CITY OF TULSA
PUBLIC WORKS
Engineering

TO: **E-mail Distribution**

RE: **GEOTECHNICAL REPORT TRANSMITTAL**

The City of Tulsa provides the attached document(s) with the following conditions:

A. The Geotechnical Report is not part of the construction documents. The Geotechnical Report is provided for informational purposes only, to assist the Contractor in understanding the general subsurface conditions at the site. The report presents the data and findings of the geotechnical engineer at the specific boring locations and times of the investigation.

B. The Contractor is solely responsible for all interpretations, conclusions, and deductions drawn from the Geotechnical Report concerning the conditions at the site affecting the execution of the Work, including, but not limited to, the subsurface conditions, the scope of work, means, methods, sequencing, and pricing.

C. The City makes no warranty or representation, express or implied, as to the accuracy, completeness, or interpretations of the data, information, and representations contained in the Geotechnical Report. The information provided is not a substitute for the Contractor's own independent investigation, judgment, and expertise.

D. The Contractor shall visit the site and make their own investigations. This will include any borings, additional borings, and/or testing to determine actual subsurface conditions and the conditions under which the Bid is to be prepared, and the Work is to be performed.

GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE
ZONE 7054
TULSA, OKLAHOMA
KLEINFELDER PROJECT NO. 20182007

November 29, 2017

A Report Prepared for:

Ms. Cynthia Y. Lynn, President
Thunderhead Testing, LLC
7224 E. 151st Street, Unit B
Jenks, Oklahoma 74008

GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE ZONE 7054
TULSA, OKLAHOMA

Prepared by:

Terry Robinson
Staff Professional I

Simon Wang, PE
Oklahoma: 27716

Reviewed by:

Xavier Barrett, PE*
Principal Professional
*Not licensed in Oklahoma

KLEINFELDER
10835 E. Independence, Suite 102
Tulsa, OK 74116
Phone: 918.627.6161
Fax: 918.627.6262

November 29, 2017
Kleinfelder Project No. 20182007

KLEINFELDER
Bright People. Right Solutions.

November 29, 2017
Kleinfelder Project No. 20182007

Ms. Cynthia Y. Lynn, President
Thunderhead Testing, LLC
7224 E. 151st Street, Unit B
Jenks, Oklahoma 74008

Subject: **Geotechnical Engineering Report**
Non-Arterial Street Maintenance Zone 7054
Tulsa, Oklahoma

Dear Ms. Lynn:

Kleinfelder has completed the authorized subsurface exploration, pavement evaluation, and geotechnical engineering evaluation for the above-referenced project in general accordance with our proposal/contract No. TUL17P56899 dated March 29, 2017. The purpose of the geotechnical study was to explore and evaluate the subsurface conditions at 49 locations across the site and to provide recommendations related to the geotechnical aspects of the project design and construction. The attached Kleinfelder report contains a description of the findings of our field exploration and laboratory testing program, our engineering interpretation of the results with respect to the project characteristics, and our design recommendations as well as construction guidelines for the planned project.

Recommendations provided herein are contingent on the provisions outlined in the ADDITIONAL SERVICES and LIMITATIONS sections of this report. The project Owner should become familiar with these provisions in order to assess further involvement by Kleinfelder and other potential impacts to the proposed project.

We appreciate the opportunity to be of service to you on this project and are prepared to provide the recommended additional services. Please call us if you have any questions concerning this report.

Sincerely,

KLEINFELDER OKLAHOMA 100, LLC
Certificate of Authorization #5918, Expires 6/30/19

Simon Wang, PE
Staff Professional II

Xavier Barrett, PE*
Principal Professional
*Not licensed in Oklahoma

SYW/KR:

Interchange Business Park, 10835 East Independence, Suite 102, Tulsa, OK 74116-5680 **p|** 918.627.6161 **f|** 918.627.6262

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE ZONE 7054
TULSA, OKLAHOMA

1. INTRODUCTION

1.1 GENERAL

Kleinfelder has completed the authorized subsurface exploration and geotechnical engineering evaluation for the Non-Arterial Street Maintenance (NASM) Zone 7054 in Tulsa, Oklahoma. The services provided were in general accordance with our proposal/contract No. TUL17P56899 dated March 29, 2017, executed on September 8, 2017.

This report includes our recommendations related to the geotechnical aspects of the project design and construction. Conclusions and recommendations presented in the report are based on the subsurface information encountered at the locations of our exploration and the provisions and requirements outlined in the ADDITIONAL SERVICES and LIMITATIONS sections of this report. In addition, an article prepared by The Geoprofessional Business Association (GBA), *Important Information About This Geotechnical Engineering Report*, has been included in APPENDIX C. We recommend that all individuals read the report limitations along with the included GBA document.

1.2 PROPOSED CONSTRUCTION

We understand that NASM Zone 7054 will be rehabilitated. NASM Zone 7054 encompasses all the streets except East 58th Street South between East 61st Street South and East 56th Street, and South Mingo Road and South Memorial Drive. In addition, a commercial development and an apartment complex at the northeast corner of East 61st Street South and South Memorial Drive are also excluded from this project. The proposed rehabilitation will consist of full reconstruction or mill and overlay of the existing pavement structure. The general location of the project site is shown on Figure 1, Exploration Location Plan and Vicinity Map.

The scope of the exploration and engineering evaluation for this study, as well as the conclusions and recommendations in this report, were based on our understanding of the project as described above. If pertinent details of the project have changed or otherwise differ from our descriptions, we must be notified and engaged to review the changes and modify our recommendations, if needed.

2. SITE CONDITIONS

2.1 SITE DISCRIPTION

The project site is bounded by South Memorial Drive to the west, East 61st Street South to the south, South Mingo Drive to the east, and East 56th Street South to the north. Commercial development and apartment complex at northeast corner of East 61st Street South and South Memorial Drive are excluded from this project.

The project site consists of a residential neighborhood. The existing roadways within the study area are two-lane roadways covered by asphaltic concrete with curb and gutters and have widths of approximately 25 feet. One roadway (S. 89th E. Ave) south of East 58th Street South had a width of approximately 34 feet. Existing overhead and underground utilities were noted within the current right-of-way during our field exploration.

2.2 SUBSURFACE CONDITIONS

Kleinfelder explored the subsurface conditions at the site by drilling and sampling 49 borings (P-1 through P-49) between September 28 and October 2, 2017. Approximate boring locations are shown on Figure 1, Exploration Location Plan and Vicinity Map. The field exploration and laboratory testing programs are presented in APPENDIX A and APPENDIX B, respectively.

In general, the entire street network, except S. 93rd East Ave. (Boring P-21) within the project limits, consisted of asphaltic concrete pavement with thickness ranging from 5.5 to 10 inches. Boring P-21 located on S. 93rd East Ave. consisted of approximately 7¼ inches of asphalt over 7¼ inches of Portland cemented concrete pavement. Approximately 7½, 3, and 2 inches of aggregate base was encountered in borings P-14, P-30, and P-43, respectively. Aggregate base was not observed in any other locations except borings P-14, P-30, and P-43.

Table 2-1 presents a brief summary of the pavement thicknesses, and a summary of the approximate boring location, the liquid limits (LL), plastic indices (PI), percent passing no. 200 sieve, and the subgrade soils at each boring location.

Table 2-1. Summary of Pavement Thickness and Subgrade Conditions									
Boring No.	GPS Coordinates	Pavement and Base Thickness (inches)*	Field No.	SUBGRADE**					
				Water Content (%)	LL	PL	PI	% Passing No. 200	Subsurface Material USCS Classification
P-1	N. 36.07983 W. -95.88576	6.25" AC	1A 1B	17.4 16.6	34 29	20 17	14 12	61 35	Sandy Lean Clay (CL) Clayey Sand (SC)
P-2	N. 36.08142 W. -95.88464	6.5" AC	2A 2B	17.8 14.1	39 33	20 18	19 15	39 44	Clayey Sand (SC) Clayey Sand (SC)
P-3	N. 36.08080 W. -95.88393	6.25" AC	3A	23.6	32	19	13	40	Clayey Sand (SC) **Auger refusal on limestone was encountered 6 inches below the bottom of pavement**
P-4	N. 36.07963 W. -95.88445	7.25" AC	4A 4B	20.6 18.7	52 45	26 17	26 28	50 46	Fill – Sandy Fat Clay (CL) Clayey Sand (SC)
P-5	N. 36.08223 W. -95.88263	6.5" AC	5A 5B	22.9 18.9	- 45	- 21	- 24	50 38	Sandy Lean Clay (CL) Clayey Sand (SC)
P-6	N. 36.08058 W. -95.88291	6.5" AC	6A	17.9	32	18	14	40	Clayey Sand (SC) **Auger refusal on shale was encountered 6 inches below the bottom of pavement**
P-7	N. 36.07983 W. -95.88139	6.0" AC	7A 7B	20.5 -	42 -	21 -	21 -	47 -	Clayey Sand (SC) Clayey Sand (SC)
P-8	N. 36.08120 W. -95.88073	6.5" AC	8A 8B	- 20.5	- 45	- 22	- 23	- 39	Clayey Sand (SC) Clayey Sand (SC)
P-9	W. 36.08220 W. -95.87918	7.5" AC	9A 9B	22.8 -	50 -	26 -	24 -	34 -	Clayey Sand (SC) Clayey Sand (SC)
P-10	N. 36.08224 W. -95.87653	8.75" AC	10A 10B	25.0 -	55 -	12 -	43 -	44 -	Clayey Sand (SC) Clayey Sand (SC)
P-11	N. 36.08226 W. -95.87447	8.75" AC	11A 11B	22.3 -	47 -	14 -	33 -	50 -	Clayey Sand (SC) Clayey Sand (SC)
P-12	N. 36.08221 W. -95.87214	8.0" AC	12A 12B	- 25.7	- 59	- 19	- 40	- 46	Clayey Sand (SC) Clayey Sand (SC)
P-13	N. 36.08226 W. -95.87073	8.25" AC	13A 13B	20.6 -	45 -	17 -	28 -	47 -	Clayey Sand (SC) Clayey Sand (SC)
P-14	N. 36.08270 W. -95.86936	7.5" AC 7.5" Aggregate Base	14A 14B	24.3 -	45 -	18 -	27 -	44 -	Clayey Sand (SC) Clayey Sand (SC)
P-15	N. 36.08123 W. -95.87799	6.0" AC	15A 15B	20.3 -	51 -	22 -	29 -	43 -	Clayey Sand (SC) Clayey Sand (SC)
P-16	N. 36.08152 W. -95.87693	9.5" AC	16A 16B	- 22.1	- 63	- 19	- 44	- 45	Clayey Sand (SC) Clayey Sand (SC)
P-17	N. 36.08181 W. -95.87597	9.0" AC	17A 17B	24.4 -	44 -	17 -	27 -	54 -	Sandy Lean Clay (CL) Sandy Lean Clay (CL)
P-18	N. 36.08202 W. -95.87508	9.25" AC	18A 18B	21.1 -	50 -	15 -	35 -	52 -	Sandy Fat Clay (CL) Sandy Fat Clay (CL)
P-19	N. 36.08080 W. -95.87597	10.0" AC	19A 19B	- 19.6	- 47	- 19	- 28	- 46	Clayey Sand (SC) Clayey Sand (SC)
P-20	N. 36.08122 W. -95.87440	10.0" AC	20A 20B	26.2 -	53 -	16 -	37 -	42 -	Clayey Sand (SC) Clayey Sand (SC)

Table 2-1. Summary of Pavement Thickness and Subgrade Conditions									
Boring No.	GPS Coordinates	Pavement and Base Thickness (inches)*	Field No.	SUBGRADE**					
				Water Content (%)	LL	PL	PI	% Passing No. 200	Subsurface Material USCS Classification
P-21	N. 36.08154 W. -95.87310	7.25" AC 7.25" PCC	21A 21B	30.6 -	56 -	20 -	36 -	43 -	Clayey Sand (SC) Clayey Sand (SC)
P-22	N. 36.08134 W. -95.87132	8.0" AC	22A 22B	- 26.9	- 60	- 24	- 36	- 42	Clayey Sand (SC) Clayey Sand (SC)
P-23	N. 36.08185 W. -95.86999	8.0" AC	23A 23B	22.8 -	53 -	24 -	29 -	46 -	Clayey Sand (SC) Clayey Sand (SC)
P-24	N. 36.07936 W. -95.87803	7.25" AC	24A 24B	- 19.3	- 52	- 17	- 35	- 40	Clayey Sand (SC) Clayey Sand (SC)
P-25	N. 36.07967 W. -95.87697	9.5" AC	25A 25B	- 25.2	- 55	- 25	- 30	- 41	Clayey Sand (SC) Clayey Sand (SC)
P-26	N. 36.08004 W. -95.87599	8.25" AC	26A 26B	21.1 -	42 -	18 -	27 -	43 -	Clayey Sand (SC) Clayey Sand (SC)
P-27	N. 36.08041 W. -95.87408	8.75" AC	27A 27B	- 25.8	- 66	- 15	- 51	- 44	Clayey Sand (SC) Clayey Sand (SC)
P-28	N. 36.08039 W. -95.87322	9.25" AC	28A 28B	- 22.9	- 67	- 16	- 51	- 42	Clayey Sand (SC) Clayey Sand (SC)
P-29	N. 36.07941 W. -95.87203	6.5" AC	29A 29B	27.0 -	60 -	22 -	38 -	42 -	Clayey Sand (SC) Clayey Sand (SC)
P-30	N. 36.07835 W. -95.87917	7.0" AC 3.0" Aggregate Base	30A 30B 30C	- 19.3 -	- 32 -	- 13 -	- 19 -	- 39 -	Clayey Sand (SC) Clayey Sand (SC) Lean Clay w/ Sand (CL)
P-31	N. 36.07792 W. -95.87830	6.75" AC	31A	30.7	34	24	10	30	Clayey Sand (SC) **Auger refusal on shale was encountered 6 inches below the bottom of pavement**
P-32	N. 36.07812 W. -95.87746	10.0" AC	32A 32B	- 18.9	- 50	- 19	- 31	- 47	Clayey Sand (SC) Clayey Sand (SC)
P-33	N. 36.07836 W. -95.87606	7.0" AC	33A 33B	23.3 -	50 -	18 -	32 -	41 -	Clayey Sand (SC) Clayey Sand (SC)
P-34	N. 36.07843 W. -95.87408	7.25" AC	34A 34B	27.3 -	48 -	20 -	28 -	40 -	Clayey Sand (SC) Clayey Sand (SC)
P-35	N. 36.07854 W. -95.87304	7.25" AC	35A	32.4	35	23	12	31	Clayey Sand (SC) **Auger refusal on shale was encountered 6 inches below the bottom of pavement**
P-36	N. 36.07858 W. -95.87178	7.0" AC	36A 36B	- 23.9	- 61	- 17	- 44	- 38	Clayey Sand (SC) Clayey Sand (SC)
P-37	N. 36.07910 W. -95.87065	5.5" AC	37A 37B	20.7 -	57 -	23 -	34 -	55 -	Sandy Fat Clay (CH) Sandy Fat Clay (CH)
P-38	N. 36.07636 W. -95.87901	7.0" AC	38A	30.3	43	25	18	26	Clayey Sand (SC) **Auger refusal on shale was encountered 6 inches below the bottom of pavement**
P-39	N. 36.07705 W. -95.87784	6.6" AC	39A 39B	22.6 -	43 -	20 -	23 -	42 -	Clayey Sand (SC) Clayey Sand (SC)
P-40	N. 36.07745 W. -95.87672	7.6" AC	40A 40B	24.4 -	46 -	21 -	25 -	35 -	Clayey Sand (SC) Clayey Sand (SC)

Table 2-1. Summary of Pavement Thickness and Subgrade Conditions									
Boring No.	GPS Coordinates	Pavement and Base Thickness (inches)*	Field No.	SUBGRADE**					
				Water Content (%)	LL	PL	PI	% Passing No. 200	Subsurface Material USCS Classification
P-41	N. 36.07796 W. -95.87493	7.5" AC	41A	34.1	38	NP	NP	22	Silty Sand (SM) **Auger refusal on shale was encountered 6 inches below the bottom of pavement**
P-42	N. 36.07727 W. 95.87404	7.25" AC	42A 42B	- 25.8	- 39	- 17	- 22	- 49	Clayey Sand (SC) Clayey Sand (SC)
P-43	N. 36.07772 W. -95.87138	5.5" AC 2.0" Aggregate Base	43A 43B	- 23.8	- 46	- 17	- 29	- 47	Clayey Sand (SC) Clayey Sand (SC)
P-44	N. 36.07695 W. -95.87248	7.5" AC	44A 44B	- -	- 39	- 19	- 20	- -	Clayey Sand (SC) Clayey Sand (SC)
P-45	N. 36.07683 W. -95.87180	6.5" AC	45A 45B	- 21.1	- 46	- 18	- 28	- 47	Clayey Sand (SC) Clayey Sand (SC)
P-46	N. 36.07631 W. -95.87758	6.5" AC	46A 46B	25.9 -	47 -	25 -	22 -	43 -	Clayey Sand (SC) Clayey Sand (SC)
P-47	N. 36.07671 W. -95.87601	7.25" AC	47A 47B	- 24.7	- 52	- 20	- 32	- 43	Clayey Sand (SC) Clayey Sand (SC)
P-48	N. 36.07643 W. -95.87391	7.3" AC	48A 48B	- 21.5	- 55	- 19	- 36	- 46	Clayey Sand (SC) Clayey Sand (SC)
P-49	N. 36.07600 W. -95.87225	7.5" AC	49A 49B	- 20.6	- 45	- 17	- 28	- 47	Clayey Sand (SC) Clayey Sand (SC)

*AC = Asphaltic Concrete, PCC = Portland cement Concrete
**LL = Liquid Limit, PL = Plastic Limit, PI = Plastic Index, NP = Non-Plastic

As shown in Table 2-1, subsurface materials encountered underneath the pavement surface and aggregate base consisted of predominantly lean clay and fat clay with varying amounts of sand, and sand material with varying amounts of clay.

Specific subsurface conditions encountered at the boring locations are presented on the respective coring logs in APPENDIX A. The thicknesses indicated on the coring logs represent the approximate boundaries between material types; in-situ, the transitions may vary or be gradual.

2.3 GROUNDWATER OBSERVATIONS

Groundwater observations were made both during and after completion of the drilling operation. The borings remained dry and no groundwater seepage was noted either during or after completion of the borings.

Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. Observations over an extended period of time through use of piezometers or cased borings would be required to better define groundwater conditions.

2.4 PAVEMENT DISTRESS SURVEY

A pavement distress survey was conducted on the existing asphalt pavement in general accordance with procedure outlined in ASTM D6433-11, which requires at least 10 percent of the project length be surveyed. The pavement distress surveys were conducted at 28 sections along the project alignment. All except for one pavement distress survey section covers an area of approximately 12 feet wide by 100 feet long. Section 11 covers an area of approximately 17 feet wide by 100 feet long.

The primary pavement distresses identified for the reference project were longitudinal and transverse cracking, alligator cracking, block cracking, pot holes, weathering and raveling. The pavement distress survey results are summarized in Table 2-2. Procedure outlined in Chapter 5 “Rehabilitation Methods with Overlays” of the AASHTO Guide for Design of Pavement Structures (1993) should be followed for preparing and repairing existing pavements for overlaying.

Table 2-2. Pavement Distress Survey Results				
Section No.	**Direction**	**Approximate Location**	**Pavement Condition Index (PCI)**	**PCI Rating**
1	Northbound	Btw. P-47 and P-37	28	Very Poor
2	Northbound	Btw. P-44 and P-35	43	Poor
3	Eastbound	P-36	56	Fair
4	Southbound	P-37	60	Fair
5	Westbound	P-29	33	Very Poor
6	Southbound	P-34	56	Fair
7	Southbound	P-41	68	Fair
8	Westbound	P-33	57	Fair
9	Eastbound	P-31	52	Poor
10	Southbound	Btw. P-38 and P-30	25	Very Poor
11	Southbound	P-46	76	Satisfactory
12	Eastbound	Btw. P-47 and P-48	65	Fair
13	Westbound	P-49	57	Fair
14	Northbound	P-6	78	Satisfactory
15	Eastbound	P-5	30	Very Poor
16	Northbound	P-3	62	Fair
17	Southbound	P-2	64	Fair
18	Northbound	Btw. P-7 and P-8	63	Fair
19	Eastbound	P-9	9	Failed
20	Westbound	P-10	57	Fair
21	Eastbound	P-11	53	Poor
22	Eastbound	P-12	57	Fair
23	Northbound	P-23	47	Poor
24	Westbound	P-22	54	Poor
25	Northbound	P-21	29	Very Poor
26	Eastbound	P-19	37	Very Poor
27	Westbound	P-26	39	Very Poor
28	Northbound	Btw. P-24 and P-15	18	Serious

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 GENERAL

The primary geotechnical considerations identified for this project are the correction of areas disturbed during the demolition of the existing pavement, variable pavement thickness/conditions and medium to high plasticity clay soils. Recommendations addressing these considerations as well as general recommendations regarding geotechnical aspects of the project design and construction are presented below.

The recommendations submitted herein are based, in part, upon data obtained from our subsurface exploration. The nature and extent of subsurface variations that may exist at the proposed project site will not become evident until construction. If variations appear evident, then the recommendations presented in this report should be evaluated. In the event that any changes in the nature, design, or location of the proposed project are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and our recommendations modified in writing.

3.2 PRIMARY GEOTECHNICAL CONSIDERATIONS

3.2.1 Demolition of Existing Pavements

Demolition of the existing pavements will be required in the initial phase of development. All debris associated with the demolition phase of the project should be removed from the site. Subgrade soils disturbed during demolition of the existing pavements will require undercutting to stable materials prior to re-compaction.

3.2.2 Various Thicknesses/Conditions of Pavement

Various thicknesses/conditions of pavement were encountered in the borings. In general, the entire street network except S. 93rd East Ave. (Boring P-21) within the project limits consisted of asphaltic concrete pavement with thickness ranging from 5.5 to 10 inches. Boring P-21 located on S. 93rd East Ave. consisted of approximately 7¼ inches of asphalt over 7¼ inches of Portland cemented concrete pavement. Approximately 7½, 3, and 2 inches of aggregate base was encountered in borings P-14, P-30, and P-43, respectively. Aggregate base was not observed in any other locations except borings P-14, P-30, and P-43.

3.2.3 Medium to High Plasticity Clay Soils

Clay soils that have a moderate to high shrink-swell potential (PI >=22) were observed in the majority of the borings. Depending upon the design grades, these materials could be exposed at finished subgrade level. Undercutting or stabilization of these soils should be anticipated. Typical remedial measures include treating the material with hydrated lime, Cement Kiln Dust (CKD) or Class “C” fly ash. Soluble sulfate tests should be performed to assess the suitability of the stabilizing materials. A complete soil stabilization mix design is beyond the scope of this project but should be considered during construction in accordance to Oklahoma Department of Transportation (ODOT) “OHD L-50 Soil Stabilization Mix Design Procedure.”

3.3 SUBGRADE DEVELOPMENT CONSIDERATIONS

3.3.1 Demolition

During demolition of the existing pavements within proposed construction areas, all broken asphalt, concrete, and other debris from demolition should be removed from the site. Areas disturbed during demolition should be thoroughly evaluated by the geotechnical engineer prior to placement of structural fill. All disturbed soils should be undercut to expose stable subgrade and the resulting excavation backfilled to the subgrade level with compacted structural fill.

3.3.2 Existing Utility Trenches

Any planned relocation or removal of existing utility lines along the proposed alignment should be completed as part of the site preparation. Excavations created by removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to compact the backfill. In addition, the base of the excavations should be thoroughly evaluated by a geotechnical engineer or engineering technician prior to placement of backfill. All backfill should be placed in accordance with the recommendations presented in the STRUCTURAL FILL section of this report.

Existing utility lines may be located within the proposed construction areas. The depth of the lines or lateral extent of the backfill is currently unknown. Areas where existing utility lines are located which exhibit soft or inconsistent soils should be thoroughly evaluated to determine the composition and consistency of the backfill material. If unsuitable material is encountered, it should be undercut and replaced with controlled structural fill.

3.3.3 Scarification, Moisture Conditioning, and Compaction

Prior to placement of structural fill, the moisture content of the exposed soils should be evaluated. Depending on the in-situ moisture content of the soils exposed, moisture conditioning of the exposed subgrade may be required prior to proofrolling and/or fill placement. The moisture content of the exposed subgrade in these fill areas should be adjusted to within the range recommended for structural fill, to allow the exposed material to be compacted to a minimum of 95 percent of the Standard Proctor maximum dry density. Extremely wet or unstable areas that hamper compaction of the subgrade may require undercutting and replacement with structural fill or other stabilization techniques.

The top 8 inches of the exposed soil subgrades should be recompacted prior to placement of the remaining pavement section. The compaction and moisture content of the soil subgrade should be prepared in accordance with the recommendations presented in the STRUCTURAL FILL section of this report.

3.3.4 Proofrolling

Following moisture conditioning, it is recommended that the exposed grade be proofrolled. Proofrolling of the subgrade aids in identifying soft or disturbed areas. Unsuitable areas identified by the proofrolling operation should be undercut and replaced with structural fill or aggregate base. If large areas of soft or unstable soil conditions extend to depths greater than 18 inches below the finish pavement subgrade elevation, we should be notified to provide additional recommendations concerning appropriate stabilization methods.

3.4 CLIMATIC CONDITIONS

Weather conditions will influence the site preparation required. Following periods of rainfall, the moisture content of the near surface soils may be significantly above the optimum moisture content. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include aerating the wet subgrade, removal of the wet materials and replacing them with dry materials, or treating the material with hydrated lime, cement kiln dust or Class “C” fly ash.

If site grading commences during summer months or following periods of extended dry and/or warm weather, moisture contents may be low and higher plasticity clay soils could have a high

swell potential. Typically discing and moisture conditioning of the exposed subgrade materials to the moisture content criteria outlined in the STRUCTURAL FILL section will reduce this swell potential of the dry materials. As an alternative, the dry materials could be undercut and replaced with structural fill.

If construction of the project is to be performed during winter months or during extended periods of cold weather, appropriate steps should be taken to prevent the soils from freezing. In no case should fill, or exterior flat work be placed on or against frozen or partially frozen materials. Frozen materials should be removed and replaced with a suitable material. Frozen materials should not be included in any compacted fills.

3.5 STRUCTURAL FILL

3.5.1 Materials

All structural fill required to achieve design grades should consist of approved materials, free of organic matter and debris. All structural fill placed within the roadway alignment should consist of sand, clayey sand, lean clay, or sandy lean clay type of soil with a Plasticity Index (PI) less than 22, as determined by the Atterberg limits test ASTM D4318, wet preparation procedure.

3.5.2 Compaction Criteria

Fill should be placed in lifts having a maximum loose lift thickness of 9 inches. All fill should be compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D698 (standard Proctor compaction). If the plasticity index of the soils is greater than 12, we recommend the moisture content of the fill at time of compaction be within a range of 0 percent to 4 percent above optimum moisture content as defined by the standard Proctor compaction procedure.

If the plasticity index of the soil is less than or equal to 12, the moisture content of the fill at time of compaction should be within a range of 2 percent below to 2 percent above optimum moisture content as defined by the standard Proctor compaction procedure. Moisture contents should be maintained within the recommended ranges until completion of the subgrade.

3.5.3 Pavement Subgrade Chemical Stabilization/Modification

Plasticity index data indicate clay soils having moderate to high shrink-swell potential are present in the project area. It is recommended that medium to high plasticity soils present in exposed subgrade be chemically stabilized with hydrated lime, Cement Kiln Dust or Class “C” fly ash. In lieu of chemical stabilization, removal/replacement of the existing subgrade with additional 12 inches of ODOT Type “A” aggregate base could be performed. If City of Tulsa preferred pavement sections (as provided Section 3.6.3) are selected, no subgrade stabilization or modification is expected to be required.

If hydrated lime is used as the stabilizing agent, a hydrated lime content of 5 to 7 percent on a dry weight basis is generally sufficient to achieve the desired modification. If CKD is used as the stabilizing agent, a cement kiln dust content of 8 to 10 percent on a dry weight basis is generally sufficient to achieve the desired stabilization. If Class "C" fly ash is used as the stabilizing agent, a Class "C" fly ash content of 14 to 17 percent on a dry weight basis is generally sufficient to achieve the desired stabilization. Laboratory tests will be necessary to determine the actual amount required and to determine the moisture content to achieve maximum potential strength.

The stabilization agent should be placed, mixed, and compacted in accordance with ODOT “Standard Specifications for Highway Construction, Section 307” (2009). Specifications for chemical stabilization/modification should be included in the project specifications.

The producer of the proposed stabilizing/modifying agent should submit chemical analysis sheets to Kleinfelder for review and approval prior to beginning construction. A complete soil stabilization mix design is beyond the scope of this project. A complete soil stabilization mix design should be performed during construction in accordance to Oklahoma Department of Transportation (ODOT) “OHD L-50 SOIL STABILIZATION MIX DESIGN PROCEDURE”.

3.6 PAVEMENTS

3.6.1 General

We understand that the Non-Arterial Streets will be designed and constructed in accordance with the City of Tulsa Asphalt Pavement Standard Details for Residential and Collector Streets (October 2013) and the City of Tulsa Concrete Pavement Standard for Residential and Collector Streets (October 2013). The design Equivalent Single Axle Loads (ESALs) for the City of Tulsa

Asphalt and Concrete Pavement Standard for Residential and Collector Streets (October 2013) is 400,000.

3.6.2 Pavement Subgrade Preparation

Pavement subgrades should be prepared in accordance with the recommendations presented in the SITE DEVELOPMENT and STRUCTURAL FILL sections of this report. Construction scheduling may result in a time lapse between the end of grading operations and the commencement of paving. Disturbance, desiccation, and/or wetting of the subgrade between grading and paving can result in deterioration of the previously completed subgrade. A non-uniform subgrade can result in poor pavement performance and local failures relatively soon after pavements are constructed.

In order to aid in the prevention of the above undesirable conditions, we recommend that the pavement subgrades be proofrolled and the moisture content and density of the top 8 inches of subgrade be checked within two days prior to commencement of actual paving operations. Proofrolling should be accomplished with multiple passes of a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading. If any significant event, such as precipitation, occurs after proofrolling, the subgrade should be reviewed by qualified geotechnical engineering personnel immediately prior to placing the pavement. The subgrade should be in its finished form at the time of the final review.

3.6.3 New Pavement

The sections presented in Table 3-1 are minimum thicknesses for City of Tulsa Residential and Collector Streets and, as such, periodic maintenance should be anticipated. We understand that the City of Tulsa prefers the design of residential and collector streets following the 4th option of Table 3-1 for asphaltic concrete design and, 2nd option for Portland cement concrete design.

Geotextile fabric is recommended between the Recompacted subgrade and ODOT Type “A” aggregate base to reduce the potential migration of fine grained soils into the aggregate base. All pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage. This includes the underlying subgrade soils since the granular base material readily transmits water. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and

cause premature pavement deterioration. The edges of the pavement sections should be protected by using curbs and gutters.

Table 3-1. City of Tulsa (COT) Standard Details for Residential and Collector Streets (Oct. 2013, STD. 726 & 727)		
COT Typical Section Type	**Minimum Asphaltic Concrete (AC) Design Thickness, inches**	**Minimum Portland Cement Concrete (PCC) Design Thickness, inches**
1	2.0 AC Surface Course, Type S4 4.5 AC Base Course, Type S3 8.0 Portland Cement Treated Base (ODOT 408) 8.0 Recompacted Subgrade (AASHTO T99)	6.0 PCC (ODOT 414) 4.0 ODOT Type "A" Aggregate Base 8.0 Recompacted Subgrade (AASHTO T99)
2	2.0 AC Surface Course, Type S4 4.5 AC Base Course, Type S3 9.0 Plant Mix Bituminous Base (ODOT 319) 8.0 Recompacted Subgrade (AASHTO T99)	6.0 PCC (ODOT 414)* 12.0 ODOT Type "A" Aggregate Base* 8.0 Recompacted Subgrade (AASHTO T99)*
3	2.0 AC Surface Course, Type S4 4.5 AC Base Course, Type S3 4.0 AC Base Course, Type S3 8.0 Recompacted Subgrade (AASHTO T99)	-
4	2.0 AC Surface Course, Type S4* 5.0 AC Base Course, Type S3* 12.0 ODOT Type "A" Aggregate Base* 8.0 Recompacted Subgrade (AASHTO T99)*	-

*City of Tulsa (COT) preferred pavement Sections.

All materials and construction procedures should be in accordance with the ODOT "Standard Specifications for Highway Construction" (2009).

3.6.4 Mill/Overlay

As shown in Table 2-2, the Pavement Condition Index (PCI) values ranged from 9 to 78 across the entire neighborhood with a weighted average of 49, which indicate a **POOR** condition. Low to high severity alligator cracks, block cracking, reflective cracking, patching, and shoulder cracking were observed within the project limits.

It is our professional opinion that mill and overlay for the proposed improvement is feasible at locations where PCI indicated very poor or better provide that all pavement distresses and deteriorated areas will be repaired per AASHTO procedures outlined in Part III,

Chapter 5 “Rehabilitation Methods with Overlays”. Mill/overlay is **NOT** recommended at locations where PCI indicated serious or failed condition, for instance, locations near boring P-9 or between P-24 and P-15.

Asphaltic Concrete (AC) mill and overlay of the existing pavement is one of the rehabilitation options for the project. Repairing deteriorated areas that require full reconstruction should be performed prior to overlay. It should be noted that areas of existing pavement course separation cracking may result in difficulties during mill and overlay operations. All the exposed cracks need to be properly treated after the milling operations of the existing pavement. Following the proper treatments of the existing cracks, the overlay operation can be performed. The overlay recommendations herein are provided for estimation of adequate pavement structure only.

Construction of an AC overlay of the existing AC pavement consists of the following construction tasks:

1. Repairing deteriorated areas, and making subgrade and drainage improvements;
2. Correcting surface rutting by milling or placing a leveling course;
3. Constructing widening, if needed;
4. Roughen the surface and applying a tack coat; and
5. Placing the AC overlay.

The flexible pavement analysis for an overlay is based on the following variables:

California Bearing Ratio (Estimated)	3.0
Initial Serviceability	4.2
Terminal Serviceability	2.0
Standard Deviation	0.49
Drainage Factor	1.0
Reliability	65%
Required Structural Number.	3.54
Existing AC Layer Coefficient	0.35

Based on the provided and assumed traffic data information as well as a design life of 20 years, a total ESAL of 400,000 was used for the new overlay AC pavements. Using this total ESAL

value, existing pavement conditions, and the design variable values stated previously, the pavement overlay section in Table 3-1 is recommended.

Table 3-1. Mill/Overlay Recommendations			
Design ESAL	**Average Mill Depth, inches**	**Total Recommended Overlay Asphaltic Concrete (AC) Thickness, inches**	**ODOT Specification Section**
400,000	2	3	411 & 708

The recommended overlay adds approximately 1-inch of new AC pavement in the overlaid sections. This added AC thickness (for the mill/overlay option) may significantly alter the grading and drainage aspects at the site.

Due to presence of high plasticity clay materials encountered at the majority of the borings, proper drainage design and construction is essential to prevent water seeping into the subgrade and minimize the shrink and swell potential of the subgrade. The swell and shrink potential of the high plasticity clay materials could be destructive to the pavement. If the Owner is not willing to take this risk, full depth reconstruction is necessary to minimize the risk.

All materials and construction procedures should be in accordance with the ODOT "Standard Specifications for Highway Construction" (2009).

3.6.5 Pavement Construction Considerations

Proper drainage below the pavement section helps prevent softening of the subgrade and has a significant impact on pavement performance and pavement life of all pavement types. We recommend that a granular blanket drain be constructed at all storm sewer inlets within the pavement areas. The blanket drain should consist of clean, crushed stone aggregate extending a minimum of 6 inches below pavement subgrade level. The blanket drains should extend a minimum of 8 feet away from the curb at all storm sewer inlets, and should be a minimum of 8 feet wide. The grade within the blanket drain should be sloped toward the storm sewer inlet, and weep holes should be drilled through the inlet to provide drainage of the granular section into

the inlet. Placement of geotextile filter fabric across the weep holes should be considered to prevent loss of soil through the weep holes.

Construction traffic on the pavements has not been considered in the design. If construction scheduling dictates the pavements will be subject to traffic by construction equipment/vehicles, the designs should be reconsidered to include the effects of the additional traffic loading.

4. ADDITIONAL SERVICES

To effectively achieve the intent of the geotechnical recommendations presented in this report and to maintain continuity from design through construction, Kleinfelder should be retained to provide observation and testing services during construction. This will provide Kleinfelder with the opportunity to observe the subsurface conditions encountered during construction, evaluate the applicability of the geotechnical recommendations presented in our report as they relate to the soil conditions encountered, and to provide follow up recommendations if conditions differ from those described in our report.

5. LIMITATIONS

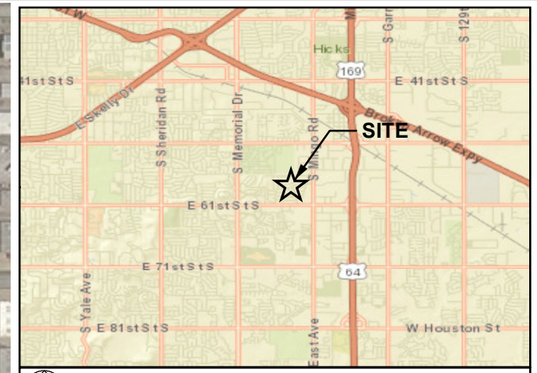
This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based 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 scope of our services did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

This 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 (2) years from the date of the report. Land use, site conditions (both on-site and off-site), regulations, or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify and hold harmless Kleinfelder from any claim or liability associated with such unauthorized or non-compliance.

The work performed was based on project information provided by Client. If Client does not retain Kleinfelder to review any plans and specifications, including any revisions or modifications to the plans and specifications, Kleinfelder assumes no responsibility for the suitability of our recommendations. In addition, if there are any changes in the field to the plans and specifications, Client must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

FIGURE

FIGURE 1. EXPLORATION LOCATON PLAN AND VICINITY MAP



VICINITY MAP — NOT TO SCALE

NOTE:
BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS COMPILED BY ESRI PRODUCTS AND 2017 MICROSOFT CORPORATION. COORDINATE SYSTEM: GCS WGS 1984

LEGEND

◎ PAVEMENT CORING

N

0 560 1100

1 " = 558 SCALE IN FEET

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.	20182007
DRAWN BY:	SYW
CHECKED BY:	KR
DATE:	10/11/2017
REVISED:	-

EXPLORATION LOCATION PLAN AND VICINITY MAP

NASM ZONE 7054
TULSA, OKLAHOMA

FIGURE 1

APPENDIX A

FIELD EXPLORATION PROGRAM

APPENDIX A
FIELD EXPLORATION PROGRAM

Kleinfelder conducted the field exploration for this study between September 28 and October 2, 2017 by drilling 49 borings to approximate 36 inches below the bottom of the existing pavement, or aggregate base, if present. Kleinfelder representatives established the boring locations in the field by using a handheld Global Positioning System (GPS) device with an accuracy of 15 feet. Locations of the borings should be considered accurate only to the degree implied by the methods used to obtain them. The approximate boring locations are indicated in Table A-1.

Table A-1. Approximate Boring Locations

Boring No.	Streets	Latitude (°)	Longitude (°)
P-1	81st East Place SB	36.07983	-95.88576
P-2	82nd East Avenue SB	36.08142	-95.88464
P-3	83rd East Avenue NB	36.08080	-95.88393
P-4	83rd East Place NB	36.07963	-95.88445
P-5	56th Place WB	36.08223	-95.88263
P-6	84th East Avenue NB	36.08058	-95.88291
P-7	85th East Avenue NB	36.07983	-95.88139
P-8	85th East Avenue SB	36.08120	-95.88073
P-9	56th Street EB	36.08220	-95.87918
P-10	56th Street WB	36.08224	-95.87653
P-11	56th Street WB	36.08226	-95.87447
P-12	56th Street EB	36.08221	-95.87214
P-13	56th Street WB	36.08226	-95.87073
P-14	56th Street WB	36.08270	-95.86936
P-15	88th East Avenue NB	36.08123	-95.87799
P-16	89th East Avenue NB	36.08152	-95.87693
P-17	90th East Avenue NB	36.08181	-95.87597
P-18	90th East Avenue SB	36.08202	-95.87508
P-19	56th Place EB	36.08080	-95.87597
P-20	56th Place WB	36.08122	-95.87440
P-21	93rd East Avenue NB	36.08154	-95.87310
P-22	57th Street WB	36.08134	-95.87132
P-23	95th East Avenue SB	36.08185	-95.86999
P-24	88th East Avenue SB	36.07936	-95.87803
P-25	89th East Avenue SB	36.07967	-95.87697
P-26	57th Street WB	36.08004	-95.87599
P-27	57th Street EB	36.08041	-95.87408
P-28	92nd East Place NB	36.08039	-95.87322

Table A-1. Approximate Boring Locations			
Boring No.	Streets	Latitude (°)	Longitude (°)
P-29	58th Place WB	36.07941	-95.87203
P-30	87th East Avenue NB	36.07835	-95.87917
P-31	59th Street WB	36.07792	-95.87830
P-32	89th East Avenue SB	36.07812	-95.87746
P-33	59th Street WB	36.07836	-95.87606
P-34	91st East Avenue SB	36.07843	-95.87408
P-35	92nd East Avenue SB	36.07854	-95.87304
P-36	59th Street EB	36.07858	-95.87178
P-37	94th East Place SB	36.07910	-95.87065
P-38	60th Place EB	36.07636	-95.87901
P-39	60th Street EB	36.07705	-95.87784
P-40	59th Place EB	36.07745	-95.87672
P-41	90th East Avenue SB	36.07796	-95.87493
P-42	59th Place WB	36.07727	-95.87404
P-43	59th Place EB	36.07772	-95.87138
P-44	92nd East Avenue NB	36.07695	-95.87248
P-45	60th Street EB	36.07683	-95.87180
P-46	89th East Avenue NB	36.07631	-95.87758
P-47	60th Street WB	36.07671	-95.87601
P-48	60th Street EB	36.07643	-95.87391
P-49	60th Place WB	36.07600	-95.87225

The existing pavement was cored with a 5-inch diameter core barrel. The borings were then advanced by solid flight augers attached to a Skid-Steer Loader. Auger cutting samples of the subgrade soils were collected at depths of 0 to 6 inches and at 6 to 36 inches below the bottom of pavement or at any material change within these depth ranges. The samples were sealed and returned to our laboratory for further examination, classification and testing.

Coring logs included in this APPENDIX, present such data as soil and bedrock descriptions, depths, sampling intervals, and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the drill crew. Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final coring logs represent the engineer's interpretation of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the coring logs were based on observations during our field work, an extrapolation of information obtained by examining samples from the borings 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.

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 7' W. of 81st East Place C/L, Southbound
GPS 36.07983° N / -95.88576° E

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)
P-1	ASPHALT		6.25
	Total Core Thickness		**6.25**

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

Sample No.	Layer Type	Layer Depth (in)
1A	Sandy Lean CLAY (CL): pale olive and light brownish gray, dry to moist	0.0 to 6.0
1B	Clayey SAND (SC): pale olive to olive, dry to moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-01

NASM Zone 7054
Tulsa, OK

CORE

P-01

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 9.5' W. of 82nd East Avenue C/L, Southbound
GPS 36.08142° N / -95.88464° E

TOP

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)
P-2	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
2A	Clayey SAND (SC): olive yellow to olive, dry	0.0 to 6.0
2B	Clayey SAND (SC): olive yellow to olive, dry	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-02

NASM Zone 7054
Tulsa, OK

CORE

P-02

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' E. of 83rd East Avenue C/L, Northbound
GPS 36.08080° N / -95.88393° E

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)
P-3	ASPHALT		6.25
	Total Core Thickness		**6.25**

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

Sample No.	Layer Type	Layer Depth (in)
3A	Clayey SAND (SC): olive and olive yellow, dry to moist, trace gravel.	0.0 to 6.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.
**Auger refusal was encountered on apparent limestone at 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-03

NASM Zone 7054
Tulsa, OK

CORE

P-03

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 9.5' E. of 83rd East Place C/L, Northbound
GPS 36.07963° N / -95.88445° E

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)
P-4	ASPHALT	Separated at 1.5 inches	7.25
	Total Core Thickness		**7.25**

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

Sample No.	Layer Type	Layer Depth (in)
4A	Fill - Sandy Fat CLAY (CH): bluish gray and gray, dry to moist, trace gravel	0.0 to 6.0
4B	Clayey SAND (SC): light brownish gray and olive, dry to moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-04

NASM Zone 7054
Tulsa, OK

CORE

P-04

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' N. of 56th Place C/L, Westbound
GPS 36.08223° N / -95.88263° E

TOP

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)
P-5	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
5A	Sandy Lean CLAY (CL): pale olive to olive, dry	0.0 to 6.0
5B	Clayey SAND (SC): pale olive to olive, dry	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-05

NASM Zone 7054
Tulsa, OK

CORE

P-05

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' E. of 84th East Avenue C/L, Northbound
GPS 36.08058° N / -95.88291° E

TOP

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)
P-6	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
6A	Clayey SAND (SC): pale olive and olive yellow, dry	0.0 to 6.0

REMARKS:
- * Asphalt type based on visual observation only.
**Power auger refusal was encountered in apparent shale 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-06

NASM Zone 7054
Tulsa, OK

CORE

P-06

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' E. of 85th East Avenue C/L, Northbound
GPS 36.07983° N / -95.88139° E

TOP

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)
P-7	ASPHALT		6
	Total Core Thickness		**6**

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

Sample No.	Layer Type	Layer Depth (in)
7A	Clayey SAND (SC): olive and olive yellow, dry to moist	0.0 to 6.0
7B	Clayey SAND (SC): olive to light brown	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-07

NASM Zone 7054
Tulsa, OK

CORE

P-07

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 9' W. of 85th East Avenue C/L, Southbound
GPS 36.08120° N / -95.88073° E

TOP

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)
P-8	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
8A	Clayey SAND (SC): pale olive and yellow, dry to moist	0.0 to 6.0
8B	Clayey SAND (SC): olive to light brown, dry to moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-08

NASM Zone 7054
Tulsa, OK

CORE

P-08

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' S. of 56th Street C/L, Eastbound
GPS 36.08220° N / -95.87918° E

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)
P-9	ASPHALT	Separated at 1.75 inches, cracked 0-1.75 inches	7.5
	Total Core Thickness		**7.5**

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

Sample No.	Layer Type	Layer Depth (in)
9A	Clayey SAND (SC): pale olive and yellow, dry to moist	0.0 to 6.0
9B	Clayey SAND (SC): olive yellow and olive	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-09

NASM Zone 7054
Tulsa, OK

CORE

P-09

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8' N. of 56th Street C/L, Westbound
GPS 36.08224° N / -95.87653° E

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)
P-10	ASPHALT		8.75
	Total Core Thickness		**8.75**

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

Sample No.	Layer Type	Layer Depth (in)
170A	Clayey SAND (SC): light brownish gray and light brownish gray, moist	0.0 to 6.0
10B	Clayey SAND (SC): light brownish gray and olive, moist, trace sand	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-10

NASM Zone 7054
Tulsa, OK

CORE

P-10

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' N. of 56th Street C/L, Westbound
GPS 36.08226° N / -95.87447° E

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)
P-11	ASPHALT	Separated at 4 inches	8.75
	Total Core Thickness		**8.75**

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

Sample No.	Layer Type	Layer Depth (in)
11A	Clayey SAND (SC): gray and light brownish gray, moist	0.0 to 6.0
11B	Clayey SAND (SC): light brownish gray and olive, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-11

NASM Zone 7054
Tulsa, OK

CORE
P-11

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 9.5' S. of 56th Street C/L, Eastbound
GPS 36.08221° N / -95.87214° E

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)
P-12	ASPHALT	Separated at 3.25 inches	8
	Total Core Thickness		**8**

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

Sample No.	Layer Type	Layer Depth (in)
12B	Clayey SAND (SC): gray, moist	0.0 to 6.0
12B	Clayey SAND (SC): gray to bluish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-12

NASM Zone 7054
Tulsa, OK

CORE

P-12

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' N. of 56th Street C/L, Westbound
GPS 36.08226° N / -95.87073° E

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)
P-13	ASPHALT	Separated at 2 inches	8.25
	Total Core Thickness		**8.25**

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

Sample No.	Layer Type	Layer Depth (in)
13A	Clayey SAND (SC): gray, moist	0.0 to 6.0
13B	Clayey SAND (SC): gray to bluish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-13

NASM Zone 7054
Tulsa, OK

CORE

P-13

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8' N. of 56th Street C/L, Westbound
GPS 36.08270° N / -95.86936° E

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)
P-14	ASPHALT		7.5
P-14	AGREGATE BASE		7.5
	Total Core Thickness		**15**

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

Sample No.	Layer Type	Layer Depth (in)
14A	Clayey SAND (SC): gray, moist	0.0 to 6.0
14B	Clayey SAND (SC): gray to bluish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-14

NASM Zone 7054
Tulsa, OK

CORE

P-14

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 9.5' E. of 88th East Avenue C/L, Northbound
GPS 36.08123° N / -95.87799° E

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)
P-15	ASPHALT		6
	Total Core Thickness		**6**

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

Sample No.	Layer Type	Layer Depth (in)
15A	Clayey SAND (SC): olive yellow and yellow, dry to moist	0.0 to 6.0
15B	Clayey SAND (SC): reddish yellow and olive yellow, dry	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-15

NASM Zone 7054
Tulsa, OK

CORE

P-15

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' E. of 89th East Avenue C/L, Northbound
GPS 36.08152° N / -95.87693° E

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)
P-16	ASPHALT	Separated at 4.25 inches, cracked 0-4.25 inches	9.5
	Total Core Thickness		**9.5**

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

Sample No.	Layer Type	Layer Depth (in)
16A	Clayey SAND (SC): gray, moist	0.0 to 6.0
16B	Clayey SAND (SC): gray and olive, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-16

NASM Zone 7054
Tulsa, OK

CORE

P-16

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' E. of 90th East Avenue C/L, Northbound
GPS 36.08181° N / -95.87597° E

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)
P-17	ASPHALT	Separated at 1.5 inches	9
	Total Core Thickness		**9**

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

Sample No.	Layer Type	Layer Depth (in)
17A	Sandy Lean CLAY (CL): gray and light brownish gray, moist	0.0 to 6.0
17B	Sandy Lean CLAY (CL): light brownish gray and olive, moist, trace sand	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-17

NASM Zone 7054
Tulsa, OK

CORE

P-17

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 7.5' W. of 90th East Avenue C/L, Southbound
GPS 36.08202° N / -95.87508° E

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)
P-18	ASPHALT		9.25
	Total Core Thickness		**9.25**

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

Sample No.	Layer Type	Layer Depth (in)
18A	Sandy Fat CLAY (CH): light brownish gray and light brownish gray, moist, trace sand	0.0 to 6.0
18B	Sandy Fat CLAY (CH): light brownish gray and yellowish brown, moist, trace sand	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-18

NASM Zone 7054
Tulsa, OK

CORE

P-18

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' S. of 56th Place C/L, Eastbound
GPS 36.08080° N / -95.87597° E

TOP

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)
P-19	ASPHALT	Separated at 5.25 inches	10
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
19A	Clayey SAND (SC): gray and yellow, dry to moist	0.0 to 6.0
19B	Clayey SAND (SC): light brownish gray and yellow, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-19

NASM Zone 7054
Tulsa, OK

CORE

P-19

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9' N. of 56th Place C/L, Westbound
GPS 36.08122° N / -95.87440° E

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)
P-20	ASPHALT	Separated at 5 inches	10
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
20A	Clayey SAND (SC): gray, moist	0.0 to 6.0
20B	Clayey SAND (SC): light brownish gray to light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-20

NASM Zone 7054
Tulsa, OK

CORE

P-20

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 7.5' E. of 93rd East Avenue C/L, Northbound
GPS 36.08154° N / -95.87310° E

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)
P-21	ASPHALT	Separated at 2.6 inches	7.25
P-21	PORTLAND CEMENT CONCRETE		7.25
	Total Core Thickness		**14.5**

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

Sample No.	Layer Type	Layer Depth (in)
21A	Clayey SAND (SC): gray, moist	0.0 to 6.0
21B	Clayey SAND (SC): gray to light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-21

NASM Zone 7054
Tulsa, OK

CORE

P-21

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' N. of 57th Street C/L, Westbound
GPS 36.08134° N / -95.87132° E

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)
P-22	ASPHALT	Separated at 2.13 inches	8
	Total Core Thickness		**8**

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

Sample No.	Layer Type	Layer Depth (in)
22A	Clayey SAND (SC): gray, moist	0.0 to 6.0
22B	Clayey SAND (SC): gray to bluish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-22

NASM Zone 7054
Tulsa, OK

CORE

P-22

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' W. of 95th East Avenue C/L, Southbound
GPS 36.08185° N / -95.86999° E

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)
P-23	ASPHALT	Separated at 1.5 inches	8
	Total Core Thickness		**8**

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

Sample No.	Layer Type	Layer Depth (in)
23A	Clayey SAND (SC): gray, moist	0.0 to 6.0
23B	Clayey SAND (SC): gray to bluish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-23

NASM Zone 7054
Tulsa, OK

CORE

P-23

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8' W. of 88th East Avenue C/L, Southbound
GPS 36.07936° N / -95.87803° E

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)
P-24	ASPHALT		7.75
	Total Core Thickness		**7.75**

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

Sample No.	Layer Type	Layer Depth (in)
24A	Clayey SAND (SC): olive and light brownish gray, moist	0.0 to 6.0
24B	Clayey SAND (SC): light brownish gray mottled olive yellow, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-24

NASM Zone 7054
Tulsa, OK

CORE

P-24

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8.5' W. of 89th East Avenue C/L, Southbound
GPS 36.07967° N / -95.87697° E

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)
P-25	ASPHALT	Separation at 2.5 inches	8.25
	Total Core Thickness		**8.25**

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

Sample No.	Layer Type	Layer Depth (in)
25A	Clayey SAND (SC): gray, moist	0.0 to 6.0
25B	Clayey SAND (SC): gray and olive, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-25

NASM Zone 7054
Tulsa, OK

CORE

P-25

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 7.5' N. of 57th Street C/L, Westbound
GPS 36.08004° N / -95.87599° E

TOP

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)
P-26	ASPHALT	Separated at 2.75 inches and 4.75 inches, cracked 0-5 inches	9.5
	Total Core Thickness		**9.5**

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

Sample No.	Layer Type	Layer Depth (in)
26A	Clayey SAND (SC): light brownish gray to olive brown, dry to moist, trace gravel	0.0 to 6.0
26B	Clayey SAND (SC): light brownish gray and olive, dry	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-26

NASM Zone 7054
Tulsa, OK

CORE

P-26

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8' S. of 57th Street C/L, Eastbound
GPS 36.08041° N / -95.87408° E

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)
P-27	ASPHALT	Separated at 4.5 inches, cracked 0-1.5 inches	8.75
	Total Core Thickness		**8.75**

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

Sample No.	Layer Type	Layer Depth (in)
27A	Clayey SAND (SC): gray and light brownish gray, moist	0.0 to 6.0
27B	Clayey SAND (SC): light brownish gray and light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-27

NASM Zone 7054
Tulsa, OK

CORE

P-27

PROJECT / LOCATION DATA:

CORE DATE September 28, 2017
LOCATION 8' E. of 92nd East Place C/L, Northbound
GPS 36.08039° N / -95.87322° E

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)
P-28	ASPHALT	Separated at 2.62 inches	9.25
	Total Core Thickness		**9.25**

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

Sample No.	Layer Type	Layer Depth (in)
28A	Clayey SAND (SC): gray, moist	0.0 to 6.0
28B	Clayey SAND (SC): gray and light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-28

NASM Zone 7054
Tulsa, OK

CORE

P-28

PROJECT / LOCATION DATA:

CORE DATE October 2, 2017
LOCATION 9' N. of 58th Place C/L, Westbound
GPS 36.07941° N / -95.87203° E

TOP

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)
P-29	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
29A	Clayey SAND (SC): gray, moist	0.0 to 6.0
29B	Clayey SAND (SC): light brownish gray and yellow, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-29

NASM Zone 7054
Tulsa, OK

CORE

P-29

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 7.5' E. of 87th East Avenue C/L, Northbound
GPS 36.07835° N / -95.87917° E

TOP

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)
P-30	ASPHALT		7
P-30	AGGREGATE BASE		3
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
30A	Clayey SAND (SC): light brownish gray and yellow, dry to moist	0.0 to 6.0
30B	Clayey SAND (SC): light brownish gray and yellow, moist	6.0 to 24.0
30C	Lean CLAY with Sand (CL): light brownish gray and yellow, moist	24.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-30

NASM Zone 7054
Tulsa, OK

CORE
P-30

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' N. of 59th Street C/L, Westbound
GPS 36.07792° N / -95.87830° E

TOP

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)
P-31	ASPHALT		6.75
	Total Core Thickness		**6.75**

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

Sample No.	Layer Type	Layer Depth (in)
31A	Clayey SAND (SC): gray and yellow, moist, trace gravel	0.0 to 6.0

REMARKS:
- * Asphalt type based on visual observation only.
** Power auger refusal was encountered at 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-31

NASM Zone 7054
Tulsa, OK

CORE

P-31

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 14' W. of 89th East Avenue C/L, Southbound
GPS 36.07812° N / -95.87746° E

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)
P-32	ASPHALT	Separated at 5.25 inches	10
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
32A	Clayey SAND (SC): light brownish gray and yellow, dry to moist, trace gravel	0.0 to 6.0
32B	Clayey SAND (SC): light brownish gray and yellow, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-32

NASM Zone 7054
Tulsa, OK

CORE

P-32

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9.5' N. of 59th Street C/L, Westbound
GPS 36.07836° N / -95.87606° E

TOP

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)
P-33	ASPHALT		7
	Total Core Thickness		**7**

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

Sample No.	Layer Type	Layer Depth (in)
33A	Clayey SAND (SC): olive and yellow, moist, trace gravel	0.0 to 6.0
33B	Clayey SAND (SC): olive and light brownish gray, moist, trace gravel	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-33

NASM Zone 7054
Tulsa, OK

CORE

P-33

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' W. of 91st East Avenue C/L, Southbound
GPS 36.07843° N / -95.87408° E

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)
P-34	ASPHALT		7.25
	Total Core Thickness		**7.25**

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

Sample No.	Layer Type	Layer Depth (in)
34A	Clayey SAND (SC): gray and greenish black, moist, trace gravel	0.0 to 6.0
34B	Clayey SAND (SC): light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-34

NASM Zone 7054
Tulsa, OK

CORE

P-34

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' W. of 92nd East Avenue C/L, Southbound
GPS 36.07854° N / -95.87304° E

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)
P-35	ASPHALT		7.25
	Total Core Thickness		**7.25**

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

Sample No.	Layer Type	Layer Depth (in)
35A	Clayey SAND (SC): light brownish gray and greenish black, moist	0.0 to 6.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.
** Power auger refusal was encountered at 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-35

NASM Zone 7054
Tulsa, OK

CORE

P-35

PROJECT / LOCATION DATA:

CORE DATE October 2, 2017
LOCATION 8' S. of 59th Street C/L, Eastbound
GPS 36.07858° N / -95.87178° E

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)
P-36	ASPHALT		7
	Total Core Thickness		**7**

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

Sample No.	Layer Type	Layer Depth (in)
36A	Clayey SAND (SC): gray, moist	0.0 to 6.0
36B	Clayey SAND (SC): gray to light brownish gray, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-36

NASM Zone 7054
Tulsa, OK

CORE

P-36

PROJECT / LOCATION DATA:

CORE DATE October 2, 2017
LOCATION 7.5' W. of 94th East Place C/L, Southbound
GPS 36.07910° N / -95.87065° E

TOP

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)
P-37	ASPHALT		5.5
	Total Core Thickness		**5.5**

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

Sample No.	Layer Type	Layer Depth (in)
37A	Sandy Fat CLAY (CH): gray, moist	0.0 to 6.0
37B	Sandy Fat CLAY (CH): gray to light brownish gray, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-37

NASM Zone 7054
Tulsa, OK

CORE

P-37

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8' S. of 60th Place C/L, Eastbound
GPS 36.07636° N / -95.87901° E

TOP

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)
P-38	ASPHALT		7
	Total Core Thickness		**7**

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

Sample No.	Layer Type	Layer Depth (in)
38A	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	0.0 to 6.0

REMARKS:
- * Asphalt type based on visual observation only.
** Power auger refusal was encountered at 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-38

NASM Zone 7054
Tulsa, OK

CORE

P-38

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9' S. of 60th Street C/L, Eastbound
GPS 36.07705° N / -95.87784° E

TOP

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)
P-39	ASPHALT		6.6
	Total Core Thickness		**6.6**

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

Sample No.	Layer Type	Layer Depth (in)
39A	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	0.0 to 6.0
39B	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-39

NASM Zone 7054
Tulsa, OK

CORE
P-39

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9' S. of 59th Place C/L, Eastbound
GPS 36.07745° N / -95.87672° E

TOP

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)
P-40	ASPHALT		7.6
	Total Core Thickness		**7.6**

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

Sample No.	Layer Type	Layer Depth (in)
40A	Clayey SAND (SC): light brownish gray and greenish black, dry to moist, trace gravel	0.0 to 6.0
40B	Clayey SAND (SC): light brownish gray and yellow, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-40

NASM Zone 7054
Tulsa, OK

CORE

P-40

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9.5' W. of 90th East Avenue C/L, Southbound
GPS 36.07796° N / -95.87493° E

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)
P-41	ASPHALT		7.5
	Total Core Thickness		**7.5**

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

Sample No.	Layer Type	Layer Depth (in)
41A	Clayey SAND (SC): light brownish gray and yellow, dry to moist	0.0 to 6.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.
** Power auger refusal was encountered at 6 inches below the bottom of the pavement.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-41

NASM Zone 7054
Tulsa, OK

CORE

P-41

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8.5' N. of 59th Place C/L, Westbound
GPS 36.07727° N / -95.87404° E

TOP

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)
P-42	ASPHALT		7.25
	Total Core Thickness		**7.25**

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

Sample No.	Layer Type	Layer Depth (in)
42A	Clayey SAND (SC): gray and greenish black, moist, trace gravel	0.0 to 6.0
42B	Clayey SAND (SC): light brownish gray, moist, trace gravel	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20182007
DRAWN BY: MAP
CHECKED BY: SYW
DATE: 11/29/2017
REVISED: -

PAVEMENT CORING LOG P-42

NASM Zone 7054
Tulsa, OK

CORE
P-42

PROJECT / LOCATION DATA:

CORE DATE October 2, 2017
LOCATION 7.5' S. of 59th Place C/L, Eastbound
GPS 36.07772° N / -95.87138° E

TOP

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)
P-43	ASPHALT	Cracked 0-5.5 inches, disintegrated below 3.5 inches	5.5
P-43	AGGREGATE BASE		2
	Total Core Thickness		**7.5**

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

Sample No.	Layer Type	Layer Depth (in)
43A	Clayey SAND (SC): gray, moist	0.0 to 6.0
43B	Clayey SAND (SC): gray to light brownish gray, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-43

NASM Zone 7054
Tulsa, OK

CORE

P-43

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8' E. of 92nd East Avenue C/L, Northbound
GPS 36.07695° N / -95.87248° E

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)
P-44	ASPHALT		7.5
	Total Core Thickness		**7.5**

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

Sample No.	Layer Type	Layer Depth (in)
44A	Clayey SAND (SC): light brownish gray and greenish black, moist, trace gravel	0.0 to 6.0
44B	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-44

NASM Zone 7054
Tulsa, OK

CORE

P-44

PROJECT / LOCATION DATA:

CORE DATE October 2, 2017
LOCATION 7' S. of 60th Street C/L, Eastbound
GPS 36.07683° N / -95.87180° E

TOP

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)
P-45	ASPHALT	Separation at 2 inches, cracked 0-2 inches	6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
45A	Clayey SAND (SC): gray, moist	0.0 to 6.0
45B	Clayey SAND (SC): gray to light brownish gray, moist	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-45

NASM Zone 7054
Tulsa, OK

CORE

P-45

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 13.5' E. of 89th East Avenue C/L, Northbound
GPS 36.07631° N / -95.87758° E

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)
P-46	ASPHALT		6.5
	Total Core Thickness		**6.5**

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

Sample No.	Layer Type	Layer Depth (in)
46A	Clayey SAND (SC): olive brown and yellow, dry to moist	0.0 to 6.0
46B	Clayey SAND (SC): olive brown and yellow, moist	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-46

NASM Zone 7054
Tulsa, OK

CORE

P-46

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 8' N. of 60th Street C/L, Westbound
GPS 36.07671° N / -95.87601° E

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)
P-47	ASPHALT	Separation at 2.5 inches	7.25
	Total Core Thickness		**7.25**

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

Sample No.	Layer Type	Layer Depth (in)
47A	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	0.0 to 6.0
47B	Clayey SAND (SC): light brownish gray and bluish gray, moist, trace gravel	6.0 to 36.0

TOP

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-47

NASM Zone 7054
Tulsa, OK

CORE

P-47

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 9' S. of 60th Street C/L, Eastbound
GPS 36.07643° N / -95.87391° E

TOP

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)
P-48	ASPHALT	Separation at 2 inches, cracked 0-1.75 inches	7.3
	Total Core Thickness		**7.3**

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

Sample No.	Layer Type	Layer Depth (in)
48A	Clayey SAND (SC): light brownish gray and greenish black, moist, trace gravel	0.0 to 6.0
48B	Clayey SAND (SC): light brownish gray and yellow, moist, trace gravel	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20182007
DRAWN BY:	MAP
CHECKED BY:	SYW
DATE:	11/29/2017
REVISED:	-

PAVEMENT CORING LOG P-48

NASM Zone 7054
Tulsa, OK

CORE

P-48

PROJECT / LOCATION DATA:

CORE DATE September 29, 2017
LOCATION 5.5' N. of 60th Place C/L, Westbound
GPS 36.07600° N / -95.87225° E

TOP

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)
P-49	ASPHALT		7.5
	Total Core Thickness		**7.5**

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

Sample No.	Layer Type	Layer Depth (in)
49A	Clayey SAND (SC): gray and greenish black, moist, trace gravel	0.0 to 6.0
49B	Clayey SAND (SC): light brownish gray and gray, moist, trace gravel	6.0 to 36.0

REMARKS:
- * Asphalt type based on visual observation only.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20182007
DRAWN BY: MAP
CHECKED BY: SYW
DATE: 11/29/2017
REVISED: -

PAVEMENT CORING LOG P-49

NASM Zone 7054
Tulsa, OK

CORE
P-49

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B
LABORATORY TESTING PROGRAM

Laboratory tests were performed on select, representative samples to evaluate pertinent engineering properties of these materials. We directed our laboratory testing program primarily toward classifying the subsurface materials as well as measuring index values of the on-site materials. Laboratory tests were performed in general accordance with applicable standards. The results of the laboratory tests are presented on the respective boring logs. The laboratory testing program consisted of the following:

- **Moisture content tests**, ASTM D 2216, Standard Test Method for Laboratory Determination of Water
- **Atterberg limits**, ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- **Sieve Analysis**, ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- **Visual classification**, ASTM D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

Exploration ID	Depth (ft.)	Sample No.	Sample Description	USCS	AASHTO	OKLAHOMA SOIL INDEX (OSI)	Water Content (%)	Atterberg Limits			Sieve Analysis (%)				
								Liquid Limits	Plastic Limits	Plasticity Index	Passing #4	Passing #10	Passing #40	Passing #100	Passing #200
P-01	0.0 - 0.5	1A	SANDY LEAN CLAY	CL	A-6		17.4	34	20	14	95	94	73		61
P-01	0.5 - 3.0	1B	CLAYEY SAND	SC	A-2-6		16.6	29	17	12	98	97	49		35
P-02	0.0 - 0.5	2A	CLAYEY SAND	SC	A-6		17.8	39	20	19	100	99	50		39
P-02	0.5 - 3.0	2B	CLAYEY SAND	SC	A-6		14.1	33	18	15	100	99	58		44
P-03	0.0 - 0.5	3A	CLAYEY SAND	SC	A-6		23.6	40	22	18	90	88	48		40
P-04	0.0 - 0.5	4A	SANDY FAT CLAY	CH	A-7-6		20.6	52	26	26	100	98	52		50
P-04	0.5 - 3.0	4B	CLAYEY SAND	SC	A-7-6		18.7	45	17	28	100	99	55		46
P-05	0.0 - 0.5	5A	SANDY LEAN CLAY	CL	A-6		22.9	32	19	13	100	98	57		50
P-05	0.5 - 3.0	5B	CLAYEY SAND	SC	A-7-6		18.9	45	21	24	100	99	42		38
P-06	0.0 - 0.5	6A	CLAYEY SAND	SC	A-6		17.9	32	18	14	100	98	45		40
P-07	0.0 - 0.5	7A	CLAYEY SAND	SC	A-7-6		20.5	42	21	21	100	100	57		47
P-08	0.5 - 3.0	8B	CLAYEY SAND	SC	A-7-6		20.5	45	22	23	100	99	46		39
P-09	0.0 - 0.5	9A	CLAYEY SAND	SC	A-2-7		22.8	50	26	24	100	95	39		34
P-10	0.0 - 0.5	10A	CLAYEY SAND	SC	A-7-6		25.0	55	12	43	100	96	47		44
P-11	0.0 - 0.5	11A	CLAYEY SAND	SC	A-7-6		22.3	47	14	33	100	100	57		50
P-12	0.5 - 3.0	12B	CLAYEY SAND	SC	A-7-6		25.7	59	19	40	100	98	47		46
P-13	0.0 - 0.5	13A	CLAYEY SAND	SC	A-7-6		20.6	45	17	28	100	98	52		47
P-14	0.0 - 0.5	14A	CLAYEY SAND	SC	A-7-6		24.3	45	18	27	100	97	48		44
P-15	0.0 - 0.5	15A	CLAYEY SAND	SC	A-7-6		20.3	51	22	29	100	95	46		43
P-16	0.5 - 3.0	16B	CLAYEY SAND	SC	A-7-6		22.1	63	19	44	100	97	49		45
P-17	0.0 - 0.5	17A	SANDY LEAN CLAY	CL	A-7-6		24.4	44	17	27	100	99	60		54
P-18	0.0 - 0.5	18A	SANDY FAT CLAY	CH	A-7-6		21.1	50	15	35	100	96	57		52
P-19	0.5 - 3.0	19B	CLAYEY SAND	SC	A-7-6		19.6	47	19	28	100	97	48		46
P-20	0.0 - 0.5	20A	CLAYEY SAND	SC	A-7-6		26.2	53	16	37	100	95	50		42
P-21	0.0 - 0.5	21A	CLAYEY SAND	SC	A-7-6		30.6	56	20	36	100	94	44		43
P-22	0.5 - 3.0	22B	CLAYEY SAND	SC	A-7-6		26.9	60	24	36	100	95	43		42
P-23	0.0 - 0.5	23A	CLAYEY SAND	SC	A-7-6		22.8	53	24	29	100	98	49		46
P-24	0.5 - 3.0	24B	CLAYEY SAND	SC	A-7-6		19.3	52	17	35	100	93	43		40

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = Nonplastic
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20182007
DRAWN BY: MAP
CHECKED BY:
DATE:
REVISED: -

LABORATORY TEST RESULT SUMMARY

NASM Zone 7054
Tulsa, OK

TABLE
B-1

Exploration ID	Depth (ft.)	Sample No.	Sample Description	USCS	AASHTO	OKLAHOMA SOIL INDEX (OSI)	Water Content (%)	Atterberg Limits			Sieve Analysis (%)				
								Liquid Limits	Plastic Limits	Plasticity Index	Passing #4	Passing #10	Passing #40	Passing #100	Passing #200
P-25	0.5 - 3.0	25B	CLAYEY SAND	SC	A-7-6		25.2	55	25	30	100	96	43		41
P-26	0.0 - 0.5	26A	CLAYEY SAND	SC	A-7-6		21.1	42	15	27	100	96	47		43
P-27	0.5 - 3.0	27B	CLAYEY SAND	SC	A-7-6		25.8	66	15	51	100	95	46		44
P-28	0.5 - 3.0	28B	CLAYEY SAND	SC	A-7-6		22.9	67	16	51	100	94	45		42
P-29	0.0 - 0.5	29A	CLAYEY SAND	SC	A-7-6		27.0	60	22	38	100	94	45		42
P-30	0.5 - 2.0	30B	CLAYEY SAND	SC	A-6		19.3	32	13	19	100	99	52		39
P-31	0.0 - 0.5	31A	SILTY SAND	SM	A-2-4		30.7	34	24	10	100	98	47		30
P-32	0.5 - 3.0	32B	CLAYEY SAND	SC	A-7-6		18.9	50	19	31	100	98	52		47
P-33	0.0 - 0.5	33A	CLAYEY SAND	SC	A-7-6		23.3	50	18	32	100	97	48		41
P-34	0.0 - 0.5	34A	CLAYEY SAND	SC	A-7-6		27.3	48	20	28	100	96	44		40
P-35	0.0 - 0.5	35A	CLAYEY SAND	SC	A-2-6		32.4	35	23	12	100	98	50		31
P-36	0.5 - 3.0	36B	CLAYEY SAND	SC	A-7-6		23.9	61	17	44	100	97	40		38
P-37	0.0 - 0.5	37A	SANDY FAT CLAY	CH	A-7-6		20.7	57	23	34	100	99	59		55
P-38	0.0 - 0.5	38A	CLAYEY SAND	SC	A-2-7		30.3	43	25	18	100	98	51		26
P-39	0.0 - 0.5	39A	CLAYEY SAND	SC	A-7-6		22.6	43	20	23	100	98	48		42
P-40	0.0 - 0.5	40A	CLAYEY SAND	SC	A-2-7		24.4	46	21	25	100	96	46		35
P-41	0.0 - 0.5	41A	SILTY SAND	SM	A-1-b		34.1	NP	NP	NP	100	96	44		22
P-42	0.5 - 3.0	42B	CLAYEY SAND	SC	A-6		25.8	39	17	22	100	98	55		49
P-43	0.5 - 3.0	43B	CLAYEY SAND	SC	A-7-6		23.8	46	17	29	100	97	50		47
P-44	0.5 - 3.0	44B	CLAYEY SAND	SC	A-6		22.7	39	19	20	100	96	45		39
P-45	0.5 - 3.0	45B	CLAYEY SAND	SC	A-7-6		21.1	46	18	28	100	97	51		47
P-46	0.0 - 0.5	46A	CLAYEY SAND	SC	A-7-6		25.9	47	25	22	100	99	54		43
P-47	0.5 - 3.0	47B	CLAYEY SAND	SC	A-7-6		24.7	52	20	32	100	93	47		43
P-48	0.5 - 3.0	48B	CLAYEY SAND	SC	A-7-6		21.5	55	19	36	100	95	50		46
P-49	0.5 - 3.0	49B	CLAYEY SAND	SC	A-7-6		20.6	45	17	28	100	97	51		47

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = Nonplastic
NA = Not Available

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20182007
DRAWN BY: MAP
CHECKED BY:
DATE:
REVISED: -

LABORATORY TEST RESULT SUMMARY

NASM Zone 7054
Tulsa, OK

TABLE
B-2

APPENDIX C

GBA DOCUMENT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org