
 <p>The cornerstone of confidence™</p>		September 2004
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<p>SEMINARS PinnacleOne Institute</p> <hr/> <p>SERVICES Program & Project Management</p> <p>Dispute Avoidance & Resolution</p> <hr/> <p>PinnacleOne is a national construction consulting firm that provides sound advice, strategic solutions and peace of mind to its clients. Its diverse, highly trained professionals guide its clients through every step of the design, construction and contract closeout process to help them achieve their goals, and at the same time, avoid and manage risk. PinnacleOne's unimpeachable objectivity, along with a proven approach to planning and attention to detail, has earned the company a reputation as one of</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <h2>Constructibility Reviews</h2> </div> <p>Given the complexities of design and construction, even the best designs will not be error-free. Most architects and engineers or owners have not competitively bid or built projects as contractors. It is also not uncommon for some of the project documents to be forgotten in pre-bid quality control reviews. Project related reports, owner-furnished equipment, or surveys are sometimes not compared to what is on the drawings. By using constructibility reviews at key points in the design process, it is usually possible to eliminate a high majority of these mistakes prior to bid before the 1-10-100-1000 Effect comes into play. This series of articles provides pointers on how to get the most out of your constructibility reviews and describes the trends that were encountered on projects that instituted a formal constructibility review process.</p> <p style="text-align: center;">USE LESSONS LEARNED BY OTHERS</p> <p>Oscar Wilde once said,</p> <p style="text-align: center;"><i>"Experience is one thing you can't get for nothing."</i></p> <p>Anyone who has had to deal with missing details, dimensional discrepancies, lack of coordination of mechanical, electrical and plumbing work or unconstructable plans during construction will tell you that the experience can be very expensive.</p> <p>In 2000, the Los Angeles Unified School District (LAUSD) embarked on a substantial program to construct over 150 new schools with a combined hard</p>	 <p>Ken Pruett</p> <p>Ken Pruett has extensive experience managing large capital improvement bond programs. Currently he is serving as Project Director at Los Angeles Harbor College for their Proposition A Bond Program which consists of \$220 million of construction of new campus facilities and the modernization of their existing educational facilities.</p> <p>Prior to his current project, Ken developed and ran the Los Angeles School District's Constructibility Review Program. The LAUSD Constructibility Program, consisting of 16 in-house reviewers and 5 outsourced review firms, conducted over 100 reviews on \$1 billion</p>

the finest consultants in the construction industry.

Headquartered in Phoenix, PinnacleOne regional operations are located in Irvine, Los Angeles, Sacramento, and Hartford.

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construction cost of \$1.5 billion through a voter-approved bond proposition. The District recognized that constructibility reviews at the conclusion of the design phase would serve to mitigate LAUSD's exposure to change orders and project delays. Due to the size of the LAUSD program, these reviews could potentially result in the savings of millions of dollars. Ultimately, the constructibility reviews on the LAUSD program caught thousands of errors, omissions, conflicts, and ambiguities in the contract documents prior to contracting.

LAUSD recognized the validity of Mr. Wilde's observation that experience is something you cannot get for free. That said, LAUSD also correctly concluded that cost of leveraging the experience of construction professionals who carried out these programs would be significantly less than dealing with design errors and other constructibility problems during construction and was money well-spent. It is estimated the District received at least a 10 to 1 pay back on the costs it spent on its formalized Constructibility Review and Construction Audit Programs. I hope that by describing below my experience developing and managing these initiatives for the LAUSD, some of the lessons we learned at LAUSD will benefit you as you embark on your construction program.

At LAUSD we organized and utilized multi-disciplinary review teams with construction-experienced personnel to implement and execute its Constructibility Review and Construction Audits. These teams began their work as the overall program was completing its design phase and transitioning into the plan check/permit phase. All of the design packages were successfully reviewed prior to submission to the permitting agency over the span of a year. LAUSD's consultants created and provided the reviewers with constructibility management tools including detailed scope of work for all review participants and comprehensive constructibility checklists. LAUSD then conducted constructibility audits on projects under construction or completed to ascertain and prevent recurring bid document errors.

At LAUSD, it became apparent after conducting only a limited number of constructibility audits that there were obvious trends in the errors and omissions in the contract documents. The LAUSD program was unique because of the large number of projects that were under construction or in design at any one time. It afforded us the opportunity to examine where previous bid document errors and omissions occurred and then apply that knowledge to the review of

worth of design in an 8-month period of time. He also created a Constructibility Audit Program for the LAUSD in order to develop and apply a lessons learned database to future LAUSD programs.

Prior to his work at LAUSD, he managed the Constructibility Review Program for the \$818 million USC replacement hospital for the County of Los Angeles, Department of Public Works.

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projects that were currently in design. We were able to continually build upon a "lesson learned" database of specific problem areas.

Lack of information about existing site conditions, coordination of MEP systems within the useable plenum space, and weaknesses between the coordination of civil, utility, and site plumbing information were some of the trends revealed. These lessons learned were added to the constructibility checklists established at the beginning of the constructibility program. Interviews with site personnel - superintendents, inspectors, and contractors also helped to formulate the lessons learned database. At LAUSD, all this information was fed back to the reviewers conducting the constructibility reviews so that there was a continual improvement in the quality and thoroughness of the reviews.

We learned many things in the process. The most notable are as follows:

- 1 **The Importance of Site Visits:** The documents reviewed on the LAUSD program consistently did a very poor job of illustrating the complete picture on-site. For the LAUSD program, the civil reviewer visited the site with topographic and utility survey and all site plan (architectural, plumbing, electrical) information in hand. The civil reviewer would verify that the conditions existing on-site were as depicted on the documents.

Projects that involved additions or modifications to existing facilities suffer in particular from unaddressed site conditions. The architectural, structural, MEP, and civil reviewers should all visit the site as a part of their review of additions/modernization projects. Close attention needs to be paid to new construction integrating with existing construction. If new raceways are shown indicated intruding into existing areas, hazardous material mitigation, plenum space conflicts, or available panelboard space for new circuits need to be addressed. Numerous times when new electrical or systems panelboards were to be added to existing electrical, mechanical, or LAN rooms, the rooms lacked the physical space to install the new panels. The site visit ended up being

one of the most revealing and beneficial aspects of the LAUSD constructibility review program.

- | **Potential Issues with "Performance" Type of Drawings/Specifications:** Most of the designs relied on "performance" type of drawings and specifications to represent certain systems. Precast panels and precast support systems, fire sprinkler systems, and shoring systems were examples of where a designer may specify these systems in a performance manner and place the design-build responsibility on the contractor. Although this seems to be standard practice within the design industry, gaps in the scope of work occur if they are not properly specified. For instance, if no fire sprinkler systems drawings are included or at best a schematic of a fire sprinkler riser line is provided, then it is likely that the bid documents fail to address the installation of power or signal to the fire sprinkler flow switches, since the switched would not be shown on the drawings.
- | **Need for Coordination with Geotechnical Recommendations:** Blanket statements about compliance with recommendations made in the referenced geotechnical reports in the structural general notes were often found to be in conflict with the information provided in the earthwork specifications or structural drawings. The geotechnical reports would often address several options or flatly made no reference to conditions shown on the drawings (i.e., allowable shoring systems). The result was a potential conflict between the geotechnical, earthwork, or structural systems which were unclear at the time of bid or were subjective and left the least expensive, and often less desirable, option to the contractor.
- | **Failure to Provide Enough Useable Plenum Space:** This was a problem that was consistently discovered in the audits or the reviews. Project budget concerns resulted in reduced floor to floor heights while at the same time aesthetic design considerations increase ceiling heights. These two factors limit plenum space with the inevitable impact to ductwork, cable trays, and ceiling-mounted equipment.
- | **Inadequate Horizontal Control:** Horizontal control (civil)

information needs to provide benchmarks and centerlines and have sufficient dimensional information to locate all major building and site features outside of easements and right-of-ways.

- | **Potential Undermining of Adjacent Property:** Site plans also need to consider adequate offsets to adjacent properties to prevent undermining of neighboring properties.
- | **Failure to Consider Miscellaneous Power Requirements:** Electrical documents need to consider all miscellaneous power requirements, such as carbon monoxide sensors, high water level alarms, irrigation controllers, automatic overhead doors, and miscellaneous mechanical equipment.
- | **Interface Between Owner FF&E and Contractor Work:** Owner-furnished kitchen or medical equipment needs to clearly define where the owner's "furnishing" scope stops and the contractor's "installation" scope begins.

The constructibility review, when conducted properly and focused on those issues that affect buildability will pay for itself. For a large public works program with construction cost of over \$500 million, a 2 to 5 per cent reduction in construction costs through a comprehensive constructibility review can result in millions of dollars in savings for what are relatively minor costs associated with conducting the reviews. It can be difficult to quantify in dollars what the review has saved an owner, since the stage of construction that the error is discovered has the biggest impact on its cost. That said, I would like to again quote Oscar Wilde:

"Experience is the name that everyone gives to their mistakes."

Don't let your mistake be not seeing the value of constructibility reviews. You need only uncover a few of the major and recurring issues listed above to realize its value. This is true no matter what the size of your construction program.

Editor's Note - This series of articles is adapted from a paper presented by Mr. Pruett in the Construction Management Association of America's E-Journal dated May 2004.

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