



SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT INDEPENDENT OFFICE OF THE INSPECTOR GENERAL

LESSON LEARNED: ANCHOR BOLT FAILURES AND QUALITY CONTROL BREAKDOWN

INVESTIGATION SUMMARY



The Office of Inspector General (OIG) received a confidential whistleblower complaint alleging potential mismanagement of materials on a BART infrastructure project, including the disposal of thousands of anchor bolts that failed during installation and concerns about inadequate quality controls. We substantiated these concerns.

During the project, approximately 93% of fabricated anchor bolts were discarded, resulting in significant material waste and at least \$1.1 million in potentially avoidable costs. The project involved technical complexity, multiple contractors, and time-sensitive construction windows, which underscored the need for stringent controls that would only be effective if they were consistently applied. Key oversight requirements, such as approving quality control plans and welding procedures prior to fabrication and adhering to testing protocols, were not completed when needed.

After conducting initial diagnostic efforts that did not identify a definitive root cause, BART discontinued further analysis and proceeded with a redesigned anchor system to avoid additional delays and cost escalation. By that point, \$1.14 million had already been spent on the original anchors, with 93% discarded (approximately 72,000 pounds of steel) and minimal recovery value. This was in addition to the \$1.1 million in potentially avoidable costs through change orders to remove and replace the failed anchors.

Established requirements were not consistently followed or enforced, limiting early detection of issues when corrective action would have been less costly.



WHY THIS WORK MATTERS



OIG investigation of allegations such as these is essential to maintaining public trust and ensuring responsible stewardship of public funds. Projects of this nature require coordination across multiple parties and operate within constrained timeframes, which can challenge consistent execution of established procedures.

Even where no recommendations arise, independent review helps clarify what occurred, reinforces adherence to existing processes, and underscores that controls are only effective when consistently applied. This focus supports stronger execution and reduces the risk of similar outcomes in future projects.

NO RECOMMENDATIONS



We did not make recommendations because the issues identified stem from inconsistent execution of established requirements rather than gaps in policy or control design.

Further, the OIG's FY 27–29 Audit Plan includes audit areas intended to evaluate project management and deliver targeted recommendations to address issues such as the errors noted in this investigation at a broader level.

CONSIDERATIONS UNDER THE CALIFORNIA FALSE CLAIMS ACT

We considered the circumstances identified in this report as potentially subject to the California False Claims Act (CFCA), which addresses false or misleading claims for payment. In this case, materials were deemed unusable and testing requirements were not completed properly.

We ultimately determined that the issues identified reflected a breakdown in the execution of quality assurance processes among the parties involved, including BART. Accordingly, we did not pursue this matter under the California False Claims Act and instead focused on understanding how these breakdowns contributed to the resulting waste. Our findings highlight the importance of ensuring that payments are supported by verified compliance and adequate documentation.

OIG REPORTING REQUIREMENT & DISCLOSURE PRACTICES

We are providing this report to comply with California Public Utilities Code § 28841, which requires that we keep BART administration, the Board of Directors, and the public informed of our fraud, waste, or abuse investigation findings and recommendations. The OIG received the whistleblower complaint in 2023 and conducted this investigation with support from an independent consultant specializing in forensic accounting and fraud examination. To avoid interference with related matters, we delayed reporting after first determining that there was no immediate risk requiring escalation.

We identify those involved in our investigations in only limited circumstances. This avoids violating privacy and confidentiality rights granted by law and creating unwarranted actions against those involved with our investigation. The decision to provide names is made on a case-by-case basis and considers all elements of an investigation. This practice does not prevent individuals from requesting documents under the California Public Records Act (CPRA). However, such disclosures may be restricted or limited by law. The investigation described in this report is associated with case number 173-2023.



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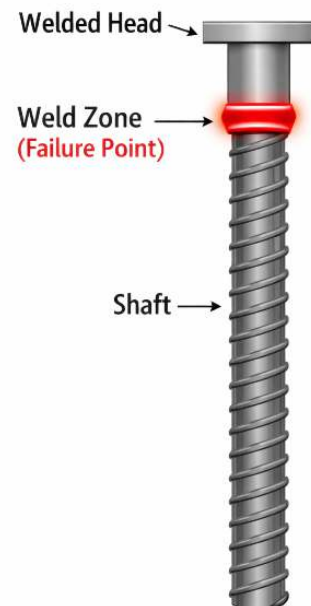
INVESTIGATION RESULTS

Project Background and Materials

In 2016, BART contracted with two construction firms for an infrastructure improvement project and with a construction management firm to oversee the construction firms' work. The project included the installation of large steel anchor bolts (anchors) used to secure structural components within the infrastructure system. These anchors were critical load-bearing elements intended to withstand significant tensile forces (stretching).

Originally, the contract specified the use of ASTM A706 Grade 60 steel, a U.S. standard material commonly used in reinforced concrete applications, particularly where weldability and seismic performance are important. In January 2018, the contractors requested approval to substitute this material with Korean standard steel (KS D 3504), citing supply limitations. Because material properties such as weldability can vary between standards, the substitution required evaluation. Therefore, BART approved the substitution with specific conditions, including:

- Limits on chemical composition (e.g., sulfur and phosphorus content) to maintain weldability.
- Submission of the proposed quality control plan (QCP)
- Submission of welding procedure specifications (WPS)



Illustrative Only

These requirements were intended to ensure that the substituted material would perform comparably to the original specification, particularly at the welded connection between the anchor shaft and head, which is a known stress point.

Fabrication Proceeded Without Full Review of Critical Documentation

Although BART approved the substitution, the anchors were ordered, fabricated, and delivered without BART first receiving the required QCP and WPS for review. As a result, BART did not have the opportunity to evaluate planned welding processes and quality control measures.

This reduced visibility into how the anchors would perform under load once installed and removed BART's ability to ask questions and provide feedback prior to fabrication.

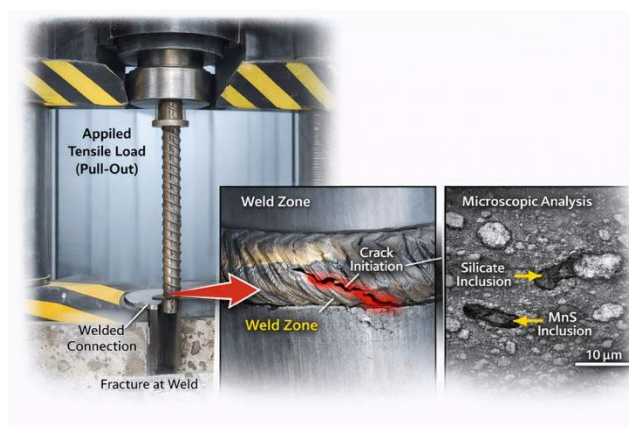
Testing and Quality Assurance Gaps

BART's project team did not receive the QCP until almost a year after the anchors were fabricated. Around that time, BART also received the manufacturer's testing reports and found that testing and quality assurance practices did not fully align with BART's requirements. Only 3 of 8,030 anchors were tested and testing was limited to a single configuration despite two sizes being fabricated.

Anchor Failures During Installation

Between April and July 2019, approximately 30% of the anchors failed during installation, with the failures consistently occurring at or near the welded connection between the anchor shaft and head. To understand the issue, the construction contractors and BART commissioned independent metallurgical testing to determine how the anchors behaved under stress.

The test results were generally consistent with expected material behavior under stress, with the weld zone functioning as a weak point where fractures both initiated and propagated. Microscopic analysis also identified non-metallic inclusions, such as silicates and manganese sulfide, in the weld area, which are common in such materials and can contribute to localized weaknesses.



Illustrative Only

Load testing showed variability with some anchors exceeding the required performance threshold and some underperforming. For example, in one test sample of 13 anchors, 9 (69%) met the tensile strength standard before ultimately failing, while the remaining 4 (31%) did not.

Despite these findings, testing did not conclusively identify a single root cause. Instead, results suggested that performance may have been influenced by a combination of factors, including welding conditions, fabrication processes, and loading during installation.

According to a third-party Certified Welding Inspector, other issues such as drilling accuracy, material variability, installation practices, and the effects of traffic in the work area may have contributed to the failures. This perspective suggests that multiple weaknesses may have combined to undermine performance, underscoring that controls are only effective when they are consistently applied. The absence of a single root cause does not indicate the failures were unavoidable, but rather that more rigorously enforced controls may have mitigated the outcome.

Project Resolution and Resulting Costs

Given the absence of a definitive root cause, BART determined that continuing the analysis would only delay the project more and drive-up costs further. Instead, they adopted an alternative anchor design and moved forward with removing and replacing the failed anchors.

By that point, \$1.14 million had already been spent on the original anchors, about 7,500 of them (93%) were identified as scrap, meaning roughly 72,000 pounds of steel were discarded, with an estimated scrap recovery value of up to \$10,000. BART also issued an additional \$1.1 million in change orders to remove the failed anchors and complete the replacement work.

These costs may have been avoidable had key quality control steps been completed prior to fabrication and installation, highlighting how technical complexity and project pressures can combine with gaps in process execution. Fabrication advanced before all review steps were completed, quality documentation was delayed, testing requirements were not fully carried out, and oversight responsibilities were not consistently enforced.

Breakdowns in Established Quality Controls

Individually, each of these gaps may not have led to failure. Together, they reduced the ability to identify and address issues early when corrective action would have been less costly. These requirements were well established and understood by both BART and its contractors, but they were not consistently followed or enforced in this instance.

Cost Impact & Material Loss Summary

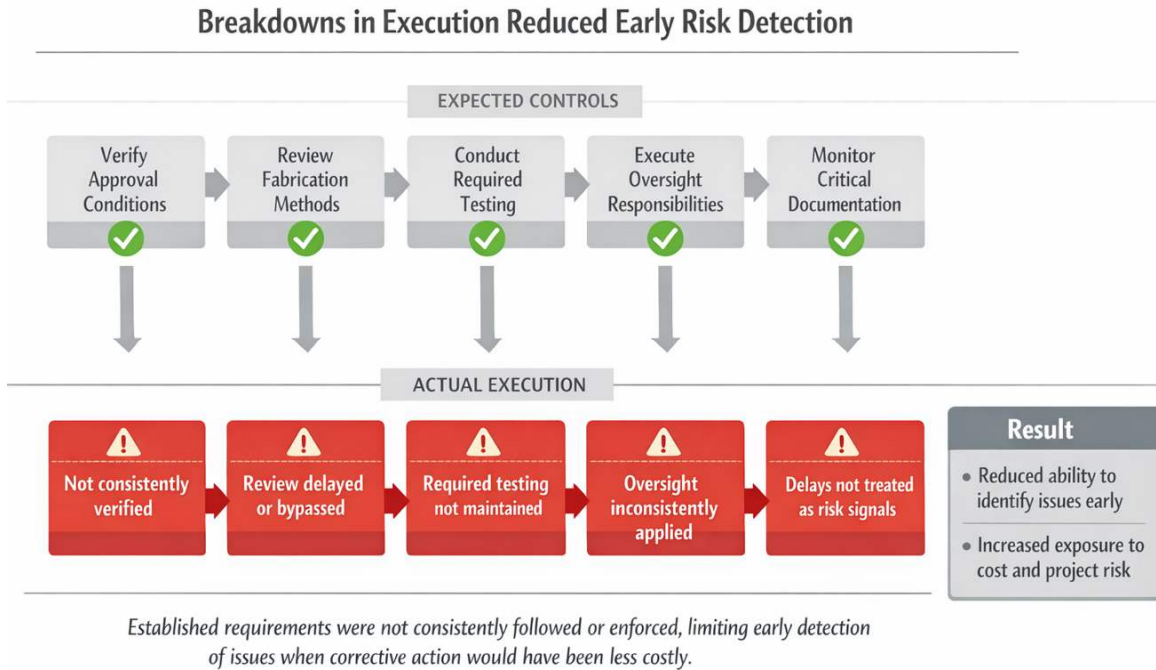
\$1.14M	Original Cost Included in Base Contract
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\$1.1M	Replacement Costs Change Orders
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72,000	LBS Steel Discarded
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7,500	Anchors 93% Marked as Scrap
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\$10K	Scrap Recovery Max Possible
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This investigation highlights key areas where execution broke down, including verifying conditions tied to approvals before proceeding, prioritizing review of fabrication methods before production begins, maintaining testing discipline even under time constraints, ensuring consistent execution of oversight responsibilities across all parties, and treating delays in critical documentation as risk indicators.

Alternative Solution

Following the original anchor bolt failures, BART's Engineer of Record developed an alternative design that eliminated the friction weld while continuing to meet the project's seismic engineering requirements. According to BART's Finding of Fact Change Notice 141, field testing demonstrated that the revised design performed in accordance with the contract.

The OIG did not independently evaluate or validate the technical adequacy of the alternative design. BART staff reported that the revised design satisfactorily met the project's seismic reinforcement objectives. The redesigned anchors were installed without failure.

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