



July 1, 2022  
Kleinfelder Project No.: 20230052.003A

Ms. Cynthia Y. Lynn, President  
Thunderhead Testing, LLC  
1540 N. 107<sup>th</sup> E. Ave.,  
Tulsa, Oklahoma 74116

**Subject:       Geotechnical Explorations**  
**City of Tulsa Non-Arterial Maintenance Zone 1153**  
**Tulsa, Oklahoma**

Dear Ms. Lynn:

Kleinfelder has completed the authorized subsurface explorations for the above-referenced project. Kleinfelder conducted the field work by performing a total of twenty (20) pavement cores on April 19 and 21, 2022, and advancing the core holes to three feet below the bottom of the pavement, aggregate base, and/or stabilized base, or hand auger refusal, whichever occurred first. The pavement cores were located in the field by a Kleinfelder representative using a hand-held Global Positioning System (GPS) with an accuracy of approximately 15 feet. The general site location and the approximate borings (C-1 through C-20) locations are shown in Figures 1 and 2, Exploration Location Plan and Vicinity Map(s).

## **FIELD EXPLORATION PROGRAM**

The existing pavement was cored with a 5-in diameter core barrel and were advanced with a hand auger to three feet into the subgrade below the bottom of the pavement, aggregate base, and/or stabilized base, or auger refusal, whichever occurred first. Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Stratification boundaries indicated on the coring logs are based on observations during our field work, an extrapolation of information obtained by examining samples from the cores, and comparisons of soils with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between material types may be gradual rather than clearly defined.

## **SUBSURFACE CONDITIONS**

The pavement and subsurface conditions are summarized in Table 1. Detailed descriptions are presented on respective core logs in Attachment A. Hand auger refusals were encountered in borings C-12, C-17, C-19, and C-20 at depths ranging from 9 to 31 inches below the bottom of the pavement.

Table 1. Summary of Pavement and Subsurface Materials			
Street	Pavement Cores	Pavement Thickness (in.)	Subgrade Materials
N. Tacoma Pl	C-1	AC 2.5" SB 6.5"	Lean Clay
N. Tacoma Ave.	C-2	AC 3.5" SB 4"	Lean Clay
N. Santa Fe Ave.	C-4	AC 3.25" SB 6.5"	Lean Clay
N. Rosedale Ave.	C-5	AC 3" SB 7"	Lean Clay
N. Quanah Ave.	C-6	AC 3" SB 7"	Lean Clay
N. Phoenix Ave.	C-7	AC 3.5" SB 7"	Lean Clay
N. Olympia Ave.	C-8	AC 8" AB 11"	Fat Clay
W. Marshall St.	C-3 and C-9	AC 2.5-2.75" SB 4.25-8.5" AB 0-7.25"	Lean Clay
N. Cheyenne Ave.	C-10 to C-12, C-17, and C-19	AC 4-7" PCC 3.5-6.75" AB 0-9"	Silty Sand, Sandy Silt, Fat Clay, Lean Clay, Lean Clay with Sand
W. Jasper St.	C-13	AC 3" LA 1" PCC 4"	Silt with Sand
N. Main St.	C-14 to C-16	AC 2-8" LA 0-2" PCC 5-6.5"	Lean Clay with Sand and Silty Clay
W. Haskell Pl	C-18 and C-20	AC 3.5-4" LA 1.5-2" PCC 2.5-3.5"	Lean Clay with Sand

AC=Asphaltic Concrete, PCC=Portland Cement Concrete, SB=Stabilized Base, AB=Aggregate Base, LA=Loose Aggregate

## LABORATORY TESTING PROGRAM

Laboratory tests including sieve analyses tests, Atterberg limit tests, and moisture contents were performed by Thunderhead on selected samples for classification purposes. In addition, soil samples were visually classified in accordance with the Unified Soil Classification System. All the lab results are summarized in Attachment B.

## LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two years from the date of this report. The work performed was based on project information provided by Client.

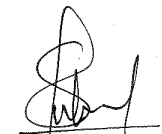
## CLOSING

We appreciate the opportunity to be of service to you on this project. Please call us if you have any questions concerning the information presented within this letter.

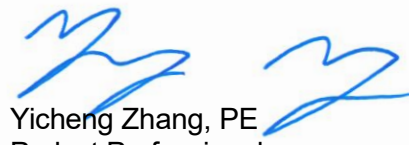
Sincerely,

### **KLEINFELDER, INC.**

Certificate of Authorization #7292, Expires 6/30/23



Subash Bhandari  
Staff Professional I



Yicheng Zhang, PE  
Project Professional

### Attachments:

- Figures – Exploration Location Plan and Vicinity Map(s)
- Attachment A – Field Exploration Program
- Attachment B – Lab Testing Program







PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Tacoma Pl.

GPS

36.17185° / -96.01035°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☒ Stripping

☒ Separation

☐ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☒ Yes

☐ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-1	ASPHALTIC CONCRETE	separation and stripping at 2.5 inches	2.5
C-1	STABILIZED BASE		6.5

Total Core Thickness

9

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-1A	Lean CLAY: brown, dark reddish brown, moist	0.0 to 6.0
C-1B	Lean CLAY: brown, dark reddish brown, moist	6.0 to 18.0
C-1C	Lean CLAY (A-6): reddish brown, moist	18.0 to 36.0

TOP

	PROJECT NO.: 20230052.003A	BORING LOG C-1	CORE
	DRAWN BY: KF CHECKED BY: SYW DATE: 5/13/2022	COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-1

PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Tacoma Ave.

GPS

36.17178° / -96.00937°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-2	ASPHALTIC CONCRETE		3.5
C-2	STABILIZED BASE		4

Total Core Thickness

7.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-2A	Lean CLAY: dark gray, moist	0.0 to 6.0
C-2B	Lean CLAY: dark brown, moist	6.0 to 10.0
C-2C	Lean CLAY: brown, moist	10.0 to 18.0
C-2D	Lean CLAY (A-6): light brown, yellowish brown, moist	18.0 to 36.0

TOP

	PROJECT NO.: 20230052.003A	BORING LOG C-2	CORE
	DRAWN BY: KF CHECKED BY: SYW DATE: 5/13/2022	COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-2



PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

W. Marshall St.

GPS

36.17141° / -96.00897°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☒ Yes

☐ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-3	ASPHALTIC CONCRETE		2.5
C-3	STABILIZED BASE		8.5

Total Core Thickness


11

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-3A	FILL - Lean CLAY: grayish brown, moist, trace asphalt	0.0 to 6.0
C-3B	Lean CLAY (A-4): grayish brown, moist	6.0 to 12.0
C-3C	Lean CLAY: light brown, yellowish brown, moist	12.0 to 36.0
C-3C	Lean CLAY: light brown, yellowish brown, moist	22.0 to 36.0

TOP



	PROJECT NO.: 20230052.003A	BORING LOG C-3	CORE
	DRAWN BY: KF CHECKED BY: SYW DATE: 5/13/2022	COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-3



PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Santa Fe Ave.

GPS

36.17217° / -96.00843°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☒ Yes

☐ No

☐ Unknown

TOP



CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-4	ASPHALTIC CONCRETE		3.25
C-4	STABILIZED BASE		6.5

Total Core Thickness

9.75

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-4A	Lean CLAY (A-6): dark gray, moist	0.0 to 6.0
C-4B	Lean CLAY: grayish brown, moist	6.0 to 15.0
C-4C	Lean CLAY (A-6): light brown, yellowish brown, moist	15.0 to 36.0



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-4

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-4

TOP

**CORE DATE** April 19, 2022  
**LOCATION** N. Rosedale Ave.  
**GPS** 36.17178° / -96.00745°

**CORE LAYER DATA:**

<b>Surface Material Type:</b>	<input checked="" type="checkbox"/> A.C.	<input type="checkbox"/> P.C.C.	<input type="checkbox"/> Continuously Reinforced Concrete
<b>Stripping or Separation in Asphalt:</b>	<input type="checkbox"/> Stripping	<input type="checkbox"/> Separation	<input checked="" type="checkbox"/> N/A
<b>Honeycomb or "D" Cracking PCC:</b>	<input type="checkbox"/> Honeycomb	<input type="checkbox"/> "D" Cracking	<input checked="" type="checkbox"/> N/A
<b>Stabilized Subgrade Beneath Pavement or Subbase?</b>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown

**CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):**

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-5	ASPHALTIC CONCRETE		3
C-5	STABILIZED BASE		7

### Total Core Thickness

10

**SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):**

Sample No.	Layer Type	Layer Depth (in)
C-5A	Lean CLAY: dark brown, moist	0.0 to 6.0
C-5B	Lean CLAY: dark brown, moist	6.0 to 15.0
C-5C	Lean CLAY (A-6): reddish brown, dark reddish brown, moist	15.0 to 36.0



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-5

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

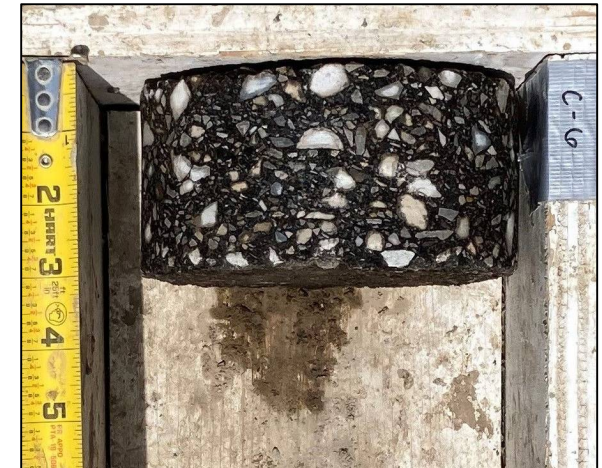
C-5

TOP

**CORE DATE** April 19, 2022  
**LOCATION** N. Qruanah Ave.  
**GPS** 36.17216° / -96.00636°

**CORE LAYER DATA:**

<b>Surface Material Type:</b>	<input checked="" type="checkbox"/> A.C.	<input type="checkbox"/> P.C.C.	<input type="checkbox"/> Continuously Reinforced Concrete
<b>Stripping or Separation in Asphalt:</b>	<input type="checkbox"/> Stripping	<input type="checkbox"/> Separation	<input checked="" type="checkbox"/> N/A
<b>Honeycomb or "D" Cracking PCC:</b>	<input type="checkbox"/> Honeycomb	<input type="checkbox"/> "D" Cracking	<input checked="" type="checkbox"/> N/A
<b>Stabilized Subgrade Beneath Pavement or Subbase?</b>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown



**CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):**

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-6	ASPHALTIC CONCRETE		3
C-6	STABILIZED BASE		7

<b>Total Core Thickness</b>	<b>10</b>
-----------------------------	-----------

**SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):**

Sample No.	Layer Type	Layer Depth (in)
C-6A	Lean CLAY (A-6): dark reddish brown, reddish brown, moist	0.0 to 6.0
C-6B	Lean CLAY: reddish brown, moist	6.0 to 36.0



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-6

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-6



PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Phoenix Ave.

GPS

36.17186° / -96.00530°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☒ Yes

☐ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-7	ASPHALTIC CONCRETE		3.5
C-7	STABILIZED BASE		7

Total Core Thickness

10.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-7A	Lean CLAY: dark brown, reddish brown, moist, trace asphalt	0.0 to 6.0
C-7B	Lean CLAY (A-6): reddish brown, moist	6.0 to 36.0

TOP



	PROJECT NO.: 20230052.003A  DRAWN BY: KF CHECKED BY: SYW DATE: 5/13/2022	BORING LOG C-7	CORE
		COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-7

PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Olympia Ave.

GPS

36.17193° / -96.00423°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-8	ASPHALTIC CONCRETE		8
C-8	AGGREGATE BASE		11

Total Core Thickness

19

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-8A	Fat CLAY: yellowish brown, brownish gray, reddish brown, moist, trace gravel	0.0 to 6.0
C-8B	Fat CLAY (A-7-6): yellowish brown, brownish gray, reddish brown, moist, trace gravel	6.0 to 36.0

TOP



PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

W. Marhsall St.

GPS

36.17132° / -96.00607°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☐ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☒ Yes

☐ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-9	ASPHALTIC CONCRETE		2.75
C-9	STABILIZED BASE		4.25
C-9	AGGREGATE BASE		7.25
Total Core Thickness			14.25

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-9A	Lean CLAY (A-6): dark brown, reddish brown, moist, trace gravel	0.0 to 6.0
C-9B	Lean CLAY: reddish brown, moist	6.0 to 36.0

TOP





PROJECT / LOCATION DATA:

CORE DATE     April 19, 2022  
LOCATION        N. Cheyenne Ave.  
GPS             36.16931° / -95.99796°

CORE LAYER DATA:

Surface Material Type:            ☒ A.C.            ☒ P.C.C.            ☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:            ☐ Stripping            ☒ Separation            ☐ N/A

Honeycomb or "D" Cracking PCC:            ☒ Honeycomb            ☐ "D" Cracking            ☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?            ☐ Yes            ☒ No            ☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-10	ASPHALTIC CONCRETE	separation at 7 inches	7
C-10	PORTLAND CEMENT CONCRETE		5
Total Core Thickness			12

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-10A	Silty SAND: brown, light brown, moist	0.0 to 6.0
C-10B	Silty SAND (A-2-4): brown, light brown, moist	6.0 to 36.0

TOP



	PROJECT NO.: 20230052.003A	BORING LOG C-10	CORE
	DRAWN BY:            KF CHECKED BY:        SYW DATE:                5/13/2022	COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-10

PROJECT / LOCATION DATA:

CORE DATE

April 19, 2022

LOCATION

N. Cheyenne Ave.

GPS

36.16836° / -95.99805°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☒ Separation

☐ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-11	ASPHALTIC CONCRETE	separation at 5 inches	5
C-11	PORTLAND CEMENT CONCRETE	mechanical fracture from 5 to 8.5 inches	3.5

Total Core Thickness

8.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-11A	Sandy SILT (A-4): brown, light brown, moist, trace gravel	0.0 to 6.0
C-11B	Silty SAND (A-4): yellowish brown, light brown, moist	6.0 to 36.0

TOP



	PROJECT NO.: 20230052.003A	BORING LOG C-11	CORE
	DRAWN BY: KF CHECKED BY: SYW DATE: 5/13/2022	COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma	C-11

PROJECT / LOCATION DATA:

CORE DATE     April 19, 2022  
LOCATION        N. Cheyenne Ave.  
GPS             36.16748° / -95.99802°

CORE LAYER DATA:

Surface Material Type:            ☒ A.C.            ☒ P.C.C.            ☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:            ☐ Stripping            ☒ Separation            ☐ N/A

Honeycomb or "D" Cracking PCC:            ☒ Honeycomb            ☐ "D" Cracking            ☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?            ☐ Yes            ☒ No            ☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics*	Layer Thickness (in)
C-12	ASPHALTIC CONCRETE	separation at 4.75 inches	4.75
C-12	PORTLAND CEMENT CONCRETE		5.75
C-12	AGGREGATE BASE		9
Total Core Thickness			19.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
------------	------------	------------------



REMARKS:  
- hand auger refusal on gravel encountered at 9 inches below the bottom of the portland cement concrete pavement.



PROJECT NO.:  
20230052.003A

DRAWN BY:            KF

CHECKED BY:        SYW

DATE:                5/13/2022

BORING LOG C-12

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-12



PROJECT / LOCATION DATA:

CORE DATE    April 21, 2022  
LOCATION        W. Jasper St.  
GPS             36.16700° / -95.99751°

CORE LAYER DATA:

Surface Material Type:            ☒ A.C.            ☒ P.C.C.            ☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:            ☐ Stripping            ☒ Separation            ☐ N/A

Honeycomb or "D" Cracking PCC:            ☒ Honeycomb            ☐ "D" Cracking            ☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?            ☐ Yes            ☒ No            ☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-13	ASPHALTIC CONCRETE	separation at 1.5 and 3 inches	3
C-13	LOOSE AGGREGATE		1
C-13	PORTLAND CEMENT CONCRETE	mechanical fracture from 4 to 8 inches	4
Total Core Thickness			8

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-13A	SILT with Sand: brown, dark brown, moist, trace gravel	0.0 to 6.0
C-13B	SILT with Sand (A-4): brown, dark brown, moist, trace gravel	6.0 to 36.0

TOP



PROJECT / LOCATION DATA:

CORE DATE

April 21, 2022

LOCATION

N. Main St.

GPS

36.16826° / -95.99689°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☒ Separation

☐ N/A

Honeycomb or "D" Cracking PCC:

☒ Honeycomb

☐ "D" Cracking

☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-14	ASPHALTIC CONCRETE	separation at 2 inches	2
C-14	PORTLAND CEMENT CONCRETE		6.5

Total Core Thickness

8.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-14A	Lean CLAY with Sand: brownish gray, moist	0.0 to 6.0
C-14B	Lean CLAY with Sand: brownish gray, moist	6.0 to 22.0
C-14C	Lean CLAY with Sand (A-6): yellowish brown, light brown, gray, moist	22.0 to 36.0

TOP



PROJECT / LOCATION DATA:

CORE DATE

April 21, 2022

LOCATION

N. Main St.

GPS

36.16658° / -95.99690°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☒ Honeycomb

☒ "D" Cracking

☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-15	ASPHALTIC CONCRETE		7.5
C-15	LOOSE AGGREGATE		2
C-15	PORTLAND CEMENT CONCRETE		5
Total Core Thickness			14.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-15A	Lean CLAY with Sand: light brown, yellowish brown, brown, gray, moist	0.0 to 6.0
C-15B	Lean CLAY with Sand (A-6): light brown, yellowish brown, brown, gray, moist	6.0 to 36.0

TOP





TOP

**CORE DATE** April 21, 2022  
**LOCATION** N. Main St.  
**GPS** 36.16480° / -95.99690°

**CORE LAYER DATA:**

<b>Surface Material Type:</b>	<input checked="" type="checkbox"/> A.C.	<input checked="" type="checkbox"/> P.C.C.	<input type="checkbox"/> Continuously Reinforced Concrete
<b>Stripping or Separation in Asphalt:</b>	<input type="checkbox"/> Stripping	<input checked="" type="checkbox"/> Separation	<input type="checkbox"/> N/A
<b>Honeycomb or "D" Cracking PCC:</b>	<input type="checkbox"/> Honeycomb	<input checked="" type="checkbox"/> "D" Cracking	<input type="checkbox"/> N/A
<b>Stabilized Subgrade Beneath Pavement or Subbase?</b>	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Unknown

**CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):**

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-16	ASPHALTIC CONCRETE	separation at 8 inches	8
C-16	PORTLAND CEMENT CONCRETE		5

**Total Core Thickness** **13**

**SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):**

Sample No.	Layer Type	Layer Depth (in)
C-16A	Silty CLAY (A-4): dark brown, olive brown, moist	0.0 to 6.0
C-16B	Silty CLAY: dark brown, moist	6.0 to 36.0



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-16

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-16

PROJECT / LOCATION DATA:

CORE DATE

April 21, 2022

LOCATION

N. Cheyenne Ave.

GPS

36.16474° / -95.99802°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☒ Separation

☐ N/A

Honeycomb or "D" Cracking PCC:

☒ Honeycomb

☒ "D" Cracking

☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics*	Layer Thickness (in)
C-17	ASPHALTIC CONCRETE	separation at 4 inches	4
C-17	PORTLAND CEMENT CONCRETE		5.5
Total Core Thickness			9.5

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-17A	Fat CLAY: brown, light brown, moist	0.0 to 6.0
C-17B	Fat CLAY (A-7-6): light brown, gray, yellowish brown, moist	6.0 to 18.0
C-17C	Fat CLAY: light brown, gray, yellowish brown, moist, trace sandy shale fragments	18.0 to 31.0

REMARKS:  
- hand auger refusal on shale encountered at 31 inches below the bottom of the pavement.

PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-17
COT NAMZ 1153 - Thunderhead Non-Arterial Maintenance Zone 1153 Tulsa, Oklahoma

CORE

C-17

TOP

PROJECT / LOCATION DATA:

CORE DATE     April 21, 2022  
LOCATION        W. Haskell Pl.  
GPS             36.16526° / -95.99755°

CORE LAYER DATA:

Surface Material Type:            ☒ A.C.            ☒ P.C.C.            ☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:            ☐ Stripping            ☐ Separation            ☒ N/A

Honeycomb or "D" Cracking PCC:            ☐ Honeycomb            ☒ "D" Cracking            ☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?            ☐ Yes            ☒ No            ☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics	Layer Thickness (in)
C-18	ASPHALTIC CONCRETE		4
C-18	LOOSE AGGREGATE		1.5
C-18	PORTLAND CEMENT CONCRETE		3.5
Total Core Thickness			9

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-18A	Lean CLAY with Sand and Gravel: brown, light brown, moist	0.0 to 6.0
C-18B	Lean CLAY with Sand: brown, moist	6.0 to 12.0
C-18C	Lean CLAY with Sand (A-6): brown, moist	12.0 to 18.0
C-18D	Lean CLAY with Sand: light brown, moist	18.0 to 36.0

TOP





PROJECT / LOCATION DATA:

CORE DATE

April 21, 2022

LOCATION

N. Cheyenne Ave.

GPS

36.16578° / -95.99805°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☒ Stripping

☒ Separation

☐ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☐ "D" Cracking

☒ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics*	Layer Thickness (in)
C-19	ASPHALTIC CONCRETE	separation and stripping below 4.25 inches	4.25
C-19	PORTLAND CEMENT CONCRETE		6.75

Total Core Thickness

11

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-19A	FILL - Lean CLAY with Sand: brown, light brown, moist, with asphalt and concrete fragments	0.0 to 8.0
C-19B	POSSIBLE FILL - Lean CLAY with Sand (A-7-6): brown, light brown, moist, trace gravel	8.0 to 20.0

TOP



REMARKS:  
- hand auger refusal on possible asphalt/concrete fragments encountered at 20 inches below the bottom of the pavement.



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-19

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-19

PROJECT / LOCATION DATA:

CORE DATE

April 21, 2022

LOCATION

W. Haskell Pl.

GPS

36.16528° / -95.99887°

CORE LAYER DATA:

Surface Material Type:

☒ A.C.

☒ P.C.C.

☐ Continuously Reinforced Concrete

Stripping or Separation in Asphalt:

☐ Stripping

☐ Separation

☒ N/A

Honeycomb or "D" Cracking PCC:

☐ Honeycomb

☒ "D" Cracking

☐ N/A

Stabilized Subgrade Beneath Pavement or Subbase?

☐ Yes

☒ No

☐ Unknown

CORE & BASE LAYER DATA (FROM TOP TO BOTTOM):

Core No.	Layer Type	Layer Characteristics*	Layer Thickness (in)
C-20	ASPHALTIC CONCRETE		3.5
C-20	LOOSE AGGREGATE		2
C-20	PORTLAND CEMENT CONCRETE		2.5

Total Core Thickness

8

SUBGRADE LAYER DATA (FROM BELOW CORES, OR AGGREGATE BASE, IF PRESENT):

Sample No.	Layer Type	Layer Depth (in)
C-20A	Lean CLAY with Sand (A-7-6): light brown, yellowish brown, gray, moist	0.0 to 6.0
C-20B	Lean CLAY with Sand: light brown, yellowish brown, gray, moist, trace sandstone fragments	6.0 to 9.0

TOP



REMARKS:  
- hand auger refusal on sandstone fragments encountered at 9 inches below the bottom of the pavement.



PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/13/2022

BORING LOG C-20


COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

CORE

C-20

Field No.	Soil Group	Station	Description	Depth (in)	LL	PI	Percent Passing						Water Content (%)	Soluble Sulfates (mg/kg)
							Passing 3 in.	Passing 3/4 in.	Passing #4	Passing #10	Passing #40	Passing #200		
C-1A				0 - 6									24.4	
C-1B				6 - 18									28.5	
C-1C	A-6		LEAN CLAY	18 - 36	36	16	100	100	100	100	99	88	22.8	
C-2A				0 - 6									4.7	
C-2B				6 - 10									19.4	
C-2C				10 - 18									15.1	
C-2D	A-6		LEAN CLAY	18 - 36	35	16	100	100	100	100	98	87	21.2	
C-3A				0 - 6									22.8	
C-3B	A-4		LEAN CLAY	6 - 12	30	8	100	100	100	100	98	90	23.3	
C-3C				12 - 36									12.7	
C-4A	A-6		LEAN CLAY	0 - 6	36	16	100	100	100	100	99	93	14.3	
C-4B				6 - 15									25.5	
C-4C	A-6		LEAN CLAY	15 - 36	37	18	100	100	100	100	99	92	21.9	
C-5A				0 - 6									31.6	
C-5B				6 - 15									28.9	
C-5C	A-6		LEAN CLAY	15 - 36	37	17	100	100	100	100	99	94	21.0	
C-6A	A-6		LEAN CLAY	0 - 6	36	15	100	100	100	100	96	88	18.8	
C-6B				6 - 36									16.2	
C-7A				0 - 6									30.3	
C-7B	A-6		LEAN CLAY	6 - 36	38	17	100	100	100	100	100	96	19.7	
C-8A				0 - 6									20.1	
C-8B	A-7-6		FAT CLAY	6 - 36	52	32	100	100	100	100	95	88	17.7	
C-9A	A-6		LEAN CLAY	0 - 6	36	14	100	100	100	100	96	88	22.3	
C-9B				6 - 36									18.1	
C-10A				0 - 6									17.8	
C-10B	A-2-4		SILTY SAND	6 - 36	NP	NP	100	100	100	100	88	15	5.8	
C-11A	A-4		SANDY SILT	0 - 6	NP	NP	100	100	100	100	99	61	19.1	
C-11B	A-4		SILTY SAND	6 - 36	NP	NP	100	100	100	100	98	39	16.9	

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.  
NP = Nonplastic



**KLEINFELDER**  
*Bright People. Right Solutions.*

PROJECT NO.:  
20230052.003A

DRAWN BY: KF

CHECKED BY: SYW

DATE: 5/25/2022

LABORATORY TEST  
RESULT SUMMARY


COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

TABLE  
  
B-1



Field No.	Soil Group	Station	Description	Depth (in)	LL	PI	Percent Passing						Water Content (%)	Soluble Sulfates (mg/kg)
							Passing 3 in.	Passing 3/4 in.	Passing #4	Passing #10	Passing #40	Passing #200		
C-13A	A-4		SILT WITH SAND	0 - 6	NP	NP	100	100	100	100	98	77	25.6	
C-13B				6 - 36									22.6	
C-14A				0 - 6									23.3	
C-14B	A-6		LEAN CLAY WITH SAND	6 - 22	32	14	100	100	100	100	97	80	22.8	
C-14C				22 - 36									16.3	
C-15A				0 - 6									30.0	
C-15B	A-6		LEAN CLAY WITH SAND	6 - 36	31	14	100	100	100	100	96	81	15.7	
C-16A	A-4		SILTY CLAY	0 - 6	27	7	100	100	100	100	98	85	18.3	
C-16B				6 - 36									20.3	
C-17A				0 - 6									27.0	
C-17B	A-7-6		FAT CLAY	6 - 18	52	25	100	100	100	100	97	93	25.3	
C-17C				18 - 31									16.0	
C-18A				0 - 6									26.0	
C-18B	A-6		LEAN CLAY WITH SAND	6 - 12	36	18	100	100	100	100	97	83	26.5	
C-18C				12 - 18									21.0	
C-18D				18 - 36									17.7	
C-19A	A-4		POSSIBLE FILL - LEAN CLAY WITH SAND	0 - 8	28	10	100	100	100	100	95	80	6.4	
C-19B				8 - 36									19.2	
C-20A				0 - 6									22.3	
C-20B	A-7-6		LEAN CLAY WITH SAND	6 - 9	42	17	100	100	100	100	92	83	22.1	

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.  
NP = Nonplastic



PROJECT NO.:  
20230052.003A

DRAWN BY: Kf

CHECKED BY: SYW

DATE: 5/25/2022

LABORATORY TEST  
RESULT SUMMARY

COT NAMZ 1153 - Thunderhead  
Non-Arterial Maintenance Zone 1153  
Tulsa, Oklahoma

TABLE  
  
B-2