



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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INTRODUCTION



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SURVEYING

SOILS & CONCRETE LAB

STARK COUNTY GRAVEL
TESTING



SAMPLING PROCEDURES

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

STARK COUNTY GRAVEL

Specifications			SIEVE SIZES AND PERCENTS PASSING												REMARKS		
			1"	3/4"	#4	#8	#30	#200	P.I.								
			Spec. Limit	100	70-100	38-75	22-62	12-45	7.0-18.0	3.0-6.0							
*Target Range																	
TEST DATA	DATE/TIME SAMPLED	LOCATION SAMPLED	TEST NO.	PERCENTS PASSING												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							P
	10/19/20	Belt	20-SCG03	100	96	63	53	39	14.0	4.9							P
	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							P
	10/30/20	Belt	20-SCG10	100	97	53	43	30	12.4	3.4							P
	11/02/20	Belt	20-SCG11	100	97	68	57	41	16.5	3.6							P
	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							P
	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							P
	11/11/20	Belt	20-SCG18	100	96	60	51	39	16.9	3.8							P

PREPARING SAMPLES & GRADATION PROCESS

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

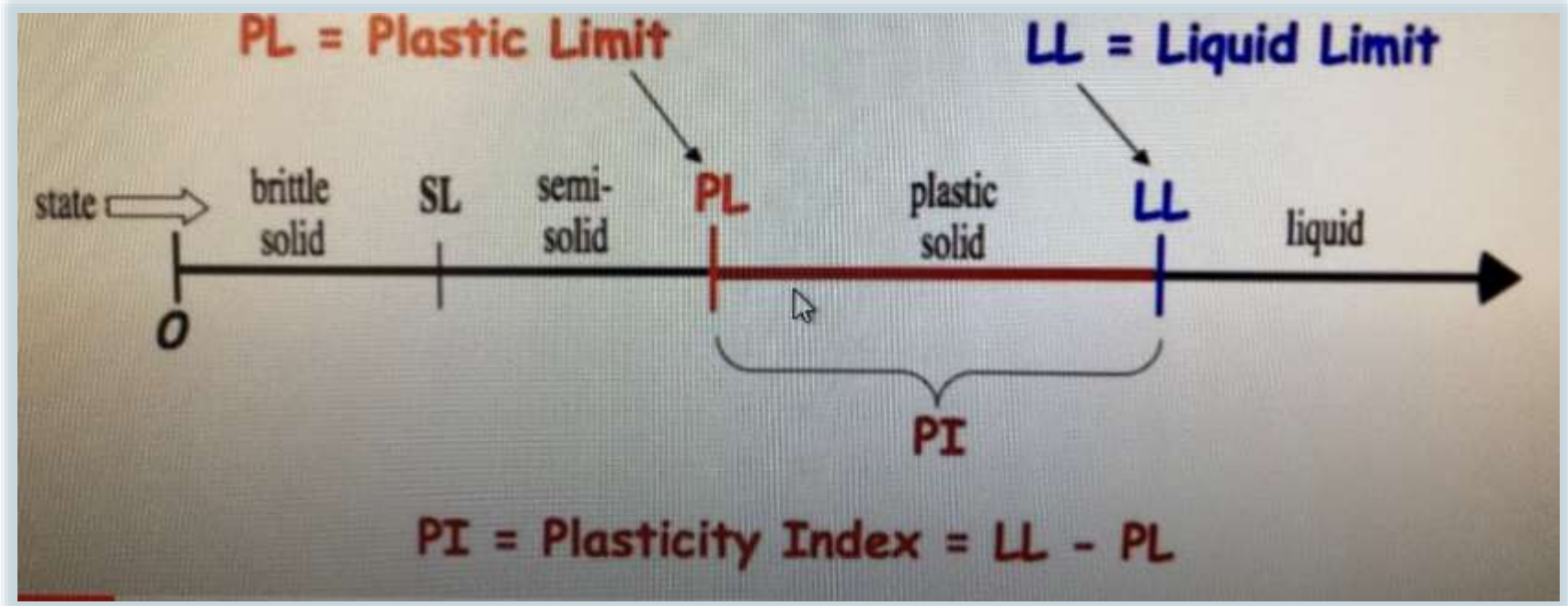
ATTERBERG LIMITS PROCEDURES

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

ATTERBERG LIMITS PROCEDURES

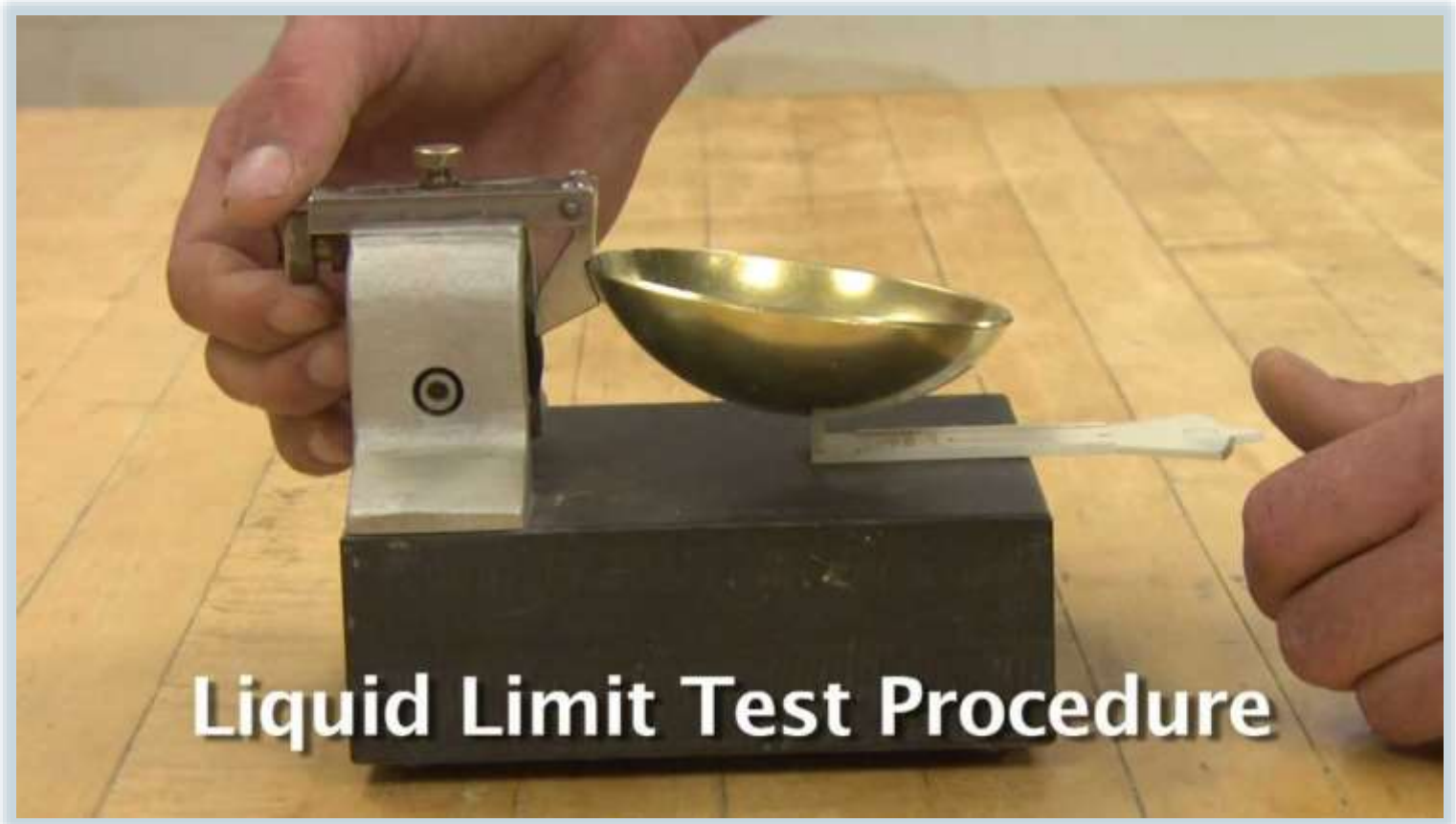


ATTERBERG LIMITS PROCEDURES

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

ATTERBERG LIMITS PROCEDURES



Liquid Limit Test Procedure

ATTERBERG LIMITS PROCEDURES



LIQUID LIMIT

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

ATTERBERG LIMITS PROCEDURES

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:

$$LL = k * w_N$$

$$k = \underline{0.985}$$

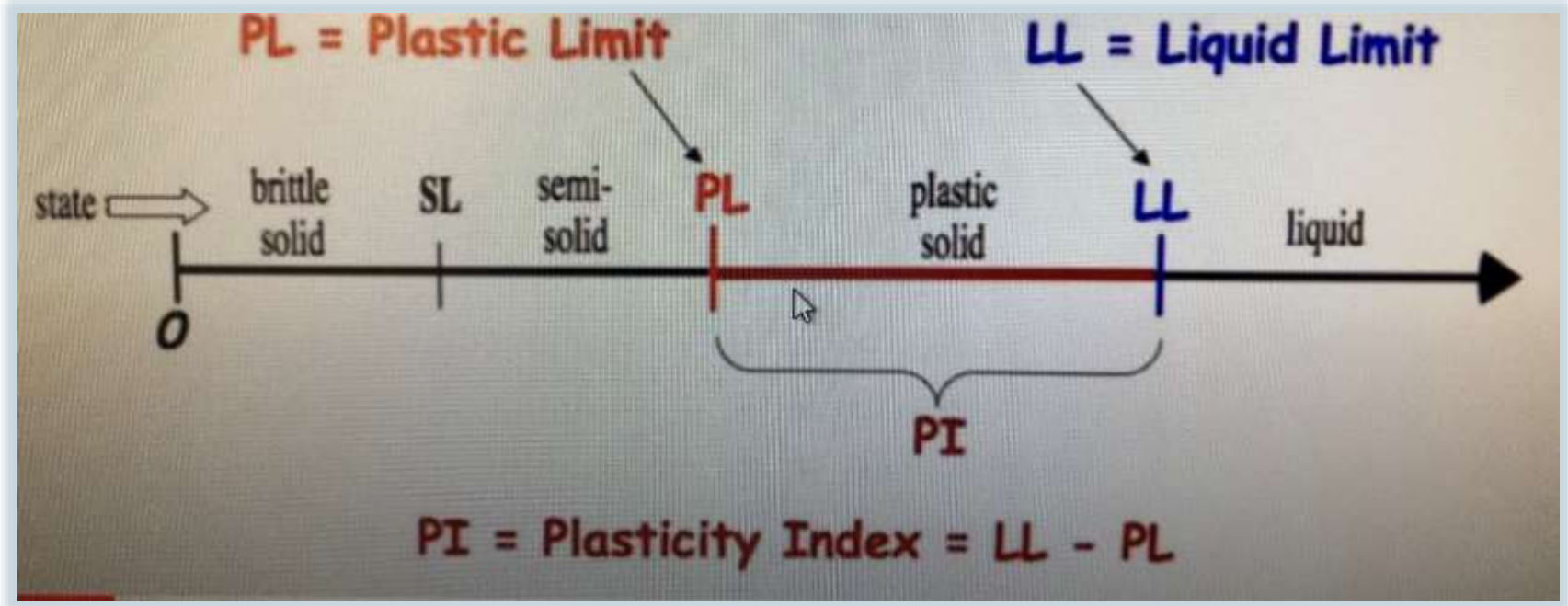
Liquid Limit	19.5
Plastic Limit	16.4
Plastic Index	3.1

ATTERBERG LIMITS PROCEDURES

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.**

ATTERBERG LIMITS PROCEDURES



ATTERBERG LIMITS PROCEDURES



ATTERBERG LIMITS PROCEDURES

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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?



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