



PDHonline Course P132 (3 PDH)

Managing Project Cost, Revenue and Profit

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2012

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Course Content

Introduction

To complete a project successfully, a Project Manager should be able to deliver contracted services to a client within the agreed-upon stipulated price, while preserving, protecting and even improving on the estimated profit. In keeping with sound business practice, the techniques discussed in this course are predicated on maintaining credibility with your clients and establishing long-term, profitable relationships.

A business is successful when it generates a profit, which means that its income exceeds its expenses. This course examines, from a contractor or consultant's perspective, the concepts and skills needed to develop realistic cost estimates for proposed services in order to cover costs and make a reasonable profit.

It is apparent, therefore, that in order to separate cost from profit you should be able to calculate your actual cost of doing business with some degree of accuracy. The amount of profit you can realize depends on a number of factors that are most often tied to market conditions, the nature of your competition and your costs. The various types of contracts commonly used by clients also affect your potential profit and financial exposure. Therefore, this course is divided into three sections. The basic principles followed in the calculation of costs and billing rates are presented in the first section. The second section reviews the most common contract types, the advantages and disadvantages associated with each type, billing rate computations and the potential pitfalls and financial exposure for each. Finally, the third section presents a case history which highlights how seemingly minor unforeseen events near the start of a project can severely impact profitability if the Project Manager is not attentive, proactive, and willing to engage and communicate with the client.

Development of Services Cost Estimates

For any company in the business of selling services, be they engineering designs, landscape architecture, architectural plans, surveying skills or a host of other enterprises, the fundamental product that is being sold is time. The time that technical staff spends performing a task or activity for a client is billed to that client in accordance with accepted accounting principles and pre-determined agreements reached between client and contractor.

Corporate management time, on the other hand, is typically not billed directly to clients, and is considered an overhead cost of the company. Overhead costs are recovered indirectly. These operational expenses are spread out and added as a fractional adjustment to each and every invoice issued by the company, as explained in later sections of this course. Between the Corporate Management and the technical staff, a middle layer of Project Managers and Discipline Leaders is generally considered partially billable and partially overhead. The following organization chart is color

coded to distinguish between the staff functions that are classified as pure overhead, mixed functions, and those hopefully one hundred percent billable components of the company.

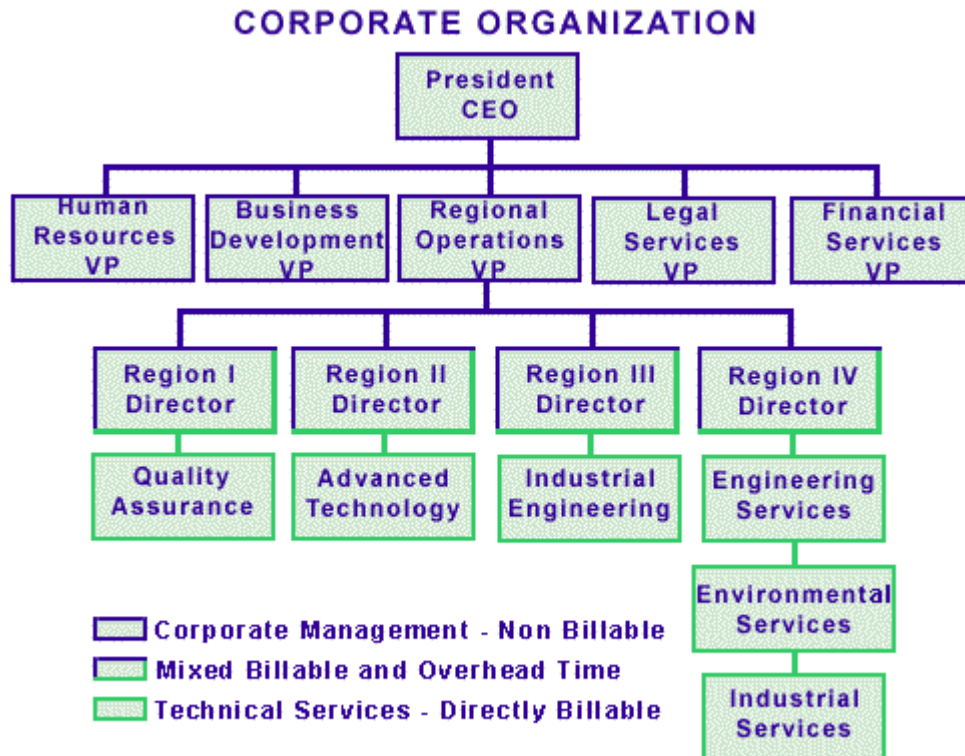


Figure 1: Example of a corporate organization chart that differentiates between the staff functions that are considered overhead versus those that are directly billable to clients.

Therefore, a pertinent question for this course is: how are the activities of all the staff in a corporation converted into dollars and cents to calculate the cost of delivering services to clients? A business is successful when it generates a profit, which means that its income exceeds its expenses.

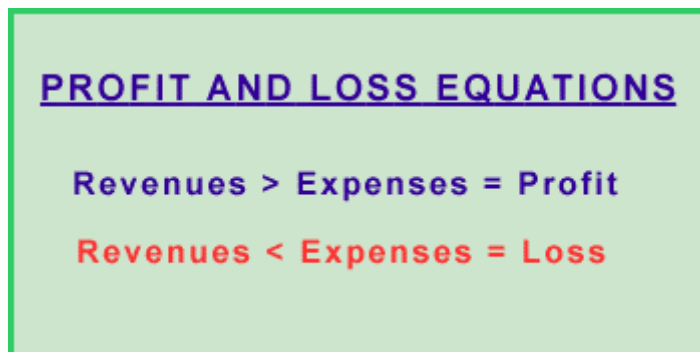


Figure 2: The difference between realizing a profit and incurring a loss depends to a great extent on the accurate estimation of expenses or services costs.

In order to estimate its amount of profit, the company must be able to identify and recover its cost to deliver services to clients. Profit can then be calculated by subtracting cost from revenue.

The pressure to develop accurate cost estimates is driven by market conditions and competition. It is common practice for clients to award contracts based not only on the merit of the technical scope of work but also, and in many cases most importantly, on the overall costs associated with the delivery of services. In order to underbid the competition, and not lose money, a Project Manager needs to have a firm grip on the elements of the proposed budget in order to know, with a high level of confidence, what can and cannot be traded in negotiation with the client.

Regular Time Cost

The basic assumption in calculating a regular time cost rate is that a company has to recover its staff salary expenses based on actual workdays in a year. The number of workdays in a calendar year is calculated as follows:

<u>Time Breakdown</u>	<u>Days</u>	<u>Hours</u>
Calendar days in a year	365	2,920
Calendar weekend days (Saturdays and Sundays)	(105)	(840)
Available Workdays (Calendar days less week ends)	260	2,080
Company Holidays (may vary by employer)	(10)	(80)
Net Available workdays per year	250	2,000
Annual Vacation days (assumed)	(15)	(120)
Absences (such as sick leave, assumed)	(7)	(56)
Actual Available workdays per year	228	1,824

Based on this analysis, employees are paid for 260 days of work (2,080 hours) per year, but may be billable for a maximum of 228 workdays (1,824 hours) per year.

However, for the calculation of billing rates, salary cost is initially computed using the net available workdays (250), prior to the deduction for vacation and absences. For example, the salary cost for a staff member who earns \$50,000/year is calculated as follows:

$$\$50,000 / 250 = \$200/\text{day}$$

Note that the rate of \$200/day does not include an adjustment for Vacation and Absences (V&A). This allowance is usually applied by using a multiplier calculated as follows:

V&A multiplier is: $(22 / 228) + 1 = 1.09649$

Therefore, the adjusted regular time cost rate/day = $\$200 * 1.09649 = \219.30

The example given above assumes 15 vacation days and 7 sick days, for a total of 22 days.

The vacation and absences (V&A) adjustment is applied by a multiplier to permit individual adjustments to be made on a case by case basis. For example, in many companies the amount of annual vacation increases with length of service and the V&A allowance can be adjusted accordingly. For example, if an employee has an annual vacation of 20 days, the calculation is adjusted as follows:

$(27/223) + 1 = 1.12107$

The equivalent adjusted regular time cost rate/day = $\$200 * 1.12107 = \224.22

Salary Related Costs

Salary related costs comprise the benefit package offered by the company to its employees. Actual salary related costs for the billable staff is calculated as a percent amount of the annual salary and added to the calculated regular time cost. Some of these costs are government mandated while others are discretionary. Examples of such costs are listed in the following figure:

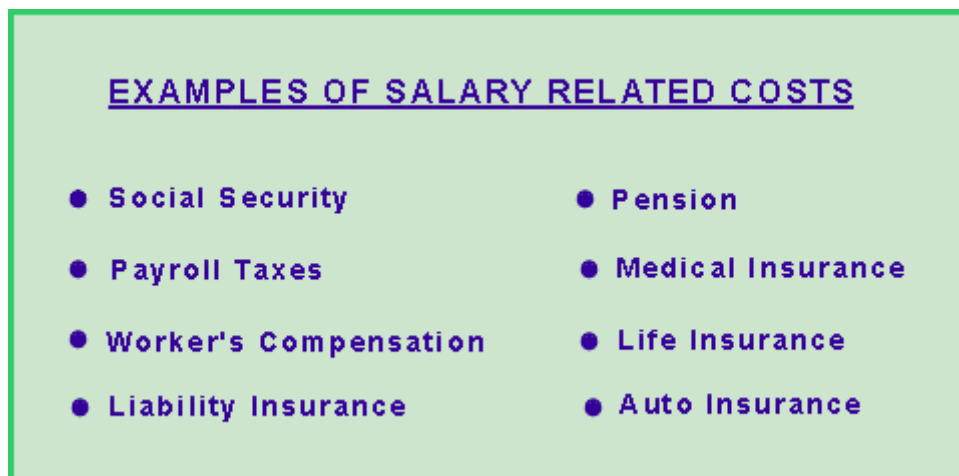


Figure 3: Examples of salary related costs that are considered part of the employee benefit package

For example, if the benefit package of our \$50,000/year employee is worth \$12,000 (24%), the adjustment to his regular time cost rate/day is calculated as follows:

$\$219.30 * 1.24 = \271.93 assuming 15 days of annual vacation, or

$\$224.22 * 1.24 = \278.03 assuming 20 days of annual vacation

Note that for the same base salary, the adjusted regular time cost is related to the length of the employee's annual vacation.

Overtime Cost

In calculating this cost, you need to consider three types of overtime:

- Regular Overtime: for work performed over the standard 8hours/day. The hourly rate for regular overtime is the same as the employee's regular hourly rate.
- Premium Time: for work performed on Saturdays and holidays. Premium time is generally paid at 1.5 times the employee's standard rate.
- Double Time: for work performed on Sundays and major holidays, paid at double the normal salary rate.

Many companies have specific guidelines that restrict exempt employees to receiving regular overtime compensation only, irrespective of when that overtime is worked. The term "Exempt Employees" refers to the highly compensated technical staff employed by the company on a full time basis. Temporary employees and hourly workers, however, usually qualify for premium time and double time compensation. A company may also decide under certain circumstances to qualify certain categories of employees to receive premium time compensation. For example, a company may decide to pay its Civil Design Engineers that work on certain projects in remote areas premium time compensation for work exceeding say 45 hours/week. Usually officers, department heads and other top management personnel are not eligible for overtime compensation.

The Regular Overtime rate is the same as the regular salary rate and is calculated as follows:

$(\text{Annual Salary} / 250 \text{ days}) = \text{daily cost rate}$

$(\text{Annual Salary} / 2000 \text{ hours}) = \text{hourly cost rate}$

The Premium time rate, which is 1.5 the regular salary rate is calculated as follows:

$1.5 * (\text{Annual Salary} / 250 \text{ days}) = \text{premium daily cost rate}$

$1.5 * (\text{Annual Salary} / 2000 \text{ hours}) = \text{premium hourly cost rate}$

The Double time, which is double the regular salary rate is calculated as follows:

$2 * (\text{Annual Salary} / 250 \text{ days}) = \text{double daily cost rate}$

$2 * (\text{Annual Salary} / 2000 \text{ hours}) = \text{double hourly cost rate}$

Note that in calculating the overtime component of cost, the vacation and absences and other salary related adjustments is omitted, because they have already been applied once in the calculation of the regular time cost. Notwithstanding this principle, many companies do not make a downward adjustment to their overtime cost and end up making extra profit from the overtime labor of their staff. The risk you run is that this practice may be discovered and disallowed during a financial audit.

Overhead Costs

Large companies group their staff into pools of technical resources that provide specialized services. Overhead pools are comprised of organizational departments or may represent a division of the company. For example, pool No. 1 may provide engineering services, while pool No. 2 may provide environmental services, pool No. 3 risk management services, and pool No. 4 quality assurance services, etc. In some companies the total number of pools can be quite large. The overhead cost of operating each pool within the company is usually calculated separately. In other words, each pool will have a different overhead multiplier. Overhead costs for each pool are calculated based on:

- Salary costs
- Non-salary costs
- Administrative costs

The following figure lists the types of overhead expenses under each of the categories listed above.



Figure 4: Categories of overhead expenses

Overhead salary expenses are composed of the local pool management, and the clerical and other support staff salaries that are not directly billable to clients. Non-salary expenses consist of actual facilities costs such as rents, utilities, maintenance, supplies and the cost of research and business development. The general administrative component consists of the allocated portion of corporate management to the pool.

Overhead is continuously adjusted throughout the year, and is usually based on a quarterly running average that reflects existing operational costs within the company at the time services are performed. Overhead is applied as a multiplier to the regular time cost, and may vary among the various pools of the same company from a low of 75% to a high of 200%. Following is an example of how overhead is calculated:

<u>Cost Element</u>	<u>Pool 50</u>
Direct Billable Bare Salary	103,542.70
Vacation, Absences & Holidays (VA&H, 17.4%)	18,016.43
Other Salary Related Costs (assumed, 24%)	24,850.25
Total Direct Base Salaries	146,409.38
Department Overhead Salaries (managerial)	29,034.10
Other Overhead Salaries (support staff)	9,027.10
Vacation, Absences & Holidays (VA&H, 17.4%)	6,622.65
Subtotal Department Overhead Salaries	44,683.85
Office Rent	16,689.70
Utilities & Maintenance	5,713.40
Subtotal Facilities Costs	22,403.10
Employee Pension Plan	1,039.20
Investment Plan Company Contribution	934.00
Worker's Compensation Insurance Premium	365.30
Company Portion of Medical Insurance	4,546.40
Group Life Insurance Policy	602.00
Third Party Liability Insurance	325.90
Payroll Taxes	4,109.40
Subtotal Overhead Employee Benefits	11,922.20
Share of Corporate General & Administrative Costs	22,973.60
Business Development	20,910.90
Research & Development	10,158.60
State & Local Taxes	1,200.50
Subtotal Other Administrative Costs	55,243.60
Total Overhead Costs	134,252.75

$$\text{Overhead Factor} = \frac{\text{Total Overhead Costs}}{\text{Total Direct Base Salaries}} \quad \text{or} \quad \frac{134,252.75}{146,409.38} = 0.9170$$

In other words, for the above example overhead is calculated at **91.70%**

Following are two examples showing the effect overhead has on the calculation of the total cost of services provided by staff with the same salary rate working for two different pools within the same company with overhead estimated at 75% and 125% respectively:

Department Name	Civil Engineering
Pool #/Title	No. 1/Engineering Services
Overhead	75%
Salary Rate	\$219.30/day

Salary Cost + Overhead = Total Regular Time Cost
$$\$219.30 * 1.75 = \$383.78/\text{day}$$

Department Name	Applied Sciences
Pool #/Title	No. 2/Environmental Services
Overhead	125%
Salary Rate	\$219.30/day

Salary Cost + Overhead = Total Regular Time Cost
$$\$219.30 * 2.25 = \$493.43/\text{day}$$

The two examples presented above stress the need to keep overhead costs under control in order to lower the total price charged for services. By increasing its number of direct billable resources and decreasing non-salary related expenses, a pool can control its overhead cost effectively. A lower overhead burden translates into attractive rates that can be offered to clients and allows a pool to remain competitive in the market place.

Direct Costs

Direct Costs are the out-of-pocket expenses incurred directly in the performance of contracted services, including supplies, equipment rental, copying services, and travel expenses. These costs are typically invoiced to clients based on actual costs multiplied by a fee that varies between 5% and 15%. The fee is added to cover the contractor's cost of advancing the necessary funds for these expenses before getting reimbursed by the client. The following figure lists some common categories of out-of-pocket expenses.



Figure 5: Example of reimbursable direct expense categories

Depending on the size of the contract and the history of prompt payment by the client, some accommodation may be reached concerning the fee that is applied to direct or out-of-pocket expenses. For example, high dollar costs that are paid to subcontractors and consultants can be passed directly to the client, at actual cost, especially if the disbursement of funds to the subcontractor occurs promptly and close to the time payment is received from the client.

Following is an example of how out-of-pocket expenses are calculated and presented by task for the first two tasks of an overseas project: The first task required two staff members to travel overseas for 10 days. The second task required two staff members to travel within the U.S. to corporate headquarters for 5 days to use specialized computer equipment.

Task 1: Overseas Travel 2 people, 10 days duration

Round Trip Air Fare	\$3,500.00
Number of person-trips (2 people, 1 trip each)	2
Subtotal - Airfare	\$7,000.00
Living Expenses (hotel, food) per day	\$180.00
Number of person-days (2 people, 10 days each)	20
Subtotal - Living Expenses	\$3,600.00
Total Task 1 Travel Costs	\$10,600.00

Task 2: U.S. Travel, 2 people, 5-days duration.

Round Trip Air Fare	\$500.00
Number of person-trips: (2 people, 1 trip each)	2
Subtotal - Airfares	\$1,000.00
Living Expenses (hotel, food) per day	\$150.00
Number of person-days (2 people, 5 days each)	10
Subtotal - Living Expenses	\$1,500.00
Total Task 2 Travel Costs	\$2,500.00

Summary of Other Direct Costs

Rental of specialized computer equipment	\$3,000.00
Drawing and map reproduction	750.00
Report preparation and reproduction	1,250.00

Telephone costs	1,000.00
Overnight mail and international courier services	1,000.00
Total Other Direct Costs	\$7,000.00

Total Out of Pocket Costs: $\$10,600 + \$2,500 + \$7,000 = \$20,100$

10% Fee on Out of Pocket expenses: $\$20,100 * 0.1 = \$2,010.00$

Billable Out of Pocket Expenses $\$20,100.00 + \$2,010.00 = \$22,110.00$

Escalation of Services Costs

Most large companies update and publish their billing-rate schedules once a year, during the month of January. These rates remain valid during the first six months of the year. On the other hand, the preparation and submittal of proposals in these companies is an ongoing process that continues uninterrupted throughout the year. In addition, the scope of work and schedule in many of these proposals also may extend over a period of several years. Nonetheless, the costing of these proposals must be completed on the basis of the schedules of charges available at the time the proposal is submitted. Therefore, there is a need to develop projections of services costs into the future. Such a projection is known as cost escalation, and is customarily done in accordance with defined guidelines as explained in the following example.

For this example, assume that a project is to be implemented over 18 months, starting in June of the current calendar year. The company proposes to incorporate a 5% escalation rate per year into its estimation of costs for performing the proposed services. For this example, we will select three employee classifications, currently charging \$250 per day, \$325 per day, and \$450 per day respectively.

The \$250, \$325 and \$450 daily rates are as of January 1 of this year. Since the project is scheduled to begin in June, halfway through the calendar year, we would apply half of the yearly escalation percentage to these rates for all the workdays to be completed this year, or 2.5%. These escalated rates would be included in our proposal to the client. Then starting January 1 of next year, these rates would be escalated an additional 5% in keeping with our proposed escalation clause. Note that the escalations are cumulative, so that the rates increase relatively rapidly, as shown in the following table:

Explanation	Staff #1	Staff #2	Staff #3
Base Daily Rates as of January 1 of this year	\$250.00	\$325.00	\$450.00
Base Rate used for Proposal for first six months of project, based on 2.5% escalation	\$256.25	\$333.13	\$461.25
Base Rate structure for work during next year, based on 5% escalation	\$269.06	\$349.79	\$484.31

Some clients may require that your proposed escalation percentage be tied to a recognized published index, such as inflation rate or cost of living index..

Calculating Revenue

The revenue of a company is derived from its billings. A profit is realized only when the invoices are paid in full and the company has recovered its expenses. The difference between revenue and cost is the profit. However, before a profit is realized, it is initially estimated and presented as part of the budget developed to perform specified services. When profit is initially estimated at the initiation of a project, it is referred to as margin. In other words, the margin represents the profit that a company hopes to realize from performing its contracted services. These relationship between revenue, cost and margin can be expressed as follows:

Cost + Margin = Revenue or Revenue - Cost = Margin (or anticipated profit)

At this point it should be recognized that one of the most important tasks of a Project Manager is to protect and improve the margin of his project, since it represents the profit that keeps the company in business. A careless or inattentive Project Manager can quite easily deplete the margin thus leading to a loss that can compromise the survival of the company. The manager's approach to a job should be to thoroughly understand the contract and scope of services and develop an appropriate project plan, schedule and budget to implement the work. Success will then depend on how well the staff is organized and focused throughout the various phases of project implementation. Maintaining good communication with the client is also quite important because a satisfied client holds the key to preserving the integrity of the margin. It should also be remembered that satisfied clients are the best source of future work and references.

The following section addresses the various types of contractual agreements commonly used for contracting or consulting work.

Contract Types

There are a number of contractual financial agreements that can be entered into between a client and a contractor. The following is a list of the most common arrangements or contract types that exist in the marketplace:

1. Cost plus percent fee
2. Cost plus fixed fee
3. Per day rates (also known as Per Diem Contracts)
4. Lump sum (also known as Fixed Price)

For each contract type listed above, the following topics are addressed:

- Typical kinds of projects that use this type of contract
- Advantages and disadvantages to the contractor and the client
- Handling changed conditions
- Handling change orders or changes in scope

- Typical billing cycle
- Calculating billing amounts
- Potential pitfalls and financial exposure

Each of these contract types may have additional stipulations, including incentive bonuses, ceiling or stipulated maximums, liquidated damages and/or retainage. These stipulations are discussed following the sections addressing the contract types.

Cost Plus Percent Fee

Under this contract type, the client reimburses cost plus a percentage of that cost for profit. In this case, the higher the total billings, the higher the margin will be. Higher billings may come in the form of more hours worked, the use of more experienced and expensive staff, or a combination of both.

Typical Types of Projects

Clients use Cost plus percent Fee contracts for projects that have a well defined goal but involve some uncertainty in what will happen once the project starts. Examples include renovations of old buildings, repair of bridges or old roadways, environmental assessments of polluted land, or architectural projects integrating existing with new structures. The clients recognize that potential bidders don't have an accurate basis upon which to determine an actual bottom line estimate. Also, the client is interested in having high-quality firms bid the project, and so has set up a contract structure that allows for the realization of a fair profit.

Advantages / Disadvantages

The advantage of this type of contract is that the more work is assigned, the higher the billings and margin will be. On the face of it, the contractor cannot lose.

The primary disadvantage to this type of contract is possible erosion of credibility with the client. The client may perceive that you are padding the work assignments by using higher-cost people than are really necessary or expending more time than the client thinks is reasonable. In such a case, you may do well financially on this project, but the chances of expansion or future work with this client is dimmed or severely diminished.

Therefore, to manage such a contract and client successfully in the short term and long run, you should be honest and proactive in negotiating planned manpower loading. Furthermore, any agreements with the client as to personnel assignments and time estimates must be documented in writing before the work starts with copies sent to the client. Such an approach ensures that you both heard the same thing at project meetings and that there is a paper trail of all agreements that were made verbally. This approach protects you, the contractor, from a technique sometimes used by clients of having a corporate officer intervene and refuse payment on the basis that there was no formal agreements relative to changes in manpower assignment or time estimates.

Handling Changed Conditions

Changed conditions can be claimed by the contractor when, after the job starts, a situation is discovered that was not identified or specified in the request for proposal. For example, the foundation for a building turns out to be solid rock instead of easily removable soil. If the client agrees that this situation is a changed condition, they will likely ask for a revised manpower estimate and schedule. Once the hours, manpower level and schedule are negotiated and documented, no contract modifications are necessary, since the contract specifies only rates and percent fee, and is generally not limited to a specific scope of work.

Handling Change Orders

Under this type of contract, a change order from the client is easily handled, since it usually only requires a revised schedule and manpower assignment. If you have established credibility early on with this client, and are performing the work on time and within budget, the process of change orders can proceed very smoothly. Change orders under this type of contractual agreement provide significantly increased revenue and margin without the client feeling that they are being taken advantage of. When a client has such a relationship with you, they will often find it expedient to provide you, the project manager, with significant change orders that were originally envisioned as separate contracts. Using this approach, the client benefits by getting work done expeditiously without having to rely on the usual proposal-bidding-award-contract negotiation cycle. Long term, profitable relationships can be forged if assignments are managed properly and a level of trust is established and maintained.

Billing Cycle

Under this type of contract, billing is usually done on a regular schedule, such as monthly or quarterly. Billing is not generally tied to specific milestones or deliverables.

Calculating Billing Amounts

Billings under this type of contract are generated by summing up the salary costs, the salary related costs, overhead, direct costs (such as out-of-pocket expenses and subcontractor costs) and a percent fee.

Total Billing = Salary cost + Salary related costs + Overhead + Direct costs + Profit

The basic information to generate the invoice is gathered from the following sources:

<u>Financial Element</u>	<u>Basis for Billing</u>
Salary	Time Sheets
Vacation, Absence and Holidays (VA&H)	% of salary (computed multiplier)
Overhead Costs	% of salary (computed multiplier)
Direct Costs	Expense Accounts, receipts, subcontractor invoices; plus handling fee multiplier
Profit	% of billable salary

Under this type of arrangement, total billing increases in proportion to total cost. The Project Manager should be aware at all times of considerations that may affect total billing. For example, total billing will be affected if the pool mix of staff performing the work differs from that used in estimating cost in the proposal.

Under this type of contract, only overhead and fee percentages are stipulated. All other elements are reimbursable based on actual cost levels that can be audited. Therefore, billings will increase as costs increase. For example, when a staff member gets a salary increase, his or her billing increases, as does the profit on that individual.

Potential Pitfalls and Financial Exposure

The Project Manager should be mindful that overhead and fee multipliers were stipulated based on a planned staff mix. Use of personnel from higher cost overhead pools during implementation of the project will result in higher than anticipated billings, which may negatively impact the client's perception.. Conversely, billing reduction occurs if lower overhead cost can be achieved.

As with all contracts, the terms and conditions should be carefully reviewed to identify other areas of potential exposure. For example, exposure may exist in the terms and conditions under the limitation of liability provision. In this case, any re-performance of services at no charge, under the liability clause, will reduce the realized profit derived from the percent fee or profit.

Cost plus fixed fee

Under this contract type, the client reimburses your cost plus a pre-agreed upon fixed amount for profit. Additional billings that result from an increase in staffing levels do not result in increased profit. The contractor recovers his cost only from such increases in the work force.

Typical Types of Projects

Clients use cost plus fixed fee for well defined projects, with apparently little to no uncertainty in the implementation of the agreed-upon scope of work.

Advantages / Disadvantages

The client's advantage is knowing the limit of his financial commitment for a given scope of work. At the same time, the client is also pressuring the contractor not to increase his defined level of effort . There are few, if any, advantages to the contractor under this type of contract. As such, it is a popular contract type among clients, especially in the construction business.

In order to realize the original profit percentage, the contractor must complete the project using the level of manpower and direct expenses originally proposed. The more hours spent on the project, the lower the percent profit gets to be. Further, since the contractor is only being reimbursed at cost, assigning more staff to complete the original scope requires the commitment of personnel that could be used more profitably on other assignments.

Handling Changed Conditions

Changed conditions provide a dilemma for the Project Manager under this type of contract. Should the contractor agree to increase manpower loading to address the changed condition with no adjustment in fee, no additional profit is realized. In fact, the profit expressed as a percentage figure actually drops.

The other approach is to develop an addendum to the contract that contains its own fixed fee covering the changed condition. This approach requires time to generate a cost estimate, negotiate with the client, get approvals and authorization to proceed, and usually causes a delay in the work, especially if the changed condition occurs on a task that is critical path to meeting project milestones. Any such delay also impacts the contractors manpower forecasts. However, the changed condition provides an opportunity for additional profit. Usually the Project Manager has to judge the magnitude of the impact caused by the changed condition, balance the various issues carefully, and make the appropriate decision accordingly.

Handling Change Orders

Under this type of contract, change orders coming from the client will generally acknowledge the contractor's right to additional fee. Under this scenario, change orders can increase profits and allow additional staff assignments. In some cases, however, a client may ask the contractor to complete a small change order without additional fee, claiming lack of funds or other logistical problems. Should the contractor agree as a "favor" to this first change order, a precedent may be established, and the contractor may be ratcheted later on into doing more and more change orders with no additional fee. At some point, the Project Manager may have to draw the line and re-negotiate with the client.

Typical Billing Cycle

As with Cost Plus Percent Fee, billing is generally done on a regular basis (for example, monthly or quarterly), independent of project milestones, since the fee is fixed and not dependent on schedule. Ideally, a percentage of the fee is included with each bill, in proportion to percent complete, billings to date, or other such measure. The fee can also be paid by the client incrementally following the completion of well-defined project milestones, independent of the other billings. In some cases, some clients may insist that a significant part of the fee is withheld until successful completion of the project, thereby maintaining significant leverage over the contractor. In such a case, the important point to clarify is how "successful completion" will be defined, and by whom. It is therefore important for the Project Manager to document in writing the various stages of satisfactory work completion as work progresses on the project.

Calculating Billing Amounts

Billings under this contract type are generated by summing up the salary costs, the salary related costs, overhead, direct costs (such as out-of-pocket expenses and subcontractors costs) and portion of fixed fee.

Total Billing = Salary cost + Salary related costs + Overhead + Direct costs + Portion of Fixed Fee

The basic information to generate the invoice is gathered from the following sources:

<u>Financial Element</u>	<u>Basis for Billing</u>
Salary	Time Sheets
Vacation, Absence and Holidays (VA&H)	% of salary (computed multiplier)
Overhead Costs	% of salary (computed multiplier)
Direct Costs	Expense Accounts, receipts, subcontractor invoices; plus handling fee multiplier
Profit	Portion of stipulated fixed dollar amount

Under this type of arrangement, the total amount of the fee for services rendered is stipulated in the contract.

Potential Pitfalls and Financial Exposure

Billing for salary, salary related cost and overhead increases in proportion to the level of effort expanded, but the fee remains fixed and does not increase. If more staff is assigned to the project, for example to meet a deadline, the company will recover its cost but will not be able to realize a profit from utilization of these additional resources. Although this may allow a contractor to keep otherwise under-utilized resources busy or “treading water”, it is a distinct disadvantage if this staff could instead be assigned to more profitable projects.

Also, since the fee is fixed, opportunity for additional profit comes only from additional fees related to changes in the scope of work approved by the client in advance. Changes in the scope of work may be caused by changed conditions noted by the contractor, or change orders issued by the client for additions to the original scope. In any case, it is important for the Project Manager to recognize and address such changes promptly and engage the client in negotiation to approve adjustments not only to the cost but also to the fee components of the billing. As with all contracts, the terms and conditions of the contract should be carefully reviewed to identify other areas of potential exposure.

Per Day Rates (also known as Per Diem Rates)

Under this type of contract, the staff is billed to the client based on fixed daily rates. The rates are usually presented in the contractor's proposal by staff classification. These rates include not only the contractor's cost components, but also the profit margin.

The unit rates are listed by staff classification based on the median salary of a given classification. Below is an example of such a schedule of charges:

PER DIEM RATE SCHEDULE ENGINEERING SERVICES	
Classification	Daily Rate
Chief Engineer	\$1,090
Consulting Engineer	\$ 975
Principal Engineer	\$ 880
Senior Engineer	\$ 750
Engineer	\$ 586
Associate Engineer	\$ 457
Assistant Engineer	\$ 365
Technician	\$ 338
Designer	\$ 405
Drafter	\$ 298
Clerk	\$ 272

Figure 6: Example of a per diem schedule of charges issued by a company for a pool that provides engineering services.

Typical Types of Projects

Per Diem type contracts have become relatively scarce over the past decade or so in the commercial sector. However, they used to be quite common on large industrial projects (such as the design of large power generating facilities) where entire floors of architects, engineers and draftsmen were engaged in full time work for months or years at a time.

Per-diem type contracts are generally encountered only where a client needs particular technical expertise for a short time and does not want to hire new staff. Such “staff augmentation” type projects allow the client to get the help they need without the time and trouble of hiring their own dedicated staff. The client will often insist that such staff works in the client's office under their supervision. They are usually interested in technical staff rather than in supervisory personnel. This is the exact business model used by the Prime Contractors of large federal projects that seek to supplement their capabilities by augmenting their in-house staff with additional qualified personnel hired temporarily from the ranks of competing firms or other subcontractors. It is also interesting to note that Temp-Agencies, whether it is for clerical, professional or trade personnel, use this same approach. Also, highly qualified consultants and specialists are usually retained and paid on the basis of pre-agreed upon per diem rates for their services.

Advantages / Disadvantages

The advantage of this type of contract to the client is temporary staff augmentation without most of the normal contractual issues associated with going out for bid and hiring of a contractor. The advantage to the contractor is that for each hour worked by the billable staff, profit is realized. Also, the client is directing the work, so there is little exposure to the contractor (as long as his people are competent). If

the client commits to specific staff levels for reasonably long lengths of time on the project, a contractor may do very well under this type of arrangement.

One obvious disadvantage of this type of contract is the exclusive dedication of your personnel to a single client. These resources are therefore unavailable for other projects or for multi-tasking in their home office. In order to keep their core staff available, some contractors will often hire “job shoppers” to fill the positions for a particular client or prime contractor. When the work is done, these temporary workers are either moved to other similar type assignments or laid off. This approach is taken to maximize profit while minimizing disruption of the core staff. In some cases, clients may make erratic and unreasonable demands on the types of technical staff needed and/or their schedule of availability. Such demands should be negotiated between client and contractor to arrive at mutually acceptable compromises.

Handling Changed Conditions

Changed conditions are usually not relevant under this type of contract, since the client is running the project. Therefore, changed conditions are identified by the client, not the contractor, and such changes usually translate into change orders, extensions or curtailment of assignments.

Handling Change Orders

Change orders are usually welcomed by the contractor, as more people and more work means more profit. Usually there are no contractual implications to adding staff to an existing assignment.

Calculating Billing Amounts

The corporate per diem rates are usually updated once a year, in January, and the dollar amount listed incorporates the following elements:

- Salary and related salary costs
- Adjustment for VA&H (vacations, absences and holidays)
- Overhead
- Escalation (for current year only)
- Profit margin

Margin levels, included in the per diem rates, are reflective of market conditions in order to maintain a competitive edge. The basic information to generate the invoice is gathered from the following sources:

<u>Financial Element</u>	<u>Basis for Billing</u>
Time Costs	Hours expended by classification
Direct Costs	Expense Accounts, receipts, plus handling fee multiplier
Profit	included in daily rate

As the table indicates, billing preparation is streamlined and greatly simplified. Time spent in work activities is multiplied by the equivalent per day rate according to the position or title of the employee within the company. The direct costs are billed separately, based on customary and documented costs plus a handling multiplier.

Potential Pitfalls and Financial Exposure

Since the daily rates in the proposal generally represent median salary ranges, actual salaries of the assigned staff will affect the resultant margin. Using staff with a base salary above the median for their classification will have a negative impact on the profit margin. Conversely, using staff with a lower base salary than the median for the classification will have a positive impact on the profit margin. Therefore, it is important for the Project Manager to review the staff mix in order to evaluate the real impact on profit.

Also, as on many contracts, workdays, billing rates, and direct costs are usually subject to audit by the client. Therefore, detailed documentation of costs and personnel assignments are important. As with all contracts, the remaining terms and conditions should be carefully reviewed to identify other areas of potential exposure.

Lump Sum (also known as Fixed Price)

A lump sum project is defined as an agreed upon scope of work delivered to a client for a fixed price. The lump sum may or may not be inclusive of the direct costs. Lump sum contracts are regarded by many people as high risk ventures. Realizing a fair profit under this type of arrangement is dependent in large part on the qualification of the Project Manager and the control he or she exercises on the delivery of services. The amount of the lump sum is usually calculated by multiplying the estimated staffing level to complete the project by the per diem rate of the staff members.

Typical Types of Projects

In general, lump sum projects tend to be for work that is relatively straight forward and there are a number of potential contractors with the requisite experience. For example, most commercial real estate transactions require an assessment of pollutants under the ground. An environmental contractor may propose to research the history of the site, drill few borings, take some water samples for chemical analysis and write a letter report. This is a typical type of small lump sum contract with a clearly defined scope of work.

Larger projects that have been proposed on a cost plus percent fee, cost plus fixed fee, or per diem fee basis may be turned into lump sum jobs during contract negotiation between client and contractor. If both parties are in agreement about the specifics of the scope of work, then a lump sum arrangement may benefit all involved. The financial exposure of the client is limited to the lump sum amount, and the contractor benefits from the freedom to allocate resources as needed and from the streamlining of the billing process under this type of contract, as explained below.

Advantages / Disadvantages

From the contractor's perspective, the advantage of a lump sum is that payments are simply linked to work progress and are not subject to audits. It should be remembered that audits tie down the resources of the company, and that preparing for and going through an audit takes time which is not usually reflected or recovered in the billings, except as part of the overhead. From the client's point of view, a lump sum agreement puts a cap on financial exposure.

The ability, skill and experience of the Project Manager are of utmost importance in deciding to proceed with a lump sum bid. The development of accurate cost estimates, based on a clearly defined schedule, scope of work and specific staff assignments are essential to protecting the built-in profit margin. Market conditions will usually dictate the level of profit that can be realized. However, it is always safe and prudent to build in a contingency factor in the budget to take care of unforeseen circumstances.. Since revenue is fixed in this case, only efficient implementation and/or a reduction in cost can improve the profit that can be realized from the project.

Under a lump sum arrangement, the company's cost can increase at a greater rate than its billing. This will occur when:

- More workdays are needed than originally estimated
- Salary cost per day is higher than originally planned
- The overhead mix is higher than originally planned
- The applied overhead exceeds the forecasted overhead

The factors listed above will result in a lower margin to cost than originally projected.

If the lump sum is calculated in present day dollars, an appropriate escalation clause should be stipulated for work to be performed in subsequent years. It is also important for the Project Manager to recognize and identify scope of work changes promptly and engage the client in negotiation to approve adjustments to the lump sum as soon as practicable.

Handling Changed Conditions

Since the lump sum contract was carefully bid with a specific scope in mind, any significant changed condition can easily turn a profitable project into a losing one. If the Project Manager does not immediately identify to the client that a changed condition exists and a modification to the lump sum is in order, the margin will be negatively affected. Clients will obviously ask you to “absorb” the changed condition without contract modification. However, this is a slippery slope that is often difficult to recover from. Managers of lump sum contracts must be ever vigilant for changed conditions, but may accommodate small changes for the sake of expediency and to maintain schedule.

Handling Change Orders

Change orders from the client must be handled the same way as changed conditions. Since the change order is a change in the scope, and the lump sum price is based directly on the original scope, a contract modification is almost always necessary. A Project Manager may choose to “absorb” a change

order (or changed condition) without contract modification in the interest of “goodwill” or the promise of future work. However, this approach is one of the main reasons that lump sum projects are considered high risk ventures. However, if managed diligently, they allow the Project Manager great flexibility in completing the work successfully while maximizing profit.

Calculating Billing Amounts

The billing amounts are usually specified in the contract and consist of periodic fractional payments of the lump sum amount. Thus, the billing process is greatly simplified.

Depending on the stipulations of the contract, direct costs are either included in the lump sum or are billed separately, based on customary and documented costs plus a handling multiplier.

Potential Pitfalls and Financial Exposure

The greatest danger in lump sum contracts is agreeing to changes in the scope of work without requiring a contract modification to cover the additional costs. Because of the competitive nature of the marketplace, the Project Manager rarely has sufficient contingency in the budget to handle more than minor scope modifications. The tendency to accept apparently minor scope changes in the name of “goodwill” should be carefully considered before such action is taken.

Additional Contract Stipulations

Clients will commonly add additional financial stipulations to requests for proposals. Some of the most common are incentive bonuses, ceilings or stipulated maximums, liquidated damage clauses and retainage. Each of these is discussed in the following sections.

Incentive Bonuses

In some cases, a client may provide an additional incentive for a contractor to meet or beat one or more scheduled project milestones. This incentive is typically a monetary bonus above and beyond the contract cost and profit structure. On large projects such incentives can be quite impressive, on the order of millions of dollars. Under such conditions, the contractor's corporate management may place significant pressure on the Project Manager and technical staff to ensure that the schedule is met and the incentive bonus won. This is not always a pleasant experience for the rank and file workers, and there is always the danger that quality may suffer due to inadequate time spent on critical tasks or widespread employee burnout. Under ideal conditions, a portion of the incentive ought to be shared with the staff responsible for meeting the deadlines. In the real world, however, the technical staff rarely shares in the benefit gained from such incentives, and the entire value of the incentive is booked as profit for the company.

In many cases, the incentive bonus clause carries with it a downside risk as well.. Clients may stipulate that if schedules or delivery dates are missed, then the contractor forfeits not only the incentive bonus but also part of the scheduled compensation. Dollar ranges may be set to limit increases or decreases in bonus and compensation based on performance.

Ceiling or Stipulated Maximum (also referred to as Not-to-Exceed)

A not-to-exceed value can be placed at any level or over a combination of tasks or activities in a contract. For example, a dollar limit or ceiling can be specified by task, a group of tasks or for some categories of direct costs either by task or group of tasks. A ceiling may also be placed on the total project cost. This type of arrangement benefits the client by limiting his financial commitment to a specified amount, while at the same time requiring the contractor to commit to a certain milestone or deliverable. Before entering into this type of agreement, the contractor should feel confident that the not-to-exceed value contains some contingency to cover unforeseen circumstances. If the not-to-exceed amount appears to be barely adequate to get the job done, the risk may outweigh the potential benefits, and the contractor may be better off turning down the assignment.

Under what conditions would a contractor be willing to enter into such agreement? Many enticements can be provided by the client, especially if the contractor is led to believe that the successful implementation of the present scope of work is likely to lead to a much bigger and more lucrative future assignment. Many a good manager has fallen victim to this enticement.

From a contractor's perspective, the accurate estimation of cost is essential to realizing a reasonable profit under this type of contractual agreement. The Project Manager must also be vigilant and watch continuously for the rate of billing versus the rate of task completion to ensure that all contractual agreements are satisfied.

Liquidated Damages

Liquidated damage clauses are the exact opposite of incentive bonuses. Under liquidated damages, the contractor is fined a certain amount for each day a milestone date is missed. Liquidated damages of several thousand dollars per day are not uncommon on larger projects. Such terms can place significant pressure on the Project Manager to make all delivery dates. As with the incentive bonus contracts, reduction in quality and/or staff burnout are inherent dangers if the project starts to fall behind. Because schedule becomes all important under such an arrangement, the Project Manager must document any and all schedule slippage that can be attributed to the action or inaction of the client, such as delayed approval of designs or plans. Detailed documentation is critical as in many cases the client and contractor end up in court over some misunderstanding.

Retainage

Under a retainage clause, the client retains some percentage or dollar amount of each invoice until pre-specified deliverables or project milestones are completed. Retainage percentages of 5% or 10% are not uncommon. Since the contractor's profit is usually wrapped in that final 5 to 10 percent of the budget, the client retains significant leverage over the contractor. Contracts where the retainage is to be held until satisfactory completion of all the work are best avoided completely, unless the project is of short duration and the definition of "satisfactory completion" is spelled out in detail. Under such a contract stipulation, the Project Manager must obtain written acknowledgement from the client that the defined milestones are considered completed. The Project Manager must also push for prompt payment of the retainage amount when it is due.

Case Study

The following case study is presented in narrative format to reinforce a number of concepts discussed in this course. After you review the information, evaluate the decisions taken by the Project Manager and consider how his/her performance could have been improved.

Background

An important Client of the Contractor issued a Request for Proposals (RFP) on the 30th of June. The RFP requested that a proposal be submitted no later than the 14th of July. Work was scheduled to start on August 1, with a total duration of five months. The RFP was received by the business development department of the Contractor on the 6th of July.

Content of RFP

The RFP requested that the Contractor submit the following information:

- A lump sum bid for the work to be done and a staff salary schedule
- A description of the engineering and procurement services needed to modernize an existing water treatment system.
- A warranty for the performance of the new system and all its designed components.
- The Client guaranteed the source, quantity and quality of the water that required treatment.
- A map of the site showing the location of the water treatment facility was included.

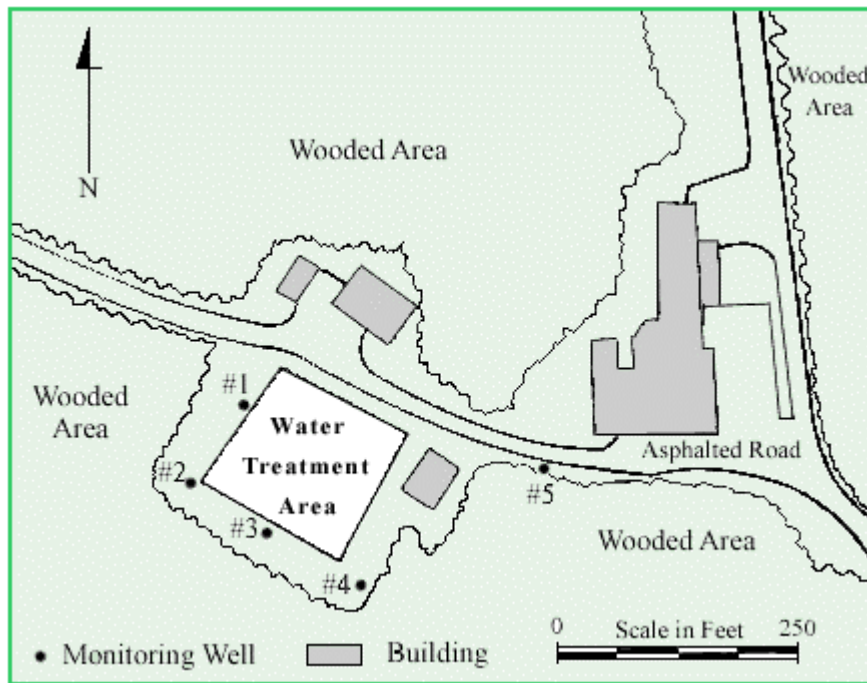


Figure 7: Location map of water treatment facility showing location of existing monitoring wells

Proposal Considerations

The Contractor is interested in winning this contract to demonstrate his ability to the Client. It is also common knowledge that the Client is planning to issue an RFP the following year for the design and construction of a multi-million dollar project which the Contractor would also like to win..

Because of the short lead time for proposal preparation, the business development department of the Contractor requested the Engineering Services group to prepare a technical description of the proposed system together with a workday estimate. The initial dollar estimate was \$100,000, with a 20% built in profit margin plus a reimbursement at cost of \$10,000 for out-of pocket expenses. After review and some “value engineering” (cut-backs) by the business development department the work was proposed for \$80,000 plus the out-of-pocket expenses at cost. The figure of \$80,000 included: direct salary cost, a benefits adjustment of 25%, a VA&H of 10%, and overhead at 100%. The workday estimate was 200 days at an average cost of \$400 per day. The proposal was submitted on time.

Post-Proposal Events

At the end of the first week in August, the Client indicated that the water quality was different from that presented in the RFP. This information was passed to the Contractor and the other bidders along with the comment that this change must not jeopardize the project schedule.

On August 15, the Client verbally advised the Contractor of the award for the authorized lump sum amount of \$80,000, that a new water quality analysis would be available within a week, and that the schedule was approved as submitted in the proposal.

Project Initiation

On the 17th of August the Project Manager of the Contractor held a meeting with the Client to discuss invoicing procedures, correspondence and reporting requirements. On the 20th of August the Client forwarded the results of the new water analysis to the Contractor's Project Manager who was also requested to confirm that there would be no schedule impact and advise if there would be any change in the lump sum price.

The Project Manager advised the client that he needed several days to evaluate the impact of the change in the water quality data, but that the engineering group will proceed at once with the preliminary design work to ensure that the schedule would not slip.

Impact of Change

Three days later, the Project Manager completed his analysis of the change and determined that there would be no schedule impact. However, additional workdays were necessary. After evaluating several scenarios, the Project Manager was able to limit the net impact of the change to 20 work-days. This 20 days out-of-scope added \$8,000 to the lump sum price . The Project Manager was pleased with his accomplishment and hand-delivered to the Client a letter detailing the price and workday variance and

confirmed that the schedule would be maintained. The next day the Client phoned his approval of the change.

Implementation Hurdles

Over the following month the Project Manager organized the participants, developed his plan for project execution and met all but one of the scheduled milestones. At the end of the second month the Project Manager received a number of phone calls which left him questioning his skills as a manager. The calls can be summarized as follows:

- Business Development determined that the Client was not satisfied with the cost of the out-of-scope and was expressing concern about the missed milestone.
- One of the discipline leaders indicated that he required 10 additional work days to complete his assigned task
- The Department Head asked for a full report on why the project was forecasting a loss and requested the submittal of a remedial plan for reversing the loss.
- The Procurement Department advised the Project Manager that the client's approval of the recommended supplier of the storage tanks was a week late.

Although this is a hypothetical case study, it is quite realistic. There are steps that the Project Manager could have taken to prevent or at least mitigate the impacts of the four problem areas listed above. Can you think of what you could have advised him to do? Below are some suggestions to start you off.

Suggestions for the Project Manager

Listed below are some questions that should have been raised with or by the Project Manager and possible suggested actions for consideration.

1. A salary structure should not have been included with a lump sum bid since its inclusion reduces pricing flexibility for any follow-up or out-of-scope work. The client cannot ask for both a salary structure detail and a lump sum bid. Per-diem rates could be provided for the benefit of the client, since these rates are all inclusive and do not provide a cost breakdown.
2. The project was accepted as a "Loss-Leader" by the Business Development Department. Recall that the initial loss estimate was equal to \$10,000 (the amount of the out-of-pocket expenses). The Project Manager should have obtained the written authorization of a corporate officer of the company recognizing and authorizing this potential loss before proceeding with the work.
3. The Project Manager should have documented the "As Sold" conditions to protect against unforeseen scope changes, especially after the Business Development Representative alerted the Project Manager to the possibility of changes in the specification of the water quality analysis.
4. When verbal notice of award was given 15 days after the proposal projected start date, the client should have been notified that the schedule needed to be revised. Otherwise, the Project Manager has tacitly agreed to a 15 day shorter schedule than originally agreed upon.

5. Since award of the contract was verbal, the Project Manager should have sent a letter to the client confirming that work would proceed under the proposed terms and conditions of the contract, but conditioning the contractor's acceptance of the terms on the finalization of the revised technical scope of work.
6. In the absence of a signed contract, the Project Manager should have obtained from the client a written letter of intent to proceed with the work, pending finalization of contract negotiation.
7. It appears that the Project Manager did the analysis of the scope change on his (or her) own and overlooked adding a profit margin and reasonable contingency to the estimate. He or she also did not consider the total financial picture of the contract and did not attempt to incorporate a contingency in his or her re-analysis for possible impact on the entire project.
8. Once the Project Manager developed the project plans, he or she should have met with the staff to clarify and build commitment to project objectives by line managers and technical staff.
9. The Project Manager should consider meeting with the Discipline Leader who is looking for extra work days to determine the basis for that request. The Project Manager should determine if anything external has changed causing the need for more workdays, or if the discipline leader is doing more work than is contractually required, or if the original time estimate was incorrect.
10. The Project Manager should contact the client regarding the delinquent approval of the recommended supplier and follow-up with a letter explaining the potential impact of the delay on schedule and total cost.

Implementation of the suggestions listed above would certainly have assisted the Project Manager in delivering the contracted services with a minimum of contractual misunderstandings. Proper management actions could also potentially reverse the initial negative profit margin and possibly realize a modest profit. These goals should be realized while striving to maintain the client's satisfaction in order maintain a favored position in the competition for the follow-up work. However, the acceptance of "loss-leader" contracts in hopes of winning future bids is a dangerous strategy. Many clients have learned how to entice contractors at each step of a project to bid at a loss by the promise of future lucrative work. This results in different contractors completing each phase of work at a loss, and may result in unwarranted and undeserved savings for the client.

Conclusion

As a Project Manager you should have now learned to:

- Analyze your billings and learned to separate cost from profit
- Differentiate between common contract types and understand the advantages and disadvantages associated with each
- Recognize the common pitfalls associated with each contract type and the potential financial exposure you may face if you do not manage your project proactively

You have also reviewed a realistic case study and advised the Project Manager on ways to improve his performance. At this point it is time for you to find out if you are ready to tackle the following real life assignment.

Actual Case - An Example of Creative Contracting

The information and photo describing the following actual case was taken from the June, 2002 issues of Engineering News Record, a weekly magazine of the construction trade.

On May 27, 2002 a tugboat and two attached barges crashed into the 1,988-foot long Interstate 40 bridge over the Arkansas River in eastern Oklahoma after the barge captain blacked out. Two piers shattered and a third tilted, "pancaking" deck sections and sending vehicles into the river. By exercising emergency powers that allow officials to bypass normal bidding procedures for contract work, the Oklahoma Department of Transportation (ODOT) hired on May 28 an engineering firm to prepare repair plans within 16 days.



Figure 8: The barge in the foreground shattered bridge piers causing a section of the interstate highway to tilt into the river.

By June 4, the ODOT had a demolition contractor on board. The removal of the dangling road section is to be completed on a cost-plus-percent fee basis. The remaining demolition is to be completed under an \$850,000 lump sum. Terms call for \$50,000 per day liquidated damages penalties after 16 working days, and incentives for early completion.

In the meantime, the ODOT's engineers completed the repair plans and estimated the repair cost at about \$10 million. The project has an aggressive 1,553 hour schedule. The winning contractor is expected to work 24/7 (24 hours per day, 7 days per week), so that the 1,553 hours translates to a 64 day schedule. The contract terms call for a \$6,000 per hour early completion incentive bonus, and a

\$6,000 per hour late completion penalty fee. That means that if the contractor runs into a problem that delays completion even one day, he is potentially penalized \$144,000.

Based on what you have learned during this course, it is worthwhile to ponder the situation a Project Manager faces under these terms. Issues such as worker safety, quality control, coordination of multiple simultaneous tasks, logistics of equipment placement and availability, delivery of supplies, management of subcontractors, not to mention sleep and employee burnout, must all be analyzed for best and worst case scenarios. With a 64 day schedule, it will be difficult to make up for lost time should there be any problems early in the project. Corporate Management will likely be exerting pressure for early completion. Are you ready to manage this project?

Outcome

The project was completed on 07/29/2002, on time and slightly ahead of the projected schedule. At completion, the actual cost of repair was reported to be \$27.5 million. This amount is significantly higher than the \$10 million estimate developed by the ODOT engineers. It is evident that the Project Manager was in complete control of the contracted tasks and schedule and must have defined in a timely fashion additional, but necessary, services which were implemented within the overall project schedule.