

HEALTH AND SAFETY (H&S) IN HOUSING

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Abstract

Inadequate or the lack of H&S negatively affects cost, environment, productivity, quality, and time. Conversely, optimum H&S is the catalyst for enhanced performance relative to the aforementioned, as a result of, inter alia, tidy sites, optimum access, and loss prevention. Accidents result in direct and indirect costs, the latter being up to twenty times that of the direct costs. Both the direct and indirect costs add to the cost of housing.

The paper reports on a study conducted among members of the National Home Builders Registration Council (NHBRC) in South Africa to primarily determine H&S related perceptions and needs. The paper concludes that there is a general need for assistance relative to H&S. The assistance required is primarily in the form of the development and implementation of an H&S programme, training of management, supervisors and workers, content and interpretation of H&S legislation, development of project H&S plans, and to a lesser extent, risk assessments. The paper recommends that the NHBRC should inter alia: develop a housing oriented H&S programme; develop housing oriented H&S guidelines; present H&S seminars and workshops; train NHBRC 'inspectors' in H&S; include the assessment of H&S in site inspections, and develop an H&S competition.

1 Introduction

Traditionally, cost, quality and time have constituted the parameters within which projects have been managed. However, increasing awareness relative to the role of H&S in overall project performance and the inclusion of H&S as a project performance measure by inter alia, petro-chemical organisations, has engendered focus on H&S by a range of stakeholders. The number of large-scale construction accidents in South Africa and the consequential media coverage has further raised the level of awareness. Furthermore, the Construction Regulations promulgated on the 18 July 2003, require inter alia, a range of interventions by clients, designers, and contractors. In terms of the Construction

Regulations clients and principal contractors are required to determine whether principal contractors and contractors respectively, have made adequate allowance for H&S [1]

A further issue relative to H&S is the synergy between H&S and the other project performance areas. Optimum H&S engenders overall project performance in terms of cost, the environment, productivity, quality, and time. Furthermore, optimum H&S reduces risk.

Image is a further issue, in that should fatalities and injuries occur on a project, they could negatively affect the image of the developer and / or contractor as perceived by the public. In terms of project progress, the outcome of incidents and accidents constitutes a major risk, as the outcome is largely fortuitous – it could be minor, moderate, major, or catastrophic i.e. a project could be brought to a standstill. A further related aspect is that of the severity rate, the number of lost working days per worker per year, which marginalizes project progress.

Given the influence of H&S on overall performance, the H&S requirements in terms of the Construction Regulations, and the findings of a previous H&S related study conducted in the housing sector of the construction industry, a study was conducted among members of the NHBRC, the objectives of the study being to determine the:

- Extent to which various aspects negatively affect contractors' H&S efforts;
- Degree of contractors' familiarity with H&S related legislation;
- Degree of assistance required relative to H&S, and
- Extent of OH&S Inspectorate visits to housing projects.

In essence, the study was directed towards determining perceptions and needs relative to H&S.

2 REVIEW OF THE LITERATURE

2.1 Statistics

During 1999, the latest year for which occupational injury statistics are available, a total of 14 418 medical aid cases, 4 587 temporary total disablements, 315 permanent disablements, and 137 fatalities were reported to the Compensation Commissioner in South Africa [2]. These equate to 1 temporary disablement for every 102 workers, 1 permanent disablement for every 1 041, and 1 fatality for every 3 925. The disabling injury incidence rate (DIIR) 0.98 means that 0.98 workers per 100 incurred disabling injuries, the all industry average being 0.78. The number of fatalities among the workers insured by the Accident Fund (AF) is the equivalent of a fatality rate of 25.5 fatalities per 100 000 full-time equivalent construction workers, which does not compare favourably with international rates.

The severity rate (SR) indicates the number of days lost due to accidents for every 1 000 hours worked. The construction industry SR 1.14 is the fourth highest, after fishing, mining, and transport, the all industry average being 0.59. Given that the average worker works 2 000 hours per year, if the SR is multiplied by 2, the average number of days lost per worker per year can be computed – the construction industry lost 2.28 working days per worker during 1999. This is equivalent to 1.0% of working time.

2.2 Cost of accidents

The COA can be categorised as being either direct or indirect. Direct costs tend to be those associated with the treatment of the injury and any unique compensation offered to workers as a consequence of being injured and are covered by workmen's compensation insurance premiums. Indirect costs which are borne by contractors include: reduced productivity for both the returned worker(s) and the crew or workforce; clean-up costs; replacement costs; costs resulting from delays; supervision costs; costs related to rescheduling; transportation, and wages paid while the injured is idle [3]. Recent research conducted in the United Kingdom (UK) determined indirect costs to be 11 times the direct costs - 11:1 [4]. Research conducted in South Africa determined the indirect costs to be 14.2 times the direct costs [5].

Research conducted in the United States of America indicates the total cost of accidents to constitute, inter alia, 6.5% of the value of completed construction [6] and in the UK approximately 8.5% of tender price [7]. Based upon the respective indirect cost multipliers determined in the UK and South Africa, namely 11 and 14.2, and the estimated compensation insurance for 2002, the total cost of accidents could have been between:

- $R\ 200.1m + (R\ 200.1m \times 11) = R\ 2\ 401.2m$, and
- $R\ 200.1m + (R\ 200.1m \times 14.2) = R\ 3\ 041.5m$

Further, based upon the value of construction work completed in the year 2002, namely R 56 343m [8] the total COA could have been between 4.3% ($R\ 2\ 401.2m / R\ 56\ 343m$), and 5.4% ($R\ 3\ 041.5m / R\ 56\ 343m$) [9]. The key issue relative to the COA is that ultimately, clients incur the COA, as the COA is included in contractors' cost structures.

2.3 Cost of prevention (COP)

Rowlinson [10] maintains H&S performance cannot be measured in economic terms, but only in social terms. Consequently, the appropriate level of expenditure on H&S should be based upon economic, political and social considerations.

However, various authors quantify the cost of prevention. Research conducted in the USA determined that the cost of administering an H&S programme usually amounts to 2.5% of direct labour costs [6]. Based upon projects undertaken by a South African general contractor and that direct labour costs usually constitute 25% of the total project, the cost of administering an H&S programme was estimated to amount to 0.65% ($25\% \times 2.5\%$) of the total project cost [5].

Research conducted by Lai in Hong Kong revealed that most contractors set aside an amount of less than 0.5%, and some even less than 0.25% of the contract sum for investing in H&S on their contracts [11].

During recent research conducted among a group of 'best practice H&S' general contractors (GCs) eight GCs responded to the question: "On average, approximately what percentage does the cost of H&S constitute of total project cost?". Two GCs (25%) recorded a percentage, namely 3% and 0.5%, and six (75%) identified ranges: three (37.5%) ' $0 \leq 1\%$ ', and three (37.5%) ' $> 1 \leq 2\%$ ' [9].

2.4 Synergy

Synergism is defined as “The interaction of different entities so that their combined effect is greater than the sum of individual efforts.” [12]. Consequently, to facilitate TQM and to enable it to proliferate in the organisation, requires that quality efforts be linked to, among others, H&S and productivity.

Research conducted among project managers (PMs) in South Africa determined, inter alia, that productivity (87.2%) and quality (80.8%) predominated in terms of aspects negatively affected by inadequate H&S (Table 1) [13].

Table 1: Aspects negatively affected by inadequate H&S [13].

Aspect	Response (%)
Cost	72.3
Environment	66.0
Productivity	87.2
Quality	80.8
Schedule	57.4
Client perception	68.1

95.8% of PMs also stated that inadequate or the lack of H&S increases overall project risk. Risk increases as a result of increased variability of resources.

2.5 Aspects that affect H&S

A survey conducted among members of the National Association of Home Builders (NAHB) investigated inter alia, the aspects that negatively affect H&S [14]. 38.1% of respondents maintained that subcontracting of non-specialist trades negatively affected H&S, which became apparent due to: more unsafe acts (75%); unsafe conditions (75%); inadequate personal protective equipment (75%); inadequate plant and equipment (75%); poor housekeeping (50%); more accidents (50%); decreased productivity (37.5%); poor quality (37.5%), and more hassle (25%).

The reasons for the subcontracting of non-specialist trades having negatively effected H&S were attributed as follows: untrained workers (87.5%); lack of awareness (75%); focus on production (75%); lack of expertise (62.5%); focus on schedule (50%), and lack of commitment (25%).

2.6 Extent of H&S education

Table 2 indicates that in 64.5% or more of respondents’ organizations, 0% of incumbents in all levels of management did not have an H&S qualification [14]. Site manager and managing director predominate in terms of the levels of management in which more than 0% of incumbents have an H&S qualification. Further, managing director predominates in terms of the mean percentage of management, which has an H&S qualification.

Table 2: Percentage of management with an H&S qualification [14].

Level	Level > 0% (%)	Mean (%)
Owner	14.3	14.3
Partner / Member	33.4	25.0
Managing Director	44.4	44.4
Contracts Manager	23.1	18.5
Site Manager	45.5	34.2
Foreman	36.4	21.7
Junior Foreman	30.0	20.0

2.7 Interventions required

The study conducted among members of the NAHB in 1995 enquired regarding the degree of attention required relative to various aspects of H&S in housing [14]. Table 3 indicates that education and training predominate in terms of more attention required, followed by publicity and focus.

Table 3: Degree of attention required with respect to various aspects of H&S in housing.

Aspect	Response (%)		
	More	Adequate	Less
Focus	50.0	38.9	5.6
Education	80.0	15.0	5.0
Training	80.0	15.0	5.0
Legislation	5.3	52.6	36.8
Publicity	55.0	35.0	10.0

3 RESEARCH

3.1 Sample stratum

The original sample stratum consisted of 7 150 members of the National Home Builders Registration Council (NHBRC).

Due to the size and potential cost related to a survey of such a magnitude, a representative sample had to be selected. A 20% random sample selection was made resulting in a reduced sample stratum of 1 440. Two questionnaires were returned to sender (RTS) and 73 questionnaires were included in the analysis of the data, which equates to a response rate of 5.1%.

3.2 Analysis

Respondents were required to indicate the extent of the effect of various aspects and the degree of assistance by responding to does not and a five-point scale. Given that effectively a six-point scale ('does not' linked to a five-point) was used and that the difference between 0 and 5 is five, ranges with an extent of 0.8 (5 / 6) are used to discuss the degree of central tendency:

- $\geq 0.00 \leq 0.83$: does not to minor effect;
- $> 0.83 \leq 1.67$: does not to minor / minor effect;

- $> 1.67 \leq 2.50$: minor to near minor / near minor effect;
- $> 2.50 \leq 3.33$: near minor to effect / effect;
- $> 3.33 \leq 4.17$: effect to near major / near major effect, and
- $> 4.17 \leq 5.00$: near major to major / major effect.

Respondents were also required to indicate the extent of their organisations' need and the degree of familiarity using a five-point scale. Given that a five-point scale was used and that the difference between 1 and 5 is four, ranges with an extent of 0.8 (4 / 5) are used to discuss the degree of central tendency:

- $\geq 1.00 \leq 1.80$: strongly disagree to disagree;
- $> 1.80 \leq 2.60$: strongly disagree to disagree / disagree;
- $> 2.60 \leq 3.40$: disagree to neutral / neutral;
- $> 3.40 \leq 4.20$: neutral to agree / agree, and
- $> 4.20 \leq 5.00$: agree to strongly agree / strongly agree.

3.3 Findings

The Gauteng, KZN, Western Cape, and Eastern Cape provinces predominated among respondents. Due to the structure of the membership lists, namely alphabetical, and that pre-printed labels were provided by the NHBRC, it is not possible to compare the percentage provinces constituted of the respondent sample vis-à-vis the original sample stratum (Table 4).

Table 4: Provinces in which organisations undertake housing.

Province	Response (%)
Eastern Cape	16.4
Free State	8.2
Gauteng	24.7
KZN	20.5
Limpopo	9.6
Mpumalanga	11.0
Northern Cape	1.4
North West	5.5
Western Cape	20.5

Table 5 indicates that 58.9% of respondents undertook housing units, which have an individual value \geq R500 000.

Table 5: Value of individual housing units organizations mostly undertake.

Range	Response (%)
$> 0 < R30\ 000$	16.4
$\geq R30\ 000 < R500\ 000$	39.7
$\geq R500\ 000 < R1m$	28.8
$\geq R1m$	30.1

Table 6 indicates that the majority of respondents mostly undertake single storey housing, whereas 43.8% of respondents mostly undertake double storey housing. Although the construction of single storey housing entails hazards and risks, the construction of double and multi-storey housing entails inter alia, the use of plant and equipment not necessarily used in the construction of single storey housing.

Table 6: Level of housing which organizations mostly undertake.

Level of housing	%
Single storey	69.9
Double storey	43.8
Triple storey	9.6
> Triple storey	1.4

Table 7 indicates the extent to which various aspects affect housing contractors' H&S in terms of percentage responses to 'does not' and a range of 1 (minor) to 5 (major), and in terms of a mean score ranging between 0 and 5 – the do not responses have been added to the 'range'. It is notable that only three aspects have mean scores above the midpoint score of 2.50, which indicates that in general these aspects can be deemed to have an above average effect on H&S. Those aspects with mean scores below the midpoint score of 2.50, can generally be deemed to have between no to a minor effect on H&S.

Given that the first three ranked aspects have mean scores $> 2.50 \leq 3.33$, they can be deemed to have a near minor to effect / effect on H&S efforts. It is notable that inadequate general training (worker) predominates, and that the former, which is related to, is followed by lack of H&S training (worker) and worker skills. Clearly, the lack of H&S training (worker) is part of a bigger issue, namely inadequate training in general. The ranking of workers' skills is essentially the function of inadequate general training.

The aspects ranked fourth to eighth have mean scores $> 1.67 \leq 2.50$, which indicates that they can be deemed to have a minor to near minor / near minor effect on H&S efforts. Time pressure ranked fourth is often cited as having a negative effect on H&S [13], which the response does not reflect. Lack of H&S education (management and supervisors) is ranked higher than inadequate general education (management and supervisors). Although this is logical, general education affects H&S efforts as management and supervisors' competences in terms of the activities and functions of management such as planning, organizing, leading, controlling, and coordinating, and technical competences affect H&S efforts substantially. A high level of subcontracting ranked seventh is often cited as marginalizing H&S efforts. This finding, namely that a high level of subcontracting effects contractors' H&S efforts corroborates the finding of the study conducted among NAHB members in 1995 [14], namely 31.8% of respondents maintained that subcontracting of non-specialist trades negatively affected H&S. Insufficient finance to hire / purchase plant e.g. mobile crane ranked eighth does affect H&S efforts. However, the level of response relative to does not and the lower end of the scale is probably attributable to the majority of the respondents undertaking single storey housing.

Inadequate equipment e.g. scaffolding, insufficient finance to hire / purchase equipment e.g. scaffolding, and inadequate plant e.g. mobile crane, which have mean scores $> 0.83 \leq 1.67$, can be deemed to have between no to a minor / minor effect on H&S efforts. Inadequate equipment e.g. scaffolding, which is at the upper limit of the range i.e. on the cut point, is a critical resource in terms of H&S efforts, and therefore the level of response to does not and the lower end of the scale relative to this aspect and insufficient finance to hire / purchase equipment e.g. scaffolding, indicates that according to respondents, capacity in terms of equipment and the procurement thereof has a minor effect on H&S efforts. This conclusion is reinforced relative to inadequate plant e.g. mobile crane. However, given that the majority of respondents undertake single storey housing the need for such plant is probably limited.

Table 7: Extent to which various aspects affect contractors' H&S efforts.

Aspect	Response (%)							Mean score	Rank
	Unsure	Does not	Minor Major						
			1	2	3	4	5		
Inadequate general training (worker)	2.9	17.1	8.6	12.9	21.4	22.9	14.3	2.95	1
Lack of H&S training (worker)	5.6	12.7	14.1	14.1	14.1	25.4	14.1	2.72	2
Workers' skills	5.7	10.0	15.7	11.4	28.6	14.3	14.3	2.60	3
Time pressure	8.6	11.4	17.1	22.9	15.7	14.3	10.0	2.30	4
Lack of H&S education (management & supervisors)	4.3	24.3	14.3	17.1	18.6	10.0	11.4	2.20	5
Inadequate general education (management & supervisors)	2.8	22.5	26.8	12.7	9.9	11.3	14.1	1.97	6
A high level of subcontracting	8.5	22.5	31.0	4.2	11.3	15.5	7.0	1.81	7
Insufficient finance to hire / purchase plant e.g. mobile crane	5.6	33.8	22.5	9.9	5.6	8.5	14.1	1.73	8
Inadequate equipment e.g. scaffolding	5.7	25.7	28.6	12.9	12.9	7.1	7.1	1.67	9
Insufficient finance to hire / purchase equipment e.g. scaffolding	5.8	30.4	27.5	11.6	5.8	11.6	7.2	1.55	10
Inadequate plant e.g. mobile crane	1.4	45.1	23.9	14.1	5.6	5.6	4.2	1.18	11

Table 8 indicates the degree to which organisations are familiar with various OH&S legislation in terms of percentage responses to a range of 1 (unfamiliar) to 5 (familiar), and in terms of a mean score ranging between 1 and 5. It is notable that all three forms of legislation have mean scores below the midpoint score of 3.00, which indicates that in general the respondents deem their organizations to be unfamiliar with the forms of legislation. The Compensation for Occupational Injuries and Disease (COID) Act of 1993 requires inter alia, that organizations register with either the Compensation Commissioner or the mutual insurer for the construction industry. Given that the Occupational H&S (OH&S) Act of 1993 inter alia, requires employers to conduct a range of interventions and schedules a range of actions by employees, familiarity therewith is essential. The Construction Regulations effectively reinforced the OH&S Act within the context of construction. However, the integration of requirements of clients and designers therein has substantial implications for organizations undertaking design-build projects in the housing sector of the industry. Consequently, familiarity with the Construction Regulations is critical.

Table 8: Organisations' degree of familiarity with OH&S legislation.

OH&S legislation	Response (%)						Mean score	Rank
	Unsure	Unfamiliar Very familiar						
		1	2	3	4	5		
Compensation for Occupational Injuries and Disease (CIOD) Act of 1993	5.8	21.7	7.2	26.1	14.5	24.6	2.96	1
Construction Regulations of 2003	5.6	23.9	12.7	23.9	15.5	18.3	2.83	2
Occupational H&S (OH&S) Act of 1993	11.6	18.8	17.4	20.3	14.5	17.4	2.75	3

Table 9 indicates the extent of assistance the respondents' organizations require relative to a range of H&S related aspects in terms of percentage responses to 'does not' and a range of 1 (minor) to 5 (major), and in terms of a mean score ranging between 1 and 6 – the do not responses have been added to the 'range'. It is notable that only three aspects have mean scores above the midpoint score of 2.50, which indicates that in general the organisations can generally be deemed to require such assistance. The organizations can generally be deemed to require between no and an average level of assistance relative to those aspects with mean scores below the midpoint score of 2.50.

More specifically, mean scores $> 2.50 \leq 3.33$ indicate that the organizations require between an average to more than an average / more than an average amount of assistance relative to the aspects, namely: development of an H&S programme; H&S training (worker), and implementation of an H&S programme. These findings are significant as 80% of NAHB respondents identified the need for both more H&S education and H&S training during the study conducted in 1995 [14]. Mean scores $> 1.67 \leq 2.50$ indicate that between less than an average to average / average amount of assistance is required: H&S training (management & supervisors); content of H&S legislation; development of project H&S plans, and risk assessment.

In general, the level of ‘does not’ require assistance response is significant.

Table 9: Degree of H&S assistance required by organizations relative to various aspects.

Aspect	Response (%)						Mean score	Rank	
	Unsure	Does not	A little A lot						
			1	2	3	4			5
Development of a H&S programme	4.2	11.3	16.9	15.5	18.3	12.7	21.1	2.75	1
H&S training (worker)	2.9	17.1	11.4	11.4	21.4	11.4	24.3	2.74	2
Implementation of an H&S programme	2.9	11.4	17.1	20.0	17.1	11.4	20.0	2.62	3
H&S training (management & supervisors)	2.9	18.6	12.9	12.9	28.6	8.6	15.7	2.48	4
Content of H&S legislation	2.8	16.9	18.3	8.5	28.2	7.0	18.3	2.46	5=
Development of project H&S plans	2.8	12.7	16.9	19.7	19.7	9.9	18.3	2.46	5=
Risk assessment	5.7	14.3	21.4	20.0	15.7	5.7	17.1	2.17	7

29.2% of respondents indicated that their organizations had a near major or major need relative to H&S, 35.4% a need, and notably 35.4% a near minor or minor need (Table 10). Overall, given that the mean score is $> 3.40 \leq 4.20$ there is between a need to near major / near major need.

Table 10: Degree of need relative to H&S.

Degree	Response (%)	Mean score
Minor	20.0	3.24
Near minor	15.4	
Need	35.4	
Near major	13.8	
Major	15.4	

It is significant that 57.7% of respondents indicated that Department of Labour inspectors had never visited any of their housing projects. Only 32.4% responded in the affirmative, and 9.9% were unsure.

Nearly the majority (60.6%) of respondents stated that their overall performance had not improved as a result of NHBRC membership, whereas only 36.6% responded in the affirmative - 2.8% were unsure.

4 CONCLUSIONS

Given the mean score of 3.24 / 5.00 relative to the general needs relative to H&S, it can be concluded that there is a general need for assistance relative to H&S. The assistance required is primarily in the form of the development and implementation of an H&S programme, training of management,

supervisors and workers, content and interpretation of H&S legislation, development of project H&S plans, and to a lesser extent, risk assessments. The cited effect of inadequate general and H&S worker training and skills, and inadequate general and H&S education of managers and supervisors on H&S efforts, and the cited degree of familiarity with legislation, reinforces this conclusion.

The Department of Labour OH&S Inspectorate does not effectively penetrate the housing sector of the construction industry, which status may also have contributed to the general and specific level of perceived needs relative to H&S.

5 RECOMMENDATIONS

The NHBRC should:

- Conduct a performance evaluation survey among its members to determine their degree of satisfaction with the NHBRC;
- Develop a housing oriented H&S programme;
- Develop housing oriented H&S guidelines;
- Present H&S seminars and workshops;
- Train NHBRC ‘inspectors’ in H&S;
- Include the assessment of H&S in site inspections, and
- Develop an H&S competition.

The Department of Labour OH&S Inspectorate should focus attention on the housing sector of the construction industry, which attention should be in the form of advice and guidance.

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