

ENGINEERING INDEX PROPERTIES
Harper County, Kansas

Engineering Index Properties table gives the engineering classifications and the range of index properties for the layers of each soil in the survey area. Depth to the upper and lower boundaries of each layer is indicated. Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. Loam, for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, gravelly. Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1998) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1998). The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in Engineering Index Properties table.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. The estimates of particle-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is generally omitted in the table.

ENGINEERING INDEX PROPERTIES--Continued
Harper County, Kansas

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
007AE: Albion-----	0-8	Sandy loam	ML, SM, CL-ML	A-2, A-4	0	0	100	75-100	60-90	25-55	15-30	NP-5
	8-16	Sandy loam	ML, SM, CL-ML	A-2, A-4	0	0	85-100	75-100	45-90	30-55	20-35	NP-10
	16-27	Loamy sand	SM	A-1, A-2	0	0	85-100	75-90	40-70	15-30	15-30	NP-5
	27-60	Sand	GM, GP-GM, SM, SP-SM	A-1, A-2, A-3	0	0-5	40-100	40-90	30-70	5-30	15-30	NP-5
Shellabarger---	0-14	Sandy loam	ML, SM	A-2, A-4	0	0	95-100	95-100	75-100	30-55	15-30	NP-5
	14-48	Sandy clay loam	SC	A-4, A-6	0	0	95-100	85-100	70-90	35-50	25-40	8-20
	48-60	Coarse sandy loam	SC, SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	50-80	10-40	15-30	NP-10
007AS: Clairemont----	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	98-100	85-100	65-95	22-40	5-20
	8-60	Loam	CL, CL-ML	A-4, A-6, A- 7-6	0	0	100	98-100	90-100	65-95	22-45	5-25
007FU: Farnum-----	0-9	Clay loam	CL	A-6	0	0	100	100	90-100	60-85	30-40	10-20
	9-60	Clay loam	CL, SC	A-6, A-7-6	0	0	100	100	70-100	45-80	35-50	15-30
007KA: Kanza-----	0-7	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	90-100	5-35	---	NP
	7-48	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	90-100	90-100	80-100	5-35	---	NP
095AD: Albion-----	0-8	Sandy loam	ML, SM	A-2, A-4	0	0	100	75-100	60-90	25-55	15-30	NP-5
	8-16	Sandy loam	ML, SM	A-2, A-4	0	0	85-100	75-100	45-90	30-55	20-35	NP-10
	16-26	Coarse sandy loam	SM	A-1, A-2	0	0	85-100	75-90	40-70	15-30	15-30	NP-5
	26-60	Gravelly sand	GM, GP-GM, SM, SP-SM	A-1, A-2, A-3	0	0-5	40-100	40-90	30-70	5-30	15-30	NP-5
095DA: Dillwyn-----	0-8	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	70-90	5-35	---	NP
	8-60	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	90-100	70-90	5-35	---	NP
Plevna-----	0-11	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	95-100	70-100	20-50	15-26	NP-6
	11-36	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	95-100	70-100	30-50	15-26	NP-6
	36-60	Sand	SM, SP	A-2, A-3	0	0	100	90-100	50-90	4-35	---	NP
095LA: Lincoln-----	0-10	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	---	NP
	10-60	Stratified fine sand to clay loam	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	5-35	---	NP
095NB: Nashville-----	0-28	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	>28	Weathered bedrock			---	---	---	---	---	---	---	---
Quinlan-----	0-13	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>13	Weathered bedrock			---	---	---	---	---	---	---	---
095SA: Shellabarger---	0-12	Loamy sand	SM	A-2	0	0	95-100	95-100	70-100	15-35	---	NP
	12-38	Sandy clay loam	SC	A-4, A-6	0	0	95-100	85-100	70-90	35-50	25-40	8-20
	38-60	Fine sandy loam	SC, SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	50-80	10-40	15-30	NP-10
095SC: Shellabarger---	0-10	Sandy loam	ML, SM	A-2, A-4	0	0	95-100	95-100	75-100	30-55	15-30	NP-5
	10-45	Sandy clay loam	SC	A-4, A-6	0	0	95-100	85-100	70-90	35-50	25-40	8-20
	45-60	Coarse sandy loam	SC, SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	50-80	10-40	15-30	NP-10
095SD: Shellabarger---	0-10	Sandy loam	ML, SM	A-2, A-4	0	0	95-100	95-100	75-100	30-55	15-30	NP-5
	10-45	Sandy clay loam	SC	A-4, A-6	0	0	95-100	85-100	70-90	35-50	25-40	8-20
	45-60	Coarse sandy loam	SC, SC-SM, SM, SP-SM	A-2, A-4	0	0	80-100	70-100	50-80	10-40	15-30	NP-10
095ZA: Zenda-----	0-13	Clay loam	CL	A-6	0	0	100	95-100	85-100	55-80	30-40	10-20
	13-60	Clay loam	CL	A-6	0	0	100	95-100	85-100	55-80	25-40	10-25
191EA: Elandco-----	0-40	Silty clay loam	CL	A-4, A-6, A- 7-6	0	0	100	100	95-100	85-95	25-45	8-25
	40-62	Silty clay loam	CL, CL-ML, ML	A-4, A-6, A- 7-6	0	0	100	100	95-100	65-95	20-45	4-25
191EC: Elandco-----	0-40	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	95-100	85-95	20-40	4-20
	40-62	Silty clay loam	CL, CL-ML, ML	A-4, A-6, A- 7-6	0	0	100	100	95-100	65-95	20-45	4-25
191LS: Lincoln-----	0-11	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	---	NP
	11-60	Stratified fine sand to clay loam	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	5-35	---	NP
191OP: Wellsford-----	0-5	Clay loam	CL	A-6, A-7-6	---	0-5	95-100	95-100	90-100	75-95	35-50	15-30
	5-17	Clay	CH, CL, MH	A-7-6	---	0-5	95-100	95-100	85-100	75-95	45-70	20-40
	17-21	Weathered bedrock			---	---	---	---	---	---	---	---
Elandco-----	0-40	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	95-100	85-95	20-40	4-20
	40-62	Silty clay loam	CL, CL-ML, ML	A-4, A-6, A- 7-6	0	0	100	100	95-100	65-95	20-45	4-25
191PD: Pond Creek-----	0-12	Silty clay loam	CL	A-6	0	0	100	100	96-100	85-98	30-40	11-20
	12-68	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20

ENGINEERING INDEX PROPERTIES--Continued
Harper County, Kansas

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Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
191RA: Renfrow-----	0-9	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-26
	9-13	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	37-49	15-26
Grainola-----	13-75	Silty clay loam	CH, CL, MH	A-6, A-7	0	0	100	100	96-100	80-99	37-70	15-38
	0-8	Silt loam	CL	A-4, A-6	---	0-15	90-100	85-95	80-90	51-80	30-37	8-14
	8-28	Silty clay	CH, CL, MH	A-7	---	0-15	90-100	70-100	70-95	60-90	41-70	20-40
	28-36	Clay	CH, CL, GC, SC, MH	A-2, A-7	0	0	25-95	20-90	20-90	15-90	41-70	20-40
	36-42	Weathered bedrock			---	---	---	---	---	---	---	---
191TA: Tabler-----	0-10	Silty clay loam	CL	A-7, A-6	0	0	100	100	96-100	80-98	32-43	11-20
	10-30	Silty clay	CH, CL, MH	A-7	0	0	100	100	96-100	90-99	41-65	18-35
	30-60	Silty clay	CH, CL, MH	A-6, A-7	0	0	96-100	96-100	92-100	80-99	38-60	15-35
191US: Ustifluvents--- 1439:	---	---	---	---	---	---	---	---	---	---	---	---
Crisfield-----	0-12	Sandy loam	SC, SM	A-6, A-2-6, A-4	0	0	95-100	95-100	65-75	30-45	10-20	NP-12
	12-24	Sandy loam	SC, SM	A-6, A-2-6, A-4	0	0	100	95-100	70-75	30-60	10-20	NP-12
	24-80	Coarse sand	SP-SM	A-3, A-1-b, A-2-4	0	0	95-100	90-100	45-55	5-40	0-5	NP-2
An: Kaski-----	0-26	Loam	CL, CL-ML	A-4, A-6, A-7	0	0	100	100	85-100	50-85	20-45	5-25
	26-40	Clay loam	CL, SC	A-4, A-6, A-7	0	0	100	95-100	85-100	45-85	25-45	7-25
	40-60	Sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	100	95-100	60-100	30-80	15-35	NP-20
At: Attica-----	0-10	Fine sandy loam	SM	A-2, A-4	0	0	100	95-100	70-100	20-50	15-20	NP-4
	10-39	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	95-100	75-100	30-55	15-26	NP-7
	39-60	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	85-100	80-100	70-100	20-50	15-26	NP-7
Be: Bethany-----	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-98	21-37	2-13
	13-17	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-50	15-26
	17-60	Silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-33
Bh: Bethany-----	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-98	21-37	2-13
	13-17	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-50	15-26
	17-60	Silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-33
Bm: Lincoln-----	0-21	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	---	NP
	21-60	Stratified fine sand to clay loam	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	5-35	---	NP
Bo: Gerlane-----	0-4	Loamy fine sand	SM	A-2	0	0	100	95-100	90-100	15-35	---	NP
	4-30	Stratified loamy sand to fine sandy loam	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	---	NP
	30-60	Clay	CH	A-7	0	0	100	100	90-100	75-95	50-70	30-45
Bp: Woodward-----	0-24	Silt loam	CL, CL-ML, ML	A-6, A-4	0	0	100	100	90-100	51-95	15-31	NP-12
	>24	Weathered bedrock			---	---	---	---	---	---	---	---
Port-----	0-27	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	27-60	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
Br: Broken Alluvial Land-----	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-100	60-90	20-35	5-15
	6-60	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-100	60-95	20-40	5-20
Ca: Carwile-----	0-14	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	36-60	15-26	NP-7
	14-20	Sandy clay loam	CL, SC	A-6, A-7	0	0	100	100	90-100	36-90	35-50	14-26
	20-60	Clay	CH, CL, SC	A-6, A-7	0	0	100	100	90-100	40-95	35-70	14-38
Cc: Case-----	0-7	Clay loam	CL	A-6	0	0	90-100	90-100	85-100	55-85	30-40	10-20
	7-60	Clay loam	CL	A-6, A-7-6	0	0	90-100	90-100	85-100	55-85	25-45	10-25
Clark-----	0-8	Loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	50-90	20-40	5-20
	8-60	Clay loam	CL	A-6	0	0	100	95-100	90-100	55-90	25-40	10-25
Ce: Corbin-----	0-16	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	75-100	25-35	5-15
	16-30	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	95-100	85-100	35-45	10-20
	30-55	Clay	CH, CL	A-7-6	0	0	100	100	95-100	90-100	45-60	25-35
	55-60	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	85-100	35-45	12-20
Cf: Corbin-----	0-16	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	75-100	25-35	5-15
	16-30	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	95-100	85-100	35-45	10-20
	30-55	Clay	CH, CL, MH	A-7-6	0	0	100	100	95-100	90-100	45-60	25-35
	55-60	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	85-100	35-45	12-20
Fa: Farnum-----	0-7	Clay loam	CL	A-6	0	0	100	100	90-100	60-85	30-40	10-20
	7-41	Clay loam	CL, SC	A-6, A-7-6	0	0	100	100	70-100	45-80	35-50	15-30
	41-60	Clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	100	95-100	65-100	30-80	20-35	5-15

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(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
					Pct	Pct					Pct	
Fm: Farnum-----	0-11	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	60-85	20-35	5-15
	11-41	Clay loam	CL, SC	A-6, A-7-6	0	0	100	100	70-100	45-80	35-50	15-30
	41-60	Clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	100	95-100	65-100	30-80	20-35	5-15
Fn: Farnum-----	0-11	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	60-85	20-35	5-15
	11-41	Clay loam	CL, SC	A-6, A-7-6	0	0	100	100	70-100	45-80	35-50	15-30
	41-60	Clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	100	95-100	65-100	30-80	20-35	5-15
Fu: Farnum-----	0-11	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	60-85	20-35	5-15
	11-41	Clay loam	CL, SC	A-6, A-7-6	0	0	100	100	70-100	45-80	35-50	15-30
	41-60	Clay loam	CL, CL-ML, SC, SC-SM	A-2, A-4, A-6	0	0	100	95-100	65-100	30-80	20-35	5-15
Ge: Gerlane-----	0-17	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	95-100	70-95	40-55	15-26	NP-6
	17-40	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	95-100	70-95	35-55	15-26	NP-6
	40-48	Loamy sand	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	95-100	70-95	15-55	15-26	NP-6
	48-60	Clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	65-95	20-40	5-25
Gn: Grant-----	0-11	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	70-90	20-32	1-10
	11-33	Silty clay loam	CL, ML	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	33-50	Silt loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	>50	Weathered bedrock			---	---	---	---	---	---	---	---
Gr: Grant-----	0-11	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	70-90	20-32	1-10
	11-33	Silty clay loam	CL, ML	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	33-50	Silt loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	>50	Weathered bedrock			---	---	---	---	---	---	---	---
GRP: Gravel Pits----	---	---	---	---	---	---	---	---	---	---	---	---
Gs: Grant-----	0-11	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	70-90	20-32	1-10
	11-33	Silty clay loam	CL, ML	A-7, A-4, A-6	0	0	100	100	90-100	70-90	30-42	8-19
	33-50	Silt loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	50-60	Weathered bedrock			---	---	---	---	---	---	---	---
INT: Aquolls-----	0-60	Variable			---	---	---	---	---	---	---	---
Ka: Kanza-----	0-8	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	90-100	5-35	---	NP
	8-60	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	90-100	90-100	80-100	5-35	---	NP
Kk: Kaski-----	0-19	Loam	CL, CL-ML	A-4, A-6, A-7	0	0	100	100	85-100	50-85	20-45	5-25
	19-40	Loam	CL, SC	A-4, A-6, A-7	0	0	100	95-100	85-100	45-85	25-45	7-25
	40-60	Sandy loam	CL, ML, SC, SM	A-2, A-4, A-6	0	0	100	95-100	60-100	30-80	15-35	NP-20
Km: Kirkland-----	0-12	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	80-97	22-30	2-10
	12-34	Silty clay	CH, CL	A-7	0	0	100	100	96-100	88-99	41-65	18-38
	34-60	Clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-65	15-38
Kr: Kirkland-----	0-12	Clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	80-98	30-43	8-18
	12-34	Silty clay	CH, CL, MH	A-7	0	0	100	100	96-100	88-99	41-65	18-38
	34-60	Clay	CH, CL, MH	A-6, A-7	0	0	100	100	96-100	76-99	37-65	15-38
Renfrow-----	0-9	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-26
	9-13	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	37-49	15-26
	13-60	Clay	CH, CL, MH	A-6, A-7	0	0	100	100	96-100	80-99	37-70	15-38
Kw: Kirkland-----	0-6	Clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	80-98	30-43	8-18
	6-34	Silty clay	CH, CL	A-7	0	0	100	100	96-100	88-99	41-65	18-38
	34-60	Clay	CH, CL	A-6, A-7	0	0	100	100	96-100	76-99	37-65	15-38
Renfrow-----	0-6	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-26
	6-60	Clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	15-38
Mc: Minco-----	0-42	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	42-60	Silt loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-97	15-31	NP-10
Mn: Minco-----	0-42	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	42-60	Silt loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-97	15-31	NP-10
Mo: Minco-----	0-42	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	15-31	NP-10
	42-60	Silt loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-97	15-31	NP-10
Na: Nashville-----	0-12	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	12-30	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	>30	Weathered bedrock			---	---	---	---	---	---	---	---

ENGINEERING INDEX PROPERTIES--Continued
Harper County, Kansas

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
Ne: Nashville-----	0-12	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	12-30	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	>30	Weathered bedrock			---	---	---	---	---	---	---	---
Nh: Nashville-----	0-12	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	12-30	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	30-60	Weathered bedrock			---	---	---	---	---	---	---	---
Nn: Nashville-----	0-7	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	7-30	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	95-100	85-100	20-35	2-10
	>30	Weathered bedrock			---	---	---	---	---	---	---	---
No: Norge-----	0-10	Loam	CL, CL-ML	A-4, A-6	0	0	95-100	95-100	95-100	65-85	20-35	5-15
	10-60	Clay loam	CH, CL, MH, SC	A-6, A-7-6	0	0	95-100	95-100	65-100	45-80	35-55	11-25
Pc: Pond Creek-----	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	13-60	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
Pd: Pond Creek-----	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	13-60	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
Pe: Pond Creek-----	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	13-60	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
Pg: Pond Creek-----	0-8	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	8-60	Silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
Ph: Dale-----	0-22	Silt loam	CL, CL-ML	A-4, A-6	0	0	95-100	95-100	90-100	65-98	25-35	5-15
	22-60	Silt loam	CL	A-4, A-6, A-7	0	0	95-100	95-100	90-100	65-98	30-43	8-20
Pk: Port-----	0-22	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	80-100	25-35	5-15
	22-44	Silt loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	85-100	30-50	8-25
	44-60	Silty clay loam	CL	A-7, A-4, A-6	0	0	100	100	90-100	85-100	30-50	8-25
Pm: Pratt-----	0-12	Loamy fine sand	SM	A-2	0	0	100	95-100	70-100	15-35	---	NP
	12-36	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	90-100	15-40	15-20	NP-6
	36-60	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	---	NP
Pn: Pratt-----	0-12	Loamy fine sand	SM	A-2	0	0	100	95-100	70-100	15-35	---	NP
	12-37	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	90-100	15-40	15-20	NP-6
	>37	Weathered bedrock			---	---	---	---	---	---	---	---
Po: Pratt-----	0-12	Loamy fine sand	SM	A-2	0	0	100	95-100	70-100	15-35	---	NP
	12-36	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	90-100	15-40	15-20	NP-6
	36-60	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	---	NP
Carwile-----	0-14	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	36-60	15-26	NP-7
	14-20	Sandy clay loam	CL, SC	A-6, A-7	0	0	100	100	90-100	36-90	35-50	14-26
	20-42	Clay	CH, CL, SC	A-6, A-7	0	0	100	100	90-100	40-95	35-70	14-38
	42-60	Sandy clay loam	CH, CL, SC	A-4, A-6, A-7	0	0	100	100	90-100	36-95	25-70	7-38
Pt: Pratt-----	0-12	Loamy fine sand	SM	A-2	0	0	100	95-100	70-100	15-35	---	NP
	12-20	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	90-100	15-40	15-20	NP-6
	20-60	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	---	NP
Tivoli-----	0-5	Loamy fine sand	SM	A-2	0	0	100	95-100	90-100	15-35	---	NP
	5-60	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-25	---	NP
Qa: Quinlan-----	0-9	Loam	CL-ML, ML, CL	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
Qn: Quinlan-----	0-9	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
Qu: Quinlan-----	0-9	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
Rc: Renfrow-----	0-9	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-26
	9-13	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	37-49	15-26
	13-60	Clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	15-38
Vernon-----	0-7	Clay loam	CL	A-6, A-7-6	0	0	95-100	90-100	90-100	70-95	35-50	17-30
	7-24	Silty clay	CH, CL	A-6, A-7-6	0	0	95-100	90-100	90-100	80-98	38-60	20-40
	24-28		CH, CL	A-6, A-7-6	0	0-5	90-100	85-100	65-100	65-96	30-60	15-38
	28-80	Weathered bedrock			---	---	---	---	---	---	---	---
Re: Ruella-----	0-9	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-100	65-85	25-35	5-15
	9-60	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-100	65-85	25-35	5-15

ENGINEERING INDEX PROPERTIES--Continued
Harper County, Kansas

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
					Pct	Pct						
Rh: Ruella-----	0-9 9-60	Loam Loam	CL, CL-ML CL, CL-ML	A-4, A-6 A-4, A-6	0 0	0 0	100 100	100 100	85-100 85-100	65-85 65-85	25-35 25-35	5-15 5-15
Ru: Ruella-----	0-9 9-60	Loam Loam	CL, CL-ML CL, CL-ML	A-4, A-6 A-4, A-6	0 0	0 0	100 100	100 100	85-100 85-100	65-85 65-85	25-35 25-35	5-15 5-15
Sa: Lesho-----	0-18 18-36 36-60	Clay loam Loam Coarse sand	CL CL SM, SP-SM	A-6, A-7-6 A-6, A-7-6 A-2, A-3	0 0 0	0 0 0	100 100 100	100 100 95-100	90-100 85-100 55-75	75-95 65-95 5-35	35-45 30-45 ---	15-22 11-22 NP
Sb: Shellabarger---	0-13 13-38 38-60	Fine sandy loam Sandy clay loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Se: Shellabarger---	0-13 13-38 38-60	Fine sandy loam Fine sandy loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Sf: Shellabarger---	0-13 13-38 38-60	Fine sandy loam Sandy clay loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Sg: Shellabarger---	0-13 13-38 38-60	Fine sandy loam Sandy clay loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Sh: Zellmont-----	0-8 8-18 18-26 26-32 32-80	Sandy loam Sandy clay loam Sandy clay loam Loam Weathered bedrock	CL, SC CL, SC SC, SC-SM, SP-SC CL, SC	A-4, A-6, A-2-4, A-2-6 A-4, A-6, A-2-4, A-2-6 A-2-4 A-2-4, A-2-6	0 0 0 0 ---	0 0 0 0 ---	95-100 95-100 80-100 85-100 ---	95-100 95-100 70-100 70-100 ---	75-100 65-100 50-80 65-100 ---	30-55 45-80 10-40 45-80 ---	25-35 30-40 20-30 30-40 ---	10-15 10-20 5-10 10-20 ---
SHH: Shellabarger---	0-10 10-45 45-60	Sandy loam Sandy clay loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Sk: Zellmont-----	0-8 8-18 18-26 26-32 32-80	Sandy loam Sandy clay loam Sandy clay loam Loam Weathered bedrock	CL, SC CL, SC SC, SC-SM, SP-SC CL, SC	A-4, A-6, A-2-4, A-2-6 A-4, A-6, A-2-4, A-2-6 A-2-4 A-2-4, A-2-6	0 0 0 0 ---	0 0 0 0 ---	95-100 95-100 80-100 85-100 ---	95-100 95-100 70-100 70-100 ---	75-100 65-100 50-80 65-100 ---	30-55 45-80 10-40 45-80 ---	25-35 30-40 20-30 30-40 ---	10-15 10-20 5-10 10-20 ---
Sm: Zellmont, erode	0-8 8-18 18-26 26-32 32-80	Sandy loam Sandy clay loam Sandy clay loam Loam Weathered bedrock	CL, SC CL, SC SC, SC-SM, SP-SC CL, SC	A-4, A-6, A-2-4, A-2-6 A-4, A-6, A-2-4, A-2-6 A-2-4 A-2-4, A-2-6	0 0 0 0 ---	0 0 0 0 ---	95-100 95-100 80-100 85-100 ---	95-100 95-100 70-100 70-100 ---	75-100 65-100 50-80 65-100 ---	30-55 45-80 10-40 45-80 ---	25-35 30-40 20-30 30-40 ---	10-15 10-20 5-10 10-20 ---
Sn: Shellabarger---	0-13 13-38 38-60	Loamy fine sand Sandy clay loam Coarse sandy loam	SM SC SC, SC-SM, SM, SP-SM	A-2 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	70-100 70-90 50-80	15-35 35-50 10-40	---	NP 8-20 NP-10
So: Shellabarger---	0-13 13-38 38-60	Fine sandy loam Sandy clay loam Coarse sandy loam	ML, SM SC SC, SC-SM, SM, SP-SM	A-2, A-4 A-4, A-6 A-2, A-4	0 0 0	0 0 0	95-100 95-100 80-100	95-100 85-100 70-100	75-100 70-90 50-80	30-55 35-50 10-40	15-30 25-40 15-30	NP-5 8-20 NP-10
Albion-----	0-6 6-21 21-60	Sandy loam Sandy loam Loamy sand	ML, SM ML, SM GM, GP-GM, SM, SP-SM	A-2, A-4 A-2, A-4 A-1, A-2, A-3	0 0 0	0 0 0-5	100 85-100 40-100	75-100 75-100 40-90	60-90 45-90 30-70	25-55 30-55 5-30	15-30 20-35 15-30	NP-5 NP-10 NP-5
Sp: Drummond-----	0-8 8-30 30-60	Loam Clay loam Variable	CL, CL-ML, ML CH, CL	A-4, A-6 A-6, A-7	0 0 ---	0 0 ---	100 100 ---	100 100 ---	96-100 96-100 ---	65-97 80-98 ---	22-39 35-60 ---	3-15 15-35 ---
Ta: Tabler-----	0-10 10-33 33-60	Clay loam Silty clay Silty clay	CL CH, CL CH, CL	A-6, A-7 A-7 A-6, A-7	0 0 0	0 0 0	100 100 96-100	100 100 96-100	96-100 90-99 80-99	80-98 90-99 80-99	32-43 41-65 38-60	11-20 18-35 15-35

ENGINEERING INDEX PROPERTIES--Continued
Harper County, Kansas

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
					Pct	Pct					Pct	
Th:	In											
Tivoli-----	0-5	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-25	---	NP
	5-60	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-25	---	NP
Vr:												
Vernon-----	0-7	Clay loam	CL	A-6, A-7-6	0	0	95-100	90-100	90-100	70-95	35-50	17-30
	7-24	Clay	CH, CL	A-6, A-7-6	0	0	95-100	90-100	90-100	80-98	38-60	20-40
	24-28		CH, CL	A-6, A-7-6	0	0-5	90-100	85-100	65-100	65-96	30-60	15-38
Renfrow-----	0-7	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-49	12-26
	7-60	Clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	15-38
W:												
Water-----	---	---	---	---	---	---	---	---	---	---	---	---
Wa:												
Kingman-----	0-10	Clay loam	CL	A-6, A-7-6	0	0	100	100	95-100	65-90	30-50	10-26
	10-60	Sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	95-100	90-100	40-90	15-40	5-20
Wd:												
Woodward-----	0-24	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	90-100	51-95	15-31	NP-12
	>24	Weathered bedrock			---	---	---	---	---	---	---	---
Quinlan-----	0-9	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
We:												
Woodward-----	0-24	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	90-100	51-95	15-31	NP-12
	>24	Weathered bedrock			---	---	---	---	---	---	---	---
Quinlan-----	0-9	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
Ww:												
Woodward-----	0-24	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	90-100	51-95	15-31	NP-12
	>24	Weathered bedrock			---	---	---	---	---	---	---	---
Quinlan-----	0-9	Loam	CL, CL-ML, ML	A-4, A-6	0	0	100	95-100	90-100	51-97	15-37	NP-14
	>9	Weathered bedrock			---	---	---	---	---	---	---	---
Za:												
Canadian-----	0-21	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-65	15-26	NP-7
	21-37	Fine sandy loam	CL, ML, SC, SM	A-4	0	0	100	98-100	94-100	36-85	15-31	NP-10
	37-60	Loamy fine sand	CL, ML, SC, SM	A-2, A-4	0	0	100	98-100	90-100	15-85	15-31	NP-10
Zf:												
Zenda-----	0-15	Fine sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0	100	95-100	85-100	35-55	20-35	5-15
	15-60	Clay loam	CL	A-6	0	0	100	95-100	85-100	55-80	25-40	10-25

