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May 18, 2012
Kleinfelder Project No. 124637

Mr. Craig Smart
HDR Engineering, Inc.
7180 Pollock Drive, Suite 200
Las Vegas, Nevada 89119

**Subject:** **Concrete Core Photographs and Compressive Strength Testing Results I-80 Bridge and Tunnel Rehabilitation Scope B – Elko County Elko County, Nevada**

Dear Mr. Smart:

As part of our geotechnical exploration, Kleinfelder was requested to core the existing Portland cement concrete pavement at five locations within each of the two tunnels for a total of ten cores. The tunnels are located along I-80 between Carlin and Elko in Elko County, Nevada. This letter provides a description of the condition of the observed concrete pavement cores and the results of compressive strength testing for each core.

The concrete cores were spaced approximately 350 feet on center with the exception of core EB-2, which deviated from the standard spacing in order to explore an area of observed surface distress. The concrete was cored with a 6 inch core barrel. Measured concrete thicknesses were generally 12 inches, although one core was 16 inches thick. Table 1 presents the approximate location and thickness of the concrete cores.

**TABLE 1 – Approximate Core Locations**

| Exploration No.* | Tunnel | Approximate Station | Measured Concrete Thickness (inches) |
|---|---|---|---|
| WB-1 | Westbound | 1791+20 | 12 |
| WB-2 | Westbound | 1787+70 | 12 |
| WB-3 | Westbound | 1784+60 | 12 |
| WB-4 | Westbound | 1781+10 | 12 |
| WB-5 | Westbound | 1777+95 | 12 |
| EB-1 | Eastbound | 1791+50 | 12 |
| EB-2 | Eastbound | 1790+60 | 11 |
| EB-3 | Eastbound | 1784+50 | 13 |
| EB-4 | Eastbound | 1781+40 | 16 |
| EB-5 | Eastbound | 1777+65 | 12 |

*Explorations were numbered from east to west.



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All cores were removed intact with the exception of cores EB-1 and EB-2. Core EB-1 was broken horizontally in one place, approximately 4 inches from the pavement surface as shown in Photos 1 and 2. This crack was also observed on the side of the core hole.


Photo 1

Photo 2




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Core EB-2 was located in an area where the existing concrete contained several potholes, cracking, and patches as shown in Photos 3 and 4.

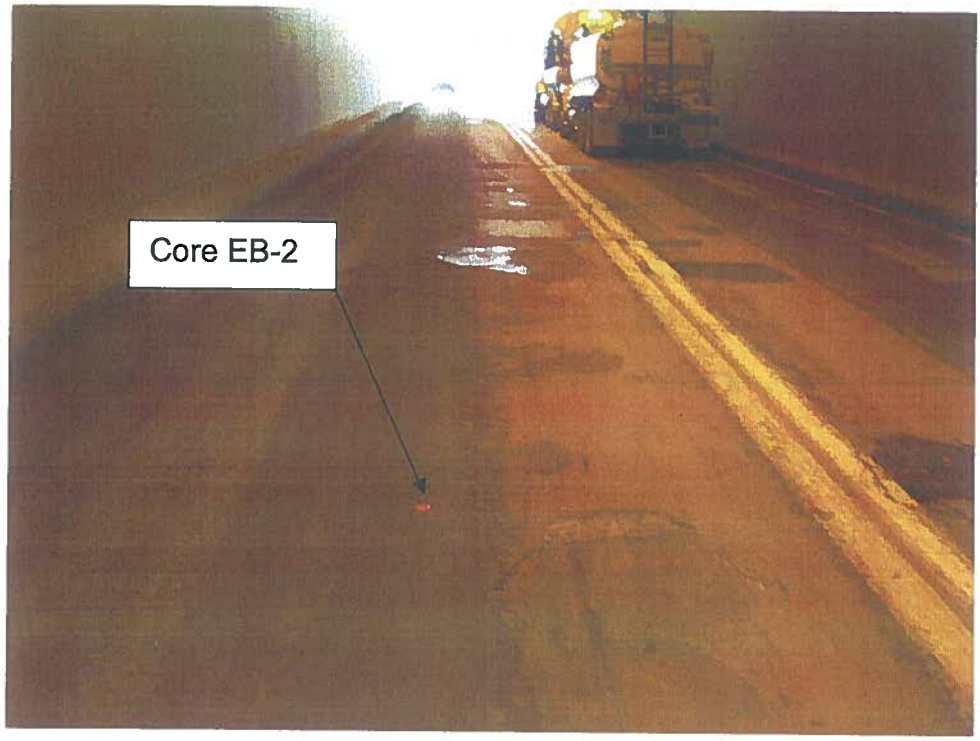


Photo 3

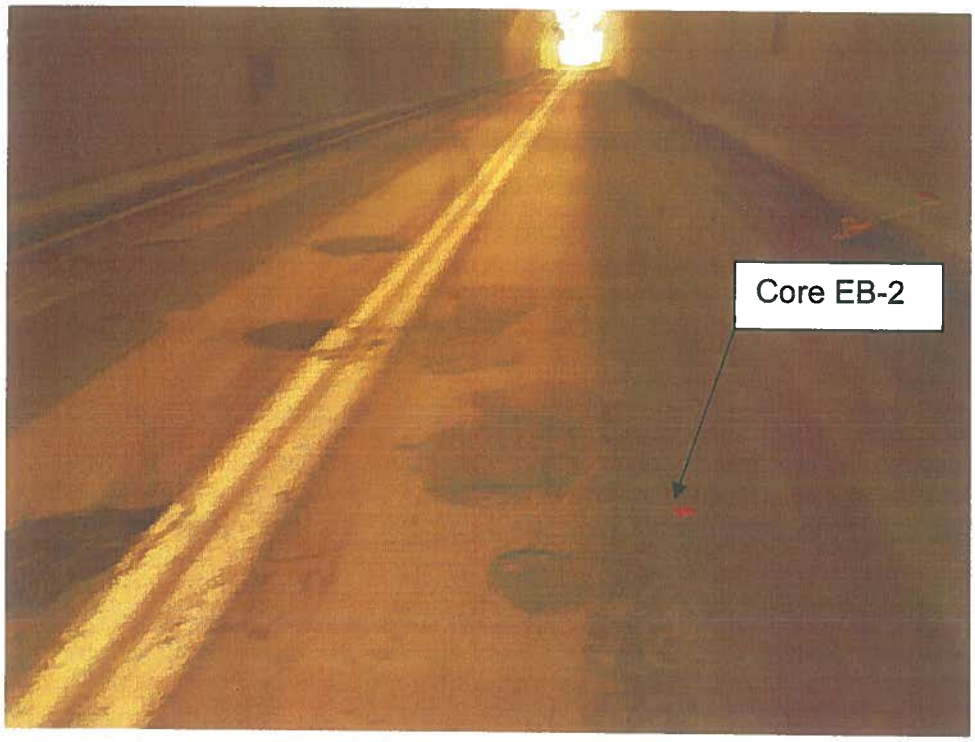


Photo 4




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The removed core was broken horizontally in two places approximately 3 inches and 5 inches from the pavement surface as shown in Photo 5.

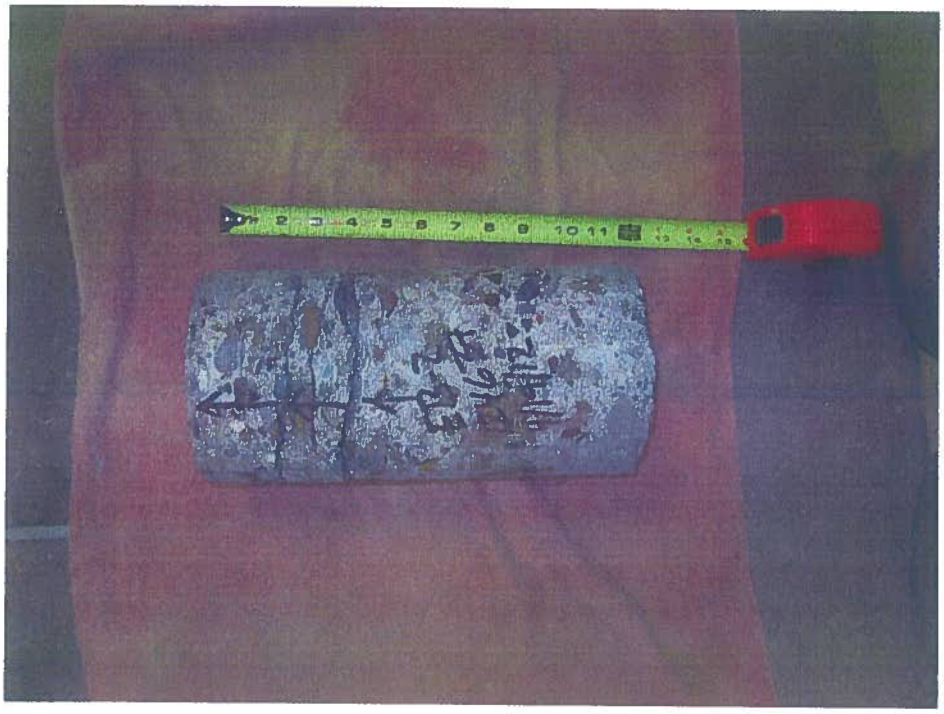

Photo 5

These cracks were also observed on the side of the core hole. The crack at a depth of approximately 3 inches is shown in Photo 6. The crack at a depth of approximately 5 inches was at the same depth as the rebar that ran horizontally through the center of the core.

Photo 6




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The rebar appeared to be undergoing corrosion with rust-color staining observed on the rebar and on the concrete as shown in Photos 7 and 8. Some light white staining indicating possible sulfate attack was present on the concrete as shown in photos 7 and 8. The rebar encountered in the cores with the exception of EB-2 did not show signs of corrosion or staining.

Photo 7

Photo 8




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In addition to the cracking and corrosion noted in cores EB-1 and EB-2, several of the cores contained small pits about one millimeter or less in diameter. The rebar encountered in the cores with the exception of EB-2 did not show signs of corrosion or staining. Portions of all cores were saved for future observation and/or testing.

Features indicative of pavement wear were generally observed throughout both the westbound and eastbound tunnels. Although general wear was observed throughout the tunnels, more pronounced areas of pavement distress were noted in several locations. The eastern approximately one third of the eastbound tunnel contained cracking and potholes as large as two feet in diameter and two to three inches in depth. Many of the potholes had been patched. Other areas of distress were observed near the east portal of the westbound tunnel and near the west portal of the eastbound tunnel. The distress in these locations consisted of primarily of cracking along with some small potholes.

The removed concrete cores were allowed to dry in the field until the surface moisture had evaporated and then sealed in large plastic bags to maintain the concrete moisture content while being transported to our lab. Concrete cores were handled and tested in general accordance with ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. Due to the in-place horizontal fracture in Core EB-1, a sample with a length/diameter ratio of 1 or greater was not able to be obtained. The length/diameter ratio for Core EB-1 was 0.96. Table 2 presents the results of compressive strength testing.

**TABLE 2 – Measured Core Compressive Strength**

| Exploration No. | Tunnel | Approximate Station | Compressive Strength (psi) |
|---|---|---|---|
| WB-1 | Westbound | 1791+20 | 7630 |
| WB-2 | Westbound | 1787+70 | 6600 |
| WB-3 | Westbound | 1784+60 | 5870 |
| WB-4 | Westbound | 1781+10 | 5090 |
| WB-5 | Westbound | 1777+95 | 6130 |
| EB-1 | Eastbound | 1791+50 | 8240* |
| EB-2 | Eastbound | 1790+60 | 4490 |
| EB-3 | Eastbound | 1784+50 | 4000 |
| EB-4 | Eastbound | 1781+40 | 4570 |
| EB-5 | Eastbound | 1777+65 | 4470 |

*Length/diameter ratio = 0.96.




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We trust this provides you with the necessary information at this time. If you have any questions regarding this letter, please contact the undersigned.

Respectfully Submitted,

**KLEINFELDER WEST, INC.**

Dustin Robbins
Staff Professional

David J. Salter, P.E.
Principal Professional

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