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UKaid from the Department for International Development

Towards Improvement of Surface Dressings in Ethiopia

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Scope

- Background
- Study findings
- Construction related problems
- Conclusions and study recommendations

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Background to this paper

- Review of surface dressings in Ethiopia
  - ERA concerns regarding performance
  - AFCAP initiated project
    - Analyse and understand the cause of surface dressing failures in Ethiopia
    - Interviews, Field investigation, Workshop with practitioners
    - Review of Design methods, Manuals, specifications
    - Recommendations for improved practice

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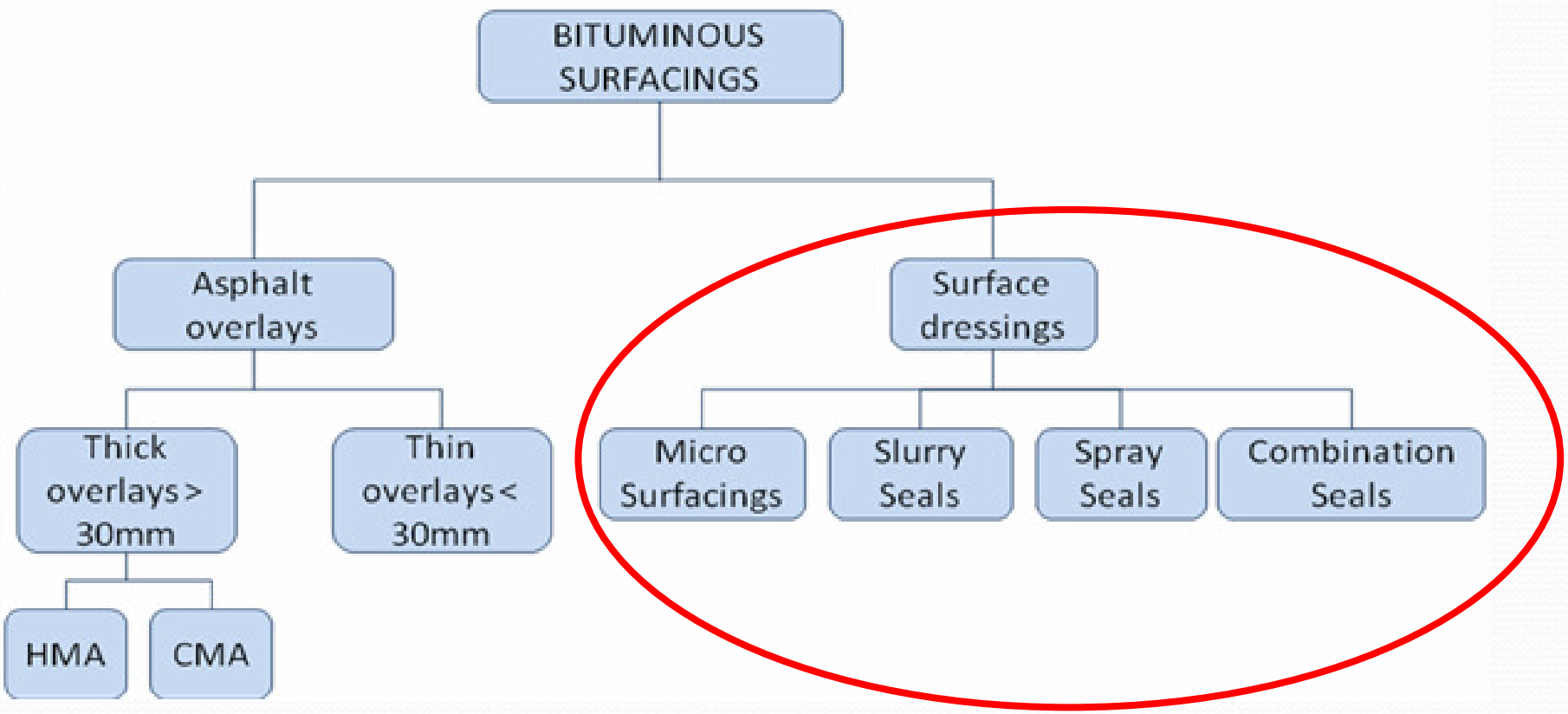
Terminology



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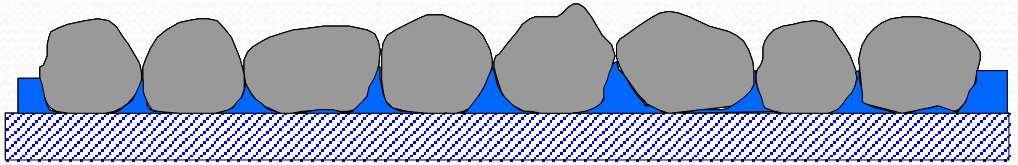
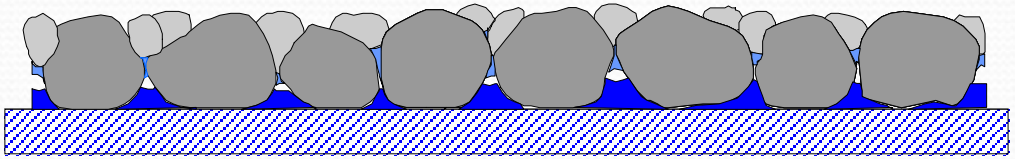
Some surface dressing types

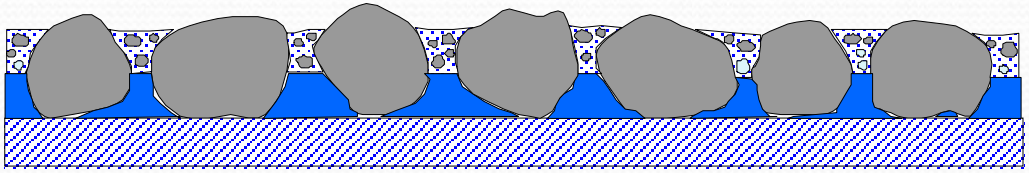
single seal



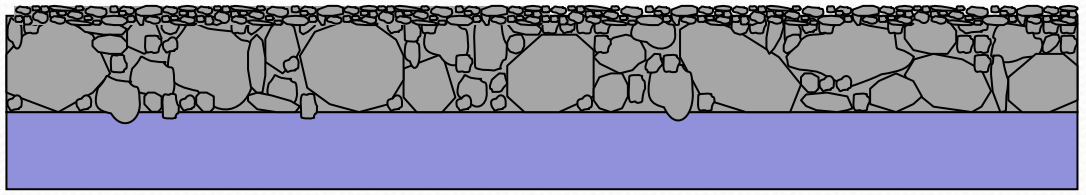
double seal



cape seal



graded aggregate/ Otta seal



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Main Findings

- Defects observed are mainly related to
  - Workmanship and knowledge
  - Equipment quality
  - Quality assurance – lack of

  Construction related
  - Design – Interpretation and assumptions with no variation due to varying conditions
  - Appropriateness of specifications

Note: Problems/ errors observed are exactly the same as found in other countries

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Focus of this paper

- Highlight some construction related problems
  - Poor transverse distribution
  - Poor transverse joints
  - Poor longitudinal joints
  - Aggregate spread
- Specifications, purpose, implications of non-adherence
- Purpose – to show that additional information and training could improve performance of surface dressings

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Poor transverse distribution

Observed

Too low binder application

Too high binder application

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Transverse distribution (Proper flair & overlap)

Transverse distribution

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Existing ERA Specification

6104 EQUIPMENT

The following equipment shall be available and in good working order:

(a) Bitumen Distributor

The bitumen distributor shall comply with the following requirements:

Tests for **uniformity of transverse distribution** of binder shall be carried out according to the Depot Spray Test (described below) before the commencement of binder spraying works and at such other times as directed by the Engineer,

6110 DEPOT SPRAYTEST

Transverse distribution

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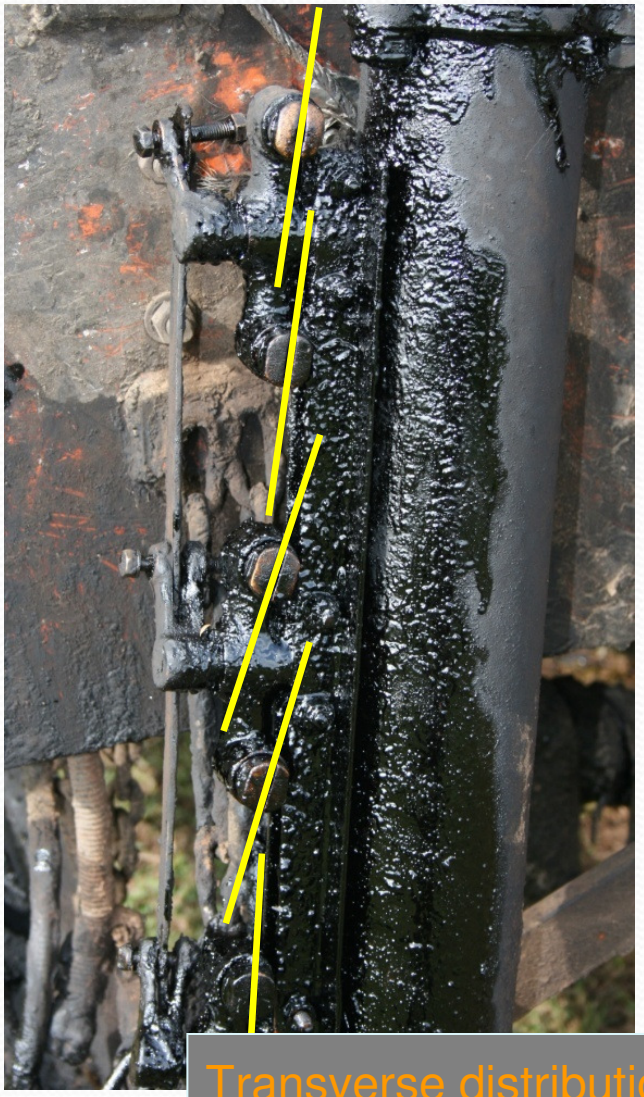
Nozzle angles

Observed



Transverse distribution

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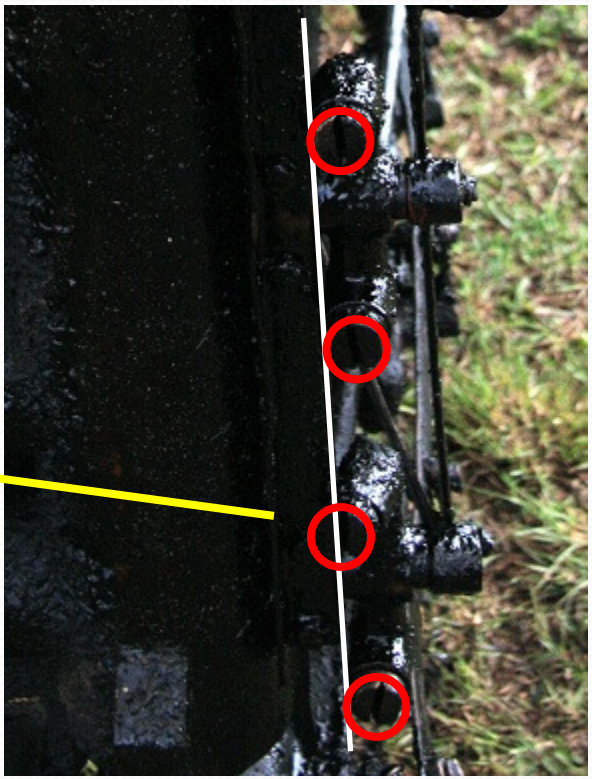
Nozzle alignment



Observed

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Existing ERA Specification

ERA Specification Clause 6104 (a)

"Before each separate application of binder, the spray bar shall be reset to **the height required to ensure the necessary uniformity of nozzle spray overlap (double or triple)** and distribution is maintained…….

Transverse distribution

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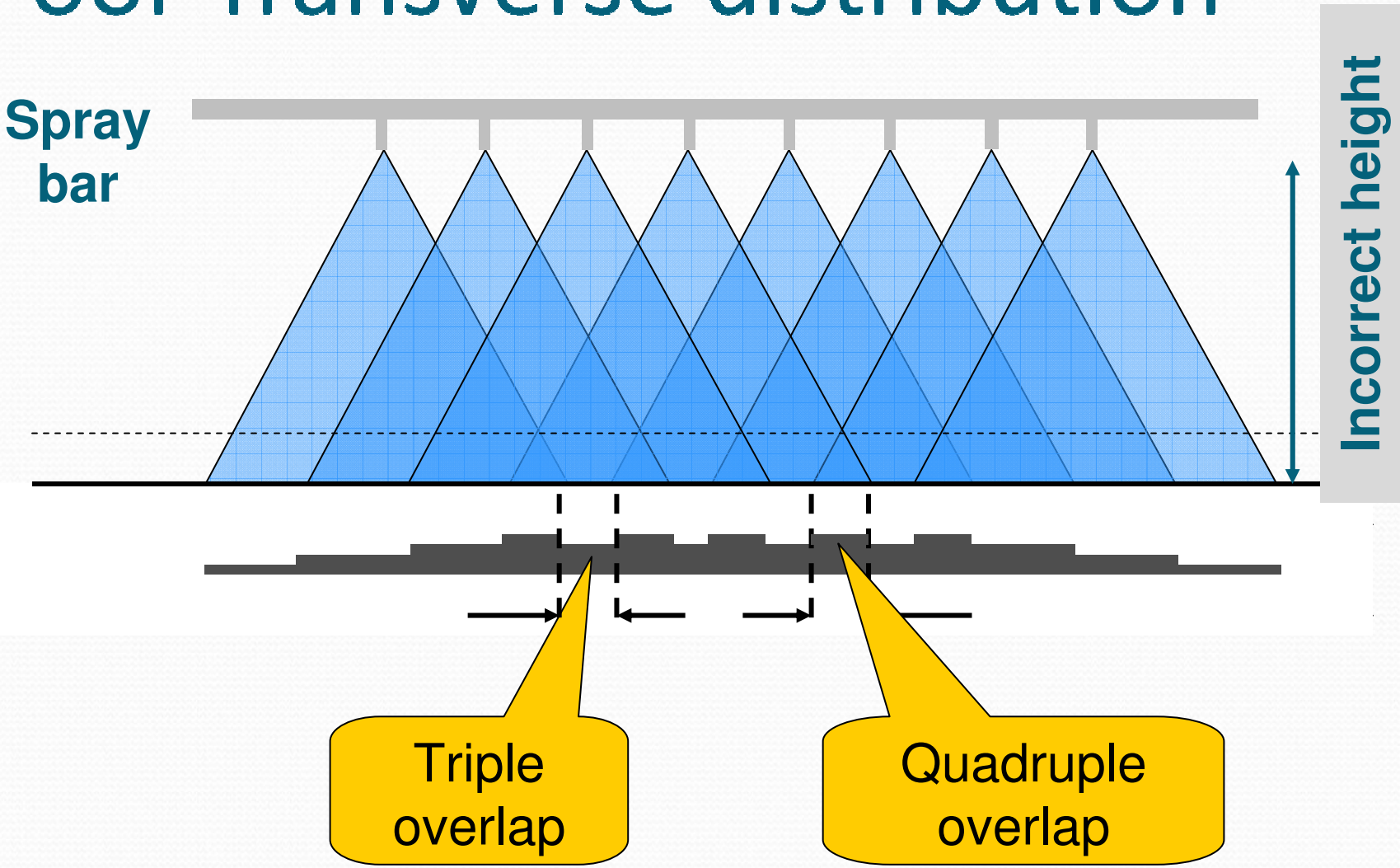
Poor Transverse distribution



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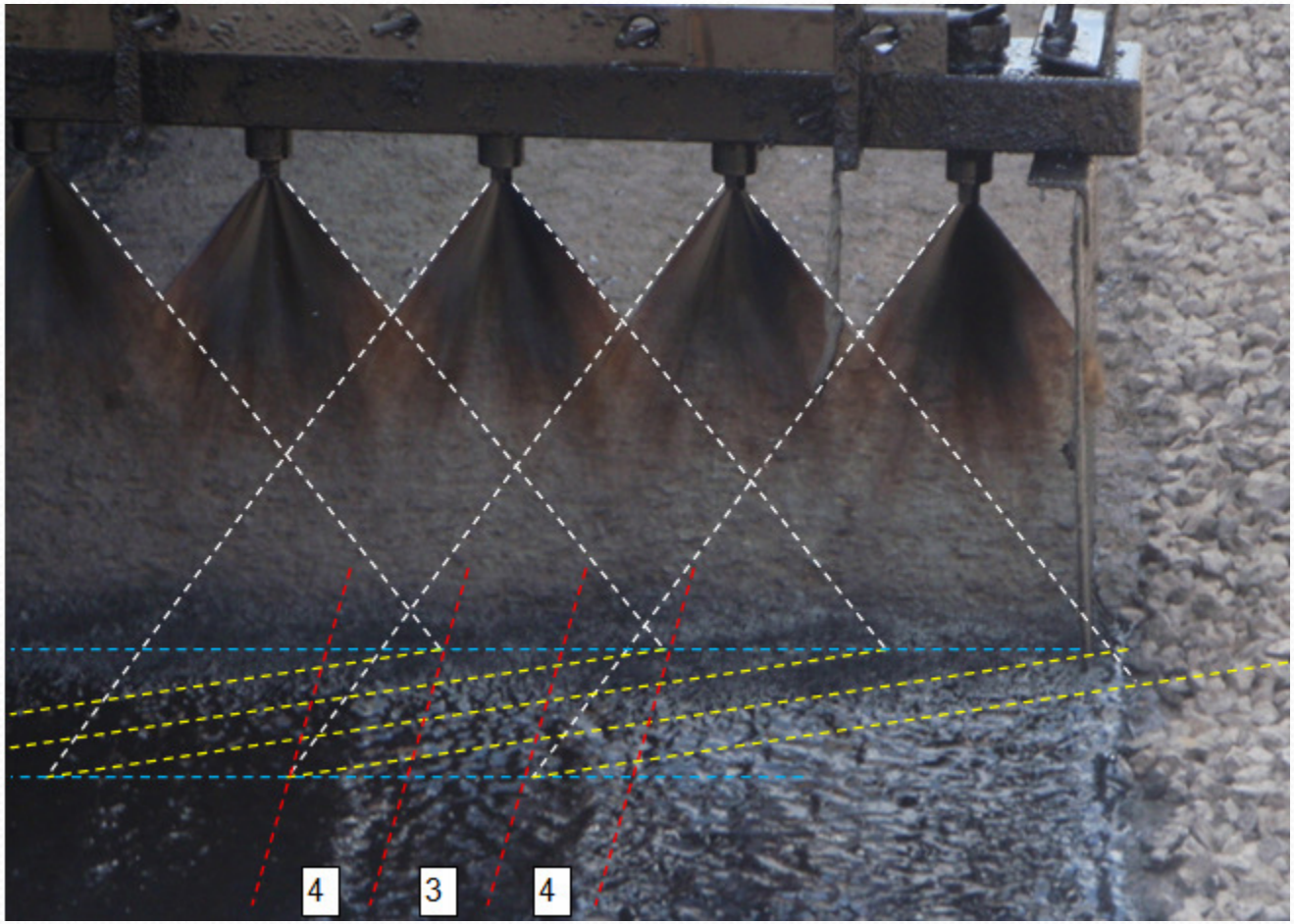

Transverse distribution

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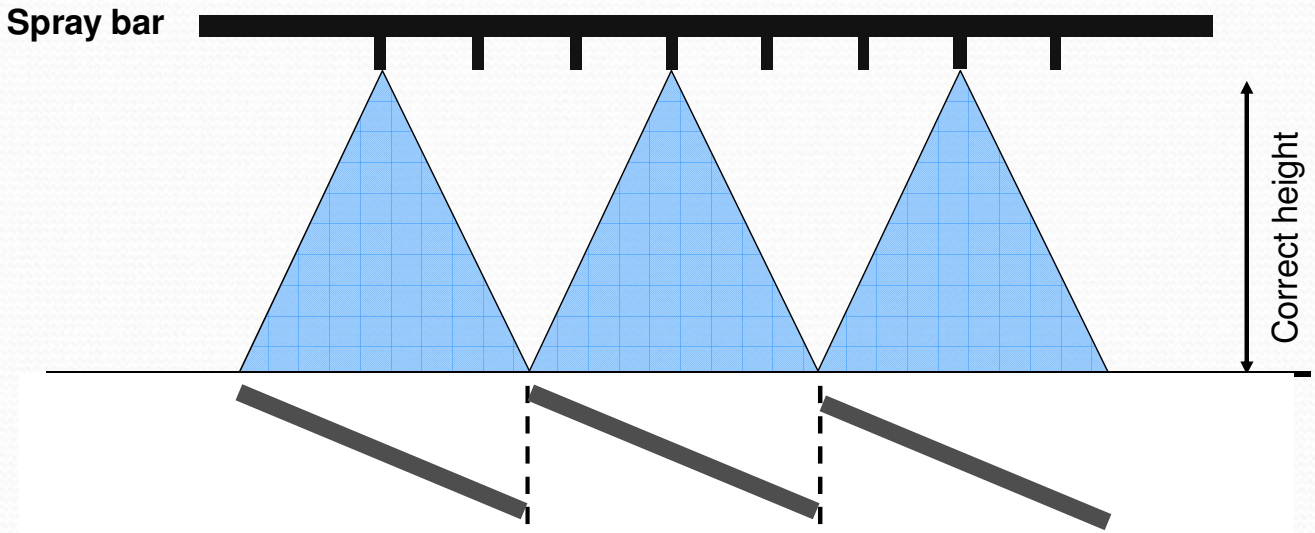
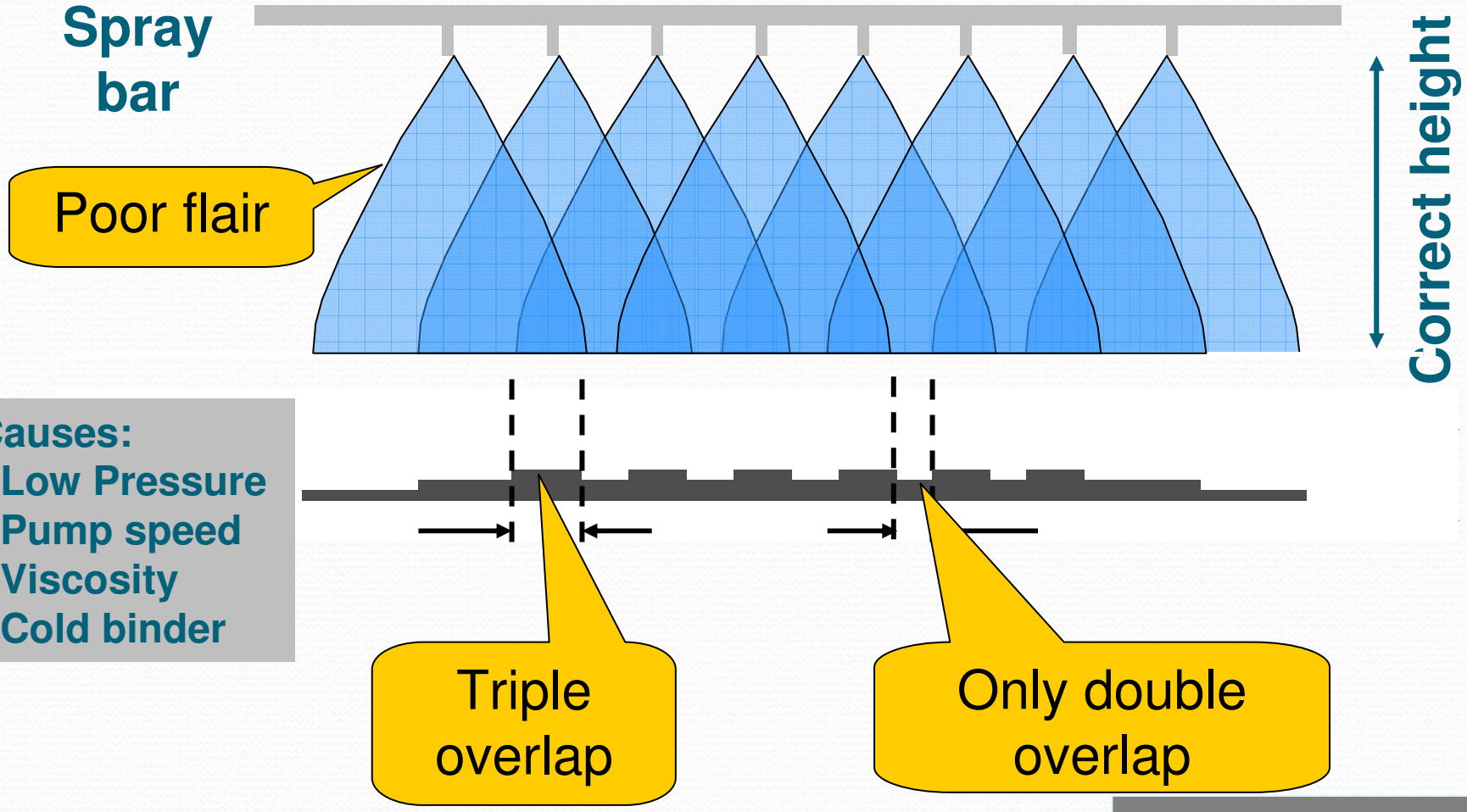
Elsewhere

Transverse distribution

Height adjustment



Poor Transverse distribution



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Poor Longitudinal Joints

Main Cause ?
•Construction

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Existing Specification

ERA Specification Clause 63A08 Demarcation of Working Area

(a) New Construction

The Contractor shall demarcate the area of the primed roadbase to be surfaced by means of setting out wire, or **string lines** down each edge of the proposed surfaced width. The control intervals for the setting out of horizontal curves shall be as agreed by the Engineer.

(b) Existing surfaces that are to be resurfaced

The centerline of the road or other **reference setting out line**, as agreed by the Engineer, shall be established immediately before the tack coat or bituminous binder is sprayed.

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Stringline could help

Longitudinal joints

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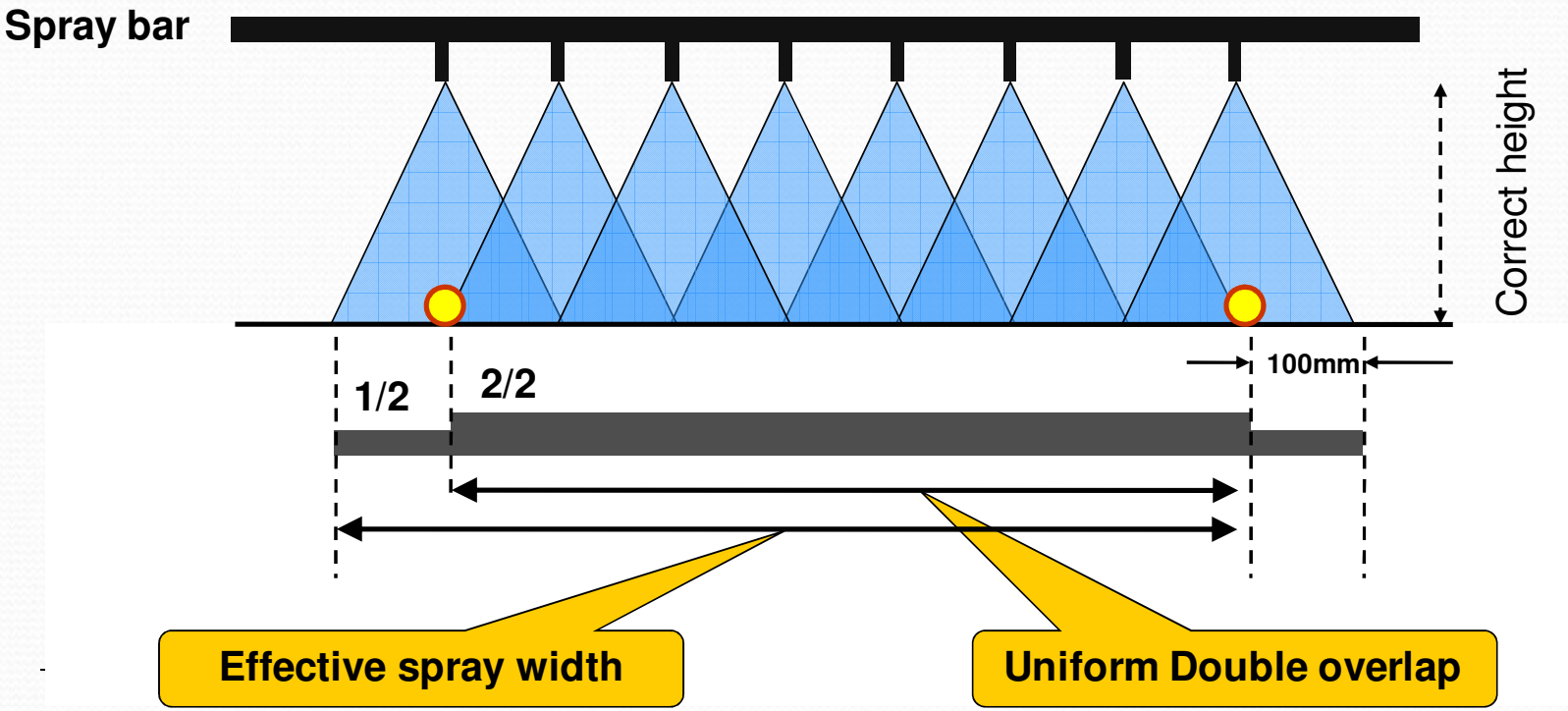
Guidelines – Stringline position



Longitudinal joints

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Stringline position

Half application

Full application

Longitudinal joints

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Existing Specification

ERA Specification 63A11 (c) Joints between binder sprays

"If in the opinion of the Engineer, the Contractor is unable to apply surfacing to the entire width specified in a single pass, the Contractor shall apply the surfacing in strips. ***Adjacent sprays shall overlap by 100mm.*** *Chippings shall not be placed on the 100mm overlap before the adjacent strip has been sprayed. The adjacent strip may not be sprayed before the preceding strip, excluding the 100mm overlap, has been covered satisfactorily with chippings in compliance with the specifications. As far as is practicable, the contractor shall so place the strips that the joint between two adjacent chipping applications shall fall on the centre line of the road".*

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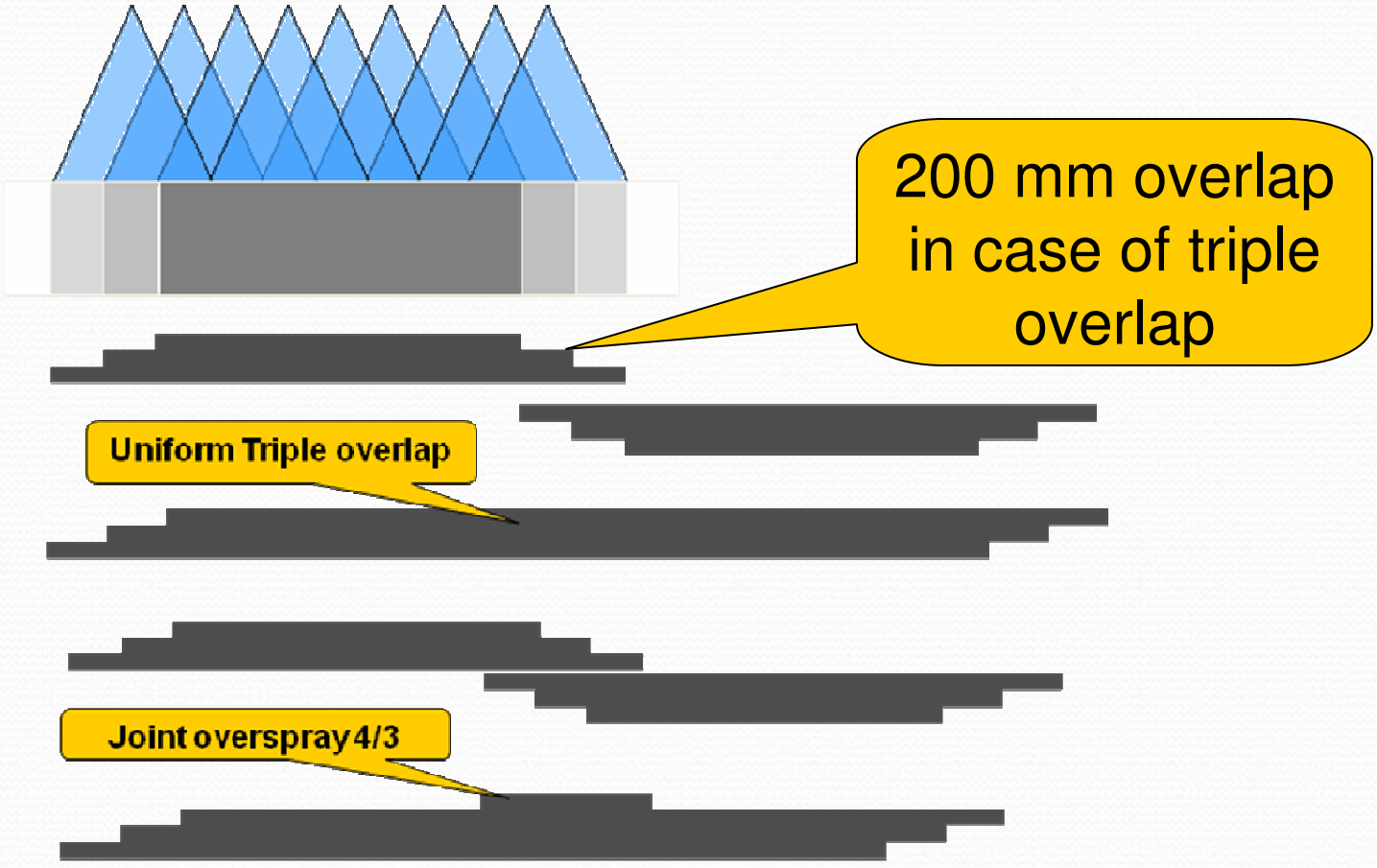
Longitudinal joint overlap



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Existing Specification-

Clause 63A11

"Chippings shall be applied by means of chip spreaders as described in Clause 63A03 (c).

Chip spreaders shall commence spreading the chippings as closely as possible behind the distributor. The chip spreader shall be operated in such a manner that the binder shall be covered with chippings and the ***wheels of the chip spreader or truck do not pass over the uncovered binder****……..*

Any areas deficient in chippings shall have additional material added to leave the carpet with a single layer of chippings lying shoulder to shoulder. It is essential to ensure that ***only one layer of chippings is applied*** *and every care shall be taken to avoid over-application of chippings".*

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Longitudinal Joints

- Damage caused
  - Chip spreader wheel running on bitumen

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Transverse Joints

Fattiness observed

Cause

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Existing Specification

ERA Specification Clause 63A11 (c)

"In order to prevent overlapping at transverse junctions of separate binder applications, the previous work along ***the joint shall be covered with twine-reinforced building paper*** *for a sufficient distance back from the joint to ensure that the spray bar of the bitumen distr required rate before the untreated sur to prevent additional binder applicatio treated section. The same method sha neat joint at the end of the run."*

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Existing Specification on over application of chippings-

Clause 63A11 –

"Chippings shall be applied by means of chip spreaders as described in Clause 63A03 (c).

Any areas deficient in chippings shall have additional material added to leave the carpet with a ***single layer of chippings lying shoulder to shoulder****. It is essential to ensure that* ***only one layer of chippings is applied*** *and every care shall be taken to avoid over-application of chippings".*

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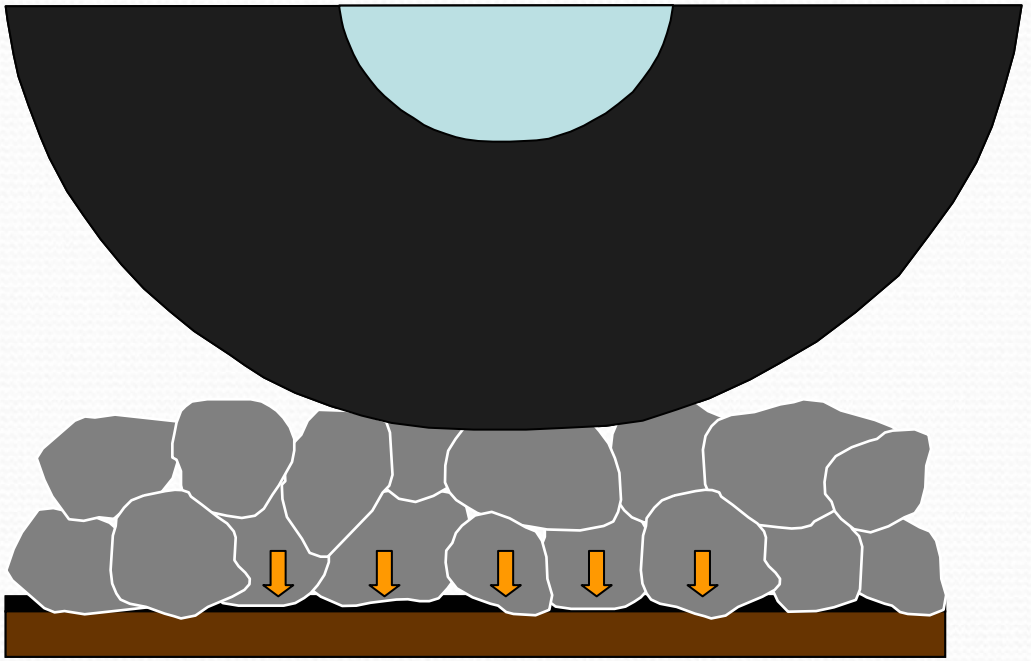
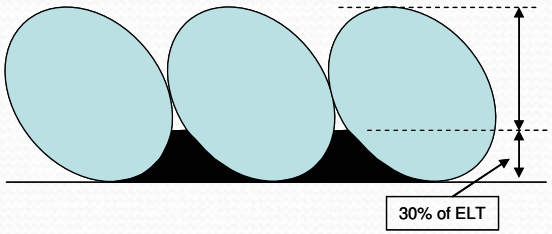
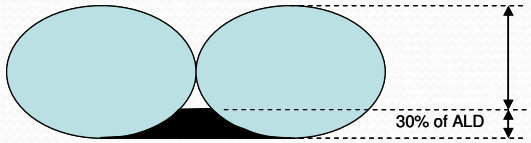
Over application of single sized aggregate



Flaky Aggregate "In Contact" – high spread rate



Flaky Aggregate on ALD "In Contact"



Impact

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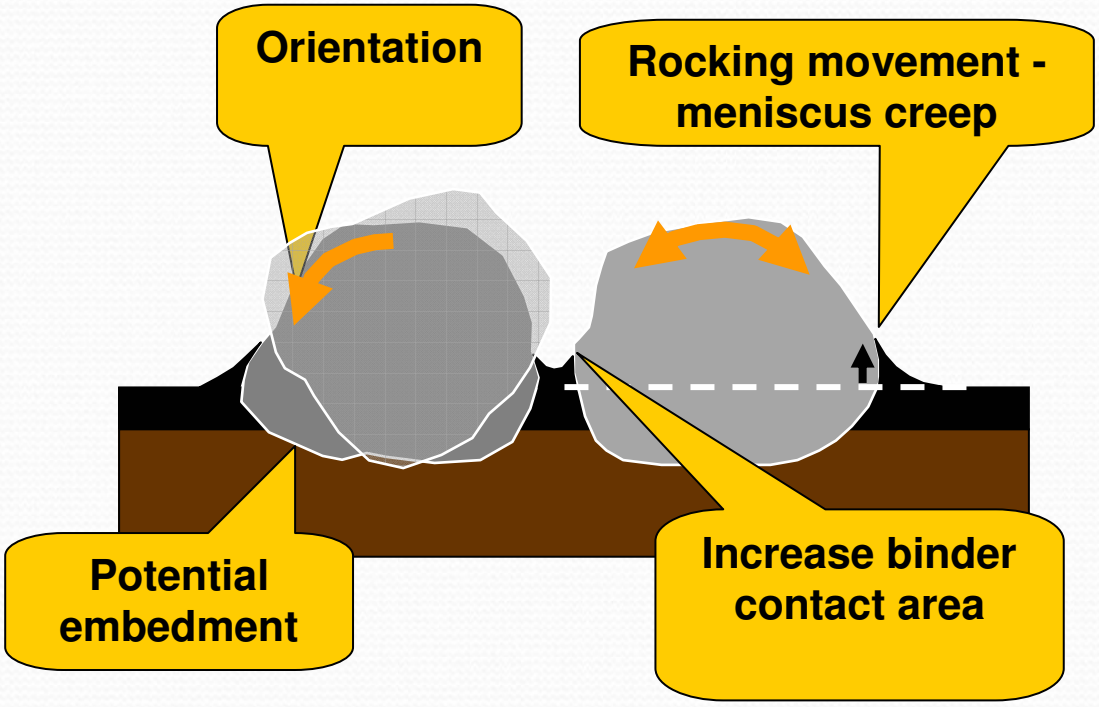
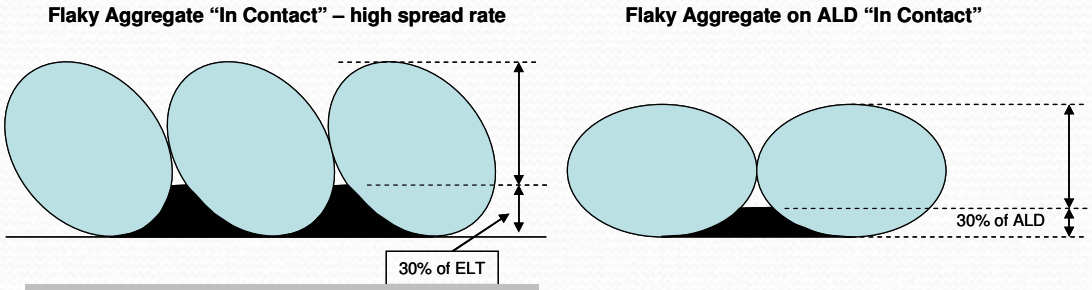
Rolling

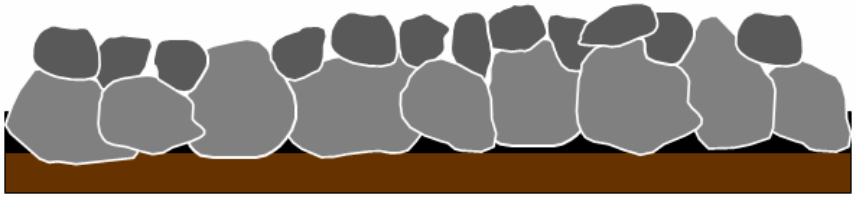




More binder required

Impact on 19/9 double seal

- Same binder application rate ?



- Too little binder
- Aggregate loss

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Important

- Local Ethiopian Contractor and consultant got it right (Ziway – Butajira)

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Conclusions

- Examples of good and poor performing surface dressings
- Concerns of ERA and local practitioners confirmed
- Designs, Manuals and Specifications could be improved but –
- Main cause of poor performance
  - Construction related issues
  - Non-adherence to existing specifications
- Priority solution
  - Training to designers, contractors and supervisors

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Study recommendations

- Optimise efforts to improve performance
  - Practical training – workmanship , QA
  - Design and specification course
  - Incorporate trials in contracts and monitor
- Guidelines documentation
  - Best practice construction and SD maintenance
  - Surface dressing/ treatment selection
- Develop Technology Transfer framework
  - Courses/ Training from external to Local
- Review and update Specifications and Design guidelines
- Audit on performance improvement

THE END