PDHonline Course C372 (6 PDH)

Bid Document Preparation for Civil Engineering Projects

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Course Content

A. REVIEW OF PROJECT PLANNING, DESIGN, AND BID DOCUMENTS

Outline of the Process

1. Initiation of Project: This step is critical in that it establishes the basic project scope, where the project is to be constructed, and sets up a preliminary budget figure. [For some reason, the budget figure established here is sometimes cast in stone when it is least likely to be accurate. This can cripple an otherwise good project and can lead to all kinds of problems. This seems most likely to occur on government projects.]

2. Preliminary Project Planning: Planning can be performed in a variety of ways, depending on the agency, type of project, and personnel involved. For example, in planning a major highway, a well-established procedure is generally followed, based on the FHWA and NEPA for those highways receiving federal aid. [NEPA is the National Environmental Policy Act of 1969.] Most States have adopted some type of planning process for highways which closely follows the requirements of NEPA and the FHWA, since federal aid may be requested at some point in the planning or design process. During the planning process, initial design parameters should be established, the budget should be refined, and preliminary engineering should occur to the point that the hard design and construction plans package preparation can commence without a lot of unanswered questions. Engineering staff should work closely with the planners to ensure critical issues are considered fully during the planning process.

http://www.epa.gov/compliance/basics/nepa.html

3. Design/Engineering/Construction Plans Preparation: At this stage in the process, the design is prepared and placed on drawings in a standard format for construction. Construction details are generated and/or provided from standard details, with sufficient instructions to the contractor to allow the project to be constructed as desired by the owning and maintaining entity or agency.

4. Integration of specifications and bid items into the package: This final and in many ways most important step [it determines whether the designer will be exposed to construction claims] is often left to a junior technician with no construction experience or bid experience. The bid items must accurately represent the work, and should conform to generally accepted current construction practice for the type of project being built. If the bid items are inadequate or require the contractor or bidder to make too many assumptions, and/or combine major work items into one or two pay items, there will be problems later on down the line. Earthwork is always a primary consideration, and is the one single item which may make or break the contractor. We will examine the role of earthwork on a civil construction project in the following sections of this course.

B. DESIGN PROCESS: CIVIL PROJECTS - HORIZONTAL CONSTRUCTION

For a typical civil project involving horizontal construction, we have the five major components of: (1) drainage; (2) underground utilities; (3) concrete work; (4) paving; and (5) earthwork. Drainage, underground utilities, concrete work, and paving are fairly standard items assuming the quantities have been calculated correctly and the key components have been specified properly on the drawings. Let's review these standard items (excluding earthwork for now) to be sure we can specify the best, least expensive, and most easily-installed components:

1. DRAINAGE - Is the project private or government? Does the Owner have a preference for particular materials? Is concrete drainage pipe mandatory due to vehicle loading or maintenance reasons? If plastic pipe and inlets are used, is their use confined to passenger car areas? Have plastic pipe or drainage structures been used in a similar installation? Most State DOT's require concrete or metal pipe for stormwater systems. If metal pipe is used, it is necessary to perform a corrosion analysis prior to specifying. Also, use of concrete pipe with "mud" joints and no rubber gaskets is a trick many contractors will use to clear out junk pipe from their storage yards. Use of "mud" (mortar) joints should not be allowed on a project. In all cases with government projects, standard specifications will be used, and should be checked for details on the items noted above.

2. UNDERGROUND UTILITIES - Specifications for materials should be the first item agreed upon, otherwise you will be backing into the design. Designs which involve water systems or sanitary sewer systems are generally all regulated by State Health Departments, County Health Departments, or environmental boards or agencies acting under statutory authority. It is incumbent upon the design firm to be fully aware of the regulations involved in designing and permitting such systems. Specifications for private utility lines and conduit under pavement or under buildings shold be considered carefully and not just left to the utilities themselves. Some items, once installed, cannot be readily excavated and replaced. If there is a problem with a utility line under a large building slab, you have the possibility of a replacement which may need to be placed in the open or in an inconvenient location, thus destroying any finished appearance which was present.

3. CONCRETE WORK - Have all items been listed with appropriate construction and fabrication details included in the construction plans package, or are there clear references to standards, state D.O.T. handbooks or references, and other common, universally accepted standards? Is the design concrete strength clearly specified either on the drawings or noted by reference to the appropriate specification section? If you make this information into a scavenger hunt, you will likely get something other than what you designed.

4. PAVING - Has concrete or asphalt pavement been specified? Are the specifications appropriate? Is subgrade drainage a problem? Is the base course and subgrade correctly defined on the construction plans? If asphalt, has the mix been defined or identified by reference? Usually this requires a referral to a state D.O.T. standard mix and specification. Have pavement surface tolerances been specified? Are spot elevations or finished surface grades shown on the construction plans? Some type of pavement cross-sections should be drawn to clearly indicate what the finished product is to be. There must be no ambiguity.

C. DESIGN PROCESS - STAGING AREAS OR WORK YARD

Have you considered a staging area for the contractor's material and equipment while the job is in progress? If a government project, adjacent land may be available, but its use should be outlined in the text of the bid documents. Most governments will require some type of rental fee for use of their land. In some cases, a separate land use agreement will have to be processed through the governmental agency which initiated the project and which executes the construction contract. Can the existing right-of-way be used for staging? If so, this also may require explicit permission, either by inclusion in the bid documents or by separate agreement. Does allowing use of existing right-of-way jeopardize safety of the roadway for vehicle users? If the project involves a bridge, what are the limitations involved in operating construction equipment on the existing bridge, if any? Should material storage on an existing bridge be expressly prohibited due to dead load restrictions? Some projects are too large or too land-locked to ignore the work yard / staging area problem, and just assume it can be left to the contractor to "figure it out." These issues are an open invitation for change orders during construction.

D. DESIGN PROCESS - EARTHWORK

The earthwork is always the wild card, due to: (a) hidden or unknown underground features; (b) ground water [which is sometimes left to the contractor to worry about, because designers choose to ignore it for cost or convenience]; (c) subsidence of the existing soil; (d) soil type [here we are referring to plastic clay, rock, or other unmanagable soils]. If any of these four earthwork items are ignored, the stage has been set for a construction claim, or series of construction claims which will result in indeterminate cost over-runs. Exploration of underground conditions and expert soil analyses are of primary importance on any civil project. This aspect of the design & bid package preparation cannot be left to an inexperienced technician or "green" engineer. If possible, arrange with the owner or contracting agency to provide in-depth soil analyses separate from the civil design process, at the commencement of design. This is a fundamental issue. A site contractor or highway contractor always makes the bulk of its profit from earthwork.

Earthwork details

In order to properly understand earthwork, one must understand how a contractor views a horizontal construction project, and how he will calculate his earthwork costs. Let's look at the steps involved in providing earthwork & pavement for a typical project:

1. **perform demolition of structures, remove buried objects;**
2. **clear large objects from the site; [trees]**
3. **strip grass and vegetation from the work area;**
4. **stockpile re-usable strippings;**
5. **proof-roll the building and parking (paved) areas;**
6. **perform cut operations where required;**
7. **stockpile usable onsite cut material;**
8. **perform onsite fill operations using onsite cut from stockpile;**
9. **compact the fill material;**
10. **haul fill material from offsite sources and dump/stockpile on site;**
11. **load and spread fill material from "offsite" stockpile;**
12. **compact the "offsite" fill material placed and spread in #11, above;**
13. **haul onto site the material used for pavement subgrade; or -**
14. **scarify the in-place subgrade material; and -**
15. **haul onto site additional subgrade material to be mixed with in-situ material;**
16. **mix the subgrade material to uniform consistency; [14 & 15, above]**
17. **compact the pavement area subgrade material to specified density;**
18. **place curbs where specified;**
19. **spread the pavement base course in lifts; [or, mix soil-cement, etc. for base]**
20. **compact the pavement base course; [may require multiple operations]**
21. **pave the pavement area in accordance with specified layers and thicknesses;**
22. **place sidewalk concrete if specified;**
23. **remove concrete forms, concrete rubble, and any other debris or excess fill;**
24. **fine grade the work area prior to topsoil placement;**
25. **place topsoil if specified;**
26. **place sod if specified;**
26. **seed the work area where specified;**
27. **place mulch material where specified;**
28. **water the grassed area;**
29. **final clean-up and inspection.**

Some of these items will require multiple sub-operations; it is likely a contractor will estimate costs of a part of his earthwork bid by equipment time and personnel on the job site. The wild card in the project total bid is not the earthwork itself, assuming hard quotes are received for paving, concrete, and offsite fill prior to bid submission. The wild card is always hidden or concealed conditions, and this includes subsidence of the existing soil on the project site.

Subsidence

What does subsidence entail? For a job located in an area known to be either rock or hard soil [either clay, gravel, or some mix of sand, clay, and gravel which is firmly consolidated], subsidence is not a primary issue if the existing soil is uniformly consolidated, has medium to high blow counts, and is of good quality. We are assuming that subsidence is not a factor if the top 10 ft. or 15 ft. of soil has the aforementioned characteristics. Organic material and poorly-consolidated granular material will present a subsidence issue, and should be addressed during the design phase. Obviously, organic material or plastic clays will have to be excavated and replaced with an approved backfill prior to proceeding with construction. Poorly-consolidated granular material can be overlooked during design, and will present the hidden subsidence problem to which we are referring.

Download the DoD "**Soil Mechanics**" Manual, publication **UFC 3-220-10N**, **[ACTIVE]** and the DoD "**Soils and Geology Procedures for Foundation Design of Building and Other Structures (Except Hydraulic Structures)**" Manual, publication **UFC 3-220-03FA [ARCHIVED] from** the web site below:

http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

Now go to the New York State DOT Technical Services web page and download their Geotechnical Manual **GCP-15, "Settlement Gages and Settlement Rods"** at the following web site:

http://www.dot.ny.gov/divisions/engineering/technical-services/geotechnical-engineering-bureau/manuals

Look carefully at the chart on page 7.1-14 of the DoD "**Soil Mechanics**" Manual. What can we extract from this chart concerning the subsidence issue? This chart gives only a description of soil density derived from blow counts. See the description of the hammer weight used to drive the sampler and determine the blow count, N, on page 7.1-7. Even if a detailed geotechnical exploration of the job site is performed during design, there still won't be a direct correlation between the compaction equipment and subsidence.

Review Table 12 on page 7.1-35 of the DoD "**Soil Mechanics**" Manual. Again there is no direct correlation between soil type and subsidence, but this table does tell you when to look for problems. Read on down to Section 3, COLLAPSING SOILS, on page 7.1-39, and Figure 5 on page 7.1-40. Note that this information refers to the standard plate load test. The plate load test will give a value for settlement under static load, but this situation is somewhat different than a contractor's crew using vibratory roller compaction equipment on a job site.

Bengt H. Fellenius has a large number of excellent papers on geotechnical studies and soil mechanics available at no charge at his web site. You may find his publication **#286 The Red Book Basics of Foundation Design** useful in your work. [Test questions from this publication are not included in this course].
Review the paper on **Deep Vibratory Compaction of Granular Soils, #266**, at the Fellenius web site:

http://www.fellenius.net/papers.html

This paper is a good source of information concerning resonance in soils when subjected to vibratory compaction; however, you will find that we still have no direct correlation between surface subsidence and roller-type vibratory compaction equipment.
Let's look at some typical roller-type vibratory compaction equipment used to compact soil on construction

projects. Go to the web sites below and download the brochures:

http://www.rentrain.com/resources/pdf/mq_soil_handbook.pdf

http://www.volvoce.com/SiteCollectionDocuments/VCE/Documents%20North%20America/Volvo%20SD160-SD200%20Product%20Brochure.pdf

The Volvo rollers come in several configurations, all with variable vibration frequency. Use of this type of equipment will set up a wave in soil, and the vibration effects will be felt hundreds of feet away from the roller itself. Use of this kind of equipment in residential areas or around buildings will produce structural damage.

How can a correlation be made to a subsidence or settlement value? The articles at the web site below explain the use of "Intelligent Compaction" and provides some information on soil density and subsidence during the compaction process:

http://www.intelligentcompaction.com/index.php?q=node/2

Soil density is one factor in subsidence, but the density referred to in the article above is primarily surface density of the top 1 to 2 ft. or so of the soil being worked. We need to determine subsidence of the top 10 ft. to 15 ft. of soil in the work area. There does not appear to be a system for designers to use to predict actual subsidence of a work area, aside from on-site measurements using the exact type of compaction equipment which will be used by the contractor. If the project is to be competetively bid, this subsidence determination then becomes difficult if not impossible to quantify precisely. Some prediction of subsidence can be made as seen in the references above by determining the soil type(s), and measuring blow counts to some estimated depth, probably 20 ft. minimum for a surface project.

We have gone around in a full circle and have found no hard data or charts which we can use to estimate or calculate subsidence for the earthwork bid items. We could have the geotechnical engineer estimate subsidence in his technical report, but such an estimate might not be accurate enough to use in preparing bid quantities. How then can one approach the subsidence issue for bidding purposes?

Project with excess cut material: If, for example, the project in question has excess cut material which is usable for fill on the project site, the earthwork should already have an embankment pay item. This pays the contractor for placing and compacting this excess fill material on the work area. If subsidence occurs, more embankment will be used during construction than was calculated during design. This extra fill volume due to subsidence will be unnoticed unless the contractor has a survey crew perform an elevation survey of the stripped and proof-rolled work area prior to placing any fill or pavement base material. The amount of excess cut material [available for sale by the contractor] will be less than anticipated, but an inexperienced or careless contractor will just assume the stripping volume was greater than anticipated, or he will blame it on his earthwork crew. This will also reduce or eliminate any profit which may have been anticipated from the sale of the excess cut material. If the contractor performed an elevation survey prior to starting work, and then takes another survey as previously described, a claim will probably be filed for lost profit on the sale of this excess cut material.

Project with trucked-in offsite fill material: If the project does not have excess cut material and offsite fill must be trucked to the jobsite, the shortfall due to subsidence will be noticable when the offsite fill begins to over-run the pay quantity. This may lead to an owner-contractor battle and a construction claim, with the owner accusing the contractor of using half-filled trucks, trucks which have slightly smaller beds than described, or of cheating on the truck tickets. If the owner has the manpower to accurately monitor the fill which is hauled onto the work site, none of these items should become issues. In this case, the designer will most likely be questioned concerning his earthwork calculations.

Determination of subsidence

How can the subsidence issue and the vanishing dirt be addressed in the bid and pay items? How does a designer protect himself from claims of incorrect quantity calculations? If the geotechnical report and blow counts from the subsurface investigation indicate poorly-consolidated soil in the top 20 ft. of the work area, subsidence will certainly be an issue. The geotechnical report should be the best source of information for subsidence, and it should be referenced in the bid documents. But we still need to address the missing dirt in the pay items. Instead of just guessing at some subsidence figure and padding the earthwork pay items, let's look at the NY State DOT web page mentioned above concerning **Settlement Gages and Settlement Rods**, **Manual GCP-15**. If an accurate figure for subsidence is desirable, the bid items should include the installation of one or more settlement rods as described in this publication. The designer will need to specify depth of the rod installation. To provide a back-up measurement, the elevations of the tops of all the settlement rods should be surveyed prior to the contractor performing any earthwork, using an offsite elevation benchmark which is far enough away from the work area so as not to be affected by the vibratory compaction equipment. This distance may be on the order of one-half to one mile or so.

As an alternative, a site elevation survey can be performed prior to construction, with another survey being taken immediately after stripping and proof-rolling the work area. The drawback to using elevation surveys is that the ground will continue to settle while it is being worked, and a completely accurate measurement will not be possible. On a paved area, some subsidence will be hidden in extra base course thickness; for example, a hidden 1-inch earth subsidence would most likely be compensated by an additional 1-inch of base course. Again, an experienced contractor will recognize the problem and may present a claim.

Calculation of Subsidence: Unit Weight, Moisture/Density, Blow Counts

For purposes of an example, assume we have a site with in-situ untouched soil having an approximate modified proctor density of 95 pcf (pounds per cubic ft.), and a blow count of between 10 and 15 for the first 10 feet of soil depth at the work site. For this example, the in-situ soil is 93 pcf at dry density. Also assume the soil has (by testing) a 100% modified proctor unit weight of 108 pcf and 95% modified proctor unit weight of 102.6 pcf. This is a fractional relationship, with [95/100] = [102.6/108]. Now, we want to see if we can calculate some type of value for subsidence.

Start with a cubic foot container, exactly 12 inches on a side. Into this container we place 93 pounds of soil, and it fills the container up to the top surface. On top of this container we place a flat plate and use pressure to compress the soil in the container. We are assuming that the one cubic foot container does not deform in any way during the testing operation. Applying pressure to the top plate, the 93 pounds of soil then compresses to a volume of 11.3 inches by 12 inches by 12 inches. The 93 pounds of soil has compressed by 0.7 inch, or to put it another way, the soil in the container has subsided seven-tenths of an inch. We insert a nuclear density guage into this compressed soil and find we have a density of 95% modified proctor. However, we have disturbed this compacted dry soil by measuring the density, so our results are suspect. If the reading on the nuclear density guage were absolutely accurate, we could make the correlation as follows:

►93 pounds = weight of soil in container (no water)
►volume of dry, compacted soil = [11.3 in. x 12 in. x 12 in.] /1728 = 0.94167 c.f.

Now we can say that 93 pcf of dry, uncompacted soil will subside 0.7 inch if compacted to 95% modified proctor, with a dry density of 98.8 pcf:

►unit weight = [93 pounds of soil / 0.94167 cf] = 98.8 pcf

If we add water, all the values change and the subsidence will change also.

So, what is the correlation? Compaction of in-situ soil from this site to 95% modified proctor density will result in 0.7 inch settlement in the top one ft. of soil. Or, in the top five feet of soil, we will have [0.7 inches settlement / ft. x 5 ft.] = 3.5 inches overall subsidence for an approximate value. But what's wrong with this number?

As we noted, adding water will change the numbers. Also, a subsidence value cannot be calculated for in-place soil like we did using the exact cubic foot volume. This volume calculation assumed the sides of the cube did not deflect. The in-place soil may heave and compress laterally as well as vertically, making any calculation like this inaccurate.

But we still have no realistic method for calculating subsidence during preparation of the pay quantities. So what can we do? Here are some suggestions, but be sure to check with legal staff to determine applicability. Quantity over-runs can become a minefield if handled improperly. If the project in question has a nominal blow count [N] of 10 to 20 for the top 15 ft. or so of soil depth, and the geotechnical engineer has been unable to give a better or more reliable figure, you can try the following:

a) Guess at a figure, such as an extra 6-inches of compacted fill over the work area. This may work out if the owner and contractor have a good working relationship, but this method is NOT RECOMMENDED for any type of government contract. In general, a "guess estimate" is to be avoided in most situations due to a likely change order.

b) Add a disclaimer to the "instructions to bidder," indicating that site subsidence is expected, and that the designer has included an additional [xxxx] C.Y. of extra fill material to the calculated onsite embankment quantity. Add a corresponding offsite fill volume increase, if applicable. Look carefully at the contract to determine what is noted for final pay quantity over-runs and under-runs, force account work, extra work provisions, and dispute resolution. Some contractors will claim the additional fill as a pay item even if they haven't used it.

c) Leave the original estimated bid quantities intact, but add a disclaimer which indicates that the final embankment [and offsite fill] volumes may be more than 10% over the estimated bid quantities, and that the contractor will have to bid accordingly. This option will produce some interesting bid results, and may generate a claim and/or lawsuit, depending on the exact terms of the contract language. If the contract requires the contractor to maintain his bid prices for items in which final quantities are within 10% of the bid quantities, a claim may be averted if the final quantities actually fall within that 10%, but not always. The phrase "unforseen site conditions" is usually applicable in this type of situation, and leads directly to change orders. Keep in mind the fact that some construction companies are actually law firms masquerading as contractors. Again, refer to the specific contract terms concerning actual bid quantity over-runs and payment(s) for over-runs.

d) If the Owner has funding available and is willing, set up an onsite test using a vibratory compactor to roll a pre-determined test area (after stripping), and use an elevation survey both before and after rolling to determine subsidence. Have this test supervised by the geotechnical engineer, and ask the geotechnical engineer to predict site settlement. Include this report or at least reference it in the bid documents, and include any volume calculations for subsidence which are figured into the estimated bid quantities. This may be the best way to resolve the subsidence issue because you have attempted to scientifically determine an exact numerical value for subsidence for the project site, and have given the information to the bidders prior to bidding. A claim may still be filed, but you have established a method and have attempted to place a figure on the item in dispute prior to bidding. This will give you credibility as an engineer and/or designer should such an issue end up in a lawsuit.

E. NY STATE DOT SPECIFICATIONS - SECTION 200 EARTHWORK

http://www.dot.ny.gov/main/business-center/engineering/specifications/2008-standard-specs-us

Go to the web site above and download Section 200, Earthwork. Let's look at these New York State DOT Earthwork specs and see what is listed for embankment in Section 203. There is no mention of subsidence in Section 203, but there is a discussion of royalties for use of fill material excavated within the right-of-way on a project. See subsection 203-1.16.

F. NY STATE DOT SPECIFICATIONS - SECTION 100 GENERAL PROVISIONS

Go to the web site linked above [Section E.] and download Section 100, General Provisions. Review the "typical section" on page 16. Also review subsections: 102-02, 102-17 [note carefully para. 2, 3, 4, & 5], 104-02, 104-03, 104-04, 104-06, 105-14, 109-02, & 109-05. It would appear the NY State DOT Contract has covered contract over-runs in complete detail. Note the definitions and descriptions in subsection 105-14, Disputed Work and Dispute Resolution.

This NY DOT Contract requires notification of changed conditions to be submitted to the Engineer, and if unresolved, claims must be submitted to the NY State Commissioner of Transportation. Be prepared to answer general test questions concerning earthwork and disputed quantities using the subsections noted above.

So how have you set up the estimated earthwork quantities for your project? Can the calculations be readily deciphered and understood by an outside party if there is a dispute? Have you left this task [especially earthwork] to a drafting technician who has never been outside of the office? Do you use a standard form for earthwork calculations? Earthwork may be the most expensive and critical item in the bid; it should not be left to an inexperienced individual to calculate.

We have purposely not discussed calculation of earthwork volumes associated with underground drainage systems, curb installations, or building and foundation demolition, as these can be estimated fairly easily using reasonable assumptions. They should, however, be included in the estimated volume calculations for the earthwork bid quantities.

G. BID PROCESS - PAY ITEM AND QUANTITY CHECK

Have you taken what should be final plans & specs and bid on the project yourself, as a bidder? Or, have you asked someone to do so for you? This is a very effective way to spot the errors and/or missing items in your bid package. If you can't prepare a bid on your own project, something is certainly wrong with the picture. It will also force you to estimate the cost of the project using the bid form developed by your staff, and come up with a final "engineer's estimate" for your client. This procedure should uncover pay items without spec references, pay items which can't be correlated with the drawings, and may help to determine quantity errors. This last quality control exercise is one which most engineers like to omit, but it is vital to preparing an accurate and complete finished product.

H. BID PROCESS - PREQUALIFICATION OF BIDDERS

A private project using private funds can be bid using an "invited bidder" list. This is prequalification using slightly different terminology. It is a quiet, uncomplicated method of preventing known troublemakers from bidding on projects. Public projects which are funded with public funds are regulated by State Law, and usually must be placed out for open bidding by either newspaper advertisement or internet notice, or both. Obviously this varies by state, but the end result is that any entity which is qualified can place a bid. How do public agencies regulate who can submit bids on public projects? Why restrict bidding? Nothing can make a project

into a disaster faster than having an incapable or financially insolvent contractor working on a project which is too big or complicated for it to handle.

Pre-qualification of bidders is desirable for large, complex projects; for example, the Connecticut DOT (ConnDOT) requires bidders on its transportation projects to be pre-qualified, but doesn't make specific note of this process on its DOING BUSINESS WITH CONNDOT web page:

http://www.ct.gov/dot/cwp/view.asp?a=2288&Q=300688&dotNav=|

Review their current construction contracting forms under the heading "Forms" in the Contractor Resources section. Then go to the web page below and check the forms which are required prior to becoming pre-qualified:

http://www.ct.gov/dot/cwp/view.asp?a=2288&q=259250

After you have reviewed these ConnDOT bidding and prequalification forms, compare them to the NY State DOT process described in the following paragraph.

The New York State Department of Transportation DOES NOT pre-qualify bidders on its transportation projects, but it does require post-bid qualification. Review the NYSDOT's Important Information for Bidders at the web page below:

http://www.dot.ny.gov/bids-and-lettings/construction-contractors/important-info

Check also the General Information on the following web page:

http://www.dot.ny.gov/bids-and-lettings/construction-contractors/general-info

Review carefully the requirements for submission of a bid on NYSDOT's projects. Be prepared to answer questions on the items listed. Also note that New York State has an electronic bid submission system. It is linked at the left side of the web page noted above.

Florida has a separate web site for businesses contracting with the State of Florida:

http://dms.myflorida.com/mfmp

Electronic pre-registration is required, and bids are submitted electronically. In addition, the Florida DOT (FDOT) pre-qualifies bidders for transportation projects:

http://www.dot.state.fl.us/cc-admin/faq.shtm

http://www.dot.state.fl.us/cc-admin/PreQual_Info/prequalified.shtm

Be prepared to answer test questions comparing NYSDOT to FDOT & ConnDOT bid processes, including prequalification, bid submission, and forms required for bidding.

I. BID PROCESS - REQUEST FOR PROPOSALS

Now let's look at the request for proposals/request for bids/request for quotations, (RFP/RFQ), which is the next step in our main objective, obtaining a bid proposal. Review the information at the following web page:

http://www.ism.ws/files/Pubs/Proceedings/WhittingtonIC.pdf

The RFP/RFQ is a fundamental component of a successful bid document preparation and bidding process. It must be clearly understood by all bidders, there must be no ambiguity, and you can never, ever assume a bidder will be able to know by experience or by being in business for some length of time exactly what you want if you don't draw it or spell it out in writing. Any assumptions required by the bidders will inevitably lead to change orders, poor product, or unusable results. Ambiguity is to be avoided at all costs. The RFP/RFQ should complement the specifications and construction drawing package, and all bid items must be synchronized with the specifications. If possible, include a specification reference for each bid item in order to avoid a scavenger hunt for the bidder. This also protects the procuring entity from unnecessary change orders and unexpected surprises during the delivery phase. In the competetive bid process, you can be sure the low bidder will make use of any error or ambiguity in order to obtain a change order. An experienced bidder will conceal his knowledge concerning fundamental omissions and errors in the RFP/RFQ, and use this information as a weapon against the purchasing or contracting agency before the contract is completed. If you left something out or have unintelligible or ambiguous bid items, a claim against your professional liability insurance policy could result. Review the information at the web page noted above, and be prepared to answer questions about the issues and terms listed therein.

J. BID PROCESS - OPENING THE BIDS

Receiving and opening the bids is the next-to-last phase in the bid process. Established buyers and governmental agencies will have a bid opening procedure in place; this usually involves a set date and time for bid submission, public opening of the bids, reading the contents of each sealed bid envelope, and public posting of the bid results. Private bid openings can lead to a variety of problems including: suspicion of "bid shopping;" allowing a favored vendor adjust his bid to be lower than the lowest submitted bid; and using the bids to establish a project budget, then allowing a group of preferred bidders to re-bid the project.
Electronic online bidding with open display of the results is one way to eliminate these problems. Go to the web page below and review the information concerning online bidding:

http://www.ism.ws/pubs/Proceedings/confproceedingsdetail.cfm?ItemNumber=11548

Note the advantages of online bidding, and be prepared to answer test questions on bid opening procedures. Be sure to review the information from the Virginia DOT bid opening procedure indicated below in the next section.

K. BID PROCESS - BID REVIEW AND ANALYSIS

Bid Analysis may be performed by hand comparison, spreadsheet analysis, or by using one of the online electronic bid submission programs, which automatically produce a spreadsheet comparison. Hand-entry of paper bid results into a spreadsheet program leads to the possibility of numerous clerical entry errors, the need to check each entry more than once, and consumes a considerable amount of time. The NYSDOT posts weekly summaries of their lettings on their Construction Opportunities Results web page:

http://www.dot.ny.gov/doing-business/opportunities/const-results

Three years of bid results are available. Note that only a total is given for each bidder.

ConnDOT also posts letting results as MSWord documents linked from the following web page:

http://www.ct.gov/dot/cwp/view.asp?a=2288&q=259258

The links provide both current and previous bid results, and again, only totals are shown for each bidder.

The Virginia DOT posts transportation bid results on the following web page:

http://www.virginiadot.org/business/const/bidresults-list.asp

Check the "Notice" link near the top left side of this page, and read the information carefully. Also go to the "Bid Tabulations" link at the top right area of this page and review the availability of complete bid results of the three lowest bidders for each project letting. Note that the Virginia DOT reads their bid results aloud, then posts the name of the apparent low bidder on their web site on the same day.

Florida has a slightly different system. Letting results are available immediately following the bid opening. Review the information and links on the web page below:

http://www.dot.state.fl.us/cc-admin/Lettings/Letting_Project_Info.shtm

Historical construction cost data is available from the FDOT's State Estimates Engineer at the following web page:

http://www.dot.state.fl.us/specificationsoffice/Estimates/Default.shtm

This web page has links to the Florida "Basis of Estimates" Manual as well as the detailed historical cost data and cost per mile for transportation projects in Florida.

The contracting agency or private client will either have in-house staff to analyze and compare the bids, or you and your firm may be retained to provide this service. In such case you will need historical price data for comparison, illustrating the need for standardized pay items (bid items), and a spreadsheet program which can be used to provide price comparisons for each bid or pay item.

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For purposes of this course we will assume the contract for procurement is a standard document which is not generated new for each bid; the only items which are unique to a particular contract package are the scope of work, bid proposal, drawings, and special specifications or provisions, which are item-specific for that particular bid package. Private firms which do not have a prepared contract text document may need to enlist legal assistance in preparing such a document.

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If your firm is called upon to analyze bid results, aside from the standard line item bid tabulation there are a few issues which you should be aware of, not the least of which is "**bid rigging**." Not only is bid rigging a Federal crime in the USA, it may be a crime in the state in which you are working, and for whom you produce bid documents.

Briefly read the information on the web sites shown below:

http://www.wa-cpa.com/2012/10/31/the-most-common-contractor-fraud-schemes/

http://www.justice.gov/atr/public/press_releases/2007/228102.htm

http://www.oecd.org/dataoecd/27/19/42851044.pdf

http://www.ism.ws/pubs/Proceedings/confproceedingsdetail.cfm?ItemNumber=11144

>What are the most common contractor fraud schemes?

> What actions does OECD recommend to reduce the possibility of “bid rigging?”

> How does the US Justice Department define “conspiracy” in a bidding and procurement situation?

> What division of the US Justice Department investigates “bid rigging” situations?

> What is the RICO statute?

> Is bid rigging on a US Government procurement action a felony?

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CONCLUSION

To conclude the discussion of the bidding process, go to the following web pages and review the information offered:

http://www.ism.ws/files/Pubs/Proceedings/HBIBHaining.pdf

http://www.ism.ws/files/Pubs/Proceedings/CJCrowderHill.pdf

Pick out the key issues discussed on these web pages, and be prepared to answer test questions on these subjects. Remember that a bad or unsuccessful bidding process can damage the credibility of the contracting agency, will ultimately result in higher costs, and will certainly affect your credibility as a practicing engineer. If you or your firm consistently produces plans packages for bidding which contain errors, conflicts, and inconsistencies, you have made the procuring and/or contracting agency a target for lowball bidders who will then ruthlessly pick your project apart for errors and ask for an endless stream of change orders. This is especially true if you work for a public agency or in a government procurement system. A quality product is your best advertisement, and is also your best defense if a lawsuit unfolds.

END OF COURSE
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