

**DESIGNING
BUILDING-ENVELOPE REPAIRS**

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RCI, Incorporated®

ABSTRACT

The complexity of materials, products, and systems used within the three facets of the building envelope—(1) the roofing (top) and (2) waterproofing (bottom) in the horizontal plane, and (3) the walls (sides) in the vertical plane—is overwhelming. The building envelope is further complicated in that various trades and sub-contractors are involved. This is compounded even more by the numerous manufacturers and design professionals associated with each component, making coordination a complex and essential effort during design and construction. The integration of the myriad systems to one another and the coordination of the various design professionals and contractors becomes a daunting challenge, if not “mission: impossible.”

If we have not made the task seem impossible, we can further exacerbate the situation by requiring the project to be specified generically (non-proprietary) and publicly bid (to be awarded to the low bidder). To tackle a job of this type, one must have deliberate methods, procedures, and concepts.

In maintaining the philosophy outlined in previous RCI presentations (1) The 75% Rule [RCI Convention Tampa, 2003] and (2) Quality Control in Your Office [RCI Convention Phoenix, 2006] we will outline the methods, procedures, and concepts to consider when addressing the total building envelope.

Specific to designs for the building envelope, we will address several key elements of three critical phases of the design/construction process: (1) drawings, (2) bidding, and (3) submittals. The methods, procedures, and concepts outlined for these elements can be used to manage and improve construction projects.

SPEAKER

RICHARD L. COOK JR., RRC, RWC, RRO, CCCA

RICK COOK has authored numerous papers on the subject of design standards, guidelines, and roofing-related issues. He has presented several papers at national symposiums and conferences, including the American Society of Civil Engineers, the RCI Building Envelope Symposia, the Construction Specifications Institute, RCI at Factory Mutual, RCI International Convention, and the Federal Construction Committee in Washington, DC. Mr. Cook has also presented dozens of papers at local and regional meetings and conferences related to the building envelope, roofing, and waterproofing. His office has been recognized 26 times in the RCI annual Document Competition for designs and reports.

DESIGNING BUILDING ENVELOPE REPAIRS

INTRODUCTION

The complexity of materials, products, and systems used within the three facets of the building envelope—(1) the roofing (top) and (2) waterproofing (bottom) in the horizontal plane, and (3) the walls (sides) in the vertical plane—is overwhelming. The building envelope is further complicated in that various trades and sub-contractors are involved. This is compounded even more by the numerous manufacturers and design professionals associated with each component, making coordination a complex and essential effort during design and construction. The integration of the various systems to one another and the coordination of the myriad of design professionals and contractors becomes a daunting challenge, if not “mission: impossible.”

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DRAWINGS

Of all the elements of the Project Manual (also referred to as the contract documents), the drawings provide an excellent opportunity to lay out the scope and extent of the work for all types of construction projects. It is my experience that a con-

tractor typically looks to the drawings first and at the specifications only if necessary. Addressing these documents is crucial to ensure a complete understanding of the scope is realized. Specific to building envelope repair, renovation, and restoration projects, which have a myriad of components and interfaces, the drawings can provide an excellent opportunity to define the scope of work in a clear and concise manner. A picture really is worth a thousand words.

ELEVATIONS

Elevations are vital in describing the extent of work, locating where critical elements are, and quantifying the amount of work. Elevations can be developed from the as-built (record) drawings when available, but they may have to be developed from scratch. In either case, more than just the major elevations (north, south, east and west) will be required. Also, the various penetrations on these elevations are seldom shown in “as-builts,” and these wall openings also may differ or may have changed due to subsequent modifications and renovations. These fenestration details are the access point for many leaks and cannot be overlooked.

THREE STEP DETAILS

We have developed the “Three Step Detail” concept in an effort to clearly identify the scope of work. Each critical detail shows the existing, preparation, and new “steps” of a detail.

This concept allows the specifier to determine when the “existing” condition is being changed or modified and also provides an opportunity to identify specific preparation requirements (i.e., widening a joint, removing incompatible materials, incorporating a bond breaker, etc.).

These details are not always “cut” on the elevations, due to their widespread existence. We often provide general notes on the “New Elevation Drawings,” stating, “All standard and fillet joints shall be replaced in accordance with Details XX and YY on Sheet W201.”

PHOTOGRAPHS

Photographs (especially considering the capabilities of digital cameras) can provide two major benefits during the design process:

1. Photographs can easily provide a “list” of each penetration and termination condition to be included within the specifications and drawings. For the CAD technician/detailer who may not have been involved in the actual field investigation, the photographs can be the basis or starting point for developing the actual details.
2. Incorporating photographs of existing conditions onto the drawings can also provide many benefits. The photographs can help the contractors “visualize” the conditions found during the investigation of the building envelope that are not accessible during the mandatory pre-bid meeting or on projects where procurement procedures will not permit a mandatory pre-bid meeting. Our experience shows that if any project justifies a mandatory pre-bid meeting, it is the building envelope restoration/renovation project.

BIDDING

The bidding process can be informal, negotiated, or competitively bid. On public projects, specific procurement procedures are required and must be followed.

ADC Engineering, Inc.’s standard operating procedures (SOP) avoid informal bidding. This is partly due to 75 percent of our work being completed under public sector/government work.

Negotiated work eliminates the competitive bid environment, but it also provides several important benefits that may justify its use:

1. Can streamline the design and bidding phase of the project
2. Allows the owner/designer the opportunity to select a qualified contractor with the specific experience and solid reputation

3. May be justified or needed, based on security, bonding, or insurance requirements.
4. Can provide a more realistic design process when considering budget issues. The contractor can be a part of the design process, providing valuable input during design versus the infamous value engineering process after a busted bid.

Four elements that can improve the bidding phase of the project are discussed below.

PREQUALIFICATION REQUIREMENTS

Although typically not permitted within most public sector/government organizations, provisions commonly exist to permit prequalification questionnaires (PQQ) on historic, unique, or complex projects. Even though justification and approval may be required, this “paperwork” will be considerably less time consuming than normal procurement procedures.

When a project includes a prequalification process, the advertisement typically summarizes the scope of the work, the PQQ requirements, how a copy of the PQQ can be attained, and when the package is due. Upon review, contractors who have properly completed the PQQ and meet the specified requirements will be approved. Other contractors will be notified of the requirement they failed to meet or properly document. Typically, an opportunity is provided to submit the additional information within a specific period of time. Once completed, only the approved contractor will be invited to the mandatory pre-bid meeting to submit a bid for the project.

A PQQ should focus on proven experience with the specific elements of the project. Other considerations include safety record, past performance, bond ratings, past litigation, uncompleted projects, required insurance coverage, required licensing, and ability to provide required contractor and manufacturer warranties.

The actual construction team can be an element of the PQQ. Obviously, it is far more critical to have the required experiences be with the actual project manager, superintendent, foreman, and various subcontractors, than just the prime contractor.

The prequalification process adds approximately three additional weeks to the bidding phase of a project, but for unique and complex projects such as building-envelope restorations, it can be very beneficial.

MANDATORY PRE-BID MEETING REQUIREMENTS

This requirement is becoming more common and acceptable on projects. ADC will not undertake a project that does not have a mandatory pre-bid meeting.

We know our contract documents are not perfect and our design intent is not crystal clear. (No one can read our minds; they can only read the contract documents.) Therefore, the opportunity to overview the project requirements, the project manual, and the actual site with the contractors provides everyone the opportunity to review these items upfront, versus the day before or even on bid day.

Providing a specific deadline (date/time) to ask any and all questions and to request any substitutions is critical. It is imperative to record all questions from everyone attending, but not to provide answers to any individual. Answers to all questions should be provided by addenda to all contractors.

It is critical not to answer any questions after the deadline. In fact, many procurement requirements would dictate the bid be postponed and an addendum be issued with that information.

ADDENDA

According to many common industry standards such as AIA and CSI, addenda can be issued until a contract is actually awarded, at which time the contract is modified by a change order or a change directive. Most individuals only think of using addenda prior to bidding.

In either case, the addenda can be a very useful tool for any project. As stated previously, our documents are not perfect, our design intent is not always “crystal clear,” and a contractor’s perspective or perception can provide valuable insight. The addenda is the tool to further clarify the design intent, correct/expand the documents, and provide responses to contractors’ questions.

Issuing addenda with changes and clarifications should be looked upon as an opportunity to better define the project scope, thus ensuring more accurate and competitive bids.

QUANTITIES AND UNIT PRICES

Incorporating defined quantities within the bid and unit prices to adjust the actual quantities can be beneficial to all parties, especially with renovation and restoration projects.

Identifying items that will require ran-

dom repairs (such as repointing, cracking, etc.) and “unforeseen” conditions (such as wood nailers within a roof assembly or wood framing below a built-in gutter) better identifies the scope of work and allows the contractor to have materials “on hand” during construction. This, obviously, better manages time and cost for everyone.

These quantities should be identified in the contract documents and the unit prices included on the bid form.

SUBMITTALS

Submittals are the critical link between the design phase and the construction phase to ensure the successful contractor understands the requirements of the contract documents. Although often overlooked or not approached in a systematic manner, submittals can:

1. Coordinate an understanding of the contract documents prior to commencing work,
2. Clarify intended means and methods not specified in the contract documents,
3. Allow for “mock-ups” or samples to be reviewed prior to ordering, fabricating, or installing work, and
4. Contribute, regretfully, to an unsuccessful project or litigation based on poor review and handling of submittals.

We shall discuss four elements of the submittal phase of a project that have proven beneficial to the submittal process.

SUBMITTAL LOG

The log or register sounds very formal and time consuming, but actually, once established, it is a tremendous time- and cost-saving benefit.

- To establish this element, obtain Specification Section 01300 Submittals (or equivalent), with specific requirements.
- The designer should prepare a log within this section that identifies all of the submittal requirements within each technical specification. This requires effort, but one must be willing to give something if one expects something in return.
- This log should be the “table of contents” for the contractor’s submittal package.

The reduction in re-submittals, incomplete submittals, and received submittals

alone will justify the effort. The submittal log also serves as a reminder for missing items. The benefits to the actual project, schedules, and contractor relationships are a substantial extra.

SAMPLES/MOCK-UPS

Mock-ups and samples are often not justified for many elements of a project, but specific to the building envelope and its flashing transitions, sheet metal components, and repair procedures, it is a necessity.

1. **Samples:** A masonry jar full of gravel or a tube of sealant have little value other than as a paperweight or to finish a home improvement project. Samples of sheet metal components or assemblies, proprietary mechanical supports, or other fabricated components allow everyone to see and approve the items prior to mass production or installation.
2. **Mock-ups:** Mock-up installations provide a far greater benefit for building envelope elements—both for aesthetics and FOR function.

Color and texture selections are needed for aesthetics and for blending/matching with renovation/repair projects.

Mock-ups are often required as part of the pre-construction or pre-installation conference.

Mock-ups, in some instances, can be built to complete testing requirements within the contract requirement to ensure the materials and installation methods can meet the requirements.

With the complexity of materials, components, and assemblies, and their transitions and intersections with other systems, a mock-up can ensure all parties (including subcontractors with coordinating systems) can resolve common items. For example, the wall contractor and window contractor can resolve items such as flashing transitions, attachment, and sealants. The mock-up can remain as a reference for the duration of the project.

REVIEW/APPROVAL

Who actually approves what is a discussion within itself.

As a design professional, an errors and omissions (E & O) insurance company will

likely recommend a specific verbiage for a submittal “stamp.” The submittal stamp verbiage should differ for a design project or a consulting project.

Make sure to:

1. Ensure that all submittals come through the prime or general contractor. Breaking this “chain of command” can have serious repercussions.
2. Ensure that the scope (contract) clearly defines responsibilities. A consultant who did not do the design for the specific system should not be approving the submittal. The same is true for a firm providing quality assurance (inspection) services for a project designed by others.
3. Consider creating a guide or standard for review comments for each specific specification section so that comments are consistent and thorough.
4. Do not forget about the various “close out” submittals required for a project. Contractor warranties, manufacturer warranties, and O & M procedures are a few of these items. A “close-out checklist” similar to the submittal log or register can ensure these items are not forgotten or overlooked.

SUBSTITUTIONS

Substitutions should be handled through a defined contractual method. A substitution request can occur during the bidding process (prior to bid) or during the construction process (after award).

The contractual procedures vary, but the basic questions are the same:

1. Is the product or system equal or better than the contract requirement?
2. What is the cost difference? (This cost should include life cycle considerations in that many substitutions may be less expensive initially but not provide the long-term service life needed.)
3. What is the advantage to the project (schedule, cost, performance, etc.)?

Obviously, it is more beneficial to have this process occur during the bidding phase, because it can incorporate the substitution for all bidders to consider while still in a competitive bid environment.

The substitution request can also be

beneficial during the construction process, but documentation and its effect on time and costs must be addressed.

In either case, a “substitution request form” outlining the specific questions to be answered, the supporting information to be provided, and the format to be used will streamline and improve the review/approval process.

CONCLUSION

Renovation, restoration, or repair to the building envelope is a daunting task, but it is not an impossible mission.

Having the expertise specific to the project scope or a team that provides this expertise is the first step (licensing, code minimums, systems, etc).

Define the scope as a consultant or design professional to ensure roles and responsibilities are clearly defined.

Define the project scope using as-built (record) drawings; the owner-reported problems are only a starting point.

- A thorough field investigation is a necessity. Destructive testing is commonly required to determine actual conditions and to develop accurate details.
- Often, the owner’s or occupants’ reported interior problems are the results of water intrusion; however, the real issue is determining the actual extent and cause in order to then solve the problem.


Solve the problem. A thorough field investigation with qualified personnel will not only identify the symptom, but also determine the problems, thus ensuring the scope of work will solve the problems.

Divide and conquer. As with any complex or substantial project, divide the project into separate, individual tasks so that the designer (or his/her team) can complete these tasks individually.

Guide specifications, letters, and details. As noted previously, these items can streamline the more common, repetitive items, thus providing more time to focus on the unique issues that justify customization. This can be done while still maintaining profitability for the work.

Develop true, as-built conditions using existing drawings or starting from scratch, developing elevations and details to clearly indicate the scope of the work.

Checklists, guidelines, and procedures provide a form of quality assurance to ensure each project is approached systemat-

ically, not overlooking the basics and fundamentals, while strategically ensuring that all elements of the project are addressed. 

REFERENCES

- 1 Articles can be found on ADC's Web site: www.adcengineering.com.