# Memo

To: Blake Johnson and Mitra Emami, HDR

From: Zia Zafir - Sacramento

Date: March 7, 2007

Project No.: 66388/8

Subject: **Revised Design Memorandum**
**TRLIA Certification**
**Statistical Analyses on QA Data**

This revised memorandum incorporates comments by USACE dated March 5,2007 and transmits results of statistical analysis on the QA tests data performed by Kleinfelder on Phases 2 and 4 of the TRLIA project. The QA tests were performed in 2005 and 2006.

**Sand Fill (Yuba Seepage Berm)**

Sand fill statistical data are summarized for Percent Fines and Field Relative Density in the form of minimum, maximum, mean, and standard deviation in the Tables 1 and 2 below. Distribution of the data is presented in Figures 1 and 2.

**Table 1 – Percent Fines QA Data Summary for Phase 2 Sand Fill**

| % Fines – PHASE 2 SAND FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 57 |
| Minimum | 1.8 |
| Maximum | 7.8 |
| Mean | 5.1 |
| Standard Deviation | 1.3 |
| No. Failing Tests | 25 |

**Table 2 – Field Relative Density Data QA Data Summary for Phase 2 Sand Fill**

| Field Relative Density – PHASE 2 SAND FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 74 |
| Minimum | 31.1 |
| Maximum | 155.6 |
| Mean | 91.0 |
| Standard Deviation | 23.8 |
| No. Failing Tests | 5 |

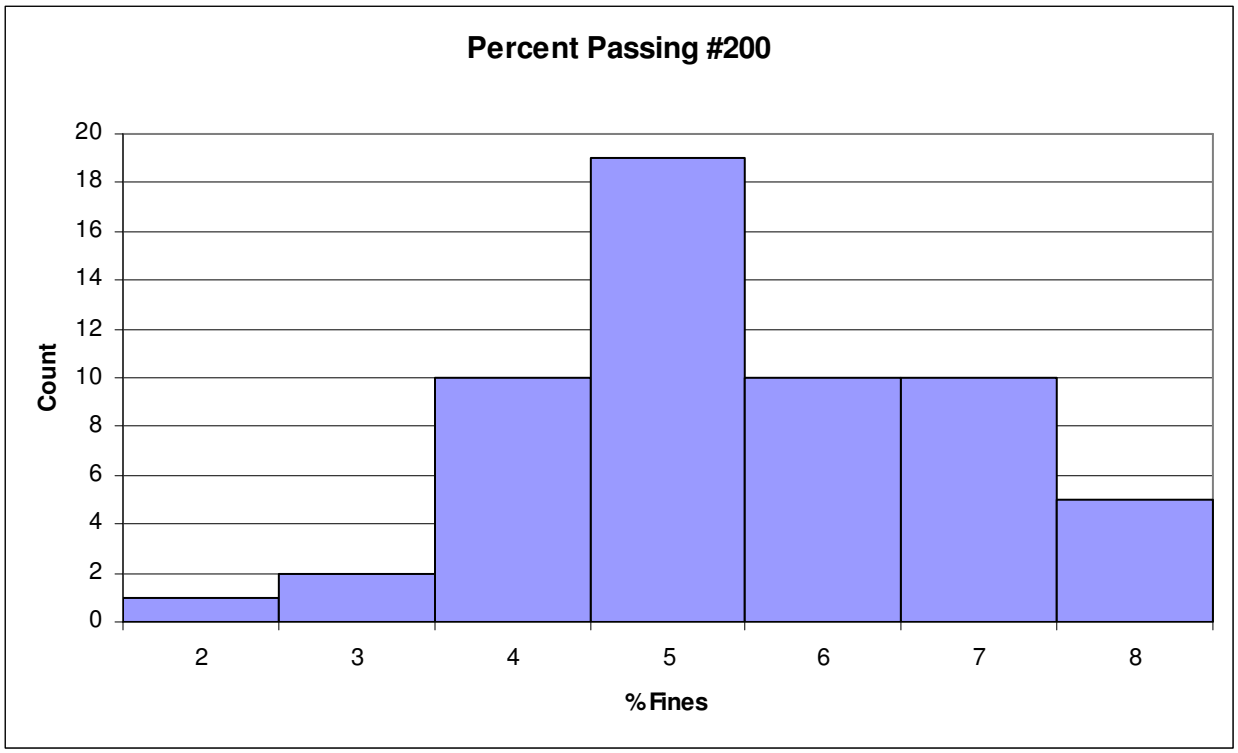


Figure 1: Histogram for Phase 2 Sand Fill – Percent Fines

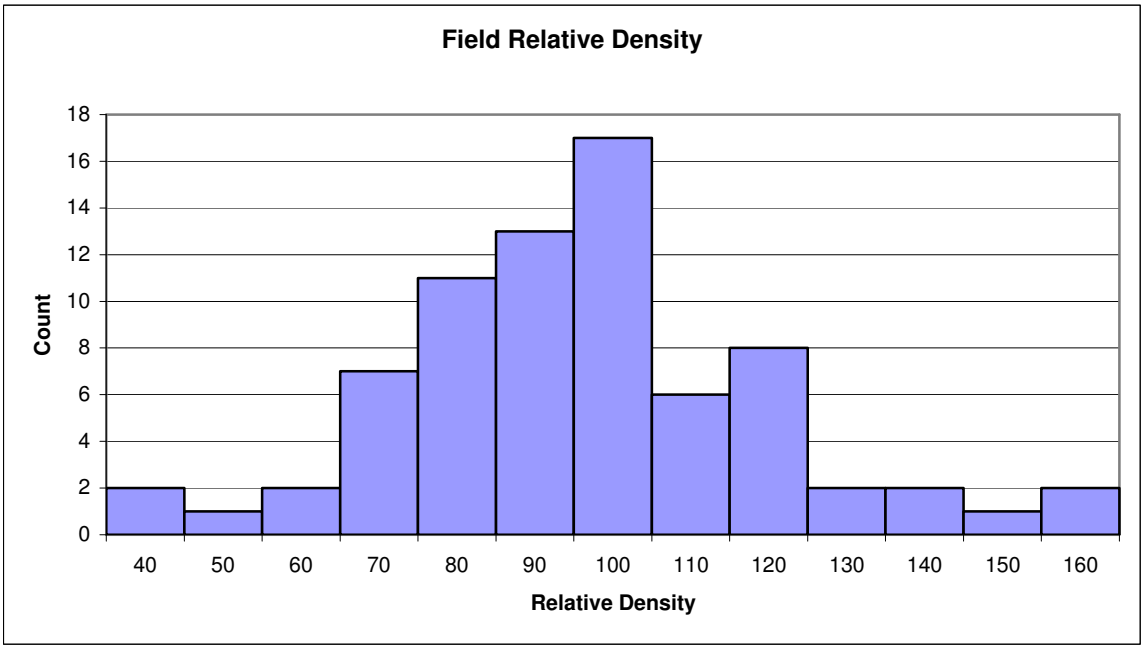


Figure 2: Histogram for Phase 2 Sand Fill – Field Relative Density

**Phase 2 WPIC Embankment Fill**

WPIC Embankment Fill statistical data are summarized for Percent Fines, Liquid Limit, Plasticity Index, and Relative Density in the form of minimum, maximum, mean, and standard deviation in the Tables 3 through 6 below. Distribution of the data is presented in Figures 3 through 6.

**Table 3 – Percent Fines QA Data Summary for Phase 2 WPIC Embankment Fill**

| % Fines – PHASE 2 WPIC EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 112 |
| Minimum | 12 |
| Maximum | 94.2 |
| Mean | 68.8 |
| Standard Deviation | 13.5 |
| No. Failing Tests | 3 |

**Table 4 – Liquid Limit QA Data Summary for Phase 2 WPIC Embankment Fill**

| LL – PHASE 2 WPIC EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 115 |
| Minimum | 0 |
| Maximum | 62 |
| Mean | 35.8 |
| Standard Deviation | 8.5 |
| No. Failing Tests | 5 |

**Table 5 – Plasticity Index QA Data Summary for Phase 2 WPIC Embankment Fill**

| PI – PHASE 2 WPIC EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 115 |
| Minimum | 0 |
| Maximum | 47 |
| Mean | 18.0 |
| Standard Deviation | 6.5 |
| No. Failing Tests | 13 |

**Table 6 – Relative Compaction QA Data Summary for Phase 2 WPIC Embankment Fill**

| Relative Compaction – PHASE 2 WPIC EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 31 |
| Minimum | 87 |
| Maximum | 98 |
| Mean | 93.5 |
| Standard Deviation | 3.1 |
| No. Failing Tests | 1 |

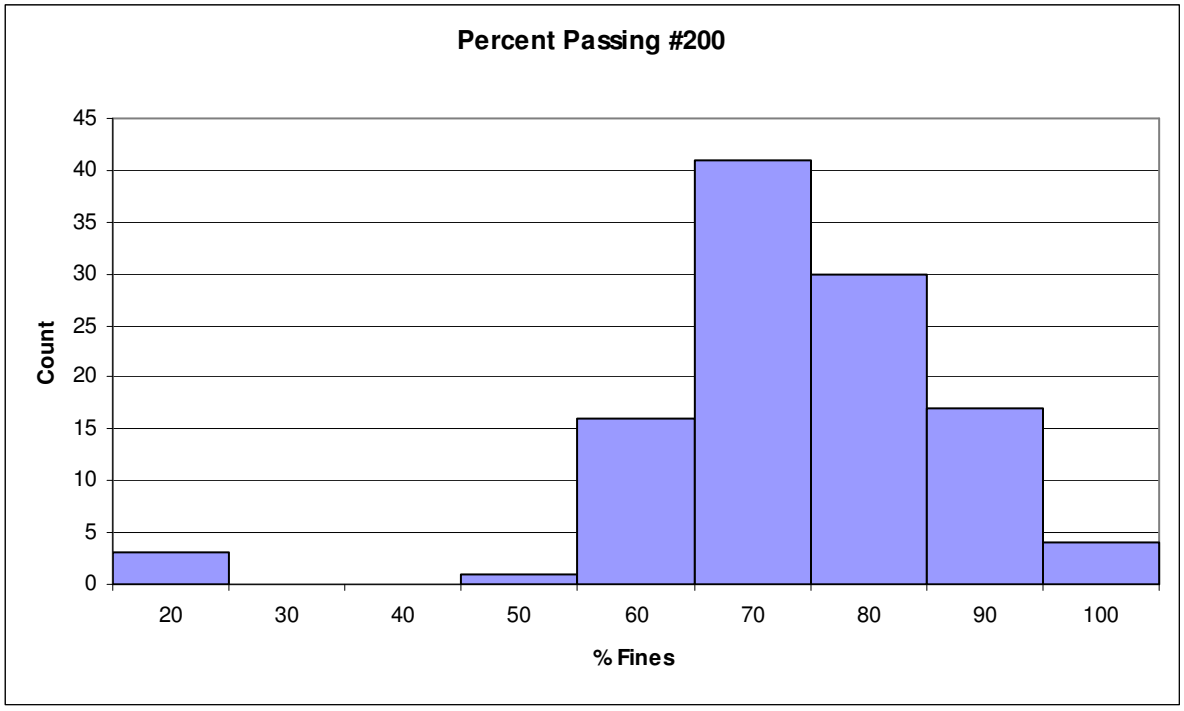


Figure 3: Histogram for Phase 2 WPIC Embankment Fill – Percent Fines

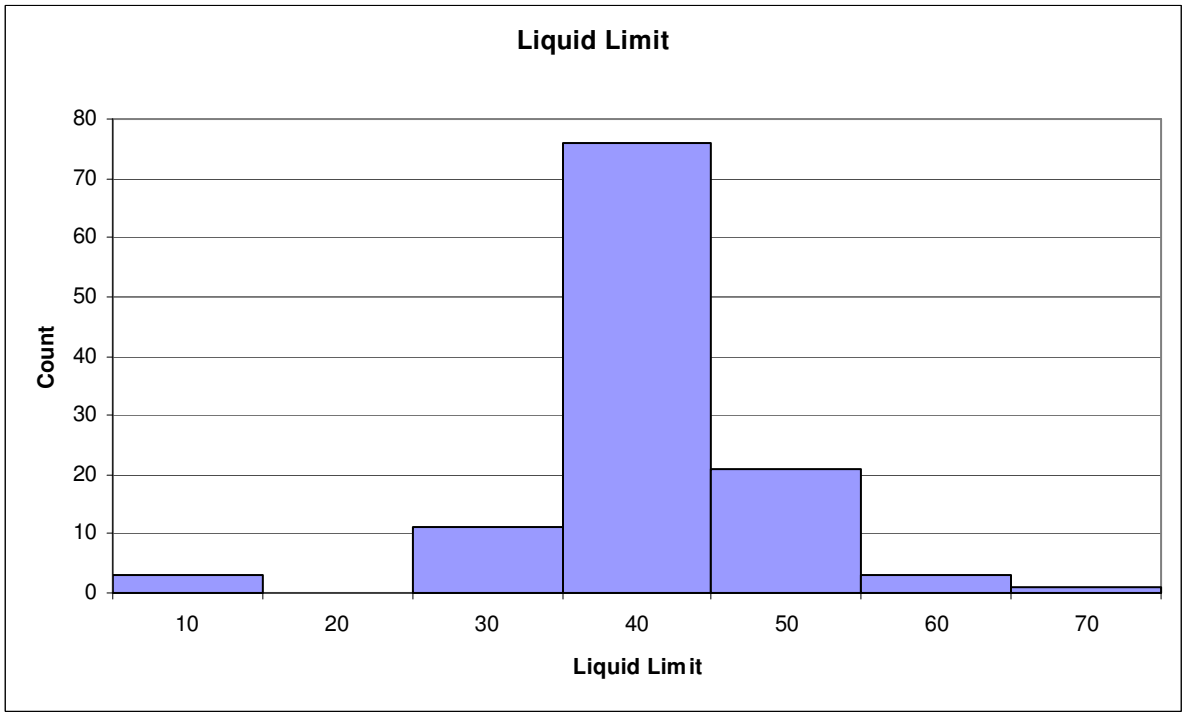


Figure 4: Histogram for Phase 2 WPIC Embankment Fill – Liquid Limit

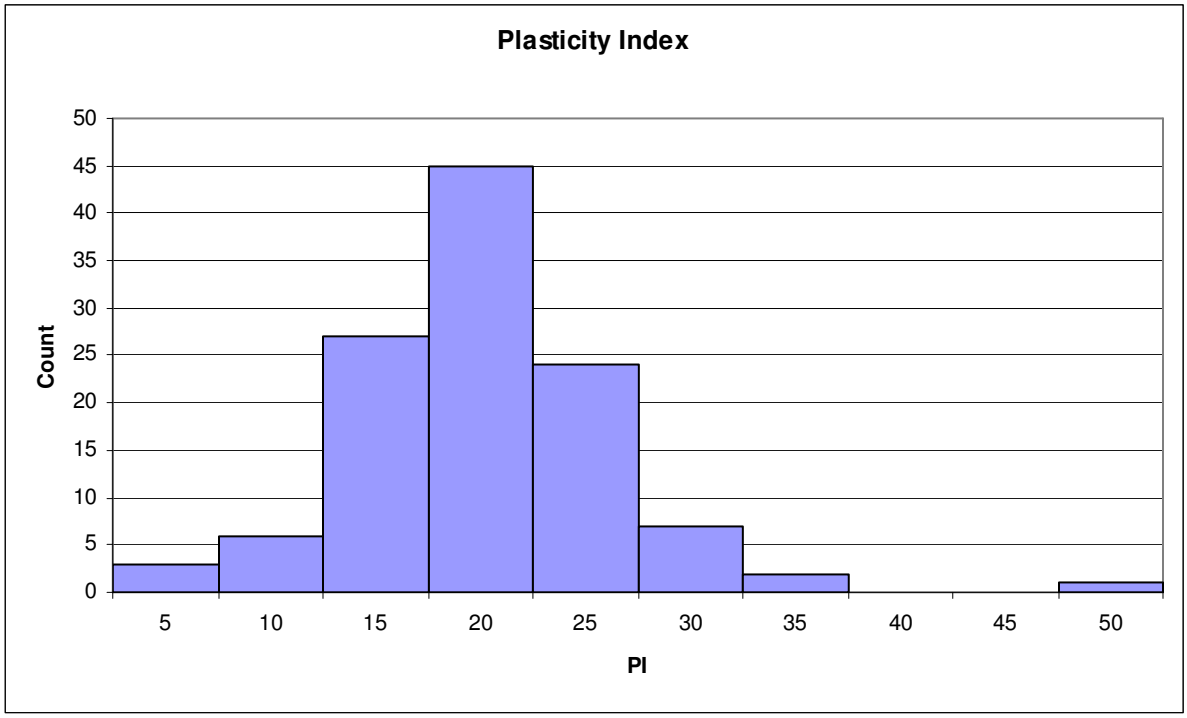


Figure 5: Histogram for Phase 2 WPIC Embankment Fill – Plasticity Index

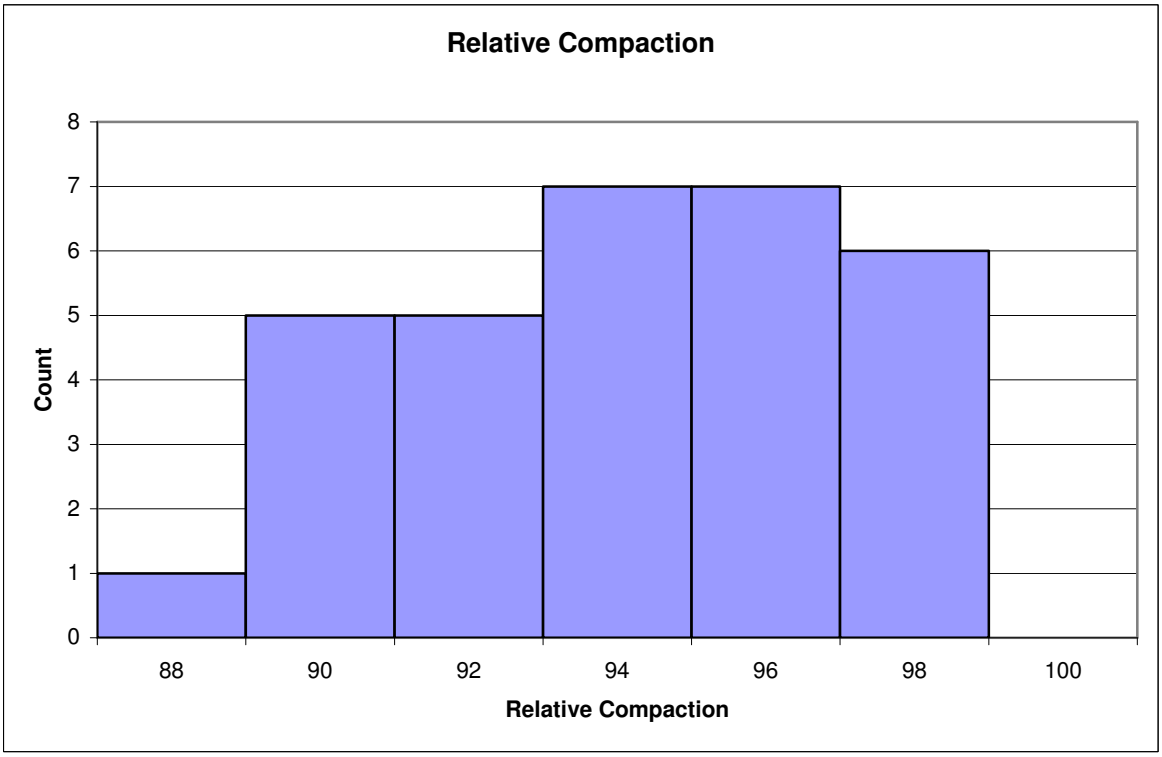


Figure 6: Histogram for Phase 2 WPIC Embankment Fill – Relative Compaction

## Phase 2 Embankment Fill

These data include data from Bear River, Olivehurst Detention Basin, Pump Station, and Ring Levee Embankment Fill. The statistical data are summarized for Percent Fines, Liquid Limit, Plasticity Index, and Relative Density in the form of minimum, maximum, mean, and standard deviation in the Tables 7 through 10 below. Distribution of the data is presented in Figures 7 through 10.

**Table 7 – Percent Fines QA Data Summary for Phase 2 Embankment Fill**

| % Fines – PHASE 2 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 68 |
| Minimum | 32.9 |
| Maximum | 91.7 |
| Mean | 66.5 |
| Standard Deviation | 10.0 |
| No. Failing Tests | 0 |

**Table 8 – Liquid Limit QA Data Summary for Phase 2 Embankment Fill**

| LL – PHASE 2 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 69 |
| Minimum | 24 |
| Maximum | 60 |
| Mean | 37 |
| Standard Deviation | 6.5 |
| No. Failing Tests | 2 |

**Table 9 – Plasticity Index QA Data Summary for Phase 2 Embankment Fill**

| PI – PHASE 2 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 69 |
| Minimum | 8 |
| Maximum | 35 |
| Mean | 17.3 |
| Standard Deviation | 5.1 |
| No. Failing Tests | 6 |

**Table 10 – Relative Compaction QA Data Summary for Phase 2 Embankment Fill**

| Relative Compaction – PHASE 2 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 61 |
| Minimum | 90 |
| Maximum | 99 |
| Mean | 94.1 |
| Standard Deviation | 2.8 |
| No. Failing Tests | 0 |

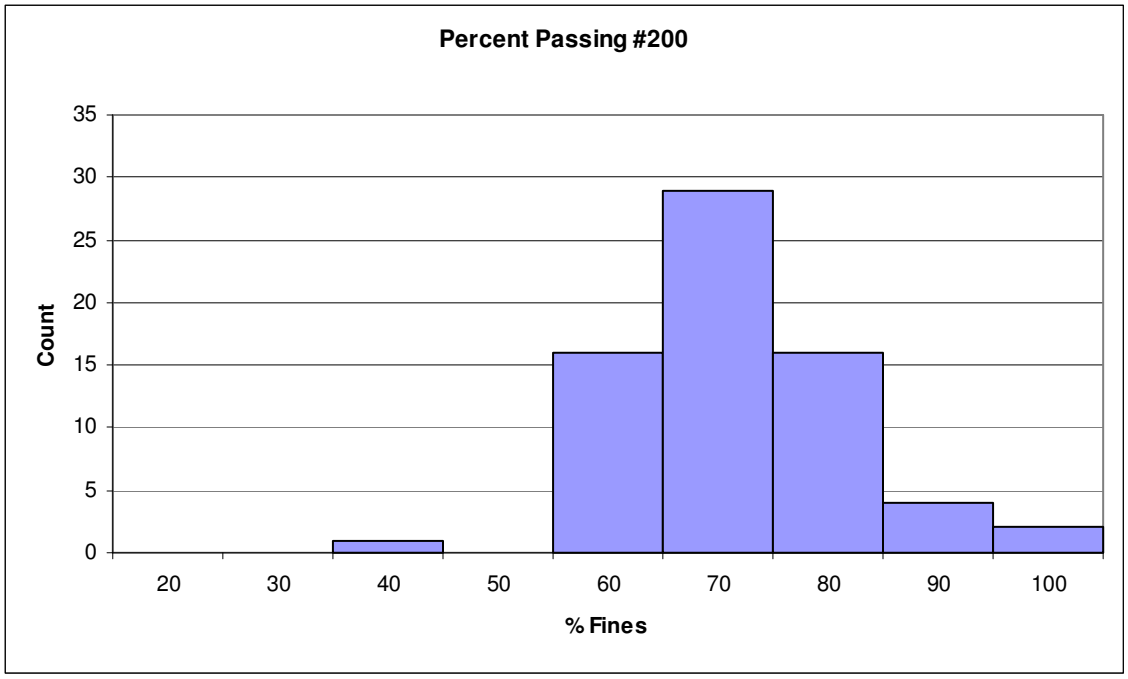


Figure 7: Histogram for Phase 2 Embankment Fill – Percent Fines

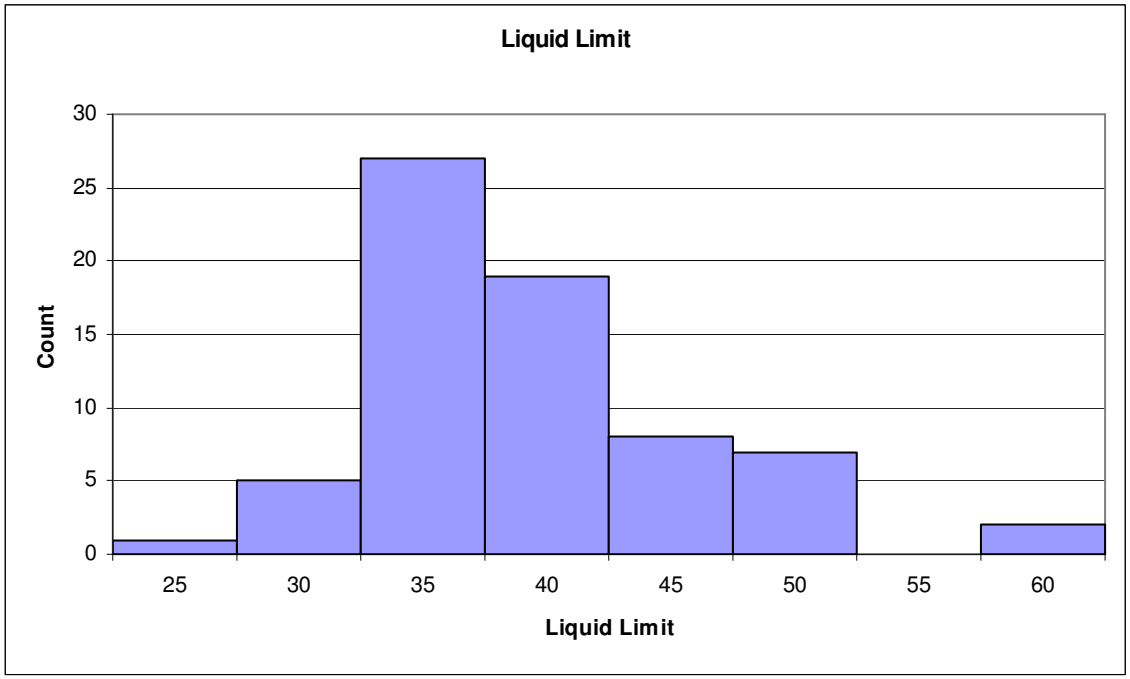


Figure 8: Histogram for Phase 2 Embankment Fill – Liquid Limit

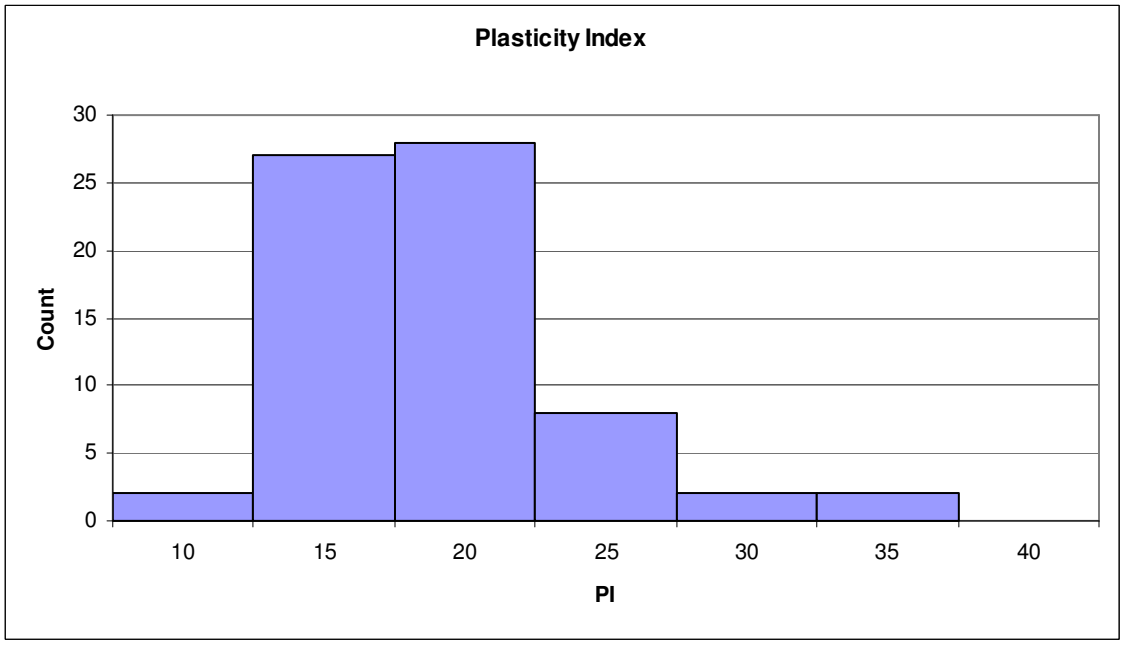


Figure 9: Histogram for Phase 2 Embankment Fill – Plasticity Index

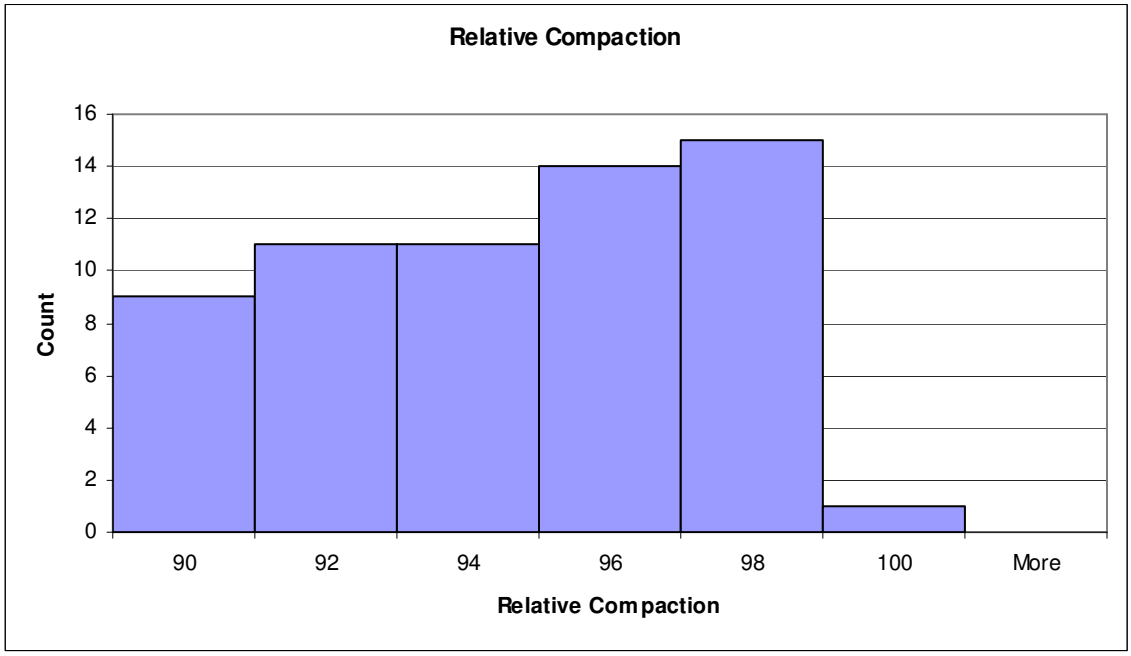


Figure 10: Histogram for Phase 2 Embankment Fill – Relative Compaction

### Phase 4 Embankment Fill

Phase 4 Embankment Fill data include the data from the impervious fill. The statistical data are summarized for Percent Fines, Liquid Limit, Plasticity Index, and Relative Density in the form of minimum, maximum, mean, and standard deviation in the Tables 11 through 14 below. Distribution of the data is presented in Figures 11 through 14. Some of the data did not meet the specifications in terms of Atterberg Limits and consisted of non-plastic silty sand. However, during the field work it was allowed to be placed on the side slopes and considered adequate for that purpose.

**Table 11 – Percent Fines QA Data Summary for Phase 4 Embankment Fill**

| % Fines – PHASE 4 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 62 |
| Minimum | 21.2 |
| Maximum | 82.8 |
| Mean | 61.4 |
| Standard Deviation | 17.2 |
| No. Failing Tests | 0 |

**Table 12 – Liquid Limit QA Data Summary for Phase 4 Embankment Fill**

| LL – PHASE 4 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 62 |
| Minimum | 0 |
| Maximum | 44 |
| Mean | 26 |
| Standard Deviation | 13.9 |
| No. Failing Tests | 0 |

**Table 13 – Plasticity Index QA Data Summary for Phase 4 Embankment Fill**

| PI – PHASE 4 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 62 |
| Minimum | 0 |
| Maximum | 27 |
| Mean | 11.9 |
| Standard Deviation | 7.1 |
| No. Failing Tests | 16 |

**Table 14 – Relative Compaction QA Data Summary for Phase 4 Embankment Fill**

| Relative Compaction – PHASE 4 EMBANKMENT FILL | |
|---|---|
| **Value** | **QA** |
| Number of Samples | 46 |
| Minimum | 87 |
| Maximum | 101 |
| Mean | 95.6 |
| Standard Deviation | 2.9 |
| No. Failing Tests | 1 |

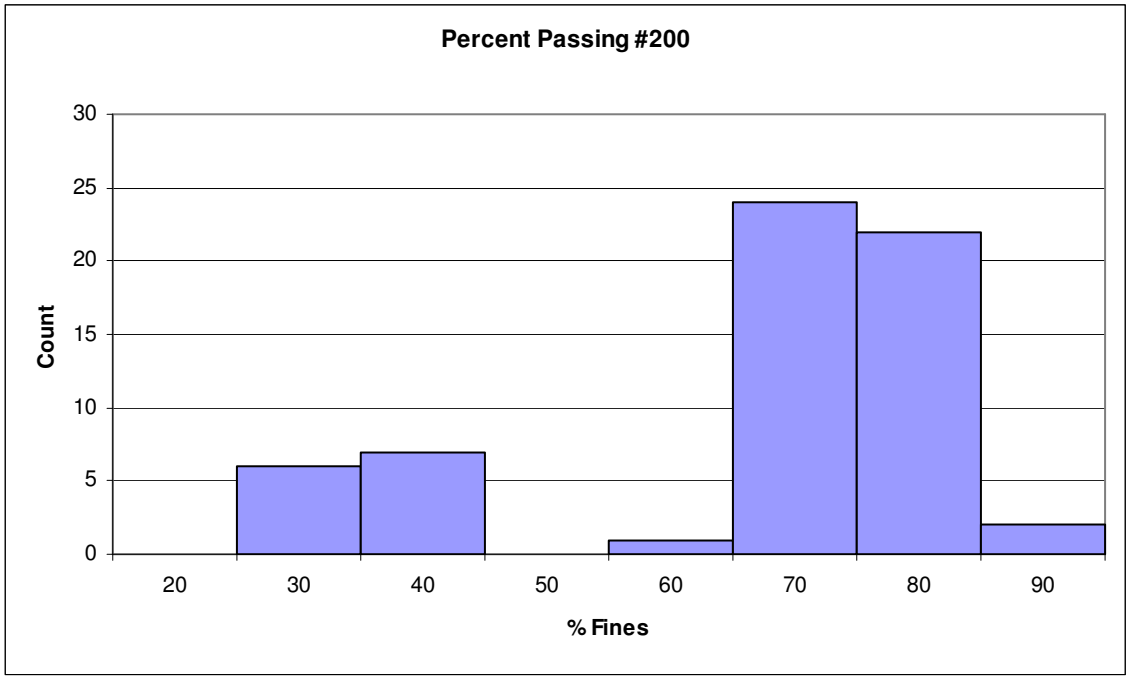


Figure 11: Histogram for Phase 4 Embankment Fill – % Fines

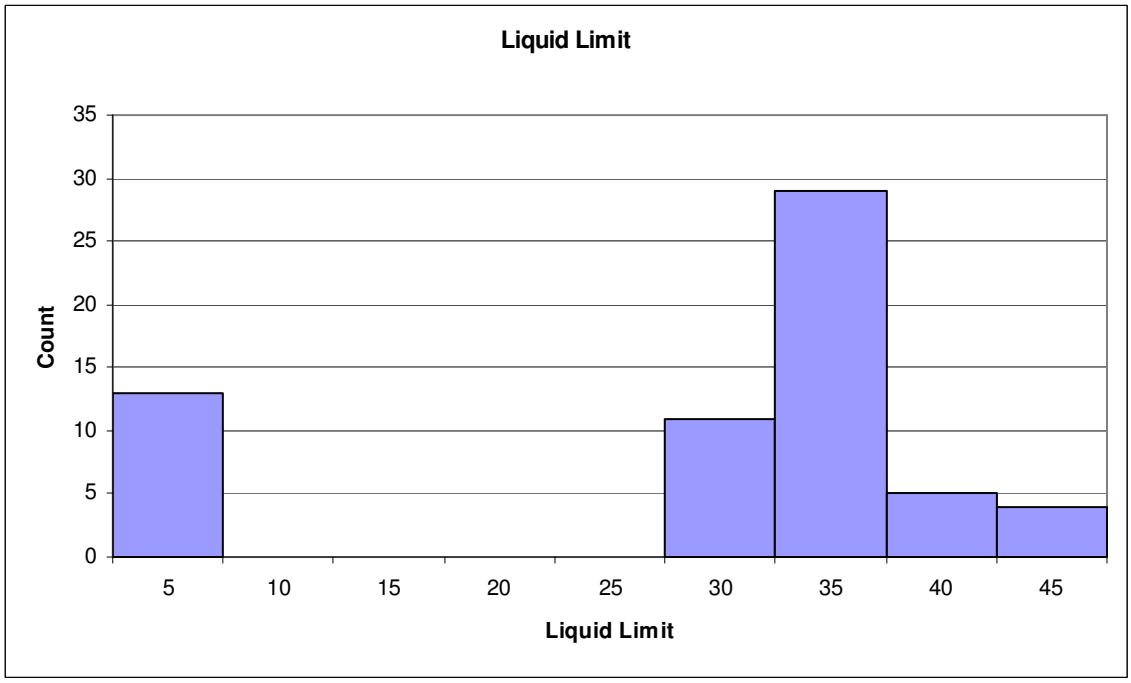


Figure 12: Histogram for Phase 4 Embankment Fill – Liquid Limit

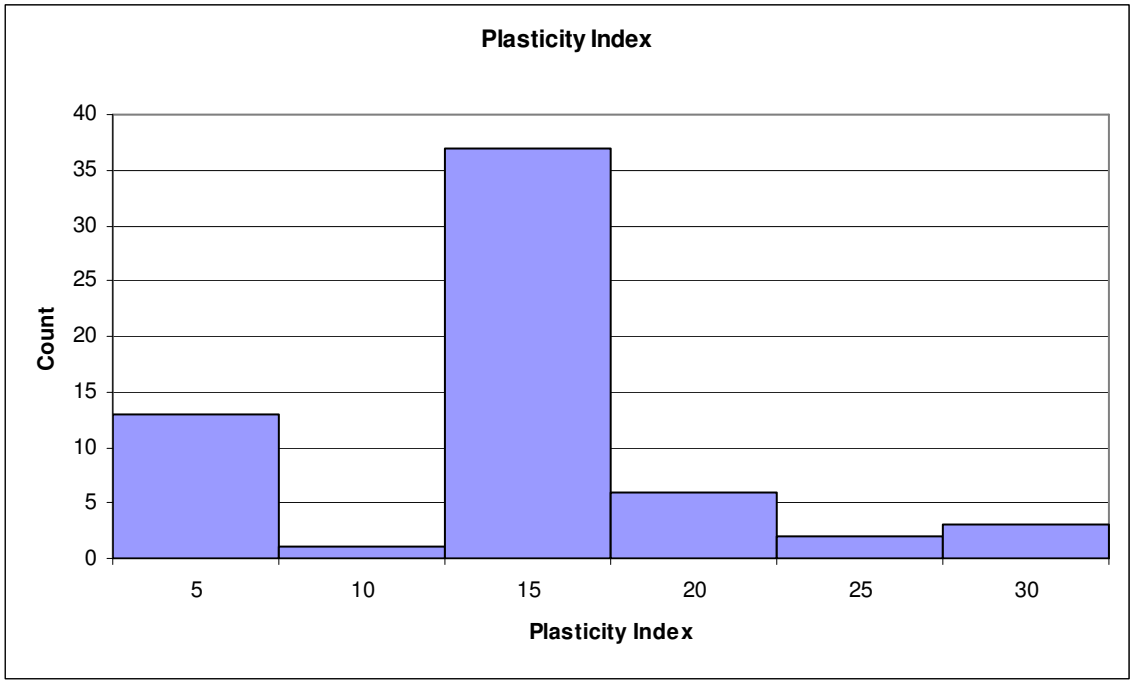


Figure 13: Histogram for Phase 4 Embankment Fill – Plasticity Index

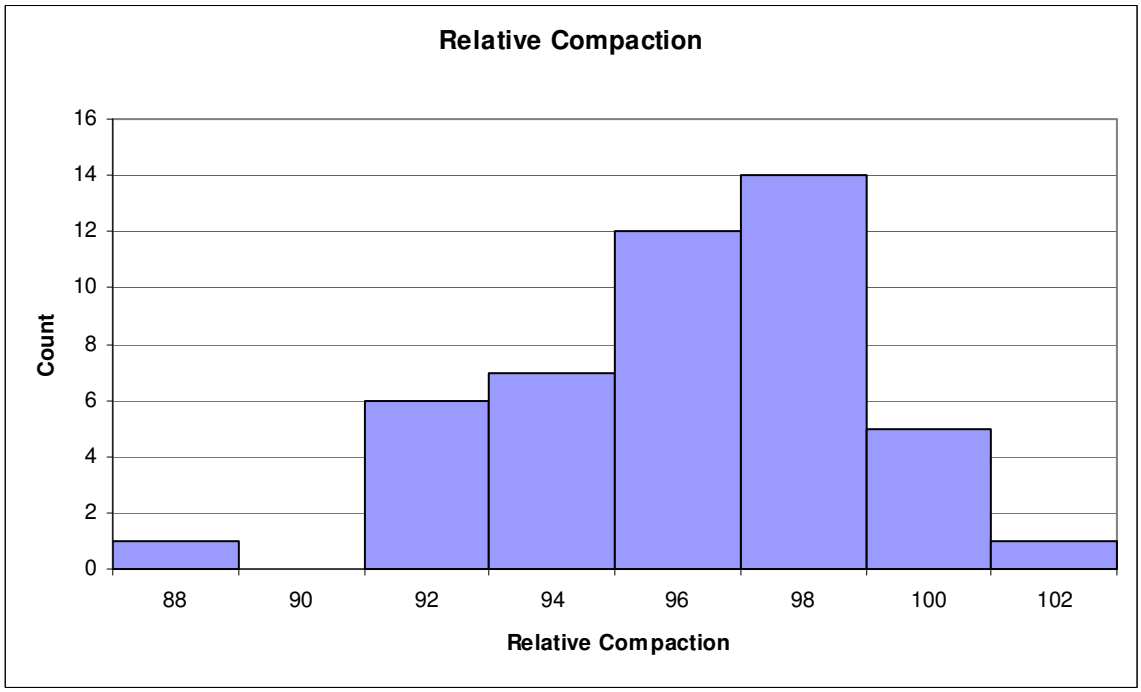


Figure 14: Histogram for Phase 4 Embankment Fill – Relative Compaction