HOW TO ESTIMATE THE COST OF A HIGH SCHOOL LABORATORY AT CONCEPTUAL LEVEL

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SECTION 1: INTRODUCTION

This technical paper is intended to provide the reader with a general understanding of how to perform professional construction estimating services at a conceptual level as they relate to the construction of a science laboratory/classroom in an existing high school building.

After establishing an order of magnitude cost for a typical science classroom, a project budget can be established and subsequently various costs can be further refined to determine scope to be identified at the conceptual stage. Whether it is a renovation to an existing science room or a complete new installation, there are many varying factors that could and will affect these types of projects including but not limited to:

- location of school in relation to urban environment and also accessibility;
- age of building and construction type;
- available services and those required to renovate building area for new modern program space;
- impact upon adjacent program areas including within and outside of building;
- the science discipline of the classroom itself whether that be for chemistry, physics or other;
- possible conflicts with the existing building construction and unknowns associated with the age of a building such as lack of as-built documentation.

These and other factors must all be taken into account for possible inclusion of costs associated with this type of work.

Main CSI (Construction Specifications Institute 2004 MasterFormat) Division

Division 02 Existing Conditions

Division 03 Concrete

Division 04 Masonry

Division 05 Metals

Division 06 Woods, Plastics & Composites

Division 07 Thermal & Moisture Protection

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Division 26 Electrical

Division 27 Communications

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Main CSI (Construction Specifications Institute 2004 MasterFormat) Subdivisions

Subdivision 02 40 00 - Demolition and Structure Moving

Subdivision 03 80 00 - Concrete Cutting and Boring

Subdivision 04 20 00 - Unit Masonry

Subdivision 05 10 00 - Structural Metal Framing

Subdivision 05 40 00 - Cold-Formed Metal Framing

Subdivision 05 50 00 - Metal Fabrications

Subdivision 06 10 00 - Rough Carpentry

Subdivision 06 20 00 - Finish Carpentry

Subdivision 06 40 00 - Architectural Woodwork

Subdivision 07 20 00 - Thermal Protection

Subdivision 08 10 00 - Doors and Frames

Subdivision 08 70 00 - Hardware

Subdivision 08 80 00 - Glazing

Subdivision 09 20 00 - Plaster and Gypsum Board

Subdivision 09 50 00 - Ceilings

Subdivision 09 60 00 - Floorings

Subdivision 09 70 00 - Wall Finishes

Subdivision 09 80 00 - Acoustic Treatment

Subdivision 09 90 00 - Painting and Coating

Subdivision 10 10 00 - Information Specialties

Subdivision 10 40 00 - Safety Specialties

Subdivision 11 50 00 - Educational and Scientific Equipment

Subdivision 12 30 00 - Casework

Subdivision 21 10 00 - Water-Based Fire-Suppression Systems

Subdivision 21 20 00 - Fire-Extinguishing Systems

Subdivision 22 10 00 - Plumbing Piping

Subdivision 22 30 00 - Plumbing Equipment

Subdivision 22 40 00 - Plumbing Fixtures

Subdivision 22 60 00 - Gas and Vacuum Systems for Laboratory and Healthcare Facilities

Subdivision 23 20 00 - HVAC Piping and Pumps

Subdivision 23 30 00 - HVAC Air Distribution

Subdivision 23 40 00 - HVAC Air Cleaning Devices

Subdivision 26 10 00 - Medium-Voltage Electrical Distribution

Subdivision 26 20 00 - Low-Voltage Electrical Transmission

Subdivision 26 50 00 - Lighting

Subdivision 27 10 00 - Structured Cabling

Subdivision 27 20 00 - Data Communications

Subdivision 27 30 00 - Voice Communications

Subdivision 27 40 00 - Audio-Video Communications

Subdivision 28 10 00 - Electronic Access Control and Intrusion Detection

Subdivision 28 20 00 - Electronic Surveillance

Subdivision 28 30 00 - Electronic Detection and Alarm

Subdivision 28 40 00 - Electronic Monitoring and Control

Brief Description

The author will discuss how a construction estimator would review the conceptual plans for a high school science laboratory with assumed typical specifications at that level, and to perform a scope of work review with quantity takeoffs of known items. Also included would be allowances for unknown variables that may be present and impact costs. The paper will be presented from the point of view of a Construction Estimator who is preparing a Budget for an Owner as opposed to a subcontractor or contractor. It is assumed for this exercise that the plans are at a low level conceptual design stage with a basic plan of the existing as-built area and the new renovated area plan, elevations and possibly details as prepared by the architect. These projects are typically bid as a number of subcontracts based upon division of trade. The construction estimator would then present the estimate in CSI Format broken down in various line items within each CSI Division and Subdivisions that would enable the Owner to determine various costs that can be evaluated for overall project costs and possible value engineering exercises. At this early conceptual level, many line items would be arranged as assemblies that will overlap with other subdivisions due to unknown factors associated with the current construction or yet to be in the design.

SECTION 2: Types of Methods of Measurements

Estimating a high school laboratory construction consists of many differing types of methods of measurements. Quantity takeoffs include the following:

Division 02 Existing Conditions

The existing type of construction for the program area including structural components, finishes etc. Demolition of items required for new construction can be measured in a number of ways:

- Removing floor and ceiling finishes can be measured in **SQFT.** The construction estimator will typically find these dimensions on the plans;
- Removal of existing partitions (masonry or gypsum board) can be measured in either **LNFT** or **SQFT** if there is a section/detail available noting the height of walls;
- Removal of finished carpentry/millwork typically is measured in **LNFT**;
- Removal of existing doors, frames and hardware is typically per **EACH**;
- Depending on the age of the existing building including the method of construction, there may be environmental abatement issues to consider. Any removal of such items if known such as lead-based paint abatement could be measured in **SQFT** or an allowance in the form a **LSUM** could be included based upon a typical expected amount;
- Other items to be removed including salvageable specialties such as markerboards, tack boards, clocks etc. would be measured as an **EACH** if noted on the plans or interior elevations.

Division 03 Concrete

- At grade level, concrete cutting for new services if required can be measured in **LNFT** per the plans;

- Removal of concrete slab-on-grade and subsequent patching would be measured in **SQFT** if widths are provided;
- Coring of concrete at suspended floors/ceilings for new access required would be measured as an **EACH** based upon the size of the opening required. Concrete repair at these locations including patching and any structural requirements would be per **EACH** based upon the size of the opening.

Division 04 Masonry

- New CMU partitions if required would be measured in **LNFT** per the plan and **SQFT** if a section, detail or note provides a height. Also, bond beams in masonry can be measured in **LNFT**;
- If an opening is required in an existing wall for new piping as an example, this can be measured as an allowance **LSUM** or as an **EACH** based upon the size of the opening. This would also apply to any patching required. Also, if the opening is required for a new door, this can be measured in **SQFT** of removal and a **LSUM** allowance for re-toothing masonry included.

Division 05 Metals

- While not typical or fully detailed at a conceptual level, structural steel can be measured in **TONS** or **LBS** if structural drawings are provided. A **LSUM** allowance may also be included if no details are available for such items as reinforcing an opening either in a floor, ceiling or roof.

Division 06 Woods, Plastics & Composites

- Rough carpentry including wood blocking typically measured as a **SQFT** or **LSUM** allowance;

- Finish carpentry such as wood railing or trim measured in LNFT if noted on plans and/or elevations;
- Millwork such as cabinetry (base or wall mounted), countertops measured in **LNFT** with noted depth if provided and per specification if known.

Division 07 Thermal & Moisture Protection

- Fire proofing of exposed steel structural components on beams and columns in **LNFT** or SQFT of surface area. Fire proofing of exposed decking in **SQFT**;
- Fire stopping at penetrations as an **EACH** or **LSUM** allowance. If any new louvers required at exterior facades either as an **EACH** with a given size or in **SQFT**.
- New metal panel systems may be used to replace windows if there are new AC units required. These can be measured as a component system as an **EACH**.

Division 08 Openings

- Doors, frames and hardware components can be measured as an **EACH**. At the conceptual stage, hardware will most likely be undefined and could be measured as an allowance for **EACH**;
- Windows may need possible replacing for the new AC units. If sizes are known can be measured in **SQFT** or as an **EACH.**

Division 09 Finishes

- Floor and ceiling finishes can be measured in **SQFT** via the plan;
- New gypsum board partitions including metal studs and insulation can also be measured in **LNFT** or in **SQFT** if a height can be provided;
- Wall finishes including paint measured in **SQFT** if ceiling height is known.

Division 10 Specialties

- Markerboards and tackboards can be measured either as an **EACH**, in **LNFT,** or in **SQFT** if a height is provided. Projections screens and other visual devices as an **EACH**;
- Signage measured as an **EACH**.

Division 11 Equipment

- Specific laboratory equipment such as chemical storage cabinets, fume hoods and the like can be measured as an **EACH.**

Division 12 Furnishings

- Laboratory work countertops, base cabinets and wall cabinets measured in **LNFT.**

Division 21 Fire Suppression

- At a conceptual level, a **SQFT** allowance based upon the program area and historical data;
- Fire extinguishers as an **EACH.**

Division 22 Plumbing

- Demolition of units in **EACH**. Demolition of piping in **LNFT**;
- New sinks, lavatories, science equipment and connections as an **EACH**;
- Piping in **LNFT**;
- Pumps, floor drains, cleanouts as an **EACH**;
- Laboratory gas piping, water piping systems, acid waste and vent piping in **LNFT**. If plans not provided , a **LSUM** allowance based upon the program area.
- Laboratory pump systems as an **EACH** or **LSUM**. Gas turrets as an **EACH.**
- Testing & certification as a **LSUM** allowance.
-

Division 23 Heating, Ventilation & Air Conditioning

- Demolition of units in **EACH**. Demolition of piping and ductwork in **LNFT**;
- New units, fans, ventilators, registers, grilles, diffusers and connections as an **EACH**;
- Ductwork in **LNFT** and if diameters are known in **LBS**. Duct insulation in **SQFT** or a **LSUM** allowance;
- Temperature controls as an **EACH** or **LSUM** allowance for the area;
- Testing & balancing as a **LSUM** allowance.

Division 26 Electrical

- Lighting as an **EACH** if ceiling plan provided, or a **SQFT** allowance based upon the program area and historical data;
- New switchboards, panels etc. as an **EACH** including an allowance for feeder runs and connections;
- Power to equipment and receptacles as a **SQFT** allowance based upon the program area and historical data;
- Motors connection, disconnect switches and associated feeders as a **SQFT** allowance based upon the program area and historical data.

Division 27 Communications

- A **SQFT** allowance based upon the program area and historical data. Define if equipment included (**EACH**) or only rough-in required.

Division 28 Electronic Safety & Security

- As a **SQFT** allowance based upon the program area and historical data.

SECTION 3: SPECIFIC FACTORS TO CONSIDER IN TAKEOFF AND PRICING

Small Quantities vs. Large Quantities (Economies of scale)

The construction estimator needs to be aware of the amount of materials required for any estimate. With regards to a high school science room, there are a number of factors to consider:

- How many science rooms are being constructed/renovated? The greater the number of new programs areas, the lower the cost of materials as it pertains to actual costs and delivery. Also, greater labor productivity can be achieved by utilizing the various trades to do work over a number of areas. This will also affect the general requirements and conditions that a general contractor includes. A higher margin of project management is typical for a standalone project as opposed to larger scope of work.
- Is the science room part of a larger project involving other new program areas of construction/renovation? Similar to the above, when there is a larger scope of work with similar trades required, labor productivity would be higher and most likely, material costs would be lower.

Geographic Location

Typical factors that will have an impact on a project of this scope based upon location include the following:

- Availability of high-end laboratory equipment and subsequent freight and installation costs. A high school that is remotely located with respect to a metropolitan city center could possibly have a higher cost of installation due to less expertise available in the local area.

- City vs. Suburban environment: Is the school in an easily accessible location with regards to method of delivery? A downtown location requiring heavy moving vehicles will impact traffic controls whereas an urban environment will typically have less accessibility issues. This could also include staging grounds for material storage. Productivity will be lowered to allow for local safety requirements for both construction workers and the local population. This is further impacted for the morning and evening rush hours when vehicular traffic is at its worst. Will there be a need to limit the work day less than a typical 8 hours due to the accessibility as a result of the location?
- Labor availability will vary based upon location. Will a project need to employ labor from out of town due to lack of expertise locally? This will greatly impact costs for the proposed project

Seasonal Effect on Work

High Schools by their nature are full of students. Relating back to new versus existing construction, with regards to renovation of an existing building we primarily are dealing with work in the summer months. It is rare to have a project in construction of such heavy magnitude as a laboratory renovation whilst students are in attendance. As a result, a project of this nature most likely will have a restricted time frame to complete all the work required. This combined with various unknowns will have an impact on critical path requirements to ensure milestones are completed on time.

- Is the project schedule condensed so much that it will require premium time to complete? Will extra shifts and overtime be required as a result?
- Is there a high demand for other similar work in the geographic location impacting on labor availability over the summer months? If so, the labor force may be stretched leading to higher costs and lower productivity due to less expertise.

Special Conditions Affecting Construction

A major factor to take into account is whether we are dealing with an existing building versus new construction? When dealing with existing construction there are many more factors to consider:

- What is the current type of construction of the building?
- How old is the building and are there accurate as-built drawings available? If not, it most likely there will be many unknowns with regards to a full understanding of existing conditions. Can the architect determine all work that is required based upon existing drawings and confirm through site visits in order to minimize any change orders that could eventuate?
- Are there environmental concerns that must be addressed as part of the scope of work? Can they be accurately measured for pricing purposes? How will this impact the project's schedule and if unknown, what sort of cost allowance should be included at an early design stage to ensure the scope of work is fully covered.
- Accessibility to the existing building? Is the science room on the ground floor or above? Does the building have an elevator capable of lifting the materials required or will an exterior hoist be required for temporary access? Are the corridors wide enough to move in equipment and materials in a typical fashion or not? Does equipment to be installed need to be shipped in a number of parts (thus requiring added labor to assemble on site at its final location) or as a full assembly?
- The impact of any openings and coring required on existing construction and does it conflict with existing services? For example, saw cutting and coring at concrete slabs will require access to other areas within the building. Are these areas similar in program nature or not? Can they be accessed without fundamentally impacting on their existing use or not?

- Are there existing utility lines that must be protected, supported, exposed, re-directed, or otherwise dealt with by the construction of new works? At a conceptual level, these would most likely be not shown.
- Existing conditions at the exterior or perimeter of the program area including the façade or ground level items such as adjacent pavement or buildings that possibly require protection or work requiring access and subsequent renovation.

SECTION 4: OVERVIEW OF LABOR, MATERIAL, EQUIPMENT, AND INDIRECT COSTS AND APPROACH TO MARKUPS

At the conceptual level of estimate, most of the costs will be determined by unit rates founded from historical data. Whether that be comparing the current project scope to other similar estimates and bid results in the same or similar location, or using an established database such as RS Means to confirm accuracy. As the design progresses, and there is a greater degree of quantity take-off, then labor and equipment costs can be included and calculated on a per hour basis including productivity factors. Unit rates should include all labor, material and equipment costs as well allowances for geographic location, local regulations and code requirements.

Allowances may be added for any required shift work due to a condensed project schedule and also for any possible premium time. These allowances could be incorporated into the unit rates or as part of the mark-ups in a lump sum or percentage of overall costs. Breaking out shift work/ premium time would allow an Owner to assess how the impact of a condensed project schedule would be versus a typical construction frame.

The material costs for a science laboratory would be based on the takeoff quantities. Small quantities would have higher costs and with larger quantities having lower costs. As mentioned, costs would be affected on whether there is only one laboratory within a project or a number of them? Is this laboratory part of a larger project again including a number of classrooms and other program areas. When dealing with these factors, the construction estimator can apply his knowledge gathered from experience in previous construction estimates.

Laboratory equipment is usually specific by their function. If similar projects have been estimated and bid previously, the costs for these items can be accurately provided in the estimate including known installations methods and times and costs for delivery.

The construction estimator must be aware of any taxes that are required if applicable, As we are dealing with an educational facility, it is possible that they may not be required for certain items. Any and all taxes that are required, would be added into the unit rates at a conceptual level estimate. Any permits required would also need to be allowed for whether in the unit rates, or if known as a lump sum allowance.

Mark-ups would include any and all of a contractor's managerial requirements, typical conditions associated with running the project including temporary facilities, project supervision on and off site and any other overheads required to successfully complete the project. At the conceptual level, a percentage of the overall division costs would be included based again on what that actual estimated cost is. If there is only one laboratory being constructed, this percentage would be higher relative to a larger scale project.

The contractor profit fee would also be included in the mark-ups, once again based upon the cost of the division totals and relative to the size of the project. The construction estimator

once again would use his knowledge of previous project estimate and bids and apply this to the estimate.

Other possible mark-ups include:

- Added allowance for environmental abatement based upon known or unknown factors;
- Premium time or shift work required for a condensed project schedule.

Finally, a conceptual level estimate is based upon limited available information. Allowances are already included for unknowns but a design contingency would also be included due to the incompleteness of the drawings and lack of specifications for this particular project. This usually takes the form of a percentage allowance based again on the sum of the division totals and applied to all items including a contractor's general requirements, overheads, bond, insurance and profit. Once again, the actual percentage would be based upon the construction estimator's experience in similar projects. As the design progresses to a complete set of documents, this contingency is lowered and eventually eliminated when dealing with final documentation. The Owner should be made aware that this relates directly to the design phase and would be separate to any construction contingency which deals with unknowns or change orders during the construction itself.

SECTION 5: SPECIAL RISK CONSIDERATIONS

Any renovation within an existing building has inherent risks. Knowing what these are prior to construction and in establishing a construction estimate is invaluable. Unknowns in construction will typically lead to delays and increased costs whether they be before or during construction. An allowance should be included for unknown factors, whether this be a

percentage contingency of the overall costs or a lump sum allowance based upon previous projects of similar scope.

Other considerations include availability and amount of equipment required and possible lead times to acquire it. Do any materials or equipment require customization also increasing possible lead times? By having has much information as possible at the conceptual level, even an early version of a project manual, the construction estimator can present to the Owner a great degree of confidence in his estimate.

SECTION 6: RATIOS AND ANALYSIS – TESTING THE BID

The construction estimator will need to analyze the conceptual estimate in order to establish whether the construction pricing is in range of what is to be expected for the size of the science program area and the equipment required. Unit costs, methods of construction, and other information may be provided from a schedule of values from previous projects that can be compared to the current project. Comparing these with previous projects in the geographic location or similar environments, the construction estimator will have a greater degree of accuracy in the estimate.

SECTION 7: OTHER PERTINENT INFORMATION

Each city, county and state has building regulations and code requirements that the construction estimator must be aware of. At every level of government, there are many authorities that require bidders to achieve either voluntary or mandatory participation goals with respect to small, disadvantaged, or minority owned businesses serving as

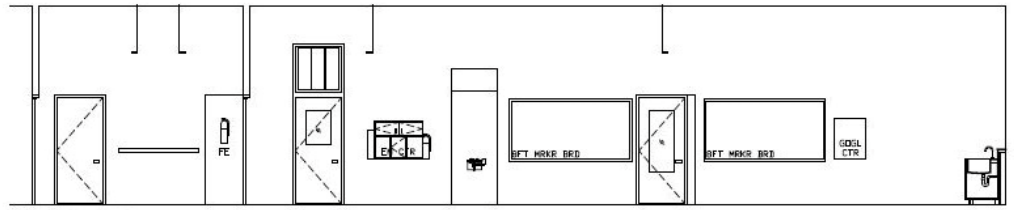
subcontractors on their construction projects. This is typical for all public work programs and state run high schools are just one example.

It is also possible that bids relating to construction for city/state authorities can only be accepted by pre-qualified contractors limiting to some extent the number of possible bids which could have an adverse effect on pricing.

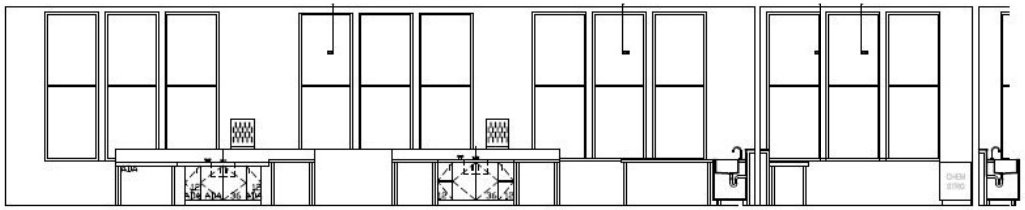
As mentioned previously, in existing construction of older buildings, there is the likelihood of environmental abatement to consider. This can have an enormous impact on costs and extensions to a project's schedule.

SECTION 8: SAMPLE PLAN AND ELEVATIONS

Below is an example of plans and elevations for a high school laboratory including an adjacent prep room. At this conceptual level, we are only provided with a scale plan with the layout of equipment in both the science and prep rooms. Equipment is marked and the supporting interior elevations allow the construction estimator to calculate various heights of walls and equipment in order to better take-off quantities required.

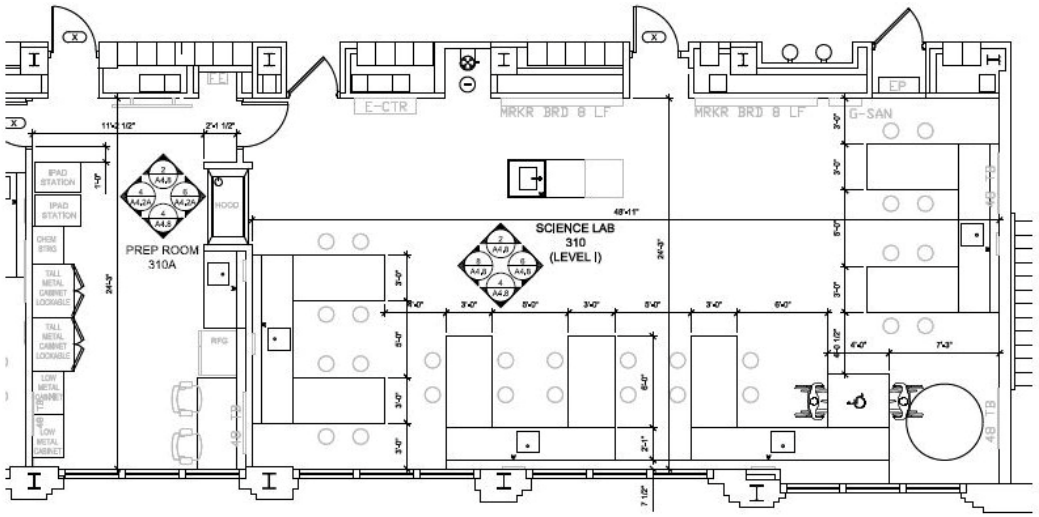


2 SCIENCE LABS 310-310A: EAST ELEVATION



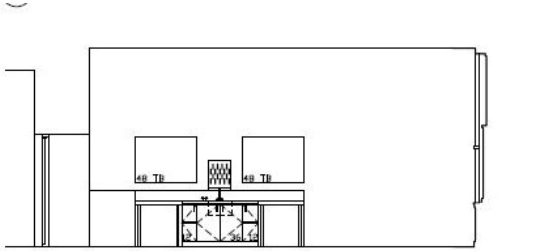
4 SCIENCE LABS 308-310: WEST ELEVATION

SCALE: 1/4" = 1'-0"



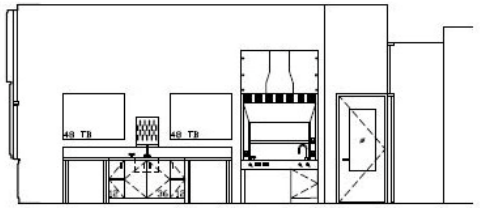
2 SCIENCE LAB 310

SCALE: 1/4" = 1'-0"



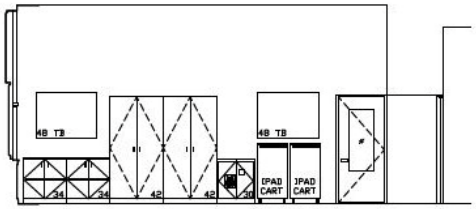
6 SCIENCE LABS 310; SOUTH ELEVATION

SCALE: 1/4" = 1'-0"



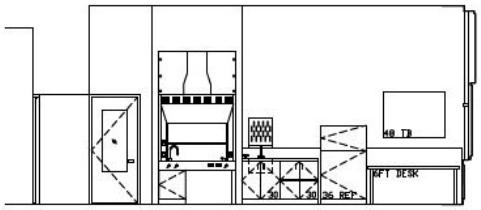
8 SCIENCE LABS 310; NORTH ELEVATION

SCALE: 1/4" = 1



4 PREP ROOM 310A NORTH ELEVATION

SCALE: 1/4" = 1'-0"



6 PREP ROOM 310A SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

SECTION 9: SAMPLE ESTIMATE – TAKEOFF AND PRICING SHEETS

Presented below is a sample estimate with takeoff and line item pricing for a conceptual level high school laboratory. At this stage of design and estimate, numerous line items are included, developed and grouped into assemblies due to them not being shown on the drawings but allowed for in a typical project of this scope. Unit rates have been adjusted based upon the various factors mentioned previously including but not limited to geographic location, physical location, labor rates, project schedule and general economies of scale. Please note that the estimate below is partially based on the above plans and elevations and is not a direct takeoff of it.

DESCRIPTION	QTY	UM	UNIT COST	TOTAL COST
DEMOLITION				
Demolish existing single door and frame assembly	2	EA	135	$270
Demolish existing full height demising partition	32	LF	35	$1,120
Demolish fume hood and ductwork (approx 20 LF) to roof	1	EA	1,950	$1,950
Demolish fixed instructors' demonstration table. Demolish piping back to the main and cap.	1	LS	1,500	$1,500
Demolish drop-in base cabinet sink	5	EA	250	$1,250
Demolish student drop-in base cabinet sink	2	EA	250	$500
Demolish wood storage cabinets, approx. 7' tall	24	LF	45	$1,080
Demolish wood base cabinets	85	LF	28	$2,380
Demolish wood wall-hung upper cabinets	24	LF	21	$504
Demolish VCT finish flooring and underlayment and resilient wall base	1,495	SF	1.45	$2,168
Demolish base cabinet island stations with epoxy tops	4	EA	250	$1,000
Demolish 16' long x 8' tall chalkboard with triple-sliding chalkboard units	1	EA	175	$175
Remove projection screen. Salvage for reinstallation	1	EA	125	$125
Remove ceiling-mounted television and associated supports	1	EA	75	$75
Demolish wall-mounted tackboard, approx. 7' long x 4' tall	2	EA	55	$110
Demolish 2' x 4' suspended ceiling grid and tile system	1,495	SF	0.80	$1,196
Remove 2' x 4' light fixtures and salvage for reinstallation	25	EA	50	$1,250
Provide openings (24" sq.) in both attic floor and roof to accommodate new exhaust fan for fume hood.	6	EA	250	$1,500
Provide openings (24" sq.) in attic floor and roof to accommodate ductwork which removes additional air from the room.	6	EA	250	$1,500

THERMAL & MOISTURE PROTECTION				
Demolish portion of structural ceiling and roof system above for new fume hood penetration for exhaust fan. Provide structural metal supports at new opening. Fireseal and patch following completion of new work	1	LS	5,000	$5,000
OPENINGS				
Provide fire-rated C Label (45 min) stained wood door with glazed vision panel with painted hollow metal frame	2	EA	2,965	$5,930
FINISHES				
Provide new VCT flooring and associated underlayment	1,495	SF	7.75	$11,586
Provide resilient wall base	225	LF	2.25	$506
Provide new 2' x 4' suspended ceiling grid and tile system	1,495	SF	5.75	$8,596
Scrape, prepare, prime and paint walls	1,640	SF	2.15	$3,526
Provide new VCT flooring and associated underlayment	336	SF	7.75	$2,604
Provide resilient wall base	80	LF	2.25	$180
Provide 1-hour fire-rated drywall partition (w/ high-impact resistant drywall)	784	SF	14.85	$11,642
Provide shaft for fume hood exhaust ductwork from room to roof opening. Shaft to be two-hour rated enclosure.	70	SF	22.50	$1,575
SPECIALTIES				
Provide required signage at new fume hood.	2	EA	118	$236
Reinstall projection screen	1	EA	225	$225
Replace existing interior room signage with new accessible interior room signage.	4	EA	125	$500
Provide full-size refrigerator with ice maker	1	EA	1,450	$1,450
Provide pegboard drying rack	1	EA	265	$265
Provide 4'x4' tackboard	7	EA	225	$1,575
Provide 8' long x 8' tall marker board with triple-sliding markerboard units	2	EA	1,675	$3,350
EQUIPMENT				
Provide student work table, metal tube framing with epoxy resin top, with adjustable legs	7	EA	1,650	$11,550
Provide wall-hung upper cabinets	8	LF	180	$1,440
Provide chemical storage cabinet	1	EA	2,650	$2,650
Provide 34" wide, low, metal storage cabinet	2	EA	1,455	$2,910
Provide 3'-6"x7' lockable, metal storage cabinet	2	EA	2,450	$4,900
Provide student work table, metal tube framing with epoxy resin top, with adjustable legs	1	EA	1,650	$1,650
Provide emergency eye wash/body shower.	1	EA	3,250	$3,250
Provide wall-mounted goggle sanitizer cabinet and goggles	1	EA	1,550	$1,550
Provide wall-mounted emergency cabinet to include fire blanket, fire extinguisher and plastic bottles.	1	EA	1,750	$1,750
Provide pegboard drying racks	4	EA	265	$1,060

Provide perimeter base cabinets	25	LF	300	$7,500
Provide epoxy resin top for student workstations.	50	LF	200	$10,000
Provide accessible fixed, plastic laminate instructor demonstration island with epoxy resin top, 30" deep, 60" wide x 34" tall	1	EA	6,875	$6,875
MEP				
Instructor demonstration island above shall include the following:	1	LS	5,500	
Provide accessible drop-in epoxy resin sink, 17" x 22" with gooseneck faucet. Connect to existing centralized neutralizing system			Included Above	
Provide gas outlet (turret)			Included Above	
Provide (1) IG quad receptacle, (1) duplex receptacle, (1) voice and (2) data receptacles at the demonstration island. Provide (1) IG duplex receptacle and TV connection by teachers station.			Included Above	
Provide emergency power off push-buttons and keyed reset switch for electrical and gas to lab stations and the instructor demonstration island. Provide transparent flip-top protective covers for push-buttons.			Included Above	
Provide central CW and HW water solenoid shut-off valve. Provide keyed on-off switch for water to lab stations and the instructor demonstration island.			Included Above	
Provide accessible by-pass fume hood	1	EA	15,450	$15,450
Provide new exhaust fan at roof to accommodate new fume hood. Fan to have acid resistant coating. Provide new curb at a minimum 14" in heigh. Approximately 1200 CFM, 1 in sp and 1 hp to be calculated and verified by EOR via calculations.	1	EA	4,780	$4,780
Provide and install new ductwork for fume hood from 3rd floor to roof. Approximately 20" by 18" in size and will be 20 ft. Ductwork to be a minimum of 18 gauge all welded stainless steel.	15	LF	235	$3,525
Provide dampers at existing return/relief. Room to operate at a negative pressure at a minimum of %5 more exhaust than supply. Approximately 2 damper for room. EOR to verify air balance and dampers required for final design via calculations and coordination with fume hood air volume requirements.	2	EA	1,425	$2,850
Coordinate/interlock operation of exhaust fan for fume hood with return/relief air from room.	1	LS	1,500	$1,500
Provide secondary means to remove additional supply air from room during fume hood operation. Provide new curb at a minimum 14" in height per. Secondary exhaust hood to be approximately 1200 CFM, 1 in sp and 1 hp. EOR to calculate exact requirements and verify with final design.	1	EA	3,150	$3,150
Interlock a secondary means to remove additional supply air from room with fume hood exhaust operation and new dampers in existing return/relief ductwork.	1	LS	1,500	$1,500

Relocate (1) supply air diffuser in ceiling so that is it not in front of fume hood. Existing diffuser is 21" by 12". Associated ductwork is 24" by 7". Modify existing ductwork to accommodate relocated diffuser. Approximately 10' of 24" by 7" ductwork.	10	LF	84	$840
Provide 1 duplex gas turret at fume hood.	1	EA	245	$245
Provide gas piping to new gas turret at fume hood. Size to be approximately 1" and connect o nearest existing gas piping. EOR to verify gas piping size required and location of existing gas piping for connection.	50	LF	65	$3,250
Provide gas valves and controls for fume hood gas turret.	1	LS	2,500	$2,500
Provide gas outlet (turret) at each student station	5	EA	475	$2,375
Provide hot and cold domestic water to the fume hood, connect to the nearest HW and HW mains.	1	LS	3,500	$3,500
Provide sanitary and vent to the fume hoods sink, connect to the nearest plumbing located in floor below. Vent to the nearest VTR.	1	LS	4,000	$4,000
Provide student drop-in epoxy resin sink with gooseneck faucet. One (1) sink to be accessible. Connect to existing centralized neutralizing system.	4	EA	2,200	$8,800
Provide ADA compliant epoxy resin sink, 21"x15"x11" deep. Connect to central neutralizing system	1	EA	2,125	$2,125
Provide 1/4" copper tubing water supply to the refrigerator/freeze 15 linear feet).	15	LF	48	$720
Provide shower alarm dome light at at corridor side of entry door. Provide connection to wall-mounted audible alarm at emergency stations	1	EA	670	$670
Provide duplex receptacle at goggle cabinet.	1	EA	375	$375
Provide new power connection for secondary exhaust fan to remove additional supply air from room during fume hood operation. Disconnect switch to be weatherproof.	1	LS	2,000	$2,000
Provide new power connection for new exhaust fan for level one fume exhaust hood. Disconnect to be weatherproof.	1	LS	5,500	$5,500
Provide (1) GFI duplex receptacle, (1) IG duplex receptacle and (1) data outlet at each student workstation.	4	EA	1,150	$4,600
Utilize existing visual strobe device. Relocate as needed.	1	EA	225	$225
Provide ceiling-mounted heat detectors and connect to existing fire alarm system.	2	EA	775	$1,550
Provide intercom speaker and call switch.	1	EA	1,865	$1,865
Utilize exsting wireless point for new lab. Relocate as required.	1	EA	225	$225
Provide 100-amp electrical isolated ground panel with split bus dedicated for Science Room.	1	EA	6,750	$6,750
Utilize existing 2x4 light fixtures to the highest extend possible. Provide additional fixtures, to match existing as necessary. Provide ceiling mounted occupancy sensors and (3) wall switches for AV mode at each entrance.	1	LS	5,000	$5,000

Provide TCE for data outlets with dedicated IG quad receptacle for 2 science rooms and 1 prep room. Modify existing concentrator switch to accept data drops from new sceince labs and prep room. Coordinate scope with CPS ITS.	1	LS	15,000	$15,000
Provide empty junction, an isolated ground duplex receptacle, and a data drop at ceiling projector location. Provide empty junction box at teacher's station for projector conduit connection.	1	EA	2,150	$2,150
Provide duplex IG receptacle and data outlet at middle of teaching wall for future Smartboard.	1	EA	855	$855
Provide gas on indicator light at corridor side of entry door	1	EA	615	$615
Reinstall salvaged 2' x 4' light fixtures	1	LS	2,000	$2,000
Provide 2 CPS standard power/data drops	1	LS	2,700	$2,700
SUBTOTAL: Base				**$248,700**
General Conditions/Bond/Insurance	8%			$19,900
Overhead & Profit	6%			$10,750
SUBTOTAL: (Total Construction Costs w/o Environ. and Design Cont.)				**$279,350**
Design Contingency	10%			$27,950
SUBTOTAL: Scope Total Construction Costs w/o Environ.				**$307,300**
Environmental Allowance	5%			$15,400
TOTAL: (Base Total Construction Costs)				**$323,000**

SECTION 10: TERMINOLOGY-GLOSSARY

Construction Specifications Institute 2004 MasterFormat

The 2004 revised edition of the Construction Specifications Institute directory of construction specification itemizations used in the construction industry to classify, itemize, and arrange specifications.

Economies of scale – refers to the fact that costs for smaller quantities of materials and equipment typically cost higher per unit than larger quantities due to varying factors.

UM – units of measurement

LSUM – lump sum

LNFT – linear feet

SQFT – square feet (area)

EACH – each, count of

TONS – tons used in structural steel

LBS - pounds

SECTION 12: COPY OF TOPIC APPROVAL LETTER

American Society of
Professional Estimators CERTIFICATION
Mailing & Administrative Office:
2525 Perimeter Place Drive, Ste. 103 • Nashville, TN 37214 • 615-316-9200 • Fax 615-316-9800 •

Summary Certification Cycle/Topic Acceptance Form

Note: This page will need to be included with your technical paper submission

August 15, 2013

Candidate Number: 0713202 Chapter Number: 7 Region: CP

Certification Discipline: 1.4 General Construction

Contact Email Address: rab2704@gmail.com

Workshop: Completed by **Sept. 30, 2013** Selected workshop format: **Online**

Online Workshop link: https://www.constclasses.com/course/view.php?id=10

Online Workshop User ID: **rbertovic** Online Workshop Password: **8AParemu**

Technical Paper: Due Date: **December 15, 2013.**

Late papers are subject to penalty of score as stated in the "Technical Paper" booklet.

Technical Paper Topic: HTETCO a High School Science Laboratory at Conceptual Level

Testing: Schedule test dates are to be scheduled during the month of March, 2014. If submitting Q&P in lieu of DST, The complete set of questions and problem will be due by March 31, 2014.

Test dates may be scheduled sooner upon approval of the Certification Coordinator.

RETURN SIGNED FORM BY AUGUST 31, 2013

I agree to the selected topic and will prepare my technical paper according to the format stated for the ASPE Certification Program.

I will meet the deadlines for the completion of the workshop, submittal of my technical paper, and testing. If I do not meet these deadlines, I understand that this certification cycle will terminate and I will need to submit a new application.

I have read the above information and by signing below agree to meet the requirements of the ASPE Certification Program and adhere to the guidelines of the program.

Signature:_____ **Date:** _____

Please retain a copy of this form for your records and technical paper. Return this form to the Society Business Office
Fax: 615-316-9800 or email tanya@aspenational.org