WORKING DRAWINGS

CLARITY FOR CONSTRUCTION

THE WORKING DRAWING IN HISTORY: There is ongoing scholarly debate as to the nature and character of ancient working drawings. Though it is difficult to imagine that some graphic format did not precede the construction of the outstanding monuments of ancient times, the fact remains that with the notable exception of descriptive stone carvings found at various sites, little evidence has come down to us of how these documents might have appeared or how they were utilized in the process of constructing a building.

The absence of such evidence should be judged against what is known of the architect's role in ancient building practice. J.J. Coulton, in his book *Ancient Greek Architects at Work,* notes that several *syngraphai,* or specifications, which list in detail the sizes and use of building materials, are still extant. He further observes that within the *syngraphai* the architect in charge of construction was called on to supply a *paradeigma,* which was a three-dimensional template or sample that would serve to direct the builders.

The recent discovery of a large hoard of ancient working drawings at the Temple of Apollo at Didyma, in present-day Turkey, sheds new light on the subject of ancient construction documents (see pages 44 and 68 of this issue for more on this finding). The location of these drawings on the actual masonry walls of the temple indicates that a certain level of design and documentation took place on site. The endurance of the Didyma model is demonstrated by the discovery of detailed drawings uncovered during the restoration of an eighteenth century structure in Williamsburg, Virginia. Discovered on the backsides of boards used for interior wood paneling were moderately detailed sketches of a mantle and archway, which correspond fairly closely with the items as they were actually executed elsewhere in the structure.

Now, the relationship of design and building where the architect is on site, and directing the operation of the building, raises a wealth of issues. Of these the most significant concerns the architect as master-builder—that is, the person responsible for both directing and designing during the building process. Today, the option of the architect being continually present on site may not be practical, although it should serve as a reminder of the level of integration and coordination of design and building that existed in antiquity and colonial times. This ought to encourage us to redevelop more fully that link and to amplify our knowledge of such practices in an effort to facilitate the process of building today. The implication of a shared background, an acknowledgment of the priority of convention and of a unified and coherent building system, should remain the foundation of any discussion regarding the detailing, or working drawings of traditional and classical architecture.

SCOPE OF WORKING DRAWINGS: Several issues come up in the context of the working drawing. First, what is the nature of this type of drawing, and how does it differ from a design drawing? Second, what information does this type of drawing intend to convey?

The principal consideration of the working drawing is to communicate, through a graphic format, the methods of erecting a building which will achieve the design intent. Implicit in this statement is the architect's familiarity with the following:

1. A KNOWLEDGE OF MATERIALS AND THE BUILDING PROCESS
2. AN ABILITY TO DIRECT THAT PROCESS THROUGH DRAWINGS
3. A MASTERING OF THE GRAPHIC METHOD, FORMS AND TOOLS THAT ARE REQUIRED TO ACHIEVE THE INTENDED RESULT

Let us begin by discussing the graphic method. In the design process, it is appropriate to be relatively loose and free regarding dimensions in the initial stages. At a certain point, however, a tightening of dimensioning begins to take place, thereby providing the foundation for the working drawing. The restrictions inherent in a scaled drawing ought not to be looked upon as a detriment to the design process; rather, one must consider the discipline analogous to the poet working within the sonnet format. Thus, one distinction between the working and design drawing is that the first constitutes an accurately scaled document illustrating the actual conditions within which the building will be realized.

At the same time, there remains a reciprocity between the design drawing and the working drawing. Later in the article we will look at examples

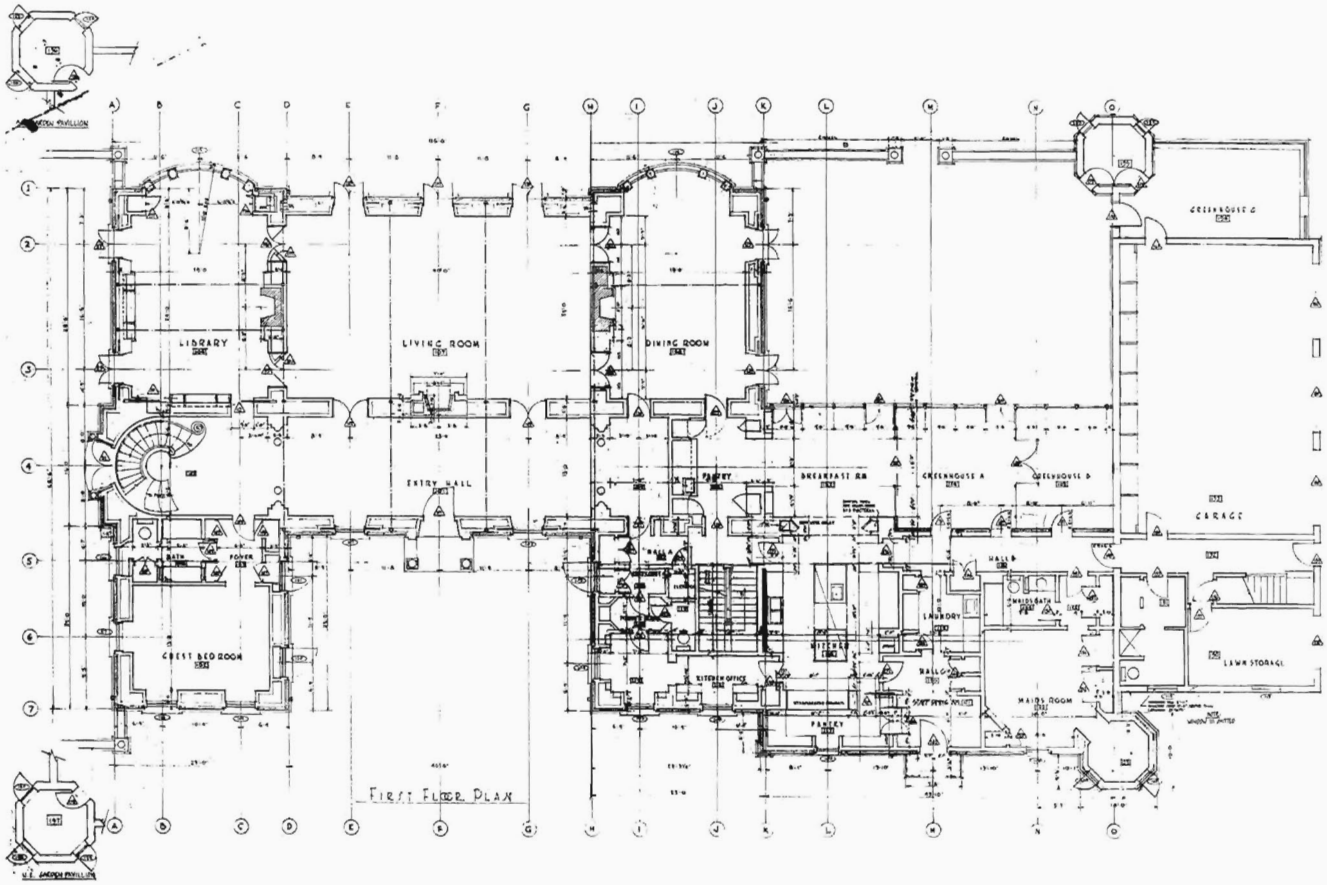


FIGURE 1, ABOVE: Easton & La Rocca, New York, New York. A residence in Lake Forest, Illinois.
FIGURE 2, RIGHT: Ken Tate Architect, Jackson, Mississippi. A residence in Baton Rouge, Louisiana.

of working drawings which reinforce this relationship. Too often, we slight the one for the sake of the other, leading either to a designer who does not deign to be limited by the conventions of the working drawing, or a detailer who thinks only about the practical aspects of the design element. It is between those extremes of a designer and detailer that architects find their place, and it is the coalescing of each which can return us, conceptually, to the ancient model of the architect as master builder.

MODERN WORKING DRAWINGS: The three principal forms of architectural drawing today are:

1. General Drawing—scale 1/8" or 1/4" = 1' - 0"
2. Scale Drawing—scale 3/4" or 3" = 1' - 0"
3. Full Size Drawing

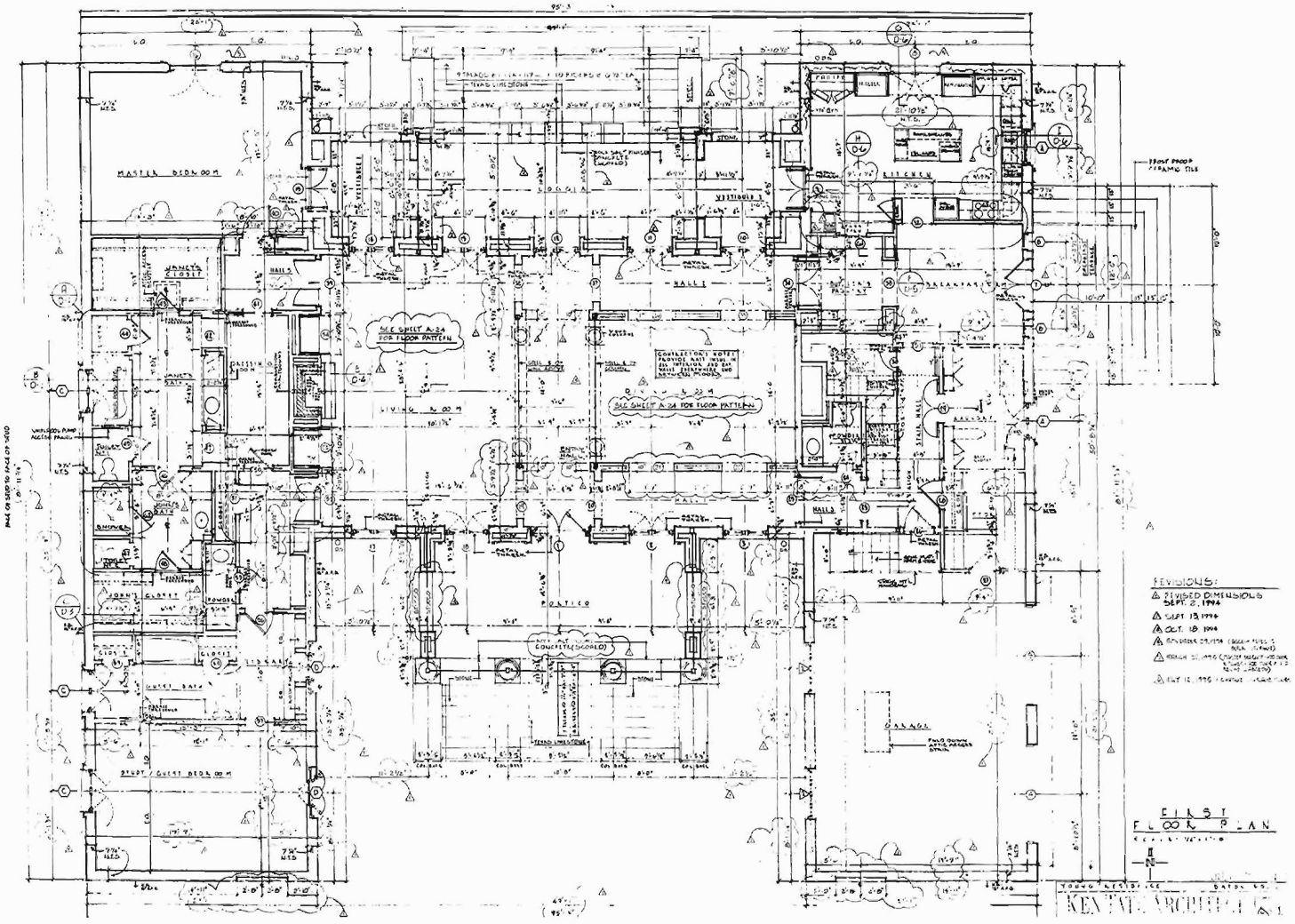
The tools for presenting information in all scales of drawing are the same; they are the conventional means of conveying two-dimensional information for a three-dimensional object. They include:

1. The Plan
2. The Elevation
3. The Section

THE PLAN: Information to be conveyed is horizontal dimensioning, and the relationship between some known point of reference, or datum. Depending upon the scale of the drawing that reference may be a survey bench mark, the known corner of the building, or the finished jamb of the door. The reference must be immediately apparent to an informed eye, and if it is an abstract reference, e.g., a surveyed bench mark noted above sea level, it should be reconciled to the building proper, such as to the finish first floor.

THE ELEVATION: Information to be conveyed is vertical dimensioning, requiring some known point of reference. Again, depending upon the scale, that reference may be the floor levels of the building, finished ceiling condition, or the door head height. Identification and coordination of material is important, and depending upon scale, delineation of the material may be essential. The elevation is the view, the visual reference of the building.

THE SECTION: Information to be conveyed is both horizontal and vertical dimensioning. Typically, the section is considered in a vertical format; the plan section, however, is a specific drawing used to coordinate vertical and horizontal conditions. Regarding the building process, the section is the drawing that most completely identifies the specific requirements of the materials of the building. Once more, this is applicable in both the horizontal and vertical planes. Whereas no single drawing is self-sufficient, the section does coordinate the plan and elevation, and grounds the two by revealing the specifics of the building.



It is the task of the architect to coordinate these graphic tools. The method in which these are presented underscores both the working drawing's origins in the design document and reflects the architect's understanding of the integrated nature of the building process. Just as the discipline of drawing simultaneously in plan, elevation and section is fundamental to good design, so too can the presentation of information in a multiple format working drawing reveal all the anticipated conditions that might occur in the building process. A coherent logic between design and execution is now established, and the potential for a well-constructed project may be realized.

We will now review examples of the three forms of drawing, and what kind of information is conveyed in each instance.

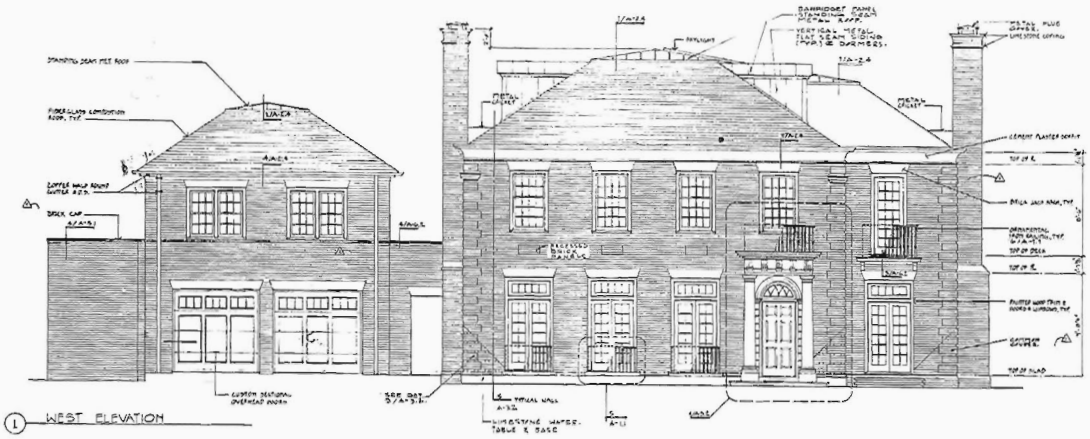
GENERAL DRAWING: FIGURE 1 is the first floor plan from a residence in Lake Forest, Illinois. A technique employed in this drawing, and one which deserves attention, is the implementation of a grid system which overlays the floor plan. This grid system, driven by governing, or axis lines, such as centers of doors, windows or columns, becomes the operative tool for measurement. As such, the grid serves as a datum to both the designer and builder by establishing consistent reference points. Further, as one develops drawings at larger scales, the grid can coordinate those details to the general drawing. This benefits both the designer and builder.

Overall dimensions are found in the outer string. As the string moves closer to the building, more specific dimensions appear. There is a tendency by many designers to dimension excessively; using a grid system mitigates the problem somewhat by encouraging the designer to focus on reconciling or measuring to the grid. In any event, one should avoid providing complex information prematurely, and in so doing run the risk of encumbering the drawing with too much information.

It is important to remind oneself to what trade a drawing is speaking. In the case of the section, the primary audience would be perhaps the foundation contractor, or more likely the carpentry framing contractor. FIGURE 1 is an excellent example of the amount of data appropriate to this scale and type of drawing, thereby preserving the clarity of the sheet. An accompanying wall section or detail, however, would have allowed one to understand the building condition that exists at the wall, thereby reconciling the floor dimensioning to the larger scale without confusing the document with too many dimensions.

FIGURE 2 graphically suffers from revised dimensions having occurred after the issuing of the drawing. At the same time, it highlights the convention for adjusting a document of record after it has been issued so as to identify new information. This point is worth emphasizing.

Once a construction drawing is issued, any alteration must always be in reference to the previously released document. Thus all parties have access to



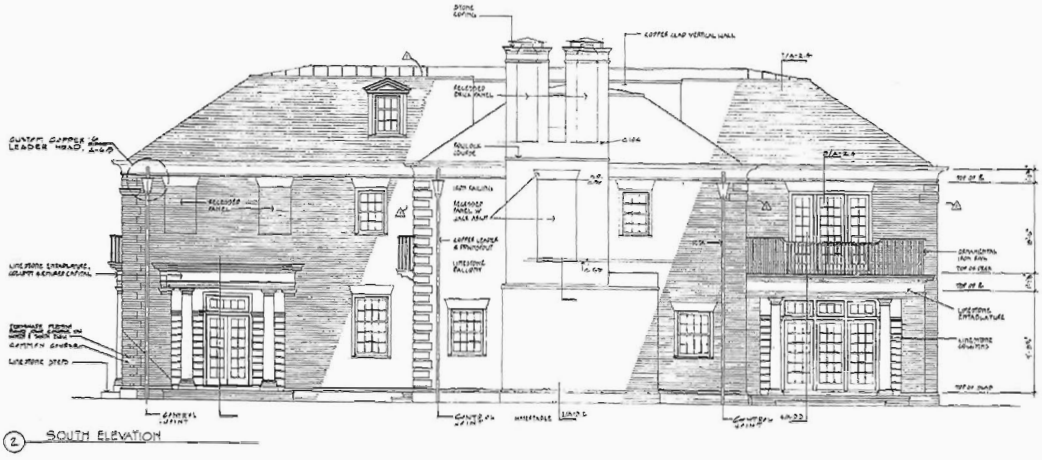


FIGURE 3, ABOVE; FIGURE 4, TOP RIGHT: Curtis & Windham Architects, Houston, Texas. A residence in Houston, Texas.
FIGURE 5, BOTTOM RIGHT: Easton & La Rocca, New York, New York. A residence in Lake Forest, Illinois.

the same information. There is no greater fear in the field than to suddenly be informed that the drawing you have been using "is not current"—second only to discovering that some known dimension has been altered but not highlighted in a document in hand.

FIGURE 3 underscores the kind of concerns that arise when drawing an elevation at this scale. First, the elevation provides the vertical dimension string; in our figure, the dimensioning begins with a datum set at the top of slab and from that benchmark dimensions are taken to limestone details. Nevertheless, the reader may be puzzled as to whom this dimensional information is directed. Perhaps it is of interest to the finish mason; however, what direction does this provide regarding floor levels or heights of windows and doors? Additional information is therefore required.

The second concern of the elevation should be the identification of material, and its graphic representation in a way that is appropriate to the scale. In that regard FIGURE 3 constitutes a successful representation. The indication from right to left regarding brick detailing, for instance, indicates an appropriate economy of drawing as the intensity of the drawing diminishes.

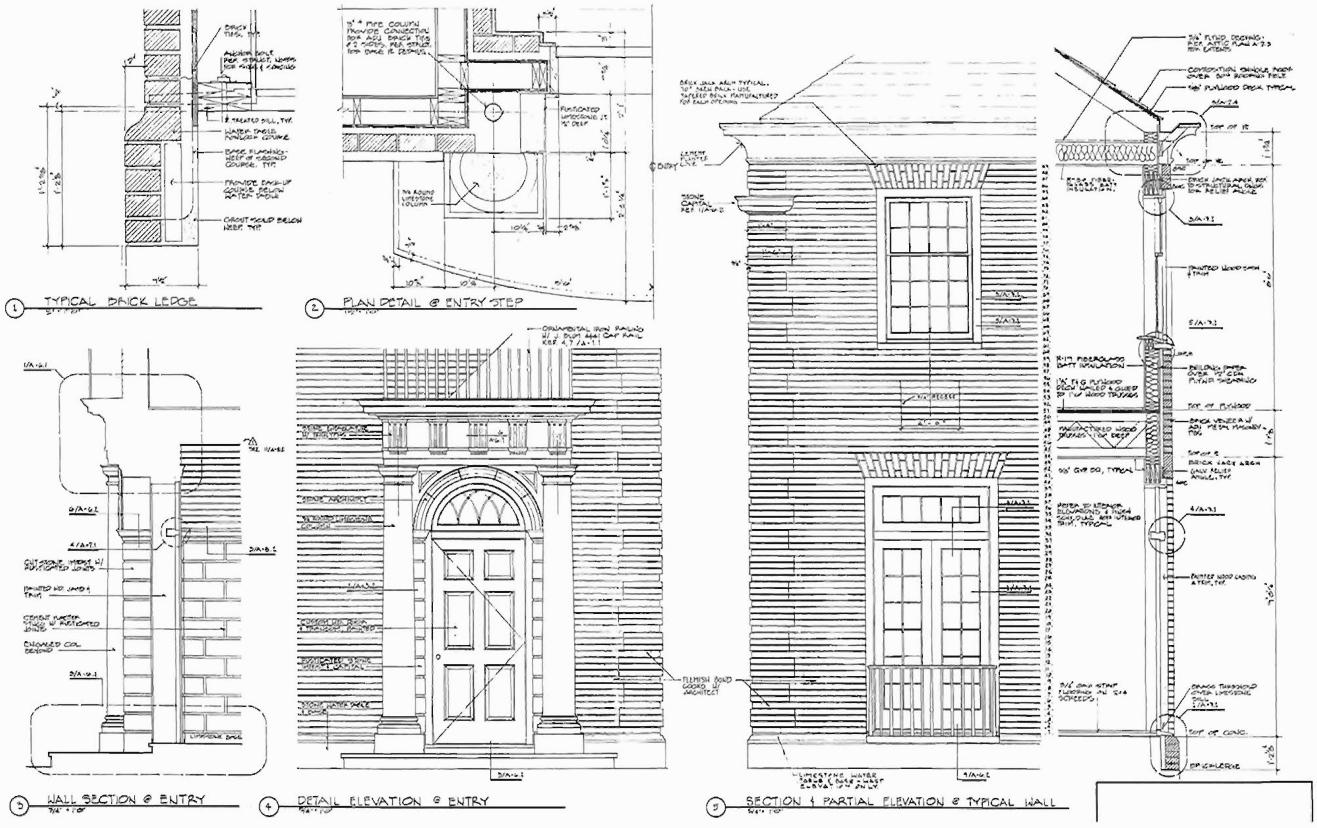
SCALE DRAWING: FIGURE 4 is a detail drawing of the front entrance shown in FIGURE 3. It serves as an example of the extent and type of information that occurs at a larger scale, as well as how the scale drawing can be reconciled to the general drawing.

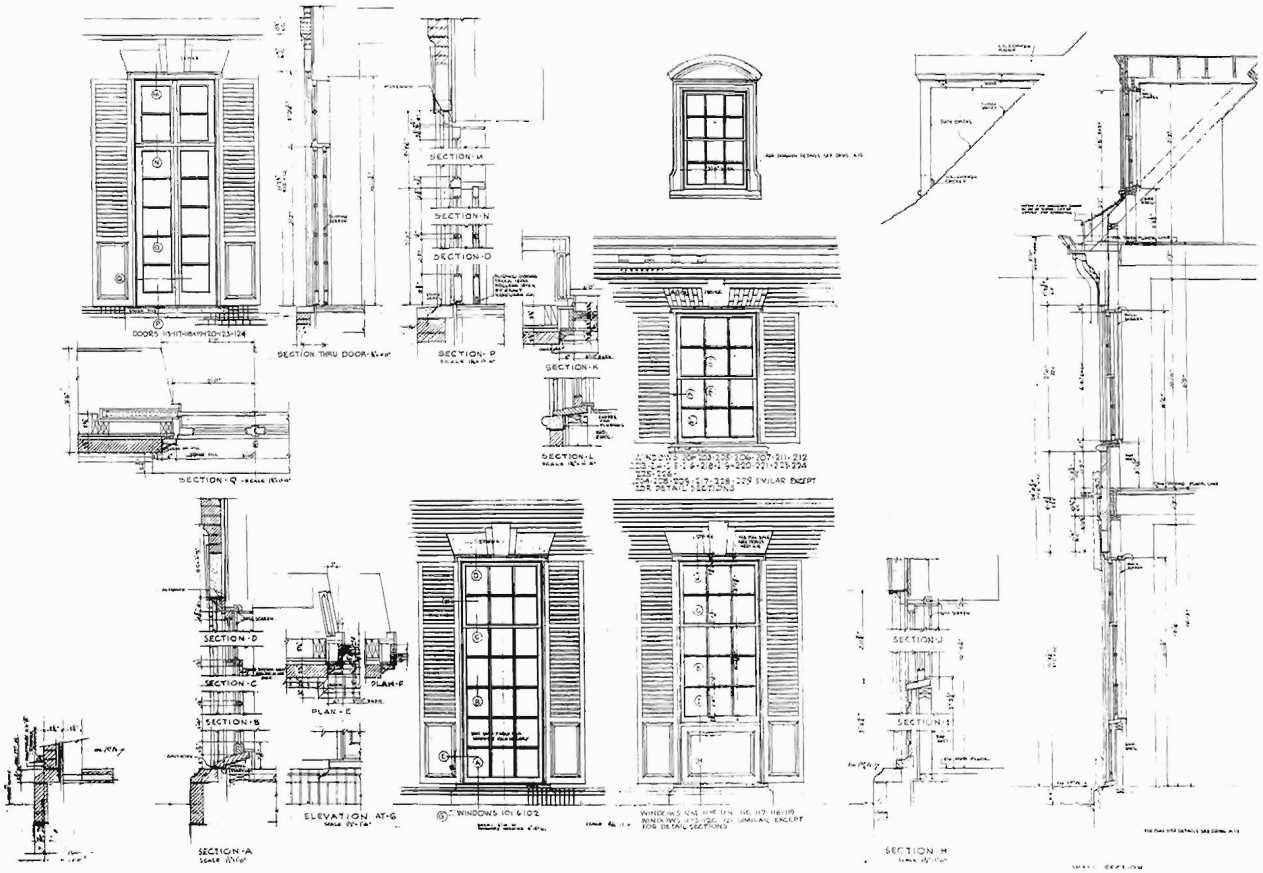
From a material standpoint, the relationship and dimension of the brick veneer to the structural framing is clarified here in both the typical brick ledge detail and the wall section. The plan detail of the entrance portico, moreover, is elaborated and dimensioned, while the unified composition of plan section and elevation convey coherently the relationships of the various dimensions of this building feature. And, as in the previous figure, from both a design and building sensibility the document informs the viewer graphically of what to expect to encounter in the course of the building process.

Nonetheless, there is lacking a dimensional reference to a particular datum. This is especially evident in the case of the wall section, where dimensioning begins at the brick ledge. One can only presume that the missing datum is clarified on another drawing. Similarly, head and perhaps sill heights of the window and door conditions should have been identified; otherwise one must look for that supplemental information on another sheet.

With the noted exception of these dimensional issues, FIGURE 4 is graphically accomplished and indicates a direction that drawings ought to follow in order to reconcile the components of plan, section and elevation.

FIGURE 5 reconciles all of the previous critiques. First, by indicating at the same scale the plan, section, and elevation of the building, all principal building details are described. While the presentation is of a typical condition, additional details serve to clarify other circumstances found in the building.


1 TYPICAL BRICK LEDGE
2 PLAN DETAIL @ ENTRY STEP
3 WALL SECTION @ ENTRY
4 DETAIL ELEVATION @ ENTRY
5 SECTION & PARTIAL ELEVATION @ TYPICAL WALL


SECTION-M
SECTION-N
SECTION-O
SECTION-P
SECTION-K
SECTION-L
SECTION-Q
SECTION-D
SECTION-C
SECTION-B
PLAN-E
PLAN-F
ELEVATION AT-G
WINDOWS 101 & 102
SECTION-A
SECTION-J
SECTION-I
SECTION-H

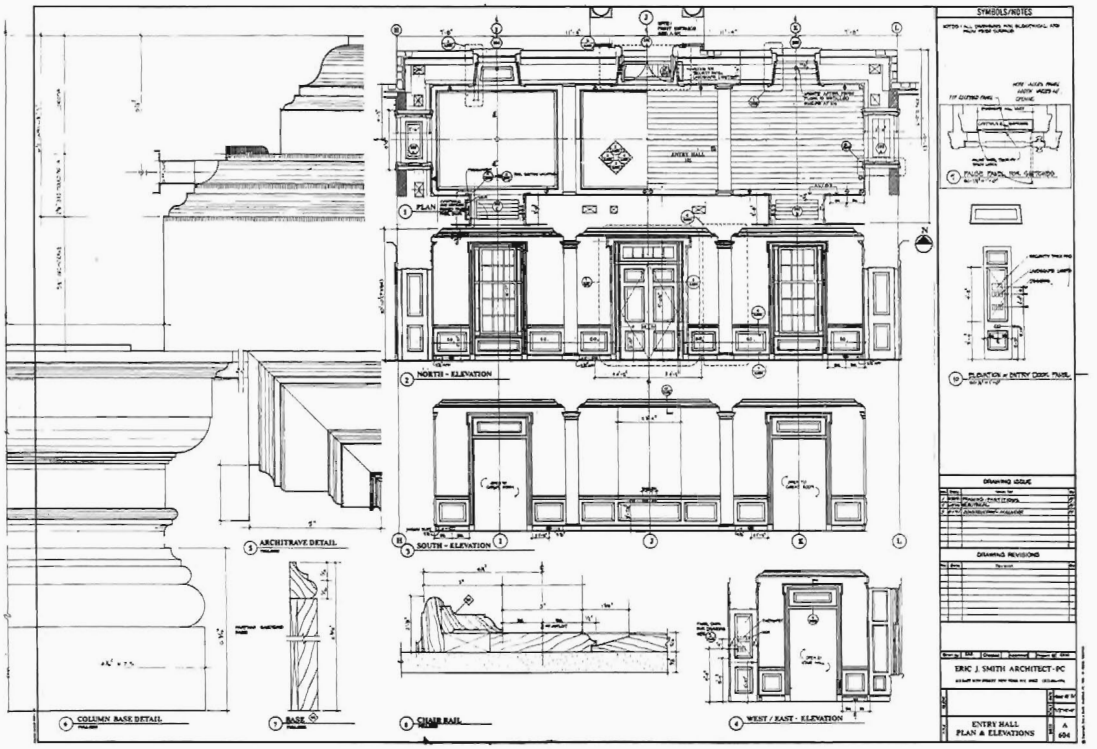


FIGURE 6: Eric J. Smith, Architect, New York, New York. A residence in Bedminster, New Jersey.

Dimensionally, the information is supplied in a clear and coherent fashion, particularly in the wall section. Here a datum is established at the finish first floor, from which all the dimensions are generated. The exterior string dimensions answer questions regarding overall height and brick and masonry coursing; the interior string provides head height, floor to ceiling, and floor framing dimensions.

FIGURE 5, while seemingly spare in information, reveals a well-studied composition. Clear and precise information is provided in a format which allows the designer and builder to reference the consequences of a detail in plan, elevation and section.

FIGURE 6 represents this same format applied to the interior. Again, a dimensioned grid implies the reconciliation of this scale drawing to the general drawing. The plan provides both floor and ceiling information in the same drawing. The elevations are referenced to the specific millwork details that are to be applied, thus insuring coordination among the trades. Lastly, the full scale details of the cornice and pilasters are immediately referenced.

One could easily imagine this drawing stapled to the framed walls of the room during construction—as in fact did happen! As such, it provides the specific information required by the carpenter, millworker, electrician, floor installer and other tradesmen. It is a true working drawing in that it graphically directs the resolution of all trades to the design intent.

FULL SCALE DRAWING: The full scale drawing is an enlargement of the scale drawing in which absolute detail information is shown. Specific dimensioning is resolved insofar as the finalized product is identified and all accompanied relationships are specified. The full scale details resolve the relationship of parts, as well as the use and specific requirements of the material. While distinct from a shop drawing, i.e.: a manufacturer's or fabricator's production drawing, full scale drawings imply a thorough comprehension of the materials with respect to strength of material, jointing and methods of securing the material to the structure. In this regard, the full scale drawing brings all of the concerns and abilities of the designer previously noted to the fore.

FIGURE 7, a detail drawing of an entablature for a restored brownstone (illustrated on page 53), provides a reference between the full scale drawing and the scale drawing. Here detailed components of an entablature are highlighted and rendered in elevation and section. The projection of the bracket, and its relationship to the entablature are idenitified. At full scale, the compositional format of the drawing and the delineation in shade and shadow of the projecting elements serve to reinforce the relationship of the parts to each other. The specific requirements of joinery are also clearly indicated and nicely resolved, facilitating the millwork fabrication as well as the eventual installation.

CONCLUSION: To return to a question posed at the beginning of the article: what is the relationship between the design process and the built form, and to what degree can one as an architect affect that relationship? Clearly, for the architect the principal means of communication remains the drawing—the studied graphic presentation of what constitutes the building condition.

Now, to be successful a drawing must be precise in presentation and accurate in dimensioning; yet to fully amplify the relationship between design and building, one must also be aware of the tools that are necessary to accurately describe a structure. A central thesis of this article has been that the thought required for developing a working drawing corresponds to that required for a design drawing. The primary concerns for each are to communicate in plan, section, and elevation and to present, where possible, those drawings in unison. The multiple-presentation format is therefore a model for understanding a building's composition or detail, and the specific elements of which they are formed. As such, the drawings serve to reconnect the architect to the construction process, and back toward the role of the master builder. —P.T.