

1                                   **Costing of Health and Safety elements in**  
2                                   **Construction Projects in Gauteng, South Africa**

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6                                   **Abstract.** The current study reports on findings from a study on the costing of  
7                                   health and safety elements in construction projects. Nine construction projects  
8                                   were purposively enrolled to the study, comprising six civil engineering and three  
9                                   building construction project. The findings showed that H&S elements were  
10                                   costed by contractors using an itemised breakdown even though such items were  
11                                   not included as a trade items in the Bills of Quantities (BOQs). The costs  
12                                   established from actual expenses incurred on construction projects revealed that  
13                                   H&S expenditure ranged between 3% and 4% for projects with a value below  
14                                   R500 million and between 4% and 5% for projects with a value above R500  
15                                   million. Further, H&S costs were found to be directly proportional to the projects  
16                                   value and indirectly influenced by the client. Costing of H&S elements has been  
17                                   a challenging task as there is no standard on how H&S elements should be priced  
18                                   in the South African construction industry. The lack of a framework to assist with  
19                                   costing of H&S elements on construction projects makes accurate and adequate  
20                                   monitoring of H&S costs to be problematic. Thus, a standardised pricing  
21                                   framework can assist contractors to cost and for clients to adequately evaluate  
22                                   bids and or variations on construction projects, and to ensure that provision for  
23                                   H&S as provided for by the Construction Regulations 2014 is made.

24                                   **Keywords:** Construction, Costing, Health and Safety (H&S), South Africa.

25                                   **1 Introduction**

26                                   The construction industry still faces the challenge of a poor H&S performance.  
27                                   Statistics provided by the Health and Safety Executive (HSE) revealed that in 2013/14,  
28                                   injuries and new cases of ill-health of workers was largely from working conditions [1]  
29                                   HSE reported that these injuries and illness cost an estimated £14.3 billion [1].  
30                                   Similarly, in South Africa, the Construction Industry Development Board [2] reported  
31                                   that the cost of accidents, both direct and indirect, amounted to R3.5 billion per year.  
32                                   The financial loss caused by occupational accidents is great amounting to as much as  
33                                   1.2 trillion USD [3]. Occupational accidents cause significant financial losses in the  
34                                   workplace [4]. According to [5] these costs can be reduced if accidents can be  
35                                   prevented. However, prevention of accidents partly depend on correctly providing  
36                                   finance for H&S. Having a pricing guide is therefore essential.

## 37 2 Pricing For H&S On Construction Projects

38 As Motchar & Arditi [6] stated, the construction industry is characterised by extreme  
39 competitiveness, with high risks and generally low profit margins when compared to  
40 other areas of the economy. The competitive nature of the industry hinders H&S  
41 performance [7]. Sumner & Farrell [8] remark that such competition has often forced  
42 contractors to look for cost savings during the construction phase and such practice  
43 leads to H&S being compromised.

44 Sumner & Farrell [8] argues that inadequate and poor H&S do not only affect other  
45 project parameters, namely: cost, quality and schedule negatively, but the sustainability  
46 of the environment as well. According to Smallwood [9] the construction industry is  
47 perceived to be price driven. Projects are awarded on the lowest tendered price and not  
48 enough consideration is given to other factors such as H&S, and quality. López-Alonzo  
49 *et al.* [10] argue that making adequate provisions for H&S on construction projects  
50 could yield benefits to the project.

51 Clients are responsible for safety implementation on a project. Consequently, we ask  
52 how can the client ensure that the contractor has made adequate allowance for H&S  
53 measures on the project if a standard pricing tool to measure such output is non-  
54 existent?

55 For many contractors, H&S is priced as a line item in the Preliminaries and General  
56 (P&Gs) section of Bills Of Quantities (BOQ) and not as an itemised trade showing a  
57 breakdown of H&S costs even though studies by the CIDB [2], [8] and [12]  
58 recommended that H&S costs should be itemised in the BOQ; be laid out using a  
59 structured approach and be priced in a special section in the BOQ respectively.

60 A H&S pricing framework for construction projects will not only assist contractors  
61 to make adequate provision for H&S on construction projects or client to ensure that  
62 the contractor has made adequate allowance for H&S on said projects but to manage  
63 and report on the H&S costs on the said projects. The lack of such pricing model makes  
64 the accurate, adequate budgeting and controlling of H&S costs unlikely.

### 65 2.1 Personal protective Equipment (PPE)

66 PPE is defined as an article of clothing or accessory, that, when used correctly, will  
67 create a barrier between a person and the H&S hazard to which they are exposed. It is  
68 designed to reduce the adverse health effects [14]. A worker needs to wear a  
69 combination of PPEs to have adequate protection against a combination of several H&S  
70 hazards [14]. Unlike PPEs which protect a person from H&S risks at work, safety  
71 equipments (SEs) are essential for the effective operations of work on site. For PPEs,  
72 example of items to be pricing for should include: protective footwear, protective  
73 clothing, hand protection, eyes and earing protection, head protection, fall  
74 arrest/prevention; respiratory protection, reflective wear, special PPEs. Smallwood  
75 recommends that one of the elements that need to be included in costing for H&S on  
76 construction projects is the inspection of safety equipments [9].

## 77 2.2 H&S staffing and training

78 The cost of Health and Safety staffing should include training. According to the  
79 Construction regulation 2014 “no contractor may allow or permit any employee or  
80 person to enter any site, unless that employee or person has undergone health and safety  
81 induction training pertaining to the hazards prevalent on the site at the time of entry”  
82 [11]. Training and induction courses are therefore part of the safety cost in a project.

## 83 2.3 H&S programmes and activities

84 The cost drivers in this category encompass various activities and initiatives taken by  
85 management within an organization to raise health and safety awareness and engage  
86 with workers on safety matters in driving the successful implementation of H&S  
87 objectives on a given project in order to achieve the desired outcomes. Amongst others;  
88 the cost for H&S programmes and activities should include H&S audits, [15]; H&S  
89 incentives and rewards [16]; H&S meetings [17]; accident investigation and reporting  
90 [18]; H&S Branding [19]; security features [20]; emergency preparedness [21] and  
91 insurance costs [22] Compensation for Occupational Injuries and Deceases Act [23]

## 92 3 The Study methods

93 We studied nine projects comprising civil engineering and building projects in two  
94 different organizations. Data was collected through both interviews [31] and documents  
95 analysis [32] in organisations with a reported good H&S records and expertise. The  
96 interviewees included four were H&S Managers and a H&S executive. Their work  
97 experience ranged between 10 and 25 years. The goal of the project was to establish the  
98 costs of H&S on a project. The choice of projects used in the case study was based on  
99 value and type. As projects are different in nature and have different requirements and  
100 scope, such factors have an impact on H&S costs.

101 Data obtained were analysed using descriptive statistics, namely: frequency count  
102 [33] percentage ratios [34] and rankings [35] Frequency count was used to identify the  
103 most and least frequent H&S cost drivers found on projects (*Figure 1*). Rankings were  
104 used to classify various cost drivers based on their FS in descending order.

## 105 4 Findings

106 The project values included in the study ranged between R31 million and R687 million.  
107 In terms of duration, the shortest project period was 10 months and the longest 27  
108 months .

109 **Table 1.** H&S cost drivers

| Item No. | Cost Drivers  | Reference |
|----------|---------------|-----------|
| 1        | PPEs          | [14]      |
| 2        | H&S Personnel | [11, 12]  |

|    |                                       |           |
|----|---------------------------------------|-----------|
| 3  | Safety Equipments (SEs)               | [9], [24] |
| 4  | H&S induction & training              | [25]      |
| 5  | H&S Inspections                       | [1]       |
| 6  | H&S Audits                            | [11, 26]  |
| 7  | H&S Incentives                        | [16]      |
| 8  | H&S Meetings                          | [11, 27]  |
| 9  | Accident investigations and reporting | [28]      |
| 10 | H&S Medicals                          | [11,14]   |
| 11 | H&S Signage                           | [29]      |
| 12 | H&S Campaigns                         | [2]       |
| 13 | First Aid                             | [21]      |
| 14 | H&S Promotions                        | [30]      |
| 15 | H&S Branding                          | [19]      |
| 16 | Security features                     | [20]      |
| 17 | Emergency Preparedness                | [21]      |
| 18 | Insurance costs                       | [22]      |

110 Document analysis revealed that the actual expenses on H&S elements ranged from  
 111 R900 thousand for a R30 million project and about R34 million for a 650 million project  
 112 (*Table 2*). In terms of the actual expenses on H&S and the project value ratios, it was  
 113 found that the actual costs ranged between 2% and 5% (*Table 3*). It was also observed  
 114 that projects with a value of R500 million and above had a higher H&S expense to  
 115 project value ratio. These projects had a ratio of 4% and above. Of interest, however a  
 116 R31 million value for project C had about 3% of its project value on H&S provisions.  
 117 On average on building projects, the percentage spent on H&S equated to 3% and 4%  
 118 on civil engineering projects.

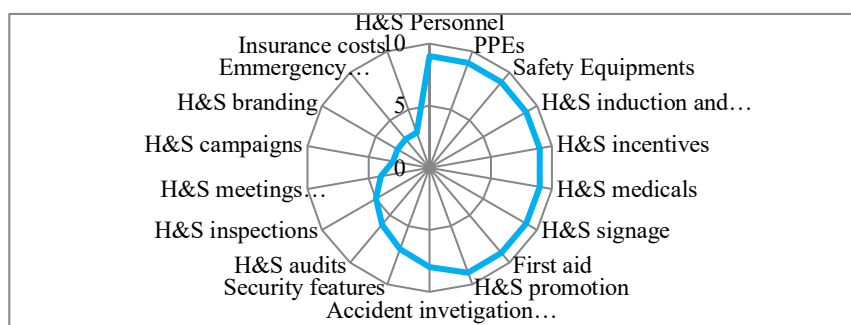
119 Nine elements were found to be the most frequent in all projects with a frequency  
 120 score of 9 (See figure 1). These included: H&S personnel, PPEs, induction and training,  
 121 incentives, medicals, signage, first aid and H&S promotions. Investigations were  
 122 ranked second with a frequency rate of 8. Security features was ranked third at 7. H&S  
 123 audits were ranked fourth at 6. H&S inspection was ranked fifth with a frequency rate  
 124 of 5. In sixth position were expenses to do with H&S meeting with frequency of 4. H&S  
 125 campaigns, H&S branding, emergency preparedness and insurances were ranked last at  
 126 3.

127 It was observed that projects with higher values also had a higher H&S expense for  
 128 the project compared to those with lesser value. H&S costs were found to be directly  
 129 proportional to the project value. Considering all elements being equal, it was observed  
 130 that for projects valued below R500 million, had H&S expenses of between 3% and 4%  
 131 Projects valued above R500 million, had H&S expenses of between 4% and 5%. Thus,  
 132 the higher the project value, the higher the cost of H&S.

133 **Table 2.** H&S expenditure ratios

| Item No. | Project Names | Project Budget Expenditure | H&S expenditure | % ratio |
|----------|---------------|----------------------------|-----------------|---------|
| 1        | Project A     | R400 000 000.00            | R9 553 995.79   | 2.39%   |
| 2        | Project B     | R195 000 000.00            | R5 203 248.74   | 2.67%   |

|   |           |                 |                |       |
|---|-----------|-----------------|----------------|-------|
| 3 | Project C | R31 500 000.00  | R957 454.78    | 3.04% |
| 4 | Project D | R630 000 000.00 | R25 690 909.42 | 4.08% |
| 5 | Project E | R500 000 000.00 | R20 688 493.19 | 4.14% |
| 6 | Project F | R687 000 000.00 | R33 664 777.73 | 4.90% |
| 7 | Project G | R86 000 000.00  | R2 680 986.22  | 3.12% |
| 8 | Project H | R72 000 000.00  | R2 410 426.05  | 3.35% |
| 9 | Project I | R372 000 000.00 | R14 791 563.62 | 3.98% |



134

135 **Fig. 1.** H&S elements priced for on construction projects136 **4.1 Findings from interviews**

137 Interview participants acknowledged that with the lack of a standardised pricing  
 138 model, clients in the CI cannot ensure that H&S measures are adequately provided for.  
 139 Participant 3, a Safety, Health and Environmental manager said:

140 *“There is no method for pricing for H&S in the construction industry. A pricing tool*  
 141 *is non-existent. How do clients adjudicate for H&S? How can the costs of H&S be*  
 142 *managed on projects?”*

143 We found that most participants itemised the cost of health and safety on their  
 144 projects as opposed to using percentages as such method is considered not accurate.  
 145 According to the participants, itemised costing approach for H&S, is better and cost  
 146 control can be achieved. Participant 5, argued that the cost of H&S should be itemised  
 147 in the BOQ in order to manage expenditure and report adequately.

148 **Table 3.** H&S cost elements

| Item No. | Category | Cost components |
|----------|----------|-----------------|
|----------|----------|-----------------|

|    |                            |                                                                                                                                      |
|----|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1  | PPEs                       | footwear, clothing, gloves, eyes and earing protection, hard hat, fall arrest strap; mouth mask, reflective wear,                    |
| 2  | Induction & Training       | On PPE ; emergency response; crane/machinery operations; accidents investigation & reporting; first aid; special training            |
| 3  | SHE personnel              | Managers; Officers (Site based); first aiders;                                                                                       |
| 4  | Medicals                   | Entry & exit medicals; cost of consultation                                                                                          |
| 5  | Site Security              | Fencing, site enclosure; access control; site illumination;                                                                          |
| 6  | Safety Equipments          | Fire extinguishers; harnesses; cones; alarm canisters; flags; speed bumps/humps; breathalysers; ladders; scaffolding; lifelines;     |
| 7  | Welfare, wellbeing         | Accommodation; transportation; skips; food; bins; ablutions; eating & cooking area; cleaning equipment; storage; cleaning personnel. |
| 8  | Signage                    | Warning, directional prohibitory signs; mandatory; emergency traffic control signs (i.e.: speed limits, Stops blocks, etc.) signs    |
| 9  | Administration             | SHE file; Permits approval; Police clearance; Inspection & audits;                                                                   |
| 10 | Investigations & reporting | Direct costs                                                                                                                         |
| 11 | Insurances                 | COVID, Insurance premiums                                                                                                            |
| 12 | Sundries                   | awards; branding; incentives                                                                                                         |

## 149 5 Conclusions

150 The study aimed at identifying key H&S pricing elements on construction projects. In  
 151 order to achieve the said objectives, it was imperative to identify the cost drivers that  
 152 should be considered when pricing for H&S and how much should be allowed for. H&S  
 153 cost drivers presented in the findings are regarded as the minimum to be priced for if it  
 154 at all H&S performance can be assured and monitored on construction projects.

155 From the findings, it was evident that contractors itemised the cost of H&S on their  
 156 projects even though such breakdown is not included as a trade in the BOQs. With the  
 157 lack of a standardised pricing model, each contractor has its own way of pricing for  
 158 H&S, which makes it difficult for client to adjudicate and ensure that contractors have  
 159 made adequate allowance for health and safety measures on their projects as required  
 160 by the Construction Regulations [11].

161 With regards to budget, health and safety costs on projects were found to be directly  
 162 proportional to the project values. Higher H&S specifications will have an impact on  
 163 H&S cost compared to projects with lower specifications. Since projects are driven by  
 164 clients, it was also observed that clients had an indirect impact on H&S cost on projects.  
 165 An H&S minded client would have a higher H&S specifications, thus affecting H&S  
 166 costs

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