The Technical Paper

"The technical paper provides a way to measure the applicant's knowledge, capabilities, experience in a specific discipline, and the ability to communicate that knowledge"

Estimating TODAY

Technical Papers that receive a score of 24 or higher, may be recommended for publication in ***Estimating Today***.

AMERICAN SOCIETY OF PROFESSIONAL ESTIMATORS

THE TECHNICAL PAPER

Technical Papers are critical to the continuing education of members of the American Society of Professional Estimators. They provide opportunities for the enhancement and expression of estimating information.

The creation of an acceptable Technical Paper is one of the requirements for becoming a Certified Professional Estimator (CPE). The Technical Paper serves to complement the question/answer and problem solving elements of the examination process. It provides the Society with an additional way to measure the applicant's knowledge, capabilities, experience in the specific discipline, and the ability to communicate that knowledge.

Within the question/answer and problem solving elements of the exam, the creator of the test materials provides a formal structure for the examinee. The Technical Paper gives the responsibility for total development to the candidate. All who have had to compose written communications are aware of the creative thought process involved, and the organizational and technical skills required. These same processes and skills were utilized to create any written composition, from the elementary level book report, to the postgraduate thesis. We are also aware of the high value placed on the ability to communicate ideas, opinions, methods and information in writing. These communication skills are essential for illustrating our worth in the profession of construction estimating.

The Technical Paper furnishes the opportunity to exercise your writing abilities and memorializes areas of the construction estimating expertise through organized, coherent documentation.

PROCESS

The Technical Paper, comprised of at least 2,500 words, must explain in detail the estimating process for your approved topic. A sample paper will be available for review during the orientation workshop. The paper must conform to the spirit of ASPE's Code of Ethics and shall be an original product, composed specifically for the purpose of attaining certification.

Information should flow in an organized manner. Passive voice has no place in technical writing. Use active voice and simple, clear, direct phrasing. First and second person is rarely appropriate in technical writing. It is preferred to use third person when talking about the facts and data to ensure a more professional air in discussing the theoretical approach for your paper. Appropriate, charts, tables, and graphs should be included for effective illustration.

Get **feedback!** Finish your paper well in advance, so that you can improve the writing. Have an outside reader review to make certain the use of correct sentence structure, proper grammar and spelling. **Math Errors will result in an automatic fail of the paper. Math errors include mistakes in excel formulas.**

TERMINOLOGY

Define terms used in the composition of the paper to assist reader understanding. Keep in mind that the persons responsible for evaluating the text may be located in different geographic areas and may not be totally familiar with your regional terminology. Develop a formal glossary when warranted.

REFERENCES

All non-original materials must be properly referenced using a commonly accepted method of notation. Consult a public librarian for knowledgeable assistance in this area. Documentation of releases required by copyrights must be included with your transmittal package.

SUBMITTAL PROCEDURES

Each candidate will receive a "request for file" notice from the Society Business Office via email. The candidate will receive the "request for file" email at least two weeks prior to their technical paper due date or upon request should the candidate wish to submit the paper sooner. The candidate will upload their paper submission for review.

Submit via electronic submission to the Society Business Office:

- **One Complete PDF of paper that includes all drawings and takeoffs**
- **Microsoft Word version of technical paper**

The paper must be received at the Society Business Office prior to the date listed in the Certification Program Schedule. **Submittals received after the specified due date will be subject to penalty of score. A point per day will be subtracted from the paper score for each day after deadline.** A paper must score 18 of 30 possible points to meet the requirements for certification as approved. Technical Paper submittals become property of the American Society of Professional Estimators. You must retain an electronic copy of your Technical Paper for the purpose of completing revisions in the event the paper fails to meet acceptance.

REVIEW PROCEDURES

The Certification Board oversees the review and evaluation process. A judgment of *"acceptable for purpose of certification"* is mandatory to satisfy this element of the program.

Format Review

Each paper is reviewed for compliance with the format elements established by the Format Review Guidelines. Authors who do not comply with the Format Guidelines are advised with a copy of the Deficient Format Review Evaluation. Candidates are instructed to resubmit revised Technical Papers prior to the date listed in the revision notification.

Content Review

The Society Business Office distributes a copy of each paper to be reviewed by two (2) certified members. The reviewers shall make every effort to

complete the Content Review within 2 to 3 weeks. The reviewer will send the evaluation to the Society Business Office.

The candidate must earn a minimum of 18***** points per the Content Criteria Evaluation Worksheet from two (2) reviewers to determine the paper "*acceptable for purpose of certification*." If one reviewer deems the paper acceptable, but the other does not, a third reviewer will grade the paper as the "tie-breaker".

An award of less than 18***** points from any of the two reviewers or/and as a result of late submittal shall constitute a judgment of "*deficient for the purpose of Certification*." Candidates will be advised of their status with a copy of the Content Criteria Evaluation Worksheet. Candidates will have one opportunity to revise their paper and resubmit for review.

Resubmitted technical papers must be received by the Society Business Office per the written notification to candidates and by the stated deadline (no exceptions). **Untimely responses or second deficient criteria judgments constitute termination for the current Certification Cycle**.

***Papers that contain a math error (includes formula errors on spreadsheets) will not be considered acceptable regardless if the score is 18 or above on the other categories.**

Second Content Review

The reviewer(s), who judged the paper to be deficient, carry out the second content review. If two reviewers judged the paper to be deficient, both must deem the paper acceptable during the second review. If one reviewer judged the paper to be "deficient" and one judged it "acceptable", only the "deficient" reviewer has to determine the paper as acceptable during the second review. Thus the paper will be acceptable for the purpose of certification.

REQUIRED ELEMENTS

Title Page

The Title Page must contain only the following elements:

1. Title of Technical Paper
2. Candidate Number / Candidate Name
3. Date Written

Society Ownership Page

The Society Ownership Page shall contain the following elements:

1. Society Ownership Statement

   You MUST include the following statement, as written, and provide your name (in typewritten characters), signature and date:

"I hereby acknowledge that the contents of this Technical Paper belong to the Society, which is free to publish or otherwise make such use of all or portions of the Paper as it sees fit. If applicable, I have designated by the use of 1/4" wide black tape on the right margin opposite the text or reference materials, those portions that

are considered proprietary, and not available for the Society's use or publication. I have obtained and attached all documentation of releases required by copyright laws for all non-original materials incorporated or referenced in this Paper."

Author Page
In approximately 100 words, write an autobiographical sketch on a separate, non-numbered page presenting your qualification to the Certification Committee.

The Title Page, Society Ownership Page and Author Page will be removed from the paper prior to review distribution to insure author confidentiality.

***You should not use your name or the name of your employer in the remaining elements of the Technical Paper*.**

Cover Page
The Cover Page must contain only the following elements:

1. Title of Technical Paper
2. Candidate Number (assigned to the applicant by the Certification Board)
3. Date Written (month and year of composition)

Number the pages concurrently starting with the cover page as page 1 and continuing through the balance of the pages. The Cover Page remains with the paper throughout the entire review process.

Table of Contents
Provide a Table of Contents, which lists **major headings and page numbers**. Page numbers are to be included on the table of contents.

Body
A Technical Paper should address the following:

1. Introduction
    a. Main MasterFormat Division
    b. Specific Sub-Division: Code and Name
    c. Brief description of subject matter

2. Types and Methods of Measurements

3. Specific factors to consider that may affect things like take-off and pricing such as quantities vs. large quantities, geographic location, and seasonal effect on work

4. Overview of labor, material, equipment, indirect costs and approach to mark-ups (in depth details of these can be found in a variety of estimating books on the market)

5. Special risk considerations

6. Ratios and analysis (present analysis tools used to test final bid; give examples)

7. Miscellaneous pertinent information

8. Sample sketch – required and relate to your content.

9. Sample take-off and pricing sheets (should be a “mini-estimate”) – required and relate to the content of the paper.

10. Glossary/Terminology (if required)

11. References (non-original material)

12. Copyright release (if required)

RECOMMENDATIONS

1. Avoid the composition of an entire policy and procedures manual and topics that are too broad in nature.

2. Be specific.

3. Based on certain criteria or assumptions, present alternative ways to estimate the same item relative to newly discovered facts or relationships.

4. Address the cost impact of laws, safety requirements, government regulations, etc., on the type of construction work you estimate. Show examples.

5. Share techniques for tracking historical cost data and other practices that have improved your professional capacities as an estimator. Identify “tell” items in estimate.

6. Avoid reference to product brands, specific companies, organizations and persons unless they are considered an industry standard.

7. Do not provide labor productivity rates, unless used in examples and pricing estimate sheets; instead, instruct means to developing them.

8. Think of your topic in terms of what would be covered in a CHAPTER of a book.

9. Use charts and graphs to illustrate a new trend in your discipline.

10. Present thoughts on one or two procedures, which have improved your accuracy in the preparation of cost estimates.

11. Illustrate how you develop an assembly or group of line items for use in preparing conceptual estimates for projects. Stick with one or two assemblies to avoid being too general. Comparison of the same assembly under different conditions and variables can also be quite interesting.

12. Remember that your Technical Paper MUST explain ***“HOW TO ESTIMATE THE COST OF…..”***

13. Include a sketch.

14. Read and follow the format guidelines.

OFFICIAL FORMAT REVIEW GUIDELINES

NOTE: Failure to meet this format will result in your paper being returned due to Format Deficiency

1. Title Page (Title, Author, Date)
2. Society Ownership Page (Signature & Date)
3. Author Page (100 words)
4. Cover Page (Title, Candidate #, Date – name of candidate not listed)
5. Table of Contents (include page numbers)
6. Introduction
    a. Main MasterFormat Division
    b. Specific Sub-Division (Code and Name)
    c. Brief Description of Subject Matter
7. Body of the Paper
8. Sample Sketch - required
9. Sample Take-off and Pricing Sheet – required
10. Terminology/Glossary (if required)
11. References (non-original material)
12. Copyright releases (non-original material)

Submit your Technical Paper according to the following:

19. 2,500 words minimum (between items 6 and 7 above)
20. **Double spaced. Single sided.**
21. Pages numbered consecutively beginning with Cover Page (Item #4)
22. Proprietary portions noted
23. **Complete PDF version of paper that includes all drawings and takeoffs**
24. **Microsoft Word version of technical paper**

A sample technical paper is available for review as end of this document.
This is only a sample, not to be copied.

FORMAT REVIEW EVALUATION WORKSHEET

Candidate:_____

Paper Title:_____

_____

	Approved	Deficiency
1. Title Page (Title, Author, Date)	_____	_____
2. Society Ownership Page (Signature & Date)	_____	_____
3. Author Page (100 Words)	_____	_____
4. Cover Page (Title, Candidate #, Date)	_____	_____
5. Table of Contents (must have pg #s)	_____	_____
6. Introduction/Body of Paper	_____	_____
a. Main MasterFormat Division	_____	_____
b. Specific Sub-Division (Code & Name)	_____	_____
c. Brief Description of Subject Matter	_____	_____
7. Sample Sketch	_____	_____
8. Sample Take-off and Pricing Sheet	_____	_____
9. Terminology/Glossary (if required)	_____	_____
10. References (if required)	_____	_____
11. Copyright releases (non-original material)	_____	_____
12. 2,500 words - minimum count in Intro/Body	_____	_____
13. Printed - single-sided, double-spaced	_____	_____
14. Pages numbered consecutively	_____	_____
15. Proprietary portions noted	_____	_____
16. One Complete PDF (including drawings and takeoffs)	_____	_____
17. Microsoft Word Version of Paper Content	_____	_____

Reviewer:_____Date:_____

Below are the suggested procedures, grading rubrics, and the grading evaluation sheet that are provided to all technical paper reviewers. Please review so that you develop an idea of the review assessment.

How to Read a Technical Paper and Write an Effective Critique

Learning to read a technical paper is a critical but rarely taught skill. Most learn on their own using trial and error. One concept to reviewing technical papers is the "three-pass" approach as developed by S. Keshav of the University of Waterloo.

"The Three-Pass Approach – the key idea is that you should read the paper in three passes, instead of starting at the beginning and reading your way to the end. Each pass accomplishes specific goals and builds upon the previous pass:

The First Pass – gives you a general idea about the paper
The Second Pass – let's you grasp the paper's content
The Third Pass – helps you understand the paper in depth

The First Pass:
The First pass is a quick scan of the paper. This pass should take about five to ten minutes and consists of the following steps:

1. Carefully read the title, introduction, and brief description
2. Read the section and sub-section headings, but ignore everything else
3. Read the conclusions
4. Glance over the references, mentally ticking off the ones you've already read

At the end of the First pass, you should be able to answer the Four Cs:

1. Category: Should reflect "How to Estimate the Cost of…**?**."
2. Context: Should reflect the approach to the estimate.
3. Correctness: Does the approach/method appear to be valid?
4. Clarity: Is the paper well written?

The Second Pass
In the second pass, read the paper with greater care. It helps to jot down the key points, or to make comments in the margins, as you read.

1. Look carefully at the Figures, diagrams and other illustrations in the paper. Pay special attention to the take-off and sample sketch. Do they support the details of the paper? Mistakes in these supporting documents will separate rushed, shoddy work from the truly excellent.

2. Remember to mark relevant unread references for further reading (this is a good way to learn more about the background of the paper).

After this pass, you should be able to grasp the content of the paper. You should be able to summarize the main gist of the paper, with supporting evidence, to someone else. This level of detail is appropriate for a paper in which you are reviewing, but may not lie in your area of specialty.

Sometimes you won't understand a paper even at the end of the second pass. This may be because the subject matter is new to you, with unfamiliar terminology and acronyms.
Or the authors may use a technique that you don't understand, so that the bulk of the paper is incomprehensible. The paper may be poorly written with unsubstantiated assertions and numerous forward references. Or it could just be that it's late at night and you're tired. You can now choose to: (a) set the paper aside, hoping you don't need to understand the presented methods in your career, (b) return to the paper later, perhaps after reading background material or (c) persevere and go on to the third pass.

The Third Pass
To fully understand a paper requires a third pass. The key to the third pass is to attempt to virtually re-implement the paper: that is, making the same assumptions as the authors, re-create the work. By comparing this re-creation with the actual paper, you can easily identify not only a paper's innovations, but also its hidden failings and assumptions.

This pass requires great attention to detail. You should identify and challenge every assumption in every statement. Moreover, you should think about how you yourself would present a particular idea. This comparison of the actual with the virtual lends a sharp insight into the proof and presentation techniques in the paper and you can very likely add this to your scope of tools. During this pass, you should also jot down ideas for improvements to the paper.

At the end of this pass, you should be able to reconstruct the entire structure of the paper, as well as be able to identify its strong and weak points. In particular, you should be able to pinpoint implicit assumptions, missing documentation to relevant work, and potential issues with techniques."[1]

Review and Evaluation
"Good papers contain something of merit. You, an expert in the subject, should be able to find it (if it exists). However, the item of merit may be poorly presented, which can undermine the paper's value."[4] Remember that critical review does not mean negative review. Identify the flaws, but try to suggest how to fix the flaws. Be constructive. Mention what the paper's value would be if it were improved. When making evaluations, keep in mind, everyone will view a job differently. If the author has suggested a method of construction that is different from what you would choose, it does not make the approach wrong.

The newly developed assessment rubrics should be helpful in your evaluation of primary technical paper traits and the estimating criteria. The criteria should be assessed by the rubric and asking a series of questions about the paper.

To critically review the paper, you should ask the following questions:

- Has the author demonstrated HOW to perform the estimate?
- Does the author demonstrate estimating knowledge of the subject?
- Has the author provided enough technical or trade associated information for the reviewer to understand the subject?
- Does the author's approach reflect an expected level of expertise for a CPE?
- Has the author demonstrated how special considerations impact the estimate?
- Does the author's use and interpretation of methodology used to develop the estimate meet that of the current industry standards or is it outdated, leading to invalid results?
- Is the paper well written? Are the details of the estimate complete?
- Was the author successful in communicating his/her points?
- Is the use of figures, tables or examples appropriate?
- Are the organization, spelling, grammar, and style satisfactory?
- Does the paper present a sample estimate? Is the estimate calculated correctly? Major errors in mathematical calculations will require a re-submittal of the paper.
- Does the paper reference a sample sketch?

Writing the Critique
You will be asked to complete a rating based criteria score sheet (see sample) and to write additional comments. Responses that are too long to fit in the allocated space may be submitted on separate pages. You should keep a copy of the paper for reference should the candidate wish to discuss your findings. Below is the format that is recommended for submitting your comments.[4]
[format developed by Alan Meier, University of California, Berkeley]

(1) Title and candidate number of the paper

(2) Summary of paper

This needs to be only 1-3 sentences, but it demonstrates that you understand the paper.

(3) Good things about the paper (one paragraph)

This is not always necessary, especially when the review is generally favorable. However, it is strongly recommended if the review is critical. Such introductions are good psychology if you want the author to drastically revise the paper.

(4) Major comments

Discuss the author's assumptions, technical approach, analysis, results, conclusions, reference, etc. Be constructive, if possible, by suggesting improvements.

(5) Minor comments

The section contains comments on style, figures, grammar, etc. If any of these are especially poor and detract from the overall presentation, then they might escalate to the 'major comments' section. It is acceptable to write these comments in list (or bullet) form.

(6) Recommendations

Provide insight to back up your decision and suggest how to improve the quality of the paper.

When to Decline

You will be asked to finish a review within a specific time. "Unfortunately, a good review takes many hours to prepare and it must compete with other obligations. Therefore, you can (and should) decline to review a paper if you cannot devote the necessary time before the deadline.

Upon inspection of the paper you may realize that you are not competent to review the paper. This is nothing to be ashamed about because staff cannot perfectly match papers and reviewers."[4] You should notify the Certification Coordinator or your Regional Certification Board member immediately to discuss your concerns.

When you decline to review a paper, the coordinator will be particularly gratified if you suggest an alternate reviewer.

The Certification Coordinator keeps a list of volunteer reviewers. One goal is to avoid asking people to review papers too frequently. If you have had a change in status and wish to either be removed or added to the list, please contact the Society Business Office.

References

1. S. Keshav, "How to Read a Paper"
   University of Waterloo, Waterloo, ON, Canada

2. UC Davis English Department Composition Program

3. Libby Allison, Director, M.A. Program in Technical Communication,
   Department of English Texas State University

4. Alan Meier, 2003. "How to Review a Technical Paper"
   University of California, Berkeley

SAMPLE CONTENT CRITERIA REVIEW
TECHNICAL PAPER EVALUATION WORKSHEET

CandidateID#:

_____

Review for paper content:

Based upon a minimum of two readings, it is my opinion that this paper deserves the following rating based on the CONTENT criteria listed below:

CRITERIA	Excellent	Good	Acceptable	Poor	Unacceptable
1. Knowledge of Estimating	**5**	**4**	**3**	**2**	**1**
2. Demonstration of Estimating Experience	**5**	**4**	**3**	**2**	**1**
3. Composition, Spelling, Grammar and Style	**5**	**4**	**3**	**2**	**1**
4. Coverage of Important Elements	**5**	**4**	**3**	**2**	**1**
5. Cohesiveness and Continuity	**5**	**4**	**3**	**2**	**1**
6. Overall Technical Merit	**5**	**4**	**3**	**2**	**1**
Subtotal of Points					
Less Points for Late Submittal					

Thus, _____ total points of the possible 30 points have been earned.
A minimum of 18 points is required to accept this paper for purposes of granting Certification to the candidate.

Reviewer Comments: (use additional sheets if necessary)

_____

_____

Reviewer:_____Date: _____Phone: _____

Please check to indicate:
MATH ERROR: _____ Paper contains math errors and therefore cannot be accepted for the purpose of certification regardless of the score above.

NOTES

Primary Trait Rubric for Technical Writing

Trait	Exceptional / Good	Good /Acceptable	Poor	Poor / Unsatisfactory
Content	♦ Writing is purposeful with logic maintained throughout.	♦ Maintains clear logical subject/position.	♦ Subject/position is vague with no unifying statement. ♦ Drifts or has lapses in logic. ♦ Paper consists of repetitions and redundancies.	♦ Insufficient writing to show that criteria are met. ♦ Math Errors present
Support	♦ All major points fully developed and supported evenly by specific detail throughout the paper (e.g. explanation, evidence, examples, figures, tables and/or graphs). ♦ Supporting evidence is understandable and well-organized.	♦ All key points developed and supported by specific detail; some key points may be less developed than others (not even or balanced). ♦ Supporting evidence illustrates the key points but lacks depth.	♦ Some key points are developed by specific detail; some may be general and some may lack depth. ♦ Supporting evidence is minimal and/or not easily interpreted.	♦ Insufficient or repetitious writing that fails to develop key points. ♦ Lacks supporting evidence and/or supporting evidence is unrelated to key points.
Organization	♦ Structure is clear, appropriate and effective. ♦ All paragraphs are appropriate and purposeful. ♦ Coherence (paragraph to paragraph) and cohesion (sentence to sentence) are effectively demonstrated throughout paper. ♦ All points are logically presented and interrelated.	♦ Structure is clear and appropriate to purpose. ♦ Most major points are appropriately paragraphed. ♦ Coherence (paragraph to paragraph) and cohesion (sentence to sentence) are demonstrated with appropriate transitions. ♦ Most points logically presented and organized.	♦ Structure is evident. ♦ May have inappropriate or intrusive transitions that disrupt the progression of ideas. ♦ Some major points appropriately paragraphed. ♦ Has coherence (paragraph to paragraph) but lacks cohesion (sentence to sentence) or vice versa. ♦ May have one or more minor digressions.	♦ Structure is missing or attempted but not obvious to the reader. ♦ Limited evidence of appropriate paragraphing. ♦ Little structure within paragraphs. ♦ May have one or more major digressions.
Focus	♦ Clearly sets purpose of paper through introduction or overview. ♦ Effective conclusion that relates to introduction and unifies the writing.	♦ Clearly sets purpose of paper through introduction or overview. ♦ Clear conclusion.	♦ Subject/position identified by only a brief, general introductory statement. ♦ Conclusion is absent or only a verbatim reiteration of the introduction.	♦ Subject/position (or issue) is unclear.

Primary Trait Rubric for Writing Mechanics

Trait	Exceptional / Good	Good /Acceptable	Poor	Poor / Unsatisfactory
Sentences and paragraphs	♦ Usage of sophisticated sentence patterns ♦ Transitional phrases or sentences are appropriately used to make sequence of events clear.	♦ Simple and some complex sentences are used. ♦ Some paragraphing to show sequence of events/ideas.	♦ Sentence structure is usually correct. ♦ Simple sentences are used. ♦ Little attempt made to paragraph writing.	♦ Sentences do not make sense. ♦ No paragraphing.
Word choice	♦ Words are used correctly and precisely.	♦ Acceptable vocabulary. ♦ Words are technologically appropriate.	♦ Simple vocabulary.	♦ Incorrect vocabulary.
Spelling	♦ Spelling is correct, including complex and irregular words.	♦ Spelling is generally accurate.	♦ Frequent spelling errors.	♦ Spelling errors interfere with understanding.
Punctuation	♦ A range of punctuation including commas, apostrophes, colons and semicolons is used accurately and effectively.	♦ Periods and capitals are used correctly and punctuation is beginning to be used within the sentence.	♦ Frequent punctuation errors.	♦ Insufficient or lacks punctuation. ♦ Incorrect use of capital letters.

Technical Paper Grading Criteria

	Excellent (5 Point)	Good (4 Point)	Acceptable (3 Point)	Poor (2 Point)	Unacceptable (1 point)
Overall Criteria of Paper	➢ Meets and exceeds all standards ➢ Is free from grammatically errors ➢ Conveys a superior understanding of audience, purpose, and context ➢ Has a special quality ➢ Contains thorough, complete and accurate information ➢ Has outstanding visual display ➢ Is well developed and organized ➢ Contains appropriate examples and citations	♦ Is a very solid paper that meets the standards for the assignment and engages the reader ♦ May contain some minor flaws, small departures from the standards. ♦ Well written and well produced with a solid understanding of audience, purpose and context. Contains proper citations and examples and is sufficiently well developed and organized	♦ Is adequate in meeting standards ♦ Does the job but does not engage the reader or stick in his/her mind ♦ Paper may use generalizations to support points ♦ May contain grammatical errors (no more than one error per 100 words)	♦ Forces the reader to do too much work to understand or read it because of serious grammatical problems or incomplete information. ♦ Fails to meet an important requirement of the assignment.	➢ Work not completed or does not address the assignment. ➢ Math Errors Present

Estimating Grading Criteria

Trait	Exceptional / Good	Good /Acceptable	Poor	Poor / Unsatisfactory
Knowledge of Estimating	♦ Proper terminology for subject ♦ In-depth coverage of levels of detail ♦ Clear description of subject matter ♦ Methods used are consistent with industry standards ♦ Ready for publication	♦ Knows subject matter ♦ Includes sufficient detail to demonstrate experience ♦ Methods used are consistent with industry standards	♦ Lacks uniformity in estimate development ♦ Methods used are inconsistent with industry standards ♦ Estimate does not address all cost (direct/indirect)	♦ General lack of communicating how to develop an estimate ♦ Lack of important factors that may affect the estimate ♦ Methods are not that of accepted industry standards ♦ Math errors present and/or formulas are creating math errors.
Demonstration of Estimating Experience	♦ Documented all portions of the estimate in an accurate, logical, consistent manner ♦ Computer generated spreadsheet and drawings ♦ Accurate computations ♦ Provides methods for listing and calculating indirect cost ♦ Demonstrated a complete and thorough understanding of the project scope and constructability ♦ Includes discussion of impact on estimate costs of various risk factors	♦ Accurate, easy to follow format for estimates ♦ Hand written takeoffs or hand drawn sketches ♦ Manually calculated, accurate computations ♦ Consideration given to indirect cost ♦ Demonstrated an understanding of the project scope and constructability ♦ Mention of impact on estimate costs of various risk factors	♦ Little knowledge of all sections of the drawings and division specifications ♦ Does not demonstrate an accurate perspective of the total project scope ♦ Inaccurate details of project constructability ♦ Does not mention impact on estimate costs of various risk factors	♦ Errors (any) in estimate computation ♦ Lack of knowledge of all sections of the drawings and division specifications ♦ Inaccurate perspective of the total project scope ♦ Inaccurate details and project constructability

American Society of Professional Estimators
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Nashville, TN 37214

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How to Estimate the Cost of a Sanitary Sewer Installation in an Urban Environment

By Daniel George Frondorf

May 24, 2008

SAMPLE

I hereby acknowledge that the contents of this Technical Paper belong to the Society, which is free to publish or otherwise make such use of all or portions of the Paper as it sees fit. If applicable, I have designated by the use of 1/4" wide black tape on the right margin opposite the text or reference materials, those portions that are considered proprietary, and not available for the Society's use or publication. I have obtained and attached all documentation of releases required by copyright laws for all non-original materials incorporated or referenced in this Paper.

_____

Daniel George Frondorf

May 24, 2008

SAMPLE

Daniel George Frondorf is a Sitework Construction Estimator in Cincinnati, Ohio. Dan's career began as a Zoning Plans Examiner for a local municipality after obtaining an AAS in Civil Engineering Technology from Cincinnati Technical College. He moved on to two roadway contracting firms before starting an estimating consulting practice, concentrating on Sitework. Today he is very active in ASPE chapter 38, and is a faculty member of ASPE chapter 38 strategic partner ACI - Allied Construction Industries (a local contractor's benevolence organization, dedicated to providing contractors education, safety training, and workforce development), presenting seminars on Construction Estimating to ACI's members.

SAMPLE

How to Estimate the Cost of a Sanitary Sewer Installation in an Urban Environment

CPE Candidate No. 0308035

May 2008

SAMPLE

How to Estimate the Cost of a Sanitary Sewer Installation in an Urban Environment

Table of Contents

SAMPLE

Section 1 Introduction

This technical paper is intended to provide the reader with a general understanding of performing professional construction estimating services as they relate to the installation of sanitary sewer systems that are built within an existing urban environment. Such installations are typically more challenging than new work performed in a new residential or commercial development or subdivision, or an installation built within previously undisturbed ground. Conflicts with existing utilities, buildings, roadways, and with the humanity occupying these features requires the Construction Estimator to factor much more than just the costs of labor, materials, and equipment into a cost estimate.

Main CSI (Construction Specifications Institute 2004 MasterFormat) Division

Division 33 Utilities

Main CSI (Construction Specifications Institute 2004 MasterFormat) Subdivisions

Subdivision 33 30 00 Sanitary Utility Sewerage Piping

Subdivision 33 39 00 Sanitary Utility Sewerage Structures

Brief Description

The author will discuss the requirements of the Construction Estimator to review the plans and specifications, to perform a scope of work review, to perform quantity takeoffs, to compile all direct and indirect costs, and to factor all of these into a cost estimate using production rates that reflect the challenges inherent to working in an urban environment. Sample takeoffs and cost estimates will be included. The paper will be presented from the point of view of a Construction Estimator who is preparing a Prime, or General Contract bid, as opposed to the point of view of a subcontractor or material supplier. It is assumed that the plans and specifications have been prepared to the level of CD (Construction Documents) by the project's civil designer. These projects are typically bid as unit priced contracts rather than as lump sum contracts. The contractor provides a unit price to quantities established by the owner or engineer, and the extended prices are all summed to determine an overall contract amount. Payments are then made at the stipulated unit prices as the work proceeds for the quantities completed.

SAMPLE

Section 2 Types of Methods of Measurements

Quantity takeoffs in utility construction measure several components, including excavated trenching spoils by **CUB YD**; pipe bedding and backfill by **CUB YD** or **TON**; specialty backfills (such as low density or “flowable” backfill) by **CUB YD**; piping material by **LIN FT**; fittings, such as tees, saddles, wyes, and bends by **EACH**; structures such as manholes by **VERT FT**; pavement restoration by **SQ FT** or **SQ YD**; lawn and yard restoration by **SQ YD**; topsoil for lawn restoration by **CUB YD**; connections to existing structures (aka taps) by **EACH**; and traffic maintenance typically by **LUMP SUM**.

Items requiring cubic yardage or tonnage measurements require 3 dimensional takeoffs, and the Construction Estimator can typically find these dimensions on the plan and profile sheets and on the typical sections or details that go along with them. Length and depth of trench can be found on the plan and profile pages; trench widths are shown on the typical sections or details. Often the width of the trench for a utility installation is dictated by the local governing agency or utility authority. Usually these are minimum trench widths. However, the Construction Estimator must factor several important items into his or her determination of actual trench width, including but not limited to safety; soil types; type of equipment needed to achieve the required depth of excavation; proximity to adjacent existing utilities, pavement, railroad tracks, buildings, fences, or any other undisturbable item. Once accurate lengths, depths, and widths can be determined, the 3 required dimensions can be used to calculate excavated trench volumes, pipe bedding and backfill, and specialty backfills. If a bedding or backfill item, such as granular fill, is sold by the TON, the Construction Estimator will utilize the appropriate conversion factor from CUB YD to TON to determine the quantities required to be purchased. It is necessary for the Construction Estimator to factor waste into the calculations. Trench spoils may swell when excavated and loaded onto a truck, making the actual volume of material to be handled more than the “bank” yardage as measured from the plans. Shrinkage of backfill may occur depending on the material placed as it is compacted, and is also subject to spillage loss as material is handled between the delivery trucks, the stockpile, and the trench itself.

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Piping material is sold in differing lengths depending on the type of material, so it is important to measure each run of pipe between each utility structure. In this way, the numbers of pipe sections, or “sticks”, for each run can be determined, and the appropriate whole number of pipe sections, or “sticks” can be included in the cost estimate. For example, a pipe run of 8” PVC SDR 35 pipe between 2 manholes is 94 LIN FT. This pipe is sold in 13’ sections. The required number of sections, or “sticks”, is 94/13 = 7.23, or 8. Rounding up to the next whole number is required because the pipe supplier will not sell .23 of a section or “stick”.

Pipe fittings required for connections or bends are simply counted on the plan and profile sheet. Manholes and other structures are determined by their VERT FT, and their locations and depths in VERT FT can be found on the plan and profile sheets. This is also true for connections, or taps, of the new sewer pipe to an existing pipe or structure. While the count, or number (EACH) of these connections is important, so is their depth in VERT FT and width in FEET, both needed to calculate the quantity of excavated trench spoils and backfill that must be factored into the cost estimate. Pavement and lawn and yard restorations are typically measured in AREA (2 dimensional) quantities, such as SQ FT, SQ YD, or ACRE (an area measurement containing 43560 SQ FT).

Very often sanitary sewers installed in urban settings are constructed within, around, or adjacent to vehicular and pedestrian traffic. This is one of the more challenging aspects of urban utility work. Costs to re-route, detour, barricade, or otherwise separate construction from vehicles and people are usually accounted for and paid for by the LUMP SUM, wherein all of the costs required (signage, pavement markings, traffic control devices, temporary pavement, etc..) are factored into a single pricing item. Usually all of this work must comply with the current edition of the Manual on Uniform Traffic Control Devices. This is the official publication of the Federal Highway Administration and is yet another document with which Construction Estimators must familiarize themselves.

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Section 3 Project Specific Factors to Consider in Takeoff and Pricing

Small Quantities vs. Large Quantities

It is widely understood that projects involving larger quantities of materials have lower unit prices than projects involving smaller quantities. On the larger projects, there is simply greater opportunity to spread direct, indirect, and overhead costs than on a smaller project. This certainly applies to utility construction, even in an urban setting. A project involving 4000 LIN FT of pipe and 24 structures will have lower unit pricing per LIN FT for the pipe and per EACH for the structures than a project having only 240 LIN FT and 2 structures.

Geographic Location

Costs can be impacted by several factors of geographical origin. Material availability varies regionally and so do their costs; project location can affect the costs of material delivery and trucking associated with the proximity of the jobsite to the supplier location or waste site in the case of excavated spoils that must be disposed of legally; labor availability varies regionally and so do its costs; in more northern regions the construction season for outside work such as utility construction is much shorter than in all other regions; additionally, soil in northern regions is more subject to freezing and this fact alone can decrease production rates for trenching, driving unit costs up.

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Seasonal Effect on Work

Utility construction in temperate climates is more impacted during the colder winter months than the hot summer months, but both extremes can contribute to variable production rates and therefore estimated construction costs. Cold weather tends to slow construction by inhibiting the efforts of man and machine, and by decreasing the ability of backfill to be compacted. Protection of poured concrete must be provided in extreme cold, extreme heat, or in rainy conditions. Visibility and safety are compromised during rainy or cloudy days; the surfaces of equipment and tools are less stable when covered with water or ice; construction schedules can be negatively impacted by poor weather, or even by simply seasonal weather. The Construction Estimator has

a duty to make himself or herself aware of the project's schedule as part of their bid review, and must incorporate the likely seasonal conditions that will be in place during that schedule and the additional costs that result, into their cost estimates.

Special Conditions Affecting Utility Installations in an Urban Environment

Because of the nature of installing a new sanitary sewer (or any utility) in an urban environment, there are several additional factors that must be accounted for by the Construction Estimator. Not the least of these is the presence of existing utility lines (water, gas, sanitary, storm, steam, etc…) that must be protected, crossed, shored, supported, exposed, re-directed, raised, lowered, or otherwise dealt with by the installation of the new sanitary sewer. Sometimes, but not always, these existing utilities are indicated on the plan and profile sheets and give the Construction Estimator an idea of what is necessary to deal with the existing while installing the new utility. Sometimes only a general idea of the location of the existing utility is given, with or without a depth. In these cases the contractor is required by either plan notes or specs or both to expose, locate, and protect the existing utility. The costs for such an operation is typically considered incidental to the cost of the new sanitary sewer. The Construction Estimator must use his or her own experience and judgment (as well as a site inspection) to determine how to handle such a requirement, which may require specialty subcontractors known as "potholers", or vacuum excavation specialists who use a combination of compressed air, high pressure water, and a long vacuum hose to extract soil from the vicinity of existing utilities. These specialists can use this non-digging excavation technique to safely expose existing utilities without conventional excavation equipment (backhoes, etc...). Once exposed, these utilities can be protected and hand dug around to allow the new installation of the sanitary sewer. It is not difficult to understand how this process can slow down the installation process and cause lower production rates. Requirements such as vacuum excavation are not typically required in working in virgin soil or previously undeveloped ground, and production rates on sites such as these are much faster. The Construction Estimator must also be aware of other existing conditions, such as adjacent pavement or buildings that possibly require shoring or other protection during new sanitary sewer

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installation. In many urban areas and in older cities, it is not uncommon to discover abandoned railroad tracks and ballast under existing pavement, forgotten remnants of streetcar systems and inter-urban railroads. It is not unusual to discover building foundations extending into the right of way of a street, or similar unforeseen circumstances. When a pipe crew is handling or dealing with requirements arising from these kinds of challenges presented by the urban environment, they are not laying pipe or building structures, and therefore productivity slows.

Because most urban areas have already been heavily developed, civil engineers and utility agencies often have no choice but to locate new utilities within the street pavement. This causes the need for not only costly pavement restoration, but usually the need for costly low density or flowable backfills to be placed within new pipe trenches. Working in the street also requires traffic maintenance. Productivity slowdowns due to traffic backups can be caused by the construction itself (pipe crews waiting for dumptrucks to return empty in the trenching process). Because of the close proximity of human life, either in vehicles or on foot or within buildings adjacent to the new sanitary sewer installation, the risk of harm increases to include not just the construction operations themselves, but to the human element nearby. Safety is always something the Construction Estimator should take seriously and account for, but it has an even greater importance on these kinds of projects because the sites are occupied by people, who must be protected. When constructing a new building, the occupation of it by the owners and their human resources occurs after construction is complete. Not so with utility installations in an urban environment. Because of the need to account for and protect humans, many utility agencies and governments have working hour restrictions and noise limits that must be adhered to by the contractor. These further limit productivity and even the choices in equipment available to perform the work, especially if night time work is required. Many cities have morning and afternoon rush hour periods during which no traffic restrictions are permissible (for example 6-9 AM and 3-6 PM, effectively reducing the workday to 6 hours, or from 9AM to 3PM). This further limits productivity. Additionally, available space for staging, job trailers, office trailers, material storage, and temporary facilities can be significantly limited. Many contractors must work out deals with private property owners to make space available nearby or within the project site. Maintaining and

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restoring these sites are good examples of indirect costs that must be accounted for by the Construction Estimator.

Lastly, the Construction Estimator must become thoroughly familiar with any geotechnical report issued as part of the bidding documents. These reports contain important information regarding the types of soil that the contractor can be expected to encounter during excavation and trenching. Limestone, shale, hard clays, and glacial till soil types can slow down trenching, while granular and sandy soils tend to cave in and can require additional excavation or expensive shoring to maintain the integrity of the trench. Soil types and trench depth are also important safety factors as well, and have an impact on productivity by possibly requiring trench sloping, safety overdigs, or possible trench box protection for the pipelaying crew. It is important to remember that whatever is excavated must be backfilled, and if granular backfill from an offsite source or flowable backfills are required, these can add significant costs to a sanitary sewer project (flowable backfill is required by many jurisdictions under pavement or within rights of way because it virtually eliminates future settlement of the utility trench area). The geotechnical report may possibly also identify any possible hazardous materials or interferences caused by existing features.

In summary, there are SIGNIFICANT factors affecting construction costs for a sanitary sewer installation in an urban environment beyond simply small vs. large quantities, geographical location, and seasonal effect on the work. The congested, surgical nature of working in an urban setting is ripe with challenges not seen in working in a previously undeveloped setting.

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Section 4

Overview of Labor, Material, Equipment, and Indirect Costs and Approach to Markups

Labor and equipment costs are calculated on a per hour basis and are typically determined based on and include the local prevailing wage rates (Davis Bacon wages) that are usually required on public works projects in most jurisdictions. Because of the need to account for so many things other than pipe laying, we will calculate labor and equipment costs in this estimate based on 10 hour days, and to keep our crews working a 40 hour week, we will use a 4 day work week. Our crew in this example will be comprised of the following :

Cost Item	Quantity	Unit	Unit Cost	Total Cost
Rubber Track Backhoe incl. Operator	1	HOUR	$150.00	$150.00
Rubber Tire Loader incl. Operator	1	HOUR	$125.00	$125.00
Tandem Axle Dumptruck incl. Operator	4	HOUR	$75.00	$300.00
Trench Box – Shoring	1	HOUR	$25.00	$25.00
Labor – Pipelayer	2	HOUR	$55.00	$110.00
Labor – Laborer	4	HOUR	$50.00	$200.00
Supervision – Foreperson	1	HOUR	$65.00	$65.00
Pickup Truck	2	HOUR	$15.00	$30.00
Tool Truck	2	HOUR	$20.00	$40.00
TOTAL HOURLY COST				**$1,045.00**
TOTAL DAILY COST based on a 10 HOUR DAY				**$10,450.00**

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Material costs are based on the takeoff quantities and will include whatever waste factors are included by the Construction Estimator. It is imperative to include the costs of freight on board (FOB) to the project site or to wherever the contractor plans to stage the project. Supplier quotations are solicited from pipe and fitting manufacturers and dealers, as well as from precast concrete suppliers for structures. Other supplies for which pricing must be obtained include granular bedding, granular and flowable backfills, and steel castings for the tops of the structures.

In addition to labor, equipment, and materials, subcontract quotations must be solicited from subcontractors to provide the following services : surveying and layout; asphalt pavement restoration; concrete pavement restoration; topsoil, lawn, and sod restoration; pavement markings if any; traffic control and maintenance specialty subcontractors; and pavement sawcutting.

There are additional indirect costs that will be incurred, such as permits, performance bonding, temporary facilities, and taxes (if applicable). Lastly, the contractor must calculate his or her own

managerial and in house costs related to project supervision and overhead attributable to this particular project.

After all costs have been calculated, all production rates reasonably estimated, and all indirect and overhead costs factored in to the total cost estimate, the management of the contractor will decide what approach to take with respect to markup, or percentage of the project's costs that it will hope to generate as profit (defined as total revenue less total costs). If the contractor has a heavy current backlog of work, he or she may decide to put a larger margin of profit into a project. If the contractor needs work, the markup decision can be little if any. Projects with higher risks and less competition tend to generate higher markups, while those with low risk and several bidders will tend to bid more competitively, and therefore have lower markups among the bidders. Markup decisions are highly variable and usually rest with the top management of each contracting firm.

Section 5 Special Risk Considerations

As previously discussed, installing sanitary sewers in an urban environment has no shortage of special risks. Such installations are typically more challenging than new work performed in a new residential or commercial development or subdivision, or an installation built within previously undisturbed ground. Conflicts with existing utilities, existing buildings, existing roadways, and with the humanity occupying these existing features requires the Construction Estimator to factor much more than just the costs of labor, materials, and equipment into a cost estimate. Slower production rates, scarcity of staging areas, exposing and locating existing utilities, dealing with traffic, shoring and protecting existing utilities and buildings, expensive pavement restorations, and extensive use of expensive flowable backfill are all factors that contribute to the complexity of installing sanitary sewers in an urban environment.

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Section 6 Ratios and Analysis – Testing the Bid

Because all sanitary sewer projects installed in an urban environment are unique, and because they are inherently full of special risk considerations, it is not always possible to develop rules of thumb that apply uniformly to all projects. However, it is always good estimating practice to maintain a database of historical costs from both field-built projects as well as estimated but unbuilt projects (of which every Construction Estimator will have a plethora). The unit costs, methods, and other particular information contained in these projects or estimates will prove invaluable as new projects are considered and new bids prepared and submitted. Consistency, accuracy, and completeness will be the result, and better bids will be submitted over the long haul if the contractor realizes that the estimating work performed today on an unsuccessful bid will likely pay off tomorrow or further down the road because of the practices and research put into today's estimate.

Section 7 Other Pertinent Information

The Construction Estimator must be aware that many local governments and utility authorities 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. Additionally, several jurisdictions are requiring bidders to adopt company wide policies regarding drug and alcohol use by employees, or actually require drug testing itself as a condition of contract award. It also has become more common that jurisdictions are requiring certain levels of OSHA (Federal Occupational Safety and Health Administration) safety training for superintendents, such as the OSHA 10 hour and the OSHA 30 hour courses. While matters such as these do not directly add cost to a construction project, they do so indirectly and must be accounted for by the Construction Estimator. Finally, all contractors must avail themselves of the free utility location services provided in each state by the individual "call before you dig" services offered by the member utilities. These services usually require a minimum of 48 hours notice before starting excavation, giving the service provider the opportunity to field locate existing underground utilities that may be encountered during a particular construction project. These

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services save dollars and lives every year by informing contractors of potential underground conflicts. This is an invaluable service to the public and to the contractor community, and do not add cost to a construction project.

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Section 8 Sample Plan and Profile View

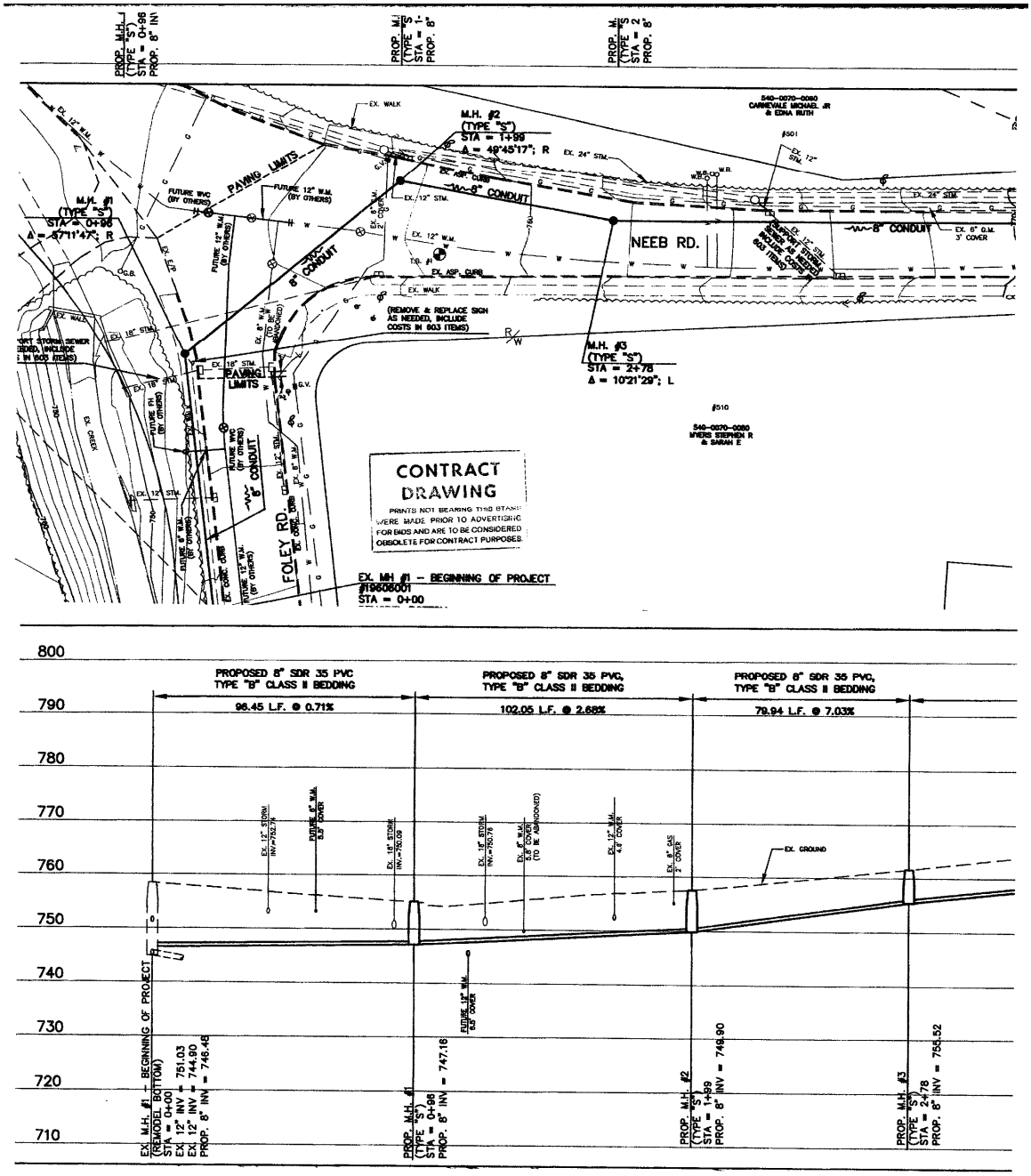

Figure 1

On this page we see a partial plan and profile (Figure 1) of a typical urban sanitary sewer installation. Please note on the profile (lower) portion the existing utility lines that will be encountered during the installation of the new sanitary sewer, which are also visible on the plan (upper) portion, which also indicates the new sanitary sewer within the paved area as well as the paving restoration limits. The interference with traffic on this project is clearly seen as the pipe run between MH1 and MH2 cuts diagonally across the intersection of the 2 streets.

Section 9 Sample Trench and Restoration Detail

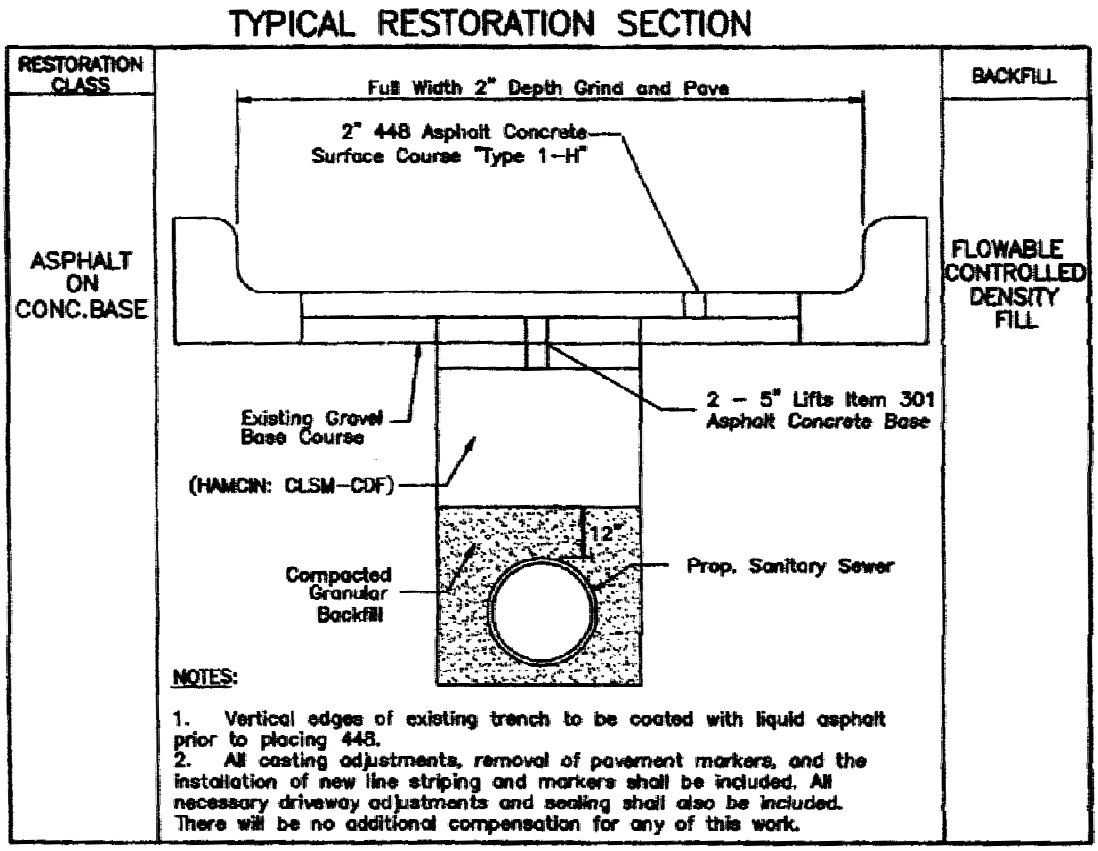

Figure 2

On this page we see a typical trench – restoration detail (Figure 2), NOT drawn to scale, that instructs the contractor how to backfill the new sanitary sewer trench as well as the asphalt pavement above it. Note that while compacted granular bedding is required below the new pipe, and compacted granular haunching is required on the sides of the new pipe, no dimensions for the depth or width are given. A 12" dimension is given for the compacted granular backfill above the pipe. Above that a flowable controlled density fill is required up to the level of the pavement subgrade, above which 10" of asphalt base (in 2 – 5" layers) is specified, then finally the surface restoration that includes grinding and resurfacing the top 2" with asphalt surface mix.

The Construction Estimator will determine the required trench depth from what is shown on Figure 1. The width of the trench will be determined by factors from a variety of sources, including but not limited to the geotechnical report (for soil types), bucket width of the trackhoe or other excavation equipment needed to reach the depth shown on Figure 1, the requirements of OSHA for a safe trench type at the needed depth, and the proximity of existing utilities, buildings, pavements, or other features that must be protected.

Once the trench width is calculated the volumes of excavated spoils and backfill quantities can be determined. These volumes must be calculated also for each structures (manhole, cleanout, junction box, etc..).

Section 10 Sample Estimate – Takeoff and Pricing Sheets

(Please note that these takeoffs are NOT based on the plans seen in Figure 1 and 2)

SANITARY STRUCTURE TAKEOFF

Name	Type	Rim Elevation	Invert Elevation	Depth VERT FT
SMH 1	48" Standard MH	848.06	841.62	6.44
SMH 2	48" Standard MH	844.76	838.26	6.50
SMH 3	48" Standard MH	841.65	834.98	6.67
SMH 4	48" Standard MH	838.79	832.48	6.31
SMH 5	48" Standard MH	838.02	831.88	6.14
EX. MH	Ex. 54" MH	836.64	828.66	7.98

SANITARY CONDUIT TAKEOFF

From Structure	To Structure	Size (inch)	Quantity	Unit	Type	Avg. Depth
SMH 1	SMH 2	12	168	LIN FT	SDR 35	6.47
SMH 2	SMH 3	12	163	LIN FT	SDR 35	6.58
SMH 3	SMH 4	12	130	LIN FT	SDR 35	6.49
SMH 4	SMH 5	12	30	LIN FT	SDR 35	6.22
SMH 5	EX. MH	12	161	LIN FT	SDR 35	7.06
	Total	**12**	**652**	**LIN FT**	**SDR 35**	

TRENCH VOLUME TAKEOFF for 12" Pipe

Assumes 4' wide vertically sided trench utilizing full height shoring box trench protection in silty clay soil

Allows for 12" of overdig below the pipe for bedding material

Trench width of 4' allows for 18" of haunching on either side of pipe

Trench Length LIN FT	Trench Width FEET	Average Depth VERT FT	Trench Volume CUB FT	Trench Volume CUB YD
652.00	4.00	7.57	19732.13	730.82

PIPE VOLUME TAKEOFF for 12" Pipe

Assumes 4' wide vertically sided trench utilizing full height shoring box trench protection in silty clay soil

Allows for 12" of overdig below the pipe for bedding material

Trench width of 4' allows for 18" of haunching on either side of pipe

Area of Cylinder = Pi (3.14)*radius squared

Volume of Cylinder = Area of Cylinder * Length

Trench Length LIN FT	Pipe Diameter FEET	Pipe Radius VERT FT	Pipe Area SQ FT	Pipe Volume CUB FT	Pipe Volume CUB YD
652.00	1.00	0.50	0.79	511.82	18.96

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GRANULAR BEDDING, HAUNCHING, and PIPE COVER TAKEOFF for 12" Pipe

Assumes 12" granular bedding, 12" granular pipe cover, and 18" granular haunching either side of pipe

Total depth of granular backfill is 36"; total width of granular backfill is 48"

Trench Length LIN FT	Granular Depth FEET	Granular Width FEET	Granular Volume CUB FT	Pipe Volume CUB FT	Granular Volume CUB FT	Granular Volume CUB YD
652.00	3.00	4.00	7824.00	511.82	7312.18	270.82
					Net	**Net**

FLOWABLE BACKFILL TAKEOFF for 12" Pipe

Assumes flowable backfill above granular backfill to 12" below trench top to allow for pavement or topsoil surface

Trench Length LIN FT	Average Trench Depth VERT FT	Granular Depth FEET	Flowable Depth FEET	Flowable Width FEET	Flowable Volume CUB FT	Flowable Volume CUB YD
652.00	6.57 12" below surface	3.00	3.57	4.00	9310.56	344.84

COST ESTIMATE for SAMPLE 12" SANITARY SEWER PROJECT

Assumptions

Production Rate for Pipe Installation in an Urban Area is 100 LIN FT per DAY

652 LIN FT / 100 = 6.52 or 7 DAYS

Production Rate for Structure Installation in an Urban Area is 1 EACH per DAY

5 EACH / 1 = 5 DAYS Total Crew Days = 12

Pavement Restoration : 4' wide * 652 LIN FT * 12" asphalt = 97 CUB YD

Pipe Sticks at 13' length, per run :

168 LIN FT	13
163 LIN FT	13
130 LIN FT	10
30 LIN FT	3
161 LIN FT	13
Total Pipe Sticks	**52**

at 13' each = 676 LIN FT actual pipe quantity required

At each structure and tap - allow 12 CUB YD Granular Backfill and 6 CUB YD Flowable backfill

Subcontractor items are the quoted prices

Material items are suppliers quotes and include FOB but exclude sales tax

Cost estimate continues on next page

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Cost Estimate **(Please note that this cost estimate is NOT based on the plans seen in Figure 1 and 2)**

Cost Item	Quantity	Hours or Units	Days	Unit Cost	Total Cost
Rubber Track Backhoe incl. Operator	1	10	12	$150.00	$18,000.00
Rubber Tire Loader incl. Operator	1	10	12	$125.00	$15,000.00
Tandem Axle Dumptruck incl. Operator	4	10	12	$75.00	$36,000.00
Trench Box – Shoring	1	10	12	$25.00	$3,000.00
Labor - Pipelayer	2	10	12	$55.00	$13,200.00
Labor - Laborer	4	10	12	$50.00	$24,000.00
Supervision – Foreperson	1	10	12	$65.00	$7,800.00
Pickup Truck	2	10	12	$15.00	$3,600.00
Tool Truck	2	10	12	$20.00	$4,800.00
Precast Structures >6'<8' tall	5	EACH	n/a	$672.60	$3,363.00
Steel Frame and Grate	5	EACH	n/a	$424.80	$2,124.00
Tap Existing Structure depth = 7.98'	1	EACH	n/a	$800.00	$800.00
Granular Backfill incl. 12% waste (structure)	81	CUB YD	n/a	$16.40	$1,328.40
Flowable Backfill incl. 5% waste (structure)	34	CUB YD	n/a	$58.20	$1,978.80
12" SDR 35 PVC Sanitary Conduit	676	LIN FT	n/a	$6.72	$4,542.72
Granular Backfill incl. 12% waste (pipe)	304	CUB YD	n/a	$16.40	$4,985.60
Flowable Backfill incl. 5% waste (pipe)	363	CUB YD	n/a	$58.20	$21,126.60
Sawcutting (trench L*2) at 8" deep	1304	LIN FT	n/a	$2.60	$3,390.40
Asphalt Trench Restoration Subcontractor	97	CUB YD	n/a	$238.60	$23,144.20
Potholing Subcontractor - expose utilities	1	8	4	$324.00	$10,368.00
Law Enforcement Officer with Cruiser	2	8	12	$45.75	$8,784.00
Surveying and Layout Subcontractor	1	8	4	$224.00	$7,168.00
Subtotal					**$218,503.72**
17.5% Overhead and Internal Costs					$38,238.15
2% Performance Bonding					$4,370.07
12.5% Profit					$27,312.97
Total Bid Amount :					**$288,424.91**

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Section 11 Copy of Topic Approval Letter from ASPE Certification Board

[redacted]

[redacted]

From: Tanya Graham [tanya@aspenational.org]
Sent: Friday, February 15, 2008 1:16 PM
To: [redacted]
Subject: ASPE Certification Topic Selection

Dear [redacted]

The Certification Board is pleased to inform you of the acceptance of your Professional Evaluation Application.

You are in the **March 08 Cycle.**

They have selected the following topic from those you submitted for your technical paper. Your paper is due no later than July 13, 2008.

HTETCO a Sanitary Sewer Installation in an Urban Environment.

Your Candidate Number is **0308035** and should be included on all correspondence. This number will be used to identify your technical paper, exams, and/or DST Questions and Problems and will maintain confidentially throughout the certification process.

Please sign and return to me either by mail or fax (615-316-9800) that you are accepting this topic.

[redacted]

Please feel free to contact me with any questions.

*HTETCO = How to Estimate the Cost of

Sue Parrish
ASPE Certification
Phone: 615-316-9200
Fax: 615-316-9800

5/29/2008

Section 12 Terminolgy-Glossary

Construction Specifications Institute 2004 MasterFormat
The 2004 revised edition of the Construction Specifications Institute directory of construction specification itemizations used extensively throughout the construction industry by designers and builders to classify, itemize, and arrange specifications (the actual instructions on how to build a particular part of an overall project). Editions previous to 2004 contained only 17 divisions; the 2004 MasterFormat contains over 40.

Davis-Bacon Act of 1931
This is a United States federal law which established the requirement for paying prevailing wages on public works projects. Most federally, state, and locally funded public works projects in the United States are subject to this act. Prevailing wage rates for public projects are usually determined by each state's Department of Labor.

Flowable Backfill
A product used to backfill pipe trenches that is composed of various ingredients including but not limited to sand, water, portland cement, fly ash, and other agents. Flowable Backfill is delivered in conventional ready mix concrete trucks and is also typically sold by the cubic yard. Because it is flowable, it is able to enter every open space within a trench and therefore virtually eliminates future settlement of a trench caused by incomplete backfill with other products or incomplete compaction. Flowable backfill does not require compaction, and often "sets up", or hardens, rapidly, enabling faster trench closings and sooner opening of a trench to traffic.

Pipe Bedding
That part of backfill around an installed utility pipe that surrounds and supports the bottom of the pipe.

Pipe Haunching
That part of backfill around an installed utility pipe that surrounds and supports the sides of the pipe.

Shoring
Any method of supporting an existing feature within on upon the ground that is disturbed by excavation. This can include steel trench boxes to prevent a vertical wall of a trench or shaft from collapsing; drilled steel, concrete, or wood piers with wood or concrete lagging panels to support exposed trench walls; temporary wood or concrete posts or supports to hold up an existing pipe exposed by excavation; these supports can be temporary or left in place after excavation.

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