ACPA SE-NCDOT 2023 Concrete Pavement Conference

Roller-Compacted Concrete Pavements Introduction & Panel Session

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SESSION OUTLINE

- Introduction to RCC Pavements
- Q&A / Panel Discussion

RCC VS. CONVENTIONAL CONCRETE MIXES

- **Aggregates**
  - Coarse and fine
- **Cement**
  - Performance/Prescriptive
- **SCMs**
  - Fly ash
  - Slag
  - Pozzolans
  - Silica fume
- **Mixing Water**
- **Chemical Admixtures**
  - Retarders
  - Water reducers
  - Superplasticizers

RCC CONSISTENCY

Continuous Pugmill Mixers

- Minimum 2 acres for small sized projects and 3-4 acres for large sized projects
- Two-inch water line with good pressure
- Power supply: 480V, 3 phase, 400 amps

RCC MIXING

RCC MIXING

RCC MIXING

RCC MIXING

RCC MIXING AND TRANSPORTING

TRANSPORTING AND PLACING

RCC PLACEMENT

RCC PLACEMENT

RCC PLACEMENT

RCC PLACING AND COMPACTION

CURING

JOINTS

- Joint nominal spacing
  - For t ≥ 7”: 15 ft. ±
  - For t < 7”: 2 to 2.5 in feet times t in inches
- Depth of cut as needed to activate full depth crack, typically about ¼ the slab thickness
- Seal vs. no seal
- Joint sealing vs. joint filling

WHY CHOSE RCC?

Benefits

- Cost savings
- Fast construction
- Early opening to traffic
- Low maintenance
- High load carrying capacity
- Sustainability attributes
  - Durability
  - About 10% reduction in cementitious content vs. PCC

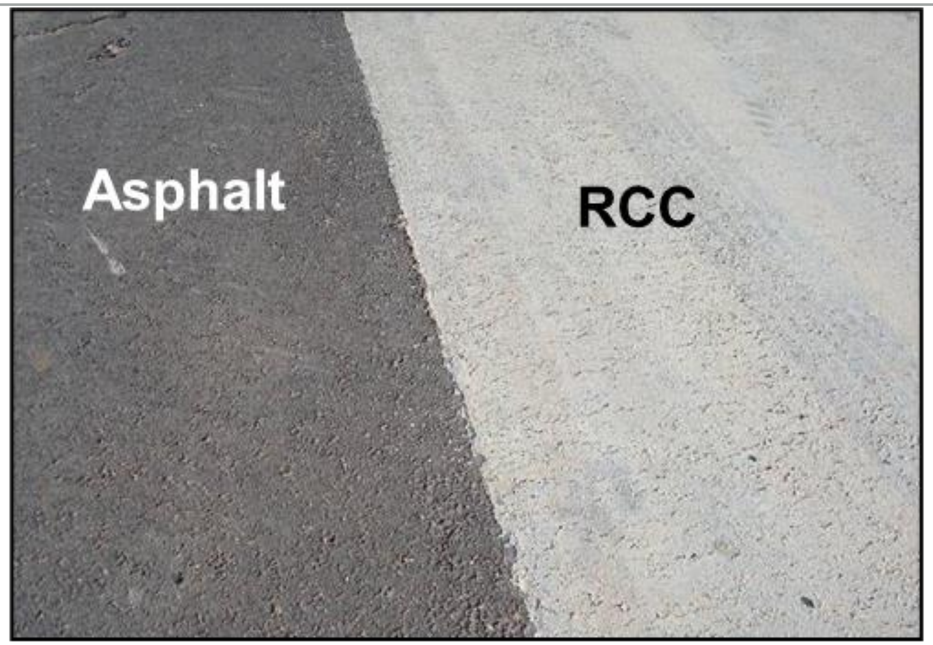
Why not consider RCC for pavements?

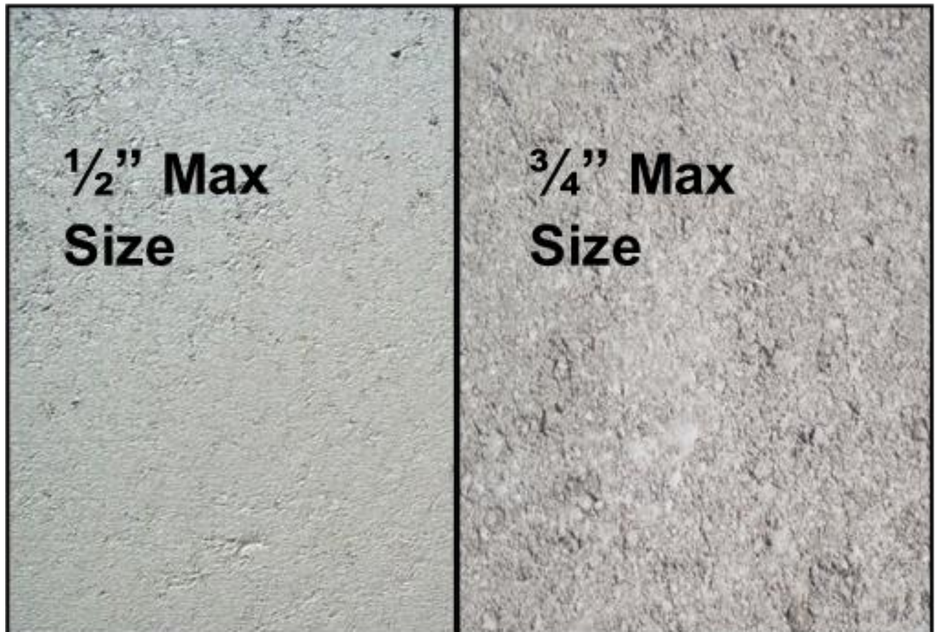
LIMITATIONS

Project Considerations

- Size to absorb mobilization cost (> 7k CY preferred)
- Geometric shape/obstacles
- Cosmetics (surface appearance)
- Ride smoothness for high speed
- Thickness in one lift
  - 4” minimum
  - 10” ± maximum

LIMITATIONS – SURFACE APPEARANCE





TROWELED RCC

- Proprietary finishing aid added at the surface
- Allow troweling and broom finishing
- Closer look to PCC at time of construction

Example Projects

- Roads and parking lots at manufacturing facilities
- Streets and roads
- Highway shoulders
- Port facilities
- Intermodal yards
- Distribution centers

EXAMPLE PROJECTS-AUTOMOTIVE MANUFACTURING PLANTS

BMW Automotive Plant, Greer, SC

- Completed in 2009
- 230k SY
- 6” & 8” RCC on 6” soil-cement

POWER GENERATION PLANTS

Plant Vogtle, Waynesboro, GA

- Completed in 2012
- 78 acres RCC
- 4”, 6”, 7”, 10” and 18” RCC on soil-cement

Highway 78, Aiken, SC

- Completed in 2009
- 4 lanes, 2 miles
- 10” RCC on subgrade
- Diamond ground for high-speed smoothness

INDUSTRIAL HAUL ROADS

Duke Energy, Plant Mayo, Roxboro, NC

- Completed in 2014
- 3± miles haul road and maintenance building parking lot

INDUSTRIAL MANUFACTURING FACILITIES

Bridgestone Tire Plant, Trenton, SC

- Completed in 2014
- 40k SY, 7” and 10”

RESIDENTIAL SUBDIVISION STREETS

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I-85 Shoulders, Atlanta, GA

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Ocean Terminal, Savannah, GA

- Constructed in 2012
- 79K SY RCC
- Saved 19% on initial cost as compared to HMA
- 33% higher structural capacity

PORTS

Colonel's Island Terminal, Brunswick, GA

- Under Construction
- 3rd RCC pavement project at the port
- 420k SY 12" and 10"
- New pavement and HMA replacement area

INTERMODAL

SC Inland Port, Greer, SC

- Completed in 2014
- 182k SY of 9.5” and 13” RCC
- Access route is also 9.5” RCC

DISTRIBUTION CENTERS

Walmart DC, Mebane, NC

- Built in 2015-2016
- 84k SY of 10.5” RCC
- 17k SY 6” RCC
- 5k reinforced concrete dolly pads

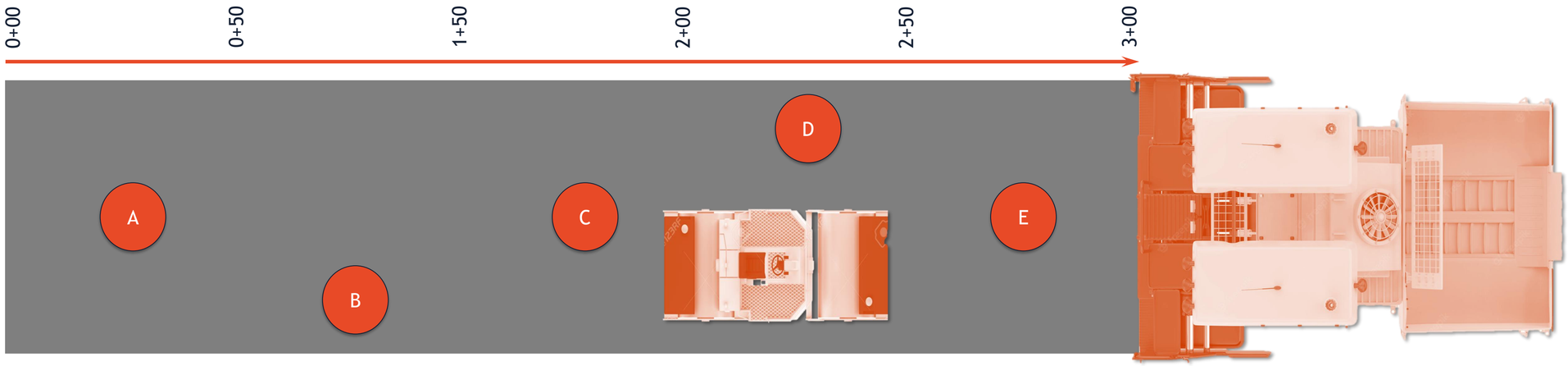
DISTRIBUTION CENTERS

Walmart DC, Mobile, AL

- Built in 2017-2018
- 372k SY of 10” RCC
- 9k SY 5” RCC

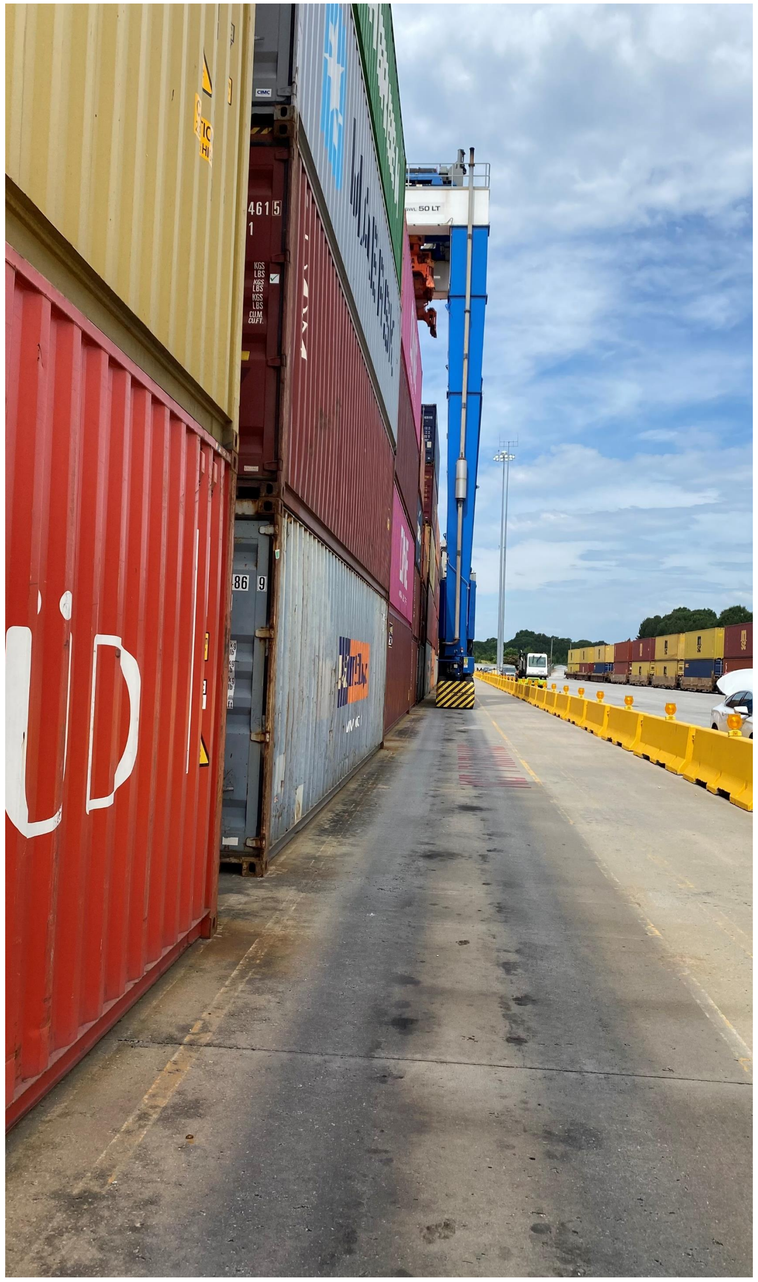
ONGOING RESEARCH – PARTIALLY FUNDED BY THE RCCPC

- UIUC Research Fellowship (Jeff , Ph.D. and Jordan Ouellet, M.A.SC.)
  - Properties of green and hardened RCC mixtures
    - Compaction energy (vibrating hammer and gyratory compactor methods)
    - Effects of percent of voids filled with paste
  - Field validation of laboratory results
    - Each test section 300’ long
    - Density, Moisture, thickness, DCP testing before and after each rolling pass

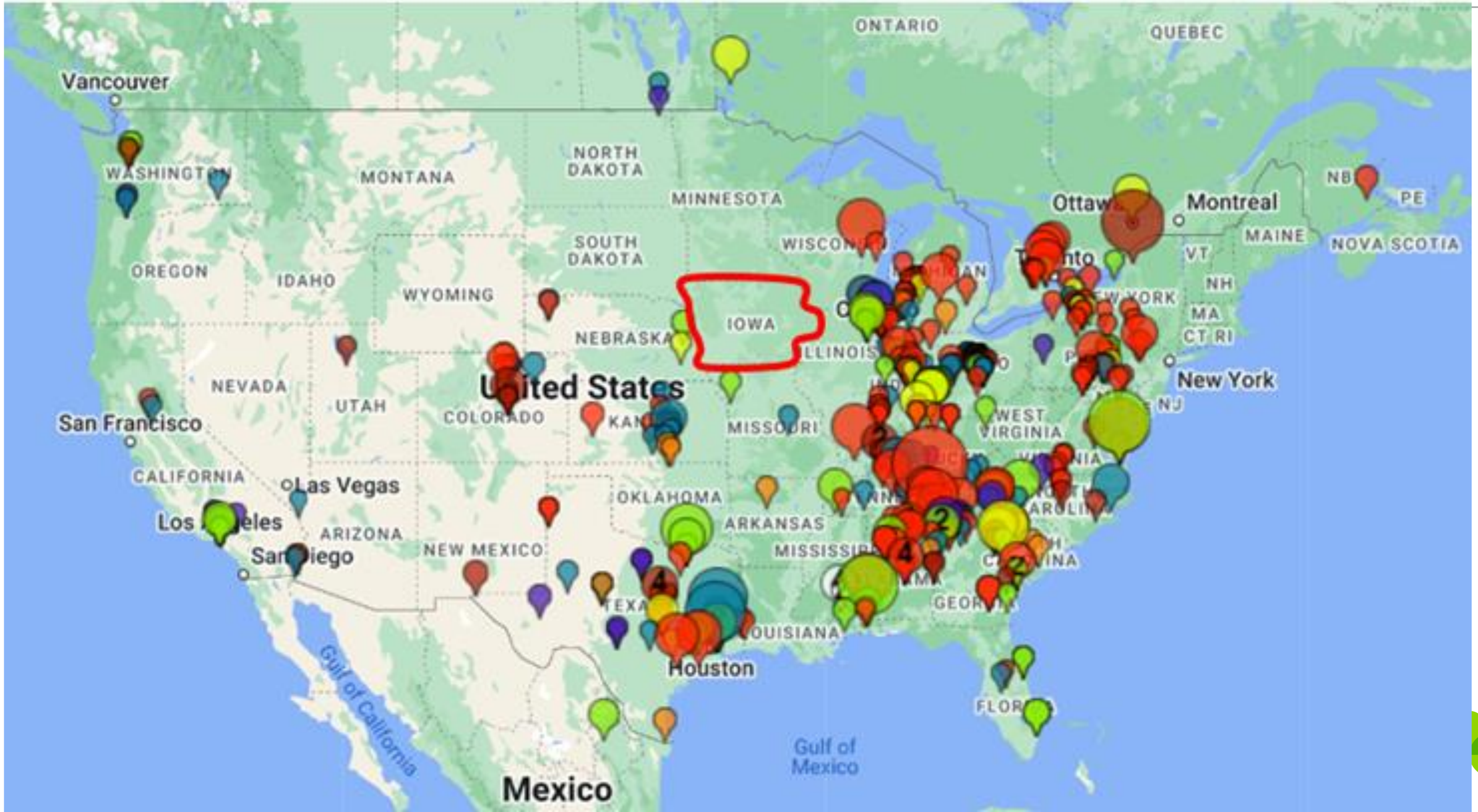


ONGOING RESEARCH – PARTIALLY FUNDED BY THE RCCPC

- ISU Research Fellowship (Halil Ceylan, Ph.D., Emin Sengun, Ph.D.)
  - Thickness design of RCC pavements for stacked containers
    - FEA using ISLAB software
      - Stacking 1 to 8 loaded containers
      - Various levels of load transfer efficiency
      - Various k values and Mr values
    - Developed draft design charts
    - Paper being peer reviewed
    - Next field validation and issuing a design manual
    - Objective is to incorporate a design model within industry accepted design tools

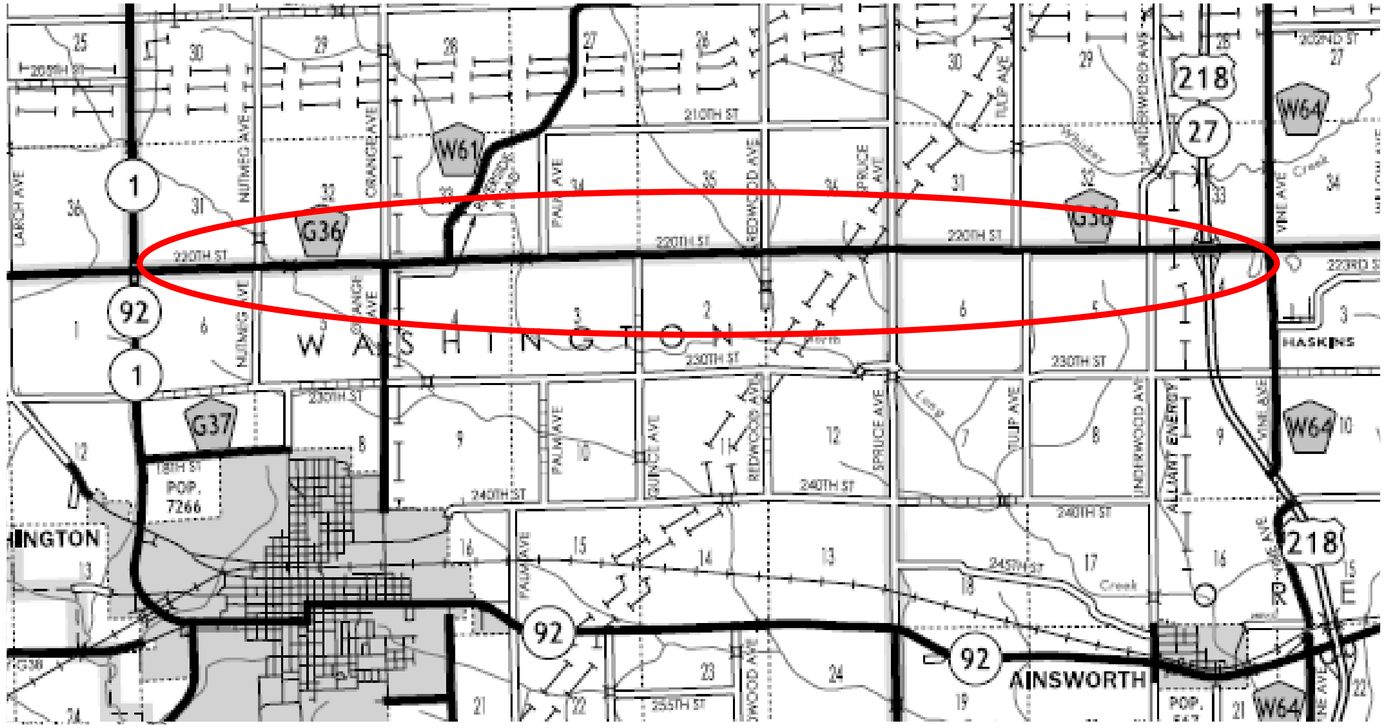


NATIONAL RCC EXPLORER, ACPA.ORG

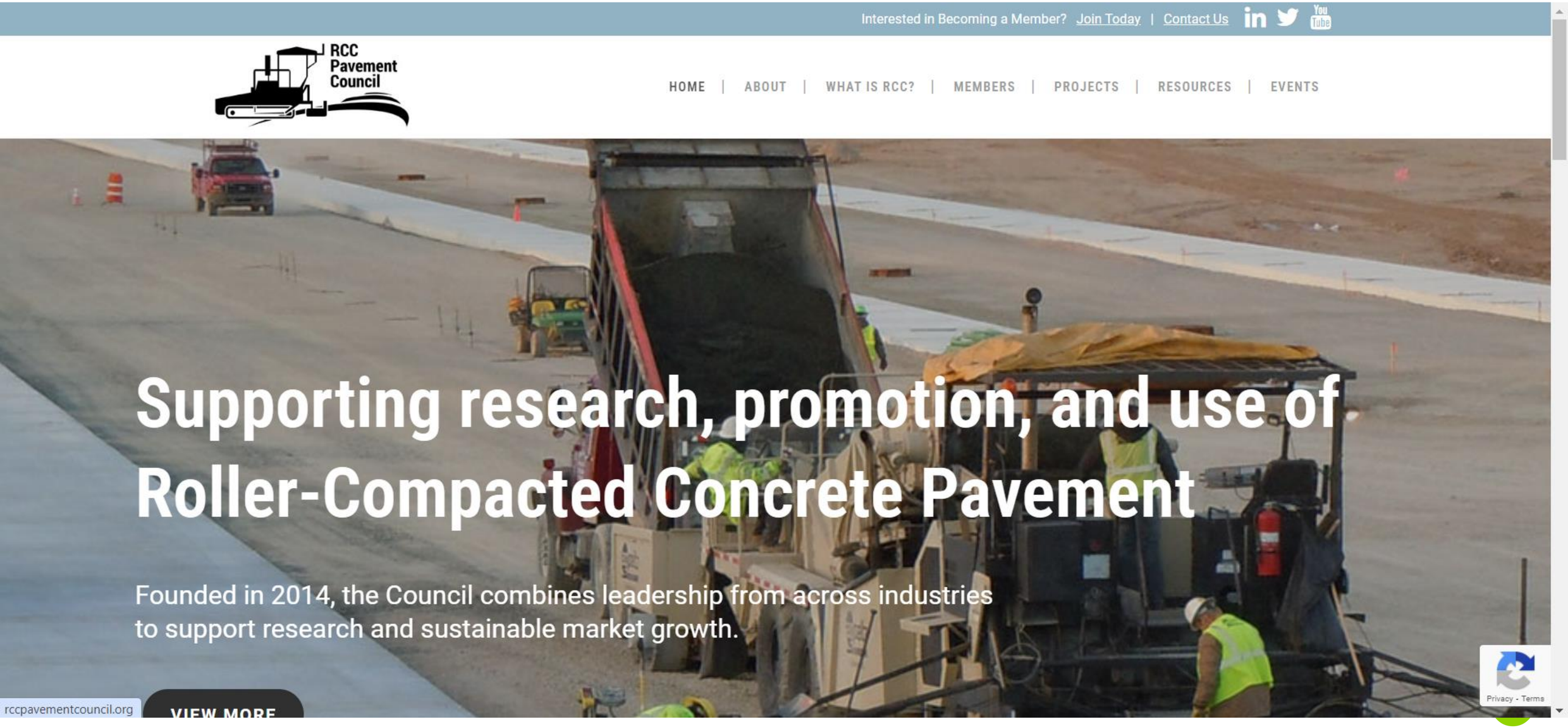


UPCOMING RESEARCH – PARTIALLY FUNDED BY THE RCCPC

- ISU
  - RCC shoulder research funded by the IDOT and the RCCPC
    - Planned 8-miles of RCC shoulders
    - Four-years research program
      - RCC mixtures using IA materials
        - Comprehensive laboratory study
      - Development of RCC specification for IDOT
      - Field demonstration, construction, and evaluation
      - Workshops
      - LCCA
      - Specification for IDOT
      - Preliminary and final reports



VALUABLE RESOURCES AVAILABLE AT THE RCC PAVEMENT COUNCIL WEBSITE: RCCPAVEMENTCOUNCIL.ORG



Roller-Compacted Concrete Pavements Panel Discussion

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