New Hope-Lambertville Toll Bridge

Pavement Rehabilitation Using
Cold In-Place Foamed Asphalt Recycling

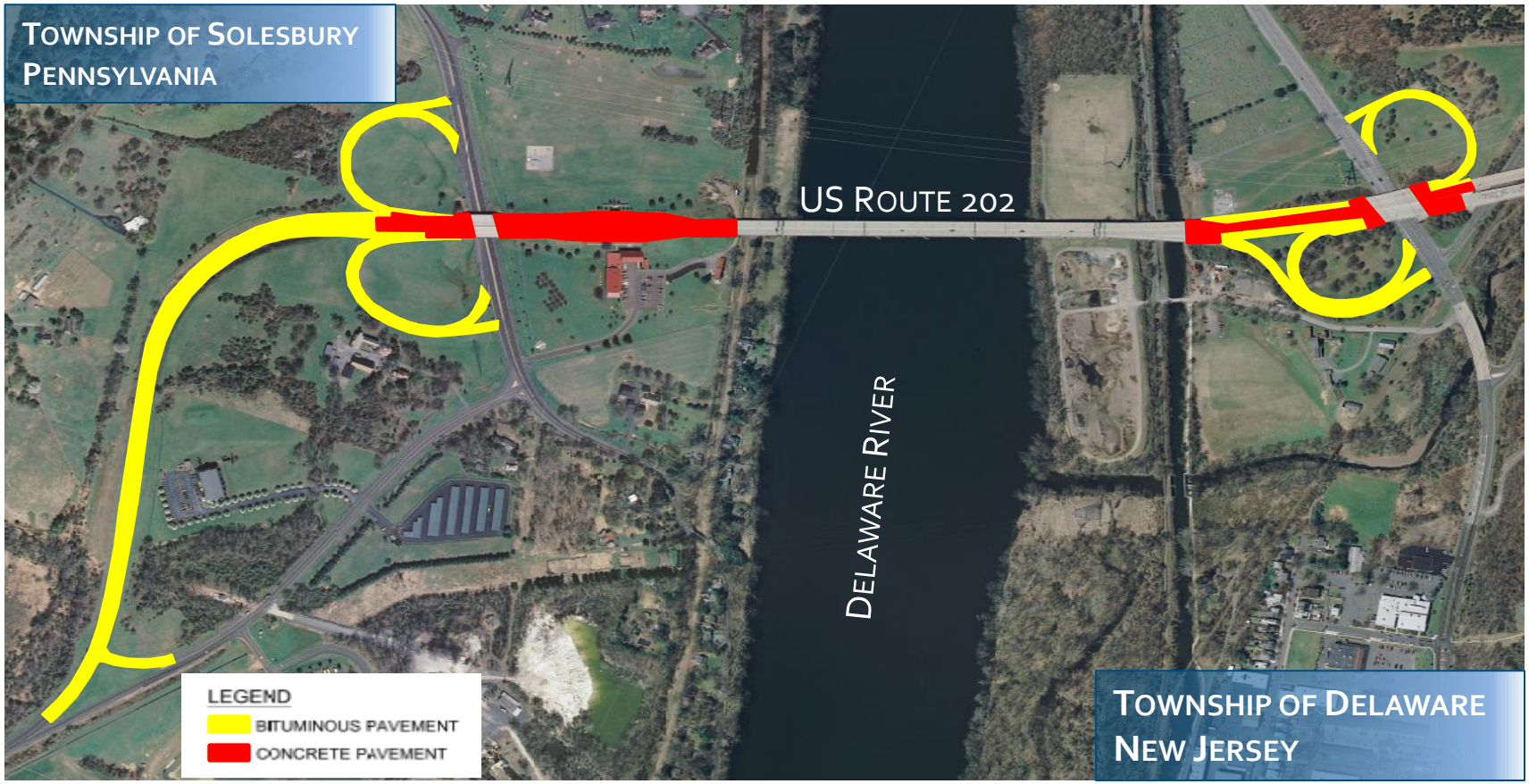
Presented By:

Gregory D. Bitsko, P.E., P.P.

Delaware River Joint Toll Bridge Commission

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

New Hope-Lambertville Toll Bridge Facility



- Route 202 Mainline- 2800 lf
- 5 Ramps- 1000 +/- lf Each
- Misc. Shoulder Areas
- ADT – 18,000 ~
  - Truck = 6.1 %

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

HMA DATA

- 33,000 Square Yards
- US Route 202 Travel Lanes- 7″-11″
- US Route 202 Shoulders- 3″-6″
- PA Ramps- 3″-6″
- NJ Ramps- 3.5″-5″

HMA DEFECTS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

DRJTBC DESIGN GOALS

- 15-Year Design Life
- Preferred No Change In Road Elevations
- Minimize Traffic Disruption

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

DESIGN ISSUES

- Pavement failure on 202 mainline
- Deterioration & substandard hma Thickness on PA ramps (3"-6" existing vs 7" required)
- Substandard hma thickness on NJ Ramps (3.5"-5" existing vs 7" required)
- Selected approach: full depth reconstruction but evaluate alternative of full depth recycling

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

WHY CONSIDER RECYCLING?

- PRIOR PILOT PROJECT IN MONMOUTH COUNTY (OAK GLEN RD., HOWELL TWP.)

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

WHY CONSIDER RECYCLING?

VIRGINIA DOT I-81

- COLD-IN-PLACE RECYCLE WITH SUBBASE STABILIZATION
- DEPTH 5 INCHES
- FOAMED ASPHALT
- LOW IMPACT TRAFFIC CONTROL

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

WHY CONSIDER RECYCLING?

VIRGINIA DOT I-81

Original Design- Conventional Reconstruction

- Duration 24 months
- Cost Estimate $42 M

Recycling Option

- Duration 4 months
- Cost $ 7.6 M

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

WHY CONSIDER FOAMED ASPHALT

- Uses AC (PG 64-22) – Not emulsion so less water is introduced
- "Curing" time reduced from several days (up to a week) down to next day or even hours (Caltrans 2-4 hrs). Allows expedited wearing course construction and/or reopening to traffic.
- Route 202 wearing course placed next day.

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

"CURING"

HIGHWAY 20, STATE OF CALIFORNIA

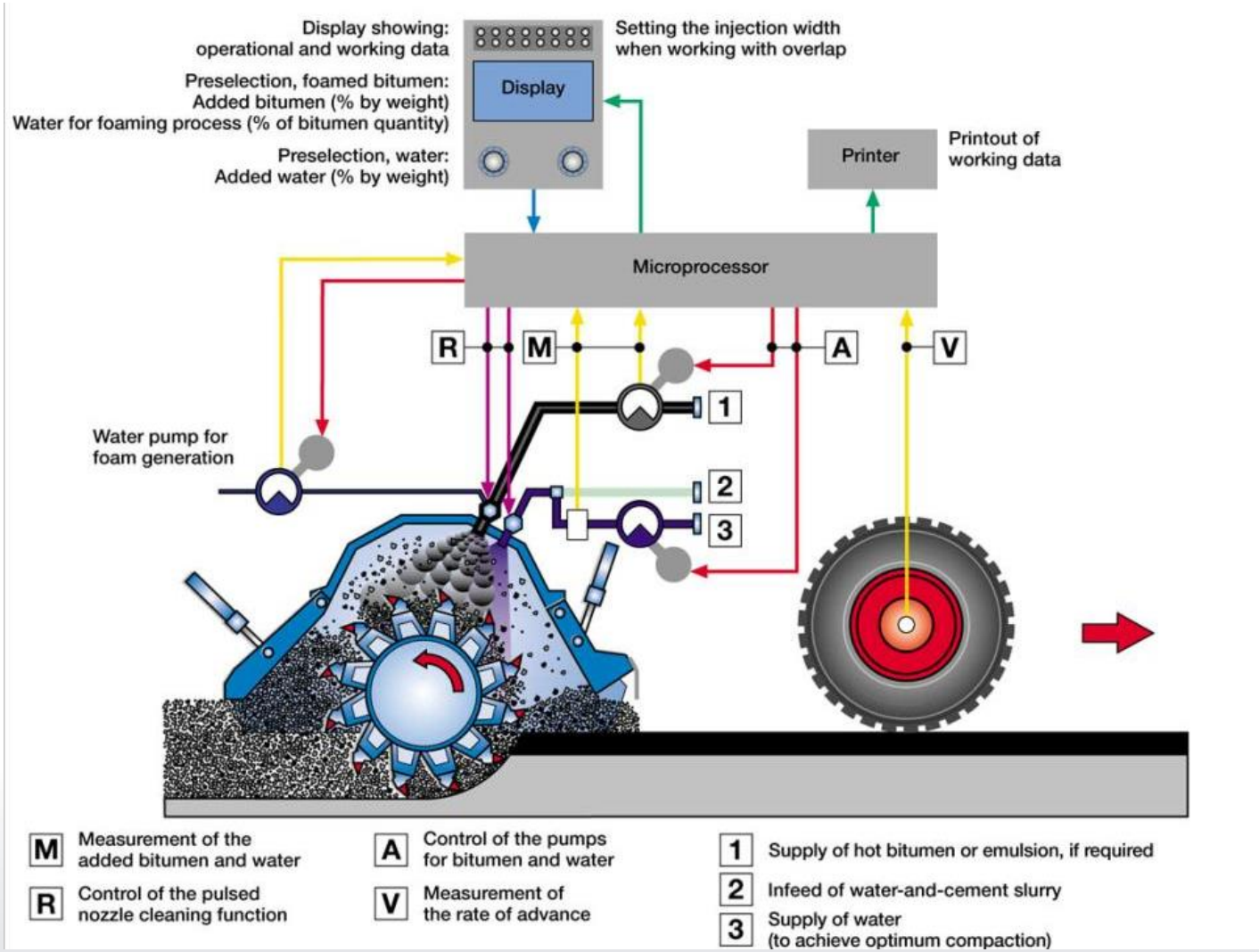
20 LANE MILES RECONSTRUCTED & REPAVED IN 20 DAYS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

RECYCLING TRAIN

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

RECYCLER SCHEMATIC



Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

EXPECTED ADVANTAGES

- COST ?
- TIME: 8' WIDE PASS AT 8"-10" DEEP:
  ≈ 30LF OF ROADWAY PER MINUTE.
- REDUCED CONSTRUCTION TRUCK TRAFFIC
  - 255 TRIPS(FOAMED) VERSUS 1,430 TRIPS(CONVENTIONAL)
    REDUCTION OF 1,175 TRIPS (80% REDUCTION)
- NO BARRIER CURB REQUIRED

PAVEMENT DESIGNS

- Bid Conventional Construction and Foamed Asphalt as exclusive alternatives

- Conventional pavement sections (All Superpave):

<u>US Route 202 Mainline & Shoulders</u>	5" Base Course 2.5" Binder Course 2" Wearing Course
<u>All Ramps</u>	5" Base Course 2" Wearing Course

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PAVEMENT DESIGN

Foamed Asphalt Pavement Sections

US Route 202 Mainline & Shoulders

- 8" Foamed Asphalt Stabilized Base Course, 2.2% PG 64-22 & 1.5% Cement (by weight)
- 2" Superpave HMA Wearing Course

All Ramps

- 6" Foamed Asphalt Stabilized Base Course, 2.2% PG 64-22 & 1.5% Cement (by weight)
- 2" Superpave HMA Wearing Course

PAVEMENT DESIGN

Foamed Asphalt Pavement Construction

All Locations

- 2" Mill
- 2" Superpave HMA Wearing Course

US Route 202 Mainline

- Initial 10" Deep Pulverization & Compaction Pass
- Final 8" Deep Foamed Asphalt Pass

US Route 202 Shoulders

- Initial 8" Deep Pulverization & Compaction Pass
- Final 8" Deep Foamed Asphalt Pass

All Ramps

- Initial 6" Deep Pulverization & Compaction Pass
- Final 6" Deep Foamed Asphalt Pass

CONSTRUCTION DURATION

- 5 DAY CLOSURES (M-F) ON RAMPS
- 12 DAY CLOSURE ON 202 SB
- 202 NB MAINTAINED AT ALL TIMES
- ALLOWED 1 NJ AND 1 PA RAMP CLOSURE CONCURRENTLY BUT NOT REQUIRED
- MAX TRAFFIC DETOUR 35 WD (37 CD)

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

BID RESULTS

FOAMED ASPHALT	CONVENTIONAL
Bid 1 - $1,112,198	Bid - $2,788,360
Bid 2 - $1,280,095	
Bid 3 - $1,519,139	
Bid 4 - $1,751,326	

- DIFFERENCE BETWEEN FOAMED ASPHALT LOW BID & CONVENTIONAL = $1,676,162 (60% REDUCTION)

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

SUMMARY OF ADVANTAGES

- COST $1,112,198 VS $2,780,360,
  SAVINGS OF $1,676,162 OR 60 %

- COMPLETED 33,000 SQUARE YARDS IN 25 WORKING DAYS

- TRUCK REDUCTION: 270 TRUCKS* VS 1,430 TRUCKS
  RESULTING IN A REDUCTION OF 1,160 TRUCKS = 80% REDUCTION

  *SLIGHT INCREASE FROM ESTIMATED DUE TO EXCESS MATERIAL

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

CONSTRUCTION OPERATIONS

- Day1: Milling

- Day 2: Caterpillar pulverizer
  - 20T sheepsfoot roller
  - Grader
  - Smooth Drum Roller

- Day 3: Portland Cement truck spreader
  - Foamed Asphalt train
  - 20T sheepsfoot roller
  - Grader
  - Smooth drum roller
  - Rubber tire roller

- Day 4: Overlay

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

PROGRESS PHOTOS

ISSUES/CHALLENGES/LESSONS LEARNED
DESIGN PROCESS

- HOW DO YOU DESIGN FOAMED ASPHALT PAVEMENT SECTION?
  - NOT HMA AND HAS NOT YET BEEN ADDRESSED IN CURRENT MECHANISTIC/EMPIRICAL PROCESS (AASHTO WARE PAVEMENT ME). NEED TO USE 1993 AASHTO EMPIRICAL METHOD.

- NEED MIX DESIGN. NO DOT GUIDANCE. USED WIRTGEN TECHNICAL MANUAL

- NEED SAMPLES TO DEVELOP MIX DESIGN .
  - CORES AND BAG SAMPLES ALTERNATIVES
  - BEFORE OR AFTER BID?

SOLUTION

- Cherry, Weber & Associates specifies minimum number of hot mix designs (3), procedure to develop mix design (Wirtgen Process), Range of AC/Cement.
- Contractor obtains samples & prepares mix designs for review and approval (includes recommended compaction)
- Cherry, Weber & Associates uses mix designs & finalizes pavement design
- For bidding, used conservative estimates of AC (3% weight) and cement (2% weight). Non pay adjusted items. Also assumed 10" pulverization.

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

EXPANSION ISSUES

- Foamed asphalt expands, Not HMA
- Extent not really determinable as based on constituent materials
- Wirtgen tech rep recommended 3" mill with variable thickness overlay
- Concern about loss of material for mix, held 2" mill

RESULT

- HAD TO REMOVE ABOUT 10-15 TANDEMS OF MATERIAL AFTER PULVERIZING

- NEXT TIME:
  - NO MILL
  - PULVERIZE ENTIRE THICKNESS (PRESERVES HMA)
  - GRADE AND REMOVE EXCESS

- HOW- TRADITIONAL LOADER, CONVEYER SYSTEM VERY EFFECTIVE

CONSTRUCTION CONTROL

- FOAMED ASPHALT IS EQUIVALENT OF FULL DEPTH RECONSTRUCTION PROJECTS. NEED SAME SURVEY CONTROL DURING GRADING

- NOT!! A MILLING PROJECT

WEATHER LIMITATIONS

- NO OPERATIONS BELOW 50°F OR IF TEMPERATURES PREDICTED TO FALL BELOW 40°F WITHIN 24 HOURS.
- WATCH MOISTURE CONTENT OF MATERIAL

COMPACTION, COMPACTION, COMPACTION

- KEY TO SUCCESS
- NUCLEAR DENSITY GAUGES WERE OUR FRIENDS
- FOR RT 202 INITIAL COMPACTION ON 10" DEEP SECTION, 137 PCF, 95 %, MP
- FOR FOAMED ASPHALT LAYERS, VARIED COMPACTION REQUIREMENTS
  - MAINLINE 131 PCF, 98% MP
  - PA RAMPS 136 PCF, 98% MP
  - NJ RAMPS 137 PCF., 98% MP

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

OPENING TO TRAFFIC

CALTRANS RT 80 SAME DAY OPENING

Recycled Shoulder

Original Pavement

Recycled No 1 & 2 Lanes Fog Seal Only

Recycled Shoulder

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

MISCELLANEOUS ISSUES

- VARIABLE EXISTING HMA LAYERS NOT A PROBLEM
- WORKED AROUND INLETS
- WIDTH RESTRICTIONS
  - 8' DRUM BUT 10' WORKING WIDTH DUE TO GEAR BOX. LEFT SIDE IS FLUSH
  - POSSIBLE CONFLICT WITH GUIDERAIL BUT CAN RUN COUNTER TO TRAFFIC
- WEARING COURSE THICKNESS FOR FUTURE MILL

FINAL THOUGHTS

- NOT A NEW PROCESS. TRACK RECORD IS OUT THERE.
- DESIGNED SYSTEM THAT OFFERS FLEXIBILITY
- REMEMBER THAT THE RECYCLER IS THE EQUIVALENT OF A HOT MIX PLANT
- SHOULD SPECIFY RANGE OF ASPHALT CEMENT AND PORTLAND CEMENT FOR MIX DESIGNS. ALSO LEANING TOWARDS 1% PORTLAND.
- DEFINITELY USE FOG COAT/SAND IF YOU WANT TO RUN ON FA PRIOR TO PAVING
- CAN REPEAT PROCESS AT ANY TIME

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP

QUESTIONS ??

Cherry, Weber & Associates
MEMBER OF THE VAN CLEEF ENGINEERING GROUP