Office of the Inspector General

Commonwealth of Massachusetts

Gregory W. Sullivan
Inspector General

A Big Dig Cost Recovery Referral: Dewey Square Air Intake Structure

March 2005

The Commonwealth of Massachusetts
Office of the Inspector General

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Dear Chairman Amorello:

I am forwarding for your review the most recent findings from my Office's continuing review of potential Central Artery/Tunnel Project (Project) cost recovery cases. These findings refer to poor construction management by the joint venture of Bechtel/Parsons Brinckerhoff (B/PB) and poor design work by the section design consultant for the C18A2 - Air Intake Structure contract at Dewey Square, the joint venture of Weidlinger Associates Inc. and Edwards and Kelsey Inc. (WEK).

Specifically, my Office found more than $1 million in potential cost recovery items against both B/PB and WEK. These items include poor design and construction coordination, failure to meet building codes, poorly designed rooms and walls, improperly sized doors and specifications for materials that did not exist.

I recommend that the matter discussed in this report be referred for cost recovery and that B/PB and the section design consultant be pursued for their share of these cost increases. My staff is available to assist you in any continuing examination of this or any other issue.

Sincerely,

Gregory W. Sullivan

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Inspector General

cc: Attorney General Thomas F. Reilly

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The Contract

The C18A2 - Air Intake Structure (AIS) contract is a three-story, 23,000-square-foot mechanical support building placed atop the existing Dewey Square Tunnel at the juncture of Atlantic Avenue and Congress Street. The main purpose of the AIS is to house two large air intake fans to supply fresh air to the rehabilitated Dewey Square Tunnel beneath it.

The AIS contract scope included structural fan supports, mechanical systems, electrical hardware such as conduits, motor control centers, control panel boxes, a lightning protection system, and electrical facilities associated with the Integrated Project Control System (IPCS).[1] This AIS contractor was to coordinate with other contractors on the supply and installation of the fans and their supporting electrical and mechanical facilities and equipment, an electric substation, and IPCS work.

On March 27, 2001, J. F. White Contracting Co. (White) submitted the apparent low bid of $12.3 million to construct the AIS. The Project issued the notice to proceed to White on May 14, 2001. As of January 2005, the cost of the contract has increased by more than $3.1 million or 25 percent to $15.4 million. This report addresses more than one-third of this cost increase.

[1] IPCS is the “smart highway” system being installed on the Big Dig.

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Findings

The Office of the Inspector General (office) is referring 11 issues to the Massachusetts Turnpike Authority for potential cost recovery. The following table lists the modifications involved:

Table 1: AIS Contract Modifications
Referred for Cost Recovery

Issue	Modification	Value	Reason
1	006 IA	$203,000	B/PB Error
2	008 FW	$22,000	Design Error
2A	087 IA	$80,000	Design Error
3	127 IA	$26,000	Design Error
4	009	$246,000	B/PB Error
5	029 IA	$67,000	Design or B/PB Error
5A	076 FW	$48,000	Design or B/PB Error
6	035 FW	$33,000	Design Error
7	067 IA	$106,000	Design or B/PB Error
8	097 FW	$39,675	Design Error
9	098 IA	$152,000	B/PB Error
10	105 FW	$10,200	Design or B/PB Error
11	Turnpike Issues	$340,000	
	Total	***$1,273,125***	

ISSUE 1: Modification 006 IA - Extra Monorail Steel - $203,000

This modification required the purchase and installation of nine extra steel supports for a hoisting system in the AIS. A component of this hoisting system is a monorail mounted from the building roof supports. This hoisting system will be used to lift and move large fans, up to 10 tons, within the building for maintenance, inspection, and replacement.

The bid specification for hoisting equipment calls for the construction contractor to "design, furnish/install and test the overhead chain hand operated monorail system."

Between July 2001 and April 2004, during construction, B/PB directed White numerous times (in response to issues raised by both WEK and White) to revise the monorail system and the roof supports for the system. The revised designs submitted by White in response to these directives were rejected numerous times by WEK.

This type of monorail system is usually referred to as "an off the shelf item," meaning that it is a commonly used in commercial/industrial construction, something that B/PB has vast experience with. Project documents do not indicate why it took nearly three years to get this monorail designed properly.

Beside the cost of the contract modification, an unknown number of hours have been charged to the taxpayers by B/PB and WEK for the nearly three years that it took to approve the monorail system. It should be noted that the WEK contract increased from $12.9 million in 1996 to more than $20 million on 2005.2

B/PB, as both design and construction manager, should have been able to sort this out much earlier and should have applied its expertise in getting the hoist system built.

Another issue regarding the monorail that should be pursued for its legal and regulatory ramifications concerns professional engineer stamps.

The contract required White to submit "shop and erection drawings signed and stamped by a Massachusetts Registered Professional Engineer (P.E.) showing loads, attachments to structures and interfaces with other equipment" for the monorail system. The contract also states that "all shop drawings providing original design or detailing performed by the contractor, including related calculations, if any, and proposed variances to the contract design, must be stamped by a Professional Engineer

[2] WEK is responsible for the design of the AIS as well as other design work in the Kneeland Street to Congress Street section of the project.

registered in the Commonwealth of Massachusetts in the appropriate discipline related to the elements of the work."

However, the manufacturer of the monorail system, U.S. Monorail under contract to White, submitted undated, unsigned drawings with a smudged stamp. The stamp belonged to the president of U.S. Monorail – an electrical engineer (registered in Massachusetts). It is inappropriate for an electrical engineer to stamp structural and mechanical design drawings. This may be a legal violation and is a contract violation.

According to engineers and architects that this office spoke with, smudged drawings may indicate an attempt to deceive those responsible for reviewing and/or approving drawings. Usually, professionals who use their stamps take great pains to ensure that the stamped information is clear and legible. There is no evidence that the drawings were subject to water or other damage. This issue should be reviewed further for a possible referral to the Massachusetts Board of Registration for Engineers.

The drawings originally submitted by U.S. Monorail were rejected for technical reasons. U.S. Monorail was then required to resubmit drawings. To our knowledge, the revised, approved monorail drawings remained unstamped yet construction proceeded.

ISSUE 2: Modification 008 FW – Equipment Access Hatch - $22,000

The equipment access hatch is located on the third floor of the AIS. B/PB issued a contract modification to White to change the original access hatch design. Apparently, WEK and its subconsultants initially designed standard hollow metal doors usually used vertically in a wall to be used as a horizontal access hatch in a floor. The modification stated that the reason for the change was that one person could not operate the door as designed. Additionally, installing hollow metal doors in a floor as an equipment access hatch is neither practical nor structurally acceptable per the state building code.

The original design should be referred for cost recovery as a designer error.

B/PB should be asked why it allowed this error to slip through the various levels of review that B/PB undertook for this design.

The modification required White to install a specially fabricated steel grate access hatch as well as special door opening hardware that had been missing from the original design.

The modification also required White to install an additional steel grate access hatch and hatch frame on the first floor of the AIS. This new hatch would provide access to the building foundation crawl space for maintenance purposes. The original design omitted this hatch; another designer error. The designer should have provided access to the crawl space. Without access, the crawl space would be like a room without a door.

ISSUE 2A: Modification 087 IA - New Fire Enclosure Around Access Door Opening - $80,000

Modification 008 FW, referred to previously, required White to change the equipment access door on the third floor of the AIS. This change resulted from an apparent designer error.

After work began on this new door, B/PB required that White add a fire enclosure at the access door in order to comply with the state building code. The designer originally called for a certain size of fire-rated door by a specific manufacturer. However, no such product existed (confirmed by this office after contacting the manufacturer) in the size needed for the AIS. As a result, the contractor had to perform a great deal of additional work, including:

- construct a concrete block wall;
- install a fire-rated ceiling:

- install a fire-rated overhead roll-up door;
- add various electrical and mechanical components for the hatch;
- remove existing ductwork;
- fabricate and install new ductwork;
- relocate a motor control panel;
- install a fire-rated door and frame with electrical controls and sensors, and
- paint (prime & finish) all new wall surfaces.

ISSUE 3: Modification 127 IA – Elevator Shaft Wall Infill - $26,000

The AIS elevator shaft was designed contrary to the state elevator code. To correct this, White received a modification for the cost of completing the enclosure of the elevator shaft so it would satisfy the requirements of the elevator code. This should have been identified as a design error.

ISSUE 4: Modification 009 – Transfer Girders Fabrication Delay - $246,000

The AIS rests atop the Dewey Square Tunnel. The AIS design called for the AIS to be supported by steel transfer girders spanning the top of the Tunnel. The realignment of the Atlantic Avenue By-Pass Road required that changes be made to the AIS girder supports.

In early 2002, White notified the steel fabricator that the girder design would change and asked the fabricator to stop work on the girders that had been ordered.

This realignment was known about before the AIS contract was awarded.

At the time of the pre-bid conference for this contract held a year earlier (January 2001), the realignment of the Atlantic Avenue By-Pass Road had been planned. In fact, the By-Pass was part of the AIS contract up until the final phases of the construction bid

process. In May 2001, under a statutory mandate this office reviewed the bid package for the AIS contract. This office wrote: “Prudent action by the Project, such as efficient site coordination and construction sequencing, will prevent costly delay claims and reduce the risk of change orders caused by additional mobilization and other delay-related costs incurred by the contractor.” The Project agreed with this comment.

This modification would have been unnecessary if White had been made aware of the realignment and if the contract specifications had been changed before the AIS contract was awarded to White. B/PB should have better coordinated this issue between the contracts.

ISSUE 5: Modification 029 IA – Standby Switchboard Room - $67,000

During AIS construction, the Central Artery Viaduct Demolition and Surface Restoration contractor, Modern Continental, submitted electrical equipment requirements to B/PB. This electrical equipment was intended for placement in the AIS third floor standby switchboard room. However, the equipment would not fit into the standby switchboard room. As a result, B/PB issued a modification to White for the reconfiguration and enlargement of the standby switchboard room, for changes to utility conduits and ductwork, the installation of additional light fixtures and addition of smoke detectors and alarm equipment that were now required for the intended use of the room.

This modification should be reviewed for cost recovery against either WEK for not designing the room properly and/or against B/PB for not coordinating contracts effectively.

ISSUE 5A: Modification 076 FW – Standby Switchboard Room Additional Ceiling - $48,000

As a follow-on to modification 029, White was required to relocate exhaust and supply fans, plenums[3] and ductwork from the stand-by switchboard room. The work also included relocating electrical lines, installing a new fire-rated ceiling and increasing the size of the heater in the room.

This additional work was needed to provide space for a follow-on contractor that would be installing equipment in the AIS. The modification also stated that building code compliance was an issue as well.

This modification should be reviewed for cost recovery against either WEK for not designing the room properly and/or against B/PB for not coordinating contracts effectively.

ISSUE 6: Modification 035 FW - T31 Granite Anchors - $33,000

The AIS design called for granite panels to be installed on portions of the external wall. The specifications for attaching the granite panels to the wall required that the base of the granite be cut to make the attachment to the outer wall. White expressed concern that cutting the granite would weaken the structural integrity of the granite wall by weakening the panels themselves.

B/PB issued a modification to White to design a new connection. White used an anchor system that allowed for easier installation and improved structural integrity.

WEK should have initially designed a better system for attaching the granite panels.

[3] The space between the real ceiling and the dropped ceiling, which is often used as an air duct for heating and air conditioning. It is also filled with electrical, telephone and network wires.

ISSUE 7: Modification 067 IA – 600 Volt Rated Wires and Cables - $106,000

In February 1998, B/PB issued a design policy memorandum requiring that 600 volt electrical wires and cables be insulated by ethylene-propylene rubber.

The AIS contract was awarded three years later.

The design specifications called for the wrong type of wire and cables. B/PB issued a modification to White for the replacement of approximately 9,000 feet of wire and cables. White also had to install additional electrical conduits for the HVAC control system.

WEK should have ensured that its specifications conformed to project directives. B/PB should have ensured that the specifications conformed to its own guidelines before the contract was awarded.

ISSUE 8: Modification 097 FW – Revise Granite Support Analysis - $39,675

The AIS design called for granite panels to be connected to the beams over each external wall opening (i.e., doors, windows, louvers).

White questioned the strength of the bolting system designed for this connection. WEK responded to White that the bolting system, as designed, would be insufficient to support the granite panels. B/PB issued a modification to strengthen the bolting system.

This modification should be referred for cost recovery against WEK for designing the wrong support system. B/PB should also be asked why it did not identify this issue during its multiple reviews of the design package for this contract.

ISSUE 9: Modification 098 IA – Coordination with C22A9, Hardware and Security - $152,000

The AIS doors and the electronic hardware for the doors were slated to be installed by the C22A9 contractor. However, this contract was not awarded until February 2003, two years after the AIS contract. This required B/PB to issue a modification to White for the installation of 20 doors with electronic hardware and the modification of 20 doors that had already been installed. All door frames had to be modified as well. Apparently, the AIS door design was incompatible with the specifications for the C22A9 contract.

B/PB should have ensured that the AIS and C22A9 contracts were better coordinated.

ISSUE 10: Modification 105 FW Door Height Adjustments - $10,200

The AIS was intended to house specific equipment. The AIS should have been designed to accommodate this equipment. It was not.

White received a modification to adjust three door openings to accommodate this equipment. The equipment could not pass through the doorways as designed and constructed.

In this office's May 2001 letter concerning the AIS, we identified this issue. A B/PB peer review of the pre-award contract documents also identified this issue. B/PB took no action to make this correction.

Cost recovery should be pursued against WEK and B/PB.

Issue 11: Turnpike Issues

The Turnpike Authority's cost recovery team has also identified three other modifications (033, 063, 119) valued at $340,000 for potential cost recovery on the AIS contract.

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