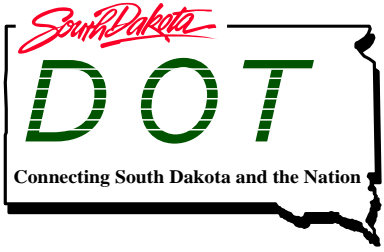


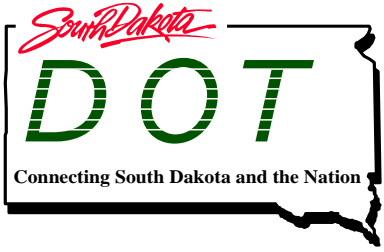
# 2013 ND Asphalt Conference

## CLASS S MIX

Rick Rowen  
SDDOT Bituminous Engineer



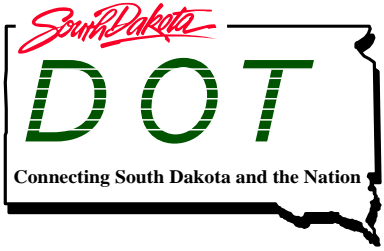
- **AC Driving Surface Options (Higher ESALs)**
  - Stone Matrix Asphalt (SMA)
  - Class S (in past used with limestone out West)
  - Micro-surfacing
  - Macro-surfacing
  - Open Graded Friction Course (OGFC)
- **AC Driving Surface Option (Lower ESALs)**
  - Class Q (gyratory design used on most projects)
  - Chip seal (needed on Q mixes)



# OFFICE OF MATERIALS & SURFACING

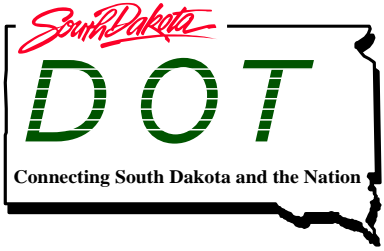
- South Dakota Standard S Aggregate since 1965

Gradation Bands	S Type 1 % Passing	S Type 2 % Passing
3/4 “ (19mm)	100	100
1/2 “ (12.5mm)	86 – 100	100
3/8” (9.5mm)	66 – 80	80 - 100
# 4 (4.75mm)	24 – 34	24 - 45
# 8 (2.36mm)	10 – 20	10 - 22
# 200 (.075mm)	4.0 – 8.0	2.0 – 5.0



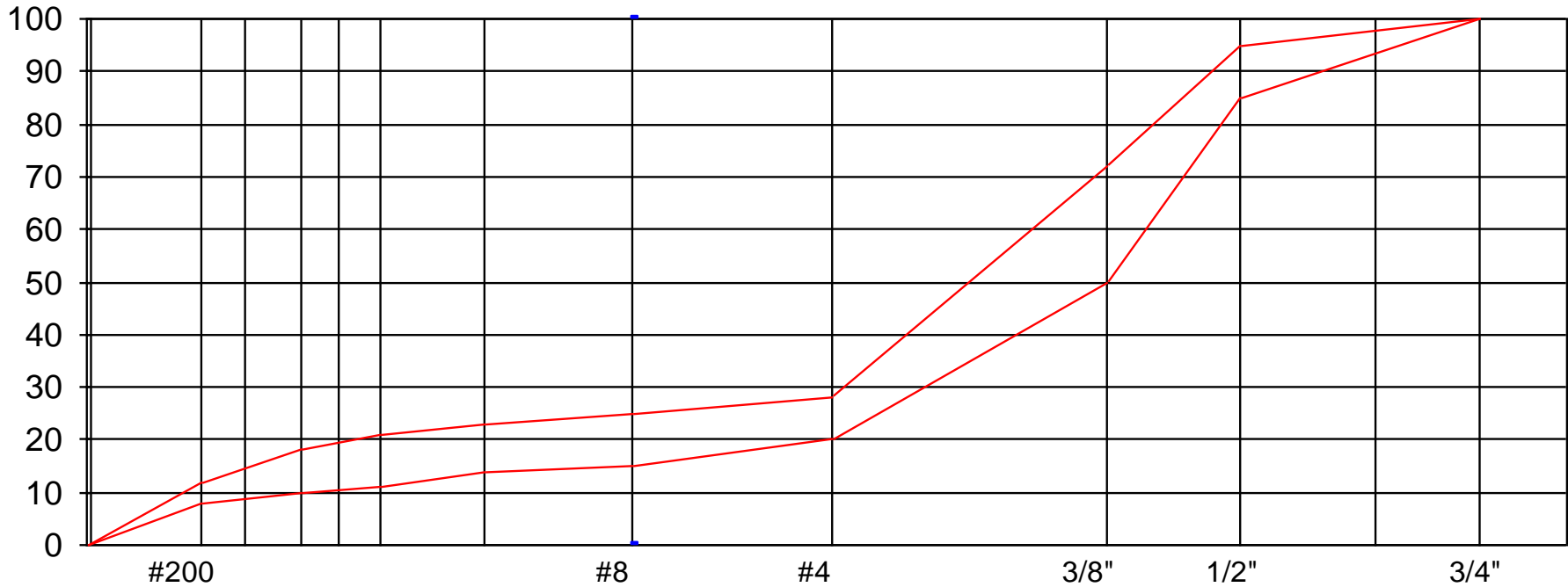
- South Dakota Gradation Bands

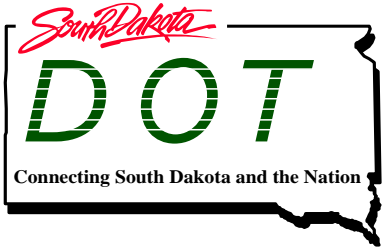
	SMA % Passing	S Modified % Passing
¾ “ (19mm)	100	100
½ “ (12.5mm)	85 – 95	86 - 100
3/8” (9.5mm)	50 – 72	66 - 80
# 4 (4.75mm)	20 – 28	24 - 34
# 8 (2.36mm)	15 – 25	10 - 20
# 200 (.075mm)	8.0 – 12.0	6.0 – 10.0



# OFFICE OF MATERIALS & SURFACING

## 0.45 POWER GRADATION (12.5 mm)



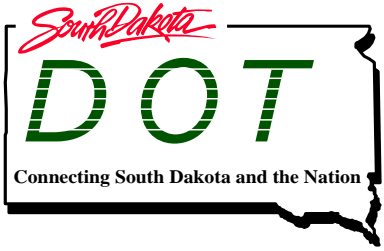


# OFFICE OF MATERIALS & SURFACING

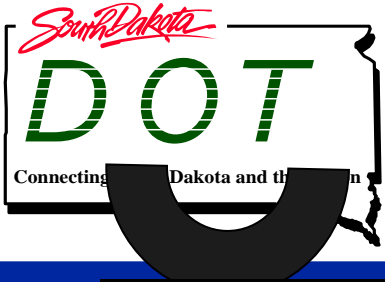
## Class S tonnage in SD

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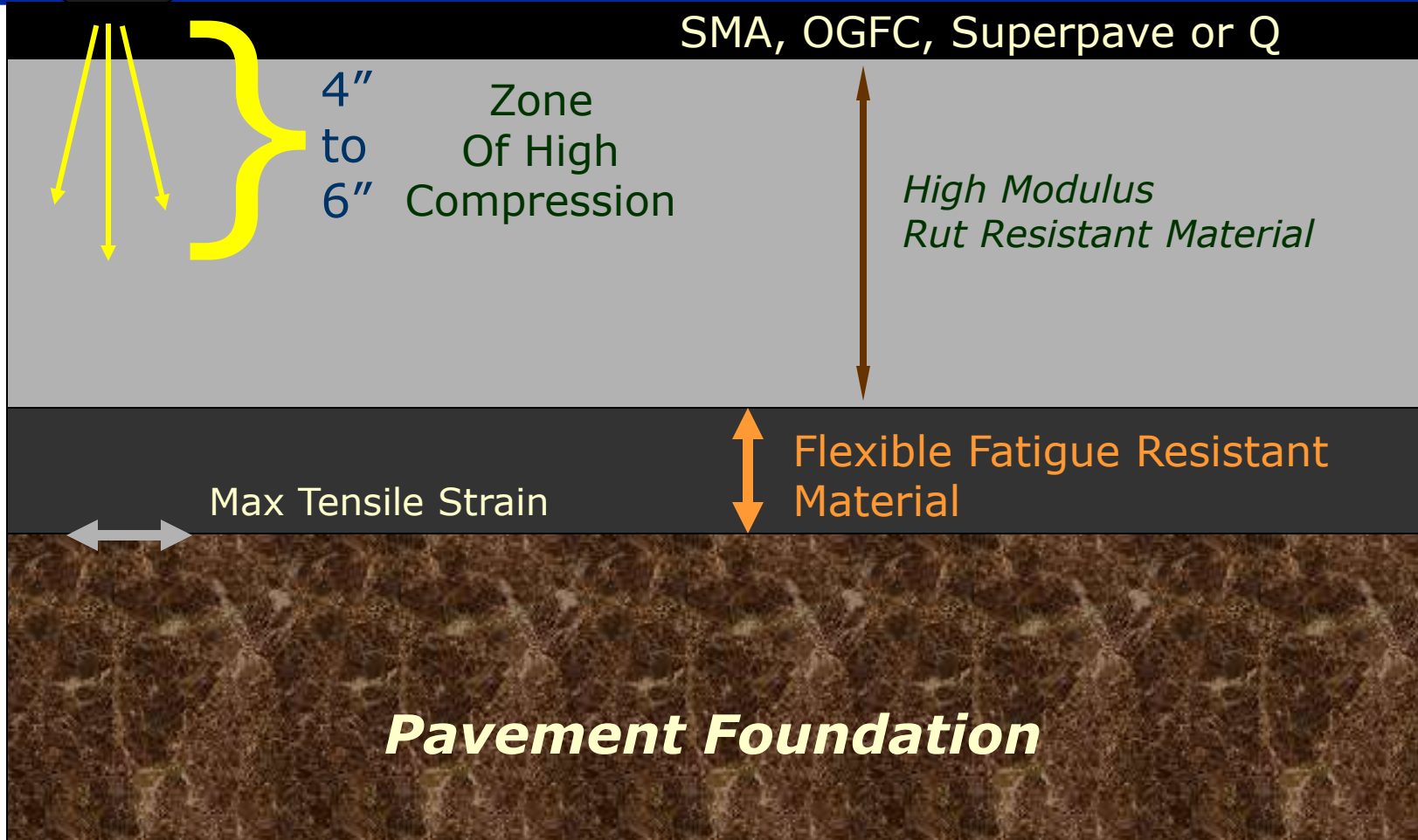
- 2005 50,000
- 2006 98,000
- 2007 0
- 2008 46,500
- 2009 90,250
- 2010 121,700
- 2011 211,600
- 2012 70,100



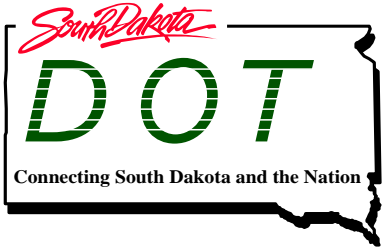
- **Overlay Decisions**
  - Desire for a surface course with a texture that would not require a chip seal
  - Durability and strength to withstand the impact of high ESALs and have good fatigue resistance
- S used since 1970's for surface course ½" to 1.5"
- Mainly used in Hills Area with limestone
- Euclid Ave. in Pierre is 1 ¼" Class S Mod. (1996)
- Need to have stone on stone contact



# OFFICE OF MATERIALS & SURFACING

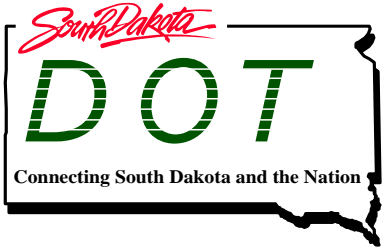






# OFFICE OF MATERIALS & SURFACING

- Contractor and DOT employee training
- SDDOT mix design using gyratory compactor
- Plant modifications, lower production rate
- Accurate fiber and mineral filler feeds
- Constant high mix delivery temperature (polymer)
- Placement (little if any hand work)
- In place density DOT controlled (vibratory breakdown rolling and then static steel)
- Avoid aggregate fracture from excessive vibratory roller passes



# OFFICE OF MATERIALS & SURFACING

- SDDOT S Modified mix design
  - Gyrotory compactor 75 to 100 gyrations
  - Stone on stone contact (NAPA Publication 1999)
    - Calculation for  $VCA_{drc} > VCA_{mix}$  in AASHTO R46
  - Absorption for + #4 aggregate (< 1.5%)
  - Draindown test SD 306 (<0.3%)
    - Cellulose fibers
  - Asphalt Pavement Analyzer
    - Rutting test



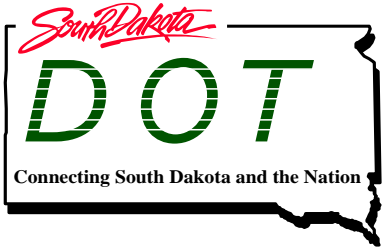
OPERATING INSTRUCTIONS  
[Illegible text]

**DANGER**  
[Illegible text]

MC 32111

Control panel with various gauges, switches, and a green emergency stop button.





## Asphalt Pavement Analyzer (TP 63-03)

- Gyrotory samples compacted to Ndes (4 % Air Voids)
- test at High PG binder temperature
- 8000 cycles, hose 100 psi and load 100 lbf
- record average of rut depth measurements

»Field sample tested in APA for rutting





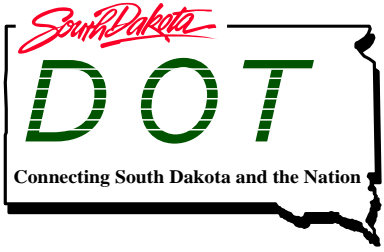
2006 6 14











# OFFICE OF MATERIALS & SURFACING

- Plant modifications, lower production rate
- Accurate fiber and mineral filler feeds
- Constant high mix delivery temperature
- Do not fracture rock with vibratory rollers
- Placement (little if any hand work)
- Workability may be improved with Warm Mix Additive





MERRICK VCI



PROPERTY OF: LEASING AND SERVICE  
MERRICK ASMAILE SOLUTIONS INC.  
8501 Plum Grove Drive  
Mechanicsville, VA 23111

Control panel with various knobs and buttons:

- Top row: A black knob labeled "REVERSE", a large blue knob labeled "SPEED", and a red emergency stop button with a glowing red light.
- Second row: A blue knob labeled "BRAKE", a blue knob labeled "REVERSE", and a green emergency stop button with a glowing green light.
- Third row: A blue knob labeled "BRAKE", a blue knob labeled "REVERSE", and a blue knob labeled "REVERSE".
- Bottom right: A single large blue knob labeled "REVERSE".

**Machine Controls**

**1. Start-Up**

Check that the machine is properly set up and that the operator is seated in the operator's seat. The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt.

**2. Operation**

The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt.

**3. Shutdown**

The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt. The operator should be wearing a seat belt and should be wearing a seat belt.

**WARNING: Read and Follow Instructions on All Labels**

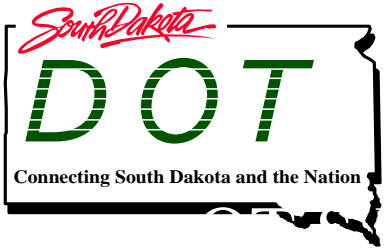
1. Read and follow all safety instructions on all labels and manuals. Failure to do so may result in injury or death.

2. Do not operate the machine if you are under the influence of alcohol or drugs, or if you are tired or otherwise impaired.

3. Do not operate the machine if you are wearing a seat belt and should be wearing a seat belt.







# OFFICE OF MATERIALS & SURFACING

- Uniform and warm mix delivery temperature
- Placement (little if any hand work)
- In place density DOT controlled (vibratory breakdown rolling and then static steel)
- Avoid aggregate fracture from excessive vibratory roller passes























2012.11.29 12:43 AM







2006 6 8

2006 6 8

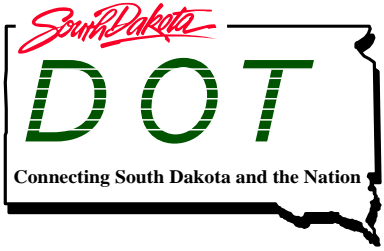
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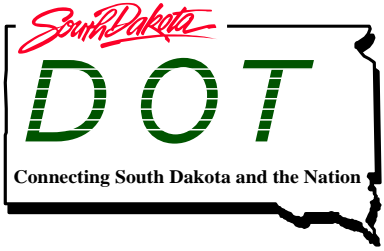






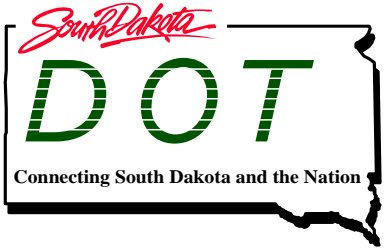
# OFFICE OF MATERIALS & SURFACING

- S Mod in 2005
- (aggregate)– \$23.50
- 6.7 % PG 70-28  
Binder - \$20.10
- 0.3 % Fibers - \$1.58
- Total \$ 45.18
- 11% higher
- Superpave in 2005
- (aggregate)– \$21.71
- 6.0 % PG 64-34  
Binder - \$18.00
- 0.5 % Lime - \$0.54
- Total \$ 40.25



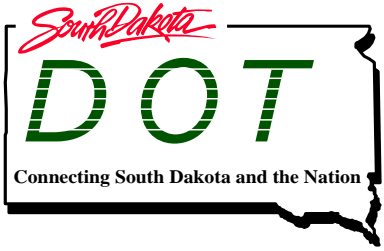
# OFFICE OF MATERIALS & SURFACING

- S Mod in 2005
- (aggregate)– \$27.80
- 5.7 % PG 64-34 Binder - \$25.99
- 0.3 % Fibers - \$1.70
- Total \$ 55.49
- 11% higher
- Q HVT in 2005
- (aggregate)– \$26.80
- 5.0 % PG 64-34 Binder - \$22.80
- 0.5 % Lime - \$0.54
- Total \$ 50.14



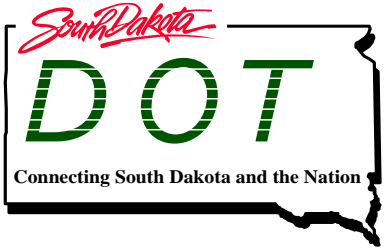
# OFFICE OF MATERIALS & SURFACING

- S Mod in 2012
- (aggregate)– \$57.00
- 5.7 % PG 64-34  
Binder - \$41.38
- 0.3 % Fibers - \$2.89
- Total \$ 101.27
- 14% higher
- Q4 in 2012
- (aggregate)– \$50.00
- 4.9 % PG 64-34  
Binder - \$35.57
- 1.0 % Lime - \$3.40
- Total \$ 88.97



# OFFICE OF MATERIALS & SURFACING

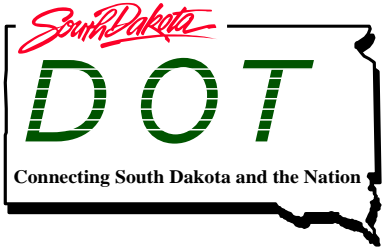
- S Mod in 2012
- (aggregate)– \$37.00
- 5.7 % PG 64-34  
Binder - \$44.40
- 0.3 % Fibers - \$2.01
- Total \$ 83.41
- 13% higher
- Q4 in 2012
- (aggregate)– \$34.00
- 5.0 % PG 64-34  
Binder - \$38.94
- 0.5 % Lime - \$0.58
- Total \$ 73.52



# OFFICE OF MATERIALS & SURFACING

- S Mod in 2012
- (aggregate)– \$54.99
- 6.4 % PG 64-34 Binder - \$53.58
- 0.3 % Fibers - \$1.85
- Total \$ 110.42
- 20% higher
- Q3 in 2012
- (aggregate)– \$44.10
- 5.5 % PG 64-34 Binder - \$46.04
- 1.0 % Lime - \$1.76
- Total \$ 91.90





# OFFICE OF MATERIALS & SURFACING

## Lessons Learned













2006 6 8



2006 6 8

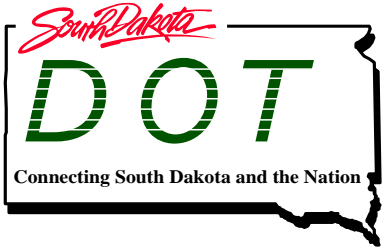












# OFFICE OF MATERIALS & SURFACING

