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REALISING HEALTH AND SAFETY IN CONSTRUCTION FIRMS AND ON PROJECTS

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Why is construction so backward?



(Woudhysen and Abley, 2004)

"So long as construction remains a backward industry, safety within it will be backward. So long as off-site manufacturing remains a footnight 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)



Introduction

- Firm:
 - Focus of H&S has been on projects
 - Production function is one of nine functions in a firm
 - H&S is a strategic issue
- Projects:
 - Entail a number of stages
 - Entail a number of stakeholders
 - Historically:
 - H&S and other risk related issues have been the contractor's responsibility
 - H&S has been transferred to the contractor
 - Section 10, OH&S Act No. 85 of 1993 (Designers)
 - 2003 and now 2014 Construction Regulations (Clients and designers)



Macro Construction H&S environment

Construction H&S occurs in a macro environment:



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



Functions in a firm

- General management
- Administration and information technology
- Financial
- Human resources
- Legal
- Marketing
- Procurement
- Production (Projects)
- Public relations



General management function

- Planning: forecasting; developing objectives; programming; scheduling; budgeting; developing procedures, and developing policies
- Organising: developing organisation structure; delegating, and developing relationships
- Leading: decision making; communicating; motivating; selecting people, and developing people
- Controlling: developing performance standards; measuring performance; evaluating performance, and correcting performance
- Coordinating



Administration and information technology function

- Administration integral aspect of H&S
- Building Information Modelling (BIM):
 - Major potential contributor to H&S
 - Interrogate constructability
 - Can generate the lineal meters of edge protection
 - Can simulate activities 'premortems'
 - Awareness and commitment by the firm is required



Financial function

- Cost of accidents (COA) increases the cost of construction:
 - Based upon the value of construction work completed in the year 2002, namely R 56 343m (South African Reserve Bank, 2003) the total COA could have been between 4.3% (R 2 401.2m / R 56 343m), and 5.4% (R 3 041.5m / R 56 343m) (Smallwood, 2004)
 - Cost of prevention is between 1% and 2%
- Workers' compensation insurance rebates
- Synergy between H&S and cost, environment, productivity, quality, and time
- Return on investment in H&S



Human resources function

- Major link between this function and H&S (obvious)
- Development and maintenance
- Not just a staff, but a line function



Legal function

- Major link between this function and H&S (obvious)
- Firm's integrity must be assured
- Undue attention and publicity is not ideal



Marketing function

- COA
- Some clients require contractors to tell them what they are going to do in terms of H&S
- Other (or the same) clients 'Its our way or the highway!'
- H&S performance of a firm enhances their attractiveness to clients, especially 'better practice' clients



Public relations (PR) function

- Relationship between an organisation and its publics
- Internal and external publics
- Internal workers, supervision, management, administrative
- External clients, project managers, designers, general public, and future (potential) students
- H&S is an integral component of corporate social responsibility (CSR)
- H&S performance of a firm enhances their image and reputation



H&S issues at 'board' level

- H&S should be a value not a priority and a legal requirement
- Corporate Social Responsibility (CSR)
- Leadership
- Commitment versus participation versus involvement
- H&S culture versus climate?
 - H&S culture embodies values, beliefs, and assumptions
 - H&S climate employees' shared perceptions of the organisational atmosphere
 - H&S culture → H&S climate → H&S performance
- Measurement?
 - Failures e.g. fatality rate and DIIR?
 - Predictors e.g. employees' perceptions of the organisational atmosphere and percentage of workers that have attended a hazard identification and risk assessment (HIRA) course?
- Accountability



Six project stages

- Project initiation and briefing
- Concept and feasibility
- Design development
- Tender documentation and procurement
- Construction documentation and management
- Project close out
- Plus (not recorded in the respective Built Environment Councils' identities of work):
 - Use refer to the H&S File
 - Deconstruction refer to the H&S File



Injaka Bridge collapse (1)



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)



Injaka Bridge collapse (2)

Department of Labour (2002):

- Causes:
 - The slide path was not under the webs
 - The placing of the sliding pads between the deck and temporary bearings was not as specified
 - Insufficient reinforcement in the deck section, especially the bottom slab
 - The failure to fully appreciate the implications of the early cracks
 - The acceptance and approval of a launching nose which was substantially less stiff than that prescribed in the project specification
 - The deviation from the project specification regarding the automatic pier deflection monitoring at pier 2
 - The deviation from the project specification regarding the height tolerances of the temporary bearings on pier 3
 - The use of design and construction personnel, at decision-making level, without appropriate qualification and experience in incremental launched bridges



Injaka Bridge collapse (3)

- No independent design reviews were conducted of either the temporary or permanent works
- Contributory causes:
 - The lack of experience on the part of design personnel in incremental launching techniques resulted in poor communications between the parties to clarify understandings and interpretations regarding the slide path position
 - The lack of clear instructions in the project specification and clear indications on the consulting engineers design drawings as to the position of the sliding path, resulted in incorrect interpretations being made
- Comment beware of 'low probability / high impact' risks e.g. Injaka Bridge



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)

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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..."



Construction Regulations (1)

- Definition of 'designer' a competent person who:
 - prepares a design
 - checks and approves a design
 - arranges for a person at work under his / her control to prepare a design including an employee of that person
 - designs temporary work including its components
- An architect or engineer contributing to, or having overall responsibility for a design
- Building services engineer designing details for fixed plant
- Surveyor specifying articles or drawing up specifications
- Contractor carrying out design work as part of a design and build project
- Interior designer, shop-fitter, or landscape architect



Construction Regulations (2)

- Relative to Structures 6 (1) designers of a structure must:
- (a) ensure that the H&S standards incorporated into the regulations are complied with in the design
- (b) take the H&S specification into consideration
- (c) include in a report to the client before tender stage:
 - all relevant H&S information about the design that may affect the pricing of the work
 - the geotechnical-science aspects
 - the loading that the structure is designed to withstand
- (d) inform the client of any known or anticipated dangers or hazards relating to the construction work, and make available all relevant information required for the safe execution of the work upon being designed or when the design is changed – may require 'design and construction' method statements
- (e) modify the design or make use of substitute materials where the design necessitates the use of dangerous procedures or materials hazardous to H&S 25



Construction Regulations (3)

- (f) consider hazards relating to subsequent maintenance of the structure and make provision in the design for that work to be performed to minimize the risk
- (g) when mandated by the client conduct inspections to ensure conformance of construction to design. If not mandated then the client's agent is responsible
- (h) when mandated by the client stop construction work not in accordance with the design's H&S aspects. If not mandated then the client's agent is responsible
- (i) when mandated by the client, during his / her final inspection of the structure include the H&S aspects of the structure, declare the structure safe for use and issue a completion certificate



Construction Regulations (4)

- Clients required to, among other:
- 5 (1) (a) Prepare a baseline risk assessment (BRA)
- 5 (1) (b) Prepare an H&S specification based on the BRA
- 5 (1) (c) Provide the designer with the H&S specification
- 5 (1) (d) Ensure that the designer takes the H&S specification into account during design
- 5 (1) (e) Ensure that the designer carries out the duties in Regulation 6 'Duties of designers'
- 5 (1) (f) Include the H&S specification (revised after the designers' reports?) in the tender documents
- 5 (1) (g) Ensure that potential PCs have made provision for the cost of H&S in their tenders
- 5 (1) (h) Ensure that the PC to be appointed has the necessary competencies and resources



Project initiation and briefing (1)

- Quality management system (QMS)
- Appointment of H&S Agent
- Client brief:
 - Client H&S goals
 - Client requirements
 - Client responsibilities
 - H&S information
 - Client interventions / contributions
- Partnering in terms of H&S
- Identify the surveys, analyses, tests, and site or other investigations required
- Client baseline risk assessment (BRA)
- Project H&S plan multi-stakeholder, including H&S policy
- H&S measurement e.g. No. of H&S issues raised and percentage of total issues
- See the end at the beginning'



Project initiation and briefing (2)



Transportation of materials and waste, Aerial Cableway Station, Table Mountain (Deacon, 1997)



for tomorrow

Project initiation and briefing (3)



Fynbos and helicopter transport, Aerial Cableway Station, Table Mountain (Deacon, 1997)



Project initiation and briefing (4)



Bahia Temple, Delhi, India (Smallwood, 2005)

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Project initiation and briefing (5)



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



Project initiation and briefing (6)



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



Project initiation and briefing (7)



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



Project initiation and briefing (8)



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



See the end at the beginning (1)




See the end at the beginning (2)

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



tomorrow

Concept and feasibility (1)

- Quality management system (QMS)
- Reference to the client baseline risk assessment (BRA)
- Reference to the H&S specification
- Concept design hazard identification and risk assessment (HIRA)
- Concept design constructability reviews
- Initiate and evolve the designer report
- H&S measurement e.g. No. of H&S issues, and design changes due to HIRAs
- 'See the end at the beginning'



Concept and feasibility (2)



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



Concept and feasibility (3)



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



Concept and feasibility (4)



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



Concept and feasibility (5)



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



Concept and feasibility (6)



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



Concept and feasibility (7)



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



Concept and feasibility (8)



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



Reduction of risk through design (1)



(Steel Construction, 2004)



Reduction of risk through design (2)



(Steel Construction, 2004)



Reduction of risk through design (3)



(Steel Construction, 2004)



See the end at the beginning (1)



Stellenbosch Collapse (Anonymous, June 2008)



See the end at the beginning (2)



Stellenbosch Collapse (Anonymous, June 2008)



See the end at the beginning (3)



Stellenbosch Collapse (Anonymous, June 2008)



See the end at the beginning (3)



Stellenbosch Collapse (Anonymous, June 2008)



See the end at the beginning (4)



with MICHAEL ELLSBERG

Foreword and Afterword by DANIEL ELLSBERG



tomorrow

Detailed design

- Quality management system (QMS)
- Communicate H&S requirements
- H&S information
- Detailed design hazard identification and risk assessments (HIRA)
- Coordination of design
- Constructability reviews
- Designer 'H&S' report
- 'Design and construction' method statements
- H&S specification (Revised by client)
- H&S measurement e.g. No. of H&S issues, and design changes or substitutions due to HIRAs
- See the end at the beginning'



Designing for H&S (1)



Precast concrete stair flights, Port Elizabeth (Smallwood)



Designing for H&S (2)



Precast concrete stair flights, Port Elizabeth (Smallwood)



Designing for H&S (3)



Plank and hollow-block composite slab, Plettenberg Bay (Hamp-Adams, 1994)



Designing for H&S (4)



An example of a generic risk assessment form (GRA) -Page 1											
NAME OF ORGANIZATION											
NAME OF PROJECT											
ACTIVITY COVERED Erecting precast plank and hollow block composite slab											
				ASSESSMENT OF RISK							
	SIGNIFICANT HAZARDS			LOW	MEDIUM	HIGH					
1	People fal	ling				3 X 3 = 9					
2	Materials	falling				3 X 2 = 6					
3	Collapse o	of structure		1 X 3 = 3							
4	Pinching			3 X 1 = 3							
5 Manual handling						3 x 2 = 6					
6 Tripping						3 x 2 = 6					
7	Failure of	blocks (material)			2 X 3 = 6						

Figure 4: Design HIRA for erecting precast plank and hollow block composite slab



Designing for H&S (5)



Pre-cast pre-stressed hollow core slab section (SA Builder Bouer, 2004a)



Designing for H&S (6)



Pre-cast pre-stressed hollow core slab section (SA Builder Bouer, 2004b)



Designing for H&S (7)

	Archi	itects	Arch.	Tech's	Mean		
Occasion (Stream)	Mean	Donk	Mean	Donk	Mean	Rank	
	Score	Ralik	Score	Ralik	Score		
Detailed design (Upstream)	3.83	1	3.30	2=	3.57	1	
Working drawings (Upstream)	3.65	2	3.32	1	3.49	2	
Concept (design) (Upstream)	3.61	3	3.30	2=	3.46	3	
Preparing project documentation	3.46	4	2.81	5	3.14	4	
Site inspections/discussions	3.38	5	2.84	4	3.11	5	
Site meetings	3.35	6	2.73	6	3.04	6	
Design coordination meetings	3.32	7	2.65	7	2.99	7	
Client meetings	2.97	9	2.54	8	2.76	8	
Constructability reviews	3.06	8	2.41	9	2.74	9	
Site handover	2.80	10	2.16	10	2.48	10	
Deliberating project duration	2.76	11	1.86	12=	2.31	11	
Pre-qualifying contractors	2.51	13	1.97	11	2.24	12	
Pre-tender meeting	2.57	12	1.78	14	2.18	13=	
Evaluating tenders	2.50	14	1.86	12=	2.18	13=	

Table 1: Frequency at which Architectural practices and Architectural Technologists consider / refer to construction ergonomics on various occasions (MS: 1.00 – 5.00) (Smallwood, 2009).



Designing for H&S (8)

	Arch	tects	Arch.	Tech's	Mean		
Aspect	Mean	Donk	Mean	Donk	Mean	Rank	
	Score	Nalik	Score	Nalik	Score		
Plan layout	3.81	1	3.38	1=	3.60	1	
Design (general)	3.75	3	3.38	1=	3.57	2	
Details	3.78	2	2.97	6	3.38	3	
Method of fixing	3.67	4	3.03	4	3.35	4	
Specification	3.63	5	3.00	5	3.32	5	
Position of components	3.38	7	2.97	7	3.18	6	
Elevations	3.18	10	3.16	3	3.17	7	
Finishes	3.50	6	2.65	11	3.08	8	
Type of structural frame	3.17	11	2.92	9	3.05	9	
Site location	2.96	14	2.95	8	2.96	10	
Schedule	3.04	12	2.81	10	2.93	11=	
Edge of materials	3.24	8	2.62	12	2.93	11=	
Texture of materials	3.21	9	2.38	15	2.80	13	
Content of material	3.01	13	2.54	13	2.78	14	
Surface area of materials	2.79	15	2.41	14	2.60	15	
Mass of materials	2.54	16	2.35	16	2.45	16	

Table 2: Frequency at which Architectural practices and Architectural Technologists consider / refer to construction ergonomics relative to various design related aspects (MS: 1.00 – 5.00) (Smallwood, 2009



Designing for H&S (9)

	Arch	itects	Arch.	Tech's	Mean		
Aspect	Mean	Donk	Mean	Donk	Mean	Rank	
	Score	Ralik	Score	Ralik	Score		
Design (general)	3.83	1	4.08	2	3.96	1	
Details	3.72	2	4.05	4	3.89	2	
Plan layout	3.57	4	4.08	3	3.83	3	
Position of components	3.50	5	4.03	5	3.77	4	
Method of fixing	3.58	3	3.83	9	3.71	5	
Site location	3.23	9	4.11	1	3.67	6=	
Finishes	3.47	6=	3.86	8	3.67	6=	
Edge of materials	3.26	8	3.94	6	3.60	8	
Specification	3.47	6=	3.70	11	3.59	9	
Type of structural frame	3.15	10	3.89	7	3.52	10	
Elevations	3.06	13	3.81	10	3.44	11	
Texture of materials	3.11	11	3.56	14	3.34	12	
Schedule	3.02	14	3.60	13	3.31	13=	
Mass of materials	2.97	15	3.65	12	3.31	13=	
Content of material	3.08	12	3.44	16	3.26	15	
Surface area of materials	2.73	16	3.46	15	3.10	16	

 Table 3: Extent to which various design related aspects impact on construction ergonomics according to

 Architectural practices and Architectural Technologists (MS: 1.00 – 5.00) (Smallwood, 2009).



Designing for H&S (10)



'Melting' mastic asphalt (still available), Canal Walk, Cape Town (Smallwood, 2000)



Tender documentation and procurement

- Client, project manager and design team:
 - Quality management system (QMS)
 - Optimum project duration
 - Contract documentation reference to H&S
 - H&S specification (Revised) 2014 Construction Regulations silent
 - Provision for equitable allowance for H&S
 - H&S pre-qualification
 - Ensure adequate allowance for H&S
- Contractors:
 - Pre-tender and pre-contract planning:
 - Site layout
 - Programme
 - Method statements general and H&S
 - H&S plan
- H&S measurement leading versus trailing



Construction documentation and management (1)

- Quality management system (QMS)
- H&S management system
- Planning:
 - Programme
 - H&S plan
 - Method statements
- Temporary works design
- H&S appointments
- H&S training
- Construction hazard identification and risk assessment (HIRA)
- H&S meetings
- H&S inspections
- H&S measurement leading versus trailing e.g. percentage of activities for which safe work procedures exist
- H&S file



Construction documentation and management (2)



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



Construction documentation and management (3)



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



Construction documentation and management (4)

Aspect								
		Not	Very	MS	Rank			
	sure	1	2	3	4	5		
Hazard identification and risk	0.0	0.0	0.0	0.0	0.0	100.0	5 00	1=
assessment	0.0	0.0	0.0	0.0	0.0	100.0	5.00	•
Risk management	0.0	0.0	0.0	0.0	0.0	100.0	5.00	1=
Administration and legal requirements	0.0	0.0	0.0	0.0	9.1	90.9	4.91	3
Physical aspects	0.0	0.0	0.0	0.0	18.2	81.8	4.82	4=
Worker participation	0.0	0.0	0.0	0.0	18.2	81.8	4.82	4=
H&S education	0.0	0.0	0.0	0.0	18.2	81.8	4.82	4=
H&S training	0.0	0.0	0.0	0.0	18.2	81.8	4.82	4=
Construction H&S management	0.0	0.0	0.0	0.0	40.0	04.0	4 00	4-
competencies	0.0	0.0	0.0	0.0	10.2	01.0	4.0Z	4-
Supervision	0.0	0.0	0.0	0.0	27.3	72.7	4.73	9
Management	0.0	0.0	0.0	0.0	36.4	63.6	4.64	10
Construction management competencies	0.0	0.0	0.0	0.0	54.5	45.5	4.45	11

Table 4: Degree of importance of aspects of an H&S programme in terms of achieving optimum H&S in respondents' organisations (MS: 1.00 – 5.00) (Smallwood, 2014).



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Construction documentation and management (4)

Aspect / Intervention / Stakeholder		Did	Minor				Major	MS	Rank
	sure	not	1	2	3	4	5		
H&S Coordinator / Manager	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
H&S Officer	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
Hazard identification and risk assessment	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
H&S induction	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
H&S training	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
Toolbox talks	0.0	0.0	0.0	0.0	0.0	18.2	81.8	4.82	1=
H&S management system (H&SMS)	0.0	0.0	0.0	0.0	0.0	27.3	72.7	4.73	7=
H&S education	0.0	0.0	0.0	0.0	0.0	27.3	72.7	4.73	7=
Focus on H&S	0.0	0.0	0.0	0.0	9.1	18.2	72.7	4.64	9=
H&S awareness	0.0	0.0	0.0	0.0	9.1	18.2	72.7	4.64	9=
H&S culture (refer to * below the table)	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
H&S Representatives	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
Safe work procedures (SWPs)	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
Feedback on H&S performance	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
Construction Regulations	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
Participation in H&S competitions	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
Participation in H&S star gradings	0.0	0.0	0.0	0.0	9.1	27.3	63.6	4.55	11=
H&S measurement	0.0	0.0	0.0	9.1	0.0	18.2	72.7	4.55	18

Table 5A: Extent to which aspects / interventions / stakeholders contributed to respondents' organisations achieving an H&S competition award (MS: 0.00 – 5.00) (Smallwood, 2014).



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Construction documentation and management (4)

Aspect / Intervention / Stakeholder		Did	Minor				Major	MS	Rank
	sure	not	1	2	3	4	5		
Allocation of financial resources to H&S	0.0	0.0	0.0	0.0	9.1	36.4	54.5	4.45	19=
H&S inspections	0.0	0.0	0.0	0.0	9.1	36.4	54.5	4.45	19=
H&S rules	0.0	0.0	0.0	0.0	18.2	18.2	63.6	4.45	21=
H&S notice board	0.0	0.0	0.0	0.0	18.2	18.2	63.6	4.45	21=
H&S legislation (OH&S Act & COID Act)	0.0	0.0	0.0	0.0	18.2	18.2	63.6	4.45	21=
H&S plans	0.0	0.0	0.0	9.1	0.0	27.3	63.6	4.45	24
First line supervision	0.0	0.0	0.0	9.1	9.1	9.1	72.7	4.45	25
H&S policy	0.0	0.0	0.0	0.0	18.2	27.3	54.5	4.36	26
Site management	0.0	0.0	0.0	9.1	0.0	36.4	54.5	4.36	27
H&S goal setting	0.0	0.0	0.0	9.1	9.1	18.2	63.6	4.36	28
Management commitment to H&S	0.0	0.0	0.0	0.0	27.3	18.2	54.5	4.27	29=
H&S meetings	0.0	0.0	0.0	0.0	27.3	18.2	54.5	4.27	29=
Integration of H&S into all activities / tasks	9.1	0.0	0.0	9.1	0.0	0.0	81.8	4.27	31
Management involvement in H&S	0.0	0.0	0.0	0.0	36.4	0.0	63.6	4.27	32=
Quality management system (QMS)	0.0	0.0	0.0	9.1	9.1	27.3	54.5	4.27	32=
Recognition of H&S performance	9.1	0.0	0.0	0.0	9.1	18.2	63.6	4.18	34
Management accountability for H&S	0.0	0.0	0.0	0.0	27.3	27.3	45.5	4.18	35
Worker participation	9.1	0.0	0.0	9.1	0.0	9.1	72.7	4.18	36

Table 5B: Extent to which aspects / interventions / stakeholders contributed to respondents' organisations achieving an H&S competition award (MS: 0.00 – 5.00) (Smallwood, 2014).



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Construction documentation and management (4)

Aspect / Intervention / Stakeholder		Response (%)								
		Did	Minor				Major	MS	Rank	
	sure	not	1	2	3	4	5			
H&S specification	0.0	0.0	0.0	18.2	9.1	18.2	54.5	4.09	37	
Client	0.0	0.0	0.0	18.2	9.1	27.3	45.5	4.00	38	
Incident investigation	0.0	9.1	0.0	0.0	18.2	18.2	54.5	4.00	39	
H&S disciplinary procedure	9.1	0.0	0.0	9.1	18.2	0.0	63.6	3.91	40	
Medical surveillance	9.1	0.0	0.0	0.0	27.3	27.3	36.4	3.73	41	
Project manager	0.0	0.0	0.0	18.2	36.4	9.1	36.4	3.64	42	
H&S message / theme for the month or week	9.1	0.0	9.1	0.0	18.2	18.2	45.5	3.64	43	
Client appointed H&S Agent	0.0	9.1	0.0	9.1	27.3	18.2	36.4	3.55	44	
H&S incentives	9.1	9.1	0.0	0.0	18.2	18.2	45.5	3.55	45	
Partnering (refer to ** below the table)	0.0	12.5	0.0	12.5	12.5	25.0	37.5	3.50	46	
Improvement process e.g. Total Quality Management (TQM)	18.2	0.0	0.0	18.2	0.0	27.3	36.4	3.27	47	
H&S Consultant	0.0	18.2	0.0	18.2	27.3	9.1	27.3	2.91	48	
H&S newsletter	0.0	18.2	9.1	9.1	27.3	9.1	27.3	2.82	49	
H&S suggestion box	9.1	18.2	9.1	0.0	18.2	18.2	27.3	2.73	50	
Designers	0.0	27.3	18.2	18.2	18.2	0.0	18.2	2.00	51	
Unions	0.0	54.5	36.4	0.0	0.0	9.1	0.0	0.73	52	

Table 5C: Extent to which aspects / interventions / stakeholders contributed to respondents' organisations achieving an H&S competition award (MS: 0.00 – 5.00) (Smallwood, 2014).


Project close out

- As built and as laid drawings
- H&S file finalise
- Project close out report:
 - Stakeholders':
 - Contributions
 - Performance in terms of H&S
 - H&S measurement trailing indicators e.g. disabling injury incidence rate (DIIR)
 - Better practice H&S



Use and deconstruction

- Use:
 - Inspections of the structure
 - H&S file (reference)
- Deconstruction:
 - Start all over again the six stages
 - H&S file (reference)



or tomorrow

Project management of H&S and complexity



Illustration 1: The holistic role of project managers (PMs) in H&S and the role of H&S in overall prformance. (Smallwood, 2005)

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tomorrow

Key points (1)

- H&S is a 'business of construction' issue, then a project issue
- Risks, but they can be managed mitigated or eliminated
- Construction is not inherently dangerous strategies, systems, procedures, and protocol
- All accidents are preventable
- Accidents = Failure of management (all stakeholders)
- Reengineer the built environment and construction
- Adopt systems thinking to address H&S complexity
- H&S is a profit centre not a 'cost'
- Optimum H&S culture H&S is a value not a priority
- Integrate H&S into all six project stages plus use and deconstruction stages
- Design for H&S
- Committed and involved clients



tomorrow

Key points (2)

- Competent project managers, designers, quantity surveyors / cost engineers, and construction managers
- QMSs
- H&S management systems
- Integrated multi-stakeholder project H&S plans
- Inclusive tertiary built environment education (construction H&S)



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