GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE
ZONE 9049
TULSA, OKLAHOMA
KLEINFELDER PROJECT NO. 20182008.001A

OCTOBER 12, 2017

A Report Prepared for:

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GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE ZONE 9049
TULSA, OKLAHOMA

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October 12, 2017
Kleinfelder Project No. 20182008.001A

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October 12, 2017
Kleinfelder Project No.: 20182008.001A/TUL17R67199

Mr. Damon D. Domer, PE
Garver, LLC
6450 South Lewis Avenue, Suite 300
Tulsa, OK 74136

Subject: **Geotechnical Engineering Report**
Non-Arterial Street Maintenance Zone 9049
Tulsa, Oklahoma

Dear Mr. Domer:

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. TUL17P61665 dated June 22, 2017. The purpose of the geotechnical study was to explore and evaluate the subsurface conditions at 47 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, INC.
Certificate of Authorization #7292, Expires 6/30/19

Simon Wang, PE
Staff Professional II

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GEOTECHNICAL ENGINEERING REPORT
NON-ARTERIAL STREET MAINTENANCE ZONE 9049
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 9049 in Tulsa, Oklahoma. The services provided were in general accordance with our proposal/contract No. TUL17P61665 dated June 22, 2017, executed on September 14, 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 9049 will be rehabilitated. NASM Zone 9049 encompasses all streets bounded by East 51st Street South / Interstate (I)-44 to the north, East 59th Street to the south, South Lewis Avenue to the east and South Utica Avenue to the west. The proposed rehabilitation will consist of full depth reconstruction 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 East 51st Street South/Interstate (I)-44 to the north, East 59th Street to the south, South Lewis Avenue to the east and South Utica Avenue to the west. The surrounding areas of the project site is a residential neighborhood. The existing roadways within the study area are two-lane roadways covered by a combination of asphaltic concrete and Portland cemented concrete with curb and gutters and have widths of approximately 25 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 47 borings (P-1 through P-47) between September 21 and 25, 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 pavement cores P-1, P-2, P-4, P-5, and P-19 through P-24 consisted of approximately 5 to 6¾ inches of Portland cemented concrete pavement. Pavement cores P-6, P-11, P-15, and P-16 consisted of approximately 2 to 5 inches of asphaltic concrete pavement over 4½ to 6¾ inches of Portland cemented concrete pavement. The remaining pavement cores consisted of approximately 3½ to 9¾ inches of asphalt pavement. Approximately 3 to 8¾ inches of treated base was encountered in borings P-8, P-25, P-27, P-28, P-30, P-31, P-35, and P-45. Approximately 4 and 5¾ inches of aggregate base was observed in borings P-3 and P-7, respectively. Aggregate base was not observed in any of the other locations.

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. 36.08877 W. -95.96692	5.75” PCC	1A 1B	16.6 -	27 -	18 -	9 -	86 -	Lean Clay (CL) Lean Clay (CL)
P-2	N. 36.08729 W. -95.96697	6.0” PCC	2A 2B	- 16.1	- 27	- 19	- 8	- 87	Lean Clay (CL) Lean Clay (CL)
P-3	N. 36.08688 W. -95.96635	6.5” AC 4.0” Aggregate Base	3A 3B	- 12.8	- 28	- 18	- 10	- 86	Lean Clay (CL) Lean Clay (CL)
P-4	N. 36.08619 W. -95.96693	5.25” PCC	4A 4B	- 11.0	- 32	- 15	- 17	- 92	Lean Clay (CL) Lean Clay (CL)
P-5	N. 36.08485 W. -95.96699	6.75” PCC	5A 5B	- 26.2	- 58	- 14	- 44	- 96	Fat Clay (CH) Fat Clay (CH)
P-6	N. 36.08367 W. -95.96697	2.0” AC 6.75” PCC	6A 6B	20.2 -	46 -	15 -	31 -	95 -	Lean Clay (CL) Lean Clay (CL)
P-7	N. 36.08198 W. -95.96692	9.25” AC 5.75” Aggregate Base	7A 7B	11.5 -	32 -	13 -	19 -	63 -	Sandy Lean Clay (CL) Lean Clay (CL)
P-8	N. 36.08087 W. -95.96688	9.75” AC 3.0” Treated Base	8A 8B	22.3 -	49 -	14 -	35 -	91 -	Lean Clay (CL) Lean Clay (CL)
P-9	N. 36.07883 W. -95.96688	9.5” AC	9A 9B	- 18.4	- 34	- 15	- 19	- 93	Lean Clay (CL) Lean Clay (CL)
P-10	N. 36.07862 W. -95.96617	9.75” AC	10A 10B	9.7 -	26 -	17 -	9 -	86 -	Lean Clay (CL) Lean Clay (CL)
P-11	N. 36.08047 W. -95.96559	5.0” AC 5.0” PCC	11A 11B	- 21.9	- 41	- 12	- 29	- 95	Lean Clay (CL) Lean Clay (CL)
P-12	N. 36.08125 W. -95.96409	8.5” AC	12A 12B	- 15.9	- 36	- 13	- 23	- 93	Lean Clay (CL) Lean Clay (CL)
P-13	N. 36.08209 W. -95.96360	7.5” AC	13A 13B	- 20.1	- 37	- 16	- 21	- 93	Lean Clay (CL) Lean Clay (CL)
P-14	N. 36.08113 W. -95.96267	9.25” AC	14A 14B	13.5 -	31 -	16 -	15 -	87 -	Lean Clay (CL) Lean Clay (CL)
P-15	N. 36.08028 W. -95.96270	4.75” AC 4.5” PCC	15A 15B	- 17.4	- 29	- 16	- 13	- 94	Lean Clay (CL) Lean Clay (CL)
P-16	N. 36.07962 W. -95.96472	4.5” AC 4.5” PCC	16A 16B	- 12.5	- NP	- NP	- NP	- 89	Silty Sand (SM) Silt (ML)
P-17	N. 36.07882 W. -95.96442	9.75” AC	17A 17B	19.5 -	37 -	14 -	23 -	94 -	Lean Clay (CL) Lean Clay (CL)
P-18	N. 36.07928 W. -95.96344	7.75” AC	18A 18B	- 16.1	- 29	- 17	- 12	- 95	Lean Clay (CL) Lean Clay (CL)
P-19	N. 36.07893 W. -95.96210	6.0” PCC	19A 19B	- 7.2	- 28	- 15	- 13	- 74	Lean Clay w/ Sand (CL) Lean Clay w/ Sand (CL)
P-20	N. 36.08051 W. -95.96162	6.25” PCC	20A 20B	- 10.8	- 26	- 17	- 9	- 83	Lean Clay w/ Sand (CL) Lean Clay w/ Sand (CL)
P-21	N. 36.08204 W. -95.96159	5.0” PCC	21A 21B	17.4 -	36 -	12 -	24 -	86 -	Lean Clay (CL) Lean Clay (CL)

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-22	N. 36.08151 W. -95.96064	6.75” PCC	22A 22B	16.1 -	40 -	13 -	27 -	97 -	Lean Clay (CL) Lean Clay (CL)
P-23	N. 36.07982 W. -95.96062	6.5” PCC	23A 23B	4.8 -	NP -	NP -	NP -	52 -	Sandy Silt (ML) Sandy Silt (ML)
P-24	N. 36.07892 W. -95.95916	6.0” PCC	24A 24B	- 8.3	- NP	- NP	- NP	- 52	Sandy Silt (ML) Sandy Silt (ML)
P-25	N. 36.08143 W. -95.95932	3.5” AC 6.5” Treated Base	25A 25B	- 21.9	- 36	- 14	- 22	- 95	Lean Clay (CL) Lean Clay (CL)
P-26	N. 36.08298 W. -95.96125	8.0” AC	26A 26B	- 13.6	- 31	- 13	- 18	- 89	Lean Clay (CL) Lean Clay (CL)
P-27	N. 36.08310 W. -95.96366	3.75” AC 5.5” Treated Base	27A 27B	- 25.8	- 40	- 14	- 26	- 95	Lean Clay (CL) Lean Clay (CL)
P-28	N. 36.08386 W. -95.96463	6.0” AC 5.5” Treated Base	28A 28B	- 15.3	- 39	- 14	- 25	- 95	Lean Clay (CL) Lean Clay (CL)
P-29	N. 36.08487 W. -95.96458	8.5” AC	29A 29B	16.1 -	20 -	12 -	8 -	60 -	Sandy Lean Clay (CL) Sandy Lean Clay (CL)
P-30	N. 36.08720 W. -95.96458	5.0”AC 7.5” Treated Base	30A 30B	- 15.1	- 36	- 14	- 22	- 95	Lean Clay (CL) Lean Clay (CL)
P-31	N. 36.08890 W. -95.96466	5.0” AC 5.0” Treated Base	31A 31B	- 19.5	- 34	- 14	- 20	- 94	Lean Clay (CL) Lean Clay (CL)
P-32	N. 36.08819 W. -95.96375	6.5” AC	32A 32B	- 10.8	- 31	- 14	- 17	- 95	Lean Clay (CL) Lean Clay (CL)
P-33	N. 36.08615 W. -95.96380	7.75” AC	33A 33B	22.8 -	44 -	14 -	30 -	94 -	Lean Clay (CL) Lean Clay (CL)
P-34	N. 36.08435 W. -95.96374	7.0” AC	34A 34B	- 2.3	- NP	- NP	- NP	- 7.5	Lean Clay (CL) Well-Graded Sand w/ Silt (SW-SM)
P-35	N. 36.08365 W. -95.96244	6.75” AC 4.0” Treated Base	35A 35B	- 16.5	- 37	- 14	- 23	- 94	Lean Clay (CL) Lean Clay (CL)
P-36	N. 36.08514 W. -95.96296	7.38” AC	36A 36B	- 21.7	- 43	- 12	- 31	- 97	Lean Clay (CL) Lean Clay (CL)
P-37	N. 36.08651 W. -95.96303	8.75” AC	37A 37B	21.1 -	44 -	13 -	31 -	97 -	Lean Clay (CL) Lean Clay (CL)
P-38	N. 36.08749 W. -95.96151	8.25” AC	38A 38B	- 19.8	- 46	- 11	- 35	- 94	Lean Clay (CL) Lean Clay (CL)
P-39	N. 36.08679 W. -95.96202	8.25” AC	39A 39B	21.6 -	51 -	14 -	37 -	100 -	Fat Clay (CH) Fat Clay (CH)
P-40	N. 36.08516 W. -95.96189	8.75” AC	40A 40B	- 20.9	- 38	- 12	- 26	- 81	Lean Clay w/ Sand (CL) Lean Clay w/ Sand (CL)
P-41	N. 36.08366 W. -95.96049	6.5” AC	41A 41B	- 18.7	- 31	- 16	- 15	- 94	Lean Clay (CL) Lean Clay (CL)
P-42	N. 36.08576 W. -95.96068	7.0” AC	42A 42B	- 22.4	- 40	- 13	- 27	- 98	Lean Clay (CL) Lean Clay (CL)

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-43	N. 36.08648 W. -95.96076	7.75" AC	43A 43B	24.4	51 -	15 -	36 -	96 -	Fat Clay (CH) Fat Clay (CH)
P-44	N. 36.08649 W. -95.95952	8.25" AC	44A 44B	- 12.0	- NP	- NP	- NP	- 61	Sandy Silt (ML) Sandy Silt (ML)
P-45	N. 36.08520 W. -95.95982	7.25" AC 8.75" Treated Base	45A 45B	14.7 -	29 -	15 -	14 -	91 -	Lean Clay (CL) Lean Clay (CL)
P-46	N. 36.08435 W. -95.95927	7.75" AC	46A 46B	- 14.9	- 27	- 14	- 13	- 89	Lean Clay (CL) Lean Clay (CL)
P-47	N. 36.08516 W. -95.95876	6.75" AC	47A 47B	- 13.7	- NP	- NP	- NP	- 62	Sandy Silt (ML) Sandy Silt (ML)

*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 with varying amounts of sand and silt with varying amounts of sand. 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.

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 pavement cores P-1, P-2, P-4, P-5, and P-19 through P-24 consisted of approximately 5 to 6¾ inches of Portland cemented concrete pavement. Pavement cores P-6, P-11, P-15, and P-16 consisted of approximately 2 to 5 inches of asphaltic concrete pavement over 4½ to 6¾ inches of Portland cemented concrete pavement. The remaining pavement cores consisted of approximately 3½ to 9¾ inches of asphalt pavement. Approximately 3 to 8¾ inches of treated base was encountered in borings P-8, P-25, P-27, P-28, P-30, P-31, P-35, and P-45.

Approximately 4 and 5¾ inches of aggregate base was observed in borings P-3 and P-7, respectively. Aggregate base was not observed in any of the other locations.

3.2.3 Medium to High Plasticity Clay Soils

Clay soils that have a moderate to moderately high shrink-swell potential (PI >=22) were observed in 21 out of the 47 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 SITE DEVELOPMENT

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 and/or unstable areas. Soft and/or unstable 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 moderately 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 6 inches of ODOT Type “A” aggregate base could be performed. If City of Tulsa preferred pavement sections (Option 4 for Asphalt and Option 2 for PCC pavements 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 the use of 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 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

4.1 CONSTRUCTION OBSERVATION AND TESTING

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. EXLORATION LOCATION PLAN AND VICINITY MAP

PLOTTED: 10/11/2017 6:42:29 AM BY: SWang

GIS FILE: C:\Users\swang\Desktop\20182008_Boring Location Diagram.mxd

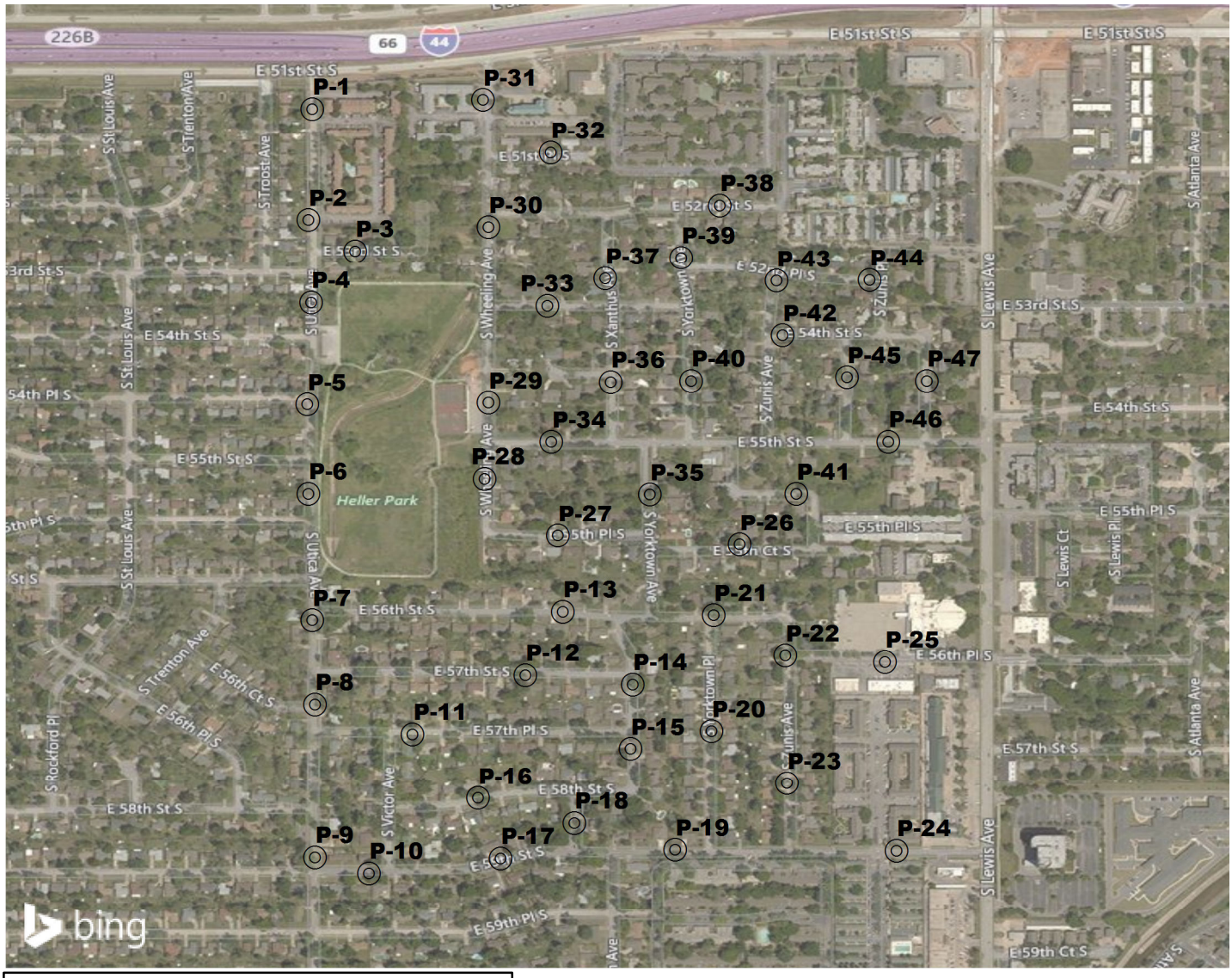
N

LEGEND

◎ PAVEMENT CORING

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

VICINITY MAP NOT TO SCALE



0 800 1600

1 " = 800 SCALE IN FEET

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PROJECT NO.	20182008
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CHECKED BY:	KR
DATE:	10/11/2017
REVISED:	-

EXPLORATION LOCATION PLAN AND VICINITY MAP

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, Oklahoma

FIGURE
1

APPENDIX A

FIELD EXPLORATION PROGRAM

APPENDIX A
FIELD EXPLORATION PROGRAM

Kleinfelder conducted the field exploration for this study between September 21 and 25, 2017 by drilling 47 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	South Utica Avenue SB	36.08877	-95.96692
P-2	South Utica Avenue SB	36.08729	-95.96697
P-3	East 53rd Street WB	36.08688	-95.96635
P-4	South Utica Avenue SB	36.08619	-95.96693
P-5	South Utica Avenue SB	36.08484	-95.96699
P-6	South Utica Avenue NB	36.08366	-95.96697
P-7	South Utica Avenue SB	36.08197	-95.96692
P-8	South Utica Avenue NB	36.08086	-95.96688
P-9	South Utica Avenue NB	36.07883	-95.96688
P-10	East 59th Street EB	36.07862	-95.96617
P-11	East 57th Place EB	36.08047	-95.96559
P-12	East 57th Street EB	36.08125	-95.96409
P-13	East 56th Street WB	36.08209	-95.96360
P-14	South Yorktown Avenue NB	36.08112	-95.96267
P-15	South Yorktown Avenue SB	36.08027	-95.96270
P-16	East 58th Street WB	36.07961	-95.96472
P-17	East 59th Street WB	36.07881	-95.96442
P-18	South Wheeling Avenue NB	36.07928	-95.96344
P-19	East 59th Street WB	36.07893	-95.96210
P-20	South Yorktown Place SB	36.08051	-95.96162
P-21	East 56th Street WB	36.08204	-95.96159
P-22	South Zunis Avenue SB	36.08151	-95.96064
P-23	South Zunis Avenue SB	36.07982	-95.96062
P-24	East 59th Street WB	36.07892	-95.95916
P-25	East 56th Street EB	36.08142	-95.95932
P-26	East 55th Court WB	36.08298	-95.96125
P-27	East 56th Place EB	36.08310	-95.96366
P-28	South Wheeling Avenue SB	36.08386	-95.96463

Table A-1. Approximate Boring Locations			
Boring No.	Streets	Latitude (°)	Longitude
P-29	South Wheeling Avenue NB	36.08486	-95.96458
P-30	South Wheeling Avenue SB	36.08719	-95.96458
P-31	South Wheeling Avenue SB	36.08889	-95.96466
P-32	East 51st Place WB	36.08819	-95.96375
P-33	East 53rd Street WB	36.08614	-95.96380
P-34	East 55th Street WB	36.08434	-95.96374
P-35	South Yorktown Avenue NB	36.08365	-95.96244
P-36	South Xanthus Avenue SB	36.08513	-95.96296
P-37	South Xanthus Avenue SB	36.08651	-95.96303
P-38	East 52nd Street WB	36.08748	-95.96151
P-39	South Yorktown Avenue NB	36.08679	-95.96202
P-40	South Yorktown Avenue NB	36.08515	-95.96189
P-41	East 55th Place EB	36.08366	-95.96049
P-42	East 54th Street EB	36.08575	-95.96068
P-43	South Zunis Avenue SB	36.08648	-95.96076
P-44	East 52nd Place EB	36.08649	-95.95952
P-45	South Zunis Place NB	36.08520	-95.95982
P-46	East 55th Street EB	36.08434	-95.95927
P-47	South Gillette Avenue NB	36.08515	-95.95876

The existing pavement was cored with a 5-inch diameter core barrel. The borings were then advanced using solid flight augers attached to a skid-steer loader to the planned depth. 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 descriptions, depths, sampling intervals, and observed groundwater conditions, if any. Conditions encountered in each of the borings were monitored and recorded by a Kleinfelder geotechnical engineer. 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 21, 2017
LOCATION 7.5' W. of S. Utica Ave. CL, Southbound
GPS 36.08877° N / -95.96692° 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)
1	PORTLAND CEMENT CONCRETE		5.75
	Total Core Thickness		**5.75**

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

Sample No.	Layer Type	Layer Depth (in)
1A	Lean CLAY (CL): light brownish gray to olive brown, moist, trace gravel	0.0 to 6.0
1B	Lean CLAY (CL): light brown to olive brown, moist	6.0 to 36.0

TOP

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PAVEMENT CORING LOG P-1

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-1

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 10' W. of S. Utica Ave. CL, Southbound
GPS 36.08729° N / -95.96697° 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)
1	PORTLAND CEMENT CONCRETE		6
	Total Core Thickness		**6**

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

Sample No.	Layer Type	Layer Depth (in)
2A	Lean CLAY (CL): light brownish gray to olive brown, dry to moist, trace gravel	0.0 to 6.0
2B	Lean CLAY (CL): light brown to olive brown, moist	6.0 to 36.0

TOP

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PAVEMENT CORING LOG P-2

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-2

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 7' N. of E. 53rd St. CL, Westbound
GPS 36.08688° N / -95.96635° 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)
1	ASPHALT		6.5
2	AGGREGATE BASE		4
	Total Core Thickness		**10.5**

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

Sample No.	Layer Type	Layer Depth (in)
3A	Lean CLAY (CL): light brownish gray to olive brown, dry to moist, trace gravel	0.0 to 6.0
3B	Lean CLAY (CL): light brown to olive brown, moist	6.0 to 36.0

TOP

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

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REVISED: -

PAVEMENT CORING LOG P-3

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-3

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 8' W. of S. Utica Ave. CL, Southbound
GPS 36.08619° N / -95.96693° 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)
1	PORTLAND CEMENT CONCRETE		5.25
	Total Core Thickness		**5.25**

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

Sample No.	Layer Type	Layer Depth (in)
4A	Lean CLAY (CL): light brownish gray to olive brown, dry to moist, trace gravel	0.0 to 6.0
4B	Lean CLAY (CL): light brown to olive brown, moist	6.0 to 36.0

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PAVEMENT CORING LOG P-4

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-4

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 8' W. of S. Utica Ave. CL, Southbound
GPS 36.08485° N / -95.96699° 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)
1	PORTLAND CEMENT CONCRETE		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)
5A	Fat CLAY (CH): olive gray to olive brown, moist	0.0 to 6.0
5B	Fat CLAY (CH): olive gray to olive brown, moist	6.0 to 36.0

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PAVEMENT CORING LOG P-5

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-5

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 9.3' E. of S. Utica Ave. CL, Northbound
GPS 36.08367° N / -95.96697° 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)
1	ASPHALT		2
2	PORTLAND CEMENT CONCRETE		6.75
	Total Core Thickness		**8.75**

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

Sample No.	Layer Type	Layer Depth (in)
6A	Lean CLAY (CL): olive brown to olive brown, moist, trace gravel	0.0 to 6.0
6B	Lean CLAY (CL): light brown and brown, moist	6.0 to 36.0

TOP

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

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PAVEMENT CORING LOG P-6

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-6

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 9' W. of S. Utica Ave. CL, Southbound
GPS 36.08198° N / -95.96692° 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)
1	ASPHALT		9.25
2	AGGREGATE BASE		5.75
	Total Core Thickness		**15**

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

Sample No.	Layer Type	Layer Depth (in)
7A	Sandy Lean CLAY (CL): light brown to olive brown, moist, trace gravel	0.0 to 6.0
7B	Lean CLAY (CL): light brown to olive brown, moist, trace gravel	6.0 to 36.0

TOP

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

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REVISED: -

PAVEMENT CORING LOG P-7

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-7

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 9' E. of S. Utica Ave. CL, Northbound
GPS 36.08087° N / -95.96688° 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)
1	ASPHALT	Separation at 3 inches	9.75
2	TREATED BASE	Disintegrated	3
	Total Core Thickness		**12.75**

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

Sample No.	Layer Type	Layer Depth (in)
8A	Lean CLAY (CL): olive brown mottled reddish yellow, moist, trace gravel	0.0 to 6.0
8B	Lean CLAY (CL): olive gray to black, moist, trace gravel	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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DATE:
REVISED: -

PAVEMENT CORING LOG P-8

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-8

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 8.9' E. of S. Utica Ave. CL, Northbound
GPS 36.07883° N / -95.96688° 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)
1	ASPHALT		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)
9A	Lean CLAY (CL): light brownish gray to light brown, moist	0.0 to 6.0
9B	Lean CLAY (CL): olive gray to black, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-9

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-9

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 8.5' S. of E. 59th St. CL, Eastbound
GPS 36.07862° N / -95.96617° 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)
1	ASPHALT		9.75
	Total Core Thickness		**9.75**

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

Sample No.	Layer Type	Layer Depth (in)
10A	Lean CLAY (CL): olive yellow to olive yellow, moist	0.0 to 6.0
10B	Lean CLAY (CL): olive brown to black, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-10

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-10

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8' S. of E. 57th Pl. CL, Eastbound
GPS 36.08047° N / -95.96559° 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)
1	ASPHALT		5
2	PORTLAND CEMENT CONCRETE		5
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
11A	Lean CLAY (CL): olive gray to olive brown, moist	0.0 to 6.0
11B	Lean CLAY (CL): olive brown to brown, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-11

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-11

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8.5' S. of E. 57th St. CL, Eastbound
GPS 36.08125° N / -95.96409° 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)
1	ASPHALT	Separation at 2.75 and 5 inches	8.5
	Total Core Thickness		**8.5**

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

Sample No.	Layer Type	Layer Depth (in)
12A	Lean CLAY (CL): olive gray to olive brown, dry, trace silt	0.0 to 6.0
12B	Lean CLAY (CL): olive to brown, dry	6.0 to 36.0

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

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-12

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-12

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9' N. of E. 56th St. CL, Westbound
GPS 36.08209° N / -95.96360° 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)
1	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)
13A	Lean CLAY (CL): olive gray to olive brown, dry to moist, trace gravel	0.0 to 6.0
13B	Lean CLAY (CL): olive gray to brown, moist	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-13

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-13

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9.5' E. of S. Yorktown Ave. CL, Northbound
GPS 36.08113° N / -95.96267° W

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)
1	ASPHALT	Separation at 5 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)
14A	Lean CLAY (CL): olive brown to olive brown, moist, trace clay	0.0 to 6.0
14B	Lean CLAY (CL): olive gray to brown, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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REVISED: -

PAVEMENT CORING LOG P-14

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-14

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8' W. of S. Yorktown Ave. CL, Southbound
GPS 36.08028° N / -95.96270° W

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)
1	ASPHALT		4.75
2	PORTLAND CEMENT CONCRETE		4.5
	Total Core Thickness		**9.25**

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

Sample No.	Layer Type	Layer Depth (in)
15A	Lean CLAY (CL): olive gray to olive brown, moist	0.0 to 6.0
15B	Lean CLAY (CL): olive to brown, moist, trace silt	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-15

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-15

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8.5' N. of E. 58th St. CL, Westbound
GPS 36.07962° N / -95.96472° W

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)
1	ASPHALT		4.5
2	PORTLAND CEMENT CONCRETE		4.5
	Total Core Thickness		**9**

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

Sample No.	Layer Type	Layer Depth (in)
16A	Silty SAND (SM): olive to olive brown, moist	0.0 to 6.0
16B	SILT (ML): olive to brown, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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DATE:
REVISED: -

PAVEMENT CORING LOG P-16

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-16

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 8.5' N. of E. 59th St. CL, Westbound
GPS 36.07882° N / -95.96442° W

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)
1	ASPHALT		9.75
	Total Core Thickness		**9.75**

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

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

TOP

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

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PROJECT NO.: 20182008
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REVISED: -

PAVEMENT CORING LOG P-17

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-17

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8' E. of S. Wheeling Ave. CL, Northbound
GPS 36.07928° N / -95.96344° W

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)
1	ASPHALT	Separation at 4.5 inches	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)
18A	Lean CLAY (CL): olive brown to olive brown, moist, trace clay	0.0 to 6.0
18B	Lean CLAY (CL): olive to brown, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-18

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-18

PROJECT / LOCATION DATA:

CORE DATE September 21, 2017
LOCATION 9' N. of E. 59th St. CL, Westbound
GPS 36.07893° N / -95.96210° W

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)
1	PORTLAND CEMENT CONCRETE		6
	Total Core Thickness		**6**

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

Sample No.	Layer Type	Layer Depth (in)
19A	Lean CLAY with Sand (CL): brown to olive brown, dry	0.0 to 6.0
19B	Lean CLAY with Sand (CL): light brown to olive brown, dry, AR on apparent sandstone	6.0 to 12.0

TOP

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-19

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-19

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9.5' W. of S. Yorktown Pl. CL, Southbound
GPS 36.08051° N / -95.96162° W

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)
1	PORTLAND CEMENT CONCRETE		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)
20A	Lean CLAY with Sand (CL): olive gray to olive brown, dry to moist	0.0 to 6.0
20B	Lean CLAY with Sand (CL): light brownish gray to light brown, moist, trace sand	6.0 to 36.0

TOP

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-20

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-20

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8' N. of E. 56th St. CL, Westbound
GPS 36.08204° N / -95.96159° W

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)
1	PORTLAND CEMENT CONCRETE		5
	Total Core Thickness		**5**

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

Sample No.	Layer Type	Layer Depth (in)
21A	Lean CLAY (CL): olive yellow to olive brown, dry to moist, trace gravel	0.0 to 6.0
21A	Lean CLAY (CL): olive gray to olive brown, moist	6.0 to 36.0

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PROJECT NO.: 20182008
DRAWN BY:
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PAVEMENT CORING LOG P-21

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE
P-21

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9' W. of S. Zunis Ave. CL, Southbound
GPS 36.08151° N / -95.96064° W

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)
1	PORTLAND CEMENT CONCRETE		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)
22A	Lean CLAY (CL): greenish gray to olive brown, dry, trace gravel	0.0 to 6.0
22A	Lean CLAY (CL): olive brown to olive brown, dry	6.0 to 36.0

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-22

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-22

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 7.5' W. of S. Zunis Ave. CL, Southbound
GPS 36.07982° N / -95.96062° W

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)
1	PORTLAND CEMENT CONCRETE		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)
23A	Sandy SILT (ML): light brownish gray to brown, dry	0.0 to 6.0
24B	Sandy SILT (ML): olive yellow to olive brown, dry, AR on apparent sandstone	6.0 to 36.0

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-23

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-23

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9' N. of E. 59th St. CL, Westbound
GPS 36.07892° N / -95.95916° W

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)
1	PORTLAND CEMENT CONCRETE		6
	Total Core Thickness		**6**

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

Sample No.	Layer Type	Layer Depth (in)
24A	Sandy SILT (ML): olive yellow to olive brown, dry	0.0 to 6.0
24B	Sandy SILT (ML): olive yellow to olive brown, dry, AR on apparent sandstone	6.0 to 36.0

TOP

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-24

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-24

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 8.5' S. of E. 56th St. CL, Eastbound
GPS 36.08143° N / -95.95932° W

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)
1	ASPHALT	Cracked 0.75-2.5 inches	3.5
2	TREATED BASE		6.5
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
25A	Lean CLAY (CL): olive to olive brown, dry to moist	0.0 to 6.0
25B	Lean CLAY (CL): olive to olive gray, moist	6.0 to 36.0

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

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PROJECT NO.: 20182008
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DATE:
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PAVEMENT CORING LOG P-25

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-25

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8.5' N. of E. 55th Ct. CL, Westbound
GPS 36.08298° N / -95.96125° W

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)
1	ASPHALT		8
	Total Core Thickness		**8**

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

Sample No.	Layer Type	Layer Depth (in)
26A	Lean CLAY (CL): olive brown to olive gray, dry to moist	0.0 to 6.0
26B	Lean CLAY (CL): olive brown and olive gray, dry to moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
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PAVEMENT CORING LOG P-26

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-26

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 5.5' S. of E. 56th Pl. CL, Eastbound
GPS 36.08310° N / -95.96366° W

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)
1	ASPHALT	Cracked 0-3.25	3.75
2	TREATED BASE		5.5
	Total Core Thickness		**9.25**

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

Sample No.	Layer Type	Layer Depth (in)
27A	Lean CLAY (CL): olive gray and yellowish brown, dry to moist	0.0 to 6.0
27B	Lean CLAY (CL): olive gray and yellow, moist	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-27

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-27

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 5' W. of S. Wheeling Ave. CL, Southbound
GPS 36.08386° N / -95.96463° W

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)
1	ASPHALT	Separation at 4.5 inches	6
2	TREATED BASE		5.5
	Total Core Thickness		**11.5**

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

Sample No.	Layer Type	Layer Depth (in)
28A	Lean CLAY (CL): olive gray and yellow, dry	0.0 to 6.0
28B	Lean CLAY (CL): olive gray and yellow, dry	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-28

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-28

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 9' E. of S. Wheeling Ave. CL, Northbound
GPS 36.08487° N / -95.96458° W

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)
1	ASPHALT	Cracked 3.5 to 8.5 inches	8.5
	Total Core Thickness		**8.5**

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

Sample No.	Layer Type	Layer Depth (in)
29A	Sandy Lean CLAY (CL): olive gray and yellow, dry to moist	0.0 to 6.0
29B	Sandy Lean CLAY (CL): olive gray and yellow, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-29

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-29

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 5.5' W. of S. Wheeling Ave. CL, Southbound
GPS 36.08720° N / -95.96458° W

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)
1	ASPHALT		5
2	TREATED BASE		7.5
	Total Core Thickness		**12.5**

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

Sample No.	Layer Type	Layer Depth (in)
30A	Lean CLAY (CL): light brownish gray to olive gray, dry, trace silt	0.0 to 6.0
30B	Lean CLAY (CL): olive to brown, dry	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-30

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-30

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 6.5' W. of S. Wheeling Ave. CL, Southbound
GPS 36.08890° N / -95.96466° W

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)
1	ASPHALT		5
2	TREATED BASE		5
	Total Core Thickness		**10**

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

Sample No.	Layer Type	Layer Depth (in)
31A	Lean CLAY (CL): gray and greenish black, moist, trace gravel. With broken red shale	0.0 to 6.0
31B	Lean CLAY (CL): light brownish gray to olive gray, moist, trace gravel	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-31

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-31

PROJECT / LOCATION DATA:

CORE DATE September 22, 2017
LOCATION 6' N. of E. 51st Pl. CL, Westbound
GPS 36.08819° N / -95.96375° W

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)
1	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)
32A	Lean CLAY (CL): light brownish gray and greenish black, dry to moist, trace gravel.	0.0 to 6.0
32B	Lean CLAY (CL): light brownish gray to olive gray, moist, trace gravel	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-32

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-32

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8.5' N. of E. 53rd St. CL, Westbound
GPS 36.08615° N / -95.96380° W

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)
1	ASPHALT	Separation at 5.25 inches Cracked 0-7.75 inches	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)
33A	Lean CLAY (CL): gray and yellowish brown, dry to moist, trace sand and gravel.	0.0 to 6.0
33B	Lean CLAY (CL): gray to yellowish brown, moist, trace sand and gravel.	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-33

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-33

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9.5' N. of E. 55th St. CL, Westbound
GPS 36.08435° N / -95.96374° W

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)
1	ASPHALT		7
	Total Core Thickness		**7**

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

Sample No.	Layer Type	Layer Depth (in)
34A	Lean CLAY (CL): gray to olive gray, moist, trace gravel.	0.0 to 6.0
34B	Well-graded SAND with Silt (SW-SM): olive yellow and olive gray, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-34

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-34

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 6' E. of S. Yorktown Ave. CL, Northbound
GPS 36.08365° N / -95.96244° W

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)
1	ASPHALT	Separation at 3.75 and 5.7 inches Cracked 3.75-7.75 inches	6.75
2	TREATED BASE		4
	Total Core Thickness		**10.75**

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

Sample No.	Layer Type	Layer Depth (in)
35A	Lean CLAY (CL): light brownish gray to olive gray, dry	0.0 to 6.0
35B	Lean CLAY (CL): olive gray and yellow, dry	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-35

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-35

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 6.5' E. of Xanthus Ave, CL, Southbound
GPS 36.08514° N / -95.96296° W

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)
1	ASPHALT		7.38
	Total Core Thickness		**7.38**

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

Sample No.	Layer Type	Layer Depth (in)
36A	Lean CLAY (CL): gray and yellowish brown, dry to moist, trace sand and gravel.	0.0 to 6.0
36B	Lean CLAY (CL): gray to light brownish gray, moist, trace sand and gravel.	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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PAVEMENT CORING LOG P-36

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-36

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9' E. of Xanthus Ave CL, Southbound
GPS 36.08651° N / -95.96303° W

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)
1	ASPHALT	Separation at 1.25 and 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)
37A	Lean CLAY (CL): gray and yellowish brown, dry to moist, trace sand and gravel.	0.0 to 6.0
37B	Lean CLAY (CL): gray to light brownish gray, moist, trace sand and gravel.	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-37

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-37

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9' N. of E. 52nd St. CL, Westbound
GPS 36.08749° N / -95.96151° W

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)
1	ASPHALT	Separation at 1, 2.25, and 3.75 inches Cracked 0-8.25 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)
38A	Lean CLAY (CL): gray and yellowish brown, dry to moist, trace sand and gravel.	0.0 to 6.0
38B	Lean CLAY (CL): gray to light brownish gray, moist, trace sand and gravel.	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
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PAVEMENT CORING LOG P-38

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-38

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8.5' E. of S. Yorktown Ave. CL, Northbound
GPS 36.08679° N / -95.96202° W

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)
1	ASPHALT	Separation at 1.5 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)
39A	Fat CLAY (CH): gray to olive gray, dry to moist, trace sand and gravel.	0.0 to 6.0
39B	Fat CLAY (CH): gray to olive gray, moist, trace sand and gravel.	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-39

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-39

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8.5' E. of S. Yorktown Ave. CL, Northbound
GPS 36.08516° N / -95.96189° W

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)
1	ASPHALT	Separation at 3.5 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)
40A	Lean CLAY with Sand (CL): olive gray to olive gray, dry to moist	0.0 to 6.0
40B	Lean CLAY with Sand (CL): olive gray and yellow, moist	6.0 to 36.0

TOP

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-40

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-40

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 7.5' S. of E. 55th Pl. CL, Eastbound
GPS 36.08366° N / -95.96049° W

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)
1	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)
41A	Lean CLAY (CL): olive yellow to olive gray, dry to moist	0.0 to 6.0
41B	Lean CLAY (CL): olive yellow and olive gray, moist	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-41

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-41

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8' S. of E. 54th St. CL, Eastbound
GPS 36.08576° N / -95.96068° W

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)
1	ASPHALT		7
	Total Core Thickness		**7**

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

Sample No.	Layer Type	Layer Depth (in)
42A	Lean CLAY (CL): gray to olive gray, dry to moist, trace gravel.	0.0 to 6.0
42B	Lean CLAY (CL): olive gray to olive gray, moist, trace gravel.	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-42

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-42

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 8' W. of S. Zunis Ave. CL, Southbound
GPS 36.08648° N / -95.96076° W

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)
1	ASPHALT	Cracked 0-3 inches	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)
43A	Fat CLAY (CH): gray to yellowish brown, dry to moist, trace gravel.	0.0 to 6.0
43B	Fat CLAY (CH): light brownish gray to olive gray, moist, trace gravel.	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
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DATE:
REVISED: -

PAVEMENT CORING LOG P-43

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-43

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9' S. of E. 52nd Pl. CL, Eastbound
GPS 36.08649° N / -95.95952° W

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)
1	ASPHALT	Separation at 1.75 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)
44A	Sandy SILT (MLS): yellowish brown to yellowish brown, dry to moist, trace gravel.	0.0 to 6.0
44B	Sandy SILT (MLS): yellowish brown to yellowish brown, moist, trace gravel.	6.0 to 36.0

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

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PROJECT NO.: 20182008
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

PAVEMENT CORING LOG P-44

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-44

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 7.5' E. of S. Zunis Ave. CL, Northbound
GPS 36.08520° N / -95.95982° W

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)
1	ASPHALT		7.25
2	TREATED BASE		8.75
	Total Core Thickness		**16**

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

Sample No.	Layer Type	Layer Depth (in)
45A	Lean CLAY (CL): olive brown to olive gray, dry to moist, trace gravel.	0.0 to 6.0
45B	Lean CLAY (CL): brown to olive gray, moist, trace gravel.	6.0 to 36.0

TOP

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

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PAVEMENT CORING LOG P-45

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-45

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9' S. of E. 55th St. CL, Eastbound
GPS 36.08435° N / -95.95927° W

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)
1	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)
46A	Lean CLAY (CL): bluish gray to olive gray, dry, trace gravel.	0.0 to 6.0
46B	Lean CLAY (CL): olive yellow and bluish gray, dry to moist, With some clay clods	6.0 to 36.0

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

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PAVEMENT CORING LOG P-46

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-46

PROJECT / LOCATION DATA:

CORE DATE September 25, 2017
LOCATION 9' E. of S. Gillette Ave. CL, Northbound
GPS 36.08516° N / -95.95876° W

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)
1	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)
47A	Sandy SILT (ML): reddish yellow to yellowish brown, dry to moist, trace gravel.	0.0 to 6.0
47B	Sandy SILT (ML): reddish yellow to yellowish brown, moist, trace gravel.	6.0 to 36.0

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

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PAVEMENT CORING LOG P-47

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

CORE

P-47

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 D2216, 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 D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

Field No.	Soil Group	Station	Description	Depth* (in)	LL	PI	Percent Passing						Water Content (%)	Soluble Sulfates (mg/kg)
							Passing 3 in.	Passing 3/4 in.	Passing #4	Passing #10	Passing #40	Passing #200		
1A	A-4		LEAN CLAY	0 - 6	27	9	100	100	97	97	96	86	16.6	
2B	A-4		LEAN CLAY	6 - 36	27	8	100	100	100	100	100	87	16.1	
3B	A-4		LEAN CLAY	6 - 36	28	10	100	100	100	100	100	86	12.8	
4B	A-6		LEAN CLAY	6 - 36	32	17	100	100	100	100	100	92	11.0	
5B	A-7-6		FAT CLAY	6 - 36	58	44	100	100	100	100	100	96	26.2	
6A	A-7-6		LEAN CLAY	0 - 6	46	31	100	100	100	100	99	95	20.2	
7A	A-6		SANDY LEAN CLAY	0 - 6	32	19	100	94	86	79	71	63	11.5	
8A	A-7-6		LEAN CLAY	0 - 6	49	35	100	100	99	97	93	91	22.3	
9B	A-6		LEAN CLAY	6 - 36	34	19	100	100	100	100	98	93	18.4	
10A	A-4		LEAN CLAY	0 - 6	26	9	100	100	94	94	93	86	9.7	
11B	A-7-6		LEAN CLAY	6 - 36	41	29	100	100	100	100	99	95	21.9	
12B	A-6		LEAN CLAY	6 - 36	36	23	100	100	100	100	99	93	15.9	
13B	A-6		LEAN CLAY	6 - 36	37	21	100	100	100	100	99	93	20.1	
14A	A-6		LEAN CLAY	0 - 6	31	15	100	100	100	99	94	87	13.5	
15B	A-6		LEAN CLAY	6 - 36	29	13	100	100	100	100	100	94	17.4	
16B	A-4		SILT	6 - 36	NP	NP	100	100	100	100	100	89	12.5	
17A	A-6		LEAN CLAY	0 - 6	37	23	100	100	100	100	98	94	19.5	
18B	A-6		LEAN CLAY	6 - 36	29	12	100	100	100	100	100	95	16.1	
19B	A-6		LEAN CLAY WITH SAND	6 - 12	28	13	100	100	98	94	88	74	7.2	
20B	A-4		LEAN CLAY WITH SAND	6 - 36	26	9	100	100	100	100	100	83	10.8	
21A	A-6		LEAN CLAY	6 - 36	36	24	100	100	100	100	99	96	17.4	
22A	A-6		LEAN CLAY	0 - 6	40	27	100	100	99	99	99	97	16.1	
23A	A-4		SANDY SILT	0 - 6	NP	NP	100	100	100	100	100	52	4.8	
24B	A-4		SANDY SILT	6 - 36	NP	NP	100	100	100	100	100	52	8.3	
25B	A-6		LEAN CLAY	6 - 36	36	22	100	100	100	100	99	95	21.9	
26B	A-6		LEAN CLAY	6 - 36	31	18	100	100	100	100	100	89	13.6	
27B	A-6		LEAN CLAY	6 - 36	40	26	100	100	100	100	98	95	25.8	
28B	A-6		LEAN CLAY	6 - 36	39	25	100	100	100	100	99	95	15.3	

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

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LABORATORY TEST RESULT SUMMARY

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

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Field No.	Soil Group	Station	Description	Depth* (in)	LL	PI	Percent Passing						Water Content (%)	Soluble Sulfates (mg/kg)
							Passing 3 in.	Passing 3/4 in.	Passing #4	Passing #10	Passing #40	Passing #200		
29A	A-4		SANDY LEAN CLAY	0 - 6	20	8	100	100	100	100	94	60	16.1	
30B	A-6		LEAN CLAY	6 - 36	36	22	100	100	100	100	100	95	15.1	
31B	A-6		LEAN CLAY	6 - 36	34	20	100	100	100	100	100	94	19.5	
32B	A-6		LEAN CLAY	6 - 36	31	17	100	100	100	100	99	95	10.8	
33A	A-7-6		LEAN CLAY	0 - 6	44	30	100	100	100	100	99	94	22.8	
34B	A-1-b		WELL-GRADED SAND WITH SILT	6 - 36	NP	NP	100	100	93	55	23	7.5	2.3	
35B	A-6		LEAN CLAY	6 - 36	37	23	100	100	100	100	99	94	16.5	
36B	A-7-6		LEAN CLAY	6 - 36	43	31	100	100	100	100	100	97	21.7	
37A	A-7-6		LEAN CLAY	0 - 6	44	31	100	100	100	100	99	97	21.1	
38B	A-7-6		LEAN CLAY	6 - 36	46	35	100	100	100	99	98	94	19.8	
39A	A-7-6		FAT CLAY	0 - 6	51	37	100	100	100	100	100	100	21.6	
40B	A-6		LEAN CLAY WITH SAND	6 - 36	38	26	100	100	100	100	96	81	20.9	
41B	A-6		LEAN CLAY	6 - 36	31	15	100	100	100	100	99	94	18.7	
42B	A-6		LEAN CLAY	6 - 36	40	27	100	100	100	100	100	98	22.4	
43A	A-7-6		FAT CLAY	0 - 6	51	36	100	100	100	100	99	96	24.4	
44B	A-4		SANDY SILT	6 - 36	NP	NP	100	100	100	100	98	61	12.0	
45A	A-6		LEAN CLAY	0 - 6	29	14	100	100	99	99	97	91	14.7	
46B	A-6		LEAN CLAY	6 - 36	27	13	100	100	100	99	98	89	14.9	
47B	A-4		SANDY SILT	6 - 36	NP	NP	100	100	100	100	98	62	13.7	

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

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LABORATORY TEST RESULT SUMMARY

NASM Zone 9049
SW Corner of E. 51st St. S. and S. Lewis Ave.
Tulsa, OK

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APPENDIX C

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT (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

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e-mail: info@geoprofessional.org www.geoprofessional.org