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CONTRACTOR'S HEAD OFFICE OVERHEAD — WHAT IS THE RIGHT FORMULA?

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Where a contractor is entitled to be compensated for owner caused delay, it is generally accepted that unabsorbed and/or additional head office overhead should constitute part of the compensation. Once entitlement is established, a simple way of calculating the amount of damages for such overhead is to apply one of several commonly used formulae.

The question of entitlement has been examined on many occasions, and in great detail, on both sides of the Atlantic. The formulae themselves, on the other hand, have received little attention. They are either accepted and used as they are found, or rejected completely.

The following comments attempt to reconstruct the logic behind the key formulae, and to assess how the results measure up against the realities of construction.

GENERAL FORMAT

Three different formulae will be discussed in this article. The Emden and Hudson formulae originated in Britain; the Eichleay formula in the United States.[1] A modified version of the Eichleay formula will also be reviewed.

For ease of comparison, we break down Emden and Hudson into the same three steps as Eichleay and Modified Eichleay. The general format of the three formulae is then the same; they differ only in details.

The **first step** is to determine the portion of the total head office overheads to be allocated to the delayed project; this amount may be called the *project overhead.* It is the amount that the delayed project would have, or should have contributed to the contractor's total head office overhead had the project not been delayed.

Once the project overhead is determined, the **second step** is to convert this "lump sum" amount of the project overhead into a daily or weekly *rate of overhead contribution.* This is a simple operation: the project overhead is divided into the period of contribution (days or weeks) i.e. the time during which the overhead contribution was made, or was supposed to be made.

In the **third step**, the daily or weekly rate of contribution is multiplied by the number of days or weeks of owner-caused compensable delay. This gives the *amount claimable* by the contractor.

THE EMDEN FORMULA

The Emden formula expresses the project overhead as an *average percentage* of the contract amount. The Emden approach is clearly illustrated in the case of *Ellis-Don Ltd. v. Parking Authority of Toronto,* a 1978 decision of the Supreme Court of Ontario.[2] The following is the reasoning of the trial judge, subdivided into three steps.

Step 1: Evidence showed that a regular and normal average rate of overhead and profit for Ellis Don, a general contractor, was 3.87% of its total bid.[3] Ellis-Don's contract amount on the Parking Authority project was $3,727,258. Applying the contractor's average rate, the judge calculated that the project would have contributed $144,279 in overhead and profit.

Step 2: The contract time — the period of contribution — was 59 weeks. That was the time it would have taken Ellis Don to earn $144,279 for overhead and profit. Therefore, if everything else had proceeded as planned, the contractor's resources employed on the project would have been contributing head office overhead and profit at the rate of $144,279 / 59 or $2,445.40 per week of contract time.

Step 3: The project was delayed 17.5 weeks by the Parking Authority. If the project had not been delayed, Ellis-Don would have put these same resources to work on other projects and received extra earnings at approximately the same rate as on the delayed project. The resulting contributions to overhead and profit would have amounted to 17.5 x $2,445.40 = $42,794.50. That was the amount the court awarded to the contractor.

The Emden formula is clear and logical — but there is a problem. In order to determine the average percentage of overhead, Emden typically looks back at the two- or three year period preceding the contract as well as the contract time. Thus, the project overhead allocation to the delayed project is primarily based on the contractor's performance in the past.

The contractor may have so much other work during the contract time and the period of delay that only a reduced contribution would be required from the delayed project but the result of the Emden calculation would not be significantly affected by this circumstance. The

1 The Emden formula appears in *Emden's Construction Law,* published by Butterworths; the Hudson formula in *Hudson's Building and Engineering Contracts,* published by Sweet & Maxwell. The Eichleay formula was advanced by the plaintiff contractor in *Eichleay Corp.,* A.S.B.C.A. No. 5183, 60-2 B.C.A. (CCH) ¶ 2688, 1960 WL 538 (July 29, 1960), aff'd on recons., 61-1 B.C.A. ¶ 2894, 1960 WL 684 (Dec. 27, 1960). Emden and Hudson are typically used to calculate lost profit as well as overhead; Eichleay is used to calculate overhead only. The discussion in this article will be limited to overhead calculations.

2 (1978) 28 Build.L.R. 98

3 That was also the percentage included by Ellis-Don in its bid. Thus, the court's approach included an element of the Hudson formula, discussed below.

Eichleay formula purports to provide a remedy for this problem.

THE EICHLEAY FORMULA

The Eichleay formula, in Step 1, focuses on the period of contract performance, *including delay.* The formula does not concern itself with averages. It allocates the contractor's total head office overhead to the delayed project based on the ratio of project billings to total billings for the period of performance.

This is only common sense. If, for example, the company has two projects generating equal billings and proceeding during the same time period, Eichleay allocates half the total head office overhead to each of the two projects.

If the contractor has extra billings from work on other projects, the formula gives a reduced amount for project overhead, and therefore also for overhead damages:

> *… the use of actually experienced total billings … provides a built-in corrective mechanism to recognize any new work that was actually performed during the delay, thus automatically reducing the amount claimed.*[4]

Thus, the Eichleay formula tries to ensure that the contractor is not overcompensated by an award of damages. However, the knife cuts both ways. If the amount of the contractor's other work during the period of performance is reduced, Eichleay increases the overhead contribution of the delayed project. In the extreme case, a contractor unable to secure any new work at all would have the entire head office overhead during the delay period awarded by Eichleay to the delayed contract.

It is difficult to see why the owner of the delayed project should pay for the contractor's lack of success on other projects. Indeed, the contractor's inability to find new work during the delay may be a reason for awarding to it no overhead at all. When a contractor is unable to obtain extra work, the unavailability of the delayed resources due to delay does not cause it any loss of overhead contributions. If freed up from the delayed project, these resources would still produce no revenues.

Steps 2 and 3 of the Eichleay formula are mathematically the same as in Emden — find the rate of contribution and apply that rate to the delay period — but there are important differences. We shall return to this later.

ABANDONED: THE HUDSON FORMULA

The courts of law favour reasonable results, and both Eichleay and Emden reflect this. They allocate to the delayed project a portion of the contractor's total overhead on a rational basis: either based on a historical average (Emden), or in proportion to the size of the project relative to the total company workload (Eichleay).

Contractors, however, follow a different logic. They take into account another variable, not included in the formulae: the market conditions at the time of bidding. During a lean period, a contractor may include very little overhead in the tender; during boom times, the overhead allocation may be high to compensate for the lean times.

An alternative approach to the calculation of project overhead that does take into account the competitive pressures on the contractor is offered by the Hudson formula. The formula calculates the project overhead by applying to the contract amount the percentage actually used by the contractor in its tender.

The Hudson formula was not used very often before it was finally abandoned, or used in name only. In some British decisions, the Emden formula is used but mistakenly referred to as the Hudson formula.

The reason for abandoning Hudson was expressed by the court in *Whittal Builders Co. Ltd. v. Chester Le Street:*[5]

> *The percentage to be taken… is not the percentage allowed by [the contractor] in compiling the price for this particular contract, which may have been larger or smaller than his usual percentage and may or may not have been realized… but the* ***average percentage*** *earned by the contractor on his turnover as shown by the contractor's accounts.*

Similarly, the Delay and Disruption Protocol published in 2002 by the Society of Construction Law in England states:

> *The use of the Hudson's formula is not supported. This is because it is dependent on the adequacy or otherwise of the tender in question, and because the calculation is derived from a number which in itself contains an element of head office overheads and profit, so there is double counting.*

Indeed, the Hudson formula requires correction for double counting. Built-in overhead should be deducted from the contract amount before the tender overhead percentage is applied. It is not clear, however, why both the court in *Whittal* and the Protocol consider the inadequacies of a typical construction tender as reason for the rejection of the formula.

Why should the contractor who has, during lean times, made a business decision and included only minimal overhead in its tender get a windfall from a formula which awards a reasonable amount? Or be awarded no more than the same reasonable amount during boom times? Finally, why should an average percentage of overhead have a better chance of being realized in a particular economic situation than what the contractor considered achievable, and built into its tender?

The real problem with the Hudson formula is that, in most cases, it is difficult or impossible to determine the overhead percentage contained in the amount of the tender. The formula is simply impractical.

STEP 1: DIFFERENCES ARE SKIN DEEP

When the structure of the two principal formulae is examined in some detail we arrive at an interesting result. Step 1 of the Emden formula can be conveniently expressed in mathematical shorthand as follows:

project overhead = contract amount x average overhead percentage [1]

The average percentage of overhead is obtained from the contractor's financial records by dividing the contractor's total head office overhead for a selected period by total company revenues for the same period. We can therefore replace the average overhead percentage in expression [1] by the ratio *total overhead / total revenues* for a given period of time. The expression then becomes:

project overhead = contract amount x total overhead / total revenues [2]

The Eichleay formula also picks a period of time, and allocates a portion of the total head office overhead for that period to the delayed project in proportion to the project billings relative to the billings of the rest of the contractor's projects:

project overhead = total overhead x project billings / total billings [3]

In order to compare the two formulae, we must ignore incidentals such as changes, extras, unpaid billings and claims. In that case, contract amounts, project billings and revenues will be substantially the same, both for individual projects and for total company turnover.

If, in expression [3], we substitute contract amount for project billings, and total revenues for total billings, that expression will appear as follows:

project overhead = total overhead x contract amount / total revenues [4]

The quantities contract amount and total overhead may switch places in expression [4] without affecting the result. Therefore, expression [4] is the same as expression [2], and Step 1 of Eichleay is structurally the same as Step 1 of Emden.

The two formulae, in essence, represent two different ways of looking for an average percentage of overhead to be applied

4 *R.G. Beer Corp.,* ENG BCA No. 4885, 86-3 BCA. It is not clear why billings are considered rather than actual revenues – billings may be, and often are, challenged by the owners, or may remain unpaid.

5 (1985) 12 Const. L.J. 356

to the contract amount. The average can be determined by examining the contractor's financial records (a) during contract time and before, as in Emden, or (b) during contract time and after, during the period of delay, as in Eichleay.

Given that the head office overhead is assumed constant, if the contractor's total revenues were also constant, it would not matter what time frame was selected to check the contractor's records because the ratio of the two quantities *total overhead / total revenues* would not change. Emden and Eichleay calculations in Step 1 would then yield the same project overhead.

STEP 2: DIFFERENT TIME FRAMES

Thus, mathematically, there is really only one formula in Step 1. Step 2 is also mathematically the same in both Emden and Eichleay. The formulae are, nevertheless, different but the difference is not in the mathematical structure. It is in the different *time frames* embedded in the formulae.

There are two time frames built into each formula. The **first time frame** is the period selected in Step 1 for reviewing the contractor's financial records to determine the project overhead.

Emden, as we have seen, calculates the project overhead based on the contractor's historical performance over an extended period of time. The calculation is not influenced by the billings or revenues during the period of delay. That time segment belongs to another, *fictitious project,* where the contractor would have been able to earn fresh revenues had it not been stuck on the delayed project.

There is a fictitious project at the basis of Eichleay too, but not the same as in Emden. In that project, the distinction between contract time and the delay period is erased, and the formula determines the project overhead for the entire time of performance. The fiction is that the delay is part of the original contract time. There is no allowance for potential billings on another project during the delay period.

The **second time frame** is the period of overhead contribution underlying Step 2. The rate of contribution is calculated by dividing the project overhead into this time period.

Emden assumes that the entire project overhead is contributed during contract time, at a uniform rate. This is the rate typically envisaged in the contractor's bid, and approximates well the rate of contribution on a normal project.

Eichleay, on the other hand, is based on the assumption that the project overhead of the fictitious project is contributed *uniformly* during the entire time of performance of the fictitious extended project. This assumption, however, is hardly ever realized in practice. The formula adds fiction upon fiction.

The illogicality of this distribution was the reason why the Eichleay formula was rejected in the 1978 decision of the New York Court of Appeals in the *Berley* case.[6] Berley, the general contractor, was delayed for about a year by owner caused problems. At the scheduled completion date, approximately 87% of the work had already been completed, leaving only $60,000 worth of work to be done during the delay period. At trial, Berley relied on the Eichleay formula.

The court noted that Eichleay would result in the recovery of the same amount of overhead even if the contract was only 1% incomplete at the time the delay took place, and that recovery would be the same if Berley had to spend only $100 to complete its work — when the contractor had already earned virtually the entire project overhead. Eichleay would still assume that the overhead was contributed during the delay period as during the contract time. The court found that the Eichleay calculations had only a "chance relationship to actual damages" and refused to accept the formula.

The same criticism would not apply if the Emden formula had been used. The contractor is perfectly justified in claiming the full amount of overhead as calculated by Emden even if only very little is required to complete the work, provided it can prove that, for some objective reason, its resources were tied up on the delayed project so that it lost the opportunity to deploy them on another project. The contractor may have a difficult time proving such a contention, but that is a completely different issue.

STEP 3: STRUCTURAL FAILURE

In Step 3, both Emden and Eichleay multiply the rate of contribution by the time period of delay, to arrive at the claimable amount.

At this stage, the Eichleay formula exhibits another major weakness. This one is part of the structure of the formula in Steps 2 and 3. The problem is that, as the delay grows, so does the duration of the fictitious project which includes the delay time. The effect is best expressed mathematically and graphically, in comparison with Emden.

Let us assume that the contractor's revenues on other projects remain constant, and there are no changes or extra work on the delayed project. In that case, as already explained, Emden and Eichleay will give the same project overhead.

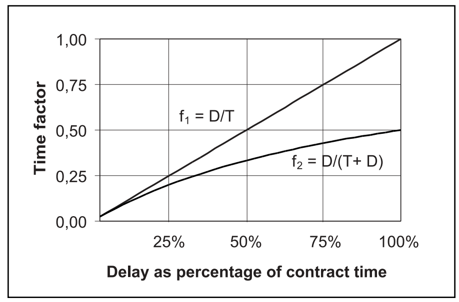
In Steps 2 and 3, both formulae divide the project overhead by the period of contribution and multiply the result by the period of delay. The two steps can be combined so that the calculation of the amount claimable by the contractor boils down to the simple general expression:

amount claimable = project overhead x delay / period of contribution [5]

Thus, once the project overhead is determined, the amount claimable is directly proportional to the ratio *delay / period of contribution.* This ratio may be called the time factor since both of its components are measured in units of time.

The period of delay is fixed, therefore the only variable, at this stage, is the period of contribution. Let us use the letter T for contract time, and denote the length of delay by the letter D. The time factor f_1 for Emden then becomes $f_1 = D / T$. The time factor set out in the Eichleay formula f_2 can be expressed as: $f_2 = D / (T + D)$, where (T + D) represents the time of performance, namely contract time and the period of delay combined.

The change in time factor for Emden and Eichleay as the delay increases is traced on the chart below. The horizontal axis shows the period of delay as a percentage of the contract time; thus, at 100%, the delay is equal to the contract time. The vertical axis shows the value of the time factor.



In the Emden formula, the time factor f_1 grows in direct proportion to the delay, as shown by the straight line on the chart. The award of overhead calculated by the formula, being proportional to the time factor, will show the same straight-line increase. For example, when the delay on a project is as long as the contract time, Emden allocates to the delay period an amount equal to the entire project overhead. The time factor at 100% delay is therefore 1.0, as shown on the chart.

Such a long delay may be unusual, but it is a useful test of the validity of the formula. The formula passes the test: during the delay, if allowed to work on another project, the contractor's resources could reasonably be expected to contribute the same amount of overhead as during the equally long contract time.

In the Eichleay formula, the time factor, represented by the curve f_2 does not track the increase in the delay except for very short delays. The straight line and the curve diverge more and more as the delay increases.

When the delay is equal to contract time (at 100% on the chart), Eichleay allocates only half the project overhead to the

6 *Berley Indus. Inc. v. City of New York,* 45 N.Y. 2d 683

delay. For even longer delays, not shown on the chart, the time factor can approach, but never quite reach, the value of 1.0. Therefore, the contractor can win no more than an amount equal to the project overhead no matter how long the delay.

The longer the delay, the more of the contractor's overhead remains unabsorbed yet Eichleay, for no logical reason, pays a smaller and smaller portion of it in damages.

NOT GIVEN A CHANCE: THE MODIFIED EICHLEAY FORMULA

During the more than forty years of the life of the Eichleay formula, there have been several attempts to modify it. The modification used in the *Schindler Haughton Elevator Corp.*[7] case — appropriately known as the Modified Eichleay formula — follows the same three step procedure as the original Eichleay. Mathematically, it is also the same as the original Eichleay.

Modified Eichleay allocates in Step 1 the total overhead to the delayed project in the same way as the original Eichleay, namely based on the ratio of project and total billings — but during *contract time* only. The formula does not look further back than contract time, as Emden does, nor does it include the delay period as does the original Eichleay. In other words, the project overhead reflects the contractor's economic situation during contract time alone.

The problem is that the contractor's billings during that period are affected by the delay on the project. The formula will not give a "normal and regular" project overhead.

The period of contribution is also contract time, as in Emden. Therefore, the amount claimable given by the formula is also proportional to the delay, as in Emden.

This modification to the standard Eichleay formula was rejected without analysis by the U.S. Court of Appeals for the Federal Circuit in *Capital Electric Co.*[8]

Referring to a series of cases dealing with the issue of overhead, the court stated:

> *... we do not believe these [Eichleay] precedents should be overruled. They are of such long standing and have been followed in so many decisions of the various board of contract appeals that such action should more properly be taken by Congress.*

Finally, in 1994 in *Wickham Contracting Co. v. Fischer*,[9] the Federal Circuit Court carved the original Eichleay formula in stone:

> *... the Eichleay formula is the exclusive means available for calculating unabsorbed overhead costs on a federal construction contract.*

WHAT IS THE RIGHT FORMULA?

The original Eichleay formula has too many weaknesses to be applicable, in spite of the fact that it is firmly established in the United States.

The Modified Eichleay formula is mathematically indistinguishable from Emden and requires no further comment but, as noted, fails to arrive at a reasonable project overhead.

The Emden formula is based on the assumption that the contractor would be able to continue earning the same rate of overhead on another project, and the formula compensates the contractor for the loss of opportunity to do so by extending the overhead rate from the contract time to the delay period.

Whether the contractor has to prove that such a rate of contribution was actually achievable on another project during the delay period is an issue that has been debated at length in the courts, but is beyond the scope of this article.

The Emden formula does, however, require adjustments to make it reflect reality more accurately.

Emden determines, in Step 1, a reasonable project overhead that *should* have been contained in the contract amount, based on the contractor's performance in the past. This amount must be adjusted to bring it, as far as possible, in line with the rationale of the Hudson formula — i.e. close to what the contractor *would* most likely have included in its tender under given market conditions.

Another adjustment should be made after Steps 2 and 3, to take into account the contractor's extra revenues (or lack of them) during the delay period, both on the delayed project and on the rest of the contractor's projects.

Neither adjustment is easy, nor an exercise in pure mathematics. The amount of effort required, and the resulting cost, will depend on how close one attempts to get to an "exact" result which — like perfect justice — is an unreachable goal.

There is another option which remains untested.

Compensation for unabsorbed head office overhead may be greatly simplified by taking appropriate steps *ahead of time*. The contractor may be required to indicate in its tender, under competitive pressures during the bidding process, the weekly or daily rate of head office overhead contribution to be applied in case of delay. The concept of liquidated damages has served for a long time to simplify the calculation of an owner's damages due to delay. It may assist just as well the contractor trying to recoup unabsorbed head office overhead.

7 GSBCA No. 5390 80-2 BCA (1980)

8 Capital Electric Co. v. U.S., 729 F.2d at 743 (Fed. Cir. 1984)

9 12 F.3d 1574, 13 FPD 1, 18 C.C. 121 (Fed. Cir. 1994)

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