

# Renovating & Reconstructing in Phases

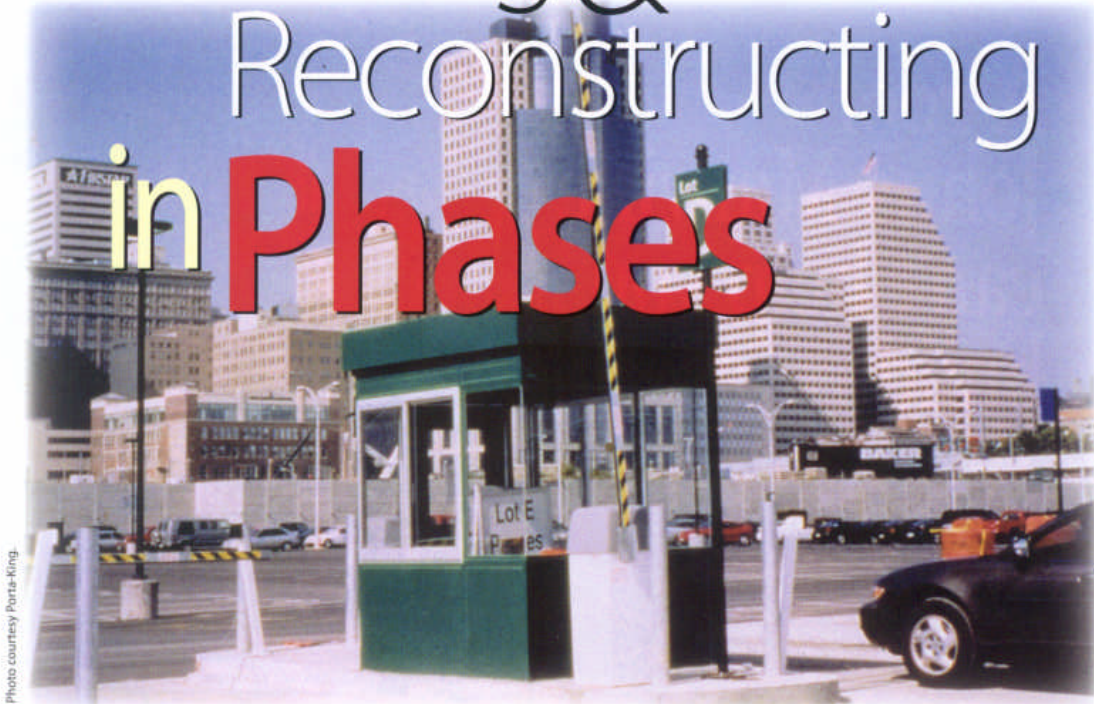


Photo courtesy Ports-King

## Specifying phased construction

by John Bunzick, CSI, CCS, CCCA

What would induce a school's owner to endure months or even years of construction only a few feet away from a building's occupants? Dust, noise, blocked corridors... the disruptions seem endless. The current school construction boon finds many communities facing this predicament, as there is no suitable land upon which to build new schools, nor available space in other facilities to temporarily house students.

Hence the need to renovate and expand occupied buildings. Nor is this dilemma limited to schools—public and private buildings of all types find similar restrictions, especially healthcare facilities. Careful planning and thorough documentation are key to every successfully phased project.

Planning for a phased project should weigh expected benefits against disadvantages. The primary argument for phasing is usually the desire to avoid the logistical hurdles of relocation and the foreseeable costs of providing temporary facilities, but these costs are often not fully appreciated. Chris Caligari of CostPro Inc. (Cambridge, Massachusetts) figures phased construction can add approximately 20–25 percent to the overall construction budget! Clearly, close scrutiny of the economics of phasing a project is essential.

Phased construction in a school can create a significant disruption to the students' education. Frequent complaints of noise, odor, and dust can be expected, along with occasional unplanned interruptions in power and water. Phased construction entails increased risk of unanticipated factors delaying important deadlines, which are usually structured around a fixed school calendar.

Missed deadlines create misery for school officials and results in sloppy workmanship as construction accelerates. The owner must provide significant staff support during construction to address problems that arise. On the contracting side, phased construction is inflexible, reducing the size and availability of work areas, increasing crew overlap and inefficiencies, and complicating equipment and materials deliveries.

The most effective way of dealing with any potentially disruptive problems is to establish direct communication between the contractor and owner. Each day, the contractor should advise the owner of the next day's planned work in an effort to prevent unexpected problems. Both parties can work to accommodate the needs of construction without undue disruption.

# Phased Construction Contract Documents CHECKLIST

## Instructions to Bidders

- Advise that project is phased.

## Supplementary Conditions

- Include basic requirement that work be completed in phases shown.
- Include requirement to meet milestone dates.
- Require overtime or off-hours work (when applicable).
- Phase-based liquidated damages (if any).
- Requirement for partial Certificates of Substantial Completion by phase.

## Section 01115—Construction Phasing

- Explain general design intent of phasing.
- Describe sequence of phases.
- Delineate scope of work for each phase.
- List milestone dates for each phase.
- Include schedule for owner's operations.
- List dates when building is not occupied.
- List specific items of work not easily shown on drawings.

## Section 01140—Work Restrictions

- Limitations on work hours imposed by phasing.
- Limitations on access to owner-occupied space by contractors.
- Occupancy-based restrictions on hazardous material remediation.
- Worker conduct and comportment, and restrictions on contact with occupants.

## Section 01310—Project Management and Coordination

- Communications responsibilities for daily problems.
- Responsibility for notifying building authorities.
- Responsibility to incorporate phasing in coordination drawings.

## Section 01320—Construction Progress Documentation

- Scheduling of phasing.
- Review of phasing schedule status.

## Section 01330—Submittal Procedures

- Submittal of MSDS sheets for hygienist's review for occupants' health and safety.

## Section 01510—Temporary Utilities

- General requirement to maintain services without interruption.
- Requirements and coordination for maintaining power, water, telephones, public address, and so forth.
- Temporary ventilation, general requirements.

## Section 01560—Temporary Barriers and Enclosures

- Dust barriers, including construction.
- Gasketing on dust barrier doors, and limitation on their use.
- Temporary means of egress.
- Temporary exit signs.
- Control of air quality in occupied spaces.
- Charcoal filters on air intakes.
- Diesel exhaust scrubbers.
- Limitation on use of noisy tools.

- Noise performance standards.
- Limitations on work to ensure occupants' safety (i.e. during steel erection).
- Flaggers and police details.

## Section 01600—Product Requirements

- Limitations on products with odors.
- Limitations on VOC-containing materials.

## Section 01730—Execution

- Contractor's responsibilities for moving owner's equipment.

## Section 0177X—Project Closeout

- Closeout requirements at completion of each phase.

## Divisions 2 through 14

- References to Division 1 requirements for phasing when specifically affecting the work of a section.
- Technical requirements for temporary work if different than that for new.
- Specific product restrictions for control of VOCs and odors.
- Specific product-related use limitations for control of noise, safety, dust, odors, and VOCs.

## Division 15

- Reference to Division 1 requirements for phasing.
- Interconnection of existing and new control systems.
- Temporary HVAC systems.
- Temporary ventilation, specific materials, and performance requirements.
- Testing and cleaning of existing systems needed for temporary work.

## Division 16

- Reference to Division 1 requirements for phasing.
- Interconnection of existing and new fire alarms, telephones, data systems, etc.
- Special equipment required for temporary interconnections.
- Sequence of installation for new power distribution.
- Temporary lighting and fire alarms at temporary egresses.
- Wiring of temporary HVAC systems.
- Testing of existing systems needed for temporary work.

## Phasing Drawings

- Physical limits of each phase on site.
- Show temporary walkways and driveways.
- Limits of each phase within building.
- Means of egress for each phase.
- Locations and details of temporary partitions and barricades, including fire ratings.

## Mechanical/Electrical/Plumbing Phasing Drawings

- Schematic location and size of temporary piping and ductwork.
- Riser diagram of temporary wiring with conductor and circuit breaker sizes.
- Temporary lighting and fire alarm devices.

## Effects on occupancy

A well-planned phased project must have a committed design team comprising the architect, owner, consulting engineers, and local building officials to keep things running smoothly. User considerations when planning phased construction include:

- Temporarily moving some occupants to an off-site facility to make space for construction;
- Erecting modular structures for temporary use;
- Dividing existing large spaces into smaller, temporary use facilities;
- Keeping the number of times a user must relocate to a minimum;

- Evaluating the needs of each temporary space (i.e. science classrooms cannot be moved into non-laboratory space); and,
- Adjacency requirements of spaces (i.e. department heads needing to be near their staff).

Planning phased construction must take into account two general themes: coordinating occupants of the building and the transition between the old and the new. In addition to aiming for a non-disruptive work environment, a phasing plan must outline a reasonable sequence of construction, and allow for the protection and life safety of occupants. Often more challenging but equally important is the connection to, and transfer of, existing building systems to new ones.

#### *Temporary space*

If temporary space must be constructed, whether within the existing structure or outside, it must be designed and detailed commensurate with the type of use and duration of the need. Temporary construction may include relocating built-in casework, lockers, food service equipment, and so forth. The necessary services for operations must be indicated in the contract documents, including lighting, power, telephone, data, HVAC, security, and finishes.

#### *Construction adjacent to occupied spaces*

Specifications can limit the use of noisy tools near occupied areas to an after-hours schedule, along with the operation of excavating equipment near existing buildings. Consider including noise performance standards measured in decibel levels (acoustical consultants can establish reasonable and enforceable standards).

Prohibit or limit the use of products that create disruptive odors if they cannot be completely isolated from occupied spaces (suggest using low-odor, water-borne adhesives and paint formulations). Consider retaining a certified industrial hygienist to develop further restrictions on products that may produce harmful or nuisance off-gassing. The hygienist can perform a design-phase review of specified products plus a construction-phase review of Material Safety Data Sheets (MSDSs).

Odors can travel surprising distances, so temporary ventilation may be required, and maintaining negative pressure within construction zones and positive pressure in occupied areas also helps. Odors can also enter a building through fenestration, ventilation systems, or cracks in the building envelope, so use charcoal filters over ventilator intakes and scrubbers on the exhaust of diesel-powered equipment. In some cases, temporary fans and ductwork may be needed to provide fresh air to occupied spaces.

#### *Construction procedure safety zones near occupied areas*

Whether for physical reasons or policy, some work cannot be done when nearby spaces are occupied. Physical limitations may include requiring a shut-down of key building services, such as water or power, and potentially dangerous work, such as overhead steel erection, may need to be limited.

Policy sometimes dictates the type of work that can be done when the building is occupied. Although asbestos abatement may be safely performed in a confined area of an occupied school, for example, the community may demand this work be done when the students are not present.

#### *Code-complying means of egress*

Phased projects inevitably affect existing means of egress, which may be through, or blocked by, areas under renovation. For each phase of construction, adequate code-compliant egress must be provided, in consultation with building and fire officials during design to determine their expectations. This may necessitate the construction of temporary doors, covered walkways, barricades, emergency lighting, and signs. The users must also adapt their evacuation plans to the new routes, so keep evacuation route maps up-to-date. (For his part, the owner should hold practice drills every time egress routes change.)

#### *Temporary barriers*

Temporary partitions to control dust and odors are usually necessary. Barriers should be dustproof, and reasonably airtight. If doors are required in the partitions (or if existing doors provide such access), they must be gasketed and their use limited to avoid creating pathways for dust and odor. Healthcare facility renovations now fall under demanding infection control requirements that may include dustproof partitioning and maintaining HEPA-filtered negative air balances within the construction zone.



Barricades are a temporary measure for keeping general building users away from construction. The barricades can be relocated a phases progress, perhaps indicating where the nearest new methods of egress are located. Photo courtesy Plastic Safety Systems Inc. Photo courtesy of Plastic Safety Systems Inc.

#### *Access to construction*

Access to construction areas may conflict with occupied spaces. Routes selected for transporting materials and labor must be evaluated for conflicts with the routes used by occupants, and separated to the maximum extent feasible. At times, flaggers or police details may be needed to control traffic, and the contractor should provide these services, rather than the owner directly, so they can be carefully coordinated construction requirements. Some conflicts may necessitate summertime or off-hours work.

#### *Site access*

Besides providing access to construction areas, access must also be maintained to site areas used by occupants, such as parking facilities and playing fields.

#### *Unforeseen conditions*

Phased construction schedules for schools are often crafted around the academic calendar, with the completion of particular areas coinciding with specific dates. A missed 'drop-dead' deadline can create severe problems, so schedules should allow some recourse should a deadline be missed.

#### *Owner-purchased items*

Owner-purchased items such as furniture and supplies must be more carefully coordinated for a phased construction project. Deliveries must be scheduled with the completion of phases, and suppliers must be induced to make partial shipments timed to the availability of each space. Time must also be provided for the owner to vacate the next phase for the contractor and move into newly completed space.

### *Temporary Certificates of Occupancy*

When newly constructed spaces are about to be occupied, a temporary Certificate of Occupancy may be required to cover that particular portion of the building. (Early review of plans by building officials can ease this process.)



*Investing in some high performance signage can help during phasing construction. This exit sign is suitable for hazardous, corrosive, humid, and other harsh environments, and especially useful in highlighting exits for evacuations in power outages and other dangerous situations. Photo courtesy Brady Signmark®.*

### **Effects on building systems**

The phasing of a construction project must carefully consider how each building system will be affected, as new building systems must be available when existing systems are removed. Renovations are particularly challenging, since systems in use in an area scheduled for later renovation may be disrupted by work taking place earlier in the project. The availability and lead time for equipment must also be factored into the phasing plan. (In fact, the need to keep existing systems running until new ones are in place may actually determine the phasing plan design.)

Even though these systems are to be ultimately demolished, their temporary use or alteration may be needed to keep occupied spaces functioning. Temporary systems may have to be installed, and the connection to, and transfer of, existing systems to new ones must be evaluated and designed into the project.

### *Heating and cooling equipment*

Major heating and cooling system components may have substantial lead times, and new equipment to be located in existing mechanical rooms must be installed during the off-season so existing equipment can be demolished. Alternatively, a temporary mechanical room can be constructed to maintain existing systems until the new one is available. Heating and cooling plants may need temporary connections to new or existing distribution systems.

### *Heating distribution*

The phasing of heating distribution starts with a careful review of the layout of the existing system. Renovations in one area may mean the removal of piping or ductwork supplying other locations. Newer HVAC control systems will likely require temporary interfaces with existing systems. Such temporary connections and control interfaces should be researched and designed by the mechanical engineer.

### *Ventilation systems*

Code complying ventilation must also be maintained for existing spaces, in some cases requiring a complete temporary system of fans and ductwork. Smaller ventilation systems serving restrooms and other spaces may also be disrupted. One strategy for maintaining these systems is to provide temporary connections to new systems.

### *Power distribution*

New electrical switchgear can also have a long lead time. Often the upgrading of building power includes changes in service and distribution system voltages, as well new equipment. Maintaining power to the existing system can sometimes be accomplished by using the existing primary switchgear as a secondary distribution panel fed from new switchgear and service. This scenario could be temporary if the existing switchgear is removed in a later phase.

The temporary connections required can become complex in situations such as lighting upgrades from 110 volts to 277 volts, and conversion of distribution from single- to three-phase. Such work may require temporary step-down/up transformers, entrance service, or even temporary utility transformers. The more complex the conversion, the more important it is the construction documents illustrate what the electrical contractor must do.

### *Electrical circuiting*

When phasing involves renovating smaller portions of a building, investigation into the location of electrical panels that feed each space may prevent problems during construction. If the panel is located in an earlier-renovated space, or if the wiring passes through such a space, temporary wiring may be required. Sometimes, the sequence of the work can be adjusted to avoid additional wiring.

### *Fire alarm systems*

Fire alarm systems can present unique challenges. Of course, existing systems must be maintained throughout the course of construction. In some cases, fire officials may require the existing system to be maintained even in the areas undergoing renovation. New control and annunciator panels may need to be brought on-line to service new work, but those panels may be located in an existing structure, requiring temporary wiring. Temporary means of egress may require pull stations. Provisions must be made for existing systems to interface with the new control panel, even if they will be removed. Fire departments must be consulted on the locations of new panels and standpipe connections, fire lanes, and other changes so they can maintain an appropriate level of fire response.

### *Public address systems, telephone, and data networks*

Like electrical wiring and fire alarms, building systems key to the owner's operations will be affected by the work. Consider the case of a new addition to an existing building where the new public address system control panel must be located in an area not yet built. A temporary location must be found, interfaces to the existing provided, or alternative plans put in place. Parallel telephone systems may need to be maintained if the existing and new cannot be interconnected. Data networks face challenges as well. Carefully planning the locations of intermediate data-frame (IDF) rooms (which house network switches) can be vital to

keeping a data network functioning. Careful location of IDF rooms may avoid the scenario of new network wiring running through spaces not yet renovated, especially since data wiring is limited in length and cannot be spliced. IDF rooms can be used as connection points for temporary portions of the network and can temporarily house servers. Telephone systems may also make use of these spaces.

#### *Security systems*

Security alarms are often easily expanded to cover new work, but consideration must be given to maintaining systems in spaces occupied by construction personnel. This may require additional zones to be added to allow the occupants and the contractor to separately control the alarms for the spaces they occupy.

#### *Domestic and fire protection water*

Domestic and fire protection water must be maintained in occupied areas, so piping in areas under renovation may be located so it can remain or be reused. However, the need for temporary shut-downs must be coordinated with scheduled occupancy. The local fire department may require a fire watch should existing fire protection systems must be temporarily taken out of service.

#### *Site utilities*

Existing site utilities may need to be relocated to allow the construction of building additions, and the new utilities plan's optimal route may not be practical if it interferes with occupied areas. For utilities intended to tie in to the new systems, temporary services may be required until those new systems are fully in place and functioning.

#### **Contract documents**

Planning should be an integral part of the design of a phased construction project, and key decisions must be indicated in both drawings and specifications. A complete description of the phases in narrative and graphical form ensures the intent of the phasing is communicated to bidders, thus reducing the potential for disagreement during construction. Temporary construction that is not included in the permanent work should be indicated.

Phased construction projects present unique challenges. The painstaking work of careful coordination and documentation is rewarded by a smoothly running project. For some, the challenge of untangling the logistics of a complex phased project is reward in itself.

## **Additional Information**

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### **Abstract**

Phased construction in a school can create a significant disruption to the students' education, and entails increased risk of unanticipated factors delaying important deadlines—usually structured around a fixed school calendar. However, forethought and thorough documentation (both narrative and graphical) ensure the intent of the phasing is achieved.