EXPERIENCE MODIFICATION RATING AS MEASURE OF SAFETY PERFORMANCE

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ABSTRACT: Workers' compensation insurance is a significant cost component of construction labor. The manual rate for these insurance premiums is state- and trade-specific so the costs can vary considerably between geographic locations and between crafts. Another aspect of workers' compensation that should be understood is the experience modification rating (EMR), which is used to modify the premium paid. This modifier is essentially an incentive for firms to strive for good safety records, as firms with poor safety records will pay higher premiums. Examples have been developed to help clarify the manner in which the EMR values are impacted by different variables. Results show graphically how injury frequency has a larger impact on the EMR computation than does injury severity. The EMR is noticeably reduced when the hourly wages paid are increased. It is also reduced when the total wages paid per year are increased. Findings suggest that some degree of caution should be exercised if two firms are to be compared on the basis of their assigned EMR values.

INTRODUCTION

Before private owners enter into construction contracts, it is becoming increasingly common for the selection of the construction firms to include an assessment of their past safety performances. Most construction contracts in the private sector are awarded through a competitive bidding process that limits the potential bidders to a select bidders list, also known as a "short list." Prequalification criteria will typically emphasize the experience that the owners have had with specific construction firms on previous projects (Hinze 1992). If an owner has had no prior working association with a specific construction firm, but the owner is interested in adding another firm to the short list, a closer scrutiny of the potential bidder will take place. One of the criteria used to assess the merits of a particular firm is its past safety performance.

Much has been written about the need for owners to evaluate the past safety performances of construction firms. While this is based to some extent on the humanitarian concern to minimize human suffering, the primary thrust for the safety evaluations is to reduce the potential exposure of owners to liability suits. Much of this concern has been attributed to the "liability crisis" that occurred during the mid-1980s. Partially in response to past liability settlements, it has become an accepted business practice among many large corporations to become directly involved in the safety aspects of their construction projects. The initial step in this process is to limit the firms, to which construction contracts will be awarded, to those that have a demonstrated track record in safety.

HOW ARE SAFE CONSTRUCTION FIRMS SELECTED?

If safety is to be a significant criterion in the selection of construction firms, it is important that a viable measure be used. One measure of safety performance that is widely used is the experience modification rating (EMR). This rating is used to adjust the cost of workers' compensation insurance premiums. The basic principles of EMRs are well-known by many practitioners and are widely publicized in a variety of publications (Oglesby et al. 1989). One of the more widely distributed publications on construction safety is one that was produced by The Business Roundtable entitled "Improving Construction Safety Performance," (1982) also known as *Report A-3*. This report states the following:

> Several relatively objective measures of past safety performance are available, notably the experience modification rate, which is applied to workers' compensation insurance premiums, and OSHA recordable injury and illness incidence rates.

The report concludes: "The experience modification rate is a widely used indicator of a contractor's past safety performance. Owners should request, from prospective contractors, EMRs for the three most recent years, which will show the firm's trend in safety performance." That report also recognizes the value of injury incidence rates as an effective measure of past safety performance. It concludes:

> The OSHA incidence rates also show past safety performance. Since these are uniform national statistics, there are no limitations in comparing rates in one part of the country with those in another. Moreover, OSHA incidence rates reflect more recent experience than EMRs. Owners should request, from contractors, OSHA incidence rates for recordable injuries and illnesses for the three most recent years.
>
> The reliability of the OSHA incidence rates are solely dependent on judicious reporting by the employer, while the EMRs are established by independent rating bureaus. Although the EMR is more objective measure than the OSHA incidence rate, there is a correlation between them. Both will indicate past safety performance.

Another Business Roundtable report, "The Workers' Compensation Crisis . . . Safety Excellence Will Make a Difference" (1991) was intended as a companion to *Report A-3*. This later report recognizes a misconception that exists concerning the computation of the EMRs.

> Due to weighting and ballast factors used to modify the EMR formula for severity and frequency, a very small contractor, with the minimum expected losses of $25,000, cannot have an EMR of less than 0.90. With payroll levels high enough and expected losses at their maximum, as in the case of a large employer, a 0.0 Experience Modification

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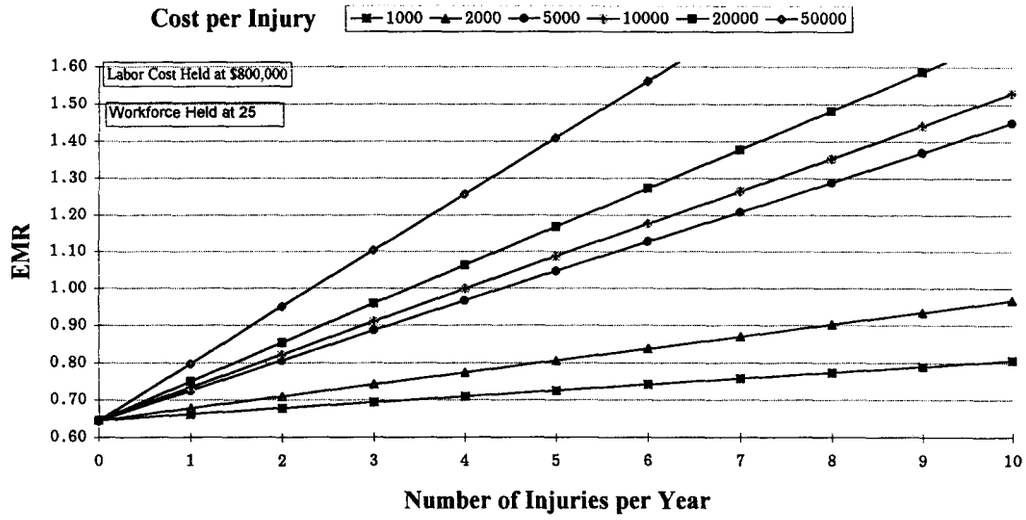

FIG. 1. EMR versus Injury Frequency and Severity

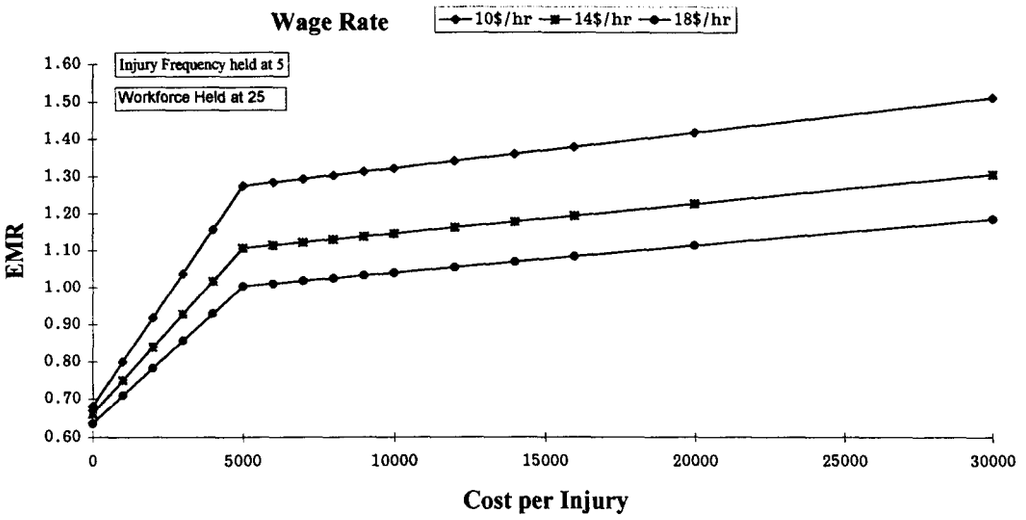

FIG. 2. EMR versus Injury Cost As Wages per Hour Are Varied

Rating is theoretically possible. It is possible, therefore, for the safety performance of a large contractor with a 0.6 EMR to actually be worse than that of (a) small contractor with a 0.9 EMR, because the large payroll provides the large contractor with the potential for a very low rating.

This Business Roundtable report points out the clear bias that exists when the EMR is used as a basis of comparing two companies with significant differences in their sizes. Despite the preceding poignant statement, the paragraph is concluded, "In spite of this, the EMR remains an excellent measure of a contractor's past safety performance." The report then continues with the statement that "the lower the EMR value, the more it is reflective of an individual contractor's ability to prevent accidents through workplace safety programs, subject to contractor size limitations."

For many years the EMR computation remained unchanged ("An In-Depth" 1982). In 1992 several changes occurred in the workers' compensation experience rating plan ("ABCs" 1992). The clear size bias discussed in the Roundtable report was not corrected with these changes.

Despite the stated shortcomings of using EMRs to evaluate safety performance, they have continued to be considered as viable criteria for the selection of safe contractors. This is demonstrated by the *A-3 Report*, which lists three sources of information that provide owners with ways to evaluate probable safety performance of prospective contractors. These include the EMR, the OSHA incidence rates for recordable injuries and illnesses, and the contractor safety attitudes and practices. While not specifically stated as being a priority ranking, the same order is used by Levitt and Samelson (1993) for their "Contractor Safety Evaluation Questionnaire." While no specific mention is made of the relative priorities of these sources of information, the inference might logically be that the first noted item, the EMR, is the most important.

THE DILEMMA

In the summer of 1993, a survey was conducted at the University of Washington with construction contractors in the Northwest, primarily Washington state. The mailed questionnaire requested information about a variety of company characteristics and work practices. Relevant to the present study, information was requested about injury frequency rates and EMRs. When conducting the analysis of the data, it was noted that injury frequency was significantly correlated with a number of variables. Similarly, the EMR values were significantly correlated with a number of variables, although these were not the same variables that were correlated with injury frequency. In general, the EMR values decreased as

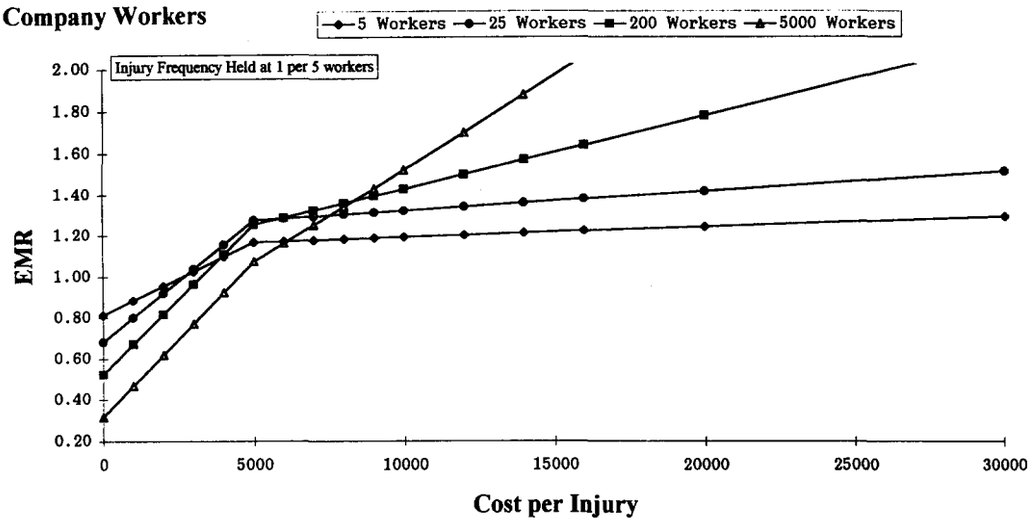

FIG. 3. EMR versus Injury Cost As Number of Workers Are Varied

the firm size increased. At the same time, injury frequency rates and the EMR values for contractors in the respective states were not correlated at all. A closer look at EMRs was warranted.

EMR COMPUTATIONS

The computation of EMRs is explained in considerable detail in a publication by Everett and Thompson (1995) entitled "Experience Modification Rating For Workers' Compensation Insurance." The formula for the computation of the EMR is presented as follows:

$$\text{Experience Modification} = \frac{A_p + WA_e + (1 - W)E_e + B}{E + B} \tag{1}$$

where A_p = actual primary losses (summation of costs below \$5,000/injury); W = weight (provided in state experience rating plan manuals); A_e = actual excess losses (Summation of costs above \$5,000/injury); E_e = expected excess loss [equal to $E \times (1 -$ discount ratio) the discount ratio is provided in state experience rating plan manuals)]; E = expected losses (equal to payroll × expected loss ratio) the expected loss ratio is analogous to the manual rate, but without the insurance administration cost; and B = Ballast (provided in state experience rating plan manuals). Examination of the equation shows that for small injuries (actual losses of \$5,000 or less) the equation is reduced to the following:

$$\text{Experience Modification} = \frac{A_p + E_e + B}{E + B} \tag{2}$$

Because of the changing values of B and W (varying from 0.07 to 0.63), it requires closer examination to determine the extent of the impact of size, injury frequency, and injury severity. The intent here is not to "walk through" the computations of the EMRs, but rather in showing the sensitivity and bias of the computations to selected variables.

SCENARIO A (IMPACT OF INJURY FREQUENCY AND INJURY SEVERITY)

To make comparisons, examples will be developed to show how changes in a single variable will impact the resulting EMR. For the first scenario, the analysis will focus on a company that employs 25 workers at \$16.00 per hour with each worker being employed a total of 2,000 hours per year. This results in an annual labor cost of \$800,000. All of these workers are in the same trade, which pays an expected loss rate of \$6 per \$100 of payroll and has a discount ratio of 0.4. The company's ballast (B) and weight (W) values are based on 1994 values from Oregon, which is one of the 32 states under the NCCI jurisdiction.

The impact on the EMR of injury frequency and injury severity is shown in Fig. 1, which shows the EMR computed for various injury frequencies and for six different fixed injury costs. By examining the change in the EMR values as the number of injuries increase, it is easy to assess the impact of the injury frequency. When the cost per injury is held constant, the EMR will increase in a straight line fashion as the number of injuries increase. For example, for injuries costing \$1,000, the EMR value will increase from about 66% when there is a single injury and increase to about 81% when 10 such injuries occur.

The impact of injury severity can also be observed in Fig. 1. For example, one \$1,000 injury results in an EMR of about 66% while one \$50,000 injury will result in an EMR of about 80%. It is generally understood that frequency has a greater impact than severity on the EMR. The extent of that impact can be seen in the illustration. For example, if five \$10,000 injuries (totaling \$50,000) occur, the resulting EMR is about 109% while a single \$50,000 injury results in an EMR of only 80%.

An obvious relationship of EMR to safety performance is that the EMR is more sensitive to the safety records of larger firms. That is, larger firms stand to benefit to a greater extent from good safety performance. The smaller firms are more limited in that the EMR cannot be reduced to the same low levels as can be realized by the larger firms.

SCENARIO B (IMPACT OF LABOR COST)

It is not widely known how the total cost of labor might impact the EMR. This can be examined by making a slight modification to the company scenario just stated. Assume that three different firms fit the preceding description of employing 25 workers working 2,000 hours per year with an expected loss rate of \$6 per \$100 of payroll and a discount ratio of 0.4. The firms differ in that each pays different hourly wages. These wages are \$10.00 (\$500,000 total annual cost), \$14.00 (\$700,000 total annual cost), and \$18.00 (\$900,000 total annual cost). With the number of injuries held constant

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at 5 (incident rate of 20 injuries per 200,000 worker hours), the EMR values are computed at different injury costs. The results are shown in Fig. 2.

The results show that the firms paying the higher hourly wages will have the lower EMR values when the injury frequency is held constant. For example, if five injuries occur at $1,000 each, the firm paying $10.00 per hour will have an EMR of greater than 80% while the firm paying $18.00 per hour will have an EMR of only 71%. Logically this can be explained by the fact that the firm paying the higher wages has paid a greater premium with which to cover the costs of the injuries. Thus, it is logical that firms paying higher wages will have lower EMRs given that they have an identical history of claims. The higher-paying firms appear to be subsidizing those firms that pay the lower wages.

SCENARIO C (IMPACT OF COMPANY SIZE)

The third scenario is one in which four different companies are compared. All of these firms pay their workers $10.00 per hour and each of their workers is employed a total of 2,000 hours each year. The differences of these firms lies in the number of employees. These firms have 5, 25, 200, and 5,000 employees. All of their workers are in the same trade which pays an expected loss rate of $6 per $100 of payroll and has a discount ratio of 0.4. The injury frequency is held constant for these four firms at one injury per year per five employees. EMR values are computed for injury costs ranging from near zero to $30,000 as shown in Fig. 3.

When the cost of an injury is less than approximately $3,000, the larger firms have the better EMR values. It can be seen that the smallest firm (annual labor cost of $100,000) has a minimum possible EMR value of about 81% when the cost of each injury is negligible. At the same time, the largest firm (annual labor cost of $100,000,000) has a minimum possible EMR value of 31%. Since the injury frequencies are the same for each of the firms, the differences shown in Fig. 3 are purely attributed to the total spent on labor. Note that when the cost of each injury exceeds about $8,000, the EMR values of the larger firms is more adversely impacted by the costs of injuries than are the smaller firms.

CONCLUSIONS

The analysis on the computation of EMR values shows that injury frequency is counted more heavily than severity. The examples developed show the extent of that weighting effect. However, the incidence rate alone is not adequately represented in the EMR values.

Results show that firms paying higher wages have lower EMR values even though their safety performance may be identical to firms paying lower wages. Before deciding that one firm has a better safety record than another because of its lower EMR, it would be appropriate to also examine the wages being paid.

The size of the firm is also a crucial factor. Smaller firms have minimum attainable values of EMR that are much higher than those of the larger firms. Thus, it is also appropriate to examine firms on the basis of their total payroll, in addition to the hourly wages they pay. Information about the computation of EMR values is understood in general terms. While various factors about the computation of EMR values are known, little seems to be known about the specific magnitude of the influence of these various factors. By recognizing the impact of hourly wages paid, total payroll, injury frequency, and injury severity on the EMR computation, a more equitable evaluation can be made of a firm. The EMR is clearly not an appropriate sole measure of safety performance for all companies.

RECOMMENDATIONS

To wisely select firms on the basis of their past safety performance, the shortcomings of using the EMR values should be fully understood. For example, for larger firms the threshold level of the highest acceptable EMR might realistically be set well below that of smaller firms. Perhaps the major point is that it may often be inappropriate to use solely the EMR values as a selection criteria for safe companies. With some diligence, a fair measure might be developed that includes injury frequency, injury severity, loss ratio, and other variables that are used to compute the EMR. A modest research effort might prove quite beneficial in accomplishing the objective of integrating several safety measures into a single reliable indicator of safety performance.

There may be a fundamental error in using the EMR as a sole selection critieria on large projects. This is especially true when a major portion of the project will be brokered or subcontracted. The risk to the owner then lies in the quality of the subcontracting firms that are actually doing the work. It would be prudent to carefully screen the major subcontractors on the basis of their safety performance records in addition to reviewing those of the general contractor or construction manager.

APPENDIX. REFERENCES

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