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Subject :- “How To Estimate The Cost Of Concrete Roof Tiles”

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HOW TO ESTIMATE THE COST OF CONCRETE ROOF TILES

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Sandy Robert Gray

Date: June, 25th 2005

HOW TO ESTIMATE THE COST OF CONCRETE ROOF TILES

AUTHOR PAGE

The author's name is Sandy Robert Gray. He holds the position of Director Of Estimating with Cumming, LLC in their Sacramento Office in Northern California.

He was born in Aberdeen, Scotland, United Kingdom where in 1997 he achieved a Bachelor Of Science With Distinction in Quantity Surveying from The Robert Gordon University.

After working as a Quantity Surveyor for the Local Government, Balfour Beattie Civil Engineers and Beedie Mitchell Quantity Surveyors, he moved to San Diego in December 2000 to work as an Estimator for Cumming, LLC Construction Cost Consultants. In 2002 he was promoted to Senior Estimator and relocated to the Company's Orange County Office in Southern California.

In 2003 he moved again, North to assist in the opening of the Company's first Northern Californian Office in Sacramento where he now is employed as Director Of Estimating for Northern California.

His current duties include preparing, managing, reviewing, organizing resources in the preparation of construction cost estimates and component unit price books from conceptual through detailed stages of design in the K thru 12, Higher Education and other institutional construction markets.

TITLE PAGE

“How to Estimate the Cost of Concrete Roof Tiles”

June 25th, 2005

CANDIDATE NUMBER - 305018

HOW TO ESTIMATE THE COST OF CONCRETE ROOF TILES

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HOW TO ESTIMATE THE COST OF CONCRETE ROOF TILES

1. INTRODUCTION / METHODOLOGY

This paper is written as part of the overall certification process for the American Society of Professional Estimators and will examine the methods for calculating the overall costs of concrete roof tiling on a job specific scenario.

The factors affecting these costs can be broken down into Materials, Labor, Equipment, and Sub Contractor Mark Ups / Indirect costs. Each of these shall be examined in the following paper in sections 5, 6, and 7 respectively.

Each of these factors will be calculated and represented on a cost / unit basis. For example, the concrete roof tiles will be displayed on a cost / sf basis, the ridge tile on a cost / lf basis and so on (this information has been collated and illustrated in a standard estimate format in Section 9).

As further clarification, additional factors that could affect the bottom line cost will be highlighted throughout the paper.

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2. MAIN DIVISIONS

From the 16 Construction Specification Institute (CSI) Divisions, the following will be included in this report:-

- Division 1 – General Requirements
- Division 7 – Thermal & Moisture Protection

Within the above Main CSI Divisions, the following Sub-Divisions will be utilized in the preparation of estimating costs.

- 01300 Administrative Requirements
- 01400 Quality Requirements
- 01500 Temporary Facilities & Controls
- 01590 Equipment Rental
- 07300 Shingles, Roof Tiles & Roof Coverings
- 07700 Roof Specialties & Accessories

For a list of items that are excluded in the overall costs examined, see Section 3.

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3. ASSUMPTIONS FOR COST MODEL

As from project to project the costs of the roof coverings can vary greatly, this report will be based on a hypothetical roof plan and specification. This will result in a more “project specific” cost build up as opposed to a “generic” cost build up for this particular situation.

The roof in question is represented by a dual pitched roof, 210'-0" x 60'-0" on plan with an 8'-0" overall rise from eaves level to ridge level. The building in question is single story, rectangular with a gable end on both East and West elevations. There are, therefore, no hips, dormers, mono-pitches, or other angled cutting required in this scenario.

The building function is classroom space for an Elementary School and shall house 12 typical classrooms together with restrooms, storage, and circulation space.

In the following calculations, the assumption made is that all roof structure, sheathing, insulation and sheathing felt / paper is in place, ready for roof finish installation.

The roof tiles themselves can vary in manufacturer, style, size, material, thickness as well as specific recommendations for installation, storage, and handling. For this hypothetical project, the following roof tiles to be used are:-

“13” x 16 ½” with a minimum lap of 2 ½” per tile. The tile is by Marley, type X or equivalent.”

Similarly, the ridge tile to be used is:-

“Marley type Y or equivalent, terracotta dry ridge tile.”

As highlighted above, the basis of the project is for new build K-12 School Construction in Sacramento County, California. There is one building on the project requiring a concrete roof tiled finish. Scaffolding for the building will be required on both longitudinal walls.

It has also been assumed that no inclement weather or other factors have delayed the project to where additional overtime work is to be considered and all labor costs reflect regular time.

Other assumptions to qualify our estimated costs would include access to the site, access to storage facilities and any possible phasing of the project. For the purposes of this exercise, we shall assume that none of the aforementioned items have a bearing on costs.

It should also be noted the items that are excluded from this estimate are as follows:-

- All roof structure, sheathing, and under tile felt / paper

- Demolition costs (the building is new construction)
- Aluminum flashings (assumed part of a separate trade)
- Premiums for PSA Labor Agreements
- Project soft costs
- Escalation of costs beyond “Today’s Dollars” (June, 2005).
- Hazardous material abatement.

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4. QUANTITIES USED IN COST MODEL

The following components will be required to complete the cost of the concrete roof tile sub trade on this project (see Appendix 1 for full quantity take off):-

- Concrete roof tiles
- Dry ridge
- Finished ends on ridge
- Cutting to tiles at ridge
- Formation of eaves course
- Cutting to tiles at gables
- Cutting to tiles around pipe / vent penetrations

The above components can be quantified as follows:-

Concrete roof tiles

2 x eaves length (210'-0") x slope length (31'-1/2") = 13,401 sf (square feet) or 134 sq (100 square feet measure).

Dry ridge

Overall length = 210 lf (linear feet).

Finished ends on ridge

At each end of ridge = 2 loc (locations).

Cutting to tiles at ridge

At either side of ridge on top row of tiles = $2 \times 210' - 0'' = 420$ lf (linear feet).

Formation of eaves course

2 x eaves length at one side (210' - 0'') = 420 lf (linear feet)

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5. MATERIALS

a. Roof tiles

The roof tiles are, individually, 13" x 16 1/2" with a lap of 2 1/2". This in turn would result in 96 tiles per square. For this project, a wastage factor of 5% shall be included = 101 tiles per square.

The concrete tiles, based on a supply quotation from Stewart Building Supplies, cost \$1.35 / tile. This cost includes delivery, suppliers mark up, and trade discount but excludes sales tax.

An additional allowance for aluminum clout nails would be required, for this example an allowance of \$0.15 / tile is to be included.

This results in an overall cost of \$159.08 / sq.

b. Ridge tiles

The ridge tiles, based on a supply quotation from Stewart Building Supplies, cost \$3.39 / lf. This cost includes delivery, suppliers mark, and trade discount but excludes sales tax.

For this project, a wastage factor of 5% shall be included.

This results in an overall cost of \$3.56 / lf.

c. Finished ends on ridge tiles

No material cost.

d. Cutting to tiles at ridge

No material cost.

e. Formation of eaves course

No material cost.

As previously mentioned, all quantity take offs can be seen in the attached Appendix 2.

As with any estimate, overall economies of scale must be examined prior to calculations of material unit costs. In this particular scenario, the roof in question is particularly large and multiple pallets of roof tiles would be required. As the dual pitch roof has no

dormers, hips or valleys, a more minimal approach to material wastage should be considered. To explain these factors further, if the portion of work in question related to patching an existing roof, the smaller quantity of tiles required which is likely to result in a higher unit sales cost from the supplier. Similarly, the likelihood of a higher wastage premium resulting from the nature of work would result in a larger ratio of quantities of tiles required in relation to the physical area on the roof required to be recovered.

Unfamiliar or unique materials specified may carry additional risk to the estimator. Special consideration should be given to any materials in this category. Technical data should be gathered as well as asserting additional information from material reps and sub-contractors who may have used particular materials in the past.

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6. LABOR

The labor costs in the estimate should be reflecting current labor rates for the location in question and are to accurately reflect the installation of all the materials and components highlighted in Section 5.

The crew for this project is to be four roof tilers and one laborer. The hourly rate for these tradesmen is shown in Appendix 3. These costs include all base salary, benefits, welfare, insurance, workers compensation, etc. This gives us an average hourly rate of \$40.59 / hour for the roof tilers and \$40.21 / hour for the laborer.

Prior to inputting labor productivity rates, additional consideration should be given to any job specific factors / special risk areas that may be a premium to the estimated productivity.

Examples of which could be:-

- Access
- Overhead work
- Nature of work, eg patch repairs

- Overall quantities of tiles required

To explain the above further, we can look at an example where the roof covering work required involved striping and retiling work around a new addition to an existing building. Access to the work could be limited due to the surrounding buildings which may impact labor productivity and output by impeding the workforces' access to and from the roof. The patching work / overhead work required would take significantly longer per unit of measurement due to the need to match existing patterns and colors without disturbing additional existing tiles. The lower the overall quantity of tiles required, the less likely the workforce on the job site are to see any benefit or learning curve resulting from repetitive work.

For this exercise, we shall assume that none of these factors existing significantly to affect the overall labor output.

The labor productivities have been estimated based on current conditions for this project. The productivities and associated costs for the following required scope of works can be seen in the attached cost estimate (Appendix 2).

- Installation of concrete roof tiles
- Installation of dry ridge
- Forming finished ends on ridge
- Cutting to tiles at ridge

- Formation of eaves course
- Cutting to tiles at gable

Special consideration should be given to the appropriate Specification section when calculating the above productivities to ensure that labor costs account for all manufacturer's installation instructions and code requirements.

Similarly to the above, if the building in question was of historic nature or surround by historically listed buildings, the labor costs would have to account for the fact that historic building methods of construction may need to be followed in installation. Again, this requirement would be highlighted in the Specifications.

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7. EQUIPMENT

The third section for the calculation of construction costs is the allowance for equipment requirements. All equipment costs should include rental charges (where applicable), operating and maintenance costs.

Special risk consideration needs to be given to choices in plant / equipment. Access issues to the overall site and buildings may impact the choice of equipment and this should be kept in mind during the estimating process. Also, dependant on the type of work being estimated, the surrounding area and local should be considered in the choice of certain types of equipment. For example, nearby residential neighborhoods may impact the equipment used in some types of demolition, or local historic buildings or ruins may affect equipment required for ground excavation.

In this situation, the only equipment cost consideration is for scaffolding.

Allowances for appropriate scaffolding required can be seen in the attached cost estimate (Appendix 2).

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8. SUB-CONTRACT MARK UPS / INDIRECT COSTS

The indirect costs relate to all costs that do not fall under the Materials, Labor, and Equipment categories but are essential to the running of the project.

The following are examples of indirect project costs:-

- Supervision
- Final clean up
- Temporary water / power / lighting
- Permits / Insurance / Bonds
- Office administration
- Safety
- Miscellaneous fees

These costs are typically determined through historical cost data that can be translated and adjusted to suit the specific project in question. Some costs will be time related and affected by the overall contract duration. Some will be specific one off type costs.

Regardless, time should be taken to analyze the requirement and to translate these costs into the estimate.

For the example in this report, these indirect costs have been reflected as a % cost mark up as indicated at the end of the materials, labor, and equipment calculations shown in Section 9.

Additional indirect costs to be considered are profit and contingency.

Construction Contingency

A construction contingency can be added to allow for any changes in conditions that may arise and affect the potentially smooth progress of the project during the construction time on site. This premium is 100% at the estimator's discretion and would vary from project to project. Some factors that may affect this would be client, architect, material specification, etc.

There is no rule of thumb for what a construction contingency should be, if any. The estimator's experience and historical cost data from previous projects, together with knowledge of the owner, architect and projects of similar nature and size in the same local are typically the best way to account for this premium.

For this example where the concrete roof tile specification is typical, that the roof shape is relatively simple, the owner and architect have a good working reputation, no "unknowns" in respect to hazardous material abatement are anticipated and no irregular

clauses in the general requirements of the specification are noted, a minimal premium percentage has been included and is indicated in the attached cost estimate (Appendix 2).

Profit

Profit needs to be added to the bottom line number to give an overall resulting premium after all the job running costs have been paid for. As with many other of the job considerations, this is very much project specific and this has been illustrated in the attached cost estimate (Appendix 2).

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9. POST ESTIMATE CONSIDERATIONS

Upon project completion, it is of most importance that all actual cost information is translated back to the estimator for a thorough examination and reconciliation of how estimated costs related to actual costs incurred in the project itself.

There are many reasons why the importance level of this is so high. For one, this forms the best source of cost information for the estimator and needs to be used and adjusted as necessary for future estimates.

These reported costs will assist greatly in assessing considerations for future cost estimates. The following are some of the areas that previous reported costs will help guide the estimator in:-

- Material storage
- Material availability
- Material / labor / equipment ratios
- Actual complexities of material installation
- Effect of new general conditions, code requirements, specifications

When collated and filed, this historical cost data will also be of major benefit in the following tasks:-

- QA / QC, spot checking future estimates
- Accurate conceptual “Cost per SF” budgets
- Increasing the estimator’s technical knowledge

To clarify, the reported cost information is a valuable resource in running final checks / ratio analysis on estimates to ensure their accuracy by continual comparative analysis of proposed costs against past costs (when adjusted to reflect similar geographical locations and points in time). Also, when preparing conceptual estimates on very limited information where a large degree of “filling in the blanks” is required on the estimator’s part, by continually cross checking previous detailed cost information, it is less likely that any holes in scope / costs would be missed. For example, in this situation, cross checking on an overall square foot basis the cost of the roof tile work including all ridge, cutting, labors, etc., would be compared with that of previous projects. Prior to issuing the estimate, any anomalies should be accounted for and explainable where necessary.

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10. SUMMARY

Using the process described in this report and that sample estimate attached, the estimator should be in a position to prepare accurate, detailed estimates within a timely manner to suit specific job deadlines.

This process should also assist the estimator with regard to cost information to be used on future projects.

Careful preparation and post contract evaluation of the estimate should help enhance the estimator's expertise giving him or her the tools to accurately deal with any cost / efficiency related questions that may arise.

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11. REFERENCES

The following references were used in preparation of this report:-

1. Classic Roof Tiling Ltd., Technical Brochure, (dated 2002).
2. Marley Roofing Products, Technical Guide (dated 2003).
3. “Building Additions”, For Pros By Pros (Taunton Press) (dated 12/10/04).
4. RS Means, Building Construction Cost Data 2005, 63rd Annual Edition
5. RS Means, Labor Rates for the Construction Industry 2005, 32nd Annual Edition

Appendix 1 - Quantity Take Off

Appendix 2 - Cost Estimate

DETAIL ELEMENTS

Element	Quantity	Unit	Unit manhours	Total hours	Labor Rate	Total Labor	Unit Mat'l	Total Mat'l	Unit Equip	Total Equip	Unit Cost (bare)	Total
1000 General Conditions												
General Conditions												
GC Costs												
Scaffolding	1	ls		-	\$ 40.59	\$0.00		\$0.00	\$4,500.00	\$4,500.00	\$4,500.00	\$4,500
Supervision	12	hr		12.00	\$ 51.09	\$613.08		\$0.00			\$51.09	\$613
Small tools allowance	1	ls		-		\$0.00	\$150.00	\$150.00			\$150.00	\$150
Load-all	1	ls		-		\$0.00		\$0.00	\$ 1,000.00	\$1,000.00	\$1,000.00	\$1,000
Mobilization	5	hr		5.00	\$ 40.59	\$202.95					\$40.59	\$203
Demobilization	5	hr		5.00	\$ 40.59	\$202.95					\$40.59	\$203
Final Clean Up	4	hr		4.00	\$ 40.59	\$162.36					\$40.59	\$162
Total - 1000 General Conditions						<u>\$1,181</u>		<u>\$150</u>		<u>\$5,500</u>		<u>\$6,831</u>

Appendix 3 - Labor Rates

Hypothetical Project
 New Constructon, K-12
 Sacramento, California

	Roofer Prevailing Wage	
	Base	
Base Rate	\$	<u>18.81</u>
Subtotal A	\$	18.81
Health/Welfare/Pension/ Fringe Package	\$	<u>11.83</u>
Subtotal B	\$	11.83
FUTA	1.00% \$	0.19
SUI	2.00% \$	0.38
FICA	8.10% \$	1.52
Workers Comp	39.79% \$	7.48
Liability Insurance	2.00% \$	<u>0.38</u>
Subtotal C	52.9% \$	9.95
TOTAL WAGE RATE	\$	<u>40.59</u>

Hypothetical Project
 New Constructon, K-12
 Sacramento, California

	Laborer Prevailing Wage	
	Base	
Base Rate	\$	<u>21.49</u>
Subtotal A	\$	21.49
Health/Welfare/Pension/ Fringe Package	\$	<u>9.08</u>
Subtotal B	\$	9.08
FUTA	1.00% \$	0.21
SUI	2.00% \$	0.43
FICA	8.10% \$	1.74
Workers Comp	28.28% \$	6.08
Liability Insurance	2.00% \$	<u>0.43</u>
Subtotal C	41.4% \$	8.89
TOTAL WAGE RATE	\$	<u>39.46</u>

Appendix 4 - Roof Sketch