Office of the Inspector General

Commonwealth of Massachusetts

Gregory W. Sullivan
Inspector General

A Big Dig Cost Recovery Proposal: Trench Drain Failures Led to Cost Increases

November 2004

The Commonwealth of Massachusetts
Office of the Inspector General

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November 2004

Dear Chairman Amorello:

I am forwarding for your review the most recent findings from my Office's continuing review of potential Big Dig cost recovery cases. These findings refer to poor design work, design management, and construction management on the part of numerous section design consultants and the joint venture of Bechtel/Parsons Brinckerhoff (B/PB).

Specifically, my Office found that B/PB failed to prepare adequate preliminary designs and specifications for trench drains in East Boston. A fundamental part of the roadway drainage system, trench drains are located throughout the project. Although trench drains have been used since the introduction of the interstate highway system, B/PB has had difficulty making them work on the Big Dig.

B/PB allowed a myriad of trench drain designs to be used on the project. B/PB approved all the designs, many of which subsequently failed. B/PB then took nearly five years to provide the designers and construction contractors with an adequate remedy for these failures. In effect, B/PB charged the taxpayers to reinvent the wheel. Construction costs for these repairs may top $5 million.

I recommend that this matter be referred to the Turnpike Authority's cost recovery team.

My staff is available to assist you in any continuing examination of this or any other issue. Thank you.

Sincerely,

Gregory W. Sullivan

Gregory W. Sullivan
Inspector General

cc: Judge Edward Ginsburg

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INTRODUCTION

This report is a referral to the Massachusetts Turnpike Authority (Turnpike Authority) from the Office of the Inspector General (Office) concerning a potential $3 to 5 million cost recovery case against the manager of the Central Artery/Tunnel Project (CA/T Project), Bechtel/Parsons Brinckerhoff (B/PB).

Cost recovery is the process by which owners may file claims against design and construction management professionals for costs associated with possible errors, omissions, or other deficient practices.

This report deals specifically with the B/PB-approved repair and reconstruction of trench drains under three contracts: C07C1 (East Boston Toll Plaza and Facilities), C07D2 (I-90 Airport Interchange), and C08A1 (I-90 Route 1A Interchange). Trench drains are part of a roadway drainage system. In East Boston and elsewhere, these drains have failed apparently because of poor design and inadequate design oversight by B/PB. B/PB compounded the problem through a delayed management response to the drain failures after construction.

Project documents estimated the cost of repairing the East Boston trench drains at more than $1.5 million. Projectwide, these repairs may cost $3 to $5 million. To date, B/PB has not assumed responsibility for these failures nor has B/PB sufficiently investigated the issue to determine responsibility for the wholesale failure of this drainage system component.

The Office brings this matter to the attention of the Turnpike Authority and recommends a further cost recovery investigation.

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BACKGROUND

B/PB has been the project manager for the CA/T Project since 1985. Part of B/PB's management responsibilities included the preparation of preliminary designs for the various sections of the CA/T Project. The preliminary designs for the CA/T Project roadway system included a storm drainage system. These drainage systems collect rainwater and safely remove it from the roadway. Part of the drainage system is a trench drain. Trench drains are channels embedded in a roadway that are covered with a metal grate that allows water to flow into and traffic to pass over the channel. They are installed in areas where roadways dip into a valley and water would pool otherwise.

This Office reviewed a number of contract modifications for construction contracts in the East Boston portion of the project. The East Boston Toll Plaza contract was issued to construct the Ted Williams Tunnel tollbooths. The contract included contract modifications numbers 150 and 175 for "trench drain temporary repair" valued at $56,513. Additional trench drain related modifications on the I-90 Airport Interchange and the I-90 Route 1A Interchange contracts brought the total value of the trench drain related modifications in East Boston alone to nearly $1.5 million. Trench drains can be found throughout the project. B/PB documents estimate the cost to correct the projectwide problem to be $3 million. Other estimates identify a figure closer to $5 million.

The need for these modifications to repair and eventually replace the trench drains by the three East Boston trench drain contractors appear to stem from:

1) B/PB's failure to include standard design details for the trench drains in the project's preliminary design; and

2) B/PB's failure to prepare standard construction contract specifications for trench drains.

B/PB left the details and specifications of the trench drains to each of the numerous final designers or Section Design Consultants (SDC) on the project. As a result, no projectwide standard existed and each SDC designed its own version of a trench drain. Some of these designs failed soon after the opening of the roadway. When roadway trench drains fail, the accumulation of water creates a road hazard and possibly flood conditions.

According to project documents, "Virtually all trench drains have failed." These failures may be attributed to the SDCs requiring the wrong trench drain frames and covers for the types of roadways being designed. For instance, in the design of the I-90 Airport Interchange contract, the SDC specified and B/PB approved the use of a grate (trench cover) designed for slow moving traffic like a taxiing airplane.[1] The grate did not include a bolt down feature that would allow the grate to withstand the high impact loads of highway traffic. After installation in the East Boston roadways, these trench drains failed because the impact of traffic dislodged the unbolted grates covering the trench drain. Concrete failure and related anchoring of frames was also problematic.

[1] Neenah Foundry Airport Trench Drain R-4990 Type Grate.

FINDINGS

FINDING 1 – Before 1999, B/PB had no projectwide design standard for trench drains.

B/PB, as project manager, had many contractual responsibilities including the development of preliminary designs and projectwide standards. B/PB did not develop a standard trench drain design until 1999, eleven years after project design began, even though trench drain failures had occurred projectwide. As a result of not having a projectwide standard, approximately 10 SDCs developed their own details and specifications for trench drains. Therefore, each section of the CA/T Project had different trench drain designs and each SDC was paid for its own trench drain designs. Not having a standard design guideline also resulted in B/PB having to review and approve many different trench drain designs at an additional cost to the taxpayers.

The differing designs could create long-term operations and maintenance issues for the Turnpike Authority. The Turnpike Authority will have to deal with ordering and stocking a variety of replacement parts for trench drain repairs and will have to develop various specifications for future repair work.

Not having a standard led to B/PB's approval of some trench drain designs that proved inadequate. These inadequate designs led to the eventual need to repair and replace faulty trench drains and to the creation of a projectwide standard to prevent the further approval of inadequate designs.

A B/PB memorandum pertaining to trench drain issues stated that B/PB did not expect to find the variation in trench drain frames and covers that had become so problematic for the project. The result has been insufficient design work, roadway damage, and added costs.

FINDING 2 – The first projectwide standard for trench drains issued by B/PB did not specify a standard type of drain.

In response to what B/PB termed the "premature" failure of certain trench drains in May 1999, B/PB issued the first projectwide design standard for trench drains. The design policy memorandum, DPM 172, directed the SDCs to comply with this new standard for the design and detail of trench drains. B/PB did not specify the type of trench drain to be used other than to note that it should be suitable for interstate highway traffic loads. Fourteen major contracts had already been designed and were under construction. These contracts did not incorporate the new design standard.

The drawing attached to design memorandum was not dated, signed by or stamped by an engineer, nor did it contain any approval signatures. The memorandum also referred to using **two-foot** wide trenches. According to an undated B/PB memorandum, a B/PB investigation of trench drain failures concluded that a width greater than **one foot** led to many failures. In other words, B/PB's 1999 standard continued to promote failure. [Note: This Office's review of project files did not find any other reference to a B/PB investigation or evidence that B/PB conducted an investigation.]

FINDING 3 – B/PB took four years to revise the trench drain standard.

B/PB issued the first standard for trench drains in 1999. Even though this standard contained an unapproved, undated drawing and continued to allow varied and sometimes ineffective designs, B/PB did not issue a design revision to correct these design problems until 2003 – four years later. This revision came too late to prevent the construction of faulty trench drains or save the taxpayers money.

In 1999, the CA/T Project paid B/PB to issue an ineffective standard. Then, in 2003, the CA/T Project paid B/PB to issue the correct standard. B/PB took so

long to release the corrected standard that the revision had no impact on design work. Design work had been completed thereby rendering the corrected standard almost useless. Interestingly, this corrected standard contained a drawing that engineers had dated, signed, stamped, and approved.

FINDING 4 – B/PB assigned the trench drain repairs to numerous contractors yet it is unclear whether the repairs have been completed.

This Office's review of records concerning the trench drain issue indicates that beginning in 2002 - three years after it issued the standard trench drain design memorandum in May 1999 - B/PB assigned trench drain repairs to three contractors working on the East Boston portion of the project. Records do not indicate whether repairs have been attempted or completed.

B/PB first assigned the job to the joint venture of DeMatteo/Flatiron (DeMatteo) on the I-90 Airport Interchange contract in April 2002 for $125,000. DeMatteo installed the trench frames and grates as part of their original contract. B/PB instructed DeMatteo to fill in the drains temporarily and then install the permanent frames and grates. The contract modification justified the work by calling the trench drain failure a differing site condition. Prior to this, the concrete around the trench drain covers began to chip and degrade from the impact of the traffic. The design had failed. This Office found no evidence that DeMatteo performed the repairs or was paid.

Differing Site Condition

A differing site condition is defined in numerous CA/T Project contracts as existing when actual latent subsurface or physical conditions at the contract site:

> [D]iffer substantially or materially from those shown in the contract documents, or from those conditions ordinarily encountered in work of the nature undertaken. The contractor may be entitled to an equitable adjustment in the contract price if the awarding authority determines that such conditions caused an increase or decrease in the cost of performance.

Given this definition, the failure of the trench drains in East Boston cannot be blamed on a differing site condition.

B/PB never referred trench drain failures for cost recovery against the designers.

Prior to 2002, B/PB had full responsibility to refer potential cost recovery matters to the commonwealth for review and possible pursuit. If B/PB believed that SDCs were responsible for the trench drain failures, B/PB should have reported the problem to the commonwealth for cost recovery review. If it was B/PB's failure, the company should have pursued cost recovery against itself. B/PB did neither preferring to issue contract modifications, effectively charging taxpayers to fix the problem.

In May 2003, B/PB revised the design memorandum and directed DeMatteo to cease all related work and began negotiations with Barletta Engineering Corporation (Barletta), the East Boston Toll Plaza contractor, to repair the East Boston trench drains. Barletta proposed a cost of $642,000. Project records do not indicate what, if anything, came from this proposal.

In October 2003, B/PB requested that the I-90 Route 1A Interchange contractor, Barletta Heavy Construction, (a firm related to Barletta Engineering), repair the trench drains. B/PB estimated $845,000 for this work - $720,000 more than the

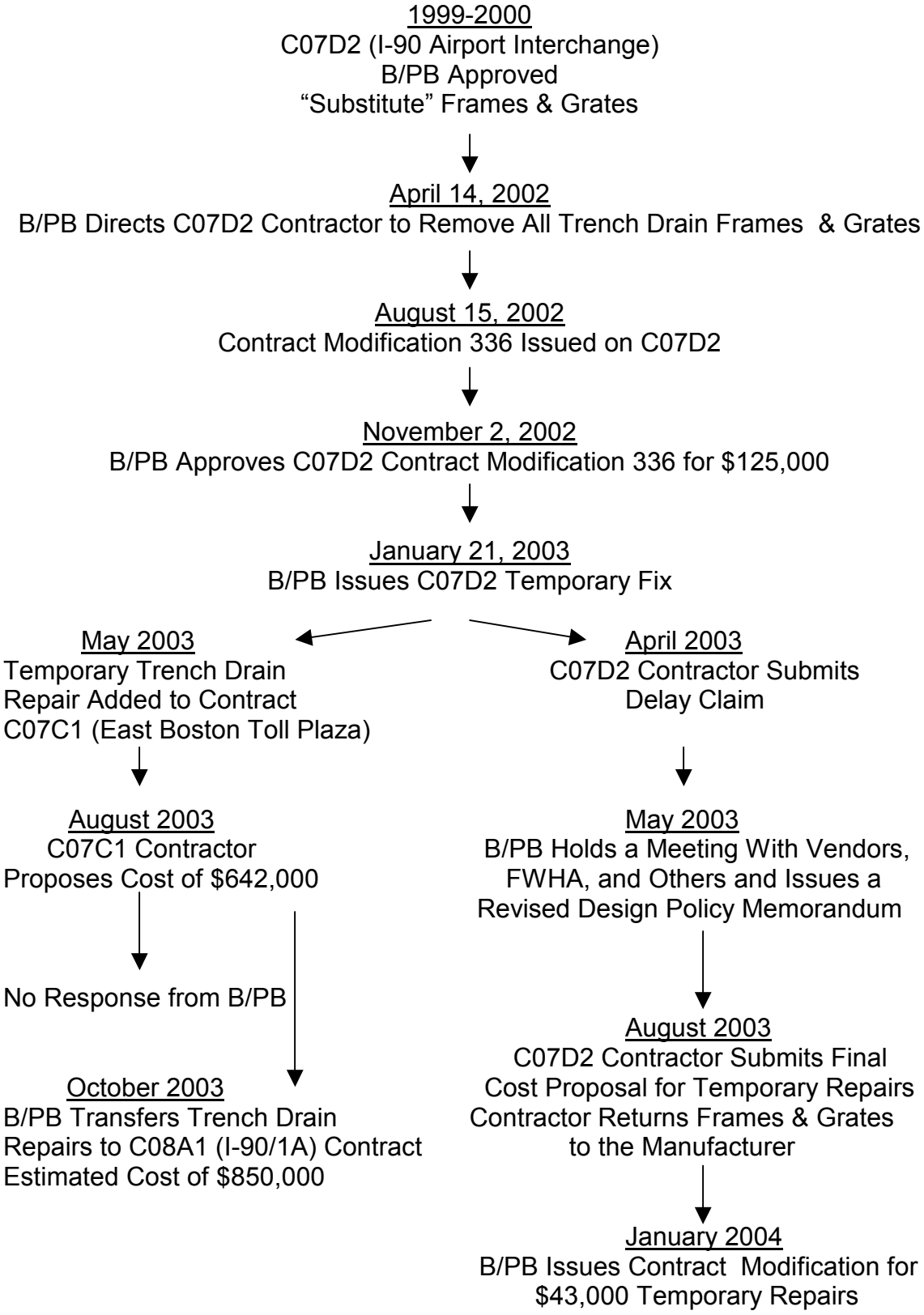
original contract modification with DeMatteo. This Office does not know if this work has been attempted, completed, or paid for. [See Attachment One for chart of East Boston trench drain repairs.]

FINDING 5 – Taxpayers have paid a high price for trench drain repairs.

East Boston trench drain failures offer just a quick glimpse of a projectwide problem. Most failures occurred after contractors had completed construction of particular sections of the project. To do the repairs, B/PB sought out the construction contractor working in closest proximity to the failed drain. This contractor received a contract modification to its contract. The contractors who performed this additional work received payment on a time and material basis. This Office and others consider this to be the most expensive form of payment to contractors.

B/PB simply reimbursed the contractors for the work. B/PB based the reimbursement on contractor estimates of the labor and materials used for the repair. As a result, trench drain repairs varied in cost and time. B/PB should have considered price when addressing this projectwide problem.

Attachment One: ***The Assignment of Trench Drain Repairs in East Boston***



CONCLUSION

The Office of the Inspector General recommends that the Turnpike Authority pursue a cost recovery investigation against B/PB regarding the failure of trench drains in East Boston and projectwide.

B/PB failed to ensure that adequate trench designs were used on the project. When trench drain designs proved inadequate, B/PB failed to take corrective action in a timely manner. B/PB's first attempts amounted to paying contractors to try "band-aid" solutions for the problem.

As a result of B/PB's failings, the taxpayers could pay $3 to 5 million more in construction costs and a yet unknown amount for added design costs.

Contract	Trench Drain Repair Costs
C08A1 (& C07C1)	$900,000
C09B2 (I-90 Seaport Access Tunnel Finishes)	$1,044,000
C09C2 (I-93/I-90 Interchange, Ramps, and Restoration at Albany Street	$1,000,000
Total Estimated Costs	**$2,944,000 (Minimal)**

What makes the failure of trench drains particularly troubling is that trench drains are a common part of roadway designs. Trench drains have existed since the 1920s and have been used extensively on roadways since the introduction of the interstate highway system in the 1950s. Although the Big Dig is a complex project, trench drains are not. Despite this fact, B/PB took nearly five years to develop a complete and reasonable design standard for trench drains after failures had been reported.

Turnpike Authority cost recovery efforts should include not only the added construction costs but also B/PB's charges for design and construction management related to the trench drain issue. In addition to the multi-year design effort to create a projectwide trench drain standard, B/PB failed at construction management as well. For example, B/PB claimed that it inspected and tested the trench drains along the Central Artery before the roadway opened in 2003. B/PB gave these trench drains passing grades. Yet, shortly after the roadway opened, the trench drains failed as they had done in East Boston.

In an undated and unsigned B/PB document pertaining to the trench drain issue, a section entitled "defense" states that B/PB did not provide specifications or design details for the project's drainage system. The inference here is that B/PB has no responsibility. B/PB's "defense" continues by stating that: "As B/PB became aware of inadequacy in the designs, steps were taken to correct those inadequacies in a timely manner."

This Office believes that a review of the facts will prove otherwise.

APPENDIX A:

Cost recovery related reports*:*

1) *A Big Dig Cost Recovery Proposal: Poor Contract Oversight by Bechtel/Parsons Brinkerhoff May Have Led to Cost Increases.* February 2004.

2) *A Big Dig Cost Recovery Referral: Contract Mismanagement by Bechtel/Parsons Brinkerhoff May Have Increased Big Dig Costs.* December 2003.

3) Proposal to Pursue Big Dig Cost Recovery: Ceiling Installation in the Ted Williams Tunnel. October 2003.

4) A Recommendation for Cost Recovery Against the Big Dig's Management Consultant: Grout Heave-Related Contractor Claims on the C11A1 Contract. February 2003.

5) A History of Central Artery/Tunnel Project Finances 1994-2001: Report to the Treasurer of the Commonwealth. March 2001.

6) A Review of the Central Artery/Tunnel Project Cost Recovery Program. December 2000.

7) Statutorily Mandated Reviews of Central Artery/Tunnel Project Building Construction Contracts 1997-1999. December 1999.

8) A Review of the Central Artery/Tunnel Project's use of Anchor Bolts on the C05B1 Tunnel Finishes Contract. December 1998.

9) Statutorily Mandated Reviews of Central Artery/Tunnel Project Building Construction Contracts 1994 - 1996. December 1996.