

THE COST OF CONSTRUCTION ACCIDENTS: AN EXPLORATORY STUDY

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ABSTRACT

This paper presents the results of a study to establish the actual accumulated costs of construction related health and safety accidents given that occupational accidents and their associated costs are a serious concern, fundamentally for management and the construction industry at large. Further, accidents have huge cost implications that potentially affect not only overall project performance but the sustainability of the enterprise. The study builds on the premise that all accidents are preventable, accompanied by positive performance impacts and outcomes. The findings of a pilot study are presented in this paper. They suggest that the costs of accidents are under calculated and in reality only represent the figurative “tip of the iceberg.”

Keywords: Cost, Direct Costs, Indirect Costs, Construction, Accident, Health and Safety

1. INTRODUCTION

Construction worker injuries and illnesses have cost implications attached which, arguably, can have a major impact on a construction organisation. It is not possible to insure against all the costs arising from accidents. However, it is possible to prevent accidents from occurring. Consequently, the costs of accidents can be avoided, time and money saved and harm to people prevented.

Research has frequently focused on the costs of occupational accidents and ill-health, without much attention to the economic benefits coupled with health and safety. This paper reports on a study of the direct and indirect costs associated with construction accidents within the context of a major stakeholder in the South African construction industry. The authors contend that all accidents are preventable. Further, the prevention of accidents results in positive performance impacts and outcomes that ultimately result in economic benefits overall.

Accidents by their very nature are undesirable events given the resultant unpleasant and damaging consequences to the affected organisation. Accidents at work and the

accompanying occupational injuries are a considerable economic burden to employers, employees and to society as a whole [1]. “During the last financial year alone, the Labour Department in South Africa has paid out R319 million (about \$50 million U.S.) on claims for work-related injuries and illnesses, and this payout is just for compensation of employees and medical costs [2]. The construction sector has the worst record relative to occupational accidents and overall health and safety performance. More workers are killed in the construction industry than in any other major industrial sector. The South African Department of Labour reports that the injury rate in construction is higher than the rate for private industry as a whole.

Construction accidents account for 4% of the global Gross Domestic Product (GDP). South Africa obviously contributes to this tragic scenario. Occupational accidents and diseases in South Africa account for approximately 3.5% of its GDP, which translates to about R30 billion (about \$4.2 billion U.S.). There are other aspects, apart from the financial and economic impacts which cannot be measured in any accurate and tangible terms, namely the strain of the loss of a family member, particularly if the worker was the only family breadwinner [3].

Typically, construction organizations do not accurately and comprehensively track or calculate the actual costs associated with occupational accidents. When the costs are tracked, they usually do not include the costs related to schedule delays, added administrative time, lower morale, increased absenteeism, and poor customer relations. These indirect costs are not, *prima facie*, so obvious.

2. DIRECT AND INDIRECT COSTS

The costs of accidents can be categorised into direct and indirect costs [4]. Various direct and indirect costs are associated with any accident and the extent of these varies with the severity of the consequences of an accident. Severity can range from minor accidents involving little or no absence from work to fatalities.

Direct Costs

Direct costs tend to be those associated with the treatment of the injury arising from the accident and any unique compensation offered to workers as a consequence of being injured. These easily-identified expenses are known as the ‘direct costs’ associated with accidents.

The direct costs are by and large covered by workmens’ compensation insurance. Further, historical records can be reviewed to determine the expenditure attributed to each particular injury. Most of these costs are covered by workers' compensation insurance, such as medical expenses, lost wages, sick leave administration, temporary disability payments and hospitalization. However, others must be covered by the business itself. What may initially be classified as an inconsequential or minor accident, can prove to be immensely costly in terms of indirect costs.

Indirect Costs

Less evident expenses associated with accidents are known as "indirect" or "hidden" costs and can typically be several times greater than the value of the direct costs. According to Levitt & Samelson (1993) indirect costs include:

- reduced productivity for both the injured worker(s) upon returning to work and the crew or workforce;
- clean-up costs;
- replacement costs;
- stand-by costs;
- cost of overtime;
- administrative costs;
- replacement worker orientation;
- costs resulting from delays;
- supervision costs;
- costs related to rescheduling;
- transportation; and
- wages paid while the injured is idle.

The indirect or hidden costs usually exceed the direct costs. Indirect cost data is considerably more difficult to access than direct costs because the information is not often captured or quantified as it accrues. When estimates of indirect costs are made, it is common for the records to be either inaccurate or incomplete or both. Research conducted by the University of Washington (Hinze, 1992) determined the indirect costs (excluding claims and material damage costs) to be more than 1.67 times the direct costs of accidents [6]. Other studies suggest that the ratio between direct costs and indirect costs varies widely, from a high of 1:20 to a low of 1:1 [7]. Research conducted in South Africa determined the indirect costs to be 14.2 times the direct costs (Smallwood, 2000).

These costs are usually several times greater than the insured or direct costs. An iceberg graphically reflects the relationship between direct and indirect costs. The costs recoverable through insurance are visible but hidden beneath the surface are the uninsured or indirect costs. Like an iceberg, most of the costs are not immediately visible. Estimated ratios of direct to indirect costs from previous studies range from less than 1:1 to 1:36. A conservative estimate for the ratio is 1:2, although several authorities use a 1:4 ratio in calculating total costs of injuries related to accidents [8].

Examples of indirect costs that are usually not covered by insurance include:

- Overtime costs
- Time lost by injured employee
- Idle workers lost time
- Remedial work/correction
- Injured employee's productivity loss costs
- Supervision and management lost time
- Incident investigation costs

- Production loss and process delays
- Transportation costs
- Training of replacement employee(s)
- Additional medical costs
- Damage to equipment, plant, tools, or other property
- Idle plant and equipment
- Legal expenses
- Reduced morale
- Overhead cost borne by injured employee/family
- Negative image
- Funeral Costs; and
- Other (including pain & suffering)

These indirect costs, which are often overlooked, have been found to be quite detrimental to the overall performance of the business. It is important to note that there is no definitive or ultimate list of cost factors that can be employed to completely determine all indirect costs relative to accidents.

Impact of severity on cost

The costs associated with construction-related accidents can vary radically depending on the severity of the consequences of the accident and other influencing conditions. Severity can range from minor accidents involving little or no absence from work to fatalities. The more severe the accident the longer the time typically required to recover and return to normal occupational duties. Consequently, the associated costs are much higher. The more intensive the medical treatment required the higher will be the costs associated with the accident.

3. RESEARCH

In an attempt to determine the cost of construction accidents, a comprehensive review of construction related accidents was conducted within a major construction organization with a five-year construction volume in excess of R150 billion (\$25 billion U.S.).

The number of accidents reported during the period of 2 April 2006 to 31 December 2008 was 710 (see Table 1). For the purposes of this exploratory study, 15 construction related accidents were randomly selected of which only five accidents were analyzed for this paper. Limitations may however exist due to the relatively small sample that was measured.

Analysis of the records highlighted the dominant prevalence of three categories of accidents, namely

1. accidents involving persons cut or caught in/between;
2. being struck by or against; and
3. falls.

Consequences ranged from fatalities to severe lost time and major medical treatment.

The South African Compensation Commissioner predetermines the approximate costs for the following types of accidents, namely [8].

Fatality	R1.500,000
Lost Time Accident	R30,000
Medical Treatment	R3,500
First Aid Treatment	R1,000

In Table 2 these estimated claim costs are used where actual costs were not available at the time the accident report was concluded. It is evident that investigation costs, irrespective of the nature of the accident, are a major cost item. Given this finding, it is imperative that the funds are spent judiciously by ensuring that an accurate and comprehensive record of costs is kept and maintained.

Of particular interest to this study is the ratio of indirect costs to direct costs despite the incompleteness of the cost records when compared with the lists of items produced from the literature.

Table 1: Total number of construction-related for 2006/2007

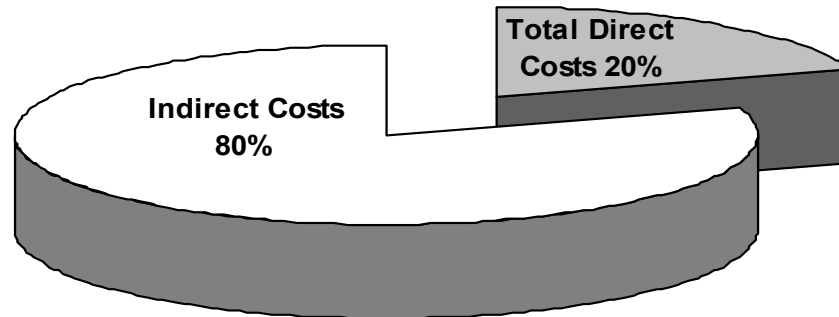
Nature of Incident	Number per type of Injury Classification					TOTAL No. of Incident Type	% of Incident Type	Cumulative sum of the %
	Fatalities	LTI's	Occupational diseases	Medicals	First Aids			
Cut or Caught in / between / on	0	32	0	113	50	195	27.46	27.46
Struck by / against	0	27	0	64	48	139	19.58	47.04
Fall (same level)	0	22	0	51	13	86	12.11	59.15
Vehicle Accident - Motor	11	15	0	50	2	78	10.99	70.14
Over Stress (over exertion, ergonomics...)	0	5	0	31	4	40	5.63	75.77
Fall (different level)	1	13	0	11	9	34	4.79	80.56
Foreign Body	0	1	0	19	14	34	4.79	85.35
Rigging / Lifting Equipment	0	7	0	13	3	23	3.24	88.59
Falling Object	1	3	0	7	10	21	2.96	91.54
Occupational Hygiene Agencies	0	0	5	5	2	12	1.69	93.24
Contact - Electrical	0	4	0	4	1	9	1.27	94.501
Explosion / Fire / Burn	0	2	0	1	6	9	1.27	95.77
Animal / Insect Bite	0	1	0	6	1	8	1.13	96.90
Plant / Equipment / Structural Failure	2	3	0	2		7	0.99	97.89
Mobile / Moving Equipment (cranes, forklifts, ...)	0	0	0	2	2	4	0.56	98.45
Contact - Environmental	1	0	0	0	2	3	0.42	98.87
Vehicle Accident - Construction	0	1	0	1	1	3	0.42	99.30
Obstacle / Hazard / Housekeeping	0	0	0	1	1	2	0.28	99.58
Unlawful Acts (fraud, theft, vandalism, assault, ...)	1	1	0	0	0	2	0.28	99.86
Handling (lifting, pulling, pushing)	0	0	0	1	0	1	0.14	100.00
total no of injury classifications	17	137	5	382	169	710	100.00	

Table 2: Direct and Indirect costs of sample accidents

Cost Category	Accident Report Number											
	i-2007-7-1208		i-2007-7-1214		i-2007-7-1230		i-2007-8-1257		i-2007-9-1601			
	Accident Cause											
	Struck Against(Rib Cage)	%	Struck By (Fracture)	%	Fall (Fatality)	%	Caught In (Dislocated shoulder)	%	Struck by (Fracture)	%	Total Costs	%
Direct												
Medical (ambulance, doctor, medication, hospital)	800	66.7%	1700	48.6%			3450	41.8%	1850	27.8%	7800	1.50%
Wages for injured person/s	400	33.3%	1800	51.4%	500000	100.0%	4800	58.2%	4800	72.2%	511800	98.50%
Direct Costs (Rands)	1200		3500		500000		8250		6650		519600	100.00%
Indirect												
Overtime costs	600	1.7%	1800	4.7%	6000	0.3%	4800	6.6%	4800	10.7%	18000	0.9%
Time lost by injured employee	1250	3.6%	1600	4.1%	60000	3.2%	2700	3.7%	1100	2.5%	66650	3.2%
Idle workers lost time	900	2.6%	450	1.2%	3000	0.2%	1200	1.6%	650	1.5%	6200	0.3%
Remedial work/Correction	400	1.1%	400	1.0%	32000	1.7%	2000	2.7%	400	0.9%	35200	1.7%
Injured employee's productivity loss costs	2300	6.5%	1350	3.5%	12500	0.7%	2600	3.6%	2200	4.9%	20950	1.0%
Supervision & Management lost time	2600	7.4%	4800	12.4%	34600	1.8%	4800	6.6%	6800	15.2%	53600	2.6%
Incident investigation costs	12500	35.5%	14700	38.1%	198500	10.6%	19300	26.5%	15600	34.9%	260600	12.6%
Production loss and process delays	2600	7.4%	3000	7.8%	148000	7.9%	18000	24.7%	2400	5.4%	174000	8.4%
Transportation costs	280	0.8%	600	1.6%	6700	0.4%	540	0.7%	400	0.9%	8520	0.4%
Training of replacement employee	450	1.3%	600	1.6%	2750	0.1%	670	0.9%	550	1.2%	5020	0.2%
Additional medical costs	200	0.6%	0	0.0%	250	0.0%	450	0.6%	150	0.3%	1050	0.1%
Damage to equipment, plant, tools, or other property.	700	2.0%	400	1.0%	600	0.0%	1200	1.6%	550	1.2%	3450	0.2%
Idle plant and equipment	250	0.7%	750	1.9%	27000	1.4%	4500	6.2%	300	0.7%	32800	1.6%
Legal expenses	0	0.0%	0	0.0%	44000	2.3%	0	0.0%	0	0.0%	44000	2.1%
Reduced morale	1250	3.6%	1400	3.6%	18000	1.0%	1500	2.1%	1300	2.9%	23450	1.1%
Overhead cost borne by injured employee/family	2700	7.7%	2650	6.9%	17000	0.9%	2400	3.3%	2100	4.7%	26850	1.3%
Negative image	0	0.0%	0	0.0%	63000	3.4%	0	0.0%	0	0.0%	63000	3.0%
Funeral Costs	0	0.0%	0	0.0%	27000	1.4%	0	0.0%	0	0.0%	27000	1.3%
Other (including pain & suffering)	6200	17.6%	4100	10.6%	1178000	62.7%	6200	8.5%	5400	12.1%	1199900	58.0%
Total Indirect Costs (Rands)	35180	100.0%	38600	100.0%	1878900	100.0%	72860	100.0%	44700	100.0%	2070240	100.0%
Total cost	36380		42100		2378900		81110		51350		2589840	
Ratio of Direct: Indirect costs	1:29		1:11		1:4		1:9		1:7		1:4	

The study explicitly established that those indirect costs relating to other costs which include pain and suffering (58%), incident investigations (12.6%) and production loss and process delays (8.4%) are the foremost construction accident expenses with the utmost financial impact.

Diagram 1: Chart illustrating the disparity between the direct and indirect costs



A distinctive finding from this study demonstrates the substantial disparity between the direct and indirect costs relative to construction accidents.

5. CONCLUSION

The findings of this exploratory study suggest that a comprehensive analysis of the cost of accidents is necessary for any organization to completely understand the broad implications of accidents. Such an analysis will enhance the prospects of an improved allocation of resources to proactive strategic health and safety interventions that will prevent accidents from occurring. However, to achieve this objective all costs need to be captured and recorded. Clearly there is an obvious need to develop a new approach to conducting accident investigations and the recording of essential data.

This preliminary study has confirmed that indirect costs exceed direct costs of accidents. Further, several costs were not recorded suggesting that the overall costs are even greater given their incompleteness and lack of accuracy. The authors argue that these costs in reality represent only a portion of the costs that are beneath the figurative "tip of the iceberg".

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