FRANKLIN COUNTY
COMMISSION AGENDA ITEM

TO: BOARD OF FRANKLIN COUNTY COMMISSIONERS	**Reviewed:**
FROM: JAMES M. HAAG, JR.	**Ext. 3552**
DEPARTMENT: PUBLIC WORKS	
DATE: 6/22/09	**No.**

ITEM: Discuss the Acorn Box Backfill Evaluation Report prepared by Terracon Consultants, Inc.

Background: Franklin County contracted with Terracon Consultants, Inc. to test and evaluate the backfill placed alongside the Acorn Box. Two test holes were drilled and the recovered material was tested and evaluated. The tests indicate the material was correctly placed and is suitable for the support of the pavement.

Recommended Action: Discuss the Acorn Box Backfill Evaluation Report prepared by Terracon Consultants, Inc.

Attachments: Terracon Report

BACKFILL EVALUATION
EXISTING BOX CULVERT
FRANKLIN COUNTY, KANSAS

PROJECT NO. 14095018
June 16, 2009

Prepared for:

FRANKLIN COUNTY, KANSAS
OTTAWA, KANSAS

Prepared by:

Terracon
Topeka, Kansas

Terracon

June 16, 2009

Terracon
Consulting Engineers & Scientists

Terracon Consultants, Inc.
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Franklin County, Kansas
1428 South Main Street, Suite 4
Ottawa, 66067

Attention: Mr. James M. Haag, Jr., P.E.
Public Works Director

RE: Backfill Evaluation
Existing Box Culvert
Franklin County, Kansas
Terracon Project No. 14095018

Dear Mr. Haag:

Terracon Consultants, Inc. (Terracon) has completed the subsurface exploration at the site of an existing box culvert in Franklin County, Kansas. These services were performed in general accordance with our proposal dated April 14, 2009. This report presents the findings of the subsurface exploration, test results and professional opinions regarding the condition of the existing backfill materials east and west of the box culvert as it relates to the support of the pavement.

We appreciate the opportunity to work with you on this project. If you have any questions regarding this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

Deepak K. Neupane, EIT
Project Manager

Stephen B. Pretsch, P.E.
Office Manager
Kansas No. 16602

STEPHEN BRIAN PRETSCH
LICENSED
6/17/09
16602
KANSAS
PROFESSIONAL ENGINEER

Enclosures

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BACKFILL EVALUATION
EXISTING BOX CULVERT
FRANKLIN COUNTY, KANSAS

TERRACON PROJECT NO. 14095018
June 16, 2009

INTRODUCTION

Terracon has completed the backfill evaluation at the site of a box culvert in Franklin County, Kansas. This exploration was performed in general accordance with our proposal dated April 14, 2009. Two (2) borings were performed at the site and individual boring logs are in Appendix A. This report presents the findings of the subsurface exploration, laboratory testing and provides professional opinions regarding the condition of the existing backfill materials east and west of the box culvert as it relates to the support of the pavement.

PROJECT DESCRIPTION

The box culvert in question is located just west the intersection of Iowa Road and John Brown Road in Franklin County, Kansas. The existing pavement along John Brown Road in this area was part of a 36 mile road improvement project that occurred in 2005, which included the construction of a 2-inch asphaltic concrete section over existing reworked gravel roads. Reportedly, road distress occurred soon after the installation of the road section, including areas near the box culvert. Franklin County is considering adding a 2-inch-thick asphaltic concrete overlay to the road as a result of the recent distress. While the pavement distress has not been limited to just the area immediately around the box culvert, Franklin County desires an evaluation of the backfill associated with the box culvert prior to placing the new asphaltic concrete overlay.

SUBSURFACE EXPLORATION AND LABORATORY TESTING PROCEDURES

Subsurface Exploration

Terracon personnel established one boring location on each side of the box culvert (within the existing road) by visually aligning each side of the culvert and then offsetting the boring a few feet. The drill crew determined relative elevations at boring locations using a surveyor's level and rod. The top of the box culvert at the south end was used as a benchmark to estimate the elevation at the borings. An elevation of 100 feet was assigned to the elevation for this benchmark. The elevations shown on the boring logs have been rounded to the nearest foot. Locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a truck-mounted, rotary drilling rig using continuous flight augers to advance the boreholes. Representative samples were obtained using thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled,

seamless steel tube with a sharp cutting edge is pushed hydraulically into the ground to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value (N). These "N" values are indicated on the boring logs at the depths of occurrence. The samples were tagged for identification, sealed to reduce moisture loss, and returned to the laboratory for testing and classification.

The drill crew prepared field logs of the borings to record data including visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The final boring logs included with this report represent the engineer's interpretation of subsurface conditions based on data from the field logs, laboratory tests and observation of the samples.

Laboratory Testing

Water content tests were performed on all samples obtained. Thin-walled tube samples were tested in the laboratory to measure their dry unit weights and natural water contents. A standard Proctor test was performed on a composite bulk sample taken within the upper three feet of the borings (below the existing pavement). The test results are provided in respective boring logs in Appendix A or can be found in Appendix B.

The soil samples were examined in the laboratory and classified in accordance with the General Notes located in Appendix C and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbols for the Unified Soil Classification System are shown on the boring logs and a brief description of the Unified System is included in Appendix C.

SUBSURFACE CONDITIONS

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

Approximately 14 inches of asphaltic concrete was encountered at Borings B-1 and B-2 at the surface. Existing fill was encountered below the asphaltic concrete. Gravelly lean to fat clay fill was encountered to a depth of approximately 3 feet and was underlain by lean to fat and lean clay fill with varying amounts of gravel. The identifiable fill extended to depths of approximately 8 feet. Materials that could be fill, identified on the logs as possible fill, was encountered below fill at both borings. The possible fill consisted of lean clays with varying amounts of sand and gravel that

extended to depths ranging from 11 to 12 feet. Below the possible fill, the borings encountered native lean and fat clay soils to the boring termination depths, 15 feet.

Water Level Observations

The borings were monitored while drilling and immediately after completion of drilling for the presence and level of groundwater. Water was observed at Borings B-2 at a depth of about 6 feet while drilling with an auger and a free static water surface was observed at a depth of about 9½ feet after completion of drilling. Water was not observed at Boring B-1 at the time of the exploration.

Fluctuations of the groundwater level may occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Groundwater levels at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. Long term monitoring in cased holes or piezometers may be required for a more accurate evaluation of the conditions.

PROFESSIONAL OPINIONS

Mr. James Haag with Franklin County reported that the relatively thick pavement section encountered at the box culvert was part of an earlier, isolated repair to the road, which was not installed by design but rather by contractor judgment in the field. Density tests performed on the subgrade materials immediately below the pavement section revealed dry densities of 113 pcf and 115 pcf. These densities were compared to a standard proctor results performed on a representative bulk sample of the material. The test results indicated compaction levels of 95.7 percent and 97.3 percent of the material's maximum dry density as determined by the standard Proctor. In our experience, road subgrades perform predictably when compacted to a minimum of 95 percent of the material's standard Proctor dry density, which both tests exceeded. Additional dry density testing was performed on the existing fill present below 3 feet with the results ranging from 107 pcf to 116 pcf at moisture contents ranging from 16.1 percent to 18.3 percent. In our opinion, the range in dry densities directly correlates to the varying percentages of gravel within the samples. Based on our experience, the dry densities fell within an anticipated range for fill placed with moisture and density control for pavements. The native soils present below the existing fill ranged in consistency from medium stiff to very stiff.

In our opinion, the fill materials explored and tested appeared to be of suitable compaction to support pavements. Provided the unexplored backfill materials associated the box culvert are consistent with the materials tested, we do not suggest the need to remove and replace the backfill prior to the installation of the new pavement section.

It should be noted that water was observed at Boring B-2 at the time of drilling but was not observed at Boring B-1. A possible exploration for encountering isolated water on one side of the box culvert includes the presence of a westward draining ditch located on the north side John Brown Road, which converts to a below grade pipe below Iowa Road. The pipe daylights through the wing wall associated with the box culvert. In our opinion, the water encountered at Boring B-2 could be the result of water entering the backfill and/or bedding surrounding the pipe, which becomes blocked and redirected at the wing wall. It is possible that trapped water could elevate to sufficient levels to impact the subgrade soils supporting the pavement. To reduce the potential of water entering and potentially impacting pavement subgrade soils, consideration could be given towards creating a concrete plug around the east end of the pipe (east side of Iowa Road). The concrete plug should be about 1 foot deep and should extend a suitable distance surrounding the pipe that would limit seepage. The pipe should also be inspected for damage and repaired as necessary.

GENERAL COMMENTS

The analysis and opinions presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until after construction of the overlay. If variations appear, we should be immediately notified so that further evaluation and supplemental opinions and recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

LOG OF BORING NO. B-1

CLIENT: Franklin County

SITE: Iowa & John Brown Road, Franklin County, Kansas

PROJECT: Backfill Evaluation - Existing Box Culvert

Boring Location: West Side of Culvert - EB Lane

Approx. Surface Elev.: 103 ft

GRAPHIC LOG / DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
14" Asphaltic Concrete	1.2 / 102			PA					
FILL: Gravely lean to fat clay, gray, brown	3 / 100		1	ST	9		11.6	115	
			2	ST	12		18.5	107	
FILL: Lean to fat clay, trace gravel, brown	5			PA					
	8 / 95		3	ST	10		16.1	107	
LEAN CLAY trace gravel, brown, stiff (Possible Fill)		CL	4	ST	6		17.2	98	3000*
	10			PA					
	12 / 91								
LEAN TO FAT CLAY brown, gray, medium stiff		CL CH	5	SS	12	7	26.6		
	15 / 88								
BOTTOM OF BORING	15								

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

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽ NONE AB
WL	▽		▽
WL			

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BORING STARTED	5-15-09		
BORING COMPLETED	5-15-09		
RIG	CME-75	FOREMAN	JJ
APPROVED	SBP	JOB #	14095018

BOREHOLE 14095018.GPJ TERRACON.GDT 6/15/09

LOG OF BORING NO. B-2

CLIENT: Franklin County

SITE: Iowa & John Brown Road, Franklin County, Kansas

PROJECT: Backfill Evaluation - Existing Box Culvert

Boring Location: East Side of Culvert - WB Lane

Approx. Surface Elev.: 103 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	14" Asphaltic Concrete				PA					
	1.2 / 102									
	FILL: Gravely lean to fat clay, gray, brown			1	ST	9		7.1	113	
	3 / 100									
	FILL: Lean clay, trace to with gravel, brown ▽			2	ST	15		16.3	109	
		5			PA					
				3	ST	6		18.1	116	
	8 / 95									
	LEAN CLAY with sand and gravel, brown, very stiff (Possible Fill) ▽		CL	4	SS	9	20	18.6		
	11 / 92	10			PA					
	LEAN TO FAT CLAY brown, gray, stiff		CL CH	5	SS	21	9	26.7		
	15 / 88	15								
	BOTTOM OF BORING									

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

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 6	WD	▽ 9.5	AB
WL	▽		▽	
WL				

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BORING STARTED	5-15-09		
BORING COMPLETED	5-15-09		
RIG	CME-75	FOREMAN	JJ
APPROVED	SBP	JOB #	14095018

BOREHOLE 14095018.GPJ TERRACON.GDT 6/15/09

LABORATORY COMPACTION CHARACTERISTICS OF SOIL REPORT

Report Number: 14095018.0001
Service Date: 05/27/09
Report Date: 06/15/09

Terracon
3113 SW Van Buren St
Topeka, KS 66611
785-267-3310

Client

Franklin County Kansas
Attn: James Haag
1428 S Main
Suite 4
Ottawa, KS 66067

Project

Box Culvert Backfill Evaluation
Iowa Road and John Brown Road
Ottawa, KS

Project Number 14095018

Material Information

Source of Material: Borings B1 and B2
Proposed Use:

Sample Information

Sample Date: 05/25/09
Sampled By: Terracon
Sample Location: 1 to 3 Feet

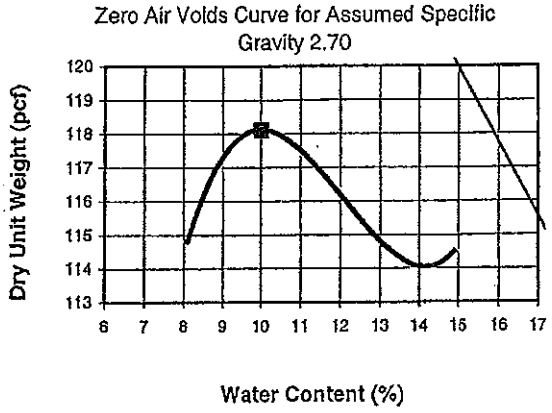
Sample Description: Gravely Lean to Fat Clay

Laboratory Test Data

Test Procedure: ASTM D698
Test Method: Method A
Sample Preparation: Dry
Rammer Type: Mechanical
Maximum Dry Unit Weight (pcf): 118.1
Optimum Water Content (%): 10.0

	Result	Specifications
Liquid Limit:		
Plastic Limit:		
Plasticity Index:		
In-Place Moisture (%):		

USCS:



Comments:

Services:

Reported To: Franklin County Kansas
Contractor: Killough Construction

Report Distribution:
(2) Franklin County Kansas

Reviewed By:
Terracon

Test Methods:

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI lots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

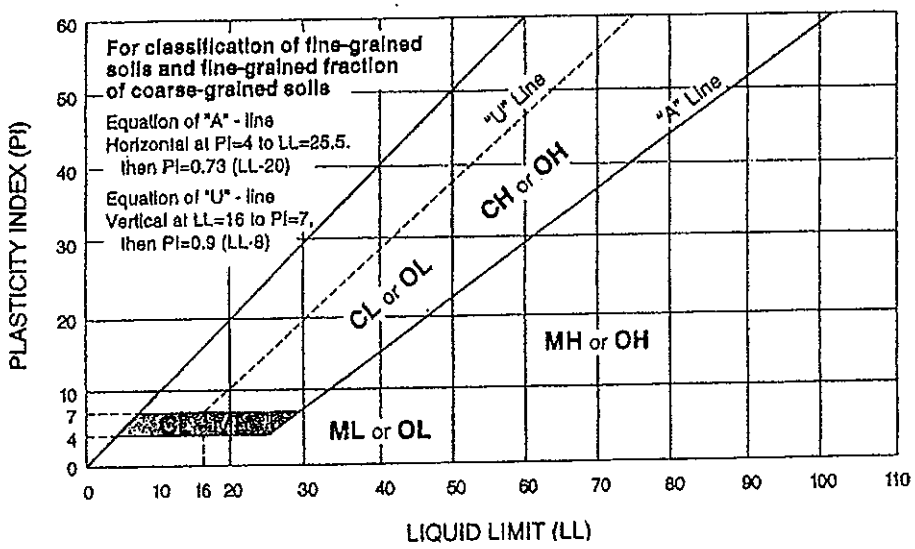
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



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