2012 Western States Regional In-Place Recycling Conference

Radisson Ontario Airport Hotel

September 11-13, 2012

Steven Escobar & Bob Staugaard

Asphalt Pavement & Recycling Technologies, Inc.

2012 Western States Regional In-Place Recycling Conference

- **In-Place Recycling –Key Aspects for Mix Designs:**

  1. **Cold-In-Place Recycling**
  2. **Hot-In-Place Recycling**
  3. **Full-Depth-Recycling**


25ft
STANLEY
ft
in

2012 Western States Regional In-Place Recycling Conference

1. **Cores are sawed to proper depth of recycle.**
2. **Visual Inspection during sawing, crushing and sieving of cores can detect any potential problems in the mix.**


GILSON
COMPANY, INC.
www.globalgilson.com
00.444.1508 / 740.548.7298
TIMER MODES:
A-MMSS B-HHMM C-SSSS D-MMMM
A
B
C
D
GILSON
COMPANY, INC
800.444.1508
www.globalgilson.com
GILSON
COMPANY, INC.
GILSON TEST-MASTER®
SERIAL NO.
MODEL NO
TM-
COVERED BY ONE OR MORE U.S. PATENT NOS.
2,358,453
2,959,285
3,098,037
3,071,969
3,367,498
3,410,408
3,439,800
3,481,468
3,744,631
OTHER PAT. PENDING

CIR Mix Design-Suggested Targets for Cold Recycling Gradation, % P

Sieve Size	Medium	Coarse
1”	100	100
3/4”	95 ± 2	85 ± 2
# 4	50 ± 2	40 ± 2
# 30	10 ± 2	5 ± 2
#200	0.8 ± 0.3	0.3 ± 0.3


Gyratory Compactor
PINE Instrument Company
EMERGENCY STOP
TEST
START
UP
RAM
DOWN
CAUTION
Pinch point hazard. Keep hands clear.
PINE Instrument Company


Circulators


CORNING

CIR Mix Design

- **Mix Design Parameters:**
  - **Marshall Original Stability – 1250 lbs.**
  - **Marshall Retained Stability – 70.0% minimum. (60% min. if Wet Stability > 1500 lbs.**

- Ratio of Emulsion Residue to Cement – 3.0 minimum.
- Raveling Test – 7.0% target value.
- Coating test for ERA - Good

CIR Mix Design

- **Other Considerations:**
  - ❖ **Just in time training (JITT)**
  - ❖ **Emulsified Recycling Agent (ERA)**

    Asphalt binder used to make ERA must meet bending beam requirements of AASHTO M320. Verifying low temperature requirements where the RAC is placed.

2012 Western States Regional In-Place Recycling Conference

- **Hot-In-Place Recycling**


Marlec
Marlec

HIR Mix Designs-Key Aspects

1. Determine the AC content & recovered binder properties (PG, viscosity, or pen) from RAP.
2. Determine gradation on recovered aggregate.
3. Use blending chart & selected recycling agent (ASTM D4552/D4552M) to obtain appropriate consistency for the climatic conditions of job.

HIR Mix Designs-Key Aspects

4. Prepare blends with recovered binder & RA to target (blend chart) ± 25w% (RA). Determine consistency.
5. Prepare mixes with RAP & RA to above targets. If gradation needs adjustments or additional mix is required for thickness, incorporate all components. Use temperatures normally obtained in the field for mixing and compacting.
6. Determine stability and air voids.

2012 Western States Regional In-Place Recycling Conference

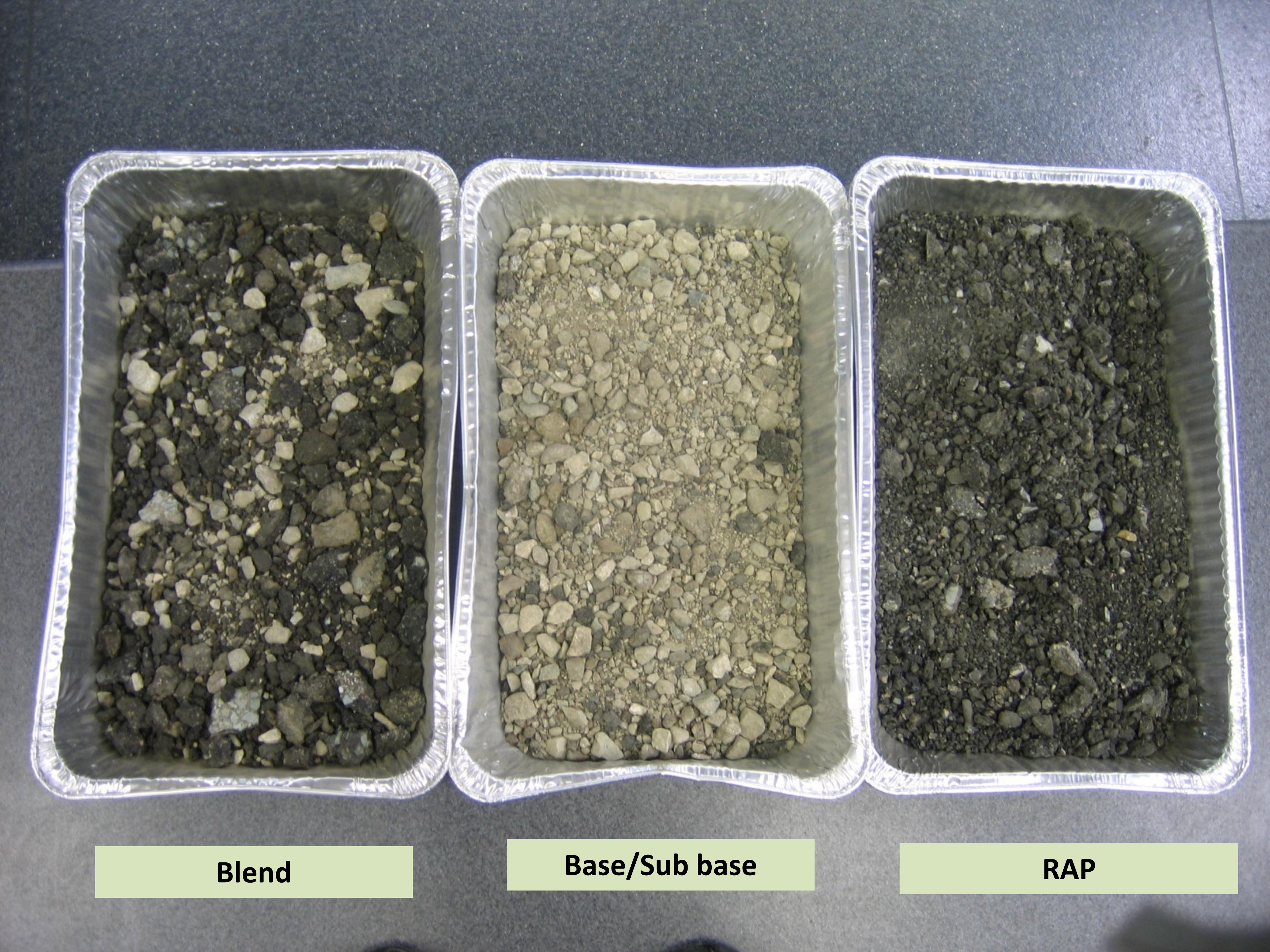
Full-Depth-Reclamation

1. **FDR-Asphalt Emulsion**
2. **FDR-Portland Cement**
3. **FDR-Lime Stabilization**
4. **FDR-Fly Ash**
5. **FDR-Cold Foam**


CAT
AL3P63
AL3P63

FDR-Emulsion-Mix Design

- **Similar to CIR but usually thicker depths:**
- **3-15”.**
- **3-4 components: RAP, Base/Sub base & blend of components.**


Blend
Base/Sub base
RAP

FDR Emulsion-Mix Design

- **Requirements separated by the fines content (p #200 sieve): < or ≥ 8%.**
- **Optimum Water Content key test: Amount of water to add depend on annual rainfall, < or > 20 inches & Sand Equivalent, > or < 30.**
- **Indirect Tensile Strength (ASTM D4867) - dry & conditioned.**

FDR-Emulsion-Mix Design

- Resilient Modulus may be too sophisticated for this use. ASTM D4123 –Discontinued. Limited labs. to run ASTM D7369 which causes time delay in getting design done.
- Suggest using Marshall Stability for correlation with CIR values.
- Thermal Cracking (IDT)-AASHTO T322. Should be used in climatic zones < -20ºC.

FDR-Emulsion-Mix Design

- **Emulsion content range = 3.5-5.5w%.**
- **Major effort is getting uniformity of all components for mix design. Variation in sample location very common.**

FDR-Cement Mix Design

- **FDR-Cement:**
- **Compressive Strength-7 days @ 95% Humidity.**
- **Wet/Dry Strengths for durability.**
- **Wide variations among specifications on amount of cement, compressive strength targets.**

FDR-Mix Designs

- **No *uniformity* among FDR Mix Designs.**
- **Need to simplify testing procedures to have more practical approach.**
- **The strength of an any FDR is mass or volume of layer being placed.**

2012 Western States Regional In-Place Recycling Conference

- **Thank you!**

- **Questions?**