

DEVELOPED BY:
THE ACE MENTOR PROGRAM OF INDIANAPOLIS, IN

Educational Goals Understand the process of estimating construction costs for a project and of bidding for a contract. Learn about and use scale when calculating costs from an architectural drawing.

Description In this three-part activity, mentors first give a brief overview of the pre-construction estimating process. Then teams of students engage in an exercise to estimate the construction costs of a hospital room. Finally, based on their estimates, teams participate in a simulation of a bid-day environment when they take bids from subcontractors (played by mentors) and submit a sealed bid for the project. The entire activity is outlined in the attached Activity Agenda.

Time 2 hours. The cost estimating exercise requires about 60 minutes, and the bid simulation takes 45 minutes.

Materials For both parts of this activity, each team of students requires:

- ▶ Ruler/Scale
- ▶ Documents (take-off drawings; scope sheets; recap sheet; responsibility matrix)
- ▶ Calculator
- ▶ Pencils and erasers
- ▶ Computer (optional)
- ▶ Large envelope in which to submit proposal without folding

The following documents are also required for the exercise (Excel files for each document are available on the ACEmentortools.org website):

- ▶ *Activity Agenda*
- ▶ *Responsibility Matrix*, one for each team
- ▶ *Scope Sheets* for students, one set for each team
- ▶ *Scope Sheets (Mentor's Key)*
- ▶ *Recap Sheet*, one for each team
- ▶ *Recap Sheet (Mentor's Key)*
- ▶ *Take-off Drawings (2)*, PDF file

During the bid simulation, telephones – land lines and/or cell phones – are needed. Each team should have exclusive access to one phone, and the three mentors who play the role of subcontractors should each have a phone.

Cost Estimating & Bid Simulation

created by Michael Brimer
and Tiffiny Summers,
both with Turner Construction,
for the Indianapolis, IN affiliate



CONSTRUCTION & CONSTRUCTION MANAGEMENT

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I. Introduction (15 minutes)

A mentor, preferably someone from a construction company, should briefly explain the pre-construction and estimating process, taking care to identify the parties involved in this process, explain their relationships, and emphasize the importance of planning a project and first “building” it on paper. See the attached Activity Agenda for other points to cover. The Activity Agenda can be distributed to students as well as mentors.

This introduction should lay the ground work for the two succeeding activities and give an overview and explanation of what students will be doing in the activity. It is important that students understand the rationale of each step in the pre-construction, estimating, and bidding process.

II. Cost Estimating Exercise (45-60 minutes)

A. Preliminary Steps (20-25 minutes)

1. Students should be broken into teams of 3-4 students each, and a mentor assigned to each team. Mentors are to act as advisors and answer questions, intervening in the exercise only as necessary. The following documents should be distributed to each team – i) Responsibility Matrix; ii) Scope Sheets (student version); iii) Recap Sheet (student version); and iv) Take-off Drawings. Note that there are several different Scope Sheets, one for each trade.

2. Each team’s first tasks (taking no more than five minutes) are to decide on a team name and to select a team captain or leader. This individual will be responsible for overseeing all activities moving forward. He/she will also record information on the Responsibility Matrix and Recap Sheet.

3. After the lead mentor explains the Responsibility Matrix (a form used to assign accountability to complete tasks), each team captain should assign two trades to each team member and record the assignments on the matrix. The captain should assign one trade to him/herself so he/she can experience taking-off a trade as well.

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4. After the Responsibility Matrix is complete, introduce the Recap Sheet, which is used to summarize all trade estimates and subcontractor bids on one form. Then ask that the captain to transfer responsibilities to the Recap Sheet under the "Bid Team Assignments" column.

5. Mentors introduce the Scope Sheet, Take-off Drawings, and the process of developing cost estimates. To help students understand the process, mentors can walk the group through estimating one trade take-off.

B. Cost Estimating Exercise (20-25 minutes)

During this phase of the activity, each mentor will need to monitor his/her team closely and address questions as they arise. Mentors will need to be hands-on during this stage. Team mentors should verify quantities and provide assistance along the way so that student estimates are correct (in the ball park).

1. After the introduction of a Scope Sheet, each team works individually to take off pre-established trades such as drywall, flooring, ceilings, light fixtures and outlets, doors, etc. The Scope Sheets identify exactly what it is that the session coordinator (estimator/lead mentor) would like the students to quantify, keeping it simple. Each team should divide the several Scope Sheets among team members according to the trades for which they are responsible (see step II.A.2 above).



As the time for bidding approaches, activity intensifies.

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- 2.** Before the calculations begin, mentors should review with students the use of scale in architectural drawings and demonstrate how to use an architect's scale or ruler to measure lengths and areas. Some students may also require direction on how to calculate an area, etc. All students should be reminded to use the correct unit of measure.

- 3.** After the materials are quantified, students should record the information and calculate the cost of the material based on pre-determined costs found on the Scope Sheets. Each trade should now have an "estimate." To explain how the cost of a project is determined, mentors should show how the quantity take-off is linked with pricing.

- 4.** Once all the students on a team have completed their "estimates" on their Scope Sheets, the captain of each team must collect the estimate information and record each category on the Recap Sheet under the "estimate value" column. Total the values so that each team has a completed estimate. This concludes the cost estimation portion of the exercise.



Taking a bid from a subcontractor.

III. Bid Simulation (30-45 minutes)

Before the bidding process can start, mentors should check to insure that each team has a completed Responsibility Matrix, Scope Sheets with completed student estimates, and a Recap Sheet that records estimates from the Scope Sheets. The Scope and Recap sheets will be used to record subcontractor bids.

Mentors will need for the bid simulation, a copy of the mentor's keys for the Scope Sheets and the Recap Sheet. Mentors playing the role of subcontractors will need the Scope Sheets in order to communicate bid information.

- 1.** Prior to the bidding simulation, the lead mentor should walk students through an example/demonstration of how to complete a Scope Sheet. This includes the basic "yes" and "no" responses, subcontractor bid number, as well as subcontractor bid adjustments. As an example, the lead mentor can use the same trade that was illustrated in step II.A.5 above.

Explain the importance, during the process of getting bids, of asking questions related to risk (e.g., addenda), sales tax, plans, specifications, and even bonding. Students need an explanation of each these items. The example/demonstration should also cover the recap of the estimate for the example used in step II.A.5 above so that the estimate can be compared to the subcontractor's bid.

The lead mentor also should walk the entire group through each question and response of a subcontractor and demonstrate how his/her responses may affect the outcome of the bid value.

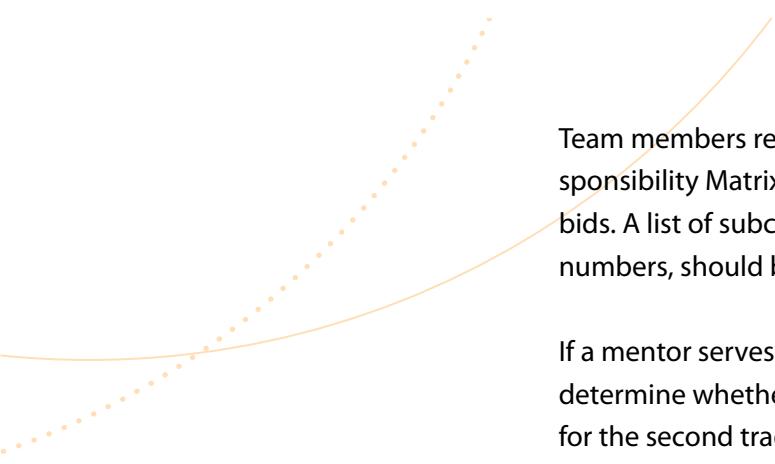
2. After the example, provide direction to the teams on where to record the bids as they are collected on the Scope Sheet. Each team captain's responsibility is to collect completed bids from their bid takers (teammates) and enter this data on the Recap Sheet. Instruct the captains to use the envelopes provided to submit and seal the bids once all the subcontractor bids have been collected. The name of the team should be written in the upper left hand corner of the envelope, and the team captain should sign his name under the team name. As with real-life bidding situations, failure to comply with instructions will mean disqualification.

3. The lead mentor explains the process of calling and getting bids from subcontractors. Outside of the conference room or classroom, but within the same office or building, several mentors play the role of "subcontractors." Each subcontractor needs access to his/her own dedicated telephone line or cell phone. (Likewise, each team needs access to at least one telephone.) Note that the Scope Sheets require bids from two subcontractor companies.

[Note: Mentors acting as subcontractors will rely on the "Scope Sheet - Mentor Key" to answer appropriately during the bidding process.]

4. The size of the class will dictate the number of "subcontractors" required. If necessary, a mentor-subcontractor can represent two trades for the same company, but not the same trade for two companies. If a mentor represents more than two trades for a company, it will be difficult for teams to get through on the phone. Because each "sub" will have multiple students trying to contact him/her, teams will need to think quickly in order to connect with the subs.

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Team members responsible for certain trades (as designated on the Responsibility Matrix) will need to call the relevant subcontractor to obtain bids. A list of subcontractors and their specialties, with their telephone numbers, should be posted in a place all students can easily see.

If a mentor serves as a “sub” for more than one trade, the lead mentor can determine whether students will be required to call back to receive a bid for the second trade, or whether they will be allowed with one call to get bids for two trades for which they are responsible. However, if two different students on a team must contact the same mentor-sub for bids by two different trades, the first student may not pass the phone to another teammate while the subcontractor is still on the line. The second student must call the subcontractor back, as this allows all teams a fair chance to reach their “subcontractors.”

5. After all the preliminary information and procedures are explained, the lead mentor announces that the bid day has started and that students should start calling subcontractor companies to receive their bids. The students are directed to “scope out” and ask all questions on the scope sheets and record the responses accordingly. Failure to record or ask a question may lead to an improper proposal submission.

Once a couple of calls have been made, the students typically catch on to the exercise as they may be somewhat timid during the first call. Mentors should support the students and encourage them through the process.

6. “Subs” should feel free to have fun with the students calling in and to make the simulation as realistic as possible. For example,

- ▶ If a student takes too long to ask questions or otherwise, the “sub” may need to take another call, etc. Thus, the student will need to call the subcontractor a second time in order to complete the information.
- ▶ Subcontractors are encouraged to ad-lib their responses and not just answer “yes” or “no” – throw in questions that will force the students to ask their team mentors questions about schedule or missing addenda.
- ▶ Or, the subcontractor may decide not to bid the project.

The idea is to keep things unpredictable for the students. This gets them excited about the exercise and makes them think outside of the exercise.

To add complexity and variation to the bidding simulation, mentors may want to throw in alternates on flooring, or revise a wall from drywall to masonry in order to demonstrate value-added thinking. The point is: Each mock exercise can be customized to the level and size of the audience.

7. This exercise may require a built-in time extension. This will provide additional flexibility for scheduling. With that said, to provide a realistic simulation of a bid day, the intent is not to wait until all teams have completed calling all subs in each of their categories. As long as all teams have coverage in each trade, establish a final deadline to receive sealed bids and do not delay the submission if the majority of teams are complete.

8. As a wrap-up, the lead mentor receives the bids, rips and reads, providing the results to the teams. Teams can be given the mentor's key Scope Sheets so that they can compare their own Scope Sheets. Teams can review their results as well as the questions or responses they may or may not have asked and thereby learn how all this affects their outcome. 

Cost Estimating and Bid Simulation Activity Agenda

COST ESTIMATING & BID SIMULATION ACTIVITY AGENDA	
GENERAL INFORMATION	
INTRODUCTION	
PRECONSTRUCTION	
<ul style="list-style-type: none"> ✓ PROCESS <ul style="list-style-type: none"> ◦ Build Project on Paper 1* ◦ Establish project Logistics (Sequence and access for construction) ✓ PLANNING <ul style="list-style-type: none"> ◦ Program/Design/Budget - Functionality of Facility to suit intended purpose (Program), Building Materials (Design), Establish Cost Parameters (Budget) ◦ Work w/ A/E/Owners to develop the facility to meet: <ul style="list-style-type: none"> * Cost, Quality, Schedule ◦ Deriving Estimates through Conceptual, Schematic, Design Development, Construction Documents ◦ Complete the documents throughout design when information is lacking (If a sun is shown, you know that water piping will be required – etc. Include it in the estimate!) 	
ACTIVITY #1 – ESTIMATE A PATIENT ROOM	
<ul style="list-style-type: none"> BREAK UP IN TO TEAMS: ◦ COME UP WITH A TEAM NAME ASSIGN TEAM LEADER/CAPTAIN <ul style="list-style-type: none"> ◦ Captain – Fill Out Responsibility Matrix with Team Assignments ◦ Captain – Fill Out Estimator Spaces and Team Name on Recap Sheet ESTIMATING EXERCISE <ul style="list-style-type: none"> ◦ Scope Sheet Explanation ◦ Take off assigned trades – determine areas, lengths, get counts ◦ Fill out Scope Sheets with take off information to determine cost ◦ Report Cost to Team Captain to fill out Recap Sheet with estimate 	
ACTIVITY #2 – MOCK BID FOR PATIENT ROOM	
<ul style="list-style-type: none"> BIDDING INTRODUCTION: WALK THROUGH OF GLASS EXAMPLE ESTIMATORS – CALL & “SCOPE” SUBCONTRACTORS #1 & #2 CAPTAIN – ENTER LOW BID VALUES IN TO RECAP SHEET CAPTAIN – ENTER ALTERNATES IN TO RECAP SHEET SUMMIT SEALED TEAM BID 	

Responsibility Matrix

ACE MOCK ESTIMATE RESPONSIBILITY MATRIX			
TEAM CAPTAIN	ESTIMATORS	TAKEOFFS & SCOPE SHEETS	EVALUATE SUB BIDS
Division 8 - DOORS AND WINDOWS			
88100 METAL DOOR, FRAME AND HARDWARE			
88200 WINDOWS			
Division 8 - FINISHES			
88300 DRYWALL PARTITIONS			
88310 ACOUSTICAL & DRYWALL CEILINGS			
88400 FLOORING			
88500 PAINTING & WALLCOVERING			
Division 14 - ELECTRICAL			
88600 ELECTRICAL (Light Fixtures & Outlets)			

These documents and the ones that follow are required for the Cost Estimating and Bid Simulation exercise and can be downloaded from the ACEmentortoos.org website

There are six Scope Sheets for different trades—glass and glazing, drywall, flooring, ceilings, painting and wall coverings, and electrical. Shown below and on the following two pages are the **student** Scope Sheets for these six trades. The **mentor's** versions with answers are not displayed here. Both the student and mentor versions of the Scope Sheets can be downloaded from ACEmentortools.org.

Scope Sheet for Students - Glass & Glazing

Glass and Glazing				ACE IU PATIENT ROOM ESTIMATE Indianapolis, IN		
ACE - Turner Scope Sheet ROOMS D314 and D315				SUBCONTRACTOR #1	SUBCONTRACTOR #2	Deemed to Be
Bid Analysis Worksheet (Student's)	Qty	Unit	Size			
BASE BID				✓		
Plans and Specifications	November 2006 Documents			✓		
Addenda Acknowledged	#1			✓		
Sales Tax Included	To Include Sales Tax			✓		
Included Bonding / Have Capability	INCLUDE BOND			✓		
Schedule and Phasing Provided in Specifications	PER ACE SCHEDULE			✓		
BASE SPECIFICATIONS AND BASE BID						
Interior Glazing (Quantified by Area = SF)	SF	\$ 30.00	\$	-		
*Length of windows times height of the Windows = Area (SF)						
3' Linear Feet * 4' Window Height = 12 Square Feet						
ADJUSTED TOTAL	SF	\$	\$	SUBCONTRACTOR #1	SUBCONTRACTOR #2	
ADD PER LINEAR FOOT						
LOW BID FOR THIS TRADE						

Scope Sheet for Students - Drywall

Drywall Partitions				ACE IU PATIENT ROOM ESTIMATE Indianapolis, IN		
ACE - Turner Scope Sheet ROOMS D314 and D315				SUBCONTRACTOR #1	SUBCONTRACTOR #2	Deemed to Be
Bid Analysis Worksheet	Qty	Unit	Size			
BASE BID				✓		
Plans and Specifications	November 2006 Documents			✓		
Addenda Acknowledged	#1			✓		
Sales Tax Included	To Include Sales Tax			✓		
IMBE/WBIE Status				✓		
Included Bonding / Have Capability	INCLUDE BOND			✓		
Schedule and Phasing Provided in Specifics	PER ACE SCHEDULE			✓		
BASE SPECIFICATIONS AND BASE BID						
Drywall Partitions (Measured either by Linear Foot or by Area in Square Feet)						
FULL HEIGHT (12') PARTITIONS (Interior Partitions)	LF	\$ 75.00	\$			
*Length of wall = Linear Footage of Wall						
OR						
Drywall Partitions (Measured either by Linear Foot or by Area in Square Feet)						
FULL HEIGHT (12') PARTITIONS (Interior Partitions)	SF	\$ 9.46	\$			
*Length of wall times height of Wall = Area (SF)						
ADJUSTED TOTAL	SF	\$	\$	SUBCONTRACTOR #1	SUBCONTRACTOR #2	
ADD PER LINEAR FOOT						
LOW BID FOR THIS TRADE						



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CONSTRUCTION ACTIVITIES

COST ESTIMATION + BID SIMULATION

COST ESTIMATION + BID SIMULATION

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Scope Sheet for Students - Flooring

Scope Sheet for Students - Ceilings

Acoustical Ceilings				ACE IU PATIENT ROOM ESTIMATE Indianapolis, IN	
Bid Analysis Worksheet					
Bid Package:	Acoustical Ceilings				
Date:					
Analyst By:					
ACE - Turner Scope Sheet ROOMS D314 and D315				Subcontractor #1	Subcontractor #2
BASE BID	QTY	UNIT	Unit	Dedicated to BB	
Plans and Specifications				✓	
November 2006 Documents				✓	
Addenda Acknowledged				✓	
				#1	
Sales Tax Included		To Include Sales Tax		✓	
MBE/WBE Status				✓	
Included Bonding / Hvac Capability		INCLUDE BOND		✓	
Schedule and Phasing Provided in Specifications		PER ACE SCHEDULE		✓	
BASE SPECIFICATIONS AND BASE BID					
Acoustical Ceiling Tile (Measured in Square Footage)	SF	\$	2.75	\$	-
"Length of roomtimes depth of room= Area (SF)"					
Drywall Ceiling (Measured in Square Footage)	SF	\$	6.00	\$	-
"Length of roomtimes depth of room= Area (SF)"					
ADJUSTED TOTAL	SF	\$	-	Subcontractor #1	Subcontractor #2
LOW BID FOR THIS TRADE					

Scope Sheet for Students - Painting and Wall Coverings

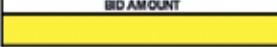
Painting and Wall Covering				ACE IU PATIENT ROOM ESTIMATE Indianapolis, IN			
ACE - Turner Scope Sheet ROOMS D314 and D315				SUBCONTRACTOR#1	SUBCONTRACTOR#2	Deemed to be	
QTY	UNIT	Rate	Total				
BASE BID							
Plans and Specifications		November 2008 Documents					✓
Addenda Acknowledged		#1					✓
Sales Tax Included		To Include Sales Tax					✓
MBE/WBE Status							✓
Included Bonding / Have Capability		INCLUDE BOND					✓
Schedule and Phasing Provided in Specifications		PER ACE SCHEDULE					✓
BASE SPECIFICATIONS AND BASE BID							
Paint Finish on Walls (Measured by Area in Square Feet)							
*Length of wall times height of wall = Area (SF)							
*Assume Painting of inside of Room only							
Painting of Full Height Partitions Room D314		SF	\$ 0.65	\$	-	-	
Painting of Full Height Partitions Room D315		SF	\$ 0.65	\$	-	-	
Painting of Drywall Ceiling		SF	\$ 0.65	\$	-	-	
ADJUSTED TOTAL		SF	\$	- \$	- \$	- \$	
ALTERNATIVE(S)							
#2 Provide Wallcovering in Room D315 in lieu of Paint							
* Add Wall Covering in Room D315 ADD/Deduct:		SF	\$ 2.50	\$	-	-	
* Delete Paint in Room D315 ADD/Deduct:		SF	\$ 0.65	\$	-	-	
ADD/Deduct:			\$	-	-	-	
LOW BID FOR THIS TRADE							

Scope Sheet for Students - Electrical

Electrical				ACE IU PATIENT ROOM ESTIMATE Indianapolis, IN			
ACE - Turner Scope Sheet ROOMS D314 and D315				SUBCONTRACTOR#1	SUBCONTRACTOR#2	Deemed to be	
QTY	UNIT	Rate	Total				
BASE BID							
Plans and Specifications		November 2008 Documents					✓
Addenda Acknowledged		#1					✓
Sales Tax Included		To Include Sales Tax					✓
MBE/WBE Status							✓
Included Bonding / Have Capability		INCLUDE BOND					✓
Schedule and Phasing Provided in Specifica		PER ACE SCHEDULE					✓
BASE SPECIFICATIONS AND BASE BID							
Light Fixtures (Quantified by Count = Each)							
Round Down Lights		EA	\$ 150.00	\$	-	-	
Square 2x2 Lights		EA	\$ 175.00	\$	-	-	
Electrical Outlets (Quantified by Count = Each)		EA	\$ 150.00	\$	-	-	
DUPLEX OUTLETS		EA	\$ 150.00	\$	-	-	
LIGHT SWITCH		EA	\$ 250.00	\$	-	-	
Data/Telephone Outlets (Quantified by Count = Each)		EA	\$ 150.00	\$	-	-	
DATA OUTLETS		EA	\$ 150.00	\$	-	-	
ADJUSTED TOTAL		SF	\$	- \$	- \$	- \$	
LOW BID FOR THIS TRADE							

The Mentor's Recap Sheet and Student Recap Sheet shown below are required for the Cost Estimating and Bid Simulation exercise and can be downloaded from the ACEmentortools.org website

Recap Sheet for Mentors

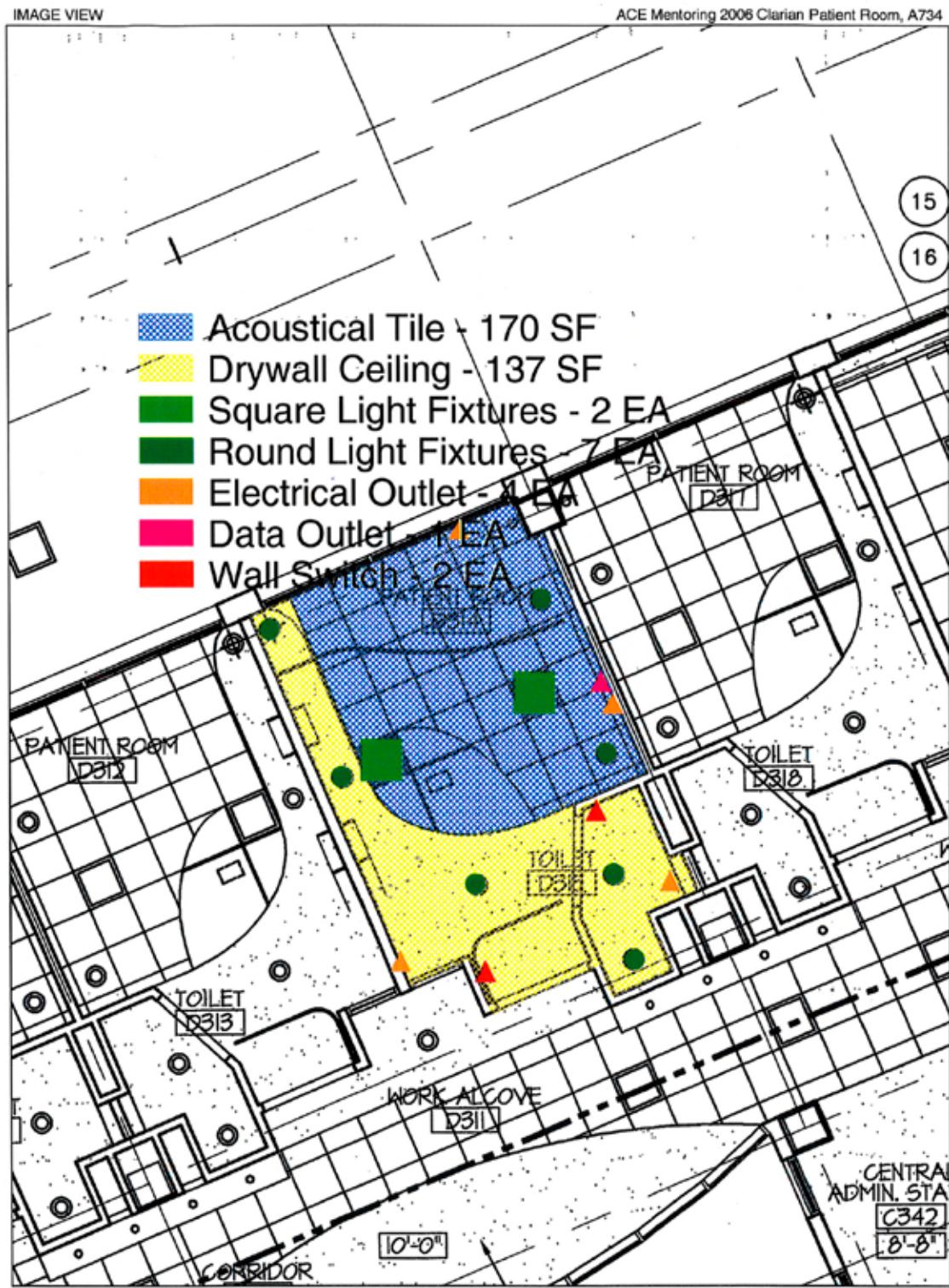
MENTOR'S RECAP SHEET				
PROJECT: IU PATIENT ROOM SUMMARY LOCATION: INDIANAPOLIS, INDIANA ARCHITECT: ACE - Turner				
ESTIMATE TYPE: Lump Sum				
BID DATE:				
CSI	Description	Estimator	Estimate Value	BID VALUE
08100	Metal Doors and Frames and Hardware			3,100
08200	Windows			300
09260	Drywall Partitions			6,000
09510	Acoustical Ceilings and Drywall Ceilings			1,000
09680	Flooring			2,000
09900	Painting and Wall Coverings			700
16000	Electrical			4,000
SUBTOTALS				
				13,700
TEAM NAME 			ALTERNATE #1	
			Provide Carpet instead of Sheet Vinyl in Room D314	
			ADD/Deduct	200
BID AMOUNT 			ALTERNATE #2	
			Provide Wall Covering instead of Paint in Room D315	
			ADD/Deduct	300

Recap Sheet for Students

STUDENT RECAP SHEET				
PROJECT: IU PATIENT ROOM SUMMARY LOCATION: INDIANAPOLIS, INDIANA ARCHITECT: ACE - Turner				
ESTIMATE TYPE: Lump Sum				
BID DATE:				
CSI	Description	Estimator	Estimate Value	BID VALUE
08100	Metal Doors and Frames and Hardware			
08200	Windows			
09260	Drywall Partitions			
09510	Acoustical Ceilings and Drywall Ceilings			
09680	Flooring			
09900	Painting and Wall Coverings			
16000	Electrical			
SUBTOTALS				
TEAM NAME 			ALTERNATE #1	
			Provide Carpet instead of Sheet Vinyl in Room D314	
			ADD/Deduct	
BID AMOUNT 			ALTERNATE #2	
			Provide Wall Covering instead of Paint in Room D315	
			ADD/Deduct	

The Take-Off Drawings shown are required for the Cost Estimating and Bid Simulation exercise and can be downloaded from the ACEmentortools.org website.

Take-Off Drawing (1)



Take-Off Drawing (2)

IMAGE VIEW

ACE Mentoring 2006 Clarian Patient Room, A134

