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FOR ENGINEERING AND SCIENCE

# Underbidding the Job

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## Year

1995

## Description

A company underestimates the costs for detail design of a city's water supply system. Later, errors are discovered in the initial costs submitted to the city. Ethical issues arise due to this mistake and are complicated by the various circumstances discussed in the study.

Suitable for courses in construction, project management, engineering economics, and general introductory, levels 1-4.

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## Introduction

You are a Project Engineer employed by Hotshot Engineers, Inc. (HEI). The company has just been selected to perform detail design and engineering/construction management for a new water supply system for the City of Cesspool, USA. The

system will serve about 50 thousand residences. This job has an estimated constructed value of between \$10M -\$15M. No contract has yet been signed. HEI profits for the preceding year were \$1.59M. It is likely that the City of Cesspool job is the only job of this size to be booked by the company in the current fiscal year (FY). About 80% of profits from the job are collectible in the current FY. Your company and the competition each submitted a comprehensive proposal and sealed secret bid. The selection was based strictly on how low the bid was and to what extent the proposed design met technical requirements. All bids became part of the public record after opening. HEI bid \$12.88M. The two competitor's bids were: Company A at \$13.38M; Company B at \$14.11M. (Bids shown to only four significant figures.) The events below occurred after a public announcement of selection of HEI.

- In a routine review of the submitted proposal and drawings in preparation for a press conference, you and the Chief Engineer discover that the cost of an important part of the purification system has been underestimated. This error occurred because part of the preliminary design concept was completed without adequate analysis. To construct as indicated by the bid HEI submitted would result in the output water not meeting EPA Regulations. To "do it right" (and meet EPA Standards) would add cost. A summary of the HEI costs/profit is tabulated below, showing the corrected values in . (Figures are rounded for our convenience here.)

**Hotshot Engineers, Inc. Bid Summary: City of Cesspool Water Works Job**

<b>ITEM or SUMS</b>	<b>S. Millions</b>
<b>Engineering &amp; Management</b>	<b>0.910</b>
<b>Construction Materials</b>	<b>2.900 (3.200)</b>
<b>Construction Labor</b>	<b>5.600 (6.600)</b>
<b>Support, Overhead, etc.</b>	<b>0.360</b>
<b>Subcontractor Services</b>	<b>0.700</b>
<b>Performance Bonds, Insurance, etc.</b>	<b>0.500</b>
<b>Environmental Impact Study</b>	<b>0.200</b>
<b>SUBTOTAL</b>	<b>11.17 (12.47)</b>
<b>Contingencies at 4.8% of subtotal</b>	<b>0.536 (0.599)</b>
<b>TOTAL</b>	<b>11.71 (13.07)</b>

<b>Profit at 10.0% of total</b>	<b>1.17 (1.31)</b>
<b>(Sum) Submitted Bid</b>	<b>12.88</b>
<b>(Sum) True (not submitted) Bid</b>	<b>(14.38)</b>

1. What is the net profit or loss in dollars to HEI to do the job "right" per the (erroneous) submitted bid?
2. Based on the information above, what is your recommendation to your boss, the Chief Engineer?
3. Suppose the Chief Engineer tells you: "Let's keep this to ourselves. Once we get the job we'll slip in some change orders to get our true cost plus a reasonable profit. After all, we disclosed all they asked for in our submitted design. If they didn't catch it, that's their problem. *Caveat emptor.* " ("Let the buyer beware.") What is your response to the Chief Engineer?
4. Now suppose that (b) did not occur but HEI management decided to proceed "normally" until there was an opportunity to "sort out" matters. You attend a combined public hearing and press conference in the City Hall of Cesspool. You are part of a small panel of HEI engineers and managers asked to tell about the design and to answer questions from the floor.

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1. At the public meeting should you mention *voluntarily* the design shortcoming and associated costing error? Explain the rationale for your answer.
2. Suppose a person in the audience asks the entire panel: "How was HEI able to underbid the competition? Your bid seems awfully low to me...but then I'm not an engineer." Nobody mentions the design shortcoming and cost error. What do you do?
3. Suppose YOU are asked the question of part (c2). State your response.
4. Suppose the events in (c2) and (c3) did not occur, but now an engineer employed by one of the competitors underbid by HEI asks you: "How was HEI able to underbid the competition?" What do you do?

## Solutions

- (a1) The true estimated cost, including contingency, is \$13.07M. Subtracting this amount from the \$12.88M bid yields a net LOSS to HEI of \$0.190M. Although not all costs can be determined precisely, the variability cannot be assumed to work in favor of HEI. Therefore, it is highly likely that the company will suffer a loss for the fiscal year that could be ruinous, depending on corporate reserves, etc.
- (a2) Withdrawing the bid appears to be the only alternative. Not enough information is given in the problem statement to discuss other options.
- (b) The Chief is proposing a variant of "low bailing," an unethical, and possibly illegal, practice. Evidently, low bailing was not a deliberate scheme in this case because an "honest" mistake occurred. However, "sloppy" engineering is evident, and this violates ethical principles. The Chief's proposed action is not permissible. If HEI accepts the Chief's scheme, the engineer is culpable and could be prosecuted in both criminal and civil courts. Of course the engineer is placed in an extremely difficult position, but cannot agree to be a party to the scheme. If a P.E., the engineer could appeal to the state entity having jurisdiction over licensure. However, it may be very difficult (perhaps impossible) to "prove" that the Chief advocated this action. If not resolvable inside HEI, the engineer may have to contact the client and disclose the mistake before the contract is signed. As Project Engineer, the engineer would be acting within the scope of the job, and more importantly, would be acting professionally, i.e. ethically.
- (c1) Because HEI has not yet had opportunity to discuss the error, it is arguable that voluntarily disclosure is not appropriate. No contract has been executed.
- (c2) Again, voluntary disclosure would be premature and unwarranted.
- (c3) and (c4) Consider responding, "Until we have had a chance to discuss our bid and compare it to the competitor's bids, it would be inappropriate to comment." Is this a deception?

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## Notes

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These problems were originally developed as part of an NSF-funded project to create numerical problems that raise ethical issues for use in engineering and other course

assignments. The problems presented here have been edited slightly for clarity.

## **Rights**

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## **Resource Type**

Case Study / Scenario

## **Parent Collection**

Numerical & Design Problems With Ethical Content

## **Topics**

Bidding Process

Engineer/Client Relationships

Workplace Ethics

## **Discipline(s)**

Civil Engineering

Engineering

Authoring Institution

Zachry Department of Civil Engineering-TAMU Ethics