

Sampling & Testing Tips Stark County, ND

Pre-Conference Graveling Workshop Dickinson, ND

January 26, 2022

NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

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CIVIL ENGINEERING & LAND SURVEYING

SOILS & CONCRETE LAB

STARK COUNTY GRAVEL TESTING



STARK COUNTY GRAVEL





SAMPLING PROCEDURES

- OBTAIN SAMPLE
- FISHER SAMPLING
- NDDOT SAMPLING
- NEXT DAY RESULTS

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					SIE	/E SIZI	ES AND	PERCENTS	S PASS	ING	
Specifications		1"	3/4"	#4	#8	#30	#200	P.I.			
opecifications	Spec. Limit	100	70-100	38-75	22-62	12-45	7.0-18.0	3.0-6.0			
	tTerret Deser						1.1				

VEL		Specific	ations
X	Τ	DATE/TIME SAMPLED	LOC
		10/14/20	Belt
		10/15/20	Belt
		10/19/20	Belt
		10/20/20	Belt
		10/21/20	Belt
		10/22/20	Belt
	≤[10/27/20	Belt
	TEST DATA	10/28/20	Belt
	ts [10/29/20	Belt
\bigcirc	≓[10/30/20	Belt
		11/02/20	Belt
		11/03/20	Belt
		11/04/20	Belt
		11/05/20	Belt
$\boldsymbol{\gamma}$		11/06/20	Belt
		11/09/20	Belt
		11/10/20	Belt
		11/11/20	Belt

						SIEV	E SIZI	ES ANI	D PERC	ENTS	PAS	SING		
Specifica	tions		1"	3/4"	#4	#8	#30	#200		P.I.				
Specifica	uons	Spec. Limit	100	70-100	38-75	22-62	12-45	7.0-18.0	1	10-60		1		
		*Target Range												
DATE/TIME SAMPLED	LOCATION SAMPLED	TEST NO.					P	ERCE	NTS PA	SSIN	G			REMARKS
10/14/20	Belt	20-SCG01	100	95	63	55	42	18.6		4.3				F #200
10/15/20	Belt	20-SCG02	100	95	63	53	39	15.7		3.0				Р
10/19/20	Belt	20-SCG03	100	96	63	53	39	14.0		4.9				Ρ
10/20/20	Belt	20-SCG04	100	96	64	56	41	15.6		2.9				F - P.I.
10/21/20	Belt	20-SCG05	100	95	57	50	38	16.6		3.4				P
10/22/20	Belt	20-SCG06	100	95	53	43	30	11.0		4.1				P
10/27/20	Belt	20-SCG07	100	96	58	48	35	14.7		3.0				P
10/28/20	Belt	20-SCG08	100	96	58	49	35	14.8		2.6				F - P.I.
10/29/20	Belt	20-SCG09	100	98	62	52	36	13.5		3.6				Р
10/30/20	Belt	20-SCG10	100	97	53	43	30	12.4		3,4	1			Р
11/02/20	Belt	20-SCG11	100	97	68	57	41	16.5		3.6	() ()			Р
11/03/20	Belt	20-SCG12	100	97	65	53	36	14.8		3.7				P
11/04/20	Belt	20-SCG13	100	95	53	45	32	12.9		3.7				P
11/05/20	Belt	20-SCG14	100	98	61	52	37	15.2		3.2				Ρ
11/06/20	Belt	20-SCG15	100	96	60	49	35	14.4		4.2				P
11/09/20	Belt	20-SCG16	100	98	56	45	31	12.2		2.4				F - P.I.
11/10/20	Belt	20-SCG17	100	96	54	46	33	14.0		4.0				Р
11/11/20	Belt	20-SCG18	100	96	60	51	39	16.9		3.8				Р

		Crushing and St	ockpili	ng Grav	el			PCN		Aggr	egate Class	13M	
Section Nun	nber	302			Title	Stark (County (Sravel		LAA	brasion		
	Miller-Bob Pit				_					Lab	Number		
regates	SW1/4 SEC 11, T1	39N, R93W Stark	County	, ND						- W.			
						SIE	VE SIZ	ES AND	PERCENTS F	ASSING			
necific	ations		49	3/4"	#4	#8	#30	#200	P.1.				
peeme	ations	Spec. Limit	100	70-100	38-75	22-62	12-45	7.0-18.0	3080				
		*Target Range											
E/TIME MPLED	LOCATION SAMPLED	TEST NO.	PERCENTS PASSING							542 - 111		REMARKS	
/27/21	Belt	21-SCG07	100	98	67	58	49	15.1	3.4				F - #30
/28/21	Selt	21-SCG08	100	98	66	57	(48)	14.4	3.3				F - #30
/29/21	Belt	21-SCG09	100	97	70	62	63	15.0	0				F - #30 & PI
/01/21	Belt	21-SCG10	100	97	68	60	49	13.7	(NP)				F - #30 & PI
/02/21	Belt	21-5CG11	100	99	69	61	9	15.7	0				F - #30 & PI
/03/21	Belt	21-SCG12	100	96	64	56	49	13.7	4.1		1 2		F - #30
/04/21	Belt	21-SCG13	100	97	69	63	9	14.5	4.1		1		F-#30 & #8
/05/21	Belt	21-SCG14	100	98	67	58	(49)	14.5					F - #30 & PI
/08/21	Belt	21-SCG15	100	97	68	61	62	12.8	0				F - #30 & PI
/09/21	Belt	21-SCG16	100	97	72	65	66	14.9	3.3				F - #30 & #8
/10/21	Belt	21-SCG17	100	99	71	61	62	14.9	3.0				F - #30
/11/21	Belt	21-SCG18	100	97	69	61	9	14.8	23		-		F - #30 & PI
/12/21	Belt	21-SCG19	100	95	68	61	63	15.3	3.7				F - #30
/15/21	Selt	21-SCG20	100	98	74	65	65	15.5	3.2				F - #30 & #8
/16/21	Beit	21-9CG21	100	97	64	56	48	13.5	3.9				F - #30
/17/21	Belt	21-SCG22	100	97	66	58	49	13.4	3.7				F - #30
/18/21	Beit	21-SCG23	100	96	69	61	62	15.0	3.7				F + #30
/22/21	Belt	21-SCG24	100	98	70	61	62	14.5	5.2				F - #30
	Pecific Prime APLED 27/21	EFTIME APLED LOCATION SAMPLED /27/21 Belt /27/21 Belt /28/21 Belt /29/21 Belt /29/21 Belt /01/21 Belt /02/21 Belt /03/21 Belt /04/21 Belt /04/21 Belt /05/21 Belt /05/21 Belt /06/21 Belt /10/21 Belt /10/21 Belt /11/21 Belt	Spec.Limit Spec.Limit Target Range E/TIME APLED LOCATION SAMPLED TEST NO. /27/21 Belt 21-SCG07 /28/21 Belt 21-SCG08 /29/21 Belt 21-SCG09 /01/21 Belt 21-SCG10 /02/21 Belt 21-SCG11 /03/21 Belt 21-SCG12 /04/21 Belt 21-SCG13 /05/21 Belt 21-SCG14 /05/21 Belt 21-SCG15 /09/21 Belt 21-SCG16 /10/21 Belt 21-SCG16 /10/21 Belt 21-SCG17 /11/21 Belt 21-SCG16 /10/21 Belt 21-SCG17 /11/21 Belt 21-SCG19 /15/21 Belt 21-SCG20 /16/21 Belt 21-SCG20 /16/21 Belt 21-SCG22 /18/21 Belt 21-SCG22 /18/21 Belt	Image: pecifications 1" Spec.Limit 100 Target Range 100 ETTIME APLED LOCATION SAMPLED TEST NO. /27/21 Belt 21-SCG07 100 /28/21 Belt 21-SCG08 100 /29/21 Belt 21-SCG10 100 /02/21 Belt 21-SCG11 100 /02/21 Belt 21-SCG12 100 /03/21 Belt 21-SCG12 100 /04/21 Belt 21-SCG13 100 /05/21 Belt 21-SCG14 100 /06/21 Belt 21-SCG15 100 /06/21 Belt 21-SCG15 100 /09/21 Belt 21-SCG16 100 /10/21 Belt 21-SCG18 100 /11/21 Belt 21-SCG20 100 /11/21 Belt 21-SCG21 100 /15/21 Belt 21-SCG21 100 /15/21	Image: system interval and interva	Image: Period constraints Image: Image constraints Image: Image: Image constraints Image: Image: Image constraints Image:	Pecifications Spec.Limit 1" 3/4" #4 #8 Spec.Limit 100 76.300 38-75 22.62 'Target Range Image	SIEVE SIZ 1" 3/4" #4 #8 #30 Spec.Limit 100 76-100 38-75 22-62 12-45 'Target Range 1 1 3/4" #4 #8 #30 EFTIME APLED LOCATION SAMPLED TEST NO. Image: Second	SIEVE SIZES AND I 1" 3/4" #4 #8 #30 #200 Spec.Limit 100 76:500 38:75 22:62 12:45 76:500 EFTIME MPLED LOCATION SAMPLED TEST NO, TEST NO, VEVENUE VENUE VENUE 127/21 Belt 21:90 (30) 98 66 57 68 16.1 14.4 128/21 Belt 21:90 (30) 98 66 57 68 14.4 129/21 Belt 21:90 (31) 100 97 70 62 63 15.0 101/21 Belt 21:90 (31) 100 97 68 60 49 13.7 100/21 Belt 21:90 (31) 100 97 68 60 49 13.7 100/21 Belt 21:90 (31) 100 97 68 61 63 14.5 100/21 Belt 21:90 (31) 100 97 68 61	SIEVE SIZES AND PERCENTS F 1" 3/4" #4 #8 #30 #200 P.1. Spec.Limit 100 70-100 38-75 22.62 1245 7.0-180 398-80 FTIME LOCATION SAMPLED TEST NO. TEST NO. PERCENTS PASSING 1227/1 Belt 21-SCG07 100 98 67 58 49 15.1 3.4 1 1228/21 Belt 21-SCG07 100 98 66 57 48 14.4 3.3 1 1228/21 Belt 21-SCG09 100 97 70 62 53 14.4 3.3 1 1228/21 Belt 21-SCG09 100 97 70 62 53 15.0 59 10 97 1202/21 Belt 21-SCG11 100 99 69 61 53 43 14.5 4.1 100/21 Belt 21-SCG14 100 96 64<	SIEVE SIZES AND PERCENTS PASSING 1" 3/4" #4 #8 #30 #200 P.I. Image Spec. Limit 100 70:00 38.75 32.62 12.45 76.180 39.64 FTIME MPLED LOCATION SAMPLED TEST NO. TEST NO. PERCENTS PASSING 27/721 Belt 21.5CG07 100 98 67 58 49 15.1 3.4 22/21 Belt 21.5CG07 100 98 66 57 49 14.4 3.3 22/21 Belt 21.5CG09 100 97 70 62 53 15.0 10 16 29/21 Belt 21.5CG10 100 97 70 62 53 15.0 10 16 20/21 Belt 21.5CG12 100 97 65 60 49 13.7 4.1 1 20/21 Belt 21.5CG13 100 97 6	SIEVE SIZES AND PERCENTS PASSING 1" 3/4" #4 #6 #30 #200 P.I. Image I	SIEVE SIZES AND PERCENTS PASSING 1" 3/4" #4 #8 #30 #200 P.I. Image I

roje	st No.		Crushing and St	ockpilir	ng Grav	el 🛛	_		PCN			Aggn	egate Class	13M	
peci	fication Section Nur	nber	302			Title	Stark C	county C	Sravel			LAA	brasion		
ocat	ion	Miller-Bob Pit										Lab.	Number		
Sourc	e of Aggregates	SW1/4 SEC 11, T1	39N, R93W Stark	County	, ND							<i>w</i> .			
							SIE	VE SIZ	ES AN	D PERC	ENTS P	ASSING			
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	specific	ations	Spec. Limit	100	70-100	38-75	22-62	12-45	7.0.18.0		3080]
			*Target Range												1
	DATE/TIME SAMPLED	LOCATION SAMPLED	TEST NO.		1			F	PERCE	NTS PA	SSING	17.	- 11 - 11 - 11 - 11 - 11 - 11 - 11 - 1		REMARKS
	11/23/21	Belt	21-SCG25	100	95	67	59	60	14.7		3.1				F - #30
	11/29/21	Selt	21-SCG26	100	97	71	63	63	15.7		3.3		1.0		F - #30 & #8
	11/30/21	Belt	21-SCG27	100	99	70	60	61	13.9		2				F - #30 & PI
	12/1/21	Belt	21-SCG28	100	99	69	60	62	14.8		3,4		100		F - #30
	12/2/21	Belt	21-SCG29	100	100	72	64	64	13.9		23		19 19		F - #30, #8 & PI
	12/3/21	Belt	21-SCG30	100	97	74	66	57	15.2		3.3				F - #30 & #8
Z	12/7/21	Belt	21-SCG31	100	97	.74	67	69	14.8		3.3				F - #30 & #8
M	12/8/21	Belt	21-SCG32	100	99	74	65	66	15.6		3.1		1.1		F - #30 & #8
EST DATA				_							- 5				
F						1.									
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	-														
								Submit	ted by F	Project Er	ngineer N	ame			
		red, these should also shall be reported to th					8	Mike N	jos, Hig	hlands E	ngineerin	9		Legen	d - Test Type
		and failing and circle a					9	Review	red by D	District Ma	sterials Co	ordinator	Name	V - Ve	rification

"Remarks" the action taken to correct the situation causing failing tests. As each item of the project is completed, submit the original copies of these reports to the district materials coordinator for correction and review. When the district materials coordinator

Submitted by Project Engineer Name	
Mike Njos, Highlands Engineering	Legend - Test Type
Reviewed by District Materials Coordinator Name	V - Verification
	P - Progress Record
Date	I - Independent Assurance

STARK COUNTY GRAVEI

PREPARING SAMPLES & GRADATION PROCESS

- SPLIT SAMPLES

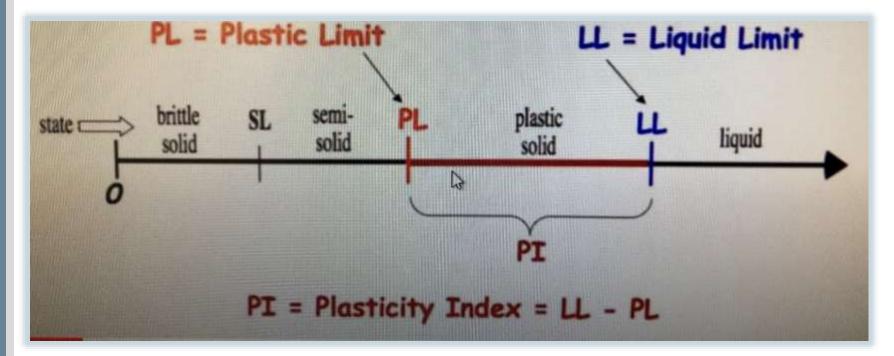
- OVEN DRY OVERNIGHT
- **GRADATIONS**
 - > COARSE AGGREGATE
 - > MINUS NO. 200 BY WASHING
 - FINE AGGREGATE



PLASTICITY INDEX, PI: The numerical difference between the liquid limit and the plastic limit. It is the moisture content at which the soil is in a plastic state.

PI = LIQUID LIMIT – PLASTIC LIMIT, OR PI = LL - PL







LIQUID LIMIT, LL: The liquid limit of a soil is the moisture content at which the soil passes from a plastic to a liquid state.

- LIQUID LIMIT APPARATUS

0 **Liquid Limit Test Procedure**



LIQUID LIMIT

- GROOVE SAMPLE
- 22-28 BLOWS TO ½" CLOSURE
- DRY SAMPLE & CALC MOISTURE CONTENT

LIQUID LIMIT		PLASTIC LIMIT
Tin #	1	2
M _T = Mass of tin, (g)	12.1	12.1
M _{MST} = Mass of tin and moist soil (g)	27.2	20.6
M _{DST} = Mass of tin and dry soil (g)	24.7	19.4
M _s = Mass of soil solids (g)	12.6	7.3
M _w = Mass of water (g)	2.5	1.2
w = Water content, (%)	19.8	16.4
No. of Drops (N)	22	

# of Blows, N	k		
22	0.985		
23	0.990		
24	0.995		
25	1.000		
26	1.005		
27	1.009		
28	1.014		

One Point Liquid Limit Calculation:

 $LL = k \star w_N$

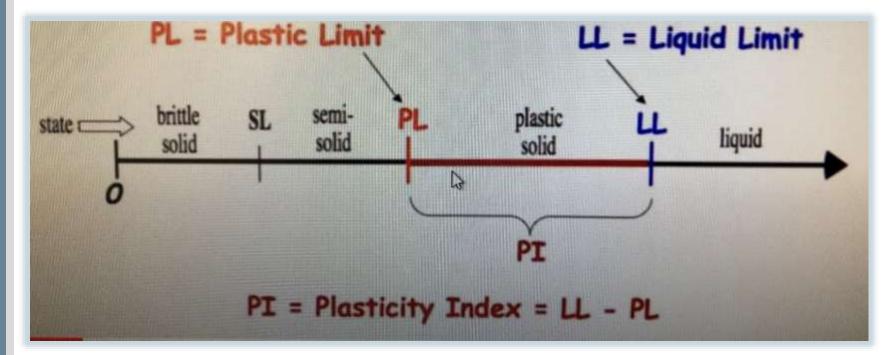
k= 0.985

Liquid Limit	19.5
Plastic Limit	16.4
Plastic Index	3.1

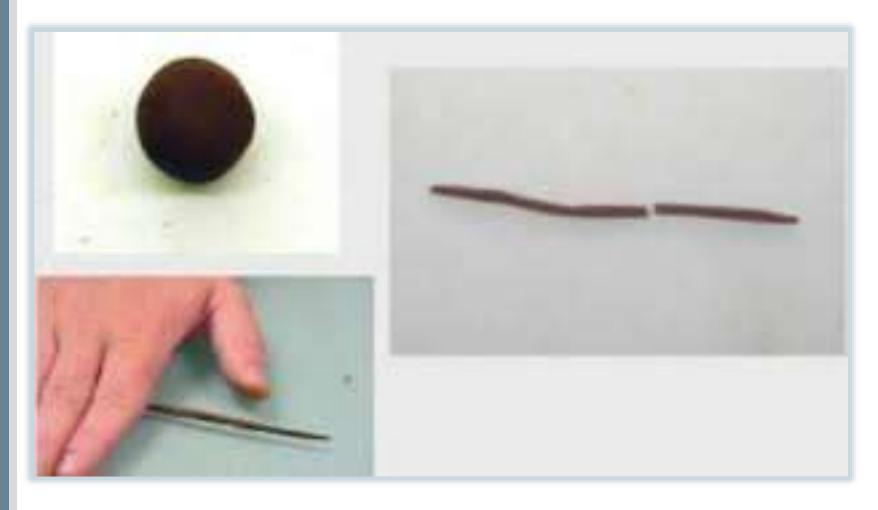
PLASTIC LIMIT, PL:

- The plastic limit of a soil is the lowest water content at which the soil remains plastic.
- The minimum water content that allows a soil sample, after which further removal of moisture, causes the sample to crumble.
- It is the transition between moisture contents in the plastic and the semi-solid state of the soil.









LIQUID LIMIT		PLASTIC LIMIT
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22	0.985		
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One Point Liquid Limit Calculation:

 $LL = k \star w_N$

k= 0.985

Liquid Limit	19.5
Plastic Limit	16.4
Plastic Index	3.1

CONCLUSION

Recommendations:

Establish an efficient sampling & testing procedure.

Spec a PI that works best for their situation.

A higher PI indicates more binder and will hold together well but may become soft and rut with a lot of moisture.

A low PI indicates less binder, will not hold together well in dry conditions, will have loose gravel, but will not rut and become soft.



QUESTIONS?



NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

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