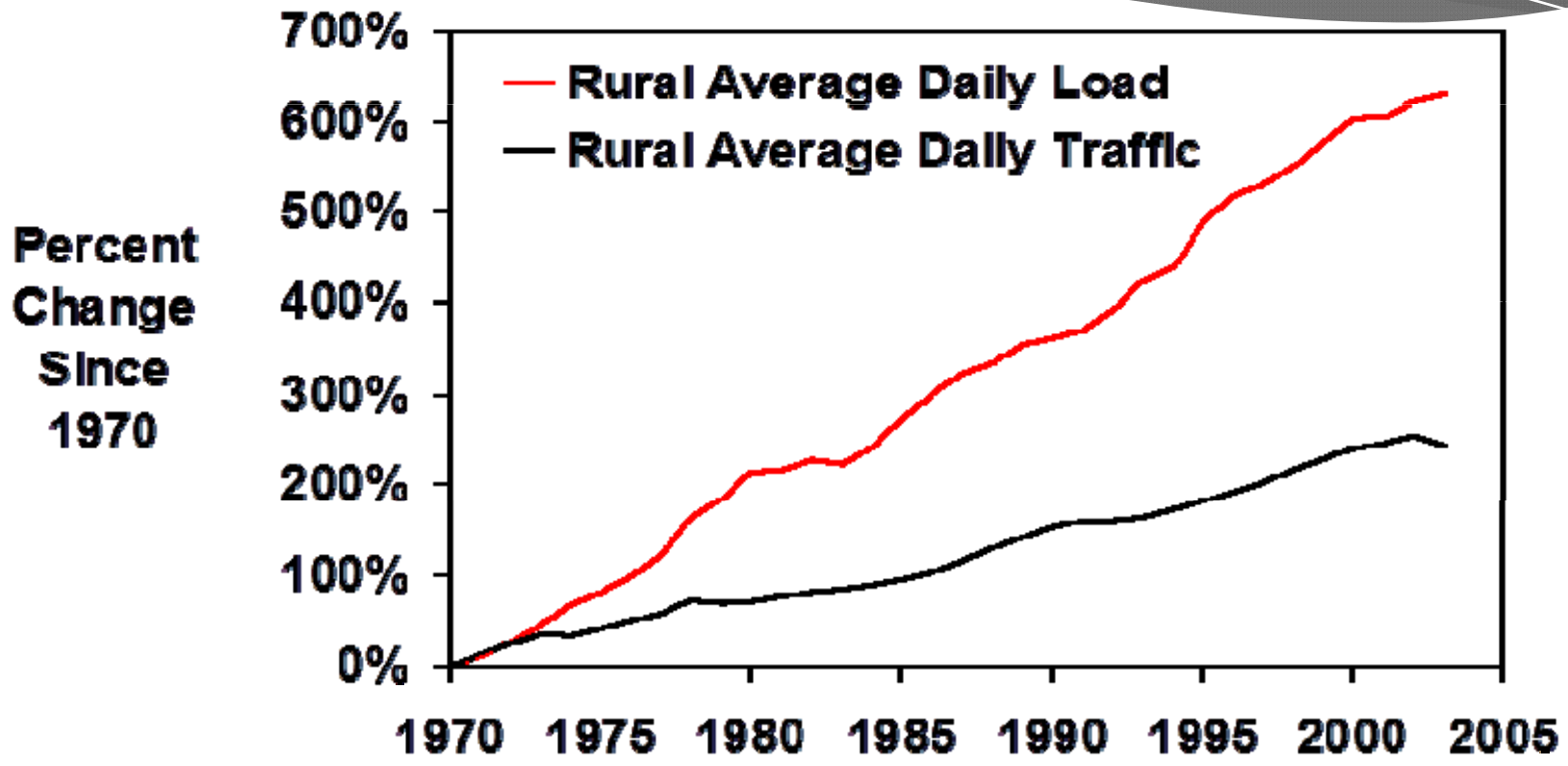
Chip Seals – Best Practices

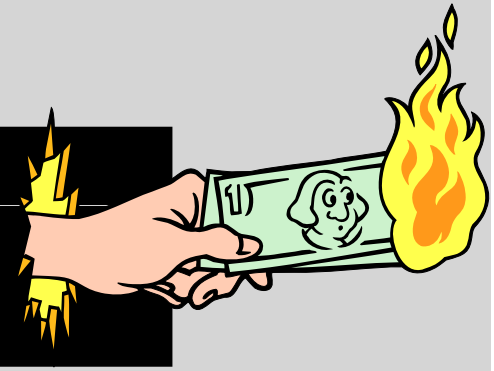
Chuck Dannheim, Heartland Asphalt Materials

Traffic & Load Growth on Rural Interstate System

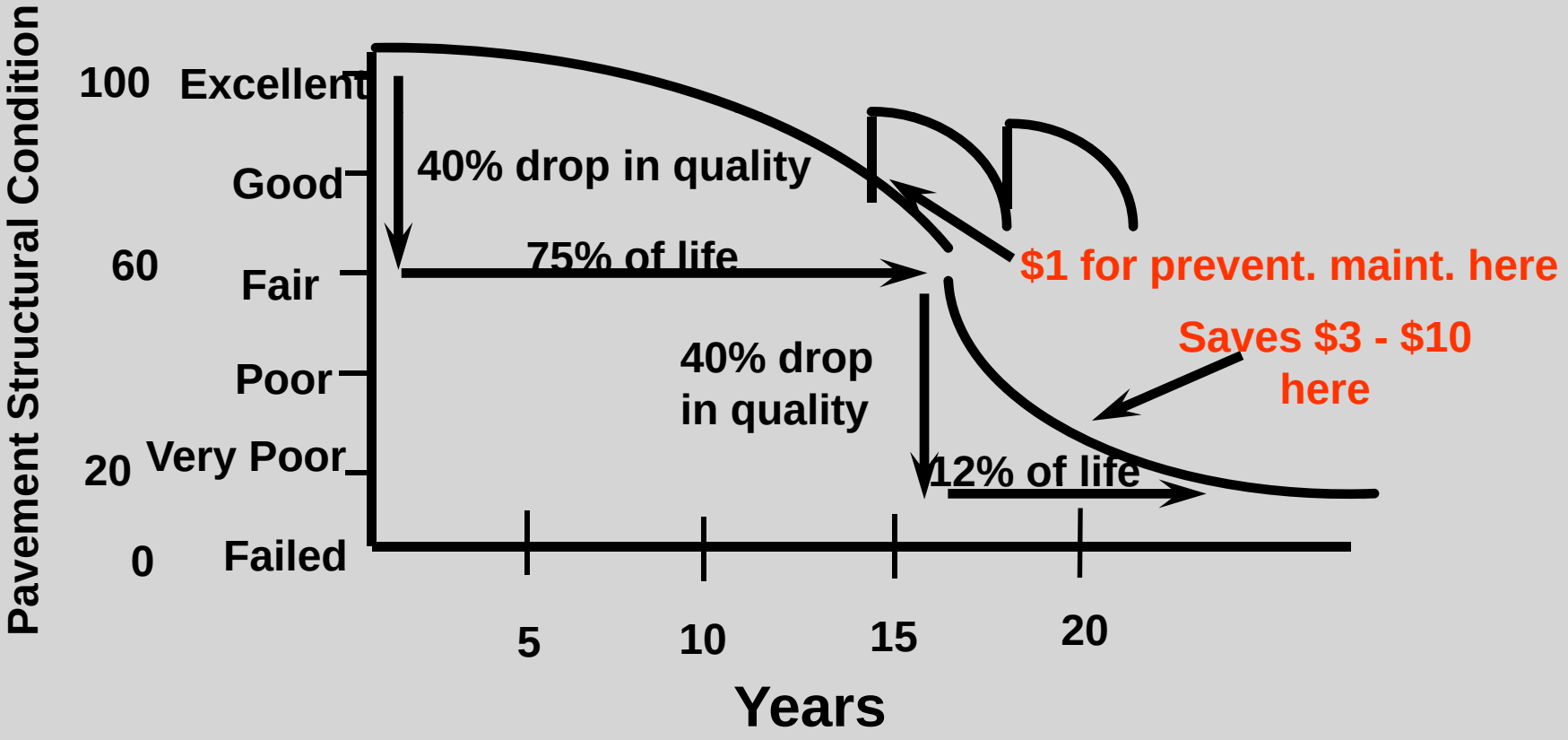


FHWA Highway Statistics 2003

Importance of Timing of Preservation



Pavement Structural Condition w/ time



Seal Coats / Chip Seals

Texas – Experience By The Numbers

* In FY 2007 TXDOT Seal Coated 14,359 Lane Miles
* Assuming that each lane averages 12’ wide, that is 102,351,890 Square Yards
* At .45 gallons per sq. yd. that is 46,058,351 gallons of asphalt or emulsion
* At 1 CY/100SY that is 930,472 cubic yards of aggregate

Seal Coat Emulsions

* CRS 2 – No polymer
  * Typically utilized for lower volume roads (County roads w/ very low ADT)
* CRS 2P – 3% polymer
  * Typically utilized on higher volume roads
  * (TXDOT rural highways)
* CRS 2 and CRS 2P
  * 70 F and rising no colder than 50 F at night!
* CRS 1P – 3% polymer – cool seasons applications
  * 50 F and rising. Designed for night temperatures below 50 F and daytime temperatures below 80 F. Emergency Applications Only!

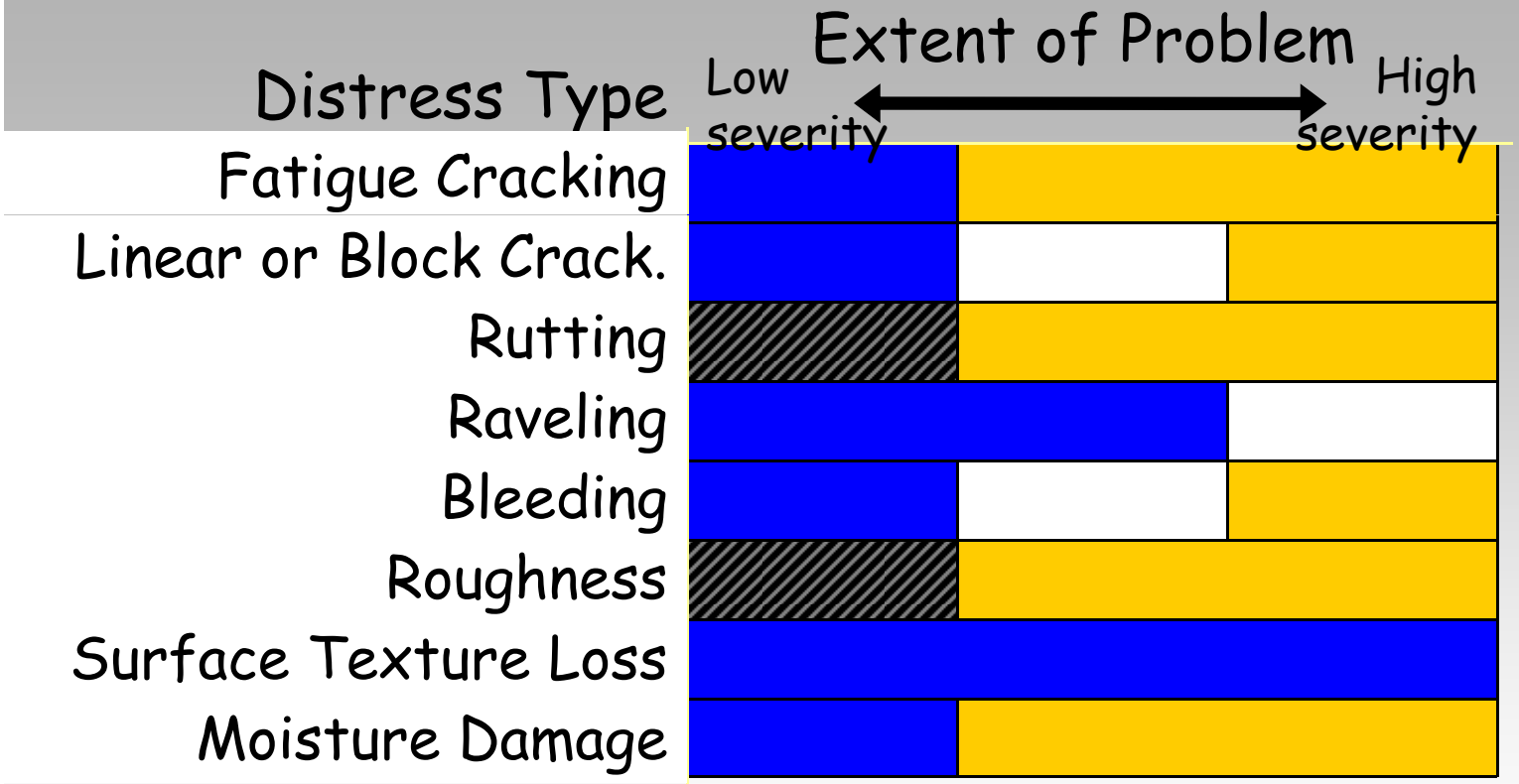
Chip Seals Serve To Correct Deficiencies Such As:

* Lack of skid resistance
* Cracks (less than ¼”)
* Raveling
* Bleeding
* Aged or Oxidized Pavement
* Provides A Uniform Appealing Surface
* Helps to reduce water infiltration

Pavement Preservation

* Renew aging surface
* Provide all-weather surface
* Waterproof base
* Seal minor surface imperfections
* Provide surface macro-texture
* Reinforce pavement

Chip Seal Site Selection
Allowable Pavement Condition



Effective

Marginal

No Impact

Not Appropriate

Cost Effective Surface Treatments

* The right treatment on the right road at the right time . . .
  * seals & preserves pavement, improves texture
* TRB Study: Chip seals most cost-effective

Slightly aged, dry, polished pavements

Successful Chip Seals

* Correct Site Selection
* Control all variables
  * Materials & construction
* Design for materials & existing surface
  * Avoid Bleeding & Chip Loss
* Traffic control essential

Design Depends Upon. . .
Is it Science or Art?

* Aggregate Size
* Aggregate Porosity
* Aggregate Voids
* Old Surface Condition
  * dry? flushed?
* Traffic
* Weather!

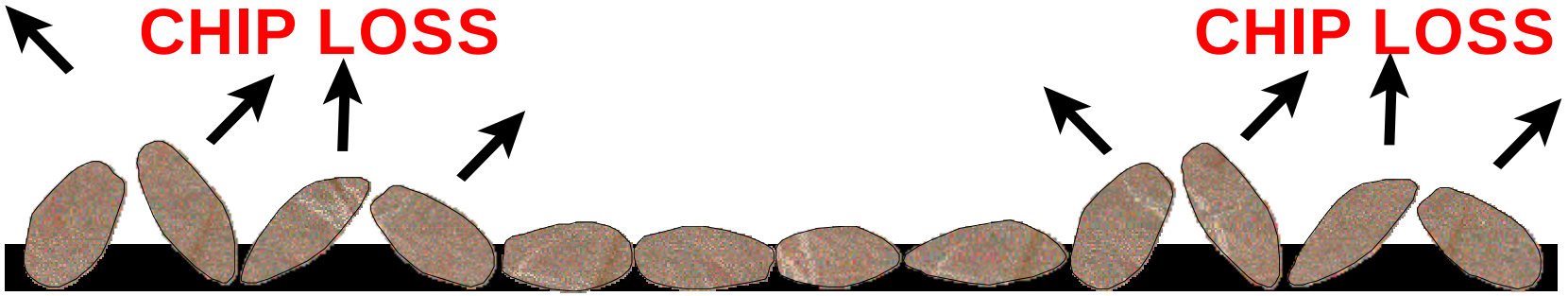
Aggregate For Seal Coat

* One-sized
* Cubical
* Clean
* Angular
* Durable
  * Non-polishing
  * Acceptable Flakiness Index

Dense Graded vs. Single Size!

Flat Chips

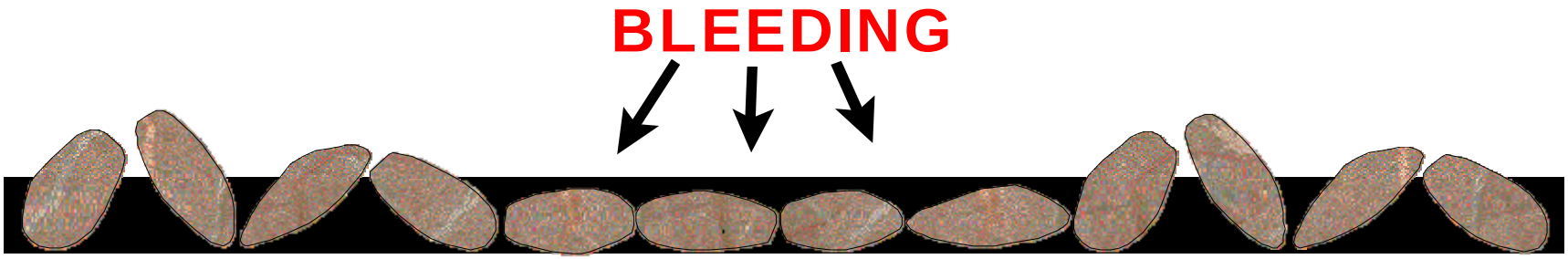
If the seal coat is designed for chips in the wheelpaths:



There is not enough binder in the non-traffic areas to prevent traffic and snow plows from dislodging the chips.

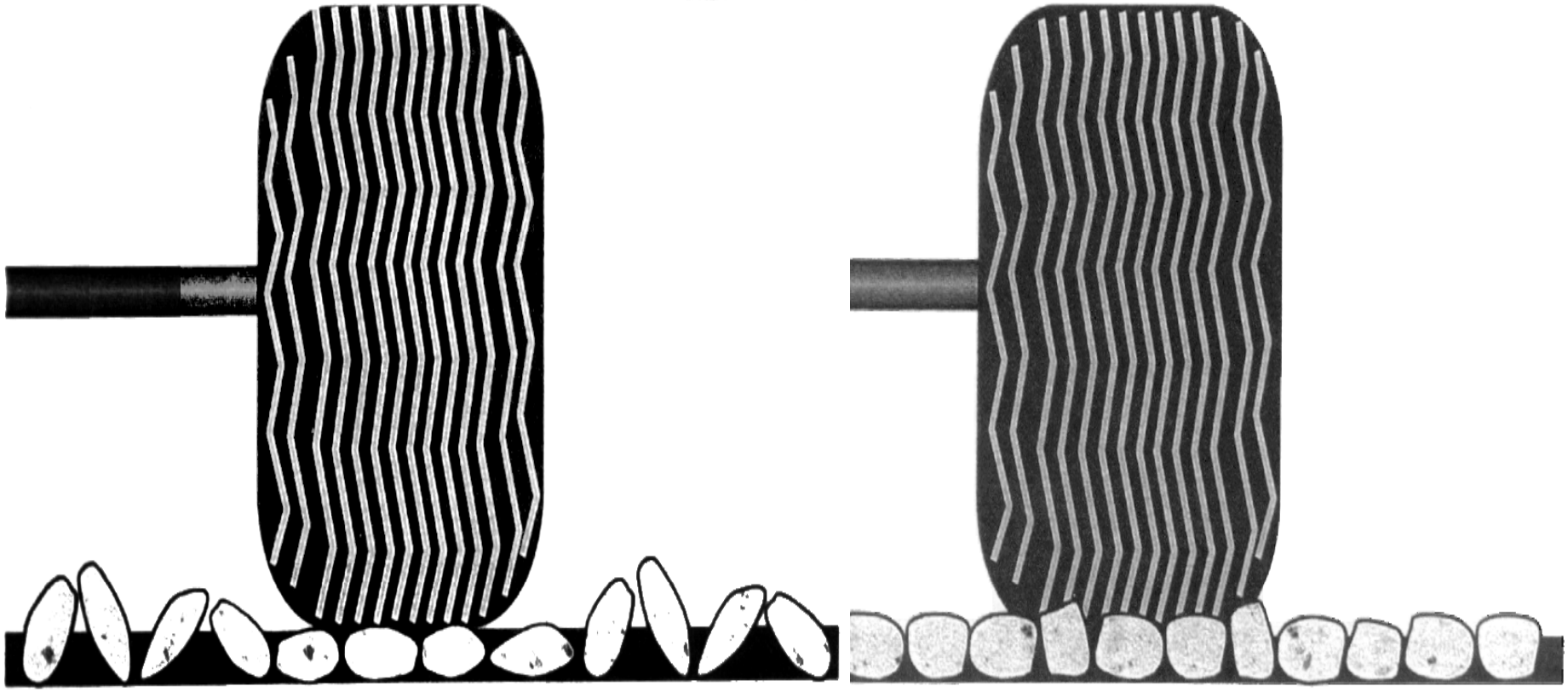
Flat Chips

If the seal coat is designed for chips in the non- traffic areas:



There is too much binder in the wheelpaths after the flat chips lay on their flattest side.

Flat Chips

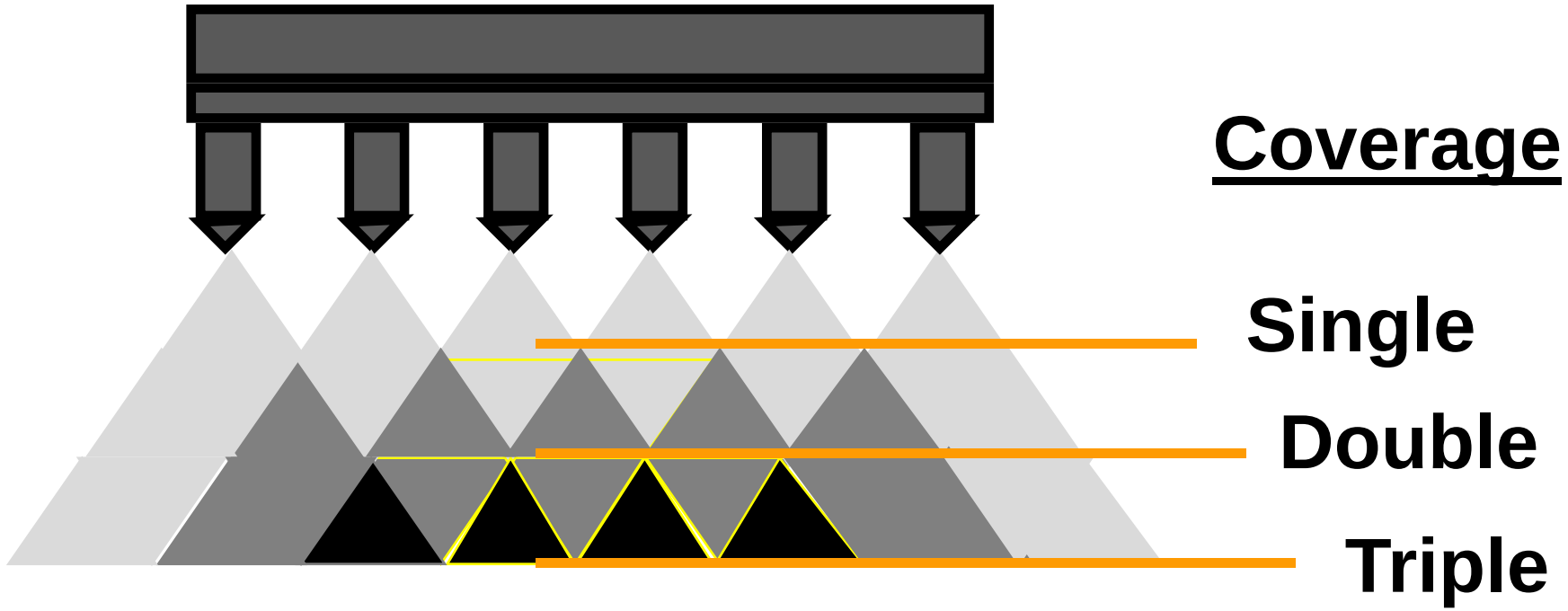


Advantages of Single Sized Chips

* Single sized chips
  * More uniform height
  * Weighs less per cubic foot
    * 47% passing the # 4 95.67 lbs/ft^3
    * 8% passing the #4 84.47 lbs/ft^3
  * More room for binder
  * Quieter surface

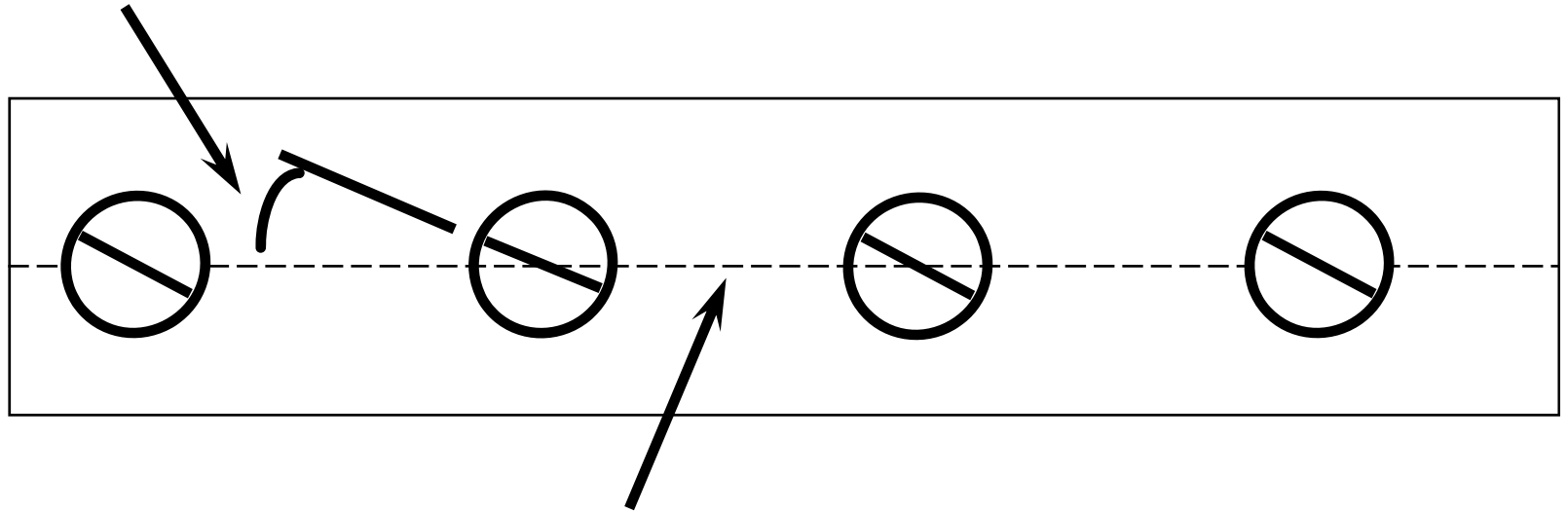
Any distributor that can be properly calibrated & adjusted to consistently give the design shot rate & proper coverage

Spray bar height must be set exactly for proper coverage



Proper Nozzle Angle Setting

Nozzle Angle Setting = 15 - 30°

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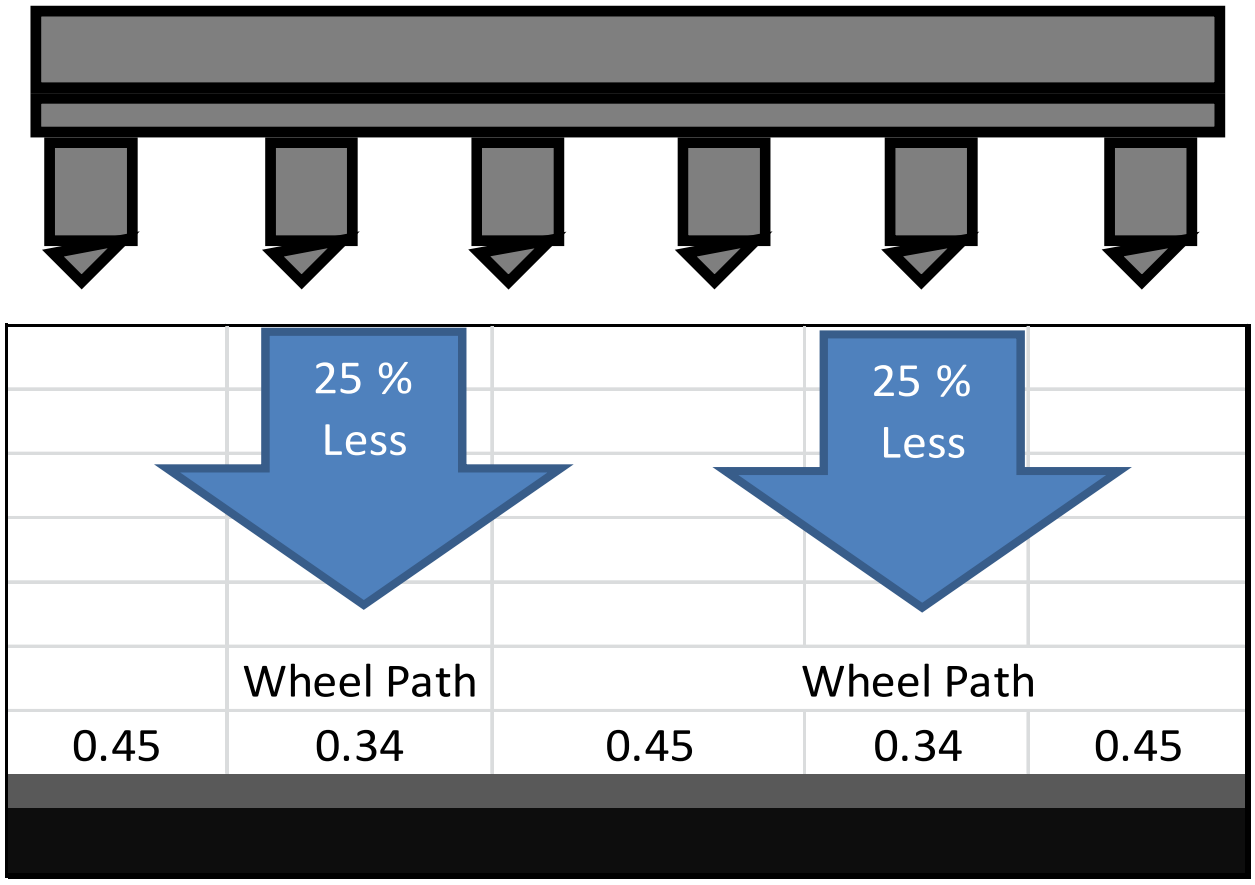
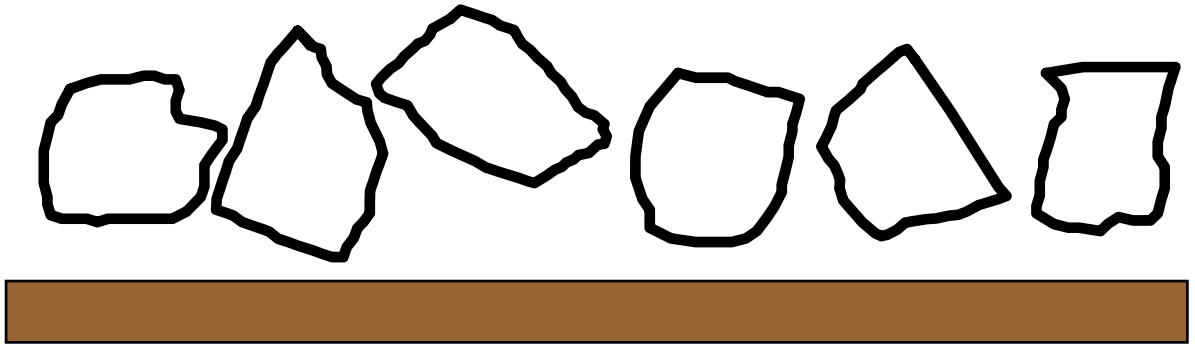
Spreader Crew Can See If There are Spray Problems


4
3
2
1

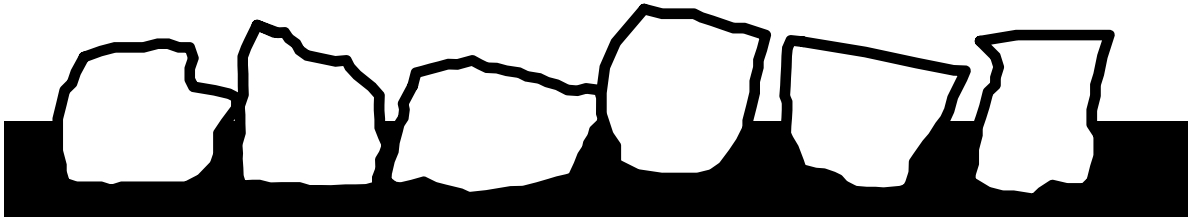
Variable Rate Nozzles



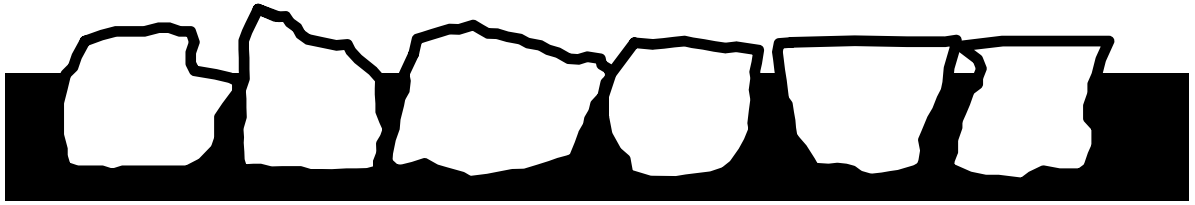


Depth of asphalt binder just before chip application

Depth of asphalt binder just after chip application



Depth of asphalt binder just after rolling



Depth of asphalt binder after considerable traffic

Shot Rate Adjustments

Pavement Condition		*Adjustment*
Flushed asphalt surface		*-0.03 gal/yd^2*
Smooth, non-porous surface		*0.00 gal/yd^2*
Slightly porous, oxidized surface		*+0.02 gal/yd^2*
Slightly pocked, porous surface		*+0.04 gal/yd^2*
Badly pocked, porous, oxidized surface		*+0.06 gal/yd^2*

Art or Science - Experience!
Seal Coat Design

* Simply a starting point for estimating costs
* Be prepared to deviate from design or plans
* Asphalt and Aggregate rates MUST be determined in the field at the time of application… conditions can change between time of design and construction
* Change rate on the fly???
* Temperature and humidity
* Traffic and pavement condition
* Demulsibility and Viscosity

Goal = 20% Voids

Aggregate Application

This is Very Important!

* When you reduce the aggregate spread rate in order to increase the % voids, it is very likely you will need to increase the asphalt rate in order to achieve the desired embedment %. The opposite effect applies if you are increasing the aggregate spread rate.

Aggregate Embedment

* Generally on low volume roads, the aggregate particles should be approximately 40 to 50% embedded.
* On high volume roads, the aggregate should be approximately 30 to 40% embedded.

Paper Joints

Clean and Neat

Quality Is In The Details!


Chip Spreaders

Aggregate

* Timing is everything!
* Depends on conditions!
* Factors change throughout the day!
* Trick of the trade…

Rolling

* Immediately After Chipping…most of the time!
* Pneumatic Tires - 60 psi
* 12 Ton Minimum
* Stop After Set
* Moderate Speed

The first rollers -- the trucks!

(Hint: train the truck drivers)

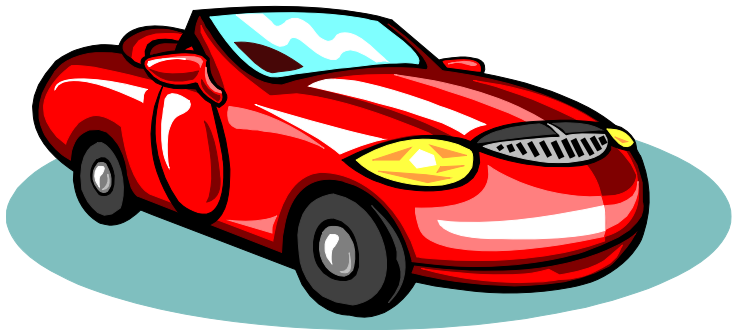
Stagger the rollers

No! Can crush the chips

Sweeping The Joints

Traffic Control

* No traffic before rolling
* Lower traffic speed until seal is cured
* Pilot car - Keep wayward traffic under control!



Most common defects in seal coat construction

* Loss of cover aggregate
* Flushing or bleeding
* Lack of adhesion to old surface

Pavement Condition Prior to Chip Seal

* Very often seal coat failures are misdiagnosed to be a material or rate problem where in fact, it was the pavement condition prior to the chip seal that created the problem.
* These conditions are very difficult to avoid; however trained engineers/inspectors can locate these areas and make adjustments.

What pavement conditions…?

* Rutting over ½” deep
* Hot or cold mix patches less than 90 days old
* Hot or cold patches without proper compaction during application
* Multiple seal coats applied in the years past
* Poor drainage in adjacent ditches
* Weak sub grade

Potential Solution…

* Use the variable rate spray bar
* Strip seal wheel paths or apply micro surfacing with a rut box
* Complete prep work 90-180 days ahead of seal coat application
* Address drainage issues as part of prep work, get the water away from the edge of the pavement.

5 Keys to Success

* Timely, quality prep work (90-180 days in advance)
* Inspect surface (day of application) to determine rates and make knowledgeable adjustments in the field.
* Utilize variable rate spray bars and modified emulsions/asphalts on higher volume roads
* Timely application of asphalt and aggregate to optimize aggregate embedment
* Re-visit your jobs from previous years to learn what works and what did not.

What can make a chip seal fail?

* Rain or wet surface
* Cool Temperatures
* Bad Emulsion/AC
* Dirty Rock
* Low Shot Rate
* Poor Workmanship
* High Traffic Count
* Not Enough Rolling

- ***2 of the above = 50% chance of failure***
- ***3 of the above = <u>100%</u> chance of failure***

What's wrong with this picture?

Discussion or Questions

- Chuck Dannheim
- Heartland Asphalt Materials