

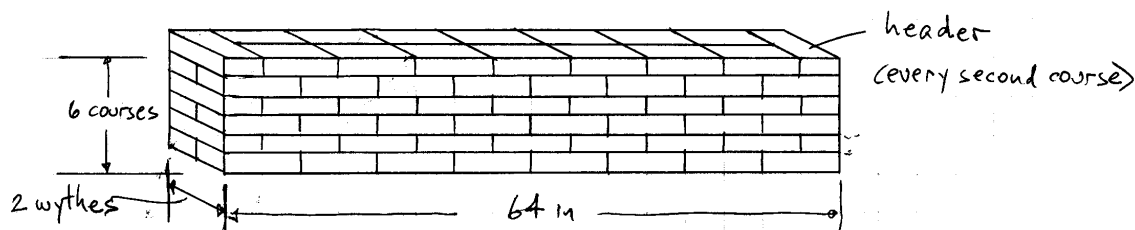
**Project 3. “Another Brick in the Wall”****Due: 3:35pm, Monday December 5, 2005.****Introduction**

This project is an exercise in construction planning and scheduling. Your group<sup>1</sup> is a construction company bidding as a subcontractor on a project for Pink Floyd Properties; Professor McNeil is the President of Pink Floyd and Michael Fry and Yukun Dong are the Project Managers. Your group will create a cost estimate and schedule for the project. To generate the cost estimate, your group will have to determine the material quantities that are used, the various tasks that must be completed to construct the project, the durations of those tasks, and the schedule of those tasks. Remember that some tasks cannot be started until other tasks are completed (one task must precede the other), whereas some tasks can proceed in parallel. The construction schedule must be submitted as a Gantt chart; the Gantt chart will identify when tasks are scheduled to start, when they are scheduled to end, and when the entire project will end.

From this project, you will learn some of the important aspects of construction planning and management. The objective of this project is to create a report, cost estimate and a schedule to accompany your bid on the project.

**Problem Description**

The project your group will bid and construct is a (dry) brick wall, as depicted in Figure 1. It is nominally 64 inches long, equivalent to eight bricks positioned end-to-end, 8 inches thick, corresponding to two wythes of brick, and approximately 16 inches high, corresponding to six courses of brick. As with any construction project, you must first provide the owner (Pink Floyd Properties) with a sealed and confidential bid document that states how much it will cost and how long it will take to build the wall. The owner has obtained engineering estimates of the cost and time required for the construction process, which will not be revealed to the bidders, and all reasonable and responsive bids should be near those estimates. In any event, you will be required to execute the project according to your own schedule and specifications.

**Figure 1. Sketch of wall (NTS)**

The wall itself must be solid; you cannot leave out any bricks or blocks. Within each wythe the bricks must be staggered, meaning that the vertical joints (properly termed the head joints) should

<sup>1</sup> You can define your group however you like up to a maximum of 4 people. You can be a group of one or a group of two, three or four. How you work together is up to you. However, you should assume for estimating purposes that your construction team has four able-bodied people.

not line up; in masonry terminology, this means that you cannot use a “stacked bond” but must use a “running bond.” The two wythes must be interconnected by at least two header bricks in every second course of brick.

### **Resources – Materials**

There are two brick suppliers competing for your business. The first source is Chajes Building Supply, and they sell bricks at a cost of \$0.80/unit. The second source is Fry Products (no relation to the project manager!), they sell bricks at a cost of \$0.70/unit, and they are located closer to the construction site. Chajes Building Supply has a lot of influence with the local zoning authorities, and they have established weight limits for trucks that are favorable to them. Trucks loaded from Chajes Building Supply can have five bricks in each load, whereas trucks loaded at Fry Products can have only four bricks in each load. Moreover, your construction company is only allowed to load one truck every thirty seconds at Fry Products. When all things are considered, it is not clear which source is less expensive.

### **Resources – Labor**

Your construction team will have two different types of workers: truckers and masons. Truckers have the task of loading and delivering bricks from one of the suppliers and delivering them to the laydown area at the job site. Masons have the task of taking those bricks from the laydown area, moving them as needed on the job site, and laying them in the wall. Work rules limit masons to carrying no more than 5 bricks at a time. A trucker is paid \$4.00 /min and a mason is paid \$6.00/min. Each trucker and each mason is paid for the time duration of their shift, and they can only work one shift in this project. For example, trucker A might start at  $t=0.0$  min and end the shift at  $t=12.0$  min, trucker B might start at  $t=1.5$  min and end the shift at  $t=16.0$  min, and mason C might start at  $t=4.5$  min and end the shift at  $t=21.0$  min. Trucker A would be paid for 12.0 min, trucker B would be paid for 14.5 min, and mason C would be paid for 16.5 min. Your construction team has four people in it, and you must decide how many workers to use. Three truckers and one mason? Two truckers and one mason? Two truckers and two masons? These are some alternatives that you should consider. Your company owns its own trucks (which look suspiciously like buckets) and therefore your workers must begin and end their shift at the jobsite where your construction office is located, at the laydown area. Your bid price should be the total cost that you estimate, increased by 10% to represent your profit.

### **Other Constraints**

Construction is often performed on sites that offer limited storage area; in this project, only 30 bricks can be stored in the laydown area at any time. Moreover, truck drivers are not permitted to run, which would be the equivalent of speeding, and therefore only a walking pace is permitted. Police will be patrolling! (Masons are not permitted to run either, even though there is no succinct metaphor.) The job site, laydown area, and brick-source areas are defined, and you can only place bricks on those prepared areas. The clock stops when the wall is completed and all workers have returned to the construction office, at the laydown area.

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<sup>2</sup> If your group has only three people in it, you can draft a TA to become the fourth worker.

<sup>3</sup> If persons in your group might be injured carrying the weights involved, you can draft substitutes.

## **Project 3 Grading**

### **Report and Bid Document (due 3:35pm, December 5, 2005)**

You must review the information needed to estimate and schedule the construction project, you must analyze and discuss at least three different alternatives, you must choose one alternative as the basis for your bid, and then you must document that alternative. Your submission must present the “as-bid” information: the total cost for the project, a detailed cost breakdown for each task, and a detailed task schedule. The task schedule must include a Gantt chart. This part of the document must be short and concise. You must also include a brief description of each alternative, about a paragraph in length, a cost and time estimate for each alternative, perhaps best represented in a table, your justification for the alternative you chose to bid, as well as the detailed cost and time breakdown for your bid.

## **Material Unit Costs, Labor Wage Rates, and Site Information**

The wall must conform to the dimensions specified. It will be constructed from brick, available to you at the two locations specified. In order to estimate the cost of the structure to be built, you have to compute the costs of the materials in the structure and estimate the cost of the labor to build it. The material and labor costs, as well as site information and project restrictions, are summarized below.

### **Unit Material Costs for This Project are as Follows:**

Brick, Chajes Building Supply	\$0.80/unit
Brick, Fry Products	\$0.70/unit

### **Labor Costs for This Project are as Follows:**

Mason	\$6.00/min
Truck Driver	\$4.00/min

### **Restrictions for This Project are as Follows:**

Maximum Truck Load (Chajes)	5/truck
Maximum Truck Load (Fry)	4/truck
Minimum Truck Headway (Fry)	30 sec
Maximum Storage at Laydown Area	30 bricks
Maximum Mason Load	5 bricks

### **Productivity Data:**

Laydown area to Chajes Building Supply, load, return, and unload	35 seconds
Laydown Area to Fry Products, load, return, and unload	32 seconds
Mason load, laydown area to wall site, masonry work, and return	48 seconds

**Project 3. "Another Brick in the Wall"**

**Due Monday December 5 3:35 PM**

Group Name: \_\_\_\_\_

Members: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**GRADING (Attach this grading sheet to the front of your report)**

**REPORT**

**General**

Title page 1 point \_\_\_\_\_  
 Overall neatness 2 points \_\_\_\_\_  
 Table of Contents 2 points \_\_\_\_\_

**Introduction**

Objective. Describe the purpose of the report 10 points \_\_\_\_\_  
 Description. Describe the items addressed  
 Describe the role of team members  
 Describe the organization of the report

**Narrative description of construction project**

(when?, what?, where? and how? the different stages of the project were conducted). 10 points \_\_\_\_\_

**Alternatives**

20 points \_\_\_\_\_

Describe the possible alternatives that were considered (at least 3)

-briefly describe the specific characteristics of each alternative

-time estimates

-cost estimates

**BID**

Brief description of chosen alternative

5 points \_\_\_\_\_

Justify why this was chosen

Detailed cost estimate

20 points \_\_\_\_\_

Detailed schedule

20 points \_\_\_\_\_

Gantt chart

- activity precedence table

- duration of each task

- critical path highlighted

- chart properly presented

-chart shown on one page

-legends etc. properly labeled

**TOTAL**

100 points \_\_\_\_\_