A World of Concrete Pavements

Better Concrete Conference
Ames, Iowa

Michael Ayers, Ph.D.
Global Pavement Consultants, Inc.

November 14, 2019

A "Different Sort" of Presentation

- First off, THANKS Dr. Taylor for giving this presentation as I am currently in Europe doing presentations on concrete overlays.
- This presentation is not a "how to" but rather a sample of experiences designing, building and rehabilitating pavements around the globe.
- US technology is widely regarded as the "gold standard" around the world.
- The major issues we routinely deal with include the following:
  - Establishing a reasonable QC/QA program and adhering to the specs.
  - Minimizing varabiality in materials and batching.
  - Convincing the owners why single lift pavements are preferable to two lift in terms of economics, performance and construction issues.

Технологические и экономические аспекты проектирования, строительства и ремонта цементобетонных покрытий автомобильных дорог

Казань, Республика Татарстан

Д-р Michael Ayers, президент компании
Global Pavement Consultants, Inc.

14 – 15 февраля, 2019

Cost-saving Innovative Technology for Concrete Road Pavement Design, Construction and Maintenance

Kazan, Tatarstan

Dr. Michael Ayers
Global Pavement Consultants, Inc.

February 14 and 15, 2019

Why Choose Concrete for Highways and Airfields?

- Longevity: Concrete pavements have been proven to have very long design lives compared with any other alternative.
- Low maintenance: Concrete pavements have traditionally had very low recurring maintenance costs.
- LCCA: A realistic life cycle cost analysis (LCCA), in most cases, will clearly show the economic benefits of concrete pavements.
- Environment: Concrete pavements have numerous environmental benefits including a reduced carbon footprint and lower heat-island effects.
- Safety: Concrete pavements provide increased reflectivity and improved skid resistance.

Pavement Design

- Pavement design in the U.S. has undergone a substantial change over the past 10 years.
- The new design methodology is based on mechanistic-empirical concepts and is applicable to a wide variety of traffic, site conditions, materials, climate and so on.
- Although a much more complex design method, the benefits are substantial.

Single Lift Versus Two Lift Pavements in Design and Construction

- Concrete pavements are designed as a single monolithic slab.
- Construction is traditionally accomplished as a single lift placement rather than 2-lift.
- Single lift pavements have the following advantages:
  - More economical.
  - Significantly less risk.
  - More predictable behavior.
- Two lift pavements have been constructed in the U.S. with marginal results, at best.
  - Built primarily as a cost saving measure by using recycled materials in the lower lift.
  - Equipment and labor costs far outweighed any savings, with no measureable performance benefits.

Comprehensive QC/QA

- A QC/QA program is intended to insure conformance with appropriate specifications.
- The extent of the program depends somewhat on the type and importance of the project.
- All of the tests used for QC/QA must conform to the appropriate testing guidelines.
- It is wise to develop plans ahead of time for what to do in case a test parameter is out of the specified limits. For instance, the entrained air content is high (or low) when measured at the paver.

Innovation Drives Performance

Innovation Drives Performance

Innovation Drives Performance

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Minsk, Belarus (2nd Ring Road)

Performance After 3+ Years In-Service

- The single lift pavement placed with the equipment shown in this presentation is performing very well with no deterioration*.
- The adjacent 2-lift pavement placed with different technology, equipment, mix design, etc. is experiencing significant surface issues as well as minor to moderate structural failures.

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

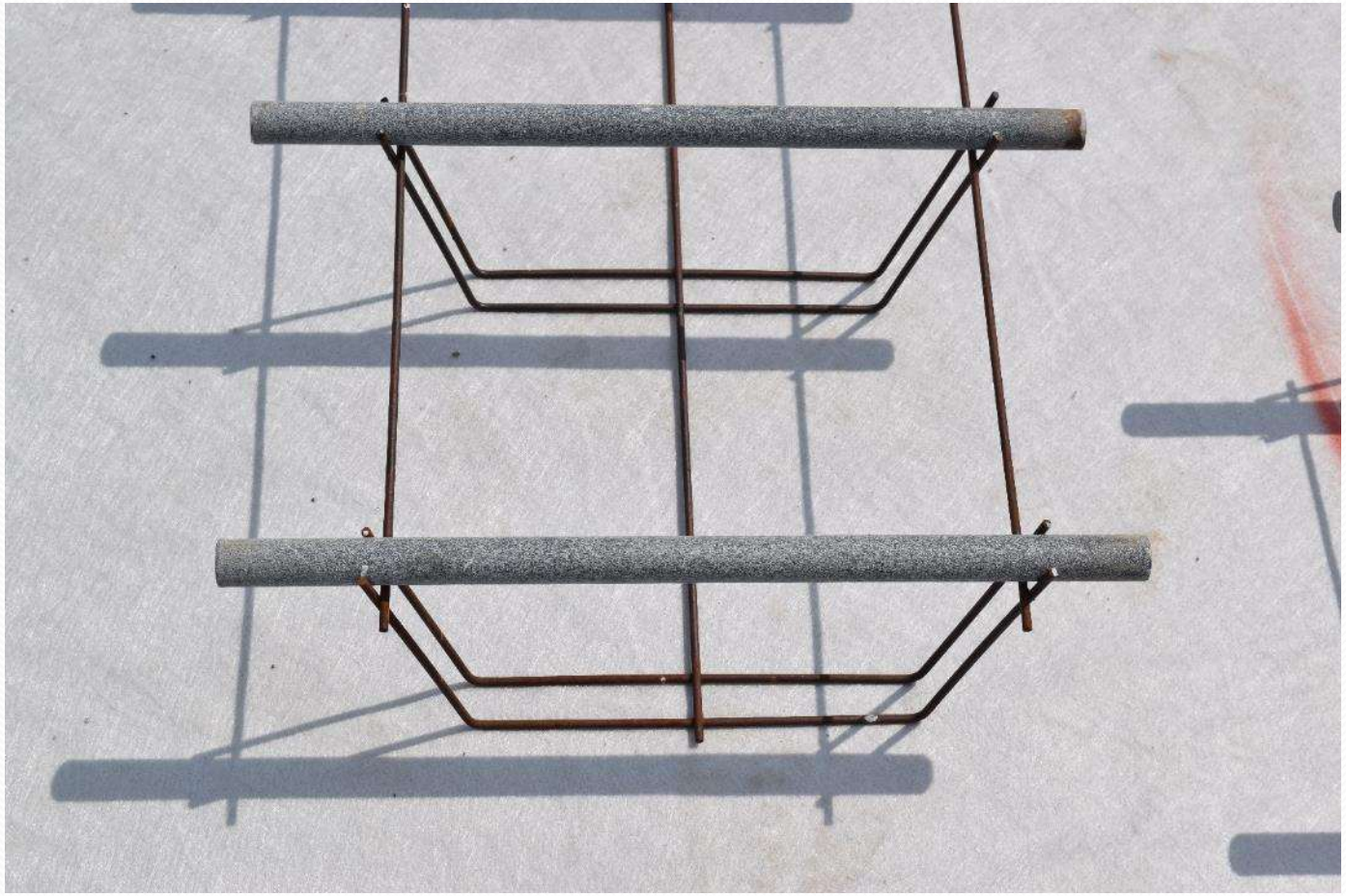
Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport

Chisinau Moldova International Airport



Chisinau Moldova International Airport

- Solution:
  - No easy fix.
  - Diamond grinding to depth necessary to remove problem is not feasible.
  - We are surface applying PAVIX CCC-100 to entire area including runway, taxiways, aprons, etc.

- UPDATE….We completed diamond grinding of approximately ½ of the airport 2 weeks ago and applied the Pavix CCC-100 to this area at a higher than normal application rate to account for the very high surface porosity.

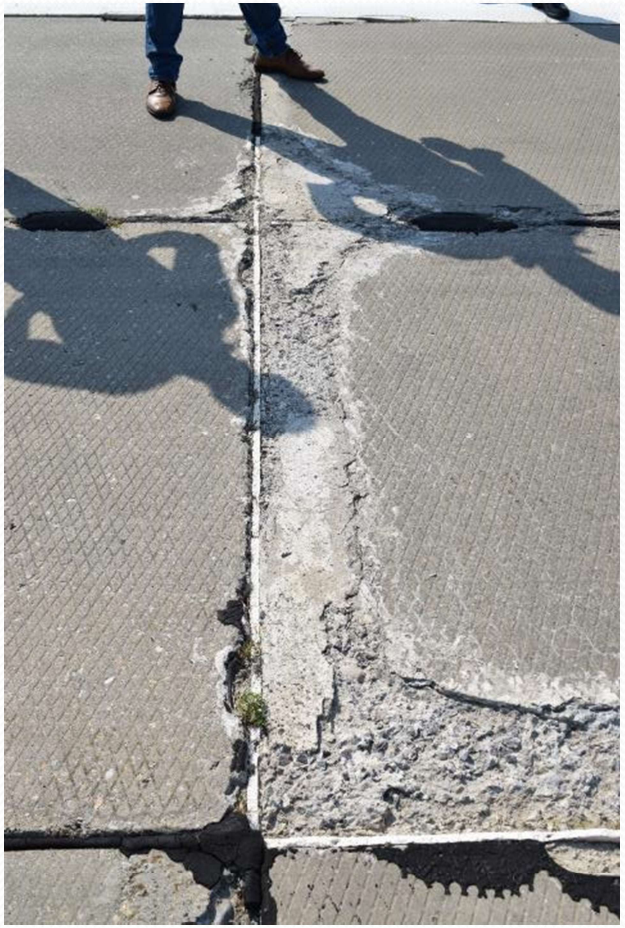
Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation



Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

Ex-Russian Military Base Renovation

- Proposed solution currently includes 2 options:
  - Conventional unbonded concrete overlay with minor pre-overlay repairs.
  - Rubblization followed by a concrete overlay.

UPDATE….the conventional unbonded OL with an asphalt innerlayer seems to be the favored option at present. We are certainly working towards that end.

Odessa, Ukraine International Airport

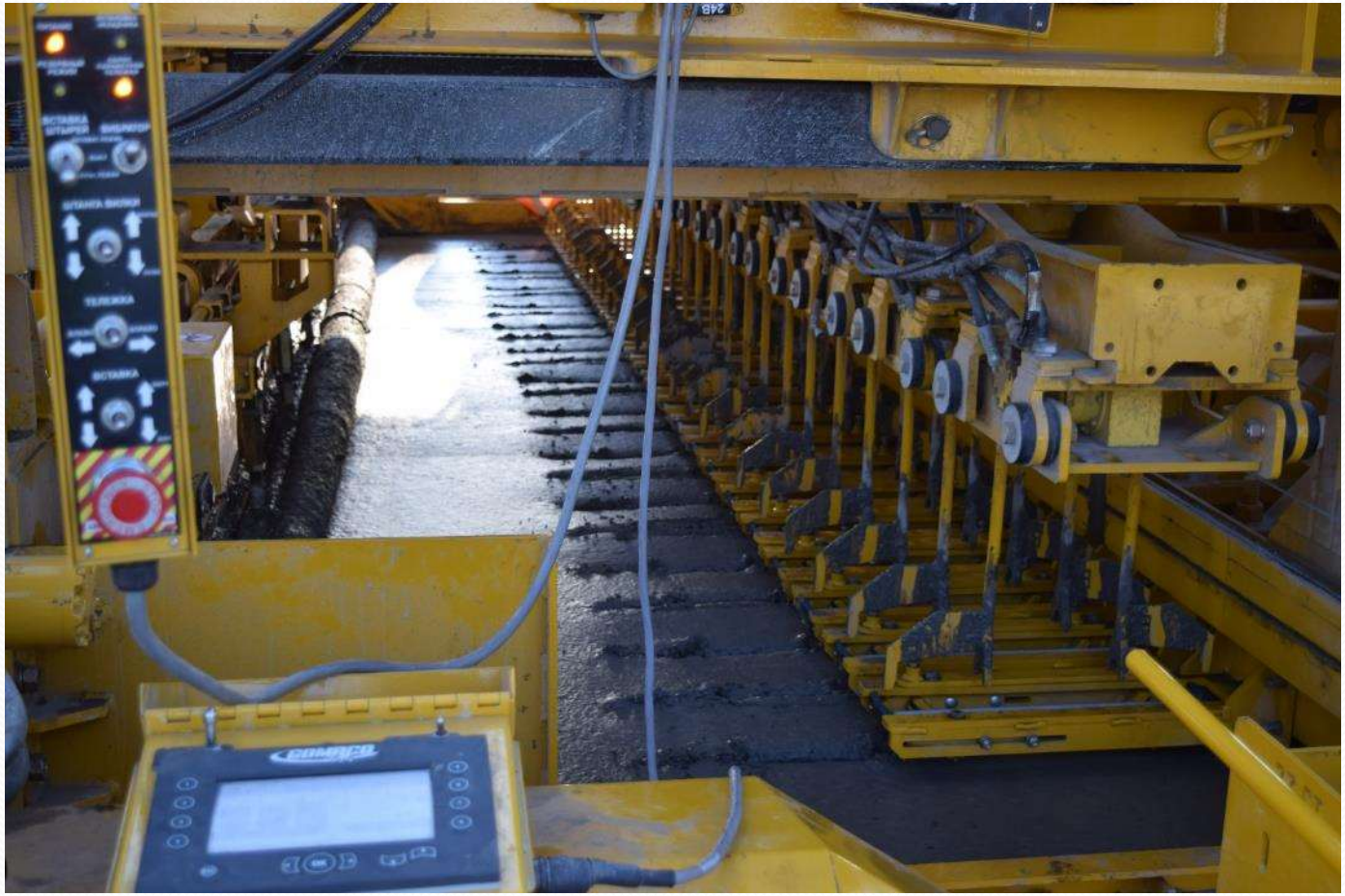
Odessa, Ukraine International Airport

Odessa, Ukraine International Airport

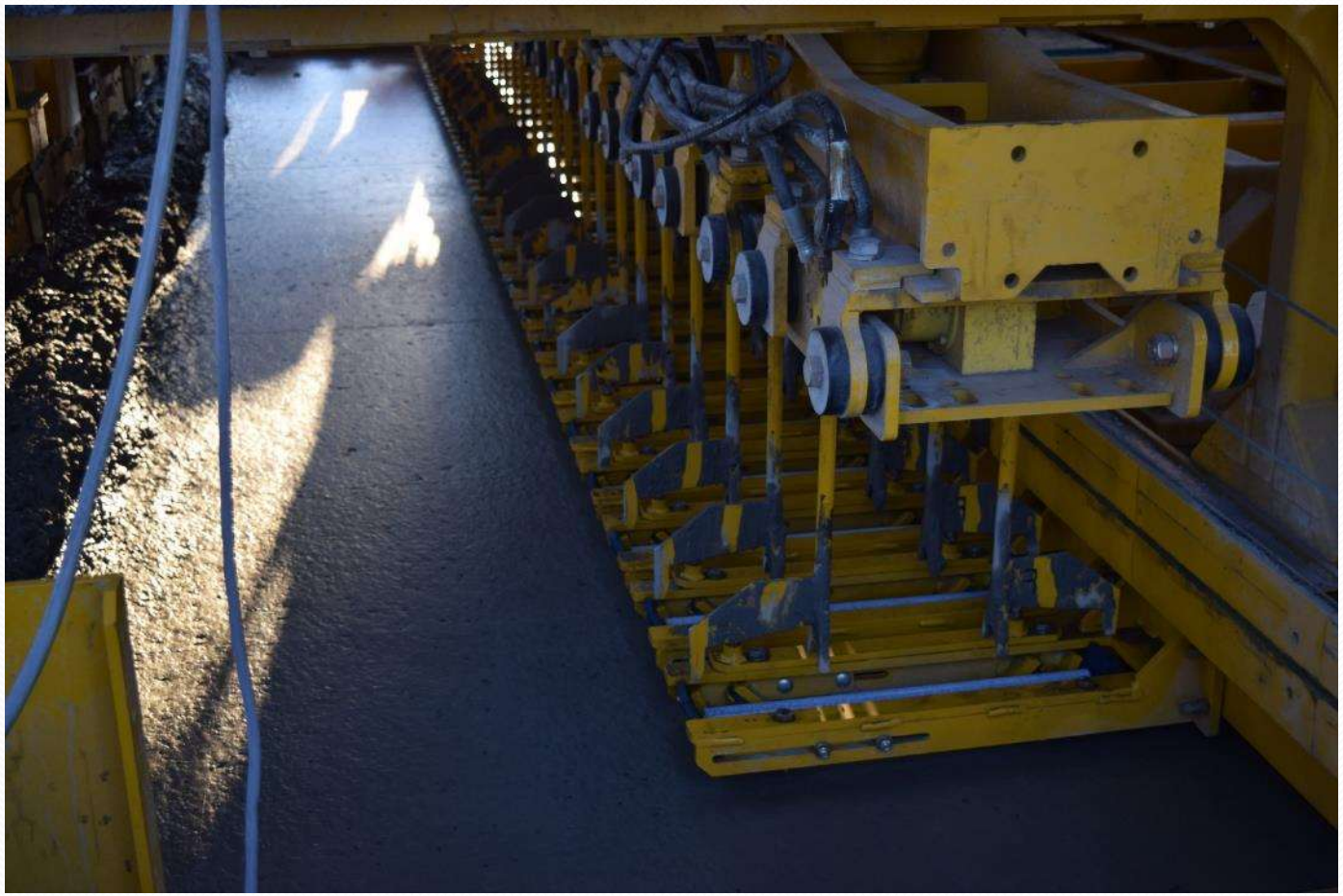
Odessa, Ukraine International Airport

Odessa, Ukraine International Airport

Odessa, Ukraine International Airport

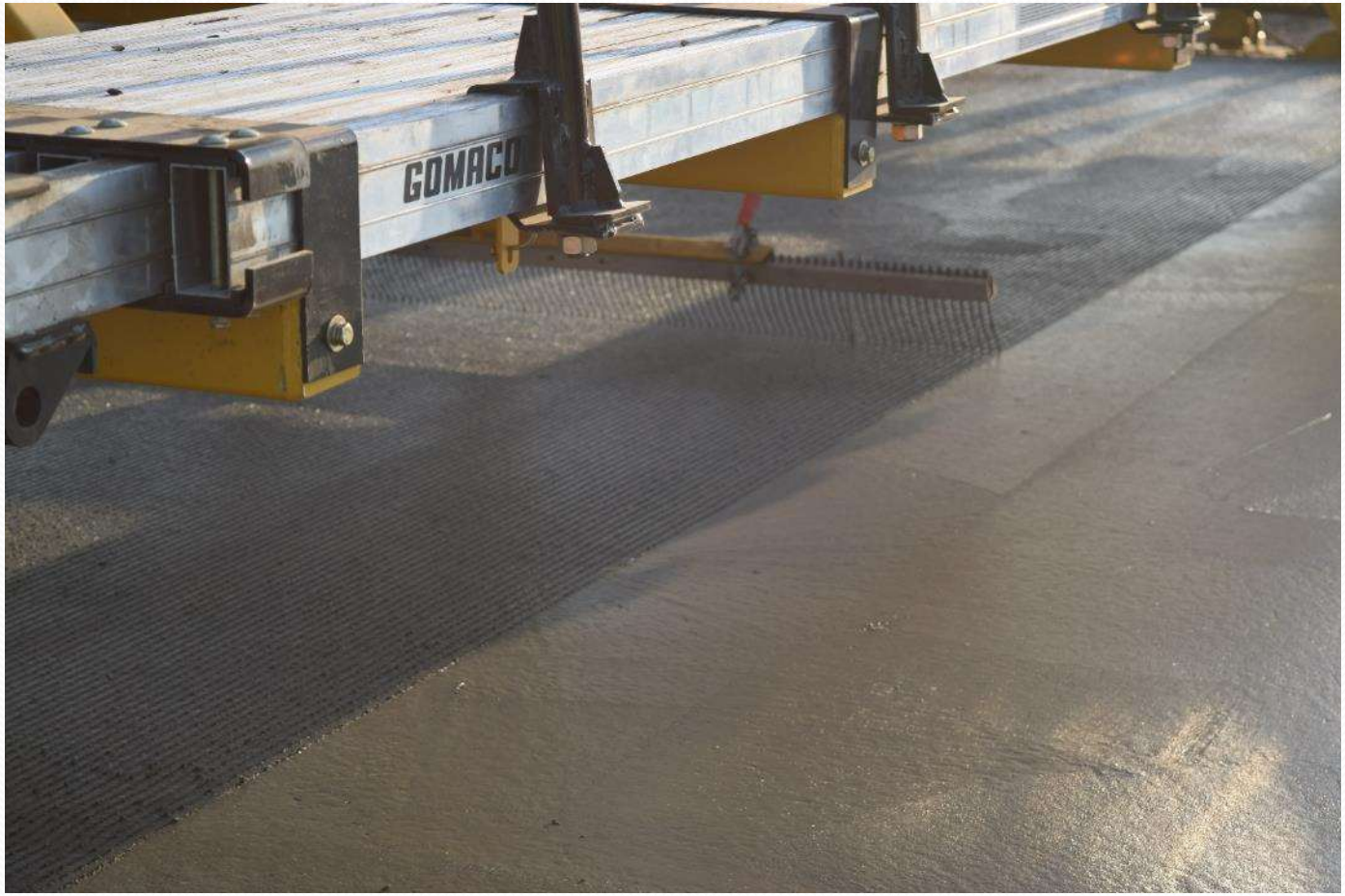


Odessa, Ukraine International Airport



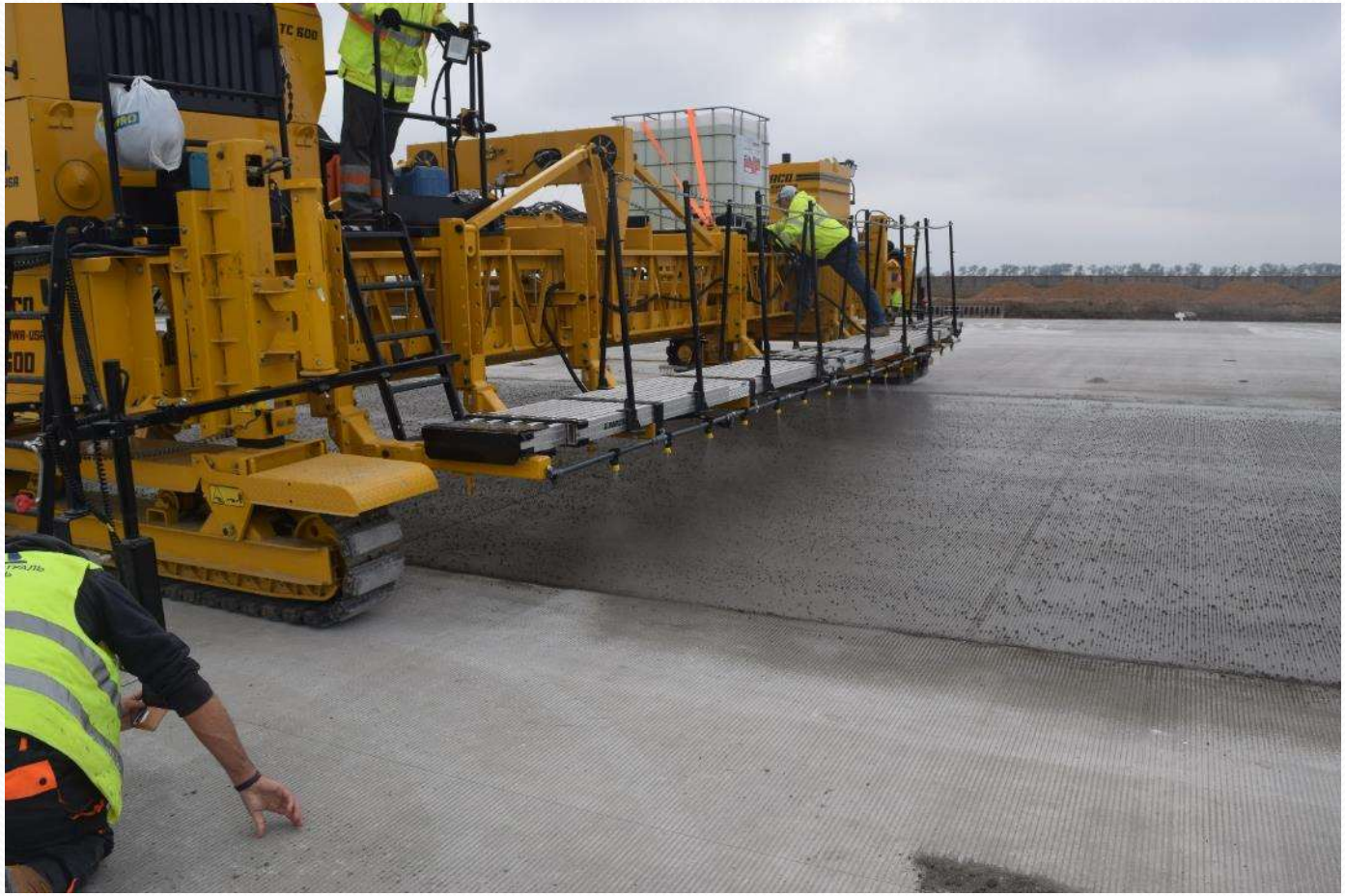
Odessa, Ukraine International Airport

Odessa, Ukraine International Airport



Odessa, Ukraine International Airport

Odessa, Ukraine International Airport



Odessa, Ukraine International Airport

Odessa, Ukraine International Airport

- Currently under construction
  - Mix design “fixed”.
  - Pavix CCC-100 application approved for fresh concrete application.
  - Plant operations, hauling and paving train optimized for production.

UPDATE….we are exploring using Pavix MCE (multi crystalline enhancer) intermixed in the concrete at the time of batching for next seasons paving operations.

Thank You!

Dr. Michael E. Ayers
President
Global Pavement Consultants, Inc.
Executive Director
Illinois Chapter of the American Concrete Pavement Association
mayers@globalpavements.com
Phone +1-217-621-3438