Accident Costs

Rethinking ratios of indirect to direct costs

By Fred A. Manuele

Presentations to management on the costs of worker injuries and illnesses can be attention-getting and convincing, provided the data are plausible and can be supported with suitable references. Unfortunately, little research and hard data exist to support the frequently used ratios of indirect to direct costs that appear in safety-related literature.

Furthermore, as in the sources cited by this article, the elements included in direct and indirect cost categories may differ (Heinrich, 1931; Grimaldi & Simonds, 1989; Leigh, Markowitz, Fahs, et al., 1997). And, the ratios in those sources are invalid because the direct costs of accidents have increased in recent years at a pace far greater than indirect costs.

This article discusses the author's review of select data pertaining to indirect and direct accident costs. Computations are made in order to update a ratio reported in a plausible research study in order to approximate the current ratio of indirect to direct costs. In addition, the author discusses the inappropriateness of the "additional sales needed" argument to cover total indirect and direct accident costs.

Unsupported Statements About Ratios

Enter "indirect and direct costs of accidents" into an Internet search engine, and the search will return a wide variety of documents that include ratios of those costs. Some pertain to the costs that an employer would bear. Others are more broad and pertain to the societal burden of such costs. Select examples relating to employer costs are highlighted.

- *The Business Results Through Health and Safety Guidebook*, from Canadian Manufacturers and Exporters (Ontario Division) and Workplace Safety and Insurance Board (2001) "demonstrates the business case for workplace health and safety and reflects the experience of Ontario businesses." The publication states, "The average workplace lost-time injury in Ontario costs over $59,000. The average lost-time workers' compensation claim cost is over $11,771." (Note: Round $11,771 to $11,800, and one finds that a 4-to-1 multiplier was used to get to $59,000. The guidebook recommends a 4:1 ratio within a cost computation system provided for employers to use.)
- The Spring 2006 issue of ASSE's *Journal of SH&E Research* contains the article, "A Survey of the Safety Roles and Costs of Injuries in the Roofing Contracting Industry" Choi (2006). The author writes, "Traditionally indirect costs are measured as being four times the direct costs (Heinrich, 1941), but the indirect costs of injuries may range from two to 20 times the direct costs."
- U.S. Fish and Wildlife Service, Division of Safety and Health, offers this: "For every dollar spent on direct costs, $4 to $10 are spent on indirect costs."

IN BRIEF

- **Safety practitioners have long used the ratio of indirect to direct costs of accidents to inform management on total accident costs. The most commonly used ratio is 4:1.**
- **No published ratios are currently valid because the increase in direct costs in the past 15 years has substantially exceeded the increase in indirect costs.**
- **A study is proposed that would follow good research protocols and provide safety practitioners with valid cost ratio data.**

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•Western National Insurance says, "Most experts estimate that the indirect costs are 3 to 10 times the direct costs of an accident."

•North Carolina Industrial Commission (2007) states, "Many seasoned experts estimate that the indirect costs of an accident are three to 10 times the direct costs."

•International Labor Organization's Introduction to Occupational Safety and Health training module states, "It has been estimated that the indirect costs of an accident or illness can be four to 10 times greater than the direct costs, or even more."

•International Safety Equipment Association (ISEA, 2002) says, "Reliable estimates place them (indirect costs) at up to 30 times the direct costs."

•OSHA (2007) indicates that "studies show that the ratio of indirect costs to direct costs varies widely, from a high of 20:1 to a low of 1:1."

Some of these references say the ratios relate to the work of seasoned experts, reliable estimates or studies made, but none of the experts or studies are cited. The ratios cited in these examples range from 1:1 to 30:1.

Differences in Cost Categories

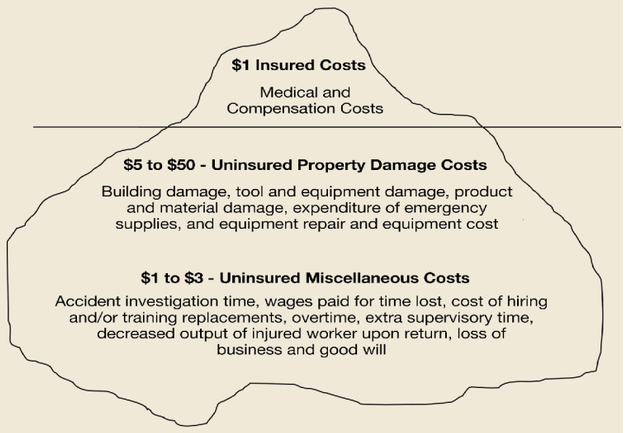
Many combinations of terms about the costs to employers of employee accidents appear in the literature, including direct and indirect, insured and uninsured, ledger and nonledger, and tangible and intangible. (Ledger and tangible costs are those for which data are created in the normal business process that can be entered into a financial ledger, such as medical and indemnity costs paid. Nonledger and intangible costs are those that occur but for which no specific data are determined, such as the value of time spent by supervisors and others who give attention to the accident, time spent providing first aid and investigation time.)

Also, the direct and indirect cost categories differ considerably among the various sources. What is an indirect or hidden or uninsured cost in one list may be excluded in another. For example, some lists include lost productivity or loss of profits as an indirect cost. Chapter 6, "Cost Analysis," in Grimaldi and Simonds (1989) *Safety Management*, 5th ed., contains a 6-page discussion on the invalid and restricted items that should not be included when computing uninsured costs. For example:

> Loss of profit of idle machines or workers is not generally a valid cost. When workers or machines are made idle, one of two things occurs. Either the production is eventually made up, or it is not. If it is made up, in the sense that over a long period of time no less goods are produced and sold than would have been had the "accident" not occurred, there is no loss of profit, apart from the increase in production costs.

For this article, the author focused on accident costs assumed by employers, the direct costs of which are the legally required indemnity payments and the medical costs paid, with all other related costs being the indirect costs. Other studies have addressed the costs of injuries and illnesses to society; however, because of the differences in cost allocation methods, those studies are of little value in determining employer costs.

Figure 1
Bird's Cost of Accidents Data: The Iceberg



Note. *Adapted from* Practical Loss Control Leadership *(Revised ed.), by F.E. Bird Jr. and G.L. Germain, 1985, Loganville, GA: Det Norske Veritas.*

Heinrich's Indirect & Direct Cost Ratios

Heinrich's (1931; 1959) presentation of the 4:1 indirect to direct cost ratio of injuries and illnesses was a historical first. It is often referenced in the literature. The following comments are derived from the first edition of the book (published in 1931), giving the results of his 1926 study.

Heinrich wrote that, according to his research and analysis, an employer's cost of the so-called "incidental" costs of worker injuries was four times as great as compensation and medical payments. This 4:1 ratio of indirect to direct costs also appeared in the three later editions of his book. Many statements in safety-related literature repeat Heinrich's 4-to-1 ratio. Although his studies were made in 1926, his ratio has had staying power.

Heinrich's direct costs of injuries and illnesses are "compensation and liability claims, medical and hospital cost, insurance premiums, and cost of lost time except when actually paid by the employer without reimbursement." His list of hidden accident cost factors includes 11 subjects, some of which have subparts. Only the major captions appear here; some have been combined:

•time of the injured employee, the other employees who stop work or who are upset;

•time of foremen, supervisors or other executives who give attention to the injury;

•time spent by first-aid attendants and hospital department staff when not paid for by the insurance carrier;

•damage to any machines, equipment and other property, and interference with the site's production;

•costs to the employer of welfare and benefit systems, and continuing the full wages of the employee after returning to work that are not fully recovered;

•loss of profit on the injured person's production, on idle machines;

•overhead (e.g., lights, heat) when the employee is away or not fully productive.

Table 1
Accident Costs: Stanford Report

Range of benefits paid ($)	No. of cases	Average benefits paid ($)	Average hidden cost ($)	Average ratio Hidden cost: Benefits paid
No lost time				
0 to 199	13	125	530	4.2
200 to 399	7	250	1,275	5.1
400+	4	940	4,740	9.2
Lost time				
0 to 2,999	9	869	3,600	4.1
3,000 to 4,999	8	3,694	6,100	1.6
5,000 to 9,999	4	6,602	7,900	1.2
10,000+	4	17,137	19,640	1.1

Note. *Analysis of accident costs by size of accident: Stanford research. Adapted from "Improving Construction Safety Performance: The User's Role" (Technical Report No. 260), by Stanford University, 1981, Palo Alto, CA: Author, Department of Civil Engineering.*

In the third and fourth editions of his book, Heinrich included data on nine cases to support his ratio (fewer in the earlier editions). This author has found no other data that authenticate his research. Also, Heinrich said, "The examples of hidden costs given in this chapter include no fatalities, major dismemberments or major permanent injuries, nor do they feature spectacular costs that result from trivial injuries." Thus, the resulting ratios he presents are limited to the less serious injuries.

Keep in mind that Heinrich's analysis was conducted in 1926. How valid could any ratios be in 2011 after 85 years of immense change in industry and business, work practices and compensation systems, and which do not consider the advances made in the practice of medicine and increases of indirect and direct costs?

Bird on Accident Costs

Bird (1974) presents the so-called iceberg theory of incident costs. In an exhibit that suggests an iceberg and is captioned "The Real Costs of Accidents Can Be Measured and Controlled," Bird illustrates his ratios of insured and uninsured costs. Bird and Germain (1985) use these same ratios but add to the descriptions of what costs are included in each category. In Bird's data, the insured costs—medical and compensation costs—are the same as direct costs in some other presentations.

The 1985 version is the base of an adaptation of the iceberg (Figure 1). As a minimum, Bird's data imply that employers absorb uninsured costs at a ratio of $6 (5+1) to $1 of insured costs. At a maximum, the ratio is $53 (50+3) to $1. This author has located no research or hard data to support such ratios. Depictions of Bird's iceberg have appeared in many texts and articles, and his cost ratios are frequently repeated.

Bird's assertion that uninsured property damage costs are 5 to 50 times the insured costs are difficult to support universally, but such high ratios could exist in an organization that experiences an incident which causes significant property dam-

Table 2
Workers' Compensation Claims

Claim value	Percentage of no. of claims	Percentage of total costs
$0 to $10,000	89%	14%
$10,000 to $25,000	5%	14%
$25,000 to $50,000	3%	20%
More than $50,000	3%	52%
$10,000 or more	11%	86%
$25,000 or more	6%	72%

Note. *Computer run of 280,000 workers' compensation claims for 2003.*

Table 3
Inflation Computations

Amount spent	Year	Had the same purchasing power as	In the year	Multiplier
$1.00	1980	$2.61	2008	2.61
$1.00	1980	$1.80	2004	1.80
$1.00	1995	$1.41	2008	1.41

Note. *Inflation computations relating purchasing power in 1 year to a subsequent year.*

age. Over a period of years, the impact of property damage costs from hazards-related incidents on indirect costs will relate directly to the investment per employee in the physical plant. Consider these two extremes.

- At a public utility, the cost of the investment in the physical plant is $1.2 million per employee. A turbine rotor was being hoisted to be returned to its bearings when a wire cable sling broke. For an injured worker, the total workers' compensation cost was $2,400; the cost of the damage to the rotor was $6.5 million.
- In a shop where employees sew shirts, the investment per worker is about $6,000. No high-cost equipment exists to be damaged, and an indirect cost ratio many times the direct costs for businesses of this nature is not plausible.

A Construction Industry Study

In August 1981, under contract to The Business Roundtable, Stanford University's Department of Civil Engineering issued Technical Report No. 260, "Improving Construction Safety Performance: The User's Role." This research is the latest study located by the author. It was conducted to provide guidance on reducing accident frequency and severity in the construction industry, and the attendant indirect and direct injury and illness costs.

In 1982, The Business Roundtable issued a condensed version of the report, "Improving Construction Safety Performance." This version does not include the research methodology; the questionnaire developed and sent to contractors; the instructions given to contractors on how to identify direct and indirect costs; or the analytical data.

The Stanford study is important work since it establishes significant data points on indirect and direct injury and illness costs. Keep in mind that the dollar amounts in the report pertain to 1980-81 when the research was conducted. Interesting discussion could take place about the method, the definitions of terms, the content of the data collection forms and the data collection system. Nevertheless, the work is deemed significant because:

1) A study was actually conducted.

2) The report confirms the lack of data to support other published ratios.

3) Research determined that as injury severity increased, the ratio of indirect to direct costs decreased.

4) The indirect cost ratio is affected by many variables and establishing a ratio of indirect to direct costs that is universally applicable to all entities at all times is not feasible, particularly because of the great variations that could occur in the cost of property damage which could result from an accident.

5) Computations indicate that, for this study, the indirect to direct cost ratio is 1.6 to 1.

The following comments expand on the foregoing observations.

1) A study was actually conducted, following accepted research practices, and the results were documented in detail. A questionnaire was developed to gather information, an instruction guide was prepared and sent to contractors, and data were gathered and analyzed. Thus, research was performed, and a report covering the data gathering, and analysis system and the conclusions drawn is available for review.

2) The report confirms the lack of data to support other published ratios. It states:

> For this aspect of the research [Hidden Cost of Accidents], much effort was expended trying to determine the source of the ratios that have appeared in various reports. No hard data [were] uncovered to substantiate any of the widely publicized ratios that had come to the attention of the researchers (Stanford, 1981).

To emphasize: No hard data were found in support of other statistics on the indirect to direct cost ratio of injuries published prior to 1981.

3) The research determined that as injury severity increased, as represented by higher workers' compensation costs, generally, the ratio of indirect costs to direct costs decreased (Table 1, p. 41).

4) Analysis of the compiled data showed that the indirect cost ratio is affected by many variables and that attempting to establish a ratio of indirect to direct costs that could be universally applied in all operations at all times is not feasible. "Still, if the accident data are separated into two general groups, large and small claims, it can be seen that smaller accidents have a larger [indirect to direct cost] multiplier."

5) The total of hidden costs for all claims was divided by the total cost for benefits paid, resulting in a 1.6:1 ratio of indirect to direct costs. But the report cautions that the 1.6:1 ratio may be low because certain indirect cost data were omitted, such as "OSHA fines and hearings and third-party liability and legal actions, and the effect of accident costs on future workers compensation premiums."

Table 1 is from the Stanford report. It is a summation of data obtained from contractors on each injury for which data are recorded in the analytical forms. In this study, the hidden cost multiplier was defined "to account for all costs other than the direct compensation of the victim(s)." That is, other than for the indemnities paid to injured workers and the attendant medical costs. "Hidden costs" are: insurance company claims handling and administration costs; other wages; efficiency loss; rehabilitation; supervisor costs; transportation; overtime costs; break-in replacement; materials, equipment, clean up and related costs; clerical costs; and other.

The data in Table 1 support the premise that as injury severity increases, the indirect cost ratio decreases. The Business Roundable report states, "The ratio [of the indirect to direct cost] varies greatly with the magnitude of the accident; however, it is not necessarily linked to the severity of the injury." The premise that as injury severity increases the ratio of indirect to direct costs decreases will withstand a logic test for various classes of injury costs.

The highest value of benefits paid for an injury in the Stanford study was $24,900. One can speculate that decreases of the ratio would continue incrementally as claim costs increased for cases valued at $25,000 to $50,000, from $50,000 to $100,000, and so on.

A Cost Distribution Study

The data in Table 2 (p. 41) were produced, confidentially, for this author by a third-party administrator for the total cost of workers' compensation claims, paid and reserves. As will be noted, cases valued at $25,000 or more represent 6% of the total number of cases and 72% of the total costs. If data were included in the Stanford study on a significant number of cases valued at $25,000 to $50,000 and more than $50,000, and a continuing decrease in the indirect to direct cost ratio occurred as the dollar value of the cases increased, the composite indirect to direct cost ratio—1.6:1—reported in the Stanford study would be much lower. However, that is speculation for which hard data do not exist.

Given the types of indirect cost categories listed in the cited studies, one can conclude that a large share of the indirect costs is expended in the 3 or 4 weeks immediately following the injury. This is an important point. For the very severe injury, say valued at $500,000 for workers' compensation cost and for which long-term disability will result, it is not reasonable to predict that the indirect cost will be at the 1.1:1 ratio for that claim value as shown in the Stanford study. That indirect cost computes at $550,000.

Table 4
Progression With Respect to Workers' Compensation Claims Costs

Average indemnity cost per lost-time claim		
1995	$10,500	
2008	$22,500	114.3% increase
Average medical cost per lost-time claim		
1995	$9,800	
2008	$25,200	157.1% increase
Total: Indemnity and medical cost per lost-time claim		
1995	$10,500 + $9,800 = $20,300	
2008	$22,500 + $25,000 = $47,500	134% increase

Note. *Data from "2009 State of the Line," by D.C. Mealy, 2009, Boca Raton, FL: National Council on Compensation Insurance.*

Updating the Stanford Indirect & Direct Cost Ratios

The relationship between indirect to direct costs has changed significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier from the Stanford study might be as of 2008. Understand that these computations are illustrative only. They were made to show, generally, how significantly the ratios may have changed. Nevertheless, they are helpful and instructive. Should statisticians delve more precisely into the trending of indirect and direct costs, their computations could achieve a higher accuracy level.

BLS's online inflation calculator uses the average Consumer Price Index for a year as a basis for data. Table 3 presents the results of these computations.

Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs are primarily the costs of time spent by persons other than the injured person, and property damage. Assume that indirect costs increased from 1980 through 2008 at the same rate as inflation: 2.61. For lost-time cases in the period from 1995 through 2008, the combined indemnity and medical claims costs increased about 3.27 times the inflation rate (134/41).

Assume that the 134% increase also applies to no-lost-time cases. Then, assume that workers' compensation claims costs (the direct costs) increased overall at about the same rate as did inflation from 1980 through 1994: $1 to $1.80, and from $1 to $1.34 for 1995 through 2008 ($1.80 + $1.34 = $3.14)—more than three times the inflation rate.

The new relationship of indirect to direct costs, reflecting increases from 1980 to 2008:

Table 5

OSHA's Ratio of Indirect to Direct Costs

Direct cost of claim	$0-2,999	$3,000-4,999	$5,000-9,999	$10,000+
Ratio of indirect to direct cost	4.5	1.6	1.2	1.1

Note. *Data from "Safety and Health Management Systems eTool: Costs of Accidents," by OSHA, 2007, Washington, DC: Author.*

•Direct cost: $3.14
•Indirect cost: $2.61
•2.61/3.14 = 0.81 (adjusted to 0.8)
•Ratio: 0.8 to 1 (an approximation)

This ratio reflects the significant differences in indirect and direct cost increases. Computations show approximately a 49% reduction of the 1.6:1 average ratio shown in the Stanford report. As workers' compensation healthcare costs continue to increase at a rate considerably higher than inflation, the value of the ratios in the Stanford report will diminish further.

A NIOSH Research Project

A team of researchers under contract with NIOSH conducted an extensive investigation to produce a 1997 report, "Costs of Occupational Injuries and Illnesses in 1992" (Leigh, Markowitz, Fahs, et al., 1997) Its title might suggest that the report would be valuable as a reference in determining indirect and direct injury and illness costs borne by an employer.

However, this report was produced for a different purpose: to establish the costs to society as a whole. Therefore, the data categories differ, which minimizes the report's usefulness as a resource to determine employer costs.

As would be typical in such a study (so the author was advised by an economist), these researchers took an important departure from a basic premise in the Heinrich, Bird and Stanford data. In each of those studies, the workers' compensation costs, namely, indemnity paid to the worker and the attendant medical costs, are the direct costs. Not so in this 1997 report. Many of the costs included as direct costs in this report do not appear as direct costs in other studies. According to the NIOSH report:

> Direct costs represent actual dollars spent or anticipated to be spent on providing medical care to an injured or ill person as well as property damage, police and fire services, administrative costs for delivering indemnity benefits and direct costs to innocent third parties. Medical costs include doctors' and nurses' services, hospital charges, drug costs, rehabilitation services, ambulance fees, payments for medical equipment and supplies.
>
> Indemnity benefit costs do not include the benefits themselves; these are implicitly accounted for in the indirect costs (lost wages). Indemnity benefit costs include the administration costs associated with providing workers' compensation indemnity or Social Security disability payments to injured or sick workers and their families. Property damage includes costs of damage to vehicles, machines, buildings and so on, directly associated with the injuries and illnesses.
>
> The largest indirect costs include the injured or sick worker's lost earnings, fringe benefits and home production. Other indirect costs include employer's costs associated with retraining and restaffing, coworker costs of lost productivity, time delays and indirect costs to innocent bystanders (Leigh, et al., 1997).

Because of the allocation of costs into direct and indirect categories, the ratios developed are not comparable with any other system discussed in this article. Much of the NIOSH report is devoted to occupational illnesses and to speculations about their indirect and direct costs. Nevertheless, the report concludes:

> Identifying the costs of occupational injury and disease in the U.S. has been an elusive goal. Our study represents the first attempt to estimate the national cost of occupational injury and illness using national data. But, even with our study, this goal remains unattained (Leigh, et al., 1997).

The case is made that because the data required for a proper study do not exist, many speculative assumptions must be made to produce speculative conclusions.

OSHA Adopted the Stanford Report Ratios

OSHA gives credibility to the ratios that arose out of the Stanford research by publishing and promoting use of the data in The Business Roundtable version of the Stanford report, with some revision. The data in Table 5 appear in OSHA's Safety and Health Management Systems eTool (2007).

OSHA acknowledges the source of its data as "Business Roundtable, Improving Construction Safety Performance: Report A-3, January, 1982."

The indirect cost ratio for the $0-2,999 "Range of Benefits Paid" in the Business Roundtable report is 4.1:1, rather than 4.5 as shown in Table 5. However, note that the OSHA exhibit shows no data for "no-lost-time" claims, for which the composite ratio would be higher than 4.1. This indicates that some combinations were made. The eTool says:

> •Workers' compensation claims which cover medical costs and indemnity payments for an injured or ill worker are the direct costs.
> •All other related costs are the indirect costs.
> •To help assess the impact of occupational injuries and illnesses on your profitability, try out OSHA's "$afety Pays" program. It uses a company's profit margin, the average cost of an injury or illness, and an indirect cost multiplier to project the number of sales you would need to cover these costs (OSHA, 2007).

An OSHA bulletin on its $afety Pays program, "Do You Know How Much Accidents Are Really Costing Your Business?" includes the ratios in Table 5 as well as a depiction of Bird's iceberg. Another bulletin (OSHA, 2009a) says that the program will:

•offer choices from a set of lost workday injuries and illnesses;
•prompt users for information to do the analysis;
•allow users to input the actual loss figures or workers' compensation costs;
•generate a report of the costs and the sales needed to cover those costs.

The injury and illness types and average costs in the OSHA set were provided by NCCI for 2004 lost-time cases only. The database is large and the costs for the injury and illness categories have validity for that year. The database has 53 injury and illness categories. The average cost for each category is provided along with the appropriate indirect cost multiplier: For 52 of the categories, the indirect cost ratio is the same: 1.1 to 1. For the 53rd category, the ratio is 1.2 to 1.

The 1.1-to-1 ratio is shown in the Stanford report for claims valued at $10,000 or more. For the 1.2-to-1 ratio, the claims value is $5,000 to $9,999. Of the 53 injury and illness categories, 32 are valued above $25,000; they range from $25,004 to $115,961. Applying a 1.1-to-1 indirect to direct cost ratio to such higher valued claims is questionable.

Table 6

Accident Cost Table

This table shows the dollars of revenue required to pay for different amounts of costs of accidents. It is necessary for a motor carrier to generate an additional $1.25 million revenue to pay the cost of a $25,000 accident, assuming an average profit of 2%. The amount of revenue required to pay for losses will vary with the profit margin.

Yearly accident costs	Profit margin				
	1%	2%	3%	4%	5%
$5,000	500,000	250,000	167,000	125,000	100,000
10,000	1,000,000	500,000	333,000	250,000	200,000
50,000	5,000,000	2,500,000	1,667,000	1,250,000	1,000,000
150,000	15,000,000	7,500,000	5,000,000	3,750,000	3,000,000
200,000	20,000,000	10,000,000	6,666,000	5,000,000	4,000,000

Note. *Data from "Accident Cost Table," by Federal Motor Carrier Safety Administration, Washington, DC: Author.*

The calculations performed to relate costs in 1980-81 to current costs resulted in a 49% reduction in the 1.6-to-1 ratio, which appears in the Stanford report as the composite ratio for all injury levels. Reducing the 1.1-to-1 ratio used in OSHA's $afety Pays program by 49% produces a revised ratio of 0.56 (rounded to 0.6) to 1. Data on indirect costs produced using this program is misleading.

Computing the "Additional Sales" Necessary to Cover Injury Costs

Bird (1974) proposes that reports to management should include data to show the "additional sales" required to pay for accident costs. Needing additional sales to cover indirect and direct costs is the subject being questioned. The following discussion shows that the premise that additional sales are necessary to cover accident costs cannot be supported.

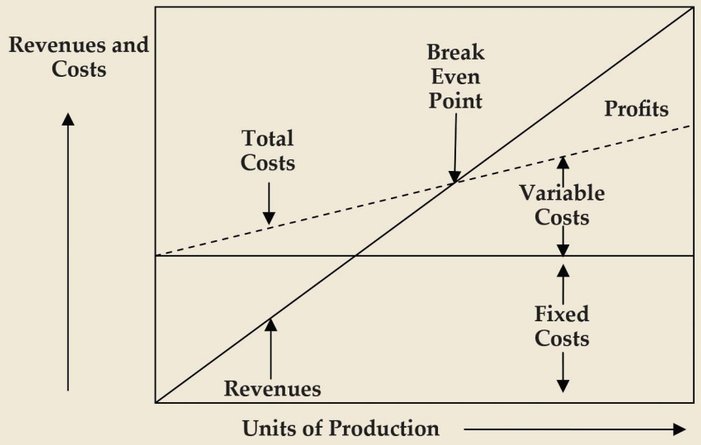
An executive with whom this subject was reviewed and whose background is in finance suggested that relating total accident costs to dollars of profit could be conceptually supported and such a comparison might have significance. For example, a report prepared by a safety professional for management indicating that injury costs are equal to 100% of profits could get attention.

Bird (1974) offers a chart that shows the amount of additional sales necessary to pay for selected levels of annual costs at certain profit margins. Duplications of this chart containing identical numbers appear in many places, as does the following example. The source of the data in Table 6 is a Federal Motor Carrier Safety Administration (FMCSA) publication, "Accident Cost Table." It was chosen because it is accessible online.

Table 6 presents a selection of the yearly accident

When revenues equal total operating costs, all indirect and direct costs incurred up to that time are recovered. Also, as sales increase and operations become profitable, revenues obtained continue to encompass all additional indirect and direct costs.

Figure 2
Break-Even Chart



cost levels shown in the FMCSA publication, but it still presents the idea adequately. To determine the additional sales necessary, accident costs are divided by the profit margin percentage selected, then converted into a decimal. In the FMCSA publication, accident costs are a combination of the indirect and direct costs.

OSHA's $afety Pays program is another example of how Bird's concept has been applied. The program literature says the program will, among other things, allow the user to "generate a report of the costs and the sales needed to cover those costs." As computations required by the program are made, a profit percentage is to be entered to produce the amount of sales necessary to cover direct and indirect costs.

As noted, statistics comparable to those in Table 6 were discussed with an operations executive whose degree is in finance. This conversation was highly instructive, particularly with respect to unit pricing methods and break-even charts, and why the computations to determine the additional sales necessary to cover indirect and direct costs are implausible. The discussion, briefly summarized, follows.

- As a company budgets for its operations, both the indirect and direct costs of injuries (unidentified for indirect costs and sometimes identified for direct costs) are included in estimates of operating costs, and the unit prices for products or services are set to recover those costs and the profit margin expected.
- Thus, from the first dollar of sales onward, a part of the indirect and direct costs are recovered.
- When revenues equal total operating costs (Figure 2), all indirect and direct costs incurred up to that time are recovered. Also, as sales increase and operations become profitable, revenues obtained continue to encompass all additional indirect and direct costs.
- No "additional sales" are needed to cover indirect and direct costs.

Consider the following example:

1) Sales budgeted for a year are $10 million.
2) A 3% profit margin and profits of $300,000 are expected.
3) Operating costs are $9.7 million.
4) Total direct and indirect costs are $300,000.
5) To determine the additional sales necessary to cover total injury costs, the $300,000 would be divided by 0.03, the result being $10 million.

Such computations will not withstand a logic test, since all indirect and direct injury costs would be contained in the operating costs as the $10 million sales goal is attained. Thus, no additional sales, in addition to the organization's total income, are necessary to cover accident costs.

Conclusion

The literature on direct and indirect costs does not present a uniformly accepted computation method. Differences in the various systems are substantial. More importantly, no published ratios are currently valid because the increase in direct costs (indemnity and medical costs resulting from an injury or illness) has exceeded the increase in indirect costs substantially in the past 15 years.

Computations in this article updating the Stanford study indicate that the ratio of indirect to direct accident costs is currently about 0.8:1. That ratio is given as an approximation. Safety professionals who use a 1-to-1 ratio can be reasonably comfortable. This author recommends avoiding the use of ratios for which there are no supporting data (4:1, 6:1, 10:1 or higher).

Petersen (1989) also expressed concern over the use of an indirect to direct cost ratio for which supporting data are questionable:

> Although hidden costs are very real, they are very difficult to demonstrate. To say arbitrarily to management that they amount to four times the insurable costs is asking for trouble. If management asks for proof, you can only say, "Heinrich said so." Management wants facts, not fantasy. Without proof, hidden costs become fantasy.

SH&E professionals need proof to support the indirect to direct cost ratios they use. ASSE or its Foundation should consider funding research to develop valid and current data on indirect to direct costs ratio. For such a study to be successful, the methodology and scope should follow good research protocols, and a statistically based number of employers would need to be educated on and committed to the time and effort necessary. Such studies are not easily undertaken. That said, such a study will likely result in a determination that the indirect to direct cost ratio is significantly lower than the ratios that have appeared in safety literature. **PS**

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