Asphalt Concrete – Basics, Maintenance, Repair, Rehabilitation

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Asphalt

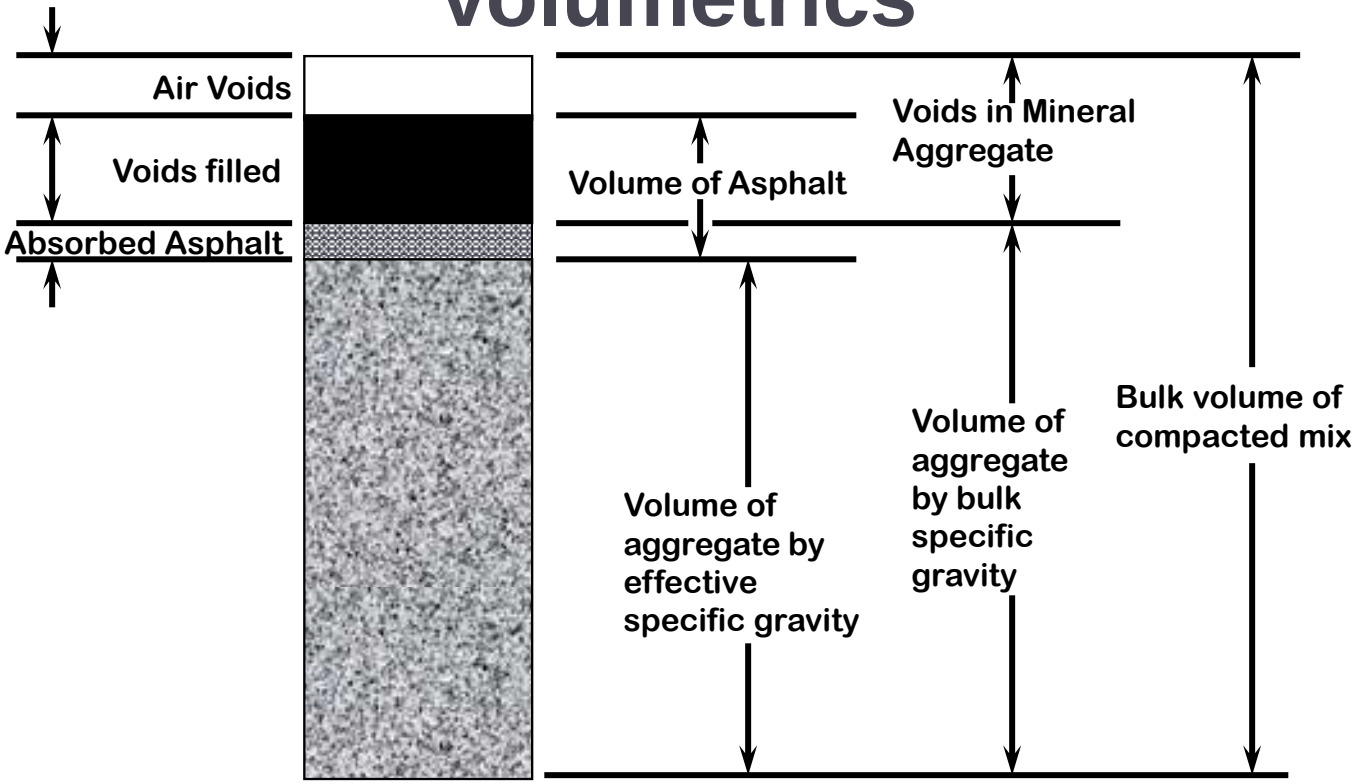
- Can adjust properties to suit the project
- Can employ a variety of preservation, maintenance, and rehabilitation methods
- Can combine maintenance methods
- Can be recycled using a variety of methods ranging from very rudimentary to complex

- But it is asphalt – an operator on a blade is not sufficient

Asphalt Concrete Introduction / Refresher

- Aggregate
- Asphalt
- Additives

Volumetrics



What affects performance?

- Quality of materials
- Proportions of materials
- Matching properties to the application
- Quality of construction
  - Density
  - Uniformity

Aggregates

- Quality – fracture, soundness, etc.
- Gradation – maximum size & size distribution
  - Lift thickness – 3 to 4 times the NMAS
  - Permeability
    - Smaller aggregate – better durability
    - Finer gradings – better durability
  - Cost

Additives

Anti-strip

- **Protection from moisture damage**
- **Lime**
- **Liquids are available**

Warm mix

- **Improves workability**
- **Allows longer hauls**
- **Aids quality in marginal conditions**

Fibers

Image courtesy of Pacific Geosource

Reclaimed Asphalt Pavement (RAP)

- Virtually all asphalt pavement is recycled – 94% back into mix, the remainder as CIR, base, etc.
- 89.2 million tons in 2019
- 97.7% of producers report using RAP
- Saved 4.5 million tons of binder, 84 million tons of aggregates
- Estimated value of $3.2 billion

RAP

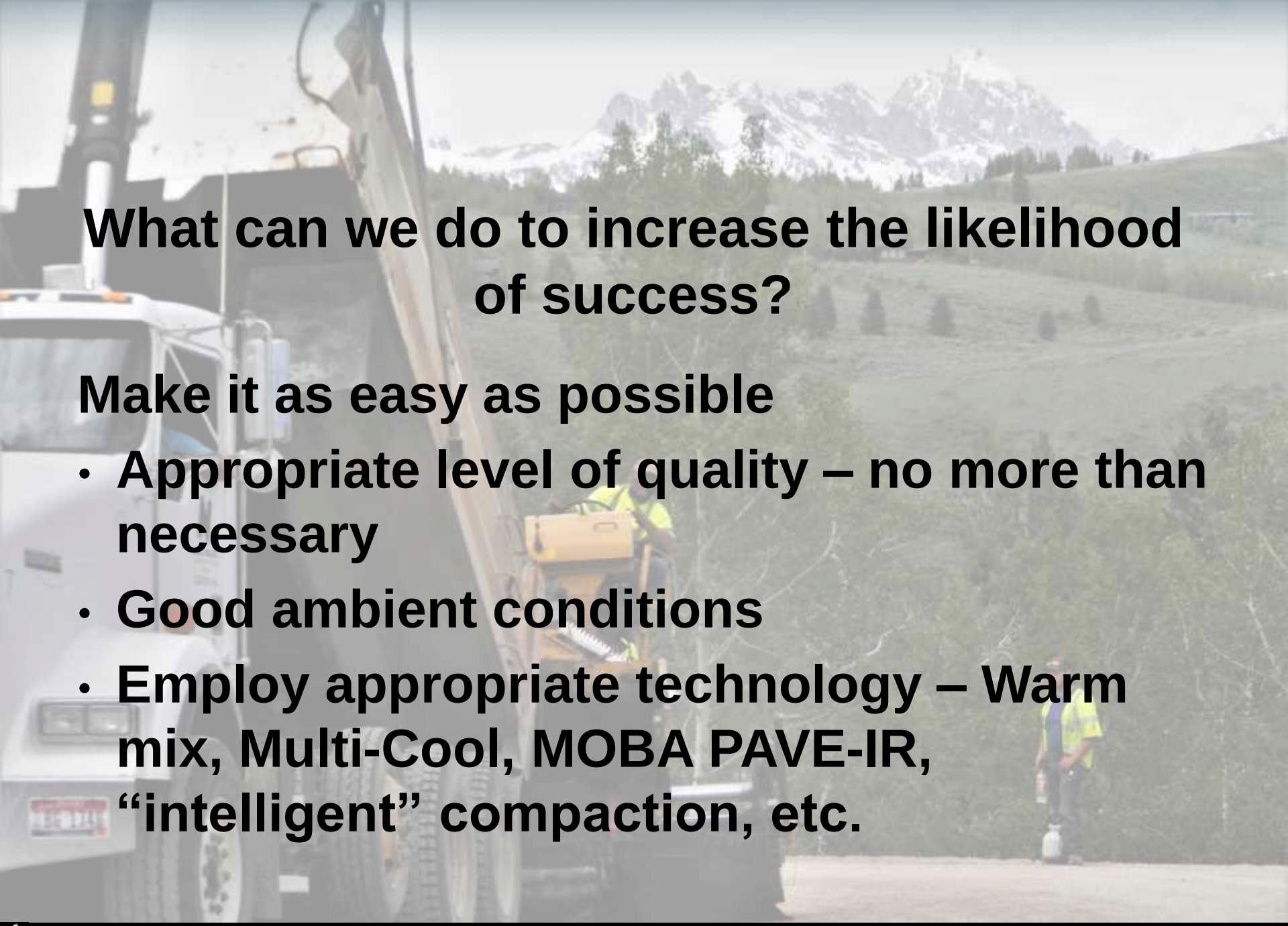
- Highest use is in plantmix - $45 per ton +/-
- High quality aggregates
- Aged binder (generally)
  - Limit RAP quantity
  - Adjust virgin binder
  - Add recycling / rejuvenating agent

Asphalt Content

- **Higher binder contents:**
  - **Thicker films = more durability**
  - **More workable**
  - **Less likely to segregate**
  - **Less rutting resistance**
  - **More fatigue resistance**

For Low-Volume Applications

- **Smaller aggregate (1/2”, 3/8”), finer gradations**
  - Thinner lifts – remember 3 to 4 times maximum size
  - Less segregation
  - Lower permeability
  - More durable
- **More binder**
  - Less segregation
  - Less permeable
  - More durable
- **Modified binders may not be worth the cost**



What can we do to increase the likelihood of success?

Make it as easy as possible

- **Appropriate level of quality – no more than necessary**
- **Good ambient conditions**
- **Employ appropriate technology – Warm mix, Multi-Cool, MOBA PAVE-IR, "intelligent" compaction, etc.**

Take Care of What You Have

- Preservation and preventative maintenance more cost-effective
- “Worst first” is not cost-effective and rarely, if ever, works

Crack Sealing

Reduce moisture infiltration into subgrade

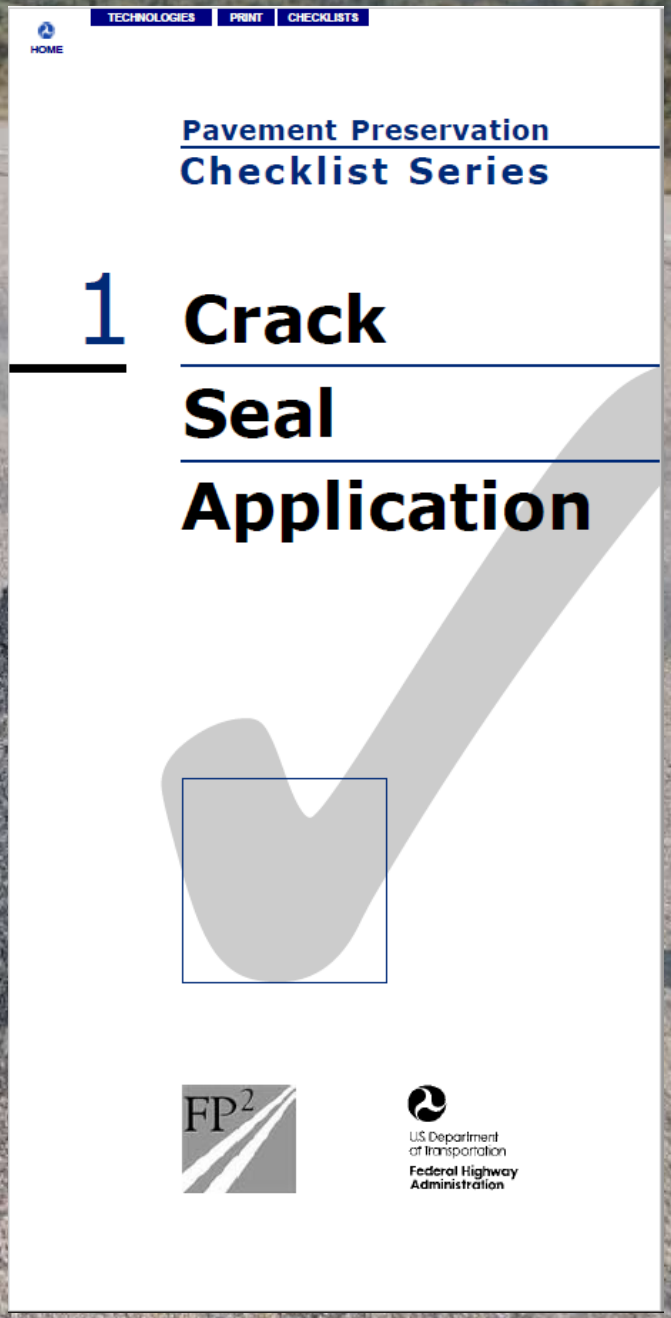
Reduce potential for incompressibles

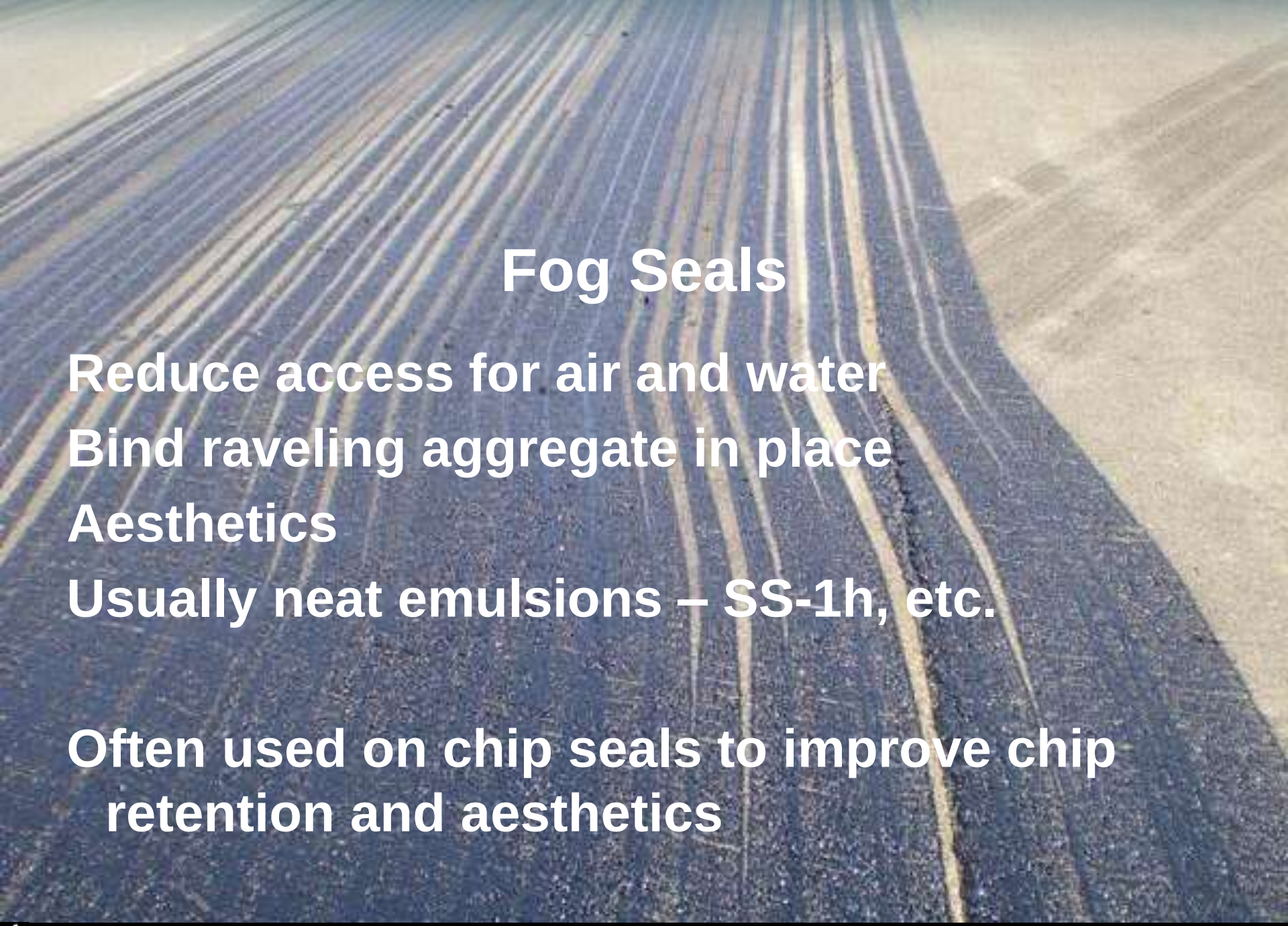
Crack Sealing

- Timing is important
  - Season
  - Subsequent treatment(s)
- Application method
  - Overband
  - Rout and fill

Crack Sealing

- Clean and dry
- Equipment in good working order
- If hot air blasting, do not overheat
- Follow manufacturer's recommendations
- Use care when opening to traffic





Fog Seals

Reduce access for air and water

Bind raveling aggregate in place

Aesthetics

Usually neat emulsions – SS-1h, etc.

Often used on chip seals to improve chip retention and aesthetics

Fog Seals

Advantages:

- **Inexpensive**
- **Quick and easy to apply**

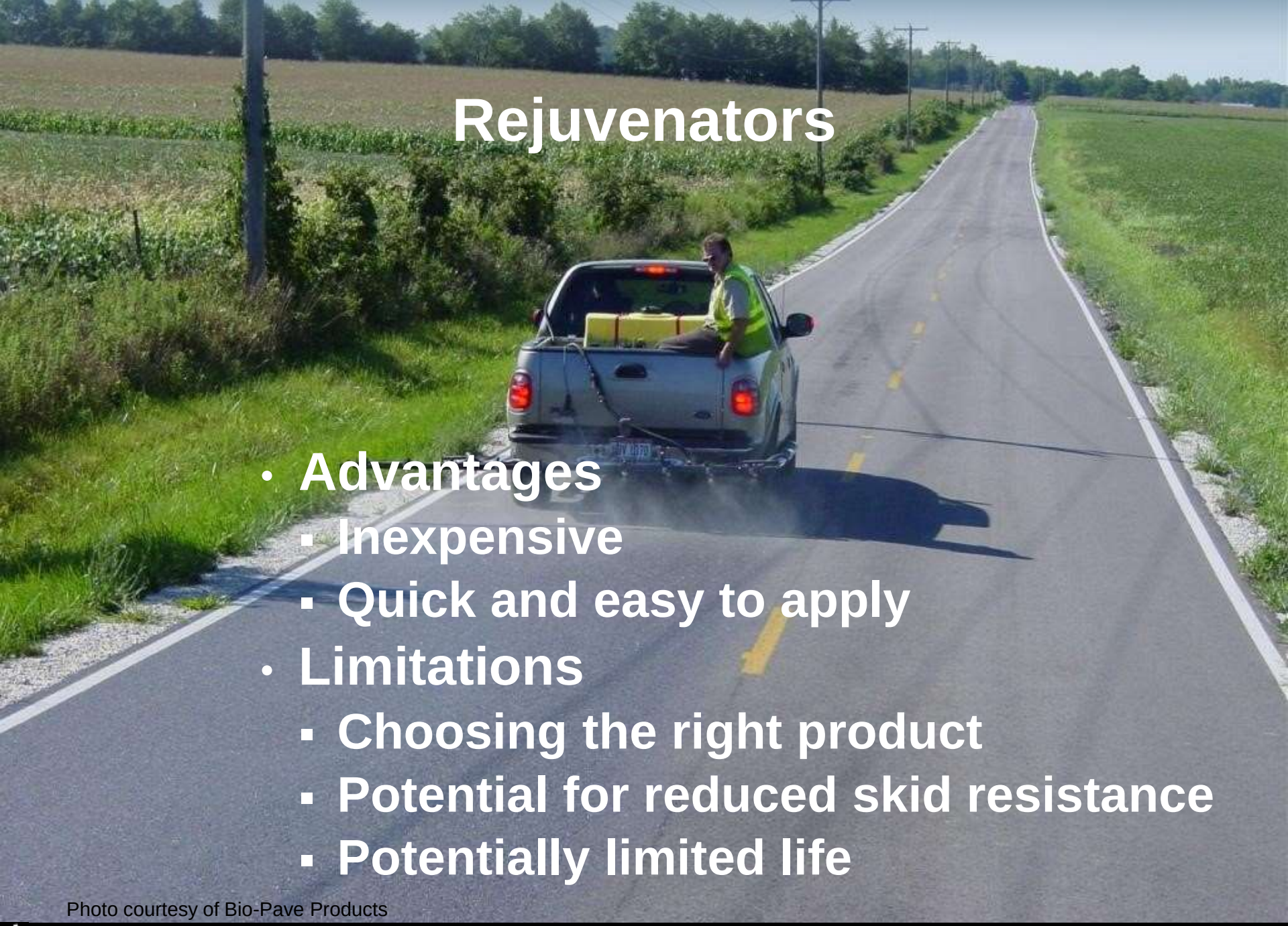
Limitations:

- **Limited life**
- **Potential for reduced skid resistance**

Fog Seal

- Need relatively open surface texture
- Clean and dry
- Proper emulsion application
  - Correct product
  - Temperature
  - Spray bar free from plugging
  - Proper nozzles, alignment, and bar height
  - Calibrated distributor
  - Proper application rate
- Can blot with sand immediately

Rejuvenators



- Advantages
  - Inexpensive
  - Quick and easy to apply
- Limitations
  - Choosing the right product
  - Potential for reduced skid resistance
  - Potentially limited life

Photo courtesy of Bio-Pave Products

Slurry Seals

Emulsion, aggregate, admixtures

Emulsion may be neat or modified

Three typical gradings – Types I, II, and III

Slurry Seals

- Advantages
  - Relatively inexpensive
  - Can improve skid resistance
  - More robust than fog seals
- Limitations
  - Only for surface defects & distresses
  - Relatively slow to set
  - Sensitive to material selection & ambient conditions

Microsurfacing

Emulsion, aggregate, admixtures

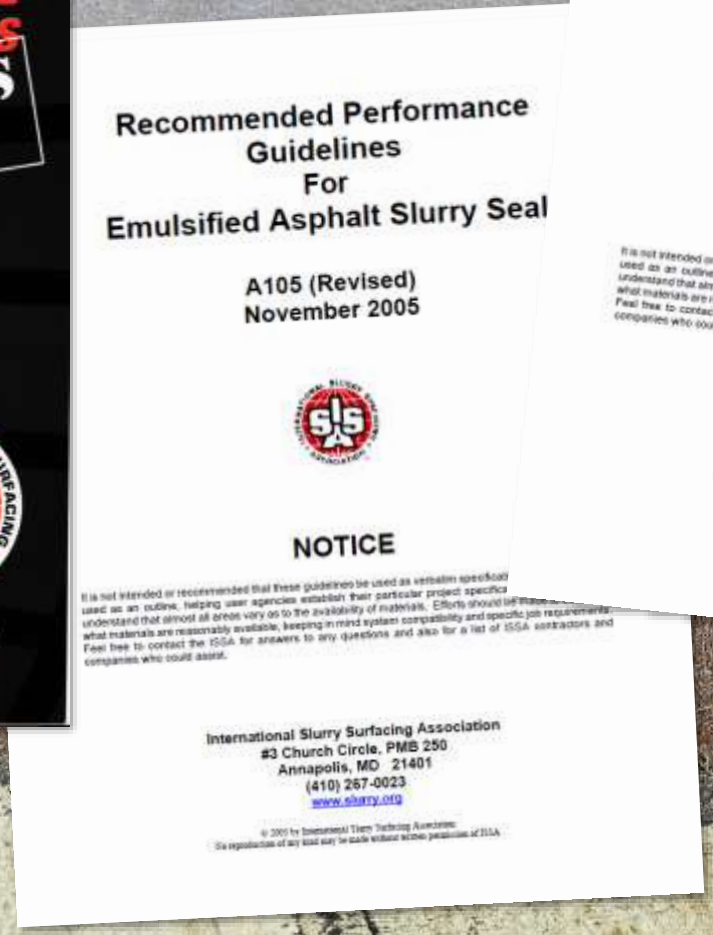
Emulsion is modified

Three typical gradings – Types I, II, and III

Microsurfacing

- Advantages
  - Relatively inexpensive (but more than slurry)
  - Can restore friction
  - Can fill ruts / shallow depressions
  - Quick return to traffic (<1 hr)
- Limitations
  - Only for surface defects
  - Sensitive to material selection & ambient conditions

Microsurfacing


Recommended Performance Guidelines For Emulsified Asphalt Slurry Seal

A105 (Revised)
November 2005

NOTICE

International Slurry Surfacing Association
#3 Church Circle, PMB 250
Annapolis, MD 21401
(410) 267-0023
www.slurry.org


ISSA A143 (revised)
May 2005

Recommended Performance Guidelines For Micro-Surfacing
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Slurry / Micro Construction

Chip Seals

Binder covered with aggregate

Chip Seals

- Binder options
  - Emulsions
    - Neat or modified
  - Hot-applied paving asphalt
    - Neat or modified
  - Asphalt-rubber
  - Cutbacks

Chip Seal Aggregates

- Clean
- Fractured
- Cubical

Size affects:

- Application rates of binder and aggregate
- Surface texture and noise

May be precoated

Can be single layer


Or double layer

Chip Seals

Can be constructed over a base course, full–depth reclamation, cold-in-place recycle, or similar substrates.

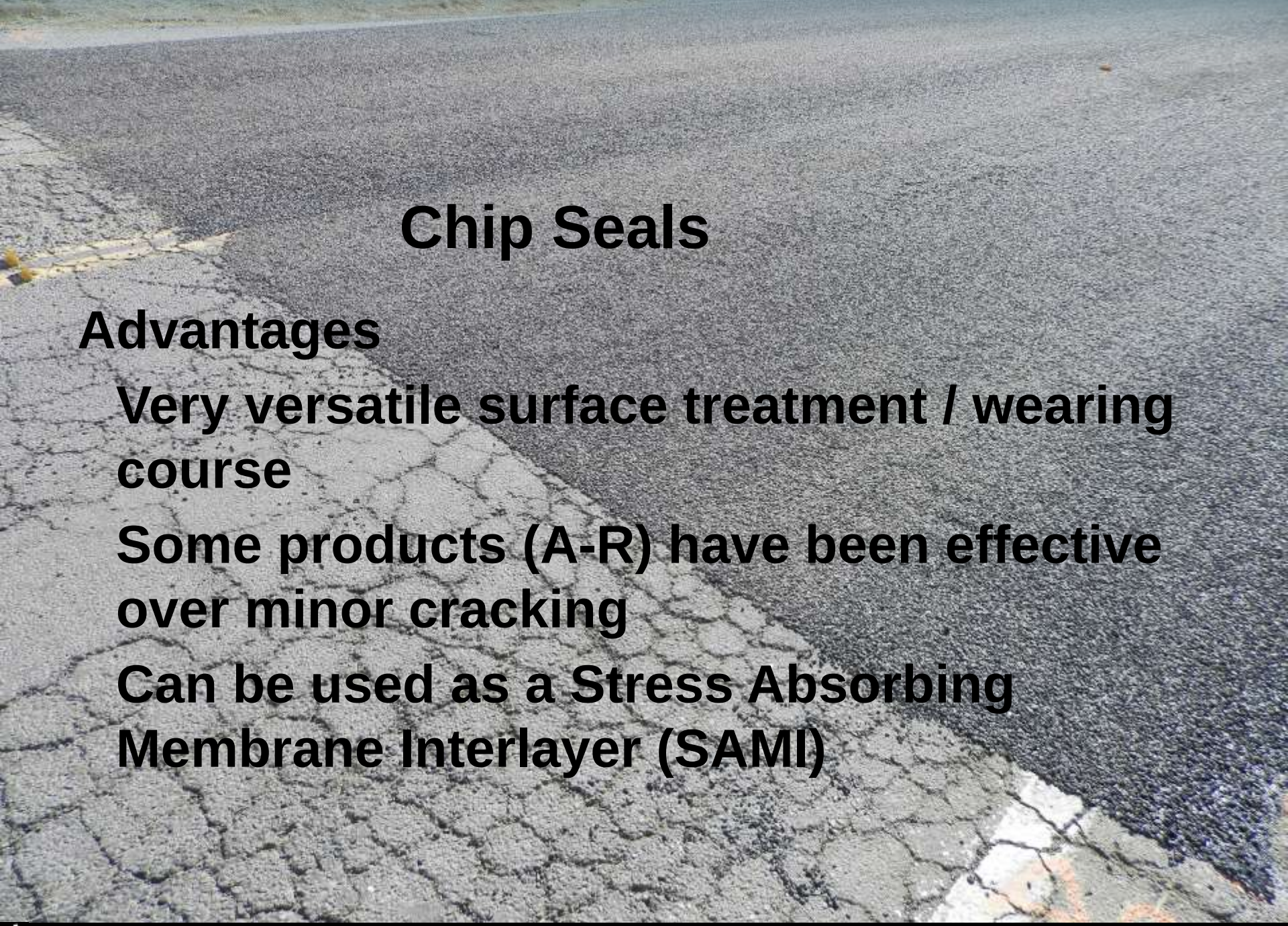
Photo courtesy of Western Emulsions

Chip Seals

Can be constructed over fabric, but materials and application rates are more critical.

Chip Seals

Condition of existing is important.



Chip Seals

Advantages

- Very versatile surface treatment / wearing course
- Some products (A-R) have been effective over minor cracking
- Can be used as a Stress Absorbing Membrane Interlayer (SAMI)

Chip Seals

Limitations

- Can be difficult to choose materials
- Sensitive to materials and ambient conditions
- Texture may preclude use in some locations
- Do not withstand shear very well


Chip Seals
Irregular areas can be difficult

Chip Seal Construction

Do not sweep too soon, do not use excessive down-force

Cape Seals and Scrub Seals

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Best Practices - Patching

- Removal methods
- Subgrade preparation
- Tack
- Material Selection
- Material Handling
- Compaction
- Fog Seal?

Removal Limits

Patching – Removal Methods

- Sawcutting
- Jackhammer
- Cold planing

Patching – Subgrade Preparation

- Saturated / Unsuitable Materials
- Stabilization
  - Rock
  - Grid and/or fabric
  - Cement or lime
- Compaction – “firm and unyielding”

- Identify and solve the root cause.

Patching – Material Selection

- **Workability**
  - Gradation
  - Segregation potential
  - Binder content
  - Binder type
- **Temperature**
- **Cost / availability**

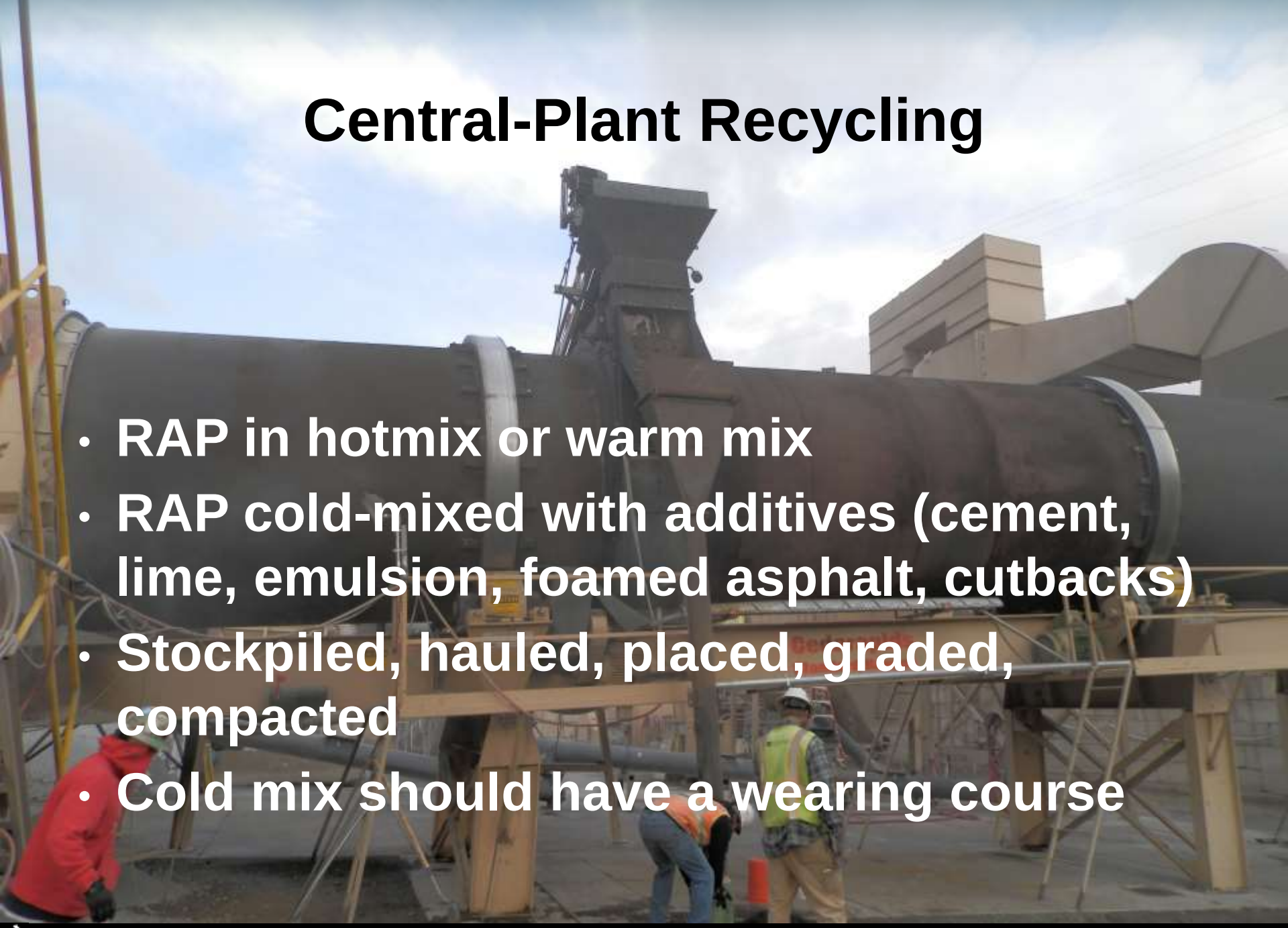
Patching – Material Handling

- Paver placed
- Loader, etc.
- By hand
- Important Considerations
  - Time – workability / compaction
  - Segregation

Recycling

- Central plant
  - Hot
  - Cold
- In-place
  - Partial depth
  - Full depth
  - Can often incorporate underlying materials
- Millings
  - Use as-is
  - Place and seal / improve
  - Place, treat, wearing course

Central-Plant Recycling



- RAP in hotmix or warm mix
- RAP cold-mixed with additives (cement, lime, emulsion, foamed asphalt, cutbacks)
- Stockpiled, hauled, placed, graded, compacted
- Cold mix should have a wearing course

Image courtesy of Graniterock

Partial-Depth Recycling

AKA Cold In-Place Recycling – CIR

- Pulverize
- Apply additives (cement, lime, emulsion, foamed asphalt)
- Moisture condition and mix
- Grade and compact

Image courtesy of Graniterock

CIR

- **Single or multiple passes**
- **Single or multiple units**

Image courtesy of Coughlin

CIR

- Recycling trains

Image courtesy of Coughlin

CIR

- Place with screed – recycler or paver
- Needs a wearing course

Full-Depth Recycling (FDR)

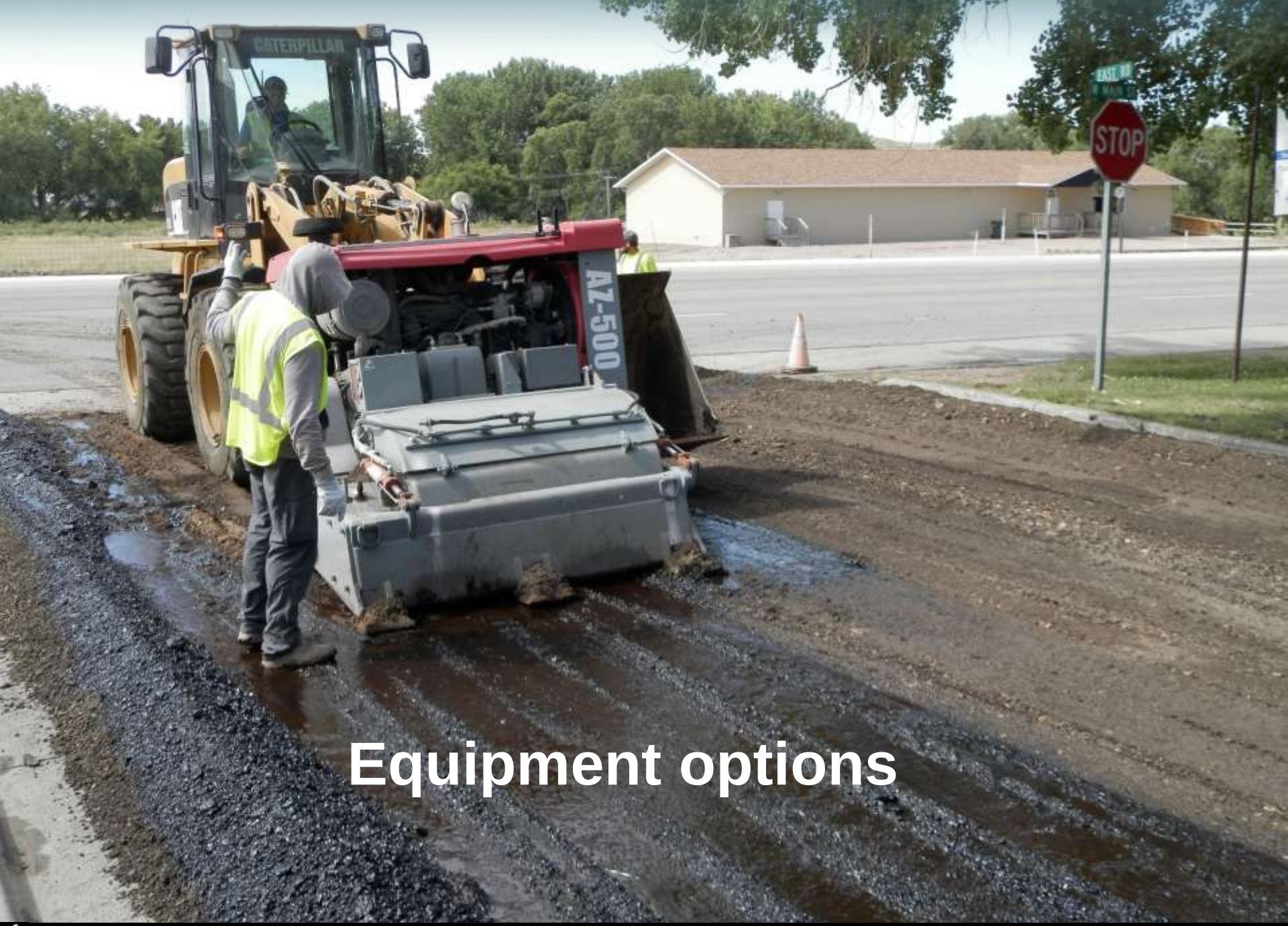
- Pulverize
- Can incorporate suitable underlying materials
- Apply additives (cement, lime, emulsion, foamed asphalt)
- Moisture condition and mix
- Grade and compact

FDR

- Single or multiple passes
- Typically single unit

Equipment options

Equipment options



Equipment options

FDR

- Place with screed or motorgrader
- Should have a wearing course

Millings

- Screen / crush for chip seal aggregate
- Screen / crush for slurry / micro
- High quality aggregates
- Reduces binder demand
- Micro milling
  - Ride improvement
  - Fines can be used as crack filler
  - Traffic as-is, or apply wearing course
  - Finer millings valuable for other uses with minimal processing.

Millings

- **Work reasonably well as-is**

Millings

- Haul, place, grade, compact, fog/prime

Millings

- **Haul, rough-dump, treat, place, compact, fog/prime or wearing course**

Surface Quality

Summary

- Appropriate level of quality
- Preserve
- Maintain
- Consider recycling
  - Central Plant – hot or cold
  - In-situ – partial-depth or full depth
  - Additives for better performance
  - Seal or apply wearing course
- Millings

Questions / Discussion

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