=
People are our most important resource	0.0	0.0	0.0	0.0	44.4	55.6	4.56	11=
A goal of 'zero incidents'	0.0	0.0	0.0	0.0	44.4	55.6	4.56	11=
A vision of a 'fatality, injury, and disease-free work place'	0.0	0.0	0.0	22.2	0.0	77.8	4.56	14
Quality management	0.0	0.0	0.0	0.0	55.6	44.4	4.44	15=
Quality Management System	0.0	0.0	0.0	0.0	55.6	44.4	4.44	15=
A goal of 'zero deviations'	0.0	0.0	0.0	11.1	33.3	55.6	4.44	17=
Designing for construction H&S	0.0	0.0	0.0	11.1	33.3	55.6	4.44	17=
H&S is a value not a priority	0.0	0.0	11.1	0.0	22.2	66.7	4.44	19

Table 1A : Importance of actions / beliefs / interventions / practices / states in terms of achieving optimum construction H&S (MS = 1.00 – 5.00) (Smallwood, 2014)

Research findings (3)

Action / Belief / Intervention / Practice / State	Response (%)						MS	Rank
	U	Least.Very						
		1	2	3	4	5		
Pre-contract planning	0.0	0.0	0.0	11.1	44.4	44.4	4.33	20=
Conformance to requirements	0.0	0.0	0.0	11.1	44.4	44.4	4.33	20=
The belief 'All accidents are preventable'	0.0	0.0	0.0	11.1	55.6	33.3	4.22	22=
Design hazard identification and risk assessments	0.0	0.0	0.0	11.1	55.6	33.3	4.22	22=
Client H&S requirements	0.0	0.0	0.0	22.2	33.3	44.4	4.22	24
Planning, organising, leading, controlling, and coordinating	0.0	0.0	11.1	0.0	44.4	44.4	4.22	25=
Strategies, systems, procedures, and protocol	0.0	0.0	11.1	0.0	44.4	44.4	4.22	25=
'Design and construction' method statements	0.0	0.0	0.0	33.3	22.2	44.4	4.11	27
Tertiary education (all built environment) that includes construction H&S	11.1	0.0	0.0	11.1	11.1	66.7	4.11	28
Integration of design and construction	0.0	0.0	0.0	22.2	55.6	22.2	4.00	29
H&S specifications	0.0	0.0	11.1	0.0	66.7	22.2	4.00	30
Pre-tender planning	0.0	0.0	0.0	44.4	22.2	33.3	3.89	31
Appropriate conditions of contract	0.0	0.0	0.0	44.4	33.3	22.2	3.78	32
Appropriate procurement system	0.0	0.0	11.1	22.2	44.4	22.2	3.78	33
Constructability	0.0	0.0	0.0	33.3	66.7	0.0	3.67	34
Client focus	0.0	0.0	11.1	44.4	22.2	22.2	3.56	35
Project duration	0.0	11.1	22.2	11.1	22.2	33.3	3.44	36
The belief 'Accidents are failures of management'	11.1	11.1	0.0	33.3	22.2	22.2	3.11	37

Table 1B : Importance of actions / beliefs / interventions / practices / states in terms of achieving optimum construction H&S (MS = 1.00 – 5.00) (Smallwood, 2014)

Conclusions (1)

- **There is an unhealthy ‘culture’ in the form of: a lack of respect for people; the focus on cost, quality, and time; ‘excusitis’; ‘construction is inherently dangerous’; ‘accidents happen’, and ‘H&S costs money’**
- **A pre-requisite for the realisation of optimum status for, and focus on H&S are respect for people, values, H&S culture, and competence, which in turn requires comprehensive tertiary built environment education, which includes construction H&S**

Conclusions (2)

- **The aforementioned, and a focus on risk management, planning, and integrated multi-stakeholder contributions throughout the six stages of projects, appropriate procurement underpinned by quality and H&S management systems, and sound management, will realise optimum H&S, provided there is a level of complementary consciousness and mindfulness**

Recommendations (1)

- **A paradigm shift is necessary in terms of how construction H&S is viewed and promoted:**
 - **Legislation constitutes a template**
 - **‘People are our most important resource’ and ‘H&S is a profit centre’ represent rallying points**
 - **The CBE and its constituent Councils and related Voluntary Associations must act**
- **Built environment tertiary education must address construction H&S in the form of the strategies, systems, procedure, protocol, and interventions related to the respective disciplines**
 - **This must reviewed during accreditation visits by the respective Councils**

Recommendations (2)

- Despite the promulgation of the Construction Regulations on 18 July 2003, this is still an issue!
- Furthermore, current inadequacies in terms of built environment practitioners' H&S competencies must be addressed through continuing professional development (CPD)

References (1)

- Amalgamated Press. 1999. Chopper inferno. *Eastern Province Herald*. 11 February, p. 1.
- Construction Industry Development Board (cidb). 2009. *Construction Health & Safety Status & Recommendations*. Pretoria: cidb.
- Crosby, P. 1979. *Quality is free*. New York: McGraw-Hill.
- Gerstein, M. and Ellsberg, M. 2008. *Flirting with Disaster Why Accidents are Rarely Accidental*. New York: Sterling Publishing Co., Inc.
- Hopcke, R.H. 1997. *There are No Accidents Synchronicity and the Stories of our Lives*. London: Macmillan.
- Irwin, A.W. and Sibbald, W.I. 1983. *Falsework A Handbook of Design and Practice*. London: Granada Technical Books.
- Levitt, S.D. and Dubner, S.J. 2014. *Think Like a Freak*. New York: HarperCollins Publishers.

References (2)

- Markman, I. 2003. *The Herald*, 14 November, p. 10.
- Payutto, P.A. 1999. *Dependent Origination*. Bangkok: Buddhadhamma Foundation.
- Reason, J. 2013. *A Life in Error From Little Slips to Big Disasters*. Farnham, Surrey: Ashgate Publishing Limited.
- Republic of South Africa. 2014. *No. R. 84 Occupational Health and Safety Act, 1993 Construction Regulations 2014*. *Government Gazette No. 37305*. Pretoria.
- Sanghi, S. 2004. *The handbook of competency mapping*. New Delhi: Response Books.
- Schwartz, D.J. 1995. *The Magic of Thinking Big*. London: Pocket Books.
- Smallwood, J.J. 1995. *The Influence of management on the occurrence of loss causative incidents in the South African construction industry*. Unpublished MSc (Constr Man) Dissertation, University of Port Elizabeth, Port Elizabeth.

References (3)

- Smallwood, J.J. 2004. Optimum cost: The role of health and safety (H&S). In: Verster JJP, ed. *Proceedings International Cost Engineering Council 4th World Congress*, Cape Town, April 2004. International Cost Engineering Council, 2004: CD-Rom Smallwood-J- Optimum Cost-Health & Safety.pdf
- Smallwood, J.J. 2006. The Practice of Construction Management. *Acta Structilia*. 13(2), pp. 62-89.
- Smallwood, J.J. 2011. Financial Provision for Health and Safety (H&S) in Construction. In: *Proceedings of the CIB W099 Conference*, Washington D.C., 24-26 August, F:\data\papers\45.pdf.
- Smallwood, J.J. 2014. Preventing Accidents in Construction. Unpublished research findings.
- Steele, D. 1983. Bloukrans Bridge. *Concrete Beton*, Nr 30 1983 06, pp. 10-11.

References (4)

- Tanphaichitr, K. 2001. *Buddhism answers life*. Bangkok: Kled Thai Co. Ltd.
- The National Spiritual Assembly of the Bahias of India. 2002. *The Dawning Place of the Remembrance of God*. New Delhi: Thomson Press.
- Travers, R. 1998. *Lowvelder*, 10 July, p. 1.
- Vosloo, L. 1999. Their final papers. *Cape Times*. 11 February, p. 1.
- Woudhuysen, J. and Abley, I. 2004. *Why is construction so backward?* Chichester, Sussex: Wiley-Academy.