



Caltrans Division of Research,  
Innovation and System Information

# Research

# Results

Geotech/Structure

**MAY 2019**

**Project Title:**

A Peer Exchange and Review of Deep Foundation Testing Methodologies at Caltrans, Transportation Pooled Fund TPF-5(263)

**Task Number:** 2444

**Start Date:** January 4, 2012

**Completion Date:** June 30, 2016

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## A Peer Exchange and Review of Deep Foundation Testing Methodologies at Caltrans, Transportation Pooled Fund TPF-5(263)

This research produced the commendations, findings, conclusions, and recommendations of a review of an in-depth analysis on gamma-gamma logging (GGL) data by an internal California Department of Transportation (Caltrans) Gamma-Gamma Logging Data Integrity Review (GamDat) Team.

### WHAT IS THE NEED?

In response to concerns regarding the handling of evidence of GGL data falsification that occurred in September 2008, and the subsequent public disclosure and State of California legislative oversight hearings in November 2011, a team of Caltrans engineers (GamDat Team) was formed by the Caltrans Structural Policy Board to review the integrity of their archived GGL test data. A technical investigative report of their findings was produced. In conjunction with that effort, the Federal Highway Administration (FHWA) assembled an external review panel (GGL Review Panel) in August of 2012 for the purpose of reviewing Caltrans' test procedures and practices for conducting GGL tests used for quality assurance during construction of CIDH concrete piles. The review panel collectively consisted of SMEs in field testing, data acquisition and management, and down-hole geophysical testing using GGL. The review panel was joined by FHWA geotechnical experts and a civil engineering professor who served as report writer.

### WHAT WAS OUR GOAL?

There were two objectives of this study, the first consisted of performing a peer review of the Caltrans Geotechnical Services Foundation Testing Branch (FTB). This review evaluated current practices used to test deep foundations (piles) on Caltrans construction projects, such as current operational practices and procedures associated with managing the testing program, conducting the tests, and managing the analysis and reports



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generated for Caltrans projects.

For the second objective, a team of Caltrans engineers, called the Gamma Gamma Logging Data Integrity Review Team (GAMDAT team), conducted a comprehensive technical review of the archived gamma gamma logging (GGL) data compiled by Caltrans over an 18 year period. In January 2013 the GAMDAT team issued a report on its comprehensive review of the gamma gamma logging testing performed by Caltrans during the past 18 years. The report described the total number of gamma gamma logging data falsifications it was able to uncover through the comprehensive review, an assessment of the impact of the falsifications on Caltrans construction projects, and recommendations for how the falsifications should be addressed by Caltrans. The GAMDAT team identified eight additional incidents of data falsification involving gamma gamma logging testing in addition to the three that Caltrans discovered in 2008 and 2009, for a total of 11 incidents of falsification.

## WHAT DID WE DO?

The GamDat Team was assembled in December 2011 at the request of Caltrans' Structure Policy Board and tasked with conducting a comprehensive technical review of the integrity of GGL data collected in the State. The review included identifying and documenting all evidence of irregular or manipulated GGL data, conducting a fully transparent review considering the advice and review of external stakeholders, and identifying opportunities to strengthen Caltrans practice. The team carried out the work through development of sophisticated data analysis tools that subject all available testing records to a high level of scrutiny. The tools identify potential irregularities in the data collection and processing, which are then further examined through a manual analysis process by team members.

FHWA reviewed the methodologies used by the GamDat Team and findings developed from the investigation. The team of FHWA and non-Federal SMEs conducted a comprehensive literature review of the materials provided and met with the GamDat Team. The external review was performed to assess Caltrans' test procedures and practices for performing GGL testing; and to evaluate the analysis methodology developed by the Caltrans GamDat Team to discover potentially irregular GGL test files. The review was conducted during the months of September through December 2012.

## WHAT WAS THE OUTCOME?

The primary findings of the review panel are that the GamDat Team has reasonably and comprehensively searched, compiled, and cataloged all available electronic GGL data files. The suite of analysis tools developed and applied to the GGL data files has to a high degree of certainty uncovered any data irregularities. The suspect rate of the GGL files searched is exceptionally low and would generally be considered as an acceptable rate of defects in quality assurance testing. The results of the GamDat investigation has shown no appearance of systemic or unit-wide intention of data falsification, or a pattern in the types of projects targeted. Ten (10) out of the eleven (11) identified cases involved the same technician. The results do not suggest that there is a safety risk to the traveling public.

The GamDat team is commended for packaging several screening tools into quality control processes to prevent issues with falsification of GGL data or improperly generated data files in the future. The data check tool was launched in October 2012, and combined with a GamDat team recommendation to eliminate field generated MSLog ASCII Standard (LAS) files, should greatly reduce a technician's ability to manipulate data

files. The review team recommends that Caltrans continue its focus on future prevention measures including those outlined in this report. In summary, Caltrans should consider developing the following:

- A written Standard Operating Procedures (SOP) manual for GGL testing.
- A formal training program for GGL technicians and engineers.
- A systematic approach to the archiving and maintenance of GGL test data.
- A written quality control and quality assurance program for GGL testing.

## WHAT IS THE BENEFIT?

The State Auditor reported (<https://www.auditor.ca.gov/pdfs/reports/I2009-0640.pdf>) that “through the GAMDAT team’s comprehensive review of the gamma gamma logging testing performed by the Foundation Testing Branch, the state bridge engineer’s analysis of the bridges and structures affected by falsified testing, and validation of the work of both the GAMDAT team and the state bridge engineer by independent peer reviewers assembled by the Highway Administration, Californians now have an accurate assessment of the extent to which the gamma gamma logging testing of California’s bridges and highway structures has been falsified and the impact that those falsifications has had on the safety of the bridges and structures that were tested improperly.”

## LEARN MORE

Caltrans website with all documents:  
<http://www.dot.ca.gov/hq/paffairs/gamma/>

The Final Report from the TPF project:  
[http://www.dot.ca.gov/hq/paffairs/gamma/DOT\\_FHWA\\_GGL\\_Peer\\_Review\\_Letter\\_and\\_Final\\_Report\\_20130206.pdf](http://www.dot.ca.gov/hq/paffairs/gamma/DOT_FHWA_GGL_Peer_Review_Letter_and_Final_Report_20130206.pdf)

The Caltrans GAMDAT team Final Report:  
[http://www.dot.ca.gov/hq/paffairs/gamma/FINAL\\_REPORT\\_GamDat\\_01-17-13.pdf](http://www.dot.ca.gov/hq/paffairs/gamma/FINAL_REPORT_GamDat_01-17-13.pdf)

The findings of this work were subsequently reviewed and published in a report by the California State Auditor, Report I2009-0640:  
<https://www.auditor.ca.gov/reports/summary/I2009-0640>

## IMAGES



FIGURE 1: Mount Sopris Testing Equipment: Winch and Computer



FIGURE 2: Mount Sopris Testing Equipment: Probe



FIGURE 3: Example of GGL Testing Site



FIGURE 4: Example of GGL Testing Site

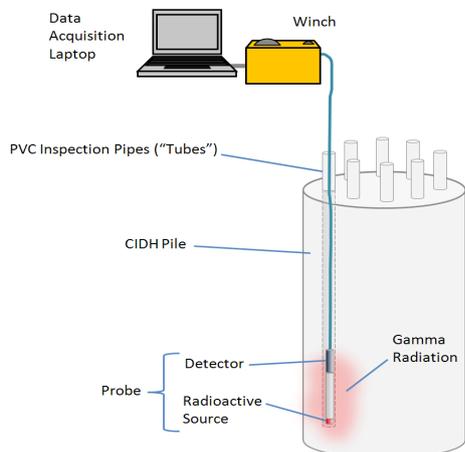


FIGURE 5: Gamma-Gamma Logging

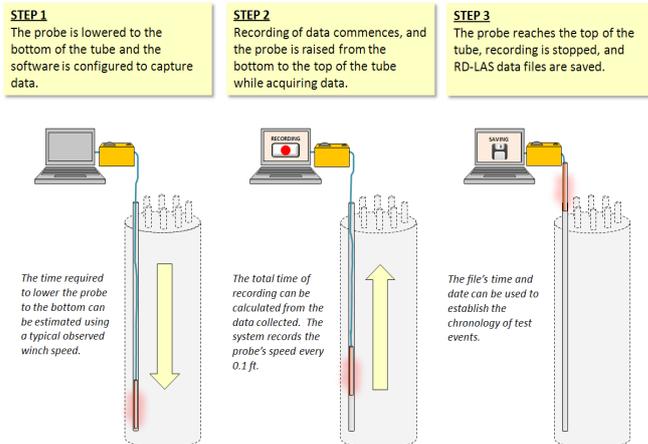


FIGURE 6: Typical Testing Sequence

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