Alaska DOT&PF
Northern Region

High Float Surface Treatments

Northern Region
HFST Surfacing 2001 - 2002

- Dalton Hwy - 112 miles
- Taylor Hwy - 41 miles
- Minto Road - 10 miles
- Other Projects - Tok Roads, Tofty Road, Elliott Hwy, Various Gravel to Pavement Projects

How have we done?

- No real total failures, with exception of the Dalton project that we overlayed in 2001
- Varying degrees of success
- We feel that we can do better

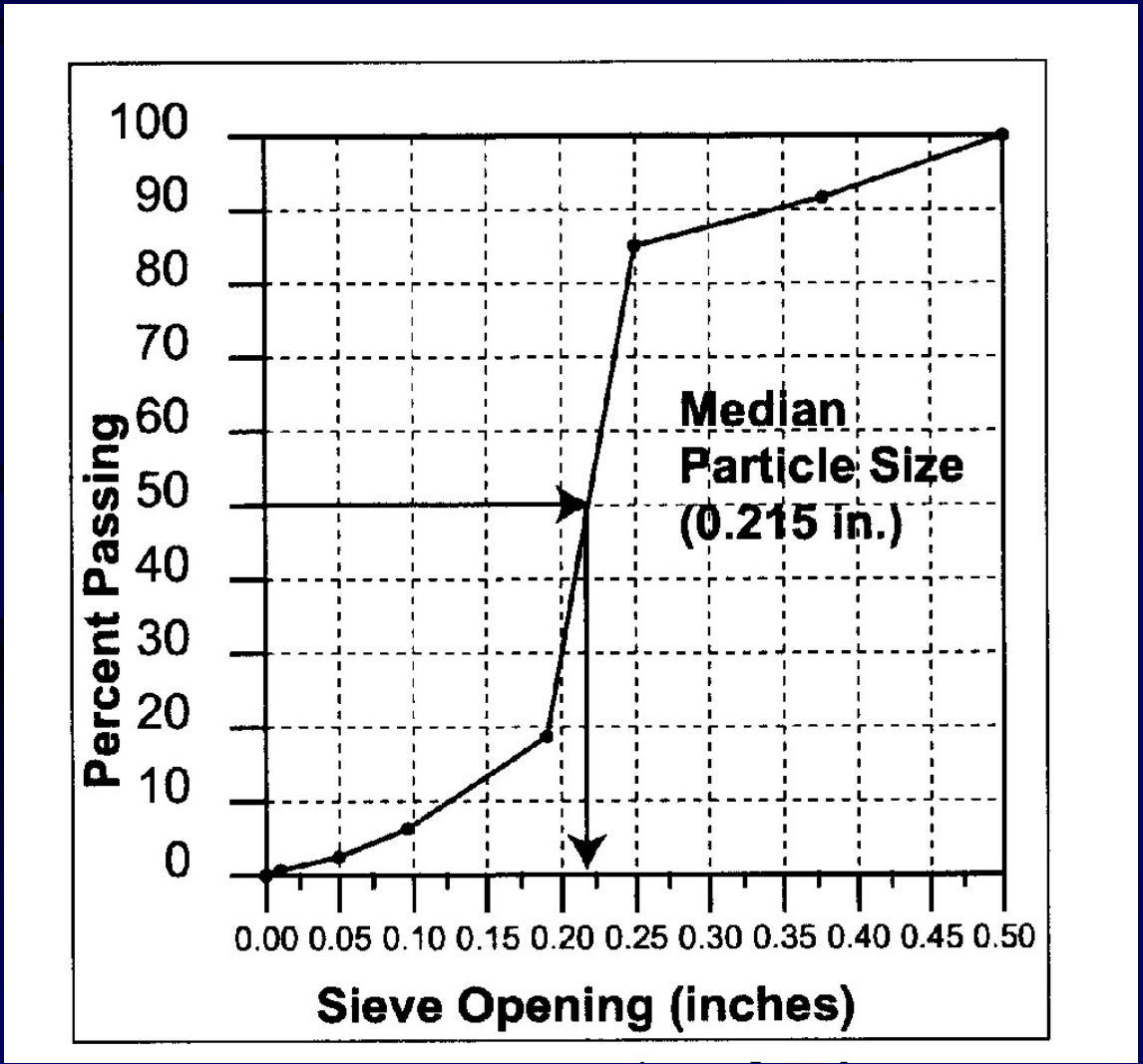
High Float Surface Treatments for Gravel Roads

- Project manager - Steve Saboundjian
- Research project - Goal is to formulate mix design procedure for HFST
- Work initiated to date
  - observation and sampling of projects
  - literature search
  - collection of project data

Basic AST Mix Design Theory (McLeod Method)

- Uses Median Particle Size and Flakiness Index to determine Average Least Dimension (ALD).
- Median particle size - size at which half the stones are larger and half smaller.
- ALD is an indication of the expected thickness of the mat in the wheelpaths.

Median Particle Size



Flakiness Index

- A measure of the aggregates percent, by weight, of flat particles.
- Measured on five different size fractions

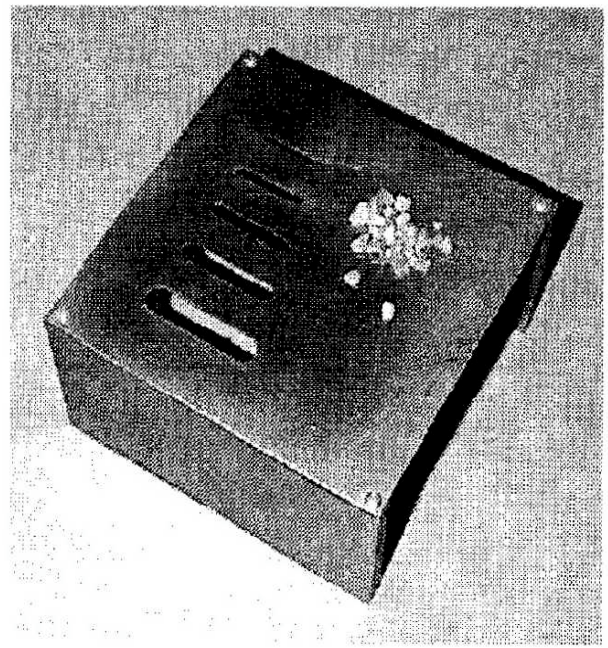


Figure D.6. Flakiness index testing plate

Why the Flakiness Index?

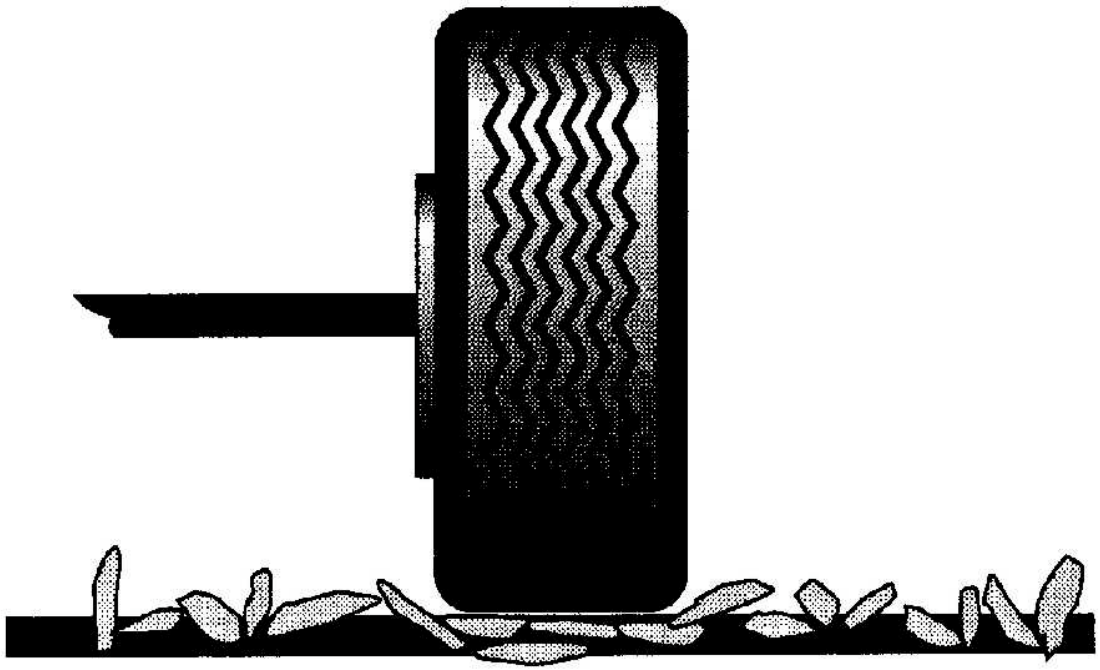


Figure 4.7. Traffic causes flat and/or elongated aggregate in wheelpath to rotate until long axis is horizontal

McLeod Theory

- Loose unit weight - determined by loosely filling a cylinder of known volume with aggregate and weighing it.
- Voids in loose aggregate - determined from the loose unit weight and bulk specific gravity of the aggregate.
- These parameters are used to calculate oil and aggregate application rates.

How This Applies to HFST's

- Although the design equations don't directly apply, the basics of the theory generally apply.
  - The mat will only be as thick as the largest stones in the aggregate.
  - Particle shape will also determine thickness.
  - The amount of room that is available for the oil is determined by gradation.

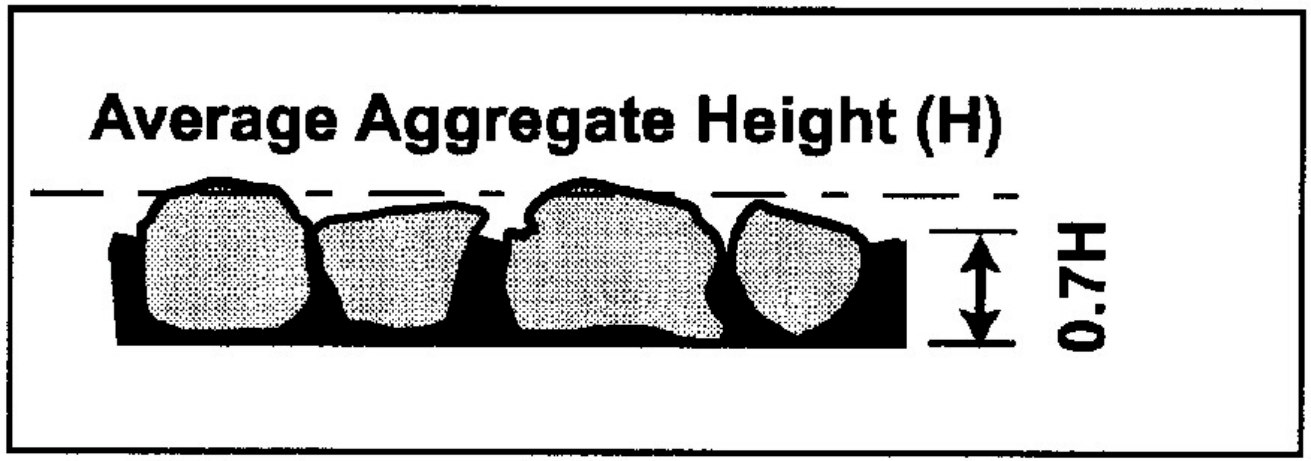


Figure D.3. McLeod design: one stone thick and proper embedment.

Areas to Investigate

- Gradations - how do our gradations look in the context of a mix design.
- Which gradations have worked, which haven't and why (or why not)?
- Oil application rates - Application rates that have worked and the aggregate gradations they worked with?

Gradation

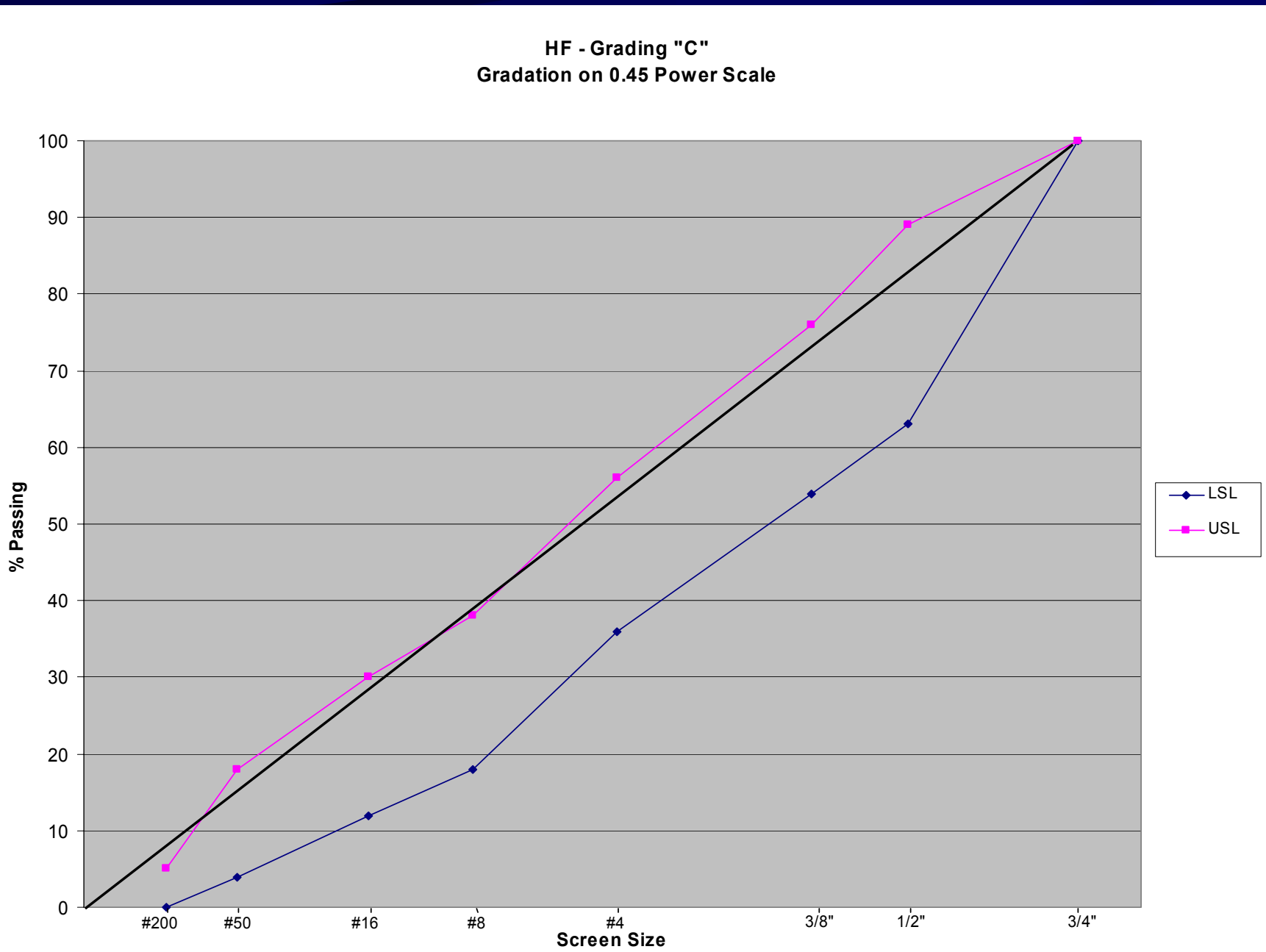
- Plot on 0.45 Power Curve
- Look at relationship to the maximum density line.

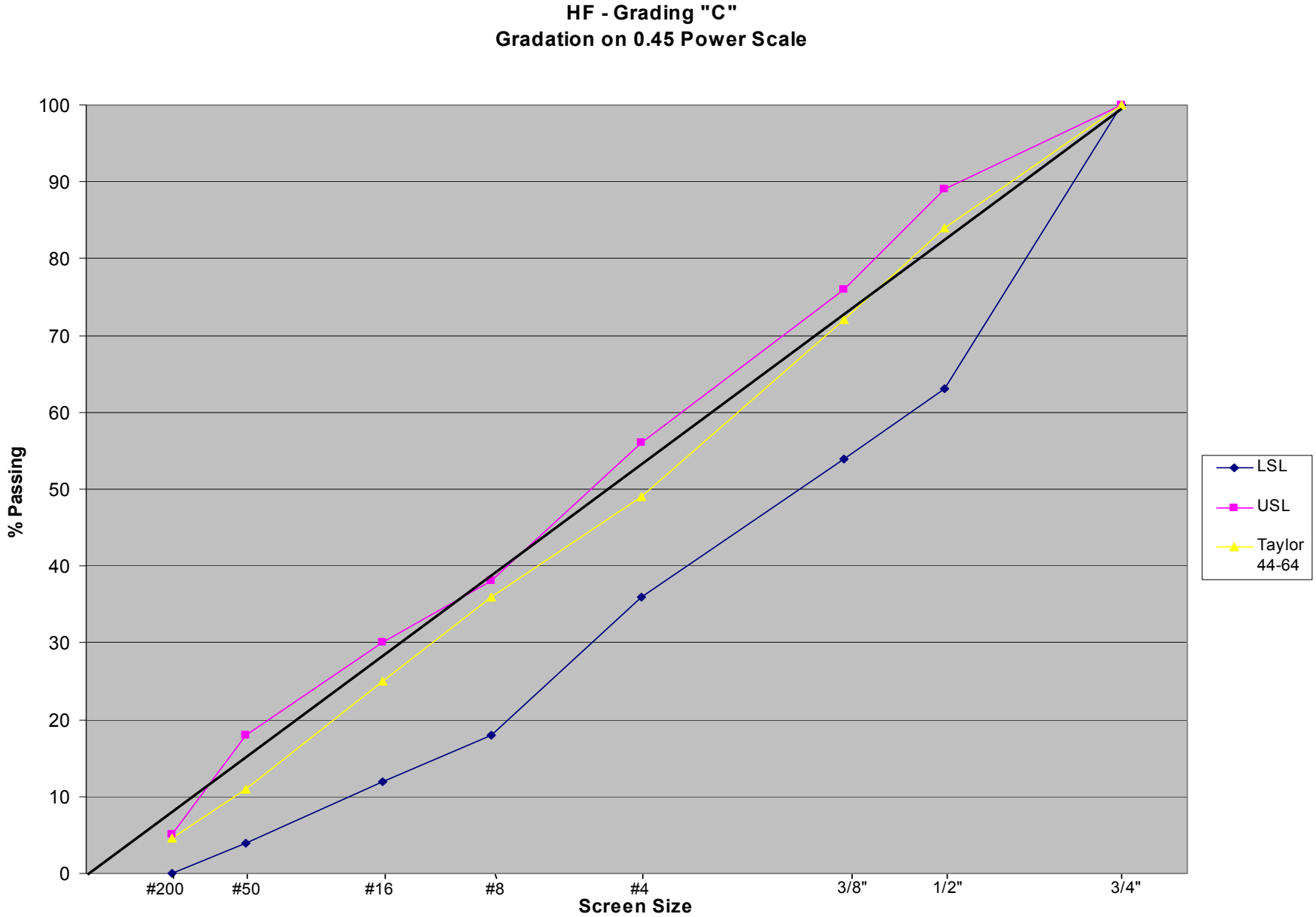
Gradation

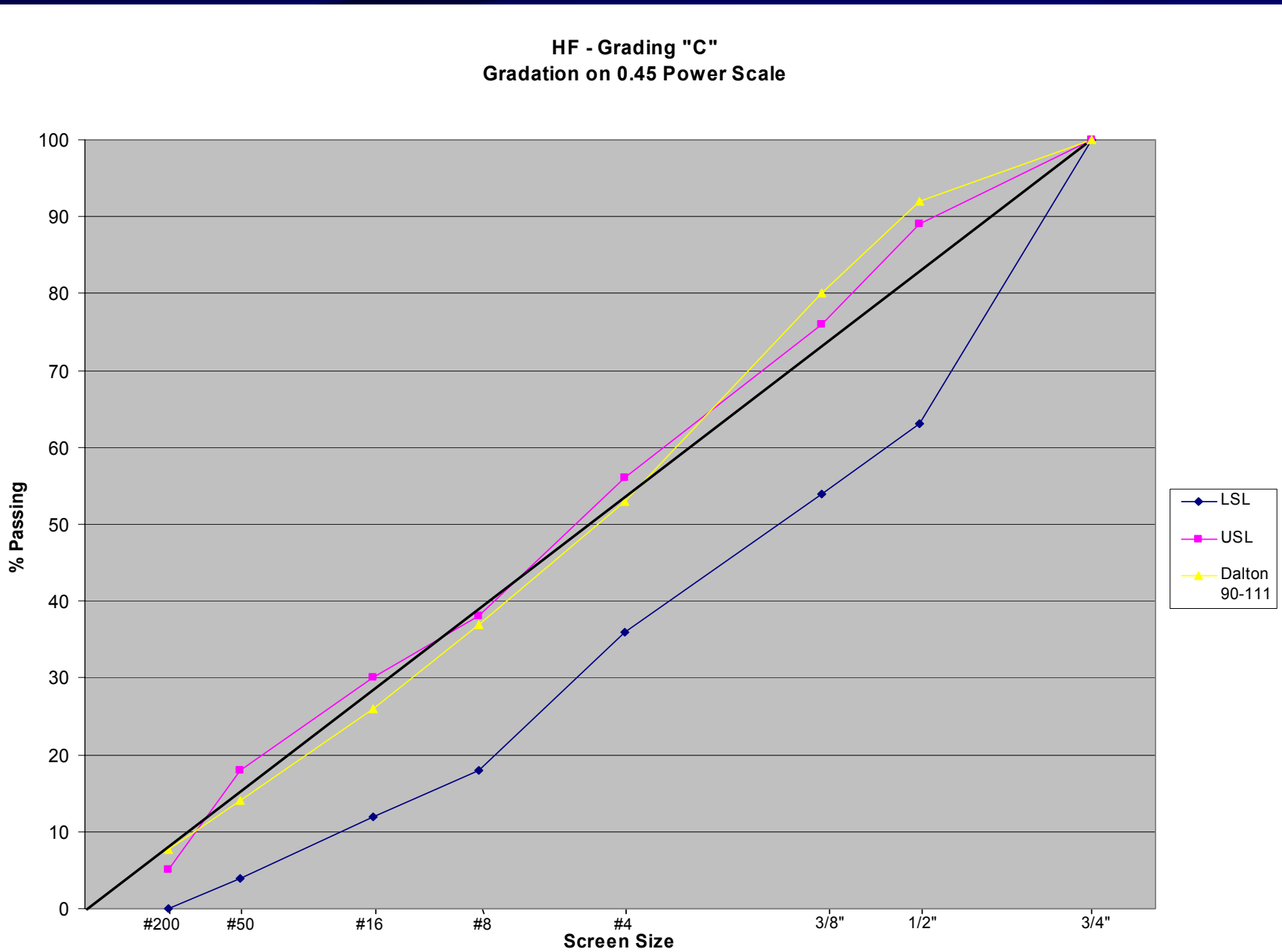
- Cover Coat - “B”
- 1 inch minus

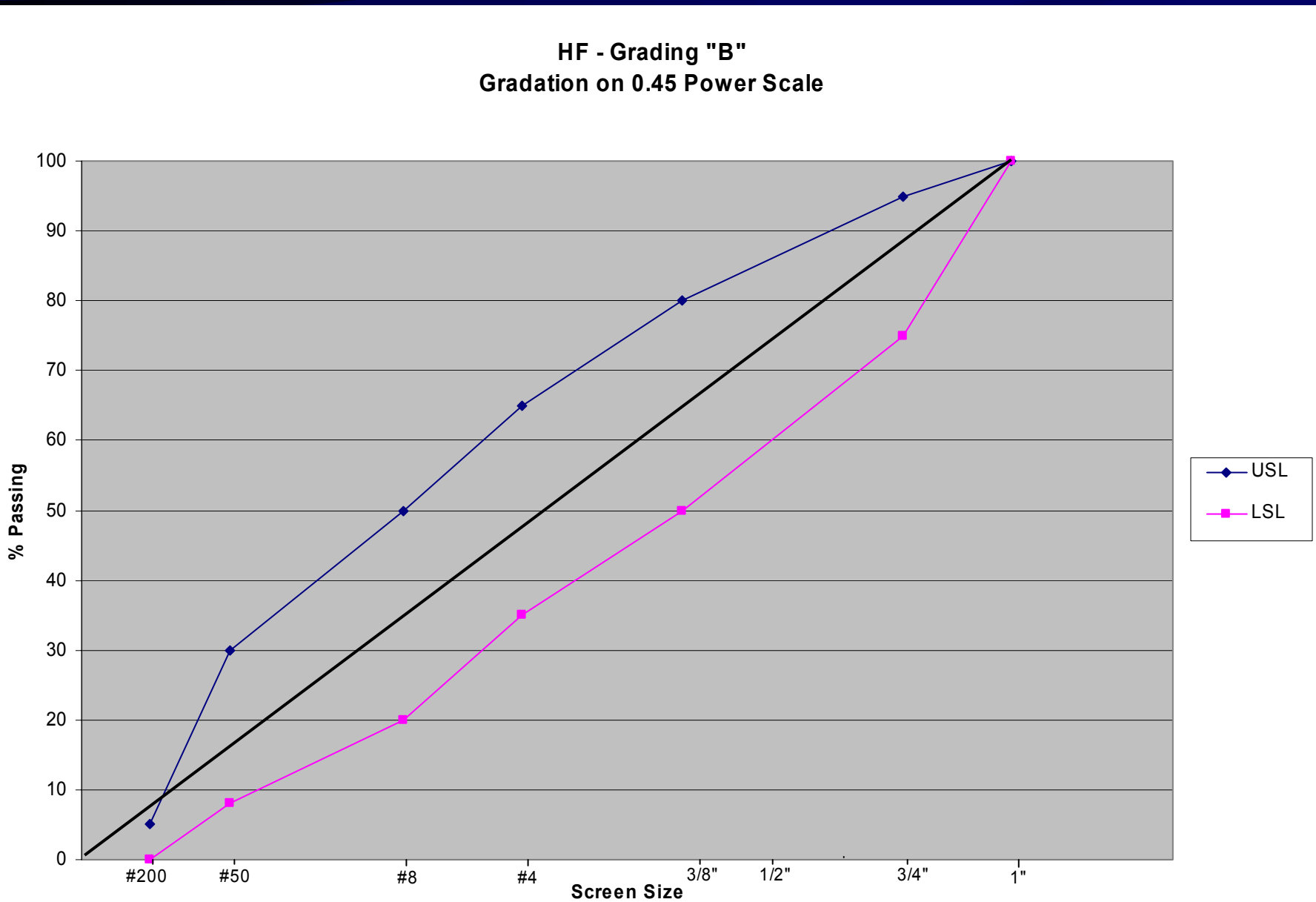
- Cover Coat - “C”
- 3/4 inch minus

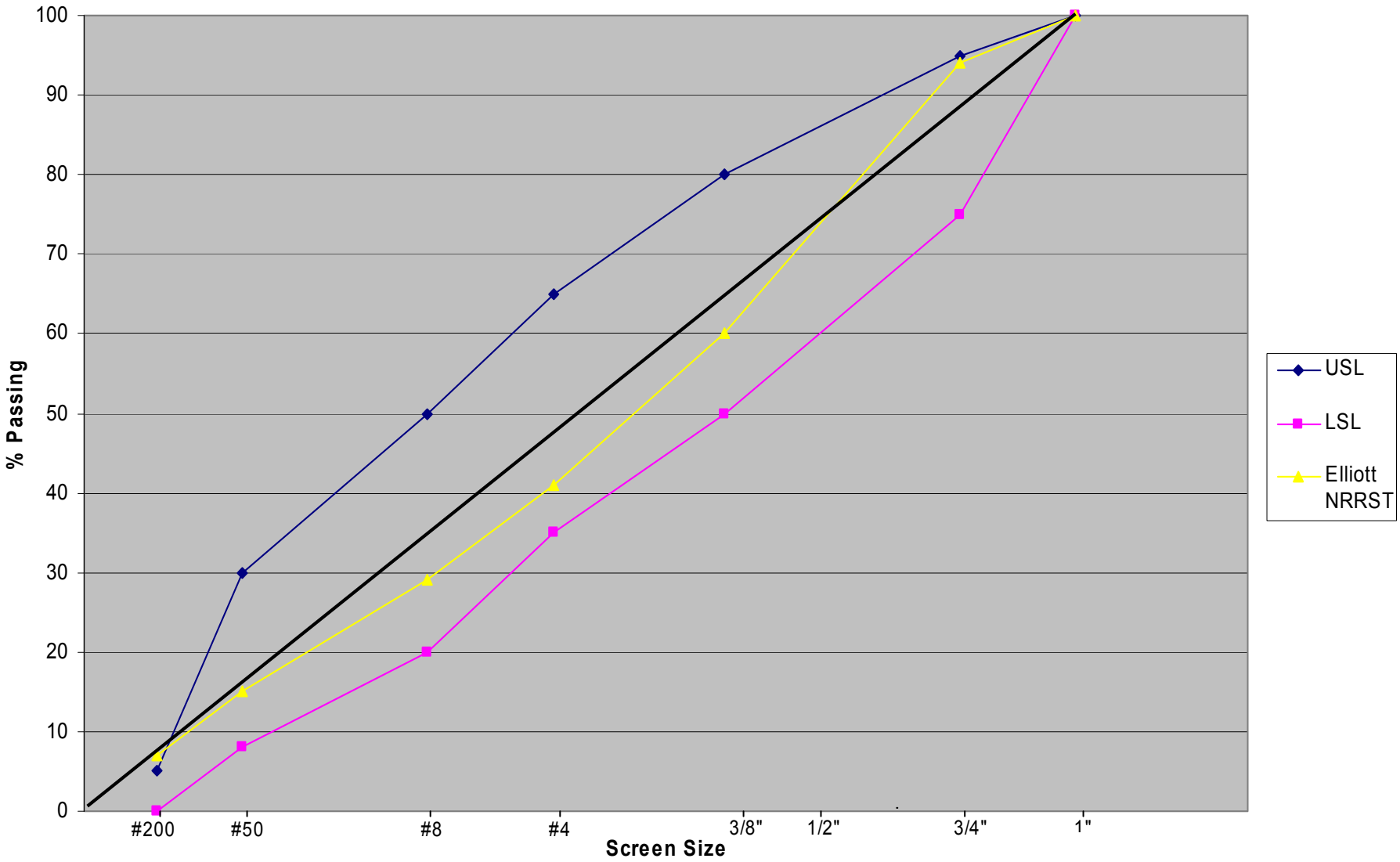
	% Passing by Weight	
Sieve Size	Grading B	Grading C
1"	100	
3/4"	75-95	100
5/8"		
1/2"		63-89
3/8"	50-80	54-76
#4	35-65	36-56
#8	20-50	18-38
#16		12-30
#40	8-30	
#50		4-18
#200	0-5	0-5
0.005mm	0-3	0-3

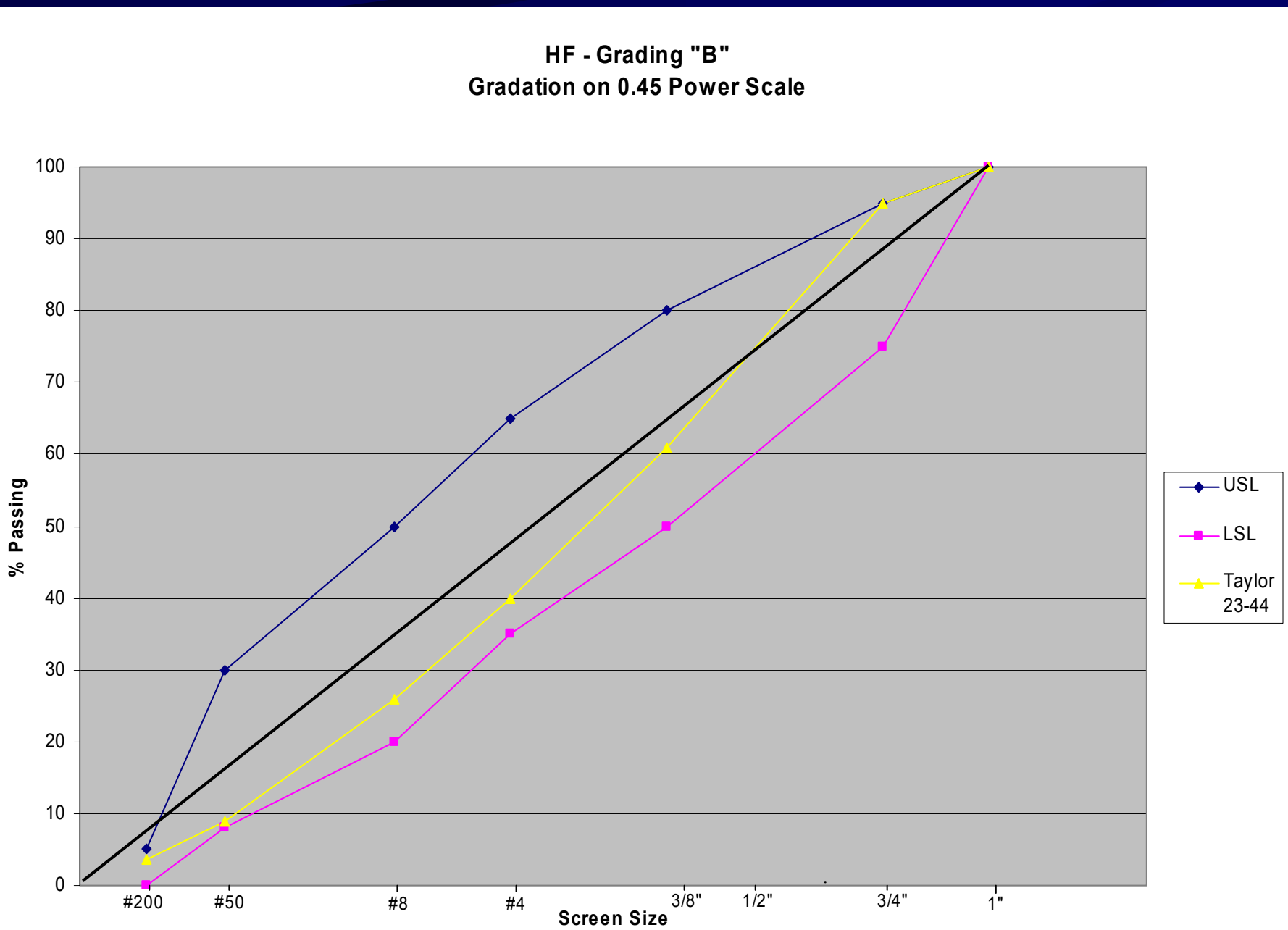

HF - Grading "C"
Gradation on 0.45 Power Scale
100
90
80
70
60
50
40
30
20
10
0
% Passing
#200
#50
#16
#8
#4
3/8"
1/2"
3/4"
Screen Size
LSL
USL


HF - Grading "C"
Gradation on 0.45 Power Scale
% Passing
100
90
80
70
60
50
40
30
20
10
0
#200
#50
#16
#8
#4
3/8"
1/2"
3/4"
Screen Size
LSL
USL
Taylor 44-64


HF - Grading "C"
Gradation on 0.45 Power Scale
% Passing
100
90
80
70
60
50
40
30
20
10
0
#200
#50
#16
#8
#4
3/8"
1/2"
3/4"
Screen Size
LSL
USL
Dalton
90-111


HF - Grading "B"
Gradation on 0.45 Power Scale
% Passing
100
90
80
70
60
50
40
30
20
10
0
#200
#50
#8
#4
3/8"
1/2"
3/4"
1"
Screen Size
USL
LSL


HF - Grading "B"
Gradation on 0.45 Power Scale
100
90
80
70
60
50
40
30
20
10
0
% Passing
#200
#50
#8
#4
3/8"
1/2"
3/4"
1"
Screen Size
USL
LSL
Elliott NRRST


HF - Grading "B"
Gradation on 0.45 Power Scale
100
90
80
70
60
50
40
30
20
10
0
% Passing
#200
#50
#8
#4
3/8"
1/2"
3/4"
1"
Screen Size
USL
LSL
Taylor 23-44

Oil Application Rate

- Our spec - 0.75 gal/yd^2 suggested oil application rate, regardless of gradation
- Canadian - average 0.62 gal/yd^2 when using 3/4 inch cover coat
- A mix design procedure is needed to come up with a realistic beginning application rate for each project

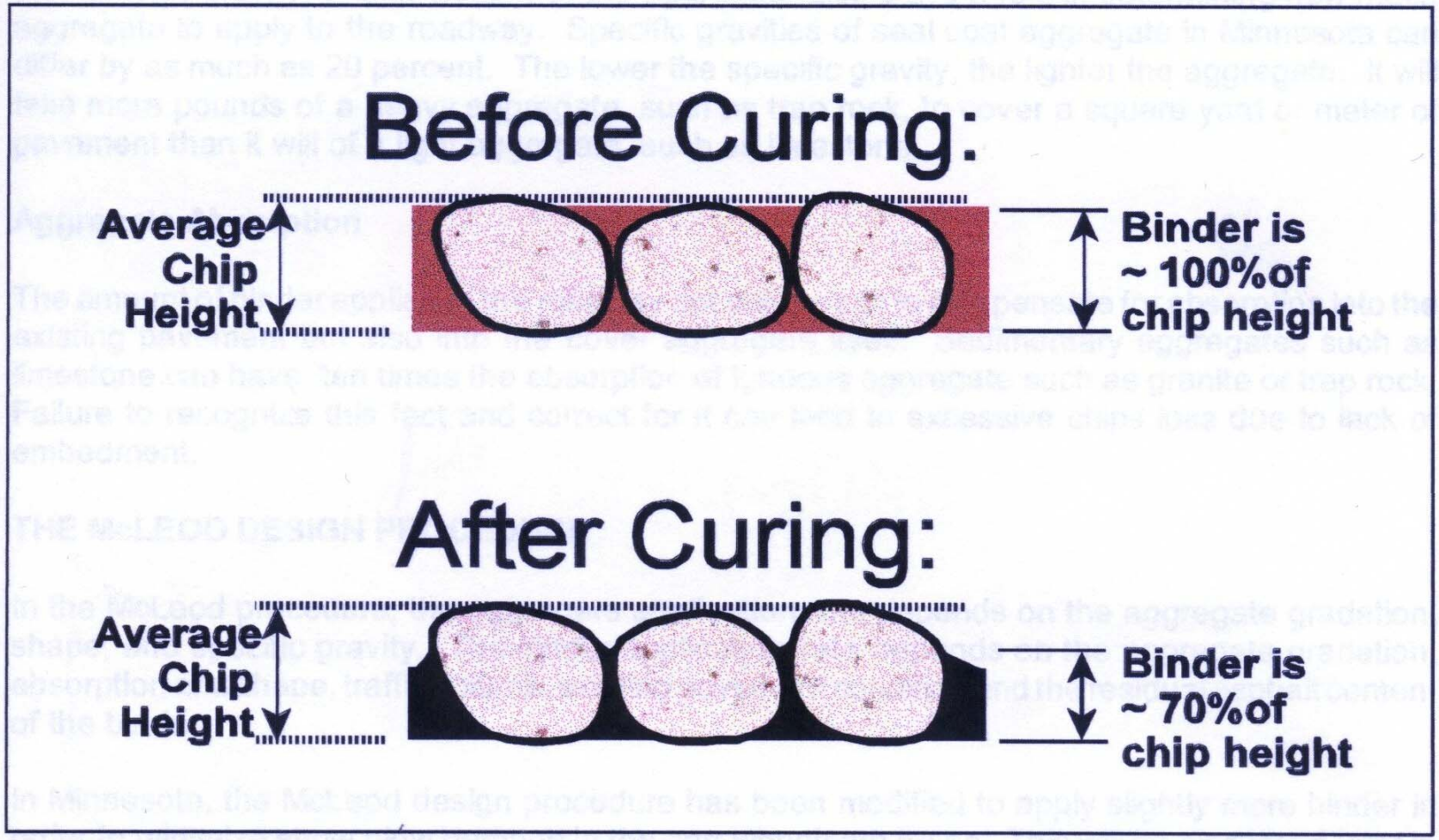


Figure 4.2. Change in volume after emulsion has cured.

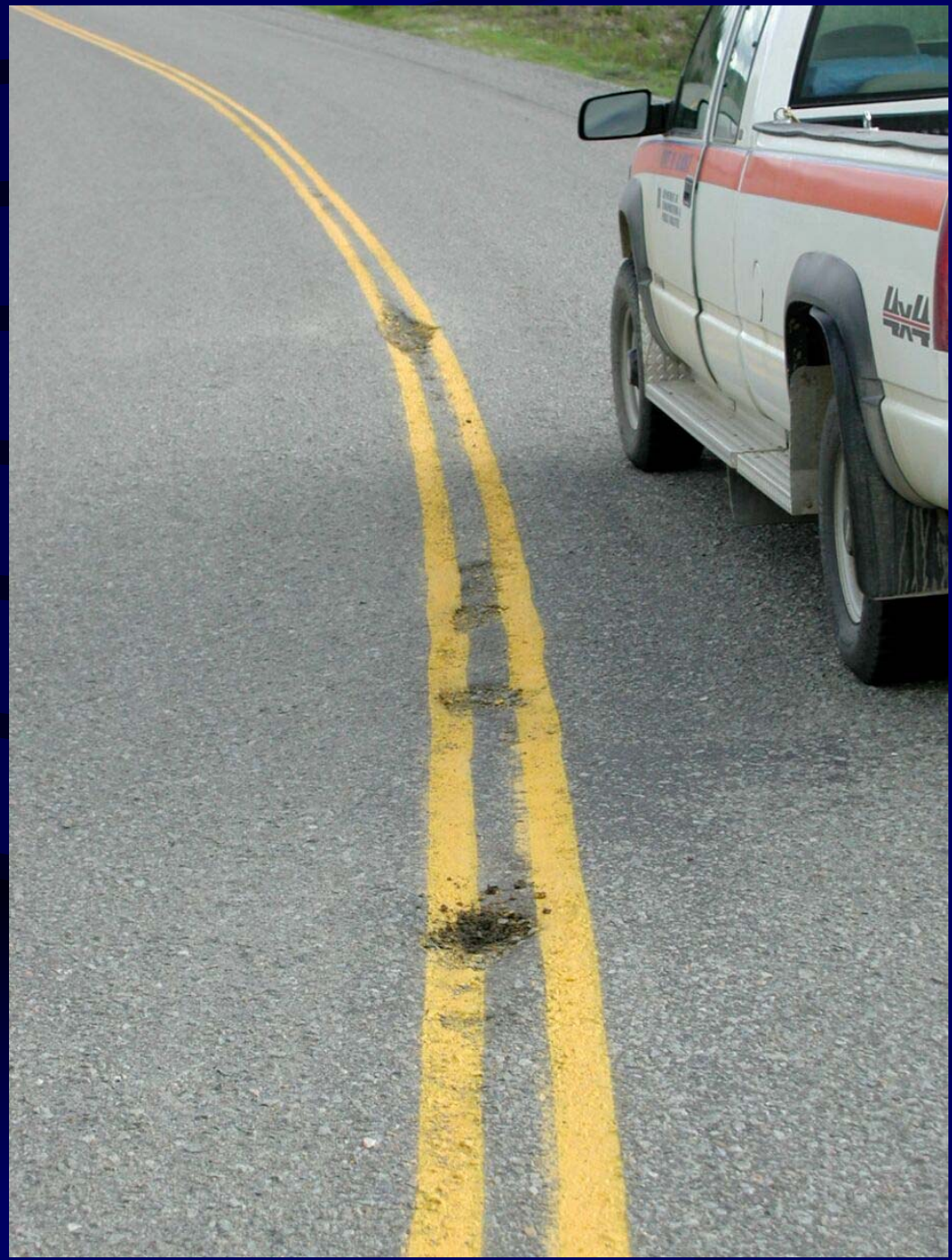
- From the Minnesota Seal Coat Handbook, 1998.

Flushing

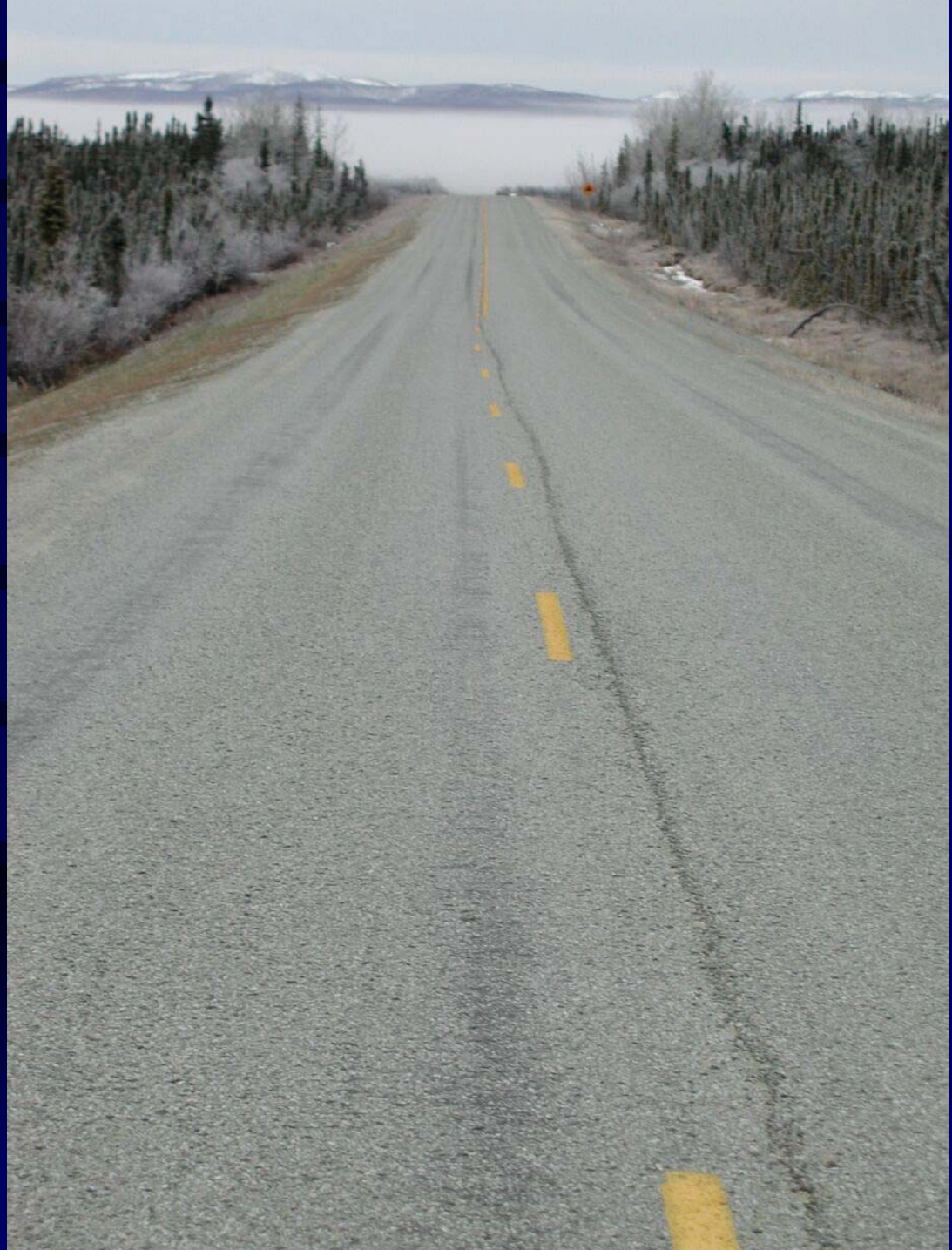
- Main mode of failure
- Caused oil application rate too high for gradation
- Can cause oil to be picked up by traffic
- Makes for slippery surface

Potholing

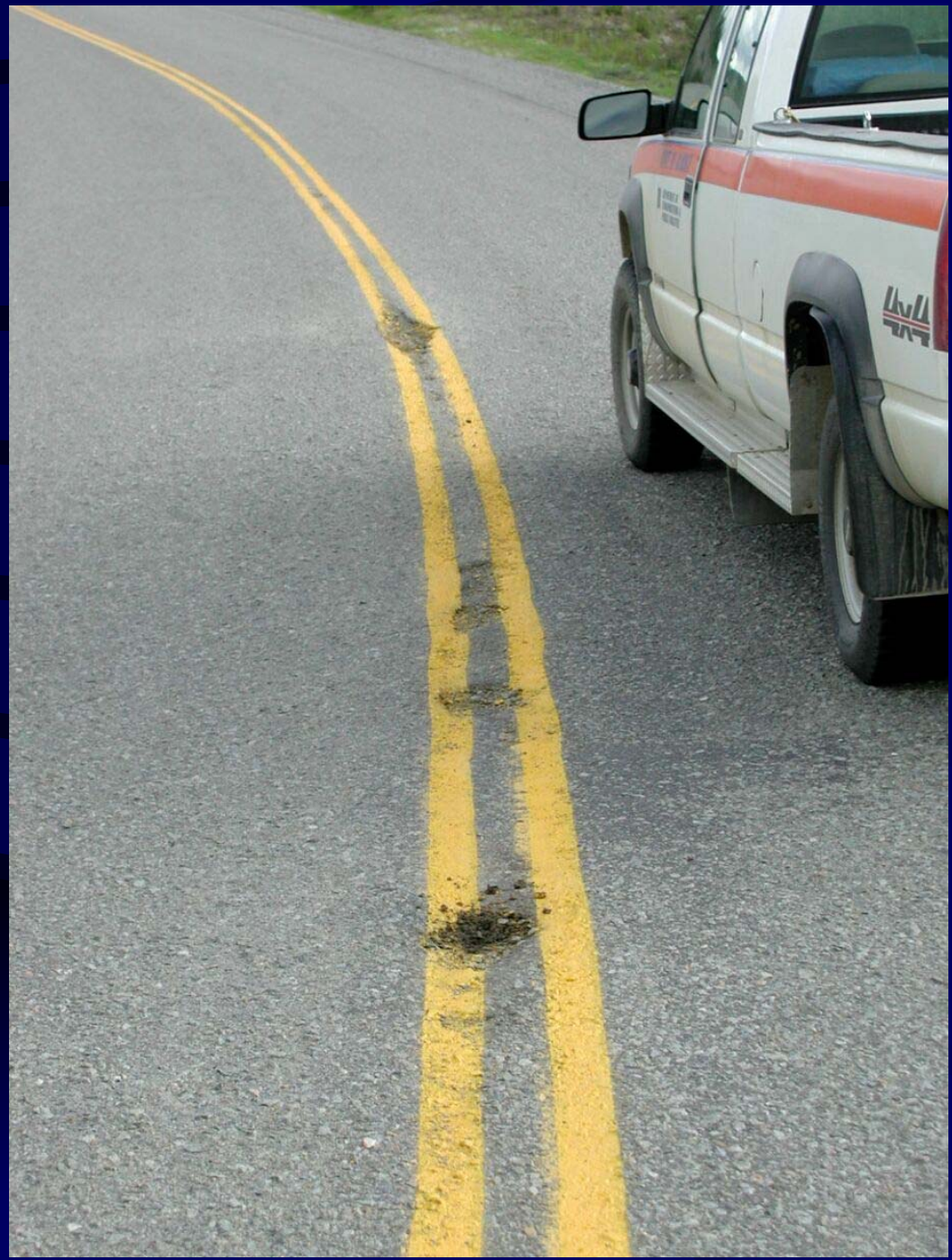
- Mainly occurs along joints due lack of overlap
- Can be the result of soft spots in the base course
- Can occur on steep grades due to tearing of the mat

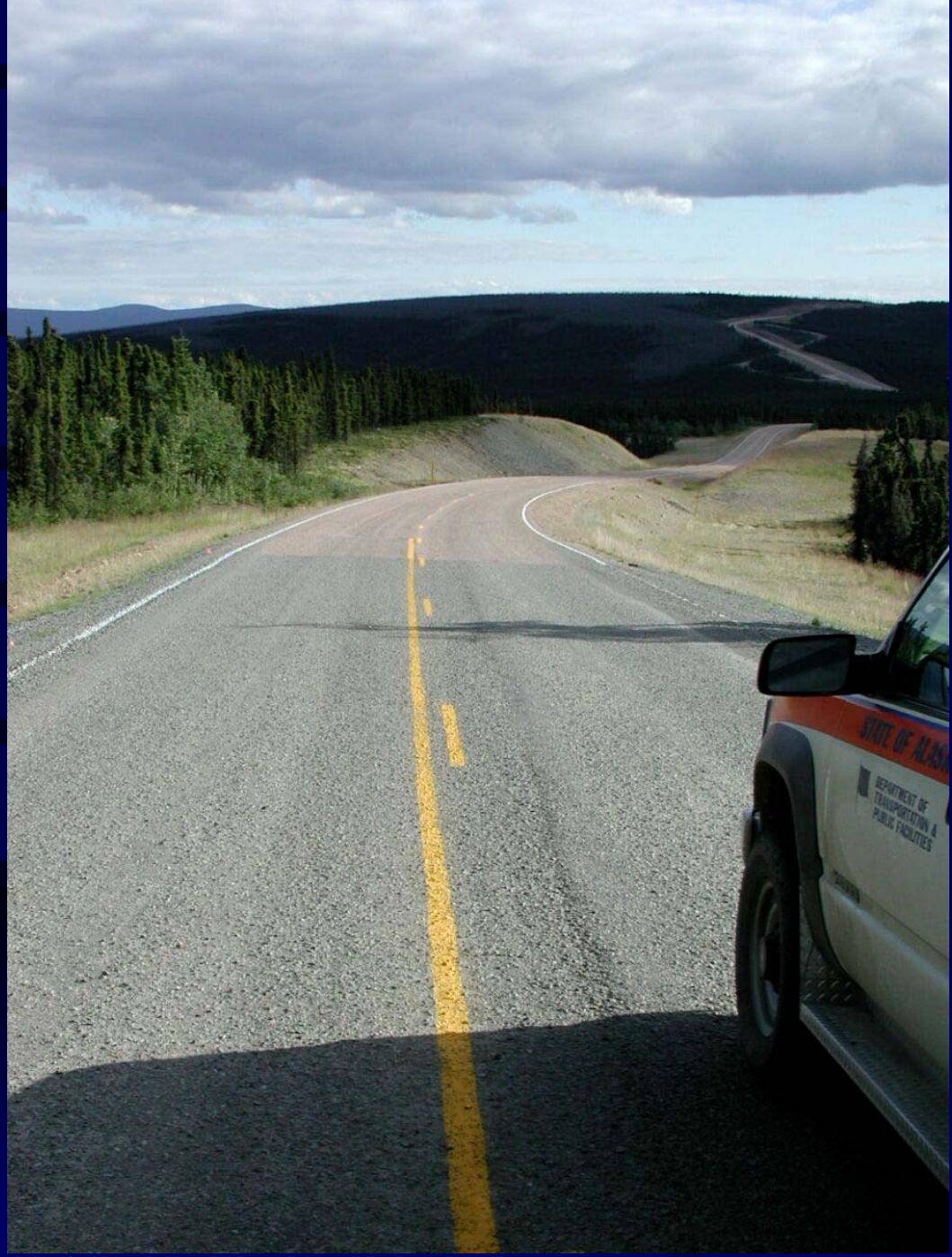


- Taylor Highway 44-64



■Taylor Highway 23-44




STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES

Lake Louise Road

Where is This Going?

- These are initial observations

- "C" gradation needs work
  - Need to force some gap grading into it
  - Add a 5/8" sieve to the spec
  - Tighter control on the -#200 spec

- “B” Gradation
  - No flushing in projects built using it
  - Mats look tougher, more durable
  - Mats are thicker
  - Seems to be working fine
- Oil Application Rate
  - Needs to be adjusted with gradation
  - Needs to be adjusted for surface (overlays,etc.)

Improvements We Need to Make

The Bump Before the Bridge


Slana
Slough

The Sandwich Layer

- Layer of granular material between bound layers

- Can collect water and fail under loading due to increased pore pressures.

Centerline Joints

Unique Challenges in the Northern Region

QUESTIONS?