AEMA
ASPHALT EMULSION MANUFACTURERS ASSOCIATION
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Comparative Analysis of Emulsion and Hot Asphalt Cement Chip Seal Performance

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Project Facts

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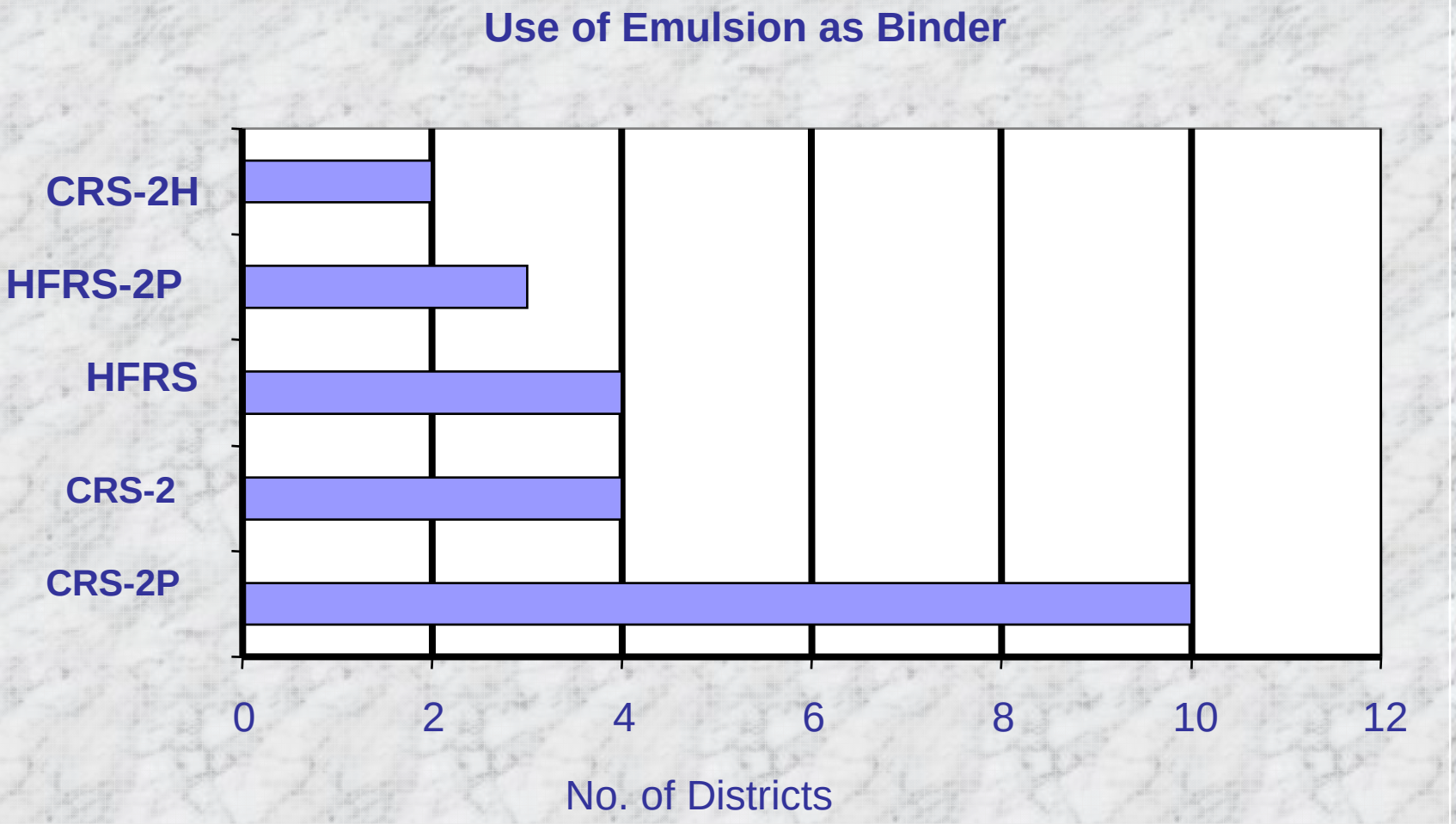
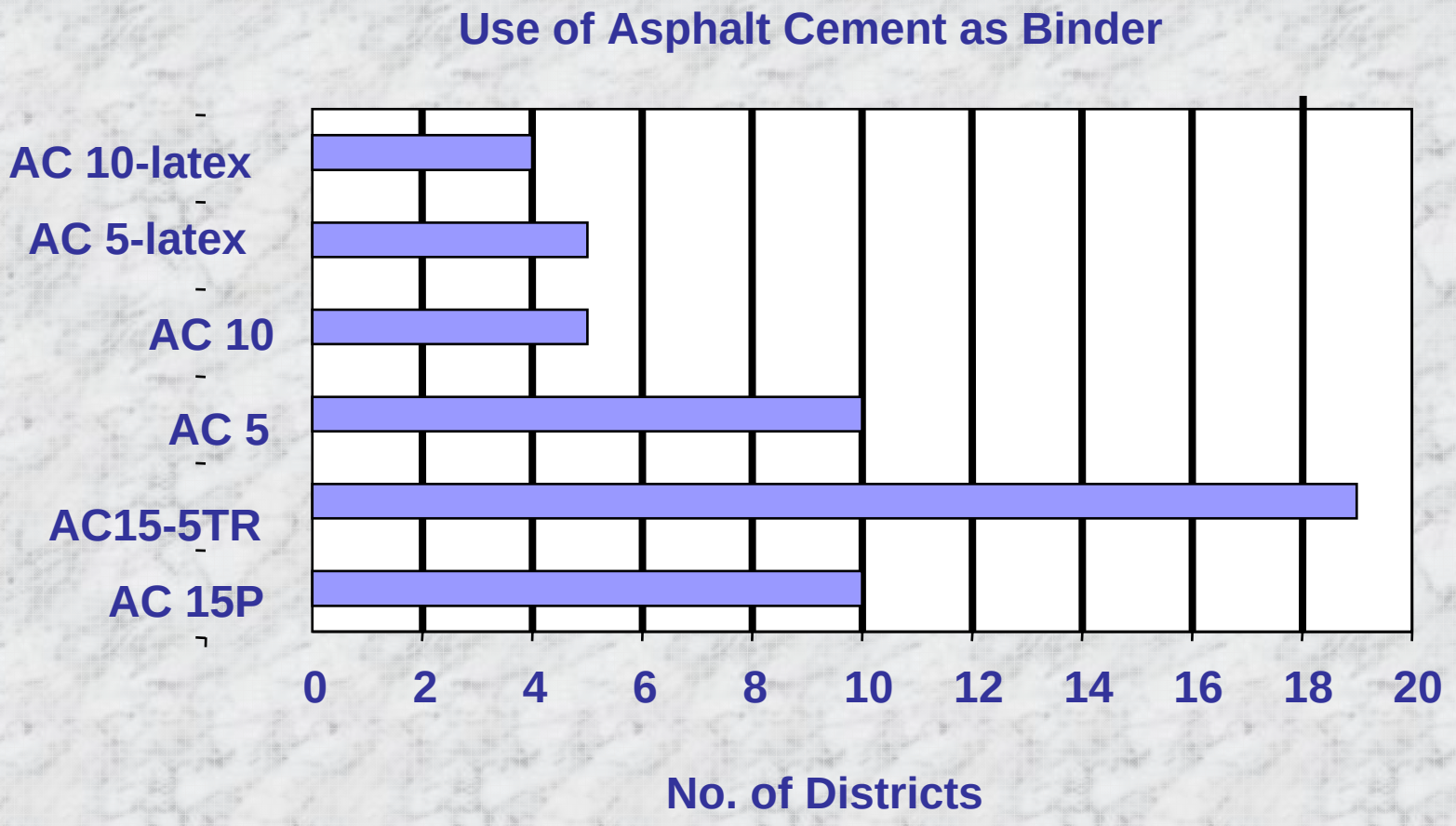
- **TxDOT Atlanta District**
  - 342 projects
  - All built since 1996
  - Same seal coat contractor
  - Same TxDOT Area Office did design/ construction administration
  - Same aggregate
  - Same asphalt supplier
  - 165 used CRS-2P no precoat
  - 177 used AC15-5TR with precoat

Emulsion Binder Usage in Texas



Hot AC Binder Usage in Texas



Chip Seal Strategies

- Two schools of thought in Texas
  - Seal as many miles of road as budget will permit: use less expensive system
  - Make every sealed mile as good as possible: use system with best performance.
- Perception is that AC15-5TR yields a better performance.
- Atlanta District policy to use AC15-5TR on higher volume roads and CRS-2P on lower volume roads.

Project Data Points

- Type of binder
- Type of aggregate
- Specifications for emulsion and asphalt cement
- Average rate shot in the main lanes
- Specifications for aggregate
- Year of installation
- Contract requirements
- Contract amount
- Amount of material used
- Location of project
- Length in feet and miles
- Area of main lanes shot
- Area of intersections & miscellaneous locations shot
- Average daily traffic
- Visible pavement distresses

PMIS Database Data Points

- Type of underlying pavement
- % deep and shallow rutting
- Patching percent
- % Base failure
- % Block cracking
- % Alligator cracking
- % Longitudinal cracking
- % Transverse cracking
- % Raveling (Shelling)
- % Flushing
- Average 18 kip wheel loads
- Average annual maintenance cost
- Date of last surface
- Distress score
- Ride score
- Surface index
- Skid number
- Pavement condition score

Flushing (Bleeding)

Shelling (Raveling)

Satisfactory Pavement

Project Performance Metrics

- 27 Discreet Metrics
  - Average High Flushing Score,
  - Average Low Flushing Score, and
  - Project Average Flushing Score,
  - Average Cost of Binder,
  - Average Cost of Aggregate,
  - Average Number of Square Yards on Main Lane, Etc.
- Weighted Average Metrics
  - Square yard weighted average of the pavement condition score
  - Square yard weighted average of the skid number

Project Performance Metrics

- Cost Index Number Metrics
  - Measure “bang for the buck.”
  - Combines engineering property with cost property.
- Pavement Condition Cost Index
  - Compare binders ability to maintain pavement condition at an acceptable price
- Skid Number Cost Index
  - Compare binders ability to maintain friction course at an acceptable price

Pavement Condition Cost Index

$$PCCI_i = \frac{Tc_i}{Ave\ PC_i} \qquad PCCI_B = \frac{\sum PCCI_i}{TP_B}$$

$PCCI_i$ = Pavement Condition Cost Index of Project "i"

$Ave\ PC_i$ = Average Pavement Condition Score of Project "i"

TC_i = Total Cost of Project "i"

$PCCI_B$ = Pavement Condition Cost Index Binder "B"

TP_B = Total number of projects using Binder "B"

Skid Number Cost Index

$$SNCI_i = \frac{TC_i}{Ave\ SN_i} \qquad SNCI_B = \frac{\sum SNCI_i}{TP_B}$$

$SNCI_i$ = Skid Number Cost Index of Project "i"

$Ave\ SN_i$ = Average Skid Number Score of Project "i"

TC_i = Total Cost of Project "i"

$SNCI_B$ = Skid Number Cost Index Binder "B"

TP_B = Total number of projects using Binder "B"

Underlying Pavement Condition in Study Area

Binder	Ave DIS	Ave RD	Ave Rut SH	Ave Rut DP	Ave Rut Sum	Ave Pat
CRS-2P	95.85	3.57	6.09	1.23	6.66	0.94
AC15-5TR	99.48	3.53	4.80	0.65	4.83	1.81

Emulsions used on roads with more rutting and lower distress scores.

Raveling (Shelling) and Flushing (Bleeding) in Study Area

Binder	Ave RAV hi	Ave RAV lo	Ave RAV	Ave FL hi	Ave FL lo	Ave FL
CRS-2P	0.24	0.00	0.12	1.05	0.18	0.61
AC15-5TR	0.14	0.00	0.07	0.88	0.13	0.51

Rated as: none =0; low = 1; medium = 2; high = 4

Shows both binders are effective & Atlanta District is getting good performance from their seals.

Pavement Condition Analysis

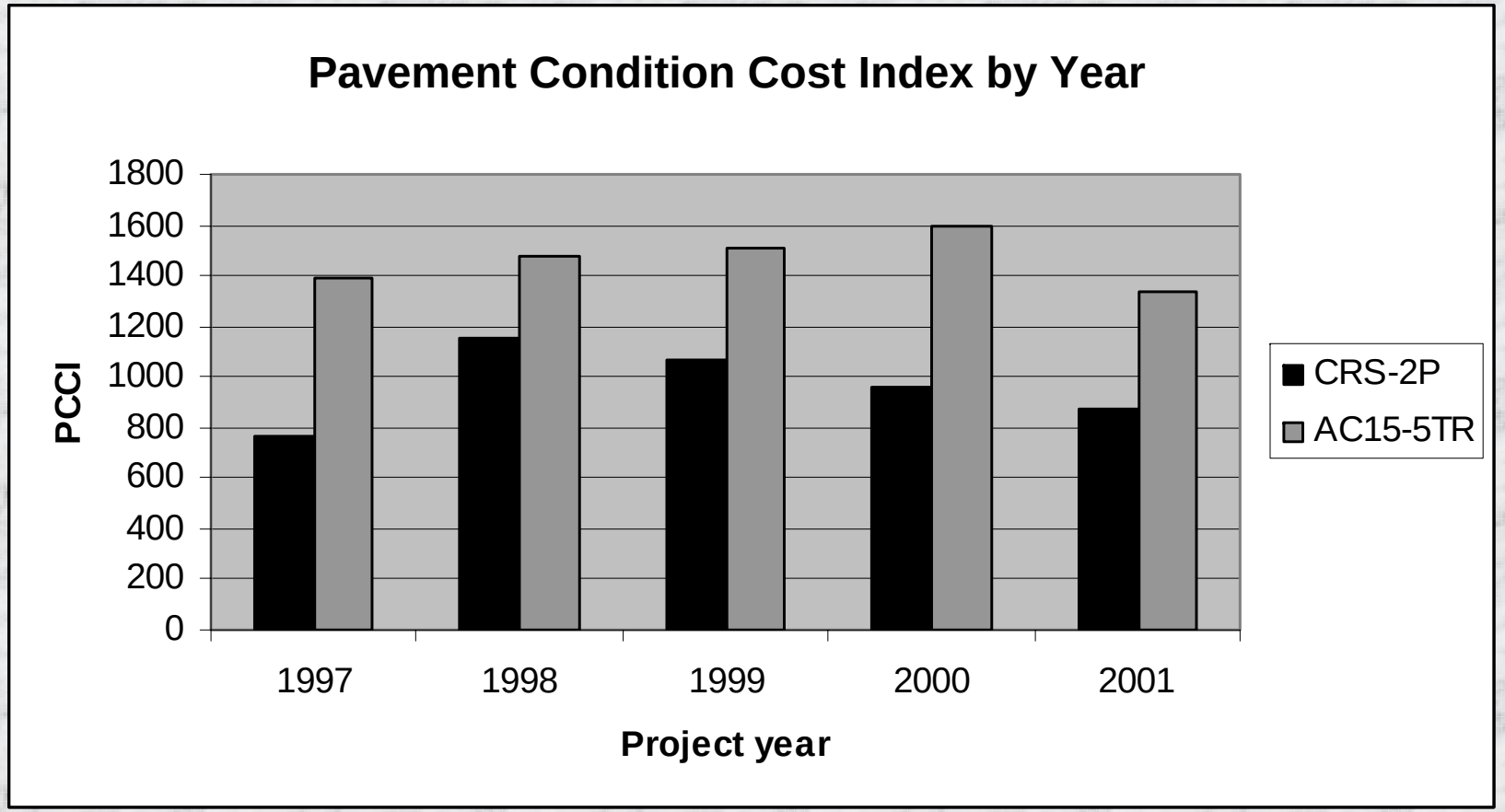
Pavement Condition Comparison

PCCI = $/Ave Unit of PC

Binder	Ave Hi PC	Ave Lo PC	Ave PC	Wt PC mi	Wt PC sy	PCCI
CRS-2P	98	76	87	86	86	949
AC15-5TR	98	78	88	86	88	1,281

- CRS-2P & AC15-5TR roughly equal performance
- CRS-2P more cost effective

Pavement Condition Cost Index Comparison by Project Year



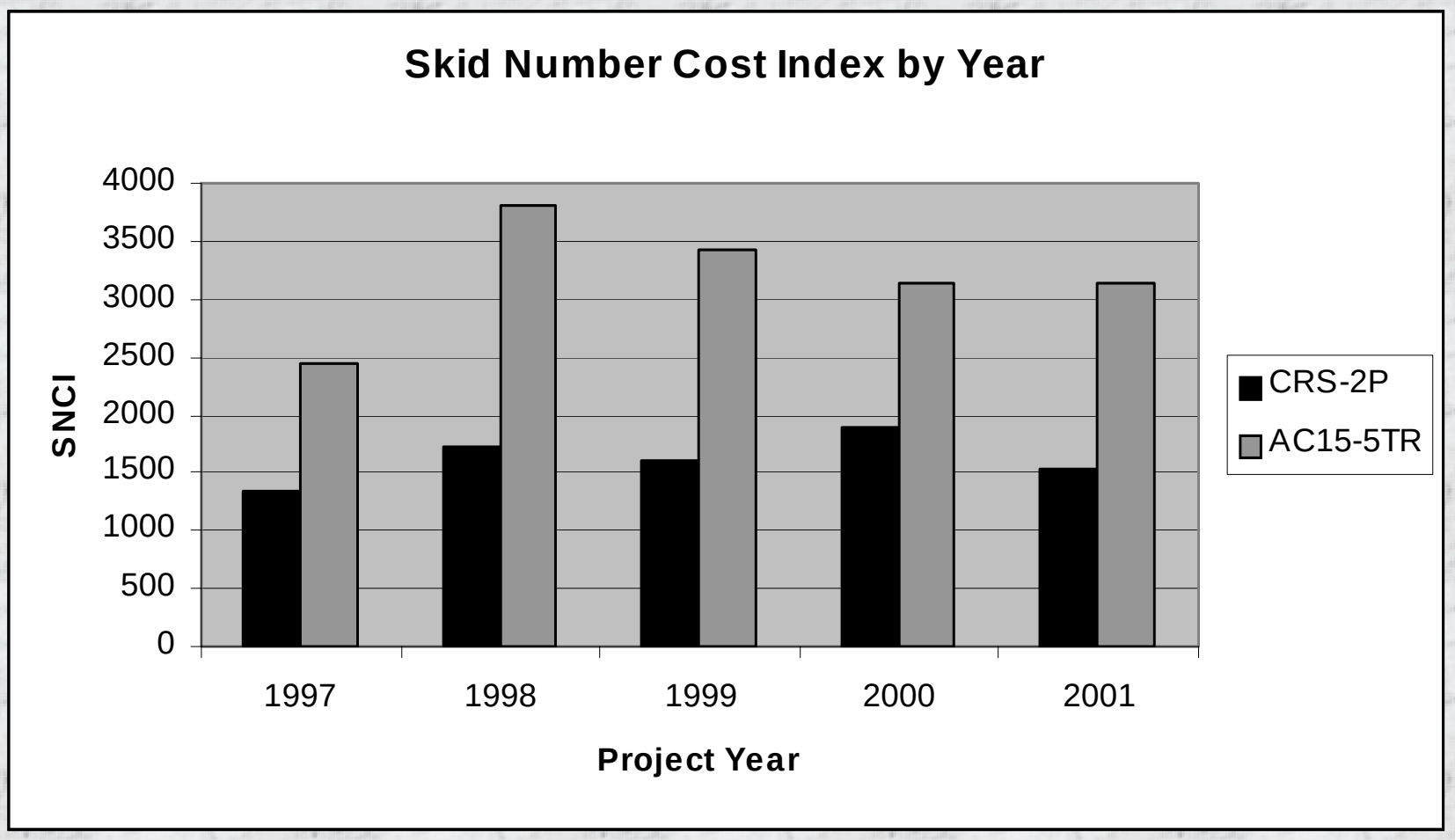
Skid Number Analysis

Skid Number Comparison
SNCI = $/Ave Unit of SN

Binder	Ave Hi SN	Ave Lo SN	Ave SN	Wt SN mi	Wt SN sy	SNCI
CRS-2P	63	44	54	54	54	1640
AC15-5TR	60	34	47	47	45	2607

- CRS-2P better skid performance
- CRS-2P more cost effective

Skid Number Cost Index Comparison by Project Year



Conclusions

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- Emulsion chip seals performed as well as the hot AC seals even though they were applied to roads with poorer underlying condition.
- Emulsion chip seals are more cost effective.