

Creation of a System-Wide Commissioning Program for a Public School District

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Synopsis

Arlington Public Schools is a major metropolitan school district in the Washington, D.C. area consisting of approximately 35 facilities and 19,000 students. As of 2001, building commissioning had never been implemented in any capital project, including renovations, renewals, mechanical system replacements, and new construction. As of fall 2002, a commissioning program has been designed and is in place. With the knowledge and supervision of the School Board, approximately \$100 million in planning, design, and construction activities will be affected by this program in the next four years. This work will be accomplished by three commissioning firms that have been retained on five-year indefinite delivery contracts. This paper presents some of the challenges and obstacles involved in initiating the program, as well as anticipated outcomes from the program.

About the Author

Roger Mosier is the Director of Design & Construction Services for Arlington Public Schools. Prior to joining Arlington Public Schools, Mr. Mosier worked as an energy consultant, commissioning provider, and construction manager. Mr. Mosier holds bachelors and masters degrees in mechanical engineering from Virginia Tech and is a licensed professional engineer.

Introduction

Arlington Public Schools (APS), located in Arlington, Virginia, consists of approximately 19,000 students housed in 35 facilities. A bond-funded renewal program has been in place for the last 15 years that provides voter-approved funding for capital projects. As this program has become more extensive in recent years, the need for commissioning has become more pronounced.

All bond expenditures are managed through APS's Department of Design and Construction Services. This includes all contracts for professional services and construction-related activities. At the time that the commissioning program was implemented in 2002, this department had five employees, though at present the number has increased to eight. Every two years a bond referendum is put before the Arlington voters. In recent bonds, the referenda have provided between \$40 and \$80 million in design and construction funding, and the voters have approved the bonds by approximately 80% approval rates.

Identifying the Need for Commissioning

APS has identified a need for commissioning due to many of the traditional reasons, such as lack of satisfaction with building performance. Several different, additional issues have factored into a decision to attempt commissioning not just for a single project, but for the entire upcoming program of construction.

APS Project Team

Like many owners, APS has a large project team for construction. For any issue that may be related to the mechanical system, involvement may be seen from any or all of the following:

- Mechanical Engineer
- Construction Manager
- APS Project Manager
- APS Maintenance Engineer
- Building Engineer
- General Contractor
- Mechanical Contractor
- Controls Contractor
- TAB Contractor

Due to the small size of the APS Design and Construction Department, several of the above team members are outsourced. The Construction Manager (CM) is typically a full-time on-site manager of the project as a representative for APS, and is a consultant. In addition, all design services are procured through consultants, as APS does not have in-house design capabilities as some of the larger school districts do. Furthermore, the APS maintenance staff does not have the time to troubleshoot mechanical systems and is usually involved only for punchlists and training.

The APS building engineer is typically a head custodian, except for the larger facilities. Certainly, the involvement of the mechanical engineer during construction is limited, and it is beyond their scope of work to attempt to troubleshoot mechanical issues. Efforts to force the mechanical engineers to address problems have not been successful.

The construction contract structure introduces issues as well. APS sole-sources the energy management control system and requires all general contractors (GC) to hire a specific installer. Typically this controls contractor is a second-tier subcontractor to the mechanical contractor. As such, any lack of performance on the part of the controls contractor, or even perceived lack of performance, leads the GC to blame APS for any problems associated with the controls system or its delivery. This type of argument will often be expanded to include all elements of the mechanical system—not just controls. It is therefore difficult to sort through the responsibilities during and after construction to determine who must respond to an issue or fix a problem.

Given this project team structure, there is typically no single point of contact for identifying and resolving mechanical systems issues during construction, other than the APS project manager. Once the warranty period starts, it is more difficult to address items as they arise, since the contractor is gone from the site, and the maintenance staff is not yet responsible for troubleshooting. The CM is perhaps the most apt person to address the construction of the mechanical system and its operation, but the CM is usually preoccupied with completion of the school in time for the arrival of students, and is often focused on dozens of other issues. Therefore, despite the best efforts of the CM, the mechanical system performance is often not on the list of critical issues, and regardless, most CMs do not have a background in mechanical systems.

Because of the above issues, which are certainly typical to many owners, it became clear that the introduction of a commissioning provider to all projects would be beneficial if not critical. Moreover, other factors also contributed to the decision to implement a commissioning program: the LEED™ program and post-occupancy reporting.

U.S. Green Building Council's LEED™ Program

The U.S. Green Building Council's Leadership in Energy and Environmental Design program is a rating system for building construction that focuses on a number of different sustainability issues. Part of the rating system includes a prerequisite for basic commissioning as well as an additional point available for enhanced commissioning. In Arlington, as well as in other districts nationwide, this program has achieved a high level of visibility and has been deemed a desirable goal by the School Board. In addition, the Arlington County Board has gone further to integrate the LEED™ program into its requirements for developers.

Because of the Board-level awareness of and desire for participation in the LEED™ program, School Board members have become familiar with the elements of the program, including commissioning. As a number of APS projects were considered for participation in LEED™, it was determined that only one would be selected for the present so that a showcase project could be completed prior to any further policy decisions regarding sustainability. The project selected

was the Langston-Brown facility: new construction of a 50,000 square foot building that is shared with Arlington County Department of Parks, Recreation, and Community Resources.

Despite the selection of only one project for participation in LEED™, it was determined that the elements of the LEED™ program would be implemented in other projects, where feasible. Given the School Board's interest in sustainability it would be anticipated that other projects, even though they would not be scored for LEED, could certainly accomplish some of the same goals. Examples of items to be implemented in other projects would include construction waste management, selection of recycled materials, design of efficient mechanical systems, storm water best management practices, low-flow and waterless toilet fixtures, and commissioning.

Thus, when the School Board agreed with staff to implement elements of sustainability where feasible in non-LEED™ projects, it made sense to include commissioning as one of those elements.

Post-Occupancy Reporting

Problems with the newly constructed mechanical systems have been apparent not only to the building occupants and facilities staff, but to parents and School Board members as well. The School Board's policy dictates that for each building that undergoes a bond-funded project with a citizen design committee, a post-occupancy report will be developed. This report includes a debriefing of the design committee and occupants, as well as an analysis of the project from an architectural and construction point of view.

In 2002, these reports were written and presented to the School Board for eight projects totaling over \$50 million. Rather than simply delivering the reports to the Board, staff was requested to present the findings of the reports at televised Board meetings. As such, the content of the reports is intended for public consumption.

One common thread throughout the reports is that the mechanical systems do not provide comfort conditions in many areas. When surveyed, occupants expressed frustration with new mechanical systems that did not work properly. At the Board presentations, staff was able to suggest commissioning as a remedy to the problem that would provide improved comfort. While recommending this solution, it was also noted that the LEED™ program requires a level of commissioning as well.

Due to the combination of factors involved, it became a natural step for APS to implement a system-wide commissioning program for all projects. Considering the feedback from the building occupants in the post-occupancy reports, it would be difficult to defend implementation of commissioning in some projects but not others, because there is a direct correlation to occupant satisfaction. Therefore, the commitment was made to implement commissioning for all bond-funded projects.

Initiating the Commissioning Program

As it became clear in the late 1990s, if not earlier, that the mechanical systems issues would not solve themselves, APS staff began to contemplate commissioning. The following chart shows the past, present and selected future construction projects for the school system.

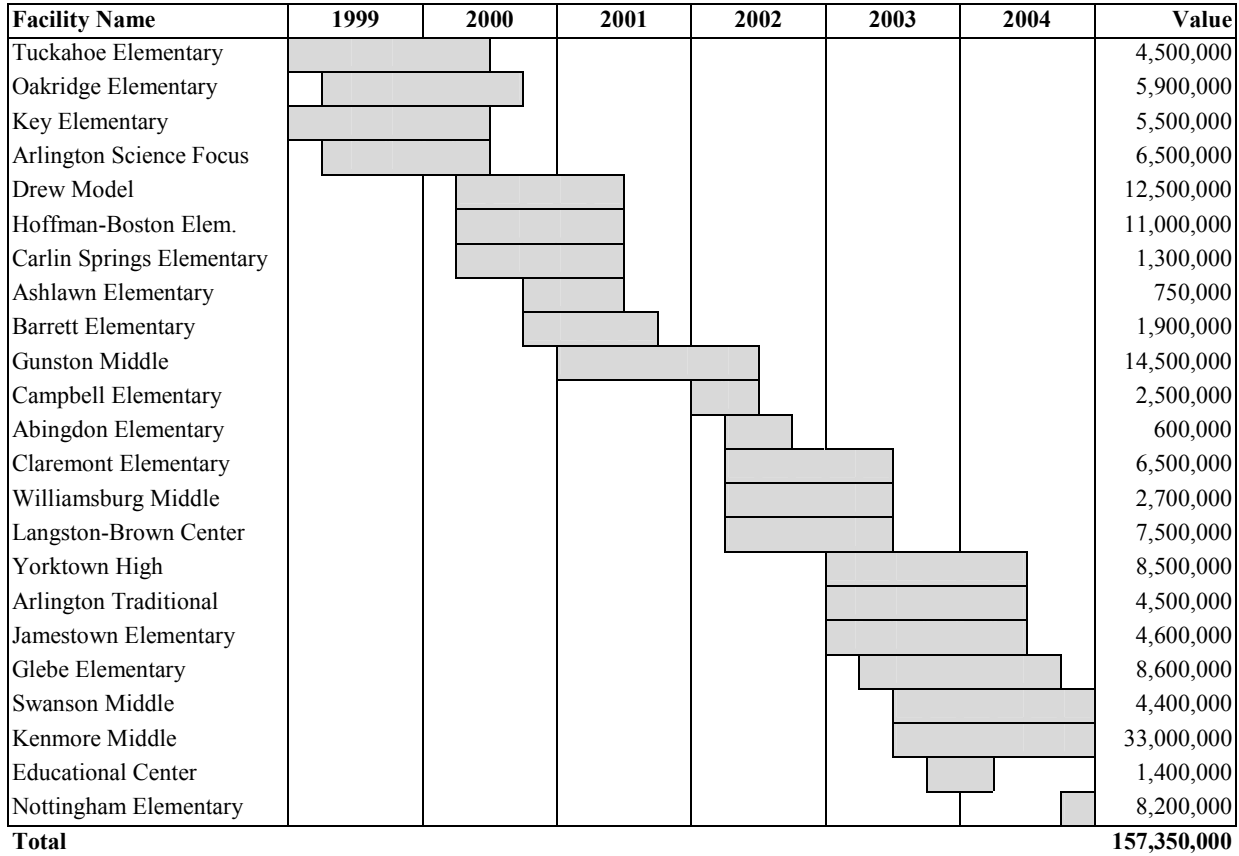


Figure A: Schedule of Projects

The commissioning program was initiated in 2002. Given the schedule above, some projects received commissioning attention midway through construction, some for the duration of construction, and others have the benefit of commissioning during the design phase.

Inclusion of the Commissioning Plan into the A/E Contracts

Although actual commissioning activities by commissioning service providers did not begin until 2002, commissioning was foreseen two years earlier. In 2000, a district-wide commissioning plan was drafted. At that time, it was apparent that mechanical system performance was a problem, and it was suspected that commissioning might be the answer. In discussions with a construction manager from one of the renewal projects, it was learned that that CM had commissioning experience, and he volunteered to draft the plan for possible use by APS. APS agreed to review the plan and potentially make use of it when considering options for the future.

The plan turned out to be a short description of design review, functional testing, and other traditional commissioning items, and was deemed simple and attractive enough to adopt.

When architectural services contracts were awarded in 2001, the commissioning plan was attached to those contracts, which include the last 11 projects listed in Figure A above. Thus, all fee issues related to architectural and engineering consultants were resolved up front in the contract negotiation phase. These contracts were awarded over a year before any commissioning activities were to take place. At that time, it was unclear whether commissioning would be implemented or whether funding would be available, but the philosophy was that if commissioning was pursued, at least the A/E firms would be on board from the beginning.

Procurement of Commissioning Services

Since 1997, APS has utilized construction management services for all major construction projects. In order to accomplish CM work, APS issued an RFP for professional services related to construction management. As a result of that RFP, three five-year open-ended CM contracts were awarded. During each five-year period, for any construction project that is funded, APS selects a construction manager from one of those three firms. Thus, each firm has an incentive to perform well on every project, as any lack of performance could lead to a selection of a competing firm for the next project. This performance-based, rather than fee-based, selection of CMs for projects has worked very well and the CM firms themselves have been satisfied, as there have been plenty of projects distributed to all three firms.

Due to the success of this approach for construction management procurement, it was determined that the same approach should be taken for commissioning. Following a similar competition process, three firms were selected in 2002: CH2M Hill, Facility Dynamics, and Reynolds Engineering. These firms competed on an overall qualifications basis with no reference to any individual project. Once the firms were selected and contracts were awarded, projects were distributed among the commissioning firms as determined by APS.

With the commissioning contracts in place, and with the design firms already anticipating commissioning, a framework is now in place whereby commissioning could be implemented as needed, as long as funding is available.

Funding for Commissioning Work

The funding for commissioning work at APS is developed on a per-project basis. APS is very fortunate in one particular aspect of its funding cycle: the design and construction of each project are achieved through separate bonds. In other words, any given bond referendum will include design funding for a project or construction funding, but not both. This allows the project to be fully developed through a public design process, with a firm estimate established, prior to the issuance of the bond referendum for construction funding. This is particularly critical due to the changing educational priorities and community needs that occur from year to year. If the design and construction funds were appropriated on a single referendum, minimal flexibility would

occur, and any increase in project scope would inevitably lead to degradation in the project. This degradation could easily lead to deletion of commissioning from the project.

Thus, when the 2002 bond package was developed, each project included a budget item for commissioning. Although each individual amount is modest, from \$30,000 to \$85,000 for most projects, taken together they represent a large level of effort for commissioning.

There are some exceptions to this availability of funding, and there are certainly some cases where projects were underestimated in some way. For those cases, funding for commissioning has been drawn from the project contingency with the hope that a commensurate decrease in change orders will help the project be delivered on budget.

Currently, budgets have been developed for commissioning of mechanical systems only. Past experiences indicate that the overwhelming majority of MEP problems experienced have been HVAC-related, so it has been determined that commissioning will be focused only in that area.

Results

At this time, the commissioning program is in place, and that program is itself the result that is the subject of this paper. Beyond that, APS has seen a number of positive aspects of the work initiated to date. The commissioning activities during design have been largely successful. It is very helpful to have a mechanical systems-focused design review early in the project. Although this has been widely reported for many years, it is certainly confirmed in Arlington. In addition, the development of items needed for commissioning, such as guide specifications and commissioning plans, are complete and streamline the projects as they move into commissioning activities.

Regarding project closeout, no fully commissioned projects have yet to reach completion. In September 2003, construction of two large projects will be completed that have been funded for commissioning on a robust level. At that time, the first indications of the overall program success will be given.

One positive aspect of the program is that there is now a contractual vehicle for miscellaneous mechanical consulting. Although open-ended contracts for mechanical design services have been in place for some time, it has been seen that design engineers typically do not have the experience or interest in performing commissioning-related activities, particularly retro-commissioning. With the new commissioning contracts in place, APS has the ability to quickly engage consultants that can solve problems in existing buildings or newly completed projects that designers have been unable to address. Another plus is that these contracts are available to APS maintenance managers as well, should a need arise.

In summary, APS is pleased with the development of the commissioning program. With the elements of a commissioning program in place, construction projects are now poised for an improved level of quality in the delivery of educational spaces for the citizens of Arlington.