

1 **The Influence of Clients and Designers on Construction**
2 **Health and Safety (H&S)**

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6 **Abstract.** A South African construction industry H&S status report cited the
7 high-level of non-compliance with H&S legislative requirements, and attributes
8 it to a deficiency of effective management and supervision of H&S on
9 construction sites as well as planning from the inception / conception of projects
10 within the context of project management. The study reported on constitutes a
11 further phase of studies to assess the status quo relative to the role of clients and
12 designers in construction H&S. A self-administered survey was conducted
13 among delegates attending a ‘Baseline Risk Assessment (BRA), Designer
14 Report, and H&S Specification’ workshop on the second day of an Association
15 of Construction Health and Safety Management (ACHASM) two-day Summit.
16 The salient findings include: the client and designer requirements of the
17 Construction Regulations are vindicated, and clients and designers can and do
18 influence construction H&S. Conclusions include: training can and does
19 influence delegates’ construction H&S culture; clients and designers influence
20 construction H&S, however, it can be in a positive or negative manner; the client
21 and designer-related requirements of the Construction Regulations are
22 vindicated, and clients and designers must be empowered to contribute to
23 construction H&S. Recommendations include: clients and designers should
24 follow the requirements of the Construction Regulations, and property
25 development and designer-related tertiary education must include, or rather
26 embed construction H&S in their programmes.

27 **Keywords:** Clients, Construction, Designers, Health and Safety.

28 **1 Introduction**

29 The report ‘Construction Health & Safety Status & Recommendations’ highlighted the
30 considerable number of accidents, fatalities, and other injuries that occur in the South
31 African construction industry [1]. The report cited the high-level of non-compliance
32 with H&S legislative requirements, which is indicative of a deficiency of effective
33 management and supervision of H&S on construction sites as well as planning from the
34 inception / conception of projects within the context of project management. The report
35 also cited a lack of sufficiently skilled, experienced, and knowledgeable persons to
36 manage H&S on construction sites.

37 Within the context of South Africa, the Construction Regulations promulgated in
38 July 2003, and amended in 2014 [2], effectively included client and designer
39 responsibility for construction H&S. Given the findings in the cidb report, and a range
40 of ‘influence of clients or designers on construction H&S’ studies, a convenience study
41 was conducted to determine construction H&S practitioners’ perceptions relative to the
42 latter two mentioned aspects, however, more specifically during the first four stages of
43 projects.

44 **2 Review of the Literature**

45 **2.1 Legislated client and designer responsibilities for construction H&S**

46 In terms of the South African Construction Regulations [2] clients are required to, inter
47 alia, conduct a baseline risk assessment (BRA), which provides the basis for the H&S
48 specification, which must then be provided to designers. Designers in turn are required
49 to, inter alia, consider the H&S specification, and in response, submit a report to the
50 client before tender stage that includes all the relevant H&S information about the
51 design that may affect the pricing of the work, the geotechnical-science aspects, and
52 the loading that the structure is designed to withstand. Designers are also required to:
53 inform the client of any known or anticipated dangers or hazards relating to the
54 construction work; make available all relevant information required for the safe
55 execution of the work upon being designed or when the design is changed; modify the
56 design or make use of substitute materials where the design necessitates the use of
57 dangerous procedures or materials hazardous to H&S, and consider hazards relating to
58 subsequent maintenance of the structure and make provision in the design for that work
59 to be performed to minimise the risk. To mitigate design originated hazards, requires
60 hazard identification and risk assessment (HIRA) and appropriate responses, which
61 process should be structured and documented.

62 **2.2 Client and designer actions relative to construction H&S**

63 A model evolved by Huang and Hinze [3] indicates that clients influence project H&S
64 through: communicating H&S; selection, and participating in H&S management.
65 Communicating H&S includes setting the project expectations for every party involved
66 through the contract and other communications. Selection includes the: selection of
67 contract type and arrangement; project design; project schedule; construction methods;
68 selection of designers, contractors, and subcontractors, and decisions regarding
69 outsourcing and vendors.

70 The International Labour Office (ILO) [4] as early as 1992 recommended that
71 designers should: receive training in H&S; integrate the H&S of construction workers
72 into the design and planning process; not include anything in a design which would
73 necessitate the use of dangerous structural or other procedures or hazardous materials
74 which could be avoided by design modifications or by substitute materials, and consider
75 the H&S of workers during subsequent maintenance.

76 According to Hecker et al. [5], H&S through design is a fundamental principle of
 77 H&S, and the hierarchy of controls is fundamental to the process of hazard reduction
 78 i.e. elimination or substitution to mitigate hazards, followed by engineering controls,
 79 behavioural modelling in the form of safe work procedures (SWPs), and then personal
 80 protective equipment (PPE).

81 Design influences and impacts on construction H&S directly and indirectly. Directly
 82 through: concept design; selection of structural frame; detailed design; selection of
 83 cladding, and specification of materials. Indirectly through: the selection of
 84 procurement system; related interventions such as prequalification; decision regarding
 85 project duration, and selection of contractor [6].

86 A design HIRA-oriented study conducted among architectural and engineering
 87 designers determined that the focus of design HIRAs is during the stages of
 88 'construction documentation and management', followed by 'tender documentation
 89 and procurement', and thereafter 'design development'. Furthermore, designers do
 90 consider / refer to various design related aspects when conducting design HIRAs, and
 91 they do undertake H&S related actions relative to projects and their practice,
 92 particularly amendment of designs and details [7].

93 **2.3 Research method and sample strata**

94 The survey entailed the administration of a twenty-seven-question questionnaire, which
 95 included solely closed 'concurrence' questions at the inception of the 'Baseline Risk
 96 Assessment (BRA), Designer Report, and H&S Specification' workshop on the second
 97 day of an ACHASM two-day Summit.

98 67 No. Responses were included in the analysis of the pre-workshop data, and 61
 99 No. in the post-workshop data.

100 The analysis of the data entailed the computation of frequencies and a measure of
 101 central tendency in the form of a mean score (MS) to enable interpretation of the
 102 percentage responses to the five-point plus 'unsure' scale.

103 **2.4 Results**

104 Table 1 provides a comparison of pre-assessment and post-assessment agreement with
 105 27 statements related to the influence of clients and designers on construction H&S in
 106 terms of a pre- and post-MS, and a percentage variance in terms of the percentage by
 107 which the post-MS is greater than the pre-MS.

108 All 27 statements are true (T), which should have attracted agreement as they did, as
 109 opposed to disagreement.

110 It is notable that 11 / 27 (40.7%) pre-MSs, and 16 / 27 (59.3%) post-MSs are > 4.20
 111 < 5.00, which indicates the concurrence is between agree to strongly agree / strongly
 112 agree.

113 Then, 16 / 27 (59.3%) pre-MSs, and 11 / 27 (40.7%) post-MSs are > 3.40 < 4.20,
 114 which indicates the concurrence is between neutral to agree / agree.

115 The biggest percentage differences between post-MSs relative to pre-MSs are:
 116 'clients influence H&S' (T) (15.6%); 'designers can mitigate hazards at the project

117 initiation and briefing stage' (T) (10.4%); 'H&S is related to constructability' (T)
118 (8.3%), and 'designers can identify hazards during the design delivery stage (T) (8.3%).

119 The biggest decreases between between post-MSs relative to pre-MSs are: 'design
120 influences H&S' (T) (-7.4%), and 'tertiary designer education should include
121 construction H&S' (T) (-5.0%).

122 It is notable that 'baseline risk assessments (BRAs) should focus on project location
123 and size related hazards' (T) has the highest post-MS (4.56). This is a new requirement
124 in terms of the 2014 Construction Regulations, and constitutes the initiation of the
125 'hazard and risk assessment' process during projects, courtesy of clients. However, the
126 post-MS of 'clients can identify hazards during the project initiation and briefing stage'
127 (T) (3.98), and 'clients can identify hazards during concept and feasibility stage' (T)
128 (4.07) are substantially lower. The post-MS of 'clients can negatively influence H&S'
129 (T) is 3.98, which indicates the potential of clients that do not fulfill their requirements
130 in terms of the Construction Regulations to marginalise construction H&S.

131 'H&S Specifications should focus on identified hazards and risk' (T) has the second
132 highest post-MS (4.50). However, previous research findings indicate that they
133 generally do not, but tend to regurgitate legislation. Given this comment, it is notable
134 that 'H&S specifications should be a useful reference' (T) has a post-MS of 4.41.
135 However, the post-MS of 'H&S specifications are a useful form of reference' (T) (4.13)
136 is 0.28 lower than the former. The concurrence relative to 'H&S Specifications should
137 not regurgitate the Construction Regulations' (T) (4.18) underscores the previous
138 statements.

139 The two statements 'Designers should consider their designs relative to construction'
140 (T) (4.43), and 'Design influences construction' (T) (4.42), which have the third and
141 fourth highest post-MSs are related in that the former is necessary due to the latter.
142 Then 'H&S is related to constructability' (T) has the joint-sixth highest post-MS (4.38),
143 constructability being the ease with which a building or structure can be assembled, and
144 which is a function of the extent to which designers considered construction. 'Designers
145 should conduct constructability reviews' (T) has a post-MS of 4.32, which underscores
146 the concurrence relative to the previous statements.

147 'Clients can positively influence H&S' (T) has a post-MS of 4.38, which is related
148 to 'clients influence H&S' (T), which has a post-MS of 4.31. It is notable that the
149 former's MS is marginally higher than the latter's MS.

150 It is notable that the post-MS of 'design influences H&S' (T) (4.18) is lower, albeit
151 marginally, than that relative to 'design can contribute to accidents' (T) (4.21), and
152 'design can positively influence H&S' (T) (4.25). It is notable that the post-MS of
153 'design can negatively influence H&S' (T), namely 4.05, is 0.20 lower than that of the
154 former statement.

155 Relative to designers, the identification and mitigation of hazards was de-linked, the
156 rationale being that designers may not be able to mitigate them. In terms of
157 identification, the post-MS of 'designers can identify hazards during the design delivery
158 stage' (T) (4.22) is higher than that relative to 'designers can identify hazards at the
159 project initiation and briefing stage' (T) (4.18), and 'designers can identify hazards
160 during the concept and feasibility stage' (T) (4.15). However, in terms of mitigation,
161 the post-MS of 'Designers can mitigate hazards at the project initiation and briefing

162 stage' (T) (4.28), is higher than that relative to 'Designers can mitigate hazards during
163 the concept and feasibility stage' (T) (4.13), and 'designers can mitigate hazards during
164 the design delivery stage' (T) (4.10).

165 Although the pre-MS of 'tertiary designer education should include construction
166 H&S' (T) is 4.54, which is 0.18 higher than the post-MS of 4.36 it falls within the upper
167 MS range, just as the post-MS of the related 'designing for H&S should be a designer
168 competency' (T) MS of 4.28.

169 The post-MS of 'procurement influences construction H&S' (T) (4.33) highlights
170 the role of procurement in construction H&S. Clients procure the services of designers,
171 and in doing so, are required to contribute to construction H&S processes.

172 **Table 1.** Comparison of pre-assessment and post-assessment agreement with statements related
173 to the influence of clients and designers on construction H&S.

Statement	MS		Post
	Pre	Post	> Pre (%)
Baseline risk assessments (BRAs) should focus on project location and size related hazards (T)	4.43	4.56	3,6
H&S Specifications should focus on identified hazards and risk (T)	4.33	4.50	5,2
Designers should consider their designs relative to construction (T)	4.47	4.43	(1,0)
Design influences construction (T)	4.49	4.42	(2,2)
H&S specifications should be a useful reference (T)	4.43	4.41	(0,6)
Clients can positively influence H&S (T)	4.40	4.38	(0,8)
H&S is related to constructability (T)	4.12	4.38	8,3
Tertiary designer education should include construction H&S (T)	4.54	4.36	(5,0)
Procurement influences construction H&S (T)	4.33	4.33	0,0
Designers should conduct constructability reviews (T)	4.30	4.32	0,4
Clients influence H&S (T)	3.86	4.31	15,6
Designers can mitigate hazards at the project initiation and briefing stage (T)	3.97	4.28	10,4
'Designing for H&S' should be a designer competency (T)	4.18	4.28	3,1
Design can positively influence H&S (T)	4.37	4.25	(3,7)
Designers can identify hazards during the design delivery stage (T)	3.97	4.22	8,3
Design can contribute to accidents (T)	4.14	4.21	2,3
H&S Specifications should not regurgitate the Construction Regulations (T)	4.05	4.18	4,4
Design influences H&S (T)	4.43	4.18	(7,4)
Designers can identify hazards at the project initiation and briefing stage (T)	4.09	4.18	2,9
Designers can identify hazards during the concept and feasibility stage (T)	3.98	4.15	5,5
H&S specifications are a useful form of reference (T / F)	3.89	4.13	8,2
Designers can mitigate hazards during the concept and feasibility stage (T)	3.97	4.13	5,4

Designers can mitigate hazards during the design delivery stage (T)	4.07	4.10	0,8
Clients can identify hazards during concept and feasibility stage (T)	3.91	4.07	5,3
Design can negatively influence H&S (T)	4.08	4.05	(0,8)
Clients can negatively influence H&S (T)	3.95	3.98	1,0
Clients can identify hazards during the project initiation and briefing stage (T)	3.88	3.98	3,6

174 **3 Discussion**

175 There was no difference between post and pre-MSs in one case, eighteen post-MSs
 176 were higher than the pre-MSs, and eight post-MSs were lower than the pre-MSs.
 177 Whereas 11 / 27 (40.7%) pre-MSs are > 4.20 < 5.00, which indicates the concurrence
 178 is between agree to strongly agree / strongly agree, 16 / 27 (59.3%) post-MSs are, which
 179 indicates that the workshop had an impact on the respondents' culture.

180 The empirical findings corroborate with those emanating from the literature courtesy
 181 of previous research.

182 Clients and designers influence construction H&S, either positively or negatively,
 183 the notable finding being that the post-MS relative to negatively was lower than that
 184 relative to positively with respect to both stakeholders.

185 **4 Conclusions**

186 Training can and does influence delegates' construction H&S culture.

187 Clients and designers influence construction H&S, however, it can be in a positive
 188 or negative manner. They can both do so during the early stages of projects, namely
 189 stage 1 'project initiation and briefing', and stage 2 'concept and feasibility'. However,
 190 designers have the potential to make a major contribution during stage 3 'design
 191 delivery stage'.

192 There is more opportunity to identify hazards during the respective stages than to
 193 mitigate them, albeit it marginally so.

194 In general, the clients and designer requirements of the 2003 and 2014 Construction
 195 Regulations are vindicated by the study. However, more importantly, the BRA
 196 requirement relative to clients courtesy of the 2014 Construction Regulations to precede
 197 the compilation of the H&S specification, is vindicated by the study, and more
 198 specifically the highest post-MS of 4.56, and the post-MS relative to 'H&S
 199 Specifications should focus on identified hazards and risk', namely 4.50.

200 Clients and designers must be empowered to contribute to construction H&S.

201 **5 Recommendations**

202 Clients and designers should follow the requirements of the Construction Regulations,
 203 however, they should adopt better practice in terms of their respective roles.

204 Property development and designer-related tertiary education must include, or rather
 205 embed construction H&S in their programmes. However, the role of clients and
 206 designers must be addressed such that they are empowered to contribute thereto, as
 207 opposed to mere reference or review of the related H&S legislation.

208 Property and designer-related associations and statutory councils must promote, and
 209 or provide the ‘role of clients and designers in construction’ continuing professional
 210 development (CPD), and evolve such guidelines and practice notes.

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