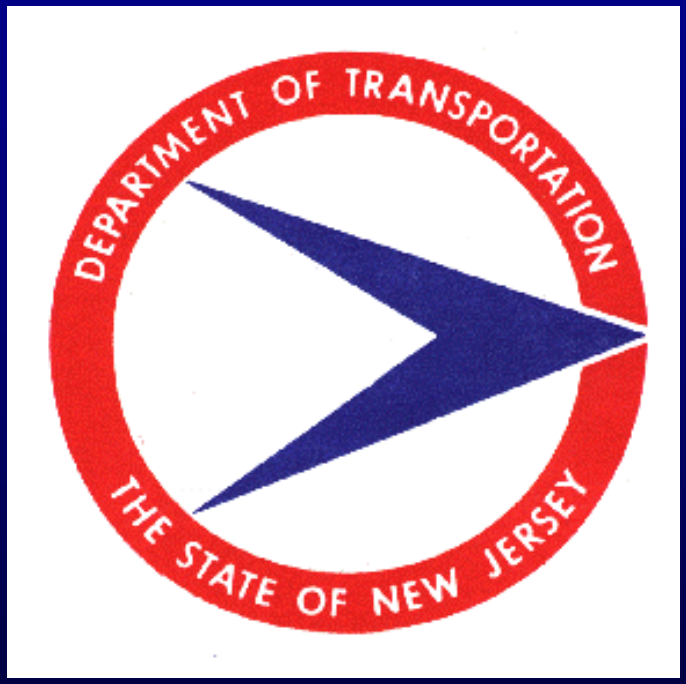
Thin Overlays



By

Robert W. Sauber
Supervising Engineer

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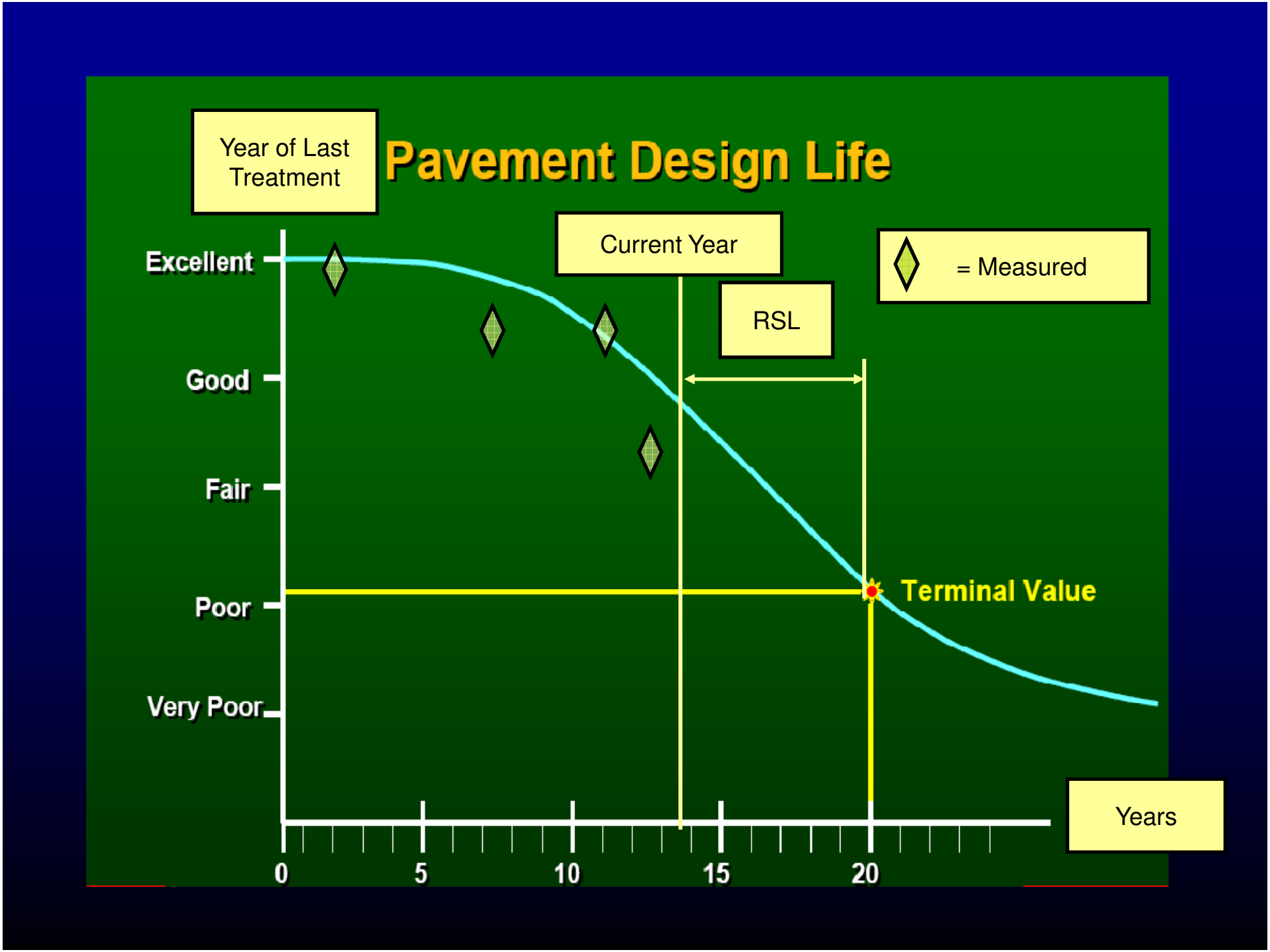
PAVEMENT PRESERVATION

NJDOT

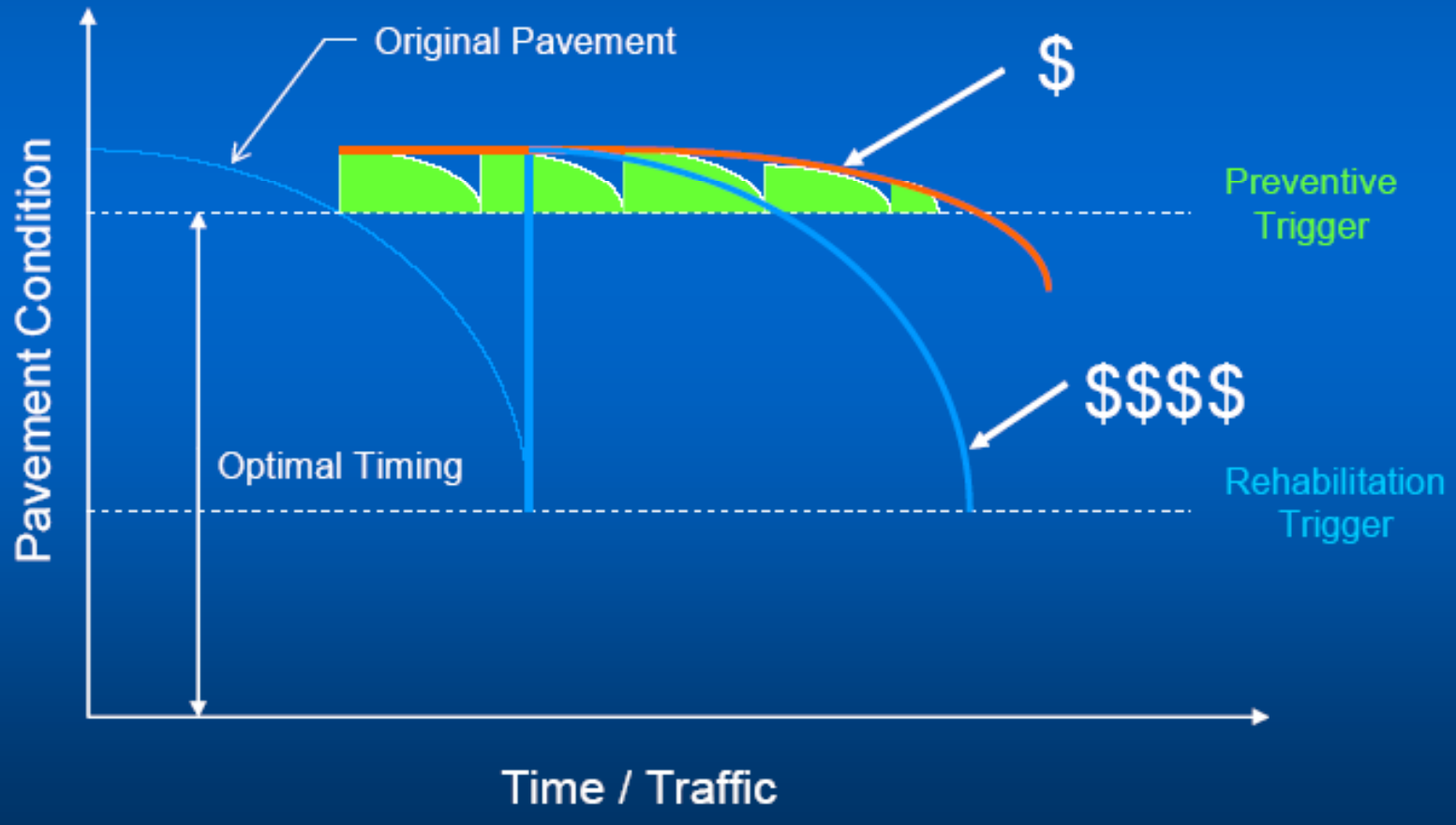
- **Increasing need to repair and maintain rapidly deteriorating infrastructure leads to:**
  - **More work zones**
  - **More public dissatisfaction with work zone traffic congestion, delay and safety**
  - **Facing the challenge of balancing essential roadway repairs and maintenance with mobility and safety concerns**
  - **Non-traditional construction methods to balance essential roadway repairs and maintenance with mobility and safety**

Presentation Outline

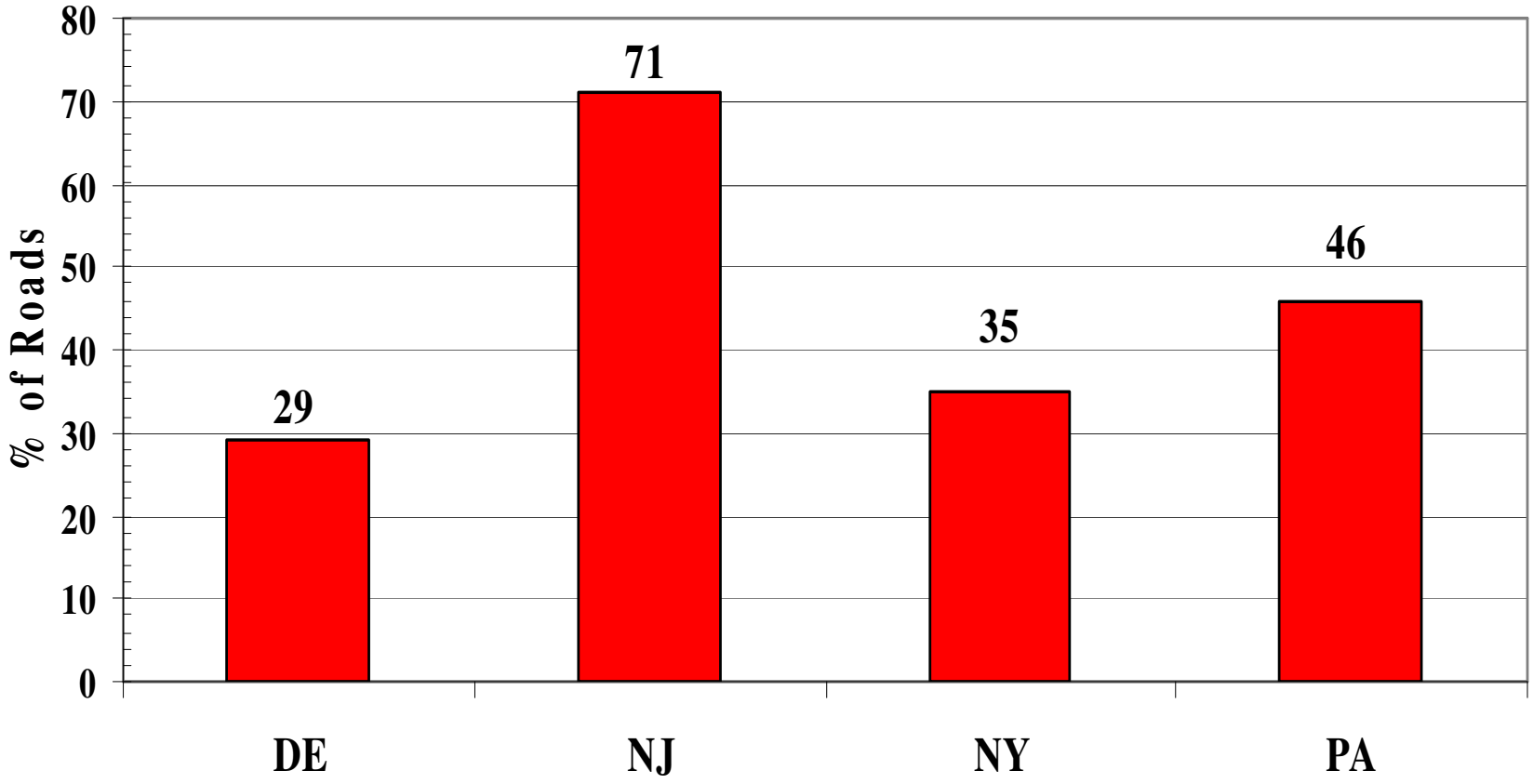
- Focus shift from pavement rehabilitation to pavement preservation
- Public may wonder why we are fixing good pavements, outreach needed
- Types of thin HMA surfacings
  - Dense-graded systems (HPTO)
  - Open-graded systems (OGFC & AR-OGFC)
  - Gap-graded systems (SMA & SMAR)
  - Ultra-thin systems (Novachip)


Year of Last Treatment
Pavement Design Life
Current Year
= Measured
RSL
Excellent
Good
Fair
Poor
Very Poor
Terminal Value
0
5
10
15
20
Years

Concept of Pavement Preservation (P^2)



ASCE's % of Major Roads in Poor or Mediocre Condition



Source: ASCE, 2005 Report Card for America's Infrastructre

Background

- Several treatments are available for pavement preservation including:
  - Cold surface seals
  - Thin HMA overlays
- Purpose of PP treatments include:
  - Extending pavement life
  - Improving ride quality
  - Correcting surface defects
  - Improving safety characteristics

Background *(cont.)*

- **Overlays for pavement preservation**
  - **Thin < 1.5 inch**
    - **HPTO, OGFC, 9.5 SMA, 9.5 HMA**
  - **Ultra thin < 1 inch**
    - **Microsurfacing, Novachip, Chip Seal**

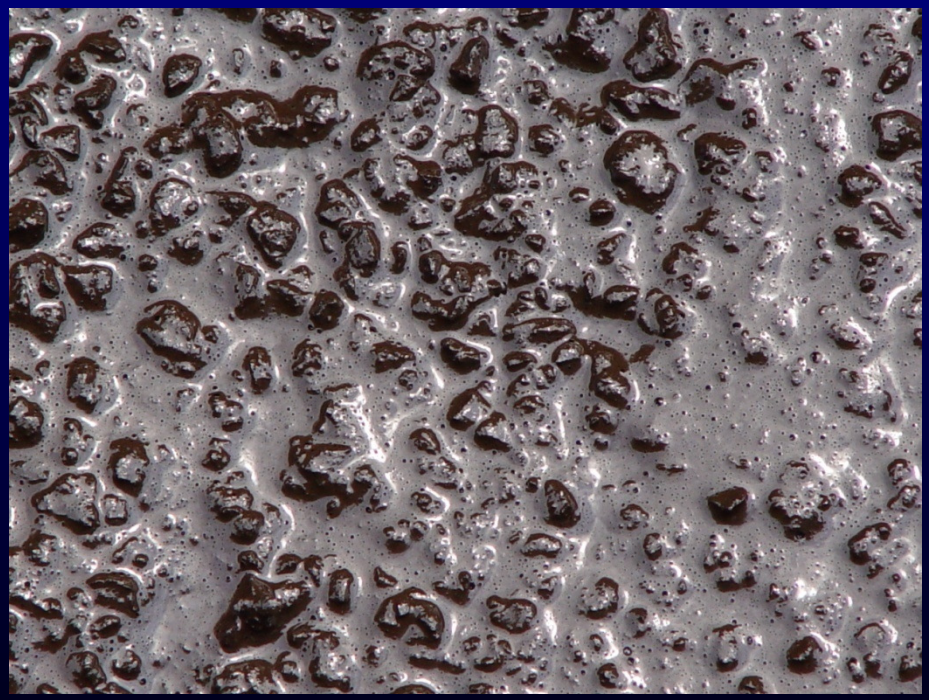
Purpose

- Describe the various thin lift maintenance treatments
- Discuss the materials used, mix design techniques, construction practices, performance history and cost factors for each treatment

Types of Thin HMA Surfacings

- Dense-graded mixes
  - Continuously graded, Superpave
  - High Performance Thin Overlay (HPTO)
- Open-graded mixes
  - 15-22% voids, fibers and polymer or crumb rubber
  - Used to reduce splash and spray, improve high speed friction and reduce tire noise
- Gap-graded systems
  - SMA and SMAR mixes (9.5mm & 12.5mm)
  - Ultra-Thin systems (Novachip)

Microsurfacing Route 29 (Preventive Maintenance)



Microsurfacing

- Also used as an interlayer, can eliminate the need for milling
- Also used to fill raveling longitudinal joints, ruts and/or rumble strips
- Cold mix of asphalt emulsion, latex, cement and aggregate
- Cures by chemical reaction called breaking, requires warmer weather
- Compaction and tack coat optional

Considerations for Each System

- General
- Materials and mix design
- Construction
- Performance
- Cost

Dense-Graded Systems

- **Thin HMA - General**
  - **Used throughout USA for maintenance and/or rehabilitation**
  - **Mixes can be continuously graded or screening mixtures**
  - **Often used as a compromise between surface treatments and structural HMA**

Dense-Graded Systems *(cont.)*

- **Thin HMA - material/mix design considerations**
  - **Quality aggregates**
  - **Generally use a softer asphalt binder**
  - **Mix design procedures similar to structural mixes**
- **Construction considerations**
  - **Weak areas must be removed and replaced**
  - **Thin layers cool more quickly; hence, must have sufficient rollers to achieve compaction**
  - **Layer thickness/aggregate size > 2.5 mm**
  - **Vibratory rollers may cause damage to overlay**

Dense-Graded Systems *(cont.)*

- **Thin HMA - Performance information**
  - **Expected life 5-10 years**
  - **Varies with traffic, existing pavement condition, environmental conditions and quality of materials and workmanship**
- **Cost information $/sy/inch**
  - **High quality mixes 3 – 5**
  - **Lower quality mixes 1.5 – 2.5**

Open-Graded Systems

- **OGFC - General**
  - Used widely in USA for improved wet weather properties and to reduce noise
  - Also referred to as open-graded friction courses or porous pavement
- **Materials/mix design considerations**
  - Use high quality aggregates
  - Use modified binders – polymers, cellulose or crumb rubber (wet process)
  - Mix design procedures consider film thickness, drain down and voids

Open-Graded Systems *(cont.)*

- **OGFC - Construction considerations**
  - **Mix temperatures must be controlled to minimize drain down**
  - **Paving accomplished with conventional equipment**
  - **Placement is easy but hand work difficult**
  - **Seating performed with steel wheeled rollers**
  - **Importance of tack coat, residual asphalt**
  - **No coring for air voids**

Open-Graded Systems *(cont.)*

- **Performance information**
  - **Pavement life similar to dense mixes when modified binder is used**
  - **Polymer/fiber and CRM mixes used in NJ have performed extremely well**
  - **Clogging of voids can reduce the splash and spray benefits**
  - **Winter maintenance more difficult**

MOGFC-2 Route I-195

Gap-Graded Systems

- SMA - General
  - Used in parts of USA as
    - Coarse matrix – high binder mixes
    - SMAR mixes
  - SMA mix concept imported from Europe
- Materials/mix design considerations
  - High quality aggregates
  - Modified binders
  - Superpave procedure used to design mixes

Gap-Graded Systems *(cont.)*

- Construction considerations
  - Manufactured using conventional equipment
  - Productivity can be impacted because of higher fines content used
  - Aggregate quality and gradation - very important - this may effect cost
  - Drain down can also be a problem as in open-graded mixes
  - Hand work and compaction can be difficult

Gap-Graded Systems *(cont.)*

- **SMA - Performance information**
  - **Good overall to date**
  - **Major issue is fat spots caused by segregation and/or drainage**
- **Cost information (% higher than conventional dense mixes)**
  - **CMHB 5-10%**
  - **AR 25-50%**
  - **SMA 23-70%**

Ultra-Thin Systems

- Special thin mix - General
  - Requires special equipment to mix or place
  - May require licenses to apply
  - Novachip® is an example
- Novachip® is a gap-graded HMA placed on a heavy application of a polymer modified membrane

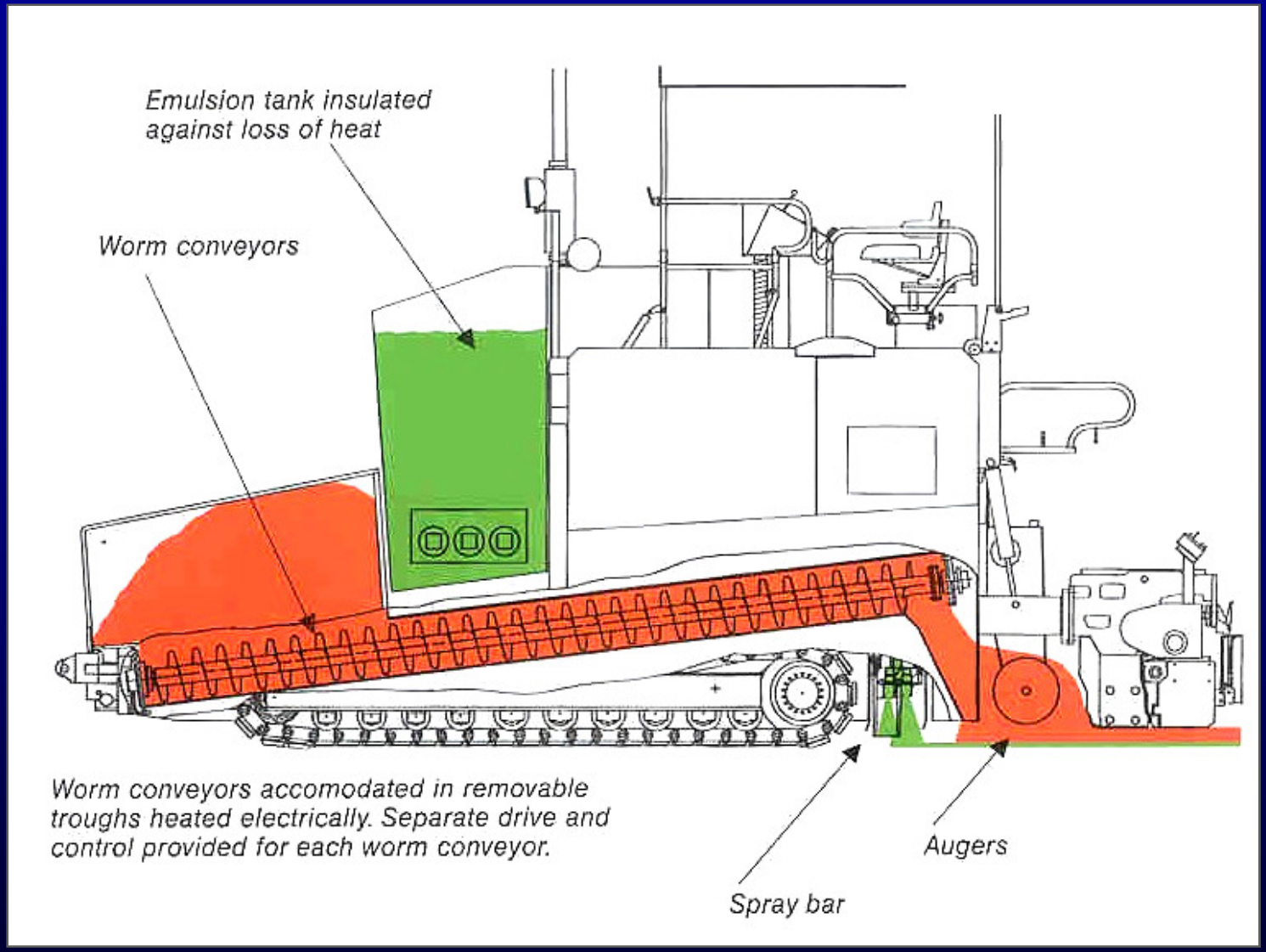
NOVACHIP

ULTRA-THIN FRICTION COURSE

Gap-Graded Systems *(cont.)*

NOVACHIP Macro-Texture

The Self-Priming Paver



The Self-Priming Paver

NOVACHIP Ultra-thin Friction Course

Gradation	Depth Min	Yield range *
¼ in. (A)	3/8 in.	45 to 65 lbs/sy
3/8 in. (B)	5/8 in.	55 to 75 lbs/sy
½ in. (C)	¾ in.	65 to 85 lbs/sy

* If proper profile

Ultra-Thin Systems *(cont.)*

- **Special thin mix - Materials/mix design considerations**
  - **Very high quality aggregate; top size can be 4.75, 6.3, 9.5 mm**
  - **Modified binders – polymers**
  - **No standard mix design procedure**
  - **Performance tests conducted using wheel tracking equipment**
  - **Mixes typically placed ¾” to 1” thick**

Ultra-Thin Systems *(cont.)*

- **Novachip - Construction considerations**
  - Requires special paver with an integrated spray bar and emulsion tank, higher maintenance
  - Conventional batch or drum plants can be used to produce the HMA
  - Can be opened to traffic quickly
- **Performance information**
  - First project placed in 1992
  - Over 20,000,000 sy placed since, primarily in Southeast
  - Expected life is 10 years
  - Reduces spray and increases friction
  - Seals the pavement surface

Ultra-Thin Systems (con't)

- Cost information
  - Highly variable to date
  - Typically 50% greater than dense-graded HMA
  - Novachip patent expires summer 2010, cost should go down but more QA will be necessary

Summary

- Thin dense-graded mixes are widely used, primarily for pavement preservation
- Thin open-graded mixes are widely used, primarily for improving wet weather driving conditions and to reduce noise
- Gap-graded mixes containing modified binders have been used by several agencies since the late 1980s
- Ultra-thin systems such as Novachip® are being used