Programs, Projects & Operations
Subcommittee Meeting
July 6, 2004
7:00 p.m.
Agenda

Programs, Projects & Operations:
John Conley, Chairperson
Rich Jansen, Vice-Chairperson
Tim Fowler
Joe Neary
Rich Tesar

Alternate Members: Dick Connealy

Staff Liaison: Gerry Bowen
Jerry Herbster
Ralph Puls *
Paul Woodward

1. Meeting Called to Order – Chairperson John Conley

2. Quorum Call

3. Adoption of Agenda

4. Proof of Publication of Meeting Notice

5. Update on USGS Water Quality Monitoring – Virginia McGuire, USGS; and Gerry Bowen

6. Review and Recommendation on Development and Management Agreement with Nebraska Wildlife Rehab, Inc for Rumsey Station Wetland – Margaret Lehning, NE Wildlife Rehab, Inc.; and Jim Becic

7. Review and Recommendation on Sarpy Water/Wastewater Study (South Half of Sarpy County) with Sarpy County and Others – Mark Wayne, Sarpy County; and Marlin Petermann

8. Review and Recommendation on Big Papio Trail (Center to Blondo) Cracking – Joe Waxse, Terracon, Inc.; and Gerry Bowen

9. Review and Recommendation on Site Grading for Amphitheater at Walnut Creek Lake and Recreation Area -- Randy Lee

10. Other Items of Interest

11. Adjourn
PAPIO-MISSOURI RIVER GROUND-WATER MONITORING NETWORK, 2004

By Virginia (Ginny) L. McGuire
U.S. Department of the Interior
U.S. Geological Survey

The U.S. Geological Survey (USGS), in cooperation with the Papio-Missouri River Natural Resources District (PMNRD), monitors ground-water quality in the PMNRD using a monitoring well network that consists of domestic, irrigation, public supply, and well nests. The monitoring well network includes wells screened in the five aquifers, which underlie the PMNRD—the Dakota, Elkhorn alluvial, Missouri alluvial, Platte alluvial, and Upland aquifers. Figure 1 shows the location of the wells in the monitoring well network and the aquifer that is the source of the well’s water.

**Ground-water monitoring in the domestic, irrigation, and public supply wells**

The sampling schedule for the domestic, irrigation, and public supply wells generally is based on the aquifer that is the source of the well’s water. About 25 to 40 domestic, irrigation, public supply wells are sampled during the summer on a three-year schedule; wells screened in the Platte and Elkhorn alluvial aquifers are sampled one summer, wells screened in the Missouri alluvial aquifer are sampled the second summer, and wells screened in the Dakota and Upland aquifers are sampled the third summer. The PMNRD can change this schedule or ask the USGS to add wells to the network. The water samples are analyzed to determine the concentration of nitrate and pesticides in the water. Figure 2 shows the nitrate concentrations from the latest available results in each well in the monitoring well network; the latest available results in a given well may be from samples collected from Summer 1992 to Summer 2003.
Figure 1. Ground-water monitoring network. Papio-Missouri River Natural Resources District, 2004 (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)
Figure 2. Distribution of latest nitrate plus nitrite concentrations in each well in the ground-water monitoring network, Papio-Missouri River Natural Resources district, 1992 through 2004 (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)
The range of nitrate plus nitrite as nitrogen concentration in all samples from the domestic, irrigation, and public supply wells vary by aquifer (Table 1). The highest median concentration (2.77 milligrams/liter) and the maximum concentration (74.6 milligrams/liter) were in wells screened in the Upland aquifer. The latest available nitrate plus nitrite as nitrogen concentration exceed 10 milligrams per liter for at least one well screened in the Dakota, Elkhorn alluvial, Missouri alluvial, and Upland aquifers.

Table 1. Maximum, minimum, and median nitrate plus nitrite as nitrogen concentration, in milligrams per liter in domestic, irrigation and public supply wells in the monitoring well network, Papio-Missouri Natural Resources District, through Summer 2003. (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakota</td>
<td>13.00</td>
<td>&lt; 0.03</td>
<td>0.85</td>
</tr>
<tr>
<td>Elkhorn alluvium</td>
<td>24.1</td>
<td>&lt; 0.04</td>
<td>1.5</td>
</tr>
<tr>
<td>Missouri alluvium</td>
<td>12.5</td>
<td>&lt; 0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Platte alluvium</td>
<td>9.23</td>
<td>&lt; 0.03</td>
<td>0.72</td>
</tr>
<tr>
<td>Upland</td>
<td>74.6</td>
<td>&lt; 0.03</td>
<td>2.77</td>
</tr>
<tr>
<td>All Aquifers</td>
<td>74.6</td>
<td>&lt; 0.03</td>
<td>0.32</td>
</tr>
</tbody>
</table>

In Summer 2004, about 30 wells screened in the Missouri alluvial aquifer and 10 wells screened in the Platte alluvial aquifer well be sampled. The constituents that will be measured in the samples from these wells are nitrate plus nitrite and pesticides.

**Ground-water monitoring in the well nests**

The well nests were designed for water quality monitoring. There are two to three wells in each well nest; the well nests have 5 to 10 foot screens generally placed at the top, middle, and bottom of the aquifer. At least one well nest is screened in each aquifer in the PMNRD—there are
two well nests screened in the Dakota aquifers, one nest screened in the Elkhorn alluvial aquifer, two nests screened in the Missouri alluvial aquifer, three nests screened in the Platte alluvial aquifer, and one nest screened in the Upland aquifer.

The sampling schedule for the well nests has changed over time. The well nests were initially sampled monthly and then bimonthly. The constituents that were measured in the samples have included trace metals, major ions, nutrients, pesticides, dissolved gases, and chlorofluorocarbons. The May 2004 nitrate plus nitrite as nitrogen concentrations in the well nests are shown in Figure 2. The well nests with the higher nitrate concentration are the Springfield, Tekamah, and Venice well nests (Table 2).

Table 2. Maximum, minimum, and median nitrate plus nitrite as nitrogen concentration, in milligrams per liter in the well nests in the monitoring well network, Papio-Missouri Natural Resources District, through May 2004. (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

<table>
<thead>
<tr>
<th>Well Nest/Aquifer</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dakota Aquifer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tekamah</td>
<td>40.6</td>
<td>&lt; 0.02</td>
<td>2.16</td>
</tr>
<tr>
<td>Walthill</td>
<td>0.15</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Elkhorn alluvium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elkhorn Crossing</td>
<td>&lt; 0.06</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Missouri alluvium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boyers Chute</td>
<td>0.08</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Homer</td>
<td>0.11</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Platte alluvium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Springfield</td>
<td>7.08</td>
<td>1.47</td>
<td>4.96</td>
</tr>
<tr>
<td>Ashland</td>
<td>0.1</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Venice</td>
<td>10.3</td>
<td>0.15</td>
<td>2.05</td>
</tr>
<tr>
<td><strong>Upland</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blair</td>
<td>0.09</td>
<td>&lt; 0.02</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>All Nests</strong></td>
<td>40.6</td>
<td>&lt; 0.02</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Starting Summer 2004, plans are to sample the well nests with low nitrate concentrations two times a year and the wells with high nitrate concentrations bimonthly. The constituents that will be measured in samples from all well nests are nutrients (nitrate, nitrite, ammonium, and phosphate), pesticides, and major ions. The additional constituents that will be measured in the samples from the well nests with high nitrate concentrations are nitrogen isotopes and dissolved gases. Nitrogen isotopes are used to determine whether the source of nitrate is from fertilizer or biological processes. Dissolved gases are used to determine if denitrification is occurring.
MEMO TO: Programs, Projects and Operations Subcommittee

RE: Nebraska Wildlife Rehab, Inc – Development and Management Agreement for Rumsey Station Wetlands

FROM: Jim Becic

Date: 28 June, 2004

The P-MRN RD Board entered into a Development and Management Agreement for the District’s Rumsey Station Wetland site on 3 July, 2000 with the Nebraska Wildlife Rehab, Inc. (NWRI). The purpose of the agreement was to allow NWRI one year of time to complete the design of their proposed Center for Environmental Education and Wildlife Rehabilitation; secure the necessary approvals and permits and to raise the required funding of $1 million dollars - or the estimated building/facilities costs. All of these steps were required to be accomplished by NWRI, prior to any physical changes to the site.

This Agreement would allow NWRI to approach potential donors and show them that they indeed had a site that would be a good location for the proposed facility and that it was “tied up” for a year. IF NWRI progressed through the Agreement successfully and through construction completion -- the land would be theirs to use for an additional 99 years.

Following this initial Agreement, NWRI approached the Board on three succeeding years and received approval for annual extensions to this Agreement in 2001, 2002, and 2003.

During the PPO Subcommittee meeting in 2003, several subcommittee members voiced reluctance to approving the third addendum to the agreement and several subcommittee members indicated that this would be their final vote of approval. To date, the NWRI has not been able to provide facility plans or show evidence of construction funding.

In the past, the District has had little to lose by approving extensions to this Agreement, since there has been little interest shown by other entities desiring to develop and manage the site. This is currently not the case.

It is the staff recommendation that the Programs, Projects, and Operations Subcommittee recommend that the Board not approve an additional addendum to NWRI for the Rumsey Station Wetlands.

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THIRD ADDENDUM TO
DEVELOPMENT AND MANAGEMENT AGREEMENT
Between
PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
And
NEBRASKA WILDLIFE REHAB, INC.
For
RUMSEY STATION WETLANDS

THIS ADDENDUM (hereinafter referred to as “this Addendum”) is entered into by and between the PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT (hereinafter referred to as “the NRD”), a governmental subdivision of the State of Nebraska, and NEBRASKA WILDLIFE REHAB, INC. (hereinafter referred to as “NWRI”), a non-profit corporation organized and existing under the laws of the State of Nebraska.

WHEREAS, the NRD and NWRI entered into an Agreement, effective as of July 3, 2000, entitled “DEVELOPMENT AND MANAGEMENT AGREEMENT BETWEEN PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT AND NEBRASKA WILDLIFE REHAB, INC. FOR RUMSEY STATION WETLANDS” (hereinafter referred to as “the Agreement”); and,

WHEREAS, by a FIRST ADDENDUM, the Agreement previously was amended to extend by one year certain deadlines provided by the Agreement; and,

WHEREAS, by a SECOND ADDENDUM, the Agreement previously was again amended to extend by one year certain deadlines provided by the Agreement; and,

WHEREAS, NWRI has requested that the NRD agree to extend by one additional year the deadline provided by paragraph 6 of the Agreement for the verification of financing

NOW, THEREFORE, in consideration of their mutual covenants contained herein, it is hereby agreed between the parties as follows, to-wit:
A. AMENDMENT. Paragraph 6 of the Agreement, as previously amended, is hereby further amended as follows, to-wit:

6. VERIFICATION OF FINANCING. Within sixty (60) days after the NRD’s approval of the Final Plans and Specifications and of the itemized estimates of the cost of construction of the NWRI Facilities and of the NRD Facilities as shown in the Final Plans and Specifications, but not later than July 1, 2004, NWRI shall submit to the NRD written evidence satisfactory to the NRD that NWRI has obtained construction financing in the amount of the Architects/Engineers’ estimates of the costs of construction of the NWRI Facilities shown in the Final Plans and Specifications, or in the amount of one million dollars, whichever amount is greater. Such construction financing may consist of: (a) unencumbered NWRI funds on deposit in a bank authorized to do business in the State of Nebraska, (b) enforceable pledges, grants, and donations of money to NWRI or the NRD for purposes of construction of the NWRI Facilities; and, (c) enforceable pledges, grants, and donations to NWRI or to the NRD of materials and in-kind services usable for construction of the NWRI Facilities, or any combination thereof. Such construction financing may not be secured by liens upon the Premises or upon any of the NWRI Facilities nor NRD Facilities, nor be secured by any rents or profits therefrom, nor permit or contemplate the imposition of construction liens or other encumbrances upon the Premises. If the requisite verification of financing has not been submitted to the NRD on or before such date then the NRD may declare this Agreement terminated. The identities of anonymous donor(s) providing financing for the NWRI Facilities, or written verification thereof, shall not be disclosed to the public in the absence of such disclosure being ordered by a Nebraska court of general jurisdiction upon a showing of good cause.

and that, except as so amended by this Addendum, the Agreement as previously amended and all provisions thereof are ratified and confirmed in all respects,
B. EFFECTIVE DATE OF ADDENDUM. This Addendum shall be effective upon execution hereof by both parties.

Executed by NWRI on this 28__ day of __________, 2003.

NEBRASKA WILDLIFE REHAB, INC., a Nebraska non-profit corporation

Attest:

By ____________________________
President

______________________________
Secretary

Executed by the NRD on this _____ day of ___________________, 2003.

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

By ____________________________
General Manager

STATE OF NEBRASKA )
) SS.
COUNTY OF SARPY )

On this ___ day of ___________________, 2003, before me, a Notary Public in and for said County, personally came the above-named STEVEN G. OLMANS, General Manager of the PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT, and acknowledged the execution of the above instrument as his voluntary act and deed and the voluntary act and deed of said natural resources district.

WITNESS my hand and Notarial Seal the date last aforesaid.

________________________________
Notary Public
Memorandum

To: PPO Subcommittee

Subject: Sarpy County Water/Wastewater Infrastructure Study Interlocal Agreement

By: Marlin Petermann, Assistant General Manager

Date: June 28, 2004

Sarpy County is requesting that the District enter into an Interlocal Agreement (draft attached) with the County and other governmental entities for the preparation of a Study Report on Water Quality issues related to Regional Water and Wastewater Systems for Platte River tributary basins in Sarpy County. Sarpy wishes to use the results of the study in conjunction with its Comprehensive Plan as a guide to address existing and future infrastructure needs in the county while protecting water quality.

The purpose for this study is to determine the viability of developing regional water and wastewater systems to protect water quality in the region generally described as that portion of Sarpy County that drains to the Platte River (see attached map). The deliverable product will be a final report that documents the steps of the study process, including identification of stakeholders and their involvement, documentation of environmental and water quality issues, and recommends an overall plan for the proposed systems and a recommended implementation schedule.

The study will identify and recommend infrastructure systems that work with the environment to maintain the character of the area, and protect and preserve water quality, while allowing growth to occur.

The interlocal agreement includes the following entities and cost shared funding:

Sarpy County $100,000
MAPA $100,000
P-MRNRD $50,000
City of Papillion $60,000
City of Bellevue $50,000
City of Omaha $15,000
City of Springfield $10,000
City of Gretna $5,000

Management recommends that the Subcommittee recommend to the Board that the General Manager be authorized to execute an interlocal agreement for a Sarpy County Water and Wastewater Infrastructure Study with Sarpy County and others, for a maximum District contribution of $50,000, subject to changes deemed necessary by the General Manager and approved as to form by District Legal Council.
This Interlocal Cooperation Agreement ("this Agreement") is entered into by and among Sarpy County, Nebraska ("the County"); the Cities of Papillion, Bellevue, Springfield, Gretna and Omaha, Nebraska; the Metropolitan Area Planning Agency ("MAPA"); and, the Papio-Missouri River NRD ("P-MRNRD") (all collectively "The Sarpy County Water and Wastewater Coalition" or "the Coalition").

WHEREAS, each member of the Coalition is a public agency, duly created and validly existing under the laws of the State of Nebraska, within the meaning of the Nebraska Interlocal Cooperation Act (§13-1801 et.seq.) (herein the "Interlocal Cooperation Act"); and,

WHEREAS, the Coalition has an interest in protecting the environment and public health from being compromised due to an inadequate water and wastewater infrastructure; and,

WHEREAS, the Coalition members have agreed that a Study on Water and Wastewater Systems in the Platte River Basin of Sarpy County ("the Study") must be conducted; and,

WHEREAS, the Coalition members have agreed that the cost of the Study is to be defrayed as herein provided.

NOW, THEREFORE, IT IS AGREED as follows:

1. Study Description:

   A. Requests for Proposals ("RFPs") to Provide Professional Engineering Services for the Study will be received by the County and reviewed by the members of the Coalition.

   B. Based upon Coalition input on the RFPs received, the County will select an engineering firm to negotiate a detailed:

      1. Scope of Work
      2. Time Schedule
      3. Study Cost

2. Study Administration:

   The County shall be the Study Administrator and shall have general supervision and control of the Study, including scope of work, contract award, supervision and control of the work.
3. **Study Financing:**

   As Study Administrator, the County shall make all payments that become due in respect to the Study and shall invoice Coalition members for their agreed shares of the Study costs as the Study is conducted. The full amount of invoices shall be due thirty (30) days after the billing date.

4. **Coalition Member’s Shares of the Study Cost:**

   - Sarpy County: $100,000
   - MAPA: $100,000
   - P-MRNRD: $50,000
   - City of Papillion: $60,000
   - City of Bellevue: $50,000
   - City of Omaha: $15,000
   - City of Springfield: $10,000
   - City of Gretna: $5,000

5. **Right to Study Report:**

   Each Coalition member shall have complete property rights to use and reproduce any and all Study data, or any other information developed in connection with this Study, for its own use.

6. **Interlocal Cooperation Act:**

   This agreement is entered into among the Coalition members pursuant to the Interlocal Cooperation Act. The Coalition members agree:

   **A.** This Agreement shall continue in force and effect until the later of the following, to-wit: (a) one (1) year after the date of completion of the Study, (b) the date upon which all terms and conditions of the Study have been paid and discharged in accordance with the terms and conditions of the resolution, contract or other instrument creating such obligation, or (c) such other date as may be determined by mutual agreement of the Coalition. No member shall have the right to withdraw from this Agreement or to modify, amend or alter its obligations hereunder prior to the termination of this Agreement unless approved by the governing body of each Coalition member.

   **A.** There is no joint entity, separate legal entity or administrative entity created hereby.

   **B.** The purpose hereof is as stated in the preambles to this Agreement.
C. No joint financing is necessary to the implementation of this Agreement.

D. This Agreement may be partially or completely terminated or modified only by mutual agreement of the Coalition as authorized and evidenced by resolutions of their respective governing bodies.

E. The County shall be the party responsible for administering this cooperative undertaking.

F. It is not anticipated that any Coalition member will need to acquire, hold or dispose of real or personal property in this cooperative undertaking, but to the extent any must do so, they shall do so in their separate corporate capacities and not jointly.

G. The Coalition hereto acknowledges, stipulates and agrees that this Agreement shall not relieve any public agency of any obligation or responsibility imposed upon it by law.

7. Effective Date:

This Agreement shall become effective upon execution by all Coalition members.

8. General Provisions:

A. Evidence of Action: Each Coalition member shall furnish the other members with a certified copy of the resolution of its governing board authorizing execution and implementation of this Agreement.

B. Notice: Notices under this Agreement shall be in writing and delivered personally or by certified mail to the Coalition members at the addresses below:

To: Attention: Deb Houghtaling
   Sarpy County Clerk
   Sarpy county courthouse, Ste 1118
   Papillion, NE 68046

To: Attention:...
   Papillion City ...
   123 East 3rd
   Papillion, NE 68046

To: Attention:...
   Bellevue City ...
210 West Mission
Bellevue, NE 68005

To: Attention: ...
Springfield City ...
PO Box 189
Springfield, NE 68059

To: Attention: ...
Gretna city ...
PO Box 69
Gretna, NE 68028

To: Attention: ...
Omaha city ...
1819 Farnam St.
Omaha, NE 68183

To: Attention: ...
MAPA
2222 Cummings St
Omaha, NE 68102

To: Attention: ...
P-MRNRD
8901 South 154\textsuperscript{th} St
Omaha, NE 68138

or to such substitute person and/or address which a Coalition member may advise the other members of in writing.

C. **Waivers:** Any waiver must be specific and in writing to be effective. The failure of a Coalition member to insist upon strict performance of any obligation under this Agreement shall not constitute or be deemed a waiver of any rights or remedies that a member might have and shall not be deemed a waiver of any subsequent breach or default.

D. **Severability:** The invalidity or unenforceability of any covenant, restriction, condition, limitation or any other provision of this Agreement, as the case may be and finally determined by a court of competent jurisdiction, shall not render the remainder of this Agreement nor any part hereof invalid or unenforceable.

E. **Governing Law:** The law of the State of Nebraska shall govern this Agreement.
F. **Amendments:** This Agreement shall be amended only by a written amendment signed by all Coalition members.

G. **Counterparts:** This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which shall constitute one and the same instrument.

H. **Entire Agreement:** This Agreement constitutes the entire agreement and understanding of the Coalition with respect to the subject matter contained herein, and supersedes all prior agreements or understandings regarding the same subject matter, whether oral or written.

IN WITNESS WHEREOF, the Coalition members have caused this Agreement to be executed by their duly authorized officers on the date and year first written above.

**ATTEST:**

__________________________________________
County Clerk

__________________________________________
Title:

**APPROVED AS TO FORM:**

__________________________________________
Deputy County Attorney

**ATTEST:**

__________________________________________
City Clerk

__________________________________________
Title:

**APPROVED AS TO FORM:**

__________________________________________
City Attorney

One signature page for each Coalition Member needs to be made up!!
Memo to the Programs, Projects, and Operations Subcommittee

Subject: Big Papio Trail

Date: July 2, 2004

From: Gerry Bowen

The recently-constructed Big Papio Trail Project between Center and Blondo has experienced cracking of the concrete trail on 4,008 of the 14,025 feet (29%) of trail installed. The project was designed by Kirkham Michael and constructed by Hawkins Construction Company of Omaha. The first concrete was poured on July 22, 2002.

The District then hired Terracon, Inc. to conduct the necessary scientific tests to determine the causes(s) of the cracking. Their report (see attached) indicates two periods of cracking occurred (early and late). The early cracking is concluded to be primarily caused by placement of “fly ash” concrete on a dry sub-grade during hot, dry, and windy afternoons.

The later cracking is concluded to be primarily caused by poor sub-grade support (compaction) which allowed the concrete to fail under traffic load.

The early cracks were routed and sealed, or sections replaced, by the contractor. The later cracks have not been repaired.

Management recommends that the Subcommittee recommend to the Board that the General Manager be authorized to negotiate with the responsible parties for correction of the pavement cracking in the District’s bicycle and pedestrian trail along the Big Papillion Creek between West Center Road and Blondo Street, and report back to the Board at its August meeting.
GEOTECHNICAL ENGINEERING REPORT

BIG PAPIO TRAIL PAVEMENT DISTRESS
WEST CENTER ROAD TO BLONDO STREET
OMAHA, NEBRASKA
PROJECT NO. STPB-28(74)
TERRACON PROJECT NO. 05035181

July 1, 2004

Prepared for:

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
Omaha, Nebraska

Prepared by:

TERRACON
Omaha, Nebraska
July 1, 2004

Papio-Missouri River Natural Resources District
8901 South 154th Street
Omaha, NE  68138-3621

Attention:  Mr. Gerry Bowen

Re:  Geotechnical Engineering Report
     Big Papio Trail Pavement Distress
     West Center Road to Blondo Street
     Omaha, Nebraska
     Project No. STPB-28(74)
     Terracon Project No. 05035181

Dear Mr. Bowen:

Terracon has completed geotechnical engineering services for the referenced project in accordance with our Proposal-Agreement dated December 5, 2003. The purpose of this report is to present the data collected, describe our interpretation and evaluation of the data relative to factors that apparently contributed to pavement distress, and provide recommendations to help remediate the distressed pavements and reduce recurrence of the problem on future trail projects.

PROJECT INFORMATION

The project consists of approximately 4½ miles of Portland cement concrete (PCC) paved trail. The trail pavement is 6 inches thick, 10 feet wide, and reportedly bears on 6 inches of compacted soil subgrade. The pavement has a surface cross-slope of about 2% that varies towards and away from the creek, depending on drainage design requirements. The trail generally is located within the creek floodway on an alignment that entailed minimal cut and fill. Exceptions to this occur below bridges at 105th Street, Interstate 680, and West Dodge Road and in the vicinity of STA 192+00 where several feet of fill was required.

The trail pavement was placed primarily from late July to early September, 2002. The portion of the trail along One Pacific Place was placed later, on December 5, 2002. The earthen shoulders adjacent to the trail were reportedly graded and seeded in the Fall of 2002. From June 6 to 9, 2003, sections of the trail pavement surface were milled by Hawkins Construction to produce the specified smoothness.

Following completion of milling operations in June, 2003, longitudinal cracks were noticed by NRD personnel in the trail pavement. The observed cracks were routed and sealed relatively
soon after they were noted. Localized distressed areas were also removed and replaced around
the same time.

Subsequent to repair of approximately 1,300 lineal feet of cracks, an additional 2,000 lineal feet
of cracks were noted. The cracks do not extend the full length of the trail but are generally
continuous along relatively long stretches. A summary of the crack locations, prepared by
Kirkham Michael in late 2003, was provided to Terracon and is referenced later in this report.

FIELD SERVICES

Terracon performed Heavy Weight Deflectometer testing on April 13, 2004. Testing was
conducted in a single pass along the centerline of the trail at intervals of 100-feet for a total of
190 test locations. A target load level of 6,000 lbf was used and actual load and deflection
measurements were automatically recorded along with distance from the start location. This
data was analyzed using techniques published in Appendix L of the AASHTO Guide for Design

Ground Penetrating Radar measurements were made on April 14, 2004 in an effort to
determine Portland Cement Concrete thickness along the entire length of the trail. Measurements were obtained along the centerline of the trail and recorded at one-foot intervals. The GPR data was analyzed using techniques presented in ASTM D-4748 “Standard Test
Method for Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar,”
with software incorporating enhanced processing functionality for automatic determination of
layer dielectric constant. Horizontal control was maintained using a commercial distance-
measuring instrument connected to the transmission of the survey vehicle. All GPR data
collected was referenced to existing landmarks (including core locations) and our reference
stationing established for this project. (Plan Station minus 370 feet). GPR measurements were
cross-referenced to measured core lengths and strengths to verify the types and thicknesses of
pavement and subgrade materials and to provide ground truth for calibration of the GPR data.

Sets of three, 3-foot deep borings were performed at each of the following sections:

- Two locations (at sealed and new cracks) in Section No. 1, one location (at new crack)
in Section No. 2, one “control” location (no cracking) in Section No. 3, Two locations (at
sealed and new cracks) in Section No. 4, and one “control” location (no cracking) in
Section No. 5.
- At each referenced location, one boring was performed about 1-foot in from each
pavement edge and one boring was performed near the center of the trail.
  - At each boring location, the pavement was cored using a 4-inch I.D. core barrel.
  - At locations of cracks, the center core was centered on the crack.
At each referenced station, transverse elevation profiles were obtained with a FACE Dipstick 2000 across the trail pavement at locations about one-foot north and south of the cores. The elevation profiles are included in the Appendix of this report.

Sampling in the soil borings was performed in accordance with our standard procedures wherein thin-walled samples (ASTM D-1587) are obtained in cohesive soils. In each boring, two samples were obtained in the top 2½ feet of soil subgrade. In addition, bulk samples of the auger cuttings were collected.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual-manual procedures and was performed by experienced personnel.

Boring layout was approximate. Distances from available reference features were measured using a calibrated wheel. The locations of the borings should be considered accurate only to the degree implied by these methods. The bore holes were backfilled after completion of sampling and the pavement surface was patched with non-shrink cement grout mix.

**Laboratory Evaluations:** Unconfined compressive strength or hand penetrometer tests, water content, and density tests were performed on representative portions of thin-walled tube samples. Each of the tube samples obtained in the field was tested and classified. In addition to this standard soil testing, selected samples of the soil subgrade were tested for moisture-density relationship (Standard Proctor) and plasticity index (Atterberg Limits). Shrinkage limits of the soils were estimated based on empirical relationship with the Atterberg Limits. The results of the laboratory soil tests are presented on the Boring Logs and in attachments included in the Appendix of this report.

Four of the concrete cores were selected by Terracon and sent to Mr. Tom Patty of Wiss Janney Elstner Associates, Inc. in Austin, Texas to have petrographic examinations performed. Cores from each of the following conditions were examined petrographically: a sealed crack, an open crack and two “control” cores from non-cracked areas. Core length and density were measured on each of the cores that were not obtained on a crack. One of the uncracked cores obtained from each location was tested for compressive strength and the other uncracked core
was tested for split-tensile strength. Results of the core testing are presented in a summary included in the report appendix.

**ENGINEERING ANALYSES**

Detailed monthly and daily weather records from Eppley Airfield for July and August, 2002 were obtained from the National Oceanic and Atmospheric Administration (NOAA). This information, as presented in the report appendix, was used to estimate evaporative loss rates for the pour dates from a nomograph in ACI 305 “Guide for Hot Weather Concreting”. Monthly summaries of daily high and average temperatures, wind speed, and total precipitation were also compiled and are included in the appendix.

Other interpretive aids that have been produced and are included in the appendix include:

- The Petrographic Analysis Report
- Plots, for each day of concrete placement, of individual and averaged modulus of subgrade reaction values, GPR pavement thickness measurements and variations in pavement condition; annotated with the time and direction of concrete placement, core set locations, core thickness measurements, evaporative loss rate, soil compaction test data, and percent occurrence of different pavement conditions.
- Plots comparing measured strengths, water contents, and densities vs. depth for each set of soil borings.
- Plots of changes in pavement elevation and horizontal movements derived from selected data summaries from surveys performed and provided to Terracon by NRD staff on six occasions between November, 2003 and May, 2004, and
- Plots of pavement elevation profiles taken at each core set location

**HWD and GPR Analyses:** Determining pavement layer properties from HWD deflection data requires layer thickness. We analyzed the GPR data to determine the thickness of the slab for each data record. From this set of results we selected the thickness value (D) corresponding to each location of an HWD test. The HWD data (load, deflections) for each test were used along with the thickness value to calculate structural properties including elastic modulus of the PCC ($E_{PCC}$), flexural strength of the PCC ($S'_c$), and static modulus of subgrade reaction (k).

Table 1 presents the statistics for the results obtained from the analyses. Variability of the results is indicated by the $C_v$ (coefficient of variance; the ratio of standard deviation to the mean). The thickness variation is low indicating fairly consistent construction of the slabs. Subgrade variation is much higher indicating support conditions are much less consistent. The PCC elastic modulus is highly variable reflecting the observed conditions; cracked slabs will have reduced elastic modulus relative to uncracked slabs constructed of the same lot of fresh concrete placed at the same time.
Table 1 - Summary of Analysis Results

<table>
<thead>
<tr>
<th>Property</th>
<th>Average</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev.</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_{GPR}$</td>
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<td>8.6</td>
<td>4.8</td>
<td>0.7</td>
<td>11%</td>
</tr>
<tr>
<td>$E_{PCC}$</td>
<td>$3.5 \times 10^6$</td>
<td>$10.1 \times 10^6$</td>
<td>$0.147 \times 10^6$</td>
<td>$1.49 \times 10^6$</td>
<td>42%</td>
</tr>
<tr>
<td>$S'_{sz}$</td>
<td>641</td>
<td>929</td>
<td>495</td>
<td>64.8</td>
<td>10%</td>
</tr>
<tr>
<td>$k$</td>
<td>50</td>
<td>92</td>
<td>12</td>
<td>15.7</td>
<td>31%</td>
</tr>
</tbody>
</table>

Note: One outlier removed, statistics are based on remaining 189 values

All HWD testing was performed at the slab centerline. The majority of cracking observed was longitudinal cracking also generally located near the centerline. Because the cracks were mostly narrow and did not appear to exhibit signs of movement (they were not “working” cracks) we believe the deflection measurements are reasonable and consistent with the assumptions used in developing the AASHTO relationships cited above. In some cases the cracks may have been more active and the resulting poor results indicative of conditions outside the range assumed for the relationships. Overall, we believe the data and analysis results reflect field conditions despite the presence of cracks at some test locations.

Pavement Load analyses: We understand normal traffic along the trail consists of occasional maintenance truck traffic (2-axle, 6-tire configuration) and occasional traffic due to mowing equipment (John Deere 4020 type tractors). We also understand portions of the trail may have received occasional heavier truck or equipment traffic during construction (milling machine, graders, etc.).

Based on our analysis of the load-deflection and laboratory test data, the subgrade soils exhibit a significantly softer response than is normally associated with similar soil materials. Based on our analysis, an average modulus of subgrade reaction of 30 to 50 pci appears to be representative of the majority of the project. We anticipate that seasonal moisture variation at and under the edges of the trail pavement could also create zones of alternating shrinkage and swelling in the underlying subgrade soils, causing further loss of support during periods of the year.

We analyzed the existing slabs using the data collected from the field and laboratory test programs to evaluate whether load effects combined with seasonal subgrade stiffness variation could result in cracking similar to that observed in the field. The analysis was based on a finite element analysis of the slab-subgrade interaction under various load combinations in addition to Ionnides' modified forms of the original Westergard formulations for maximum stresses due to edge loading. Based on these analyses, the load due to a tractor tire, if applied near the edge of the slab, could result in bending stresses in the slab on the order of 75 to 95 percent of the concrete modulus of rupture. The load due to a loaded concrete transit truck applied near the edge of the slab could also result in bending stresses in the slab on the order of 80 to 100 percent of the concrete modulus of rupture. The load due to a heavily loaded, single axle...
maintenance truck (at 16,000 to 24,000 GVW) could cause bending stresses in the slab on the order of 60 to 75 percent of the concrete modulus of rupture. These values are for a uniform 50 pci subgrade with no loss or concentration of support at the edges. The presence of non-uniform edge support and softer subgrade below the center would increase the risk of structural failure.

Based on these analyses, it appears the occasional heavier loads that the trail has experienced may have a significant role in the later longitudinal cracking that has been observed. At stress levels greater than about 85 percent of the concrete rupture strength, it would only require a few passes to initiate cracking in the slab. These load conditions combined with the other seasonally related subgrade support issues and the potential for some built in tensile stresses due to plastic and drying shrinkage could easily result in the observed cracking.

CONCLUSIONS

The first observed cracking in the trail, most of that which was routed and sealed, typically appears to have a different general pattern than most of the cracking that has occurred since. The early cracks generally do not as often run continuous through the transverse sawed joints, and are more prone to deviate from the center line of the trail and to sometimes curve towards the pavement edge near the transverse joints. A dual crack occasionally splits off the original crack at these locations in the early cracking areas. The later cracking is more often continuous through the transverse joints and tends to more commonly follow the pavement centerline.

The petrographic analyses indicates that the crack from the routed and sealed location did not appear to go through as much aggregate as the core with the later open crack. This suggests earlier crack development, or initiation, before the concrete had gained full strength in the routed and sealed location. Although the petrographic examination did not detect signs of severe water deprivation, such as excessive amounts of unhydrated cement, there was likely some water loss and internal tension stresses developed.

Both the more random cracking patterns and the petrographic findings indicate that the initial cracks were more likely affected by internal tension stresses generated by concrete shrinkage, while the later cracks appear to generally be more characteristic of a typical traffic load-induced failures. The concrete shrinkage affecting the early cracks was probably a result of not only the high evaporative loss rate during hot, dry and windy afternoons, but also by absorption of water from the fluid concrete by relatively dry subgrade soils. Due to the design slope of the subgrade, water contents were probably higher on the low side if rainwater ponded in areas exposed to rain events. This could have caused variable non-uniformity in the subgrade absorption and support conditions.
In areas of relatively dry subgrade, wetting of the edge soils due to rains subsequent to pavement placement could also have caused local subgrade heave along the pavement edges due to swelling of the underlying clays. This non-uniform support condition, combined with internal shrinkage stress, could have significantly reduced the traffic load required to initiate cracking in the bottom of the pavement section. These cracks may not have become apparent until hot and dry weather and vegetative water withdrawal caused the edge soils to dry and shrink again, allowing the crack to propagate to the surface.

The characteristics observed to be most commonly associated with the areas of later crack development are comparatively low subgrade modulus, soil strength and density. The drying of the edge soils due to hot, dry weather and vegetative demand also likely caused shrinkage of the soils to some distance under the pavement edges. The volumetric shrinkage of the soil mass along the pavement edges could have also resulted in development of some outward tensile stress due to subgrade adhesion on the bottom of the pavement. These effects could have reduced the effective edge support of the pavement and significantly reduced the traffic loads required to cause cracking. It is our opinion that the majority of the later cracking was caused by traffic loading combined with relatively poor subgrade support capacity. This appears to typically have been primarily caused by inadequate subgrade strength, but may have been exacerbated by internal shrinkage stresses due to the effect of the flyash on the concrete mix.

The subgrade compaction tests that were performed indicated that the subgrade compaction met project specifications, except for the tests performed at STA 117. However, the number, frequency and/or locations of the compaction tests do not appear to have been adequate to be sufficiently representative of the actual subgrade conditions, based on the borings and deflectometer tests. The reports indicated that after three failing tests at STA 117, the engineer's on-site representative stated the subgrade was deemed adequate, regardless of the test results. This is one of the most marked areas of low subgrade strength and later crack development.

In general, the concrete characteristics (strengths, air content, density, and thickness) appear not to have typically been a major contributor to the cracking problems. However, the flyash utilized in the concrete mix reduces the bleed rate and increases the likelihood for evaporation rates to exceed the bleed rate, increasing the risk of plastic shrinkage problems. Plastic shrinkage generally appeared to play a more significant role in the early cracking. But it is difficult to quantify whether internal tension stresses due to plastic shrinkage could have persisted long enough in the pavement section to play a significant role in the later cracking.

There has also been mention by a Lyman Richey representative that the combined effects of the flyash and water reducer may have caused an adverse effect on the normal hydration regulation action of the sulfates (gypsum) provided in the Portland cement. Little information appears available about the specifics of this problem termed “sulfate deprivation”, but there is
anecdotal evidence that it may increase the risk of shrinkage cracking. A new procedure for calorimetric testing of the PCC mixes to help evaluate the effect on hydration characteristics of flyash and admixture combinations appears to warrant consideration to help better evaluate the potential for future problems in this regard. Persistent internal tension stress due to this type of shrinkage could have exacerbated the later cracking problems the trail has exhibited.

ENGINEERING RECOMMENDATIONS

The existing cracked pavements will necessitate increased maintenance, on a regular basis, to rout and keep the cracks effectively sealed. This will be required to control against progressive deterioration due to water infiltration and local spalling of the crack edges. Although some additional cracking would be expected, the amount of new cracking would generally be expected to be progressively less over time. Protecting the trail from exposure to heavy equipment loads will also be important in reducing additional cracking. Establishing vegetation selected for low water demand and limited root system depth along the edges of the trail would also help reduce the potential magnitude of subgrade shrinkage along the pavement edges. With these factors adequately addressed, the trail in affected areas would be expected to remain relatively intact and serviceable for its intended use for support of light traffic loads.

From the perspective of reducing the risks of similar cracking problems on future projects, improvement of the strength and uniformity of the subgrade is considered the most important factor. Increasing the number, frequency and reliance on compaction and moisture testing is considered central to this issue. Visual observations can be particularly misleading when the subgrade surface appears relatively dry.

It would also be prudent to increase the level of subgrade improvement by specifying deeper compaction or chemical stabilization with flyash or cement. Alternatively, design of the pavement section on a more pronounced embankment to increase drainage, or use of impermeable shoulders could be considered to reduce shrink/swell of the subgrade soils along the pavement edges. High water demand vegetation should be avoided in close proximity to the pavements.

Not using flyash in the PCC mix, or possibly performing testing to help avoid adverse admixture interactions, may reduce the potential for shrinkage crack development during hot, dry and windy placement conditions. Alternatively, placing the concrete during the early morning or late afternoon, or other times of low evaporation rate, may help in this regard. If the flyash is causing long-term shrinkage, its elimination may also reduce the pavement’s sensitivity to cracking in soft subgrade areas.
We appreciate the opportunity to be of service to you on this project. Please contact Joe Waxse at (402) 330-2202 if you have any questions regarding this report or if we can be of further service to you.

Sincerely,
TERRACON

Scott G. Miller, E.I.
Construction Services Manager

SGM/JAW:sgm/leblyms

Attachment – Appendix A

Copies to: Addresssee (3)
# TABLE 1
CONCRETE CORE TEST SUMMARY

<table>
<thead>
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<th>Core No.</th>
<th>1A</th>
<th>1B</th>
<th>1C</th>
<th>2A</th>
<th>2B</th>
<th>2C</th>
<th>3A</th>
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<tbody>
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<td>3+12 Cen</td>
<td>3+12 Rt</td>
<td>13+09 Lt</td>
<td>13+09 Cen</td>
<td>13+09 Rt</td>
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<td>r&amp;s</td>
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<td>no</td>
<td>open</td>
<td>no</td>
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<td>6170</td>
<td></td>
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<td>5670</td>
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<table>
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<th>4B</th>
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<th>5B</th>
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<td>94+20 Rt</td>
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<th>7C</th>
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<td>129+10 C</td>
<td>129+10 R</td>
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<td>r&amp;s</td>
<td>r&amp;s</td>
<td>no</td>
<td>no</td>
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<td>Split Tensile Strength, psi</td>
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<td>555</td>
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<td>Compressive strength, psi</td>
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<td>6610</td>
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<td></td>
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</tr>
</tbody>
</table>

**NOTES:**
- no = no Crack
- R&S = routed and sealed
- open = open crack
GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:
- SS: Split Spoon - 1½” I.D., 3” O.D., unless otherwise noted
- ST: Thin-Walled Tube - 3” O.D., Unless otherwise noted
- PA: Power Auger
- HA: Hand Auger
- DB: Diamond Bit - 4”, N, B
- AS: Auger Sample
- HS: Hollow Stem Auger
- PS: Piston Sample
- WS: Wash Sample
- FT: Fish Tail Bit
- RB: Rock Bit
- BS: Bulk Sample
- PM: Pressuremeter
- DC: Dutch Cone
- WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:
- WL: Water Level
- WGI: Wet Cave In
- DCI: Dry Cave In
- AB: After Boring
- WS: While Sampling
- WD: While Drilling
- BCR: Before Casing Removal
- ACR: After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu, psf | Consistency
--- | ---
< 500 | Very Soft
500 - 1,000 | Soft
1,001 - 2,000 | Medium
2,001 - 4,000 | Stiff
4,001 - 8,000 | Very Stiff
8,001 -18,000 | Hard
> 18,000 | Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

| N-Blows/ft. | Relative Density |
--- | ---
0-3 | Very Loose
4-9 | Loose
10-29 | Medium Dense
30-49 | Dense
50-80 | Very Dense
80+ | Extremely Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of Components Also Present in Sample) | Percent of Dry Weight
--- | ---
Trace | < 15
Within | 15 - 29
Modifier | > 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample) | Percent of Dry Weight
--- | ---
Trace | < 5
Within | 5 - 12
Modifier | > 12

GRAIN SIZE TERMINOLOGY

Major Component Of Sample | Size Range
--- | ---
Boulders | Over 12 in. (300mm)
Cobbles | 12 in. to 3 in. (300mm to 75mm)
Gravel | 3 in. to #4 sieve (75mm to 4.75mm)
Sand | #4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay | Passing #200 sieve (0.075mm)
**LOG OF BORING NO. 1A**

**CLIENT**
Papio-Missouri River NRD

**ARCHITECT/ENGINEER**

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

<table>
<thead>
<tr>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION</th>
<th>DEPTH, ft</th>
<th>USGS SYMBOL</th>
<th>NUMBER</th>
<th>RECOVERY, %</th>
<th>SPT - N BLOWS, fl</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, pd</th>
<th>UNCONFINED STRENGTH, psi</th>
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<td>0.6</td>
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<td>1.5</td>
<td>(FILL) LEAN CLAY, trace sand</td>
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<td>28</td>
<td>90</td>
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**BOTTOM OF BORING**

---

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer*

**WATER LEVEL OBSERVATIONS, ft**

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**BORING STARTED** 5-27-04

**BORING COMPLETED** 5-27-04

**RIG** SIMCO

**DRILLER** DM

**APPROVED** JAW

**JOB #** 05035181
**LOG OF BORING NO. 1B**

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**ARCHITECT/ENGINEER**

**PROJECT**
Big Papio Trail Pavement Distress

<table>
<thead>
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<th>GRAPHIC LOG</th>
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<th>WATER CONTENT, %</th>
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**BOTTOM OF BORING**

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**WATER LEVEL OBSERVATIONS, ft**

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<td>BORING COMPLETED</td>
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**RIG**
SIMCO DRILLER DM

**APPROVED**
JAW JOB # 05035181

*Calibrated Hand Penetrometer*

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.
**LOG OF BORING NO. 1C**

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

**TABLE**

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<td>ST</td>
<td>5</td>
<td>20</td>
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<td>9000+</td>
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**DESCRIPTION**
- 6" PCC at surface
- (FILL) LEAN CLAY, trace sand
  - Dark brown
  - Trace gravel

**BOTTOM OF BORING**

---

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

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<tr>
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**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW

**JOB #**
05035181
# LOG OF BORING NO. 2A

## CLIENT
Papio-Missouri River NRD

## SITE
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

## PROJECT
Big Papio Trail Pavement Distress

### GRAPHIC LOG

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</table>
| 1.5       | (FILL) LEAN CLAY, trace sand
Dark brown                      |              | 1      | ST   | 10   | 28           | 90              |                   | 2000*                  |
|           |                                           |             |        |      |             |                 |                   |                       |                          |
|           | LEAN CLAY, trace sand
Dark brown
Medium            |             | 2      | CL   | 9    | 31           | 87              |                   | 1500*                  |
|           |                                           |             |        |      |             |                 |                   |                       |                          |
| 3         | BOTTOM OF BORING                           |             |        |      |             |                 |                   |                       |                          |

**The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.**

*Calibrated Hand Penetrometer

## WATER LEVEL OBSERVATIONS, ft

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**BORING STARTED**
5-27-04

**BORING COMPLETED**
5-27-04

**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW
**JOB #** 05035181
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<td>76</td>
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<td>34</td>
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**DESCRIPTION**

- **Graphic Log**: Boring Location: STA 309
- **Description**
  - 6" PCC at surface
  - **(Fill) Lean Clay**, trace sand
    - Dark brown
  - **Lean Clay**, trace sand
    - Very dark brown
    - Soft
    - Trace root holes at 1' to 2'

**WATER LEVEL OBSERVATIONS, ft**

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<tbody>
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**Materials**

- **RIG**: SIMCO
- **DRILLER**: DM
- **Approved**: JAW
- **Job #**: 05035181

---

*Calibrated Hand Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.
## LOG OF BORING NO. 2C

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<td></td>
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</tr>
<tr>
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<td>(FILL) LEAN CLAY, trace sand</td>
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<td>ST</td>
<td>10</td>
<td>27</td>
<td>84</td>
<td>2000*</td>
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<tr>
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<td>Very dark brown</td>
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The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

---

**WATER LEVEL OBSERVATIONS, ft**

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**BORING STARTED** 5-27-04

**BORING COMPLETED** 5-27-04

**RIG** SIMCO  
**DRILLER** DM

**APPROVED** JAW  
**JOB #** 05035181
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<td><strong>LEAN CLAY, trace sand Brown</strong></td>
<td>CL 1</td>
<td>ST 12, 27, 93, 2000*</td>
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**WATER LEVEL OBSERVATIONS, ft**

- WL 0
- WL 0
- WL 0

**Terracon**

**BORING STARTED** 5-27-04
**BORING COMPLETED** 5-27-04
**RIG** SIMCO
**DRILLER** DM
**APPROVED** JAW
**JOB #** 05035181

*Calibrated Hand Penetrometer*

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.
# LOG OF BORING NO. 3B

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

### GRAPHIC LOG

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### SAMPLES

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*Calibrated Hand Penetrometer

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**WATER LEVEL OBSERVATIONS, ft**

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**BORING STARTED**
5-27-04

**BORING COMPLETED**
5-27-04

**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW

**JOB #**
05035181

---

*The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.*
# LOG OF BORING NO. 3C

**CLIENT**  
Papio-Missouri River NRD

**SITE**  
Big Papio Creek from Center St. to Blindo St.  
Omaha, Nebraska

**PROJECT**  
Big Papio Trail Pavement Distress

<table>
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**WATER LEVEL OBSERVATIONS, ft**

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**BORING**

**STARTED**  
5-27-04

**COMPLETED**  
5-27-04

**RIG**  
SIMCO

**DRILLER**  
DM

**APPROVED**  
JAW

**JOB #**  
05035181

*Calibrated Hand Penetrometer*
**LOG OF BORING NO. 4A**

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

**Boring Location:** STA 9420

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<th>DRY UNIT WT, pdl</th>
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*Calibrated Hand Penetrometer

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

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**BORING DATES**

- **BORED STARTED:** 5-27-04
- **BORED COMPLETED:** 5-27-04

**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW

**JOB #**
05035181
# LOG OF BORING NO. 4B

**CLIENT**

Papio-Missouri River NRD

**SITE**

Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**

Big Papio Trail Pavement Distress

<table>
<thead>
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<th>NUMBER</th>
<th>TYPE</th>
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<th>SPT BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, lb</th>
<th>UNCONSOLIDATED STRENGTH, psi</th>
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<td>0.5</td>
<td>6&quot; PCC at surface</td>
<td></td>
<td>PA</td>
<td>1</td>
<td>ST 9</td>
<td>25</td>
<td>87</td>
<td>3000*</td>
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<tr>
<td></td>
<td>(FILL) LEAN CLAY, trace sand</td>
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<tr>
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<tr>
<td></td>
<td>With sand seams and pockets</td>
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<tr>
<td>2</td>
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<td></td>
<td>CL</td>
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<td>ST 11</td>
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<tr>
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<td>With silty fine sand pockets</td>
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<td>BOTTOM OF BORING</td>
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The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

<table>
<thead>
<tr>
<th>WL</th>
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**Terracon**

**BORING STARTED**

5-27-04

**BORING COMPLETED**

5-27-04

**RIG**

SIMCO

**DRILLER**

DM

**APPROVED**

JAW

**JOB #**

05035181

*Calibrated Hand Penetrometer*
### LOG OF BORING NO. 4C

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

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<tr>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION</th>
<th>USGS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, In.</th>
<th>SPT-N BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT</th>
<th>UNCONFINED STRENGTH, psf</th>
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<td>6&quot; PCC at surface</td>
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</tr>
<tr>
<td>2</td>
<td>LEAN CLAY, trace sand</td>
<td>CL</td>
<td>1</td>
<td>ST</td>
<td>10</td>
<td>30</td>
<td>78</td>
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<td>(Possible fill)</td>
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<td>Dark brown</td>
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<tr>
<td>2</td>
<td>LEAN CLAY, trace sand</td>
<td>CL</td>
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<td>ST</td>
<td>15</td>
<td>24</td>
<td>85</td>
<td>7000*</td>
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</tr>
<tr>
<td></td>
<td>Brown</td>
<td></td>
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<td>BOTTOM OF BORING</td>
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The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

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<tr>
<th>WL</th>
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**BORING STARTED**
5-27-04

**BORING COMPLETED**
5-27-04

**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW

**JOB #**
05035181

*Calibrated Hand Penetrometer*
# LOG OF BORING NO. 5A

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

**BORING LOCATION:** STA 1119

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<td>0.5</td>
<td>6&quot; PCC at surface</td>
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<tr>
<td>2</td>
<td>(FILL) LEAN CLAY, trace sand Brown to dark brown</td>
</tr>
<tr>
<td>3</td>
<td>LEAN CLAY, trace sand Dark brown</td>
</tr>
<tr>
<td></td>
<td>BOTTOM OF BORING</td>
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<table>
<thead>
<tr>
<th>DEPTH, ft</th>
<th>USCS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, %</th>
<th>SPT - N BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, lb/ft³</th>
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<tr>
<td>1</td>
<td>ST</td>
<td>10</td>
<td>22</td>
<td>88</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>101</td>
<td>8500*</td>
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<tr>
<td>2</td>
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<tr>
<td></td>
<td>CL</td>
<td>24</td>
<td>88</td>
<td>7500*</td>
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</table>

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

<table>
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<tr>
<th>WL</th>
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**BORING STARTED** 5-27-04

**BORING COMPLETED** 5-27-04

**RIG** SIMCO
**DRILLER** DM

**Terracon**

**APPROVED** JAW
**JOB #** 05035181

*Calibrated Hand Penetrometer*
# LOG OF BORING NO. 5B

## CLIENT
Papio-Missouri River NRD

## SITE
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

## PROJECT
Big Papio Trail Pavement Distress

### GRAPHIC LOG
### DESCRIPTION

<table>
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<th>USCS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, %</th>
<th>SPT. N BLOWS / ft.</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, lb/ft^3</th>
<th>UNCONFINED STRENGTH, psi</th>
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</thead>
<tbody>
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<td>CL</td>
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<td>ST</td>
<td>28</td>
<td>89</td>
<td>590</td>
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<td>2500*</td>
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<tr>
<td>1</td>
<td>LEAN CLAY, trace sand</td>
<td>Brown</td>
<td></td>
<td>34</td>
<td>87</td>
<td>1500*</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>LEAN CLAY, trace sand</td>
<td>Very dark brown</td>
<td>Stiff</td>
<td>36</td>
<td>72</td>
<td>2500*</td>
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<td>32</td>
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The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

### WATER LEVEL OBSERVATIONS, ft

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BORING STARTED 5-27-04
BORING COMPLETED 5-27-04
RIG SIMCO DRILLER DM
APPROVED JAW JOB # 05035181
LOG OF BORING NO. 5C

**CLIENT**  Papio-Missouri River NRD  
**ARCHITECT/ENGINEER**

**SITE** Big Papio Creek from Center St. to Blondo St.  
Omaha, Nebraska

**PROJECT** Big Papio Trail Pavement Distress

<table>
<thead>
<tr>
<th>DEPTH, ft</th>
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<th>TYPE</th>
<th>RECOVERY, %</th>
<th>SPT - N BLOWS / ft</th>
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<th>DRY UNIT WT, lb</th>
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<td>1.5</td>
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<td>ST</td>
<td>33</td>
<td>88</td>
<td>1500*</td>
<td></td>
<td></td>
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<tr>
<td>2.5</td>
<td>CL</td>
<td>3</td>
<td></td>
<td>34</td>
<td>85</td>
<td>2500*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DESCRIPTION**
- 6" PCC at surface
- **(FILL) LEAN CLAY**, trace sand Brown
- LEAN CLAY, trace sand  
  Very dark brown

**Boring Location:** STA 1119

**BOTTOM OF BORING**

---

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

<table>
<thead>
<tr>
<th>WL</th>
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**BORING STARTED**  5-27-04

**BORING COMPLETED**  5-27-04

**RIG**  SIMCO

**DRILLER**  DM

**APPROVED**  JAW  
**JOB #**  05035181

*Calibrated Hand Penetrometer*
# Log of Boring No. 6A

## Client
Papio-Missouri River NRD

## Site
Big Papio Creek from Center St. to Blondo St.
Omaha, Nebraska

## Boring Location
STA 12910

### Description

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<th>Sample Type</th>
<th>Description</th>
<th>USGS Symbol</th>
<th>Number</th>
<th>Recovery, In.</th>
<th>SPT N Blows, ft</th>
<th>Water Content, %</th>
<th>Dry Unit Wt, psf</th>
<th>Unconfined Strength, psi</th>
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</thead>
<tbody>
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<td>0.5</td>
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<td>6&quot; PCC at surface</td>
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<td>1</td>
<td>26</td>
<td>91</td>
<td>1500*</td>
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<tr>
<td>1.5</td>
<td>1</td>
<td>(Fill) Lean Clay, trace sand</td>
<td>ST 12</td>
<td>21</td>
<td>103</td>
<td>4000*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Lean Clay, trace sand</td>
<td>ST 10</td>
<td>28</td>
<td>87</td>
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<td>Bottom of Boring</td>
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<td>28</td>
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<td>3000*</td>
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**Note:** The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

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**BORING**

**Boring Started:** 5-27-04

**Boring Completed:** 5-27-04

**Rig:** SIMCO

**Driller:** DM

**Approved:** JAW

**Job #:** 05035181
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<td>6&quot; PCC at surface</td>
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<tr>
<td>(FILL) LEAN CLAY, trace sand</td>
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<tr>
<td>Dark brown</td>
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<tr>
<td></td>
</tr>
<tr>
<td>1.5</td>
</tr>
<tr>
<td>LEAN CLAY, trace sand</td>
</tr>
<tr>
<td>Dark brown</td>
</tr>
<tr>
<td></td>
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<td>3</td>
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<td>BOTTOM OF BORING</td>
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<tr>
<th>USCS SYMBOL</th>
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<th>TYPE</th>
<th>SPT - N BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, pd</th>
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<td></td>
<td>1</td>
<td>ST</td>
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<td>23</td>
<td>96</td>
<td>2000*</td>
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<td>88</td>
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</table>

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft

<table>
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<tr>
<th>WL</th>
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BORING STARTED 5-27-04
BORING COMPLETED 5-27-04
RIG SIMCO DRILLER DM
APPROVED JAW JOB # 05035181
## LOG OF BORING NO. 6C

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Biondo St.  
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

### BORING LOCATION: STA 12910

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<th>TYPE</th>
<th>RECOVERY, in.</th>
<th>SPT BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, psi</th>
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<td>ST</td>
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<td>69</td>
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**BOTTOM OF BORING**

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*Calibrated Hand Penetrometer

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**WATER LEVEL OBSERVATIONS, ft**

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**BORING**

| BORING STARTED | 5-27-04 |
| BORING COMPLETED | 5-27-04 |

**RIG**

<table>
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<th>SIMCO</th>
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**APPROVED**

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<th>JOB #</th>
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*The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.*
# LOG OF BORING NO. 7A

**CLIENT**
- Papio-Missouri River NRD

**SITE**
- Big Papio Creek from Center St. to Blondo St.
- Omaha, Nebraska

**PROJECT**
- Big Papio Trail Pavement Distress

## GRAPHIC LOG

<table>
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<tr>
<th>DESCRIPTION</th>
<th>DEPTH, ft</th>
<th>USCS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, %</th>
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<th>WATER CONTENT, %</th>
<th>DRY UNIT WT,pcf</th>
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<tr>
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<td>(FILL) LEAN CLAY, trace sand</td>
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<td>ST</td>
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<td>19</td>
<td>102</td>
<td>6500*</td>
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**BOTTOM OF BORING**

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The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS, ft**

<table>
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**BORING**

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<tbody>
<tr>
<td>BORING COMPLETED</td>
<td>5-27-04</td>
</tr>
</tbody>
</table>

**RIG**
- SIMCO

**DRILLER**
- DM

**APPROVED**
- JAW

**JOB #**
- 05035181
### LOG OF BORING NO. 7B

**CLIENT**
Papio-Missouri River NRD

**SITE**
Big Papio Creek from Center St. to Blonde St.
Omaha, Nebraska

**PROJECT**
Big Papio Trail Pavement Distress

#### GRAPHIC LOG

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DEPTH, ft</th>
<th>USCS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, %</th>
<th>SPT BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, psf</th>
<th>UNCONFINED STRENGTH, psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; PCC at surface</td>
<td>0.5</td>
<td>PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(FILL) LEAN CLAY, trace sand</td>
<td></td>
<td></td>
<td>1</td>
<td>ST</td>
<td>10</td>
<td>23</td>
<td>99</td>
<td>2500*</td>
<td></td>
</tr>
<tr>
<td>Dark brown to light brown</td>
<td></td>
<td></td>
<td>2</td>
<td>ST</td>
<td>4</td>
<td>21</td>
<td>101</td>
<td>8000*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>105</td>
<td>5500*</td>
<td></td>
</tr>
</tbody>
</table>

**BOTTOM OF BORING**

---

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

**WATER LEVEL OBSERVATIONS, ft**

<table>
<thead>
<tr>
<th>WL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**BORING**

<table>
<thead>
<tr>
<th>BORING STARTED</th>
<th>5-27-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>BORING COMPLETED</td>
<td>5-27-04</td>
</tr>
</tbody>
</table>

**RIG**
SIMCO

**DRILLER**
DM

**APPROVED**
JAW

**JOB #** 05035181
# LOG OF BORING NO. 7C

## CLIENT
Papio-Missouri River NRD

## SITE
Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska

## BORING LOCATION
STA 15506

## DESCRIPTION

<table>
<thead>
<tr>
<th>DEPTH, ft</th>
<th>USCS SYMBOL</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, %</th>
<th>SPT - N BLOWS / ft</th>
<th>WATER CONTENT, %</th>
<th>DRY UNIT WT, lb</th>
<th>UNCONFINED STRENGTH, psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>PA</td>
<td>1</td>
<td>ST</td>
<td>9</td>
<td>24</td>
<td>99</td>
<td>5500*</td>
<td>8500*</td>
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<tr>
<td></td>
<td></td>
<td>2</td>
<td>ST</td>
<td>11</td>
<td>21</td>
<td>104</td>
<td>6500*</td>
<td>9000+**</td>
</tr>
</tbody>
</table>

## BOTTOM OF BORING

6" PCC at surface

**FILL** LEAN CLAY, trace sand
Dark brown to light brown

---

### WATER LEVEL OBSERVATIONS, ft

<table>
<thead>
<tr>
<th>WL</th>
<th></th>
</tr>
</thead>
</table>

---

BOARING STARTED 5-27-04

BOARING COMPLETED 5-27-04

RIG SIMCO DRILLER DM

APPROVED JAW JOB # 05035181

---

*Calibrated Hand Penetrometer

*The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.*
### Unified Soil Classification System

#### Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests

<table>
<thead>
<tr>
<th>Coarse-Grained Soils</th>
<th>Gravels</th>
<th>Clean Gravels</th>
<th>Gravels with Fines</th>
<th>Sands</th>
<th>Clean Sands</th>
<th>Sands with Fines</th>
<th>Fine-Grained Soils</th>
<th>Slits and Clays</th>
<th>Inorganic</th>
<th>Organic</th>
<th>Highly organic soils</th>
<th>Primarily organic matter, dark in color, and organic odor</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 50% retained on No. 200 sieve</td>
<td>More than 50% of coarse fraction retained on No. 4 sieve</td>
<td>Less than 5% fines</td>
<td>More than 12% fines</td>
<td>50% or more of coarse fraction passes No. 4 sieve</td>
<td>Less than 5% fines</td>
<td>More than 12% fines</td>
<td>50% or more passes the No. 200 sieve</td>
<td>Liquid limit less than 50</td>
<td>Plots on or above &quot;A&quot; line</td>
<td>Liquid limit — oven dried</td>
<td>Liquid limit — not dried</td>
<td>Peat</td>
</tr>
<tr>
<td>Gravels</td>
<td>More than 50% of coarse fraction retained on No. 4 sieve</td>
<td>Clean Gravels</td>
<td>Gravels with Fines</td>
<td>Sands</td>
<td>Clean Sands</td>
<td>Sands with Fines</td>
<td>Fine-Grained Soils</td>
<td>Slits and Clays</td>
<td>Inorganic</td>
<td>Organic</td>
<td>Highly organic soils</td>
<td>Primarily organic matter, dark in color, and organic odor</td>
</tr>
<tr>
<td>More than 50% of coarse fraction retained on No. 4 sieve</td>
<td>Gravels with Fines</td>
<td>More than 12% fines</td>
<td>Sands</td>
<td>Clean Sands</td>
<td>Clean Sands</td>
<td>Clean Sands</td>
<td>Inorganic</td>
<td>Slits and Clays</td>
<td>Liquid limit less than 50</td>
<td>Plots on or above &quot;A&quot; line</td>
<td>Liquid limit — oven dried</td>
<td>Liquid limit — not dried</td>
</tr>
<tr>
<td>Gravels</td>
<td>Gravels with Fines</td>
<td>More than 12% fines</td>
<td>Sands</td>
<td>Sands</td>
<td>Sands</td>
<td>Sands</td>
<td>Inorganic</td>
<td>Slits and Clays</td>
<td>Liquid limit less than 50</td>
<td>Plots on or above &quot;A&quot; line</td>
<td>Liquid limit — oven dried</td>
<td>Liquid limit — not dried</td>
</tr>
<tr>
<td>Less than 5% fines</td>
<td>More than 5% fines</td>
<td>Fines classify as ML or MH</td>
<td>Fines classify as CL or CH</td>
<td>Fines classify as ML or MH</td>
<td>Fines classify as ML or MH</td>
<td>Fines classify as ML or MH</td>
<td>Organic</td>
<td>Liquid limit — oven dried</td>
<td>Liquid limit — not dried</td>
<td>Organic clay</td>
<td>Organic silt</td>
<td></td>
</tr>
<tr>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td>Cu ≥ 4 and 1 ≤ Cc ≤ 3 &amp; Cu &lt; 4 and/or 1 &gt; Cc &gt; 0</td>
<td></td>
</tr>
<tr>
<td>GW</td>
<td>GP</td>
<td>GM</td>
<td>GC</td>
<td>SM</td>
<td>SC</td>
<td>Clayey sand</td>
<td>CL</td>
<td>ML</td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>P</td>
</tr>
</tbody>
</table>

**Notes:**

- **Based on the material passing the 3-in. (75-mm) sieve.
- **If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- **Gravels with 5 to 12% fines require dual symbols:
  - GW-GM well-graded gravel with silt
  - GW-GC well-graded gravel with clay
  - GP-GM poorly graded gravel with silt
  - GP-GC poorly graded gravel with clay
- **Sands with 6 to 12% fines require dual symbols:
  - SW-SM well-graded sand with silt
  - SW-SC well-graded sand with clay
  - SP-SM poorly graded sand with silt
  - SP-SC poorly graded sand with clay

---

**For classification of fine-grained soils and fine-grained fraction of coarse-grained soils**

**Equation of "A" line:**

Horizontal at Pi = 4 to LL = 25.5, then Pi = 0.73 (LL = 20)

**Equation of "U" line:**

Vertical at LL = 18 to Pi = 7, then Pi = 0.9 (LL = 8)

---

**Other Symbols:**

- **Pi ≥ 4 and plots on or above "A" line.
- Pi < 4 or plots below "A" line.
- Pi plots on or above "A" line.
- Pi plots below "A" line.

---

**Plasticity Index (PI):**

<table>
<thead>
<tr>
<th>PLASTICITY INDEX (PI)</th>
<th>LIQUID LIMIT (LL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
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<td>40</td>
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<td>80</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

---

**Plots:**

- **CL or OL**
- **ML or OL**
- **CH or OH**
- **MH or OH**
- **U LINE**
- **A LINE**

---

**Notes:**

- **If soil contains 15 to 25% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
- **If soil contains 30% plus No. 200 predominantly sand, add "sandy" to group name.
- **If soil contains 30% plus No. 200, predominantly gravel, add "gravely" to group name.
- **If soil contains ≥ 30% plus No. 200, predominantly clay, add "clayey" to group name.
- **Pi ≥ 4 and plots on or above "A" line.
- Pi < 4 or plots below "A" line.
- Pi plots on or above "A" line.
- Pi plots below "A" line.
Laboratory Compaction Characteristics of Soil

Client Name: ____________________________
Project Name: Pepio Trail
Location: Omaha, NE.

Source Material: Borings 1A-3C, 5A-6C
Sample Description: ____________________________

Material Designation: ____________________________ Sample date: ____________________________
Test Method: Method A
Test Procedure: ASTM D698
Sample Preparation: X Mechanical _____ Manual
Rammer: ____________________________

Project No.: 05035181 Date: 6/22/2004

TEST RESULTS
Maximum Dry Unit Wt.: 103.5 pcf
Optimum Water Content: 19.6 %

Liquid Limit: _____ Plastic Limit: _____
Plasticity Index: _____
% passing # 200 sieve: _____

Reviewed by: ____________________________

Zero air voids for specific gravity of 2.68
Big Papio Trail
Ambient Weather Conditions, August 2002

Date

Degrees f, 100ths/in, MPH

Tavg
Tmax
PrecipTotal
Avg Wind Spd
Big Papio Trail
Ambient Weather Cond., 7/22/02

Conc. Temp = 84
Avg. Temp = 83
Avg. RH = 45%
Avg. Wind = 9mph
Evap. Rate = 0.18avg

Temp
Rel. Hmd.
Wind spd
Big Papio Trail
Subgrade Modulus vs. Condition
July 22, 2002

Evap. Rate = 0.18
% Uncracked = 47
(avg k = 50)
% Early Cracks = 47
(avg k = 37)
% Later Cracks = 6
(avg k = 21)

Afternoon Pour N-S
Compaction Tests
Station, feet

Core Set #1
1B = 6.1”

Core Set #2
2B = 6.0”

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6” Design thickness

Replaced
Later Cracks
Sealed Cracks
Uncracked
Big Papio Trail
Soil Properties - Sta 3+12

Legend
- Left
- Center
- Right

Slope - Away from Creek (Lt)
Condition - Sealed Crack

Qc, ksf - Water Content, % - Density, pcf

Depth, ft

0 10 20 30 40 50 60 70 80 90 100 110
Big Papio Trail
Ambient Weather Cond., 7/30/02

Avg. Temp = 90

Conc. Temp = 88

Avg. RH = 45%

Avg. Wind = 12mph

Evap. Rate=0.24avg

Temp
Rel Hmd
Wind Spd
Evap. Rate = 0.24
% Uncracked = 100 (avg k = 58)
% Early Cracks = 0
% Later Cracks = 0

Big Papio Trail
Subgrade Modulus vs. Condition
July 30, 2002

Sloped Towards Creek

Morning Pour S-N
Evap. Rate = 0.24
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0

Subgrade modulus

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" design Thickness

Compaction Tests 7/29-100.7@15.4 7/29-106.0@15.2

Station, feet
Big Papio Trail
Ambient Weather Cond., 7/31/02

Conc. Temp = 92
Avg. Temp = 95
Avg. RH = 39%
Avg. Wind = 16mph
Evap. Rate = 0.35avg

Temp
Rel Hmd
Wind Spd
Big Papio Trail
Subgrade Modulus vs. Condition
July 31, 2002

Core Set #3
3B = 5.7"
Sloped Towards Creek

Evap. Rate = 0.35
% Uncracked = 46
(avg k = 42)
% Early Cracks = 0
% Later Cracks = 54
(Avg k = 29)

Morning Pour S-N
Compaction Test
7/29-100.5@14.6
Station, feet

Condition
- Replaced
- Later Cracks
- Sealed Cracks
- Uncracked
Big Papio Trail
Subgrade Modulus vs. Condition
December 5, 2002

Evap. Rate = low
% Uncracked = 84   (avg k = 50)
% Early Cracks = 0
% Later Cracks = 16    (Avg k = 37)

Station, feet

Compaction Tests

Sloped Towards Creek

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" design Thickness

Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

7/29-106.7@14.6  7/31-100.5@14.6
Big Papio Trail
Ambient Weather Cond., 8/1/02

Conc. Temp = 86
Avg. Temp = 82
Avg. RH = 43%
Avg. Wind = 17mph
Evap. Rate=0.32avg

- Temp
- Rel Hmd
- Wind Spd
Big Papio Trail
Subgrade Modulus vs. Condition
August 1, 2002

Evap. Rate = 0.32
% Uncracked = 100
(ave k = 54)
% Early Cracks = 0
% Later Cracks = 0

Afternoon Pour S-N

Sloped Towards Creek

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6” Design Thickness

Replacement
Later Cracks
Sealed Cracks
Uncracked
Big Papio Trail
Ambient Weather Cond., 8/7/02

Conc. Temp = 88
Avg. Temp = 85
Avg. RH = 57%
Avg. Wind = 10mph
Evap. Rate=0.17avg

Degrees f, %, mph

0:00 6:00 12:00 18:00 0:00

Time
Big Papio Trail
Subgrade Modulus vs. Condition
August 7, 2002

Evap. Rate = 0.17
% Uncracked = 93
(avg k = 51)
% Early Cracks = 7
(avg k = 39)
% Later Cracks = 0

Core Set #4
4B = 6.45"

Station, feet

Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Big Papio Trail
Soil Properties - Sta 94+20

Legend

- Left
- Center
- Right

Qc, ksf - Water Content, % - Density, pcf

Depth, ft

Slope - Away from Creek (Rt)
Condition - No Crack
### Big Papio Trail
Ambient Weather Cond., 8/8/02

- **Avg. Temp** = 82
- **Conc. Temp** = 90
- **Avg. RH** = 39%
- **Avg. Wind** = 10 mph
- **Evap. Rate** = 0.26 avg

**Degrees f, %, mph**

- **Temp**
- **Rel Hmd**
- **Wind Spd**

**Time**

- 0:00
- 6:00
- 12:00
- 18:00
- 0:00
Big Papio Trail
Subgrade Modulus vs. Condition
August 8, 2002

Station, feet

Subgrade modulus

Evap. Rate = 0.26
% Uncracked = 71
(avg k = 60)
% Early Cracks = 29
(avg k = 41)
% Later Cracks = 0

Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

Sloped Towards Creek
Afternoon Pour S-N

Compaction Test
Big Papio Trail
Ambient Weather Cond., 8/9/02

- Conc. Temp = 87
- Avg. Temp = 83
- Avg. RH = 41%
- Avg. Wind = 10mph
- Evap. Rate = 0.22 avg

Temp
Rel Hmd
Wind Spd
Big Papio Trail
Subgrade Modulus vs. Condition
August 9, 2002

Sloped Towards Creek
Core Set #5
5B = 5.3” (5C=6”)

Evap. Rate = 0.22
% Uncracked = 34
(avg k = 52)
% Early Cracks = 9
(avg k = 41)
% Later Cracks = 57
(avg k = 33)

Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

Morning Pour S-N

Compaction Tests
8/6-85.6@18.5, 8/7-92.3@14.0, 8/7-90.8@17.9
8/7-103.4@18.0
Big Papio Trail
Soil Properties - Sta 111+19

Legend
- Left
- Center
- Right

Qc, ksf - Water Content, % - Density, pcf

Depth, ft

Slope - Away from Creek (Rt)
Condition - Open Crack
Big Papio Trail
Ambient Weather Cond., 8/10/02

Conc. Temp = 86
Avg. Temp = 87
Avg. RH = 49%
Avg. Wind = 5mph
Evap. Rate = 0.10avg
Big Papio Trail
Subgrade Modulus vs. Condition
August 10, 2002

Evap. Rate = 0.10
% Uncracked = 44   (avg k = 50)
% Early Cracks = 16   (avg k = 32)
% Later Cracks = 40   (avg k = 33)

Morning Pour S-N
Sloped Towards Creek

Core Set #6
6B = 5.5"

Station, feet
12400 12500 12600 12700 12800 12900 13000 13100 13200 13300 13400 13500 13600 13700 13800

Subgrade modulus
80 70 60 50 40 30 20 10 0

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

Morning Pour S-N
Sloped Towards Creek
Evap. Rate = 0.10
% Uncracked = 44   (avg k = 50)
% Early Cracks = 16   (avg k = 32)
% Later Cracks = 40   (avg k = 33)

Core Set #6
6B = 5.5"

Station, feet
12400 12500 12600 12700 12800 12900 13000 13100 13200 13300 13400 13500 13600 13700 13800

Subgrade modulus
80 70 60 50 40 30 20 10 0

Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Big Papio Trail
Soil Properties - Sta 129+10

Slope - Away from Creek (Rt)
Condition - Sealed Crack

Legend

- Left
- Center
- Right

Qc, ksf - Water Content, % - Density, pcf

Depth, ft

0 10 20 30 40 50 60 70 80 90 100 110

0 1 1 0 0 1 1 0
Big Papio Trail
Ambient Weather Cond., 8/29/02

- Conc. Temp = 82
- Avg. Temp = 80
- Avg. RH = 58%
- Avg. Wind = 9mph
- Evap. Rate = 0.13avg

Avg. Temp = 80
Big Papio Trail
Subgrade Modulus vs. Condition
August 29, 2002

Evap. Rate = 0.13
% Uncracked = 100   (avg k = 59)
% Early Cracks = 0
% Later Cracks = 0

Morning Pour S-N

- Replaced
- Later Cracks
- Sealed Cracks
- Uncracked
Big Papio Trail
Ambient Weather Cond., 8/30/02

Conc. Temp = 86
Avg. Temp = 80
Avg. RH = 53%
Avg. Wind = 10mph
Evap. Rate=0.19avg
Big Papio Trail
Subgrade Modulus vs. Condition
August 30, 2002

Evap. Rate = 0.19
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0

Morning Pour S-N

Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

Compaction Tests

8/19-107.1@14.7
8/19-99.7@18.5
Big Papio Trail
Subgrade Modulus vs. Condition
August 31, 2002

Morning Pour S-N
Evap. Rate = 0.32
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0

Subgrade modulus vs. station, feet

- measured moduli
- Condition
- Avg Moduli
- Pvmt. Thickness
- 6" Design Thickness

Condition:
- Replaced
- Later Cracks
- Sealed Cracks
- Uncracked

Evap. Rate = 0.32
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0
# Big Papio Trail Pavement Distress

## Pavement Condition Summary

<table>
<thead>
<tr>
<th>Location</th>
<th>Condition</th>
<th>KM Summary</th>
<th>Current</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0+00 to Ped Bridge (2025')</td>
<td>Routed and Sealed (or rpl.)</td>
<td>714</td>
<td>775</td>
<td>+61?</td>
</tr>
<tr>
<td></td>
<td>Open Cracks</td>
<td>242</td>
<td>100</td>
<td>?</td>
</tr>
<tr>
<td>Ped Bridge to Pacific (7000')</td>
<td>Routed and Sealed (or rpl.)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Open Cracks</td>
<td>592</td>
<td>811</td>
<td>+219</td>
</tr>
<tr>
<td>Pacific to I-680 (1530')</td>
<td>Routed and Sealed (or rpl.)</td>
<td>246</td>
<td>260</td>
<td>~</td>
</tr>
<tr>
<td></td>
<td>Open Cracks</td>
<td>21</td>
<td>0</td>
<td>~</td>
</tr>
<tr>
<td>I-680 to ACC Trail (3470')</td>
<td>Routed and Sealed (or rpl.)</td>
<td>323</td>
<td>394</td>
<td>+62</td>
</tr>
<tr>
<td></td>
<td>Open Cracks</td>
<td>1169</td>
<td>1668</td>
<td>+499</td>
</tr>
<tr>
<td>North Bridge to Blondo</td>
<td>Routed and Sealed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Open Cracks</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Approximately 2579’ of open crack
Approximately 1429’ of sealed crack
Total = 4008’/14025’ = 29%
BIG PAPIO TRAIL
Petrographic Examination of Four Concrete Cores

Center to Blondo Streets
Omaha, Nebraska

INTRODUCTION

At the request of Mr. Joe Waxse of Terracon located in Omaha, Nebraska, Wiss, Janney, Elstner Associates, Inc., (WJE) has performed petrographic studies for four concrete cores removed from the Omaha hike and bike facility known as Big Papio Trail. It is our understanding that the concrete for the four-mile long hike and bike trail was placed during 2003, and soon after placement significant longitudinal cracks developed in some areas. Some cracks have since been routed and sealed. The purpose of the studies was to assess the basic composition of the cores and characterize the cracks to aid in determining if properties of the mix contributed to the cracking. Accordingly, the cores, identified as 1-B, 3-B, 4-B, and 7-B, were examined using methods given in ASTM C856, Petrographic Examination of Hardened Concrete.

STUDIES

Sample Description

The four cores had diameters of 4 in. and lengths ranging from 5-7/8 in. to 6-3/8 in. Each core was marked with the Terracon Job No. 05035181 and identified with the following station numbers:

<table>
<thead>
<tr>
<th>Core No.</th>
<th>Station Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-B</td>
<td>312</td>
</tr>
<tr>
<td>3-B</td>
<td>4706</td>
</tr>
<tr>
<td>4-B</td>
<td>9420</td>
</tr>
<tr>
<td>7-B</td>
<td>15506</td>
</tr>
</tbody>
</table>

Cores 1-B and 3-B were drilled over cracks, and elastomeric joint filler was in the routed crack in Core 1-B (see Figure 1).

The top surfaces of the cores had received broom-texture finishes; however, the surface of Core 1-B had been tine-grooved using diamond-blade equipment. The bottom surfaces of the cores showed that placement was on a granular-clay loam base material.

Mix Design

A mix design, marked as Lyman Richey and reportedly used on the “NRD Trail Project” from Center Street to Blondo Street, called for 513 lbs. cement, 51 lbs. fly ash, and 0.45 lb. /lb. water. The strength requirement was reported to be 4000 psi.
Petrographic Examination

The concrete mix represented by all four cores contained a crushed limestone coarse aggregate having a nominal top size of 3/4 in. The fine aggregate was natural siliceous sand. The aggregates appeared normal ingradation, distribution, and soundness.

The cementitious materials content (cement plus fly ash) was estimated at 5-1/2 to 6 bags per cubic yard. The fly ash component was estimated at 15 to 20 percent of the total cementitious materials. The optical and textural features of the hydration products were consistent with concrete having a water-cementitious materials ratio (w/cm) in the range of 0.45 to 0.50. Although consolidation appeared normal and adequate, entrapped air voids were present in all four cores.

Each of the cores was air-entrained with estimated air contents as follows:

<table>
<thead>
<tr>
<th>Core No.</th>
<th>Estimated Air (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-B</td>
<td>6 to 6-1/2</td>
</tr>
<tr>
<td>3-B</td>
<td>5-1/2 to 6</td>
</tr>
<tr>
<td>4-B</td>
<td>6 to 6-1/2</td>
</tr>
<tr>
<td>7B</td>
<td>5 to 5-1/2</td>
</tr>
</tbody>
</table>

Crack Features

The cracks observed in Core 1-B passed vertically through some of the coarse limestone aggregate particles and several of the coarse particles in Core 3-B indicating that the slab had gained significant strength before the cracking occurred. Indications of some water loss into the base material were slight, but a zone of darker paste adjacent to the bottom of Core 1-B was readily apparent. Dark zones at the bottoms of Cores 3-B, 4-B, and 7-B were less apparent (see Figures 2, 3, and 4).

CONCLUSIONS

The petrographic studies indicated that all four cores were consistent with the submitted mix design. Features of the mix did not indicate the cause of the cracking. Since the cracks are longitudinal and passed through some of the coarse aggregate particles, the cause for the cracking may be related to environmental influences (soil mechanics) and/or loading by equipment using the trail as a roadway.

NOTE: Samples will be discarded after 90 days unless other disposition is requested. Charges will be made for storage after that period.
Figure 1. Scanned image of section through Core 1-B showing routed crack with sealer and full-depth view of crack. Note the darkened paste zone adjacent to the bottom, indicating water loss into the base material while the mix was still plastic.
Figure 2. Full-depth crack in Core 3-B. The cracks pass through limestone coarse aggregates and some of the siliceous granitic gravel particles.
Figure 3. Scanned image of Core 4-B.
Figure 4. Scanned image of Core 7-B.
Memorandum

TO: PPO Subcommittee

SUBJ: Site Grading for Amphitheater at Walnut Creek

DATE: June 28, 2004

FROM: Randy Lee, Assistant Park Superintendent

The Papillion Area Concert Band (PACB) has requested a joint effort between the City of Papillion and the Papio-Missouri River Natural Resources District to work together to grade the future Amphitheater site. The City of Papillion City Council has approved a resolution to allow their Public Works staff to assist with the grading project and provide the necessary equipment available from the city to complete the grading project.

The grading will require approximately 31,000 cubic yards of material to be cut and placed on the site. I consulted with Jeff Ray the Civil Engineer with Schemmer & Associates for the Amphitheater project about an estimate for the cost of grading. He concluded that a job of this size would cost approximately $1.25 per cubic yard to be cut and placed on the site.

This agreement if approved will begin to foster a working relationship between the City of Papillion and the NRD at the recreation area and possibly co-sponsor other projects and begin a process over the next several years to prepare for the eventual transfer of the Recreation Area to the City of Papillion.

Management recommends that the subcommittee recommend to the Board that the General Manager be authorized to coordinate with the City of Papillion to provide manpower and equipment for the purpose of grading the Amphitheater site.
The dirt numbers for the amphitheater note the cut is the same number for all and we can adjust the fill on site to make it work.

Thanks.

Jeff Ray

-----Original Message-----
From: Jorgensen, Brent
Sent: Wednesday, April 07, 2004 3:05 PM
To: Ray, Jeff
Subject: Site balance - adjustment of compaction factor.

Site Balances:

35% Compaction:
Current stratum: Fg_Eg
Site name = 441402
Cut = 30886 yards  Fill = 33411 yards
Net = 2525 yards FILL

30% Compaction:
Site name = 441402
Cut = 30886 yards  Fill = 32173 yards
Net = 1287 yards FILL

25% Compaction:
Current stratum: Fg_Eg
Site name = 441402
Cut = 30886 yards  Fill = 30936 yards
Net = 50 yards FILL

Brent Jorgensen, RLS
The Schemmer Associates

1044 N 115th Street, Suite 300
Omaha NE, 68154-4436
402.493.4800
402.493.7951 Fax
DEVELOPMENT AGREEMENT
BETWEEN
THE PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
AND
PAPILLION AREA CONCERT BAND

THIS AGREEMENT (hereinafter referred to as “this Agreement”) is entered into as of this 12th day of August, 1999, by and between the PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT (hereinafter referred to as “the NRD”), a governmental subdivision of the State of Nebraska, for itself and for its successors and assigns, and PAPILLION AREA CONCERT BAND (hereinafter referred to as “PACB”) a non-profit corporation organized and existing under the laws of the State of Nebraska.

WHEREAS, the NRD is the owner of a tract of land (hereinafter referred to as “the Recreation Area”) located southwest of the intersection of 96th Street and State Highway 370, near Papillion, in Sarpy County, Nebraska, which was acquired by the NRD for the NRD’s Dam Site 21 Project, now known as the Walnut Creek Recreation Area; and,

WHEREAS, PACB has proposed that the NRD grant to PACB a lease permitting PACB to construct, operate, maintain and use outdoor amphitheater facilities on approximately three (3) acres of land (hereinafter referred to as "the Amphitheater Complex") within the Recreation Area, east of Walnut Creek Lake and north of the existing parking area, such facilities to consist of an outdoor performing arts amphitheater, public restrooms and a concession area (all hereinafter collectively referred to as "the PACB Facilities"), the proposed lease (hereinafter referred to as "the
PACB Lease") to be in the form as attached hereto as Exhibit "A" and incorporated herein by reference; and,

WHEREAS, a diagram showing the approximate boundaries of the Amphitheater Complex, and showing the expected location and configuration of the PACB Facilities therein, is attached hereto as Exhibit "B" and incorporated herein by reference; and,

WHEREAS, PACB has proposed that PACB design and that the NRD construct and maintain an 80-110-car expansion (hereinafter referred to as "the PACB Parking Expansion") of the existing NRD public parking area east of Walnut Creek Lake, constructed to the same standards as such existing parking area; and,

WHEREAS, the NRD is willing to accept PACB’s proposals and willing to grant the Lease, subject to the approval of this Agreement by the Mayor and Council of the City of Papillion, Nebraska (which expects to assume responsibility for the Recreation Area in the future), and subject to compliance by PACB with the terms and conditions hereinafter provided.

NOW, THEREFORE, in consideration of the mutual covenants of the parties, contained herein, it is hereby agreed between the parties as follows:

1. **SCHEMATIC DESIGN OF THE PACB FACILITIES.** - Within 1460 days after the effective date of this Agreement, with the aid of such architects and engineers as PACB deems necessary and at PACB’s sole cost and expense, PACB shall prepare written schematic plans and preliminary cost estimates for the PACB Facilities in the Amphitheater Complex, and for the PACB Parking Expansion, and shall submit such schematic plans and cost estimates to the NRD for its approval, which approval shall not be withheld unreasonably.
2. **PRELIMINARY DESIGN OF THE PACB FACILITIES.** - Within 90 days after the NRD’s approval of PACB’s written schematic plan for the PACB Facilities and for the PACB Parking Expansion, with the aid of such architects and engineers as PACB deems necessary and at PACB’s sole cost and expense, PACB shall prepare design development drawings and cost estimates for the PACB Facilities and for the PACB Parking Expansion and shall submit such drawings, cost estimates to the NRD for its approval of such drawings. It shall be the responsibility of NRD to prepare the metes and bounds legal description of the Amphitheater Complex and surrounding area.

3. **FINAL DESIGN OF THE PACB FACILITIES.** - Within 90 days after the NRD’s approval of the design development drawings for the PACB Facilities and for the PACB Parking Expansion, and with the aid of such architects and engineers as PACB deems necessary, PACB, at its sole cost and expense, shall prepare final plans, specifications and cost estimates for the PACB Facilities, and final plans, specifications and cost estimates for the PACB Parking Expansion, and shall submit such final plans, specifications and cost estimates to NRD for its written approval.

4. **AMPHITHEATER FINANCING.** - Within ten (10) years after the effective date of this Agreement PACB shall submit to the NRD for its approval a written verification from a bank authorized to do business in the State of Nebraska that PACB has unencumbered funds on deposit in such bank in an amount equal to or greater than the architect’s estimate of the costs of construction of the PACB Facilities. If such submission to the NRD occurs more than one year after the date of the NRD’s written approval of PACB’s final plans, specifications and cost estimates for the PACB Facilities, such submission shall be accompanied by an architect’s up-dated estimate of the cost of the PACB Facilities. The NRD, as a condition to its approval of such verification, may require that PACB give sufficient
security that the PACB Facilities to be constructed will be completed free and clear of liens and in a manner satisfactory to the NRD.

5. **EXECUTION OF LEASE.** - After PACB’s submission of the aforesaid bank verification, if within ten (10) years after the effective date of this Agreement, the NRD and PACB shall execute the PACB Lease in the form as attached hereto as Exhibit “A,” the PACB Lease to relate to the tract of land described in the legal description of the Amphitheater Complex submitted by PACB and approved by the NRD. The PACB Lease and this Agreement shall be construed together. If such bank verification has not been submitted to the NRD within ten (10) years after the effective date of this Agreement, then the NRD may, without demand of any kind or notice to PACB or any other person, declare this Agreement terminated.

6. **AMPHITHEATER CONSTRUCTION.** - Within 6 months after the execution of the PACB Lease, and, with the aid of such contractors and other assistants as PACB deems necessary, PACB, at its cost and expense, shall commence construction of the PACB Facilities in the Amphitheater Complex; and within eighteen (18) months after the commencement of such construction, PACB shall finish construction of the PACB Facilities, such construction to be performed in a good and workmanlike manner, at PACB’s sole cost and expense, and in accordance with the final plans and specifications approved by the NRD. NRD may approve granting of an extension if the majority of the construction is finished within 18 months which approval shall not be withheld unreasonably.

7. **CONSTRUCTION OF SUBSEQUENT PACB FACILITIES.** - During or after construction of the PACB Facilities, and with the aid of such contractors and other assistants as PACB deems necessary, PACB, at its cost and expense, may construct the additional facilities of the PACB Facilities in the Amphitheater Complex in
accordance with plans and specifications of the PACB Facilities submitted by PACB and approved by the NRD. Such construction to be performed in a good and workmanlike manner, at PACB’s sole cost and expense.

8. CONSTRUCTION OF PARKING FACILITIES. - Within ninety (90) days after PACB’s commencement of construction of the PACB Facilities, with the aid of such contractors as the NRD deems necessary and at NRD’s sole cost and expense, the NRD shall commence construction of the PACB Parking Area in the Amphitheater Complex, and the NRD shall finish construction of such PACB Parking Area within six (6) months after the commencement of construction thereof, all at the NRD’s sole cost and expense and in accordance with the final plans and specifications prepared by PACB and approved by the NRD. Upon completion of construction thereof, the PACB Parking Area shall be opened and remain equally available to the public and to the patrons of the PACB.

9. ENTRANCE SIGN. - After PACB’s construction of the PACB Facilities, PACB, and at its own cost and expense, may construct and maintain a sign at the 96th Street entrance to the Recreation Area identifying the PACB Facilities, in accordance with plans and specifications for such sign prepared by PACB and approved in writing by the NRD which approval shall not be withheld unreasonably.

10. EFFECTIVE DATE OF AGREEMENT. - This Agreement shall be effective after execution hereof by both parties and upon approval hereof being endorsed at the foot of this Agreement by the Mayor of the City of Papillion, Nebraska, such approval to be made pursuant to an authorizing resolution adopted by the City Council of the City of Papillion, Nebraska.
11. **APPLICABLE LAW.** - Each party to this Agreement shall follow all statutes, both federal and state, together with existing ordinances as may be applicable, in carrying out the faithful performance and terms of this Agreement. Each party hereto shall, whenever applicable, require performance under the Fair Labor Standards Act.

12. **AUTHORIZED OFFICIALS.** - The President of PACB and the General Manager of the NRD are authorized to take such actions and make such determinations on behalf of their respective parties as are required or permitted for the respective parties by this Agreement and as such officers in their discretion determine necessary.

13. **DURATION.** - This Agreement shall have permanent duration, commencing upon the execution hereof by the parties.

14. **USE COVENANTS.** - Except as otherwise provided herein or otherwise authorized in writing by the NRD, PACB shall use the Amphitheater Complex solely for musical and/or theatrical performances and/or educational functions, and/or community activities related thereto, including without limitation the sale of refreshments and food in connection with such performances, and may charge reasonable attendance fees for such performances.

15. **CONSTRUCTION OF IMPROVEMENTS** - Except as otherwise provided herein or otherwise authorized in writing by the NRD, PACB shall not make any improvement to or alteration or modification of the Amphitheater Complex or other portion of the Recreation Area without written plans and specifications for such improvement, alteration or modification being first submitted to and approved in writing by the NRD. Any improvements, alterations or modifications made by PACB to the Amphitheater Complex shall become part of the Recreation Area and the property of the NRD.
16. **PERSONAL PROPERTY** - All personal property of PACB or any of its members in the Recreation Area shall be at the sole risk of PACB.

17. **HOLD HARMLESS** - PACB agrees to defend, indemnify and hold the NRD harmless from and against any and all claims and causes of action for personal injury, property damage, or property loss arising out of, in the course of, or as a result of the use or occupancy of the Recreation Area by PACB or any of its officers, agents, employees, contractors, permittees, patrons or invitees, except as may be solely and proximately caused by the negligence of the NRD, its officers, agents or employees.

18. **DEFAULT.** - Should PACB make default in the performing, fulfilling, keeping or observing of any of PACB’s covenants, conditions, provisions or agreements herein contained, or should a petition in bankruptcy be filed by PACB or should PACB be adjudged bankrupt or insolvent by any court or should a trustee or receiver in bankruptcy or a receiver of any property of PACB be appointed in any suit or proceeding by or against PACB or should this Agreement by operation of law pass to any person other than PACB, then an in any of such events, the NRD may, without demand of any kind or notice to PACB or any other person, at once declare this Agreement terminated.

19. **AMENDMENT** - The terms and conditions of this Agreement may be amended only in writing by the mutual agreement of the parties.

20. **ASSIGNMENT** - PACB may not transfer, assign or hypothecate this Agreement or transfer, assign or hypothecate any of the rights granted thereby without written approval, excepting only transfer, assignment or hypothecation to the City of Papillion for which this document shall constitute such written approval.
Executed by PACB on this 26th day of September, 1999.

PAPILLION AREA CONCERT BAND, a Nebraska non-profit corporation

By [Signature]
President

Attest:

[Signature]
Secretary

Executed by the NRD on this 18th day of August, 1999.

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

By [Signature]
General Manager

Approved by the CITY OF PAPILLION, NEBRASKA, on this 21st day of October, 1999.

CITY OF PAPILLION, NEBRASKA

By [Signature]
Mayor