## ROLLER COMPACTED CONCRETE (RCC) APPLICATIONS IN PORT, INTERMODAL AND MILITARY FACILITIES

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#### OUTLINE

Why & When should you use RCC?

Why are we talking about Intermodal facilities at an airport conference?

Project Examples:
Port Facility
Intermodal Facility
Military Facility

#### > RCC Economics: What does it cost?

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#### WHAT IS RCC? - WAYNE ALREADY COVERED THAT



#### Think of it as a third type of pavement.



# WHY IS RCC USED AT INTERMODAL, PORT AND MILITARY FACILITIES?



### **POTENTIAL PROBLEMS WITH RUTTING**



Credit: Chris Carwie, AG Peltz Group

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#### POTENTIAL PROBLEMS WITH RUTTING DUE TO CHANNELIZED LOADINGS



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#### **POTENTIAL PROBLEMS WITH PAVEMENT PUNCTURES**

Credit: Chris Carwie, AG Peltz Group



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## SERVICE DISRUPTION

Credit: Chris Carwie, AG Peltz Group



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### HAVE YOU SEEN ANY OF THESE POTENTIAL PROBLEMS AT AN AIRPORT FACILITY?



#### YES! THERE ARE A LOT OF SIMILARITIES





#### WHERE COULD YOU USE RCC AT AN AIRPORT?



#### MAINTENANCE YARD, PARKING LOTS, ROADS





#### HOW DO YOU DESIGN AN RCC PAVEMENT?

- Follows rigid pavement design methods
- Plain, undoweled, unreinforced concrete pavement
- Heavy Duty Pavements
  - PCA RCC-PAVE Program
  - ACPA AirPave (need to manipulate input and confirm correct load is applied)
  - PCASE by USACE
- Medium and Light Duty Pavements
  - Street Pave by ACPA
  - WinPAS by ACPA
  - ACI design tables





# **RCC FOR PORT FACILITIES**

Credit: PortofHouston.com



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### **PORT EXAMPLES**

- Bayport Terminal Complex 2007
- Port of Montreal 2013
- ➢ Port of Long Beach 2016
- Port of Houston several projects over the years

Credit: AG Peltz, Lafarge, CEMEX



# **RCC FOR INTERMODAL FACILITIES**

Credit: Fares Abdo, Morgan Corp.



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### **INTERMODAL EXAMPLES**

- > CN Intermodal, Calgary 1998
- Norfolk International Terminal 2009
- Memphis Regional Intermodal Facility 2012
- Charlotte Regional Intermodal Facility 2013
- KCS Wylie Intermodal Facility 2015

Credit: AG Peltz



#### INTERMODAL FACILITIES - KCS RAILWAY, KENDLETON, TX



95K SY of 17" RCC for Container Storage

- 47K SY of 6" RCC for Automobile Storage Yard
- Pervious Pavement Strip – eliminated need for high cost drainage structures

Credit: Chris Carwie, AG Peltz Group

#### INTERMODAL FACILITIES - KCS RAILWAY, KENDLETON, TX



Credit: Chris Carwie, AG Peltz Group

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#### **OTHER INTERMODAL FACILITIES WITH RCC**

- BN Intermodal Facility (1986 Denver)
  - Largest dual lift RCC project in the United States at that time
  - Approx. 60,000 SY of 20" RCC
- KCS Intermodal Facility (2011)
  - Toluca, Mexico
  - 120K SY of 17" RCC Pavement



Credit: Chris Carwie, AG Peltz Group



# **RCC FOR MILITARY FACILITIES**

Credit: Chris Carwie, AG Peltz Group

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#### FORT BENNING, GA - 1986



Tank Trail and Hardstand



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### **OTHER MILITARY FACILITIES**



### **US ARMY CORPS EXAMPLE**

Owner:	US Army Corps of Engineers
Size:	Over 45,000 square yards of 8" RCC Pavement
Туре:	RCC Pavement
Designer:	US Army Corps of Engineers
Contractor:	AG Peltz Group
Paving Date:	February 2014

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#### CITY STREETS & HIGHWAY SHOULDERS HAVE ALSO BEEN SUCCESSFULLY CONSTRUCTED WITH RCC



## **RCC EXPLORER**

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#### Application

- 92 Industrial/Trucking Facility
- 52 Local Street
- 49 Port or Intermodal Facility

CONCRETE

even smarter than you think

### SOUTH CAROLINA INLAND PORT GREER, SC

#### 182,500 SY of RCC - completed Jan. 2014

Credit: Fares Abdo, Morgan Corp.



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## **SC INLAND PORT – SITE CONDITIONS**

- Variable soils
  - Sandy SILT in fill area
  - Silty SAND in cut areas



➢ 0.5% grade

Credit: Fares Abdo, Morgan Corp.



#### **SC INLAND PORT**



#### **SC INLAND PORT – CTS BASE CONSTRUCTION**



Credit: Fares Abdo, Morgan Corp.

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#### WHY CTS BASE?



Credit: Fares Abdo, Morgan Corp.

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#### **RCC MIXING: CONTINUOUS MIX PUGMILL**



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#### **RCC MIXING: CONTINUOUS MIX PUGMILL**

- 250 to 600 tons/hr
- Excellent mixing efficiency
- Mobile, erected on site
- Mobilization cost



Credit: Fares Abdo, Morgan Corp.





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#### RCC Placement – 1<sup>st</sup> lift







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#### **DUAL LIFT CONSTRUCTION**



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## WHAT DOES RCC COST?

#### Initial Cost

- 15%-20% lower than conventional concrete
- Competitive against HMA on initial cost basis
- Life-Cycle Cost
  - 15%-20% less than conventional asphalt



#### **RCC RESOURCES**



**Roller-Compacted Concrete Pavements** as Exposed Wearing Surface Version 1.3 - September 4, 2014

This document provides a guideline specification useful for developing project specifications for soller compacted concrete (RCC) as an exposed RCC payment surface, that may or may not be diamond ground for smooth ness and/or texture. BCC as a base/subbase lawers is not covered in this specification. The information is also not wholly applicable for non-payments applications such as backfills, daws or liners. This guideline should not be used as a specification reference in contract documents. An owner, engineer or contractor must consider the svalable options and apply these guidelines to preste specifications for specific lacal projects.

This document references appropriate material standards, test methods and specifications of American Association of State Highway and Transportation Officials (MSHTO), ASTM international BASTMI, and Canadian Standards Association (CSA). These references assume that the contractor and the engineer will use the most up-to-date and applicable standards or methods that are in effect when bids are colicited for the project. It also accornes that the specification writer will choose the standard or test most suitable for their agency/project.

Pastnotes accompany many of specification providing herein. These added details describe reasoning for certain specification features, as well as provide considerations and important information for the specification writer

#### ACPA's ROLLER-COMPACTED CONCRETE TASK FORCE

The following individuals serve on the ACPA RCC Task Porce as members or friends, and have contributed their expertise, experiences and efforts to onste this guideline

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**JUNE 2016** FHWA HIF 16 003

National Concrete Pavement Technology Center

#### **Roller-Compacted Concrete Pavement**

Tech Brief

US Department

of framportation

**Federal Highway** 

This Tech Brief presents an overview of the best practices for roller-compacted concrete pavement. The Tech Brief discusses RCC pavement uses and provides information on RCC mixtures and construction of RCC pavaments.

#### INTRODUCTION

Roller-compacted concrete (RCC) as a paved surface. offers facility owners and pavement designers a concrete pavement alternative that may better meet the requirements of specific pavement projects than conventionally cast in-place concrete pavements. RCC pavement applications can be tailored to the specific needs of a project, particularly those associated with roadway projects within the residential, commercial, and urban roadway sectors RCC pavement has been used in the following applications [1]:

- Heavy-duty applications
  - Ports and airports Military installations
  - Intermodal facilities.
- Light commercial industrial applications
  - Warehouses and manufacturing facilities Commercial and industrial parking lots
  - Maintenance and storage yards.
- · Roadway applications Highway frontage roads and shoulders
  - Minor arbirials
  - Gity streets and local roads

An important benefit of RCC is its cost-effectiveness and ease of construction. RCC pavement essentially mimors a conventional portland cement concrete (PCC) pavement in terms of joint spacing and design thickness. However, RCC is engineered and constructed differently than conventional concrete, involving different placement and design considerations even though the concrete moture is made of the same constituent materials. Some of the differences include the following [1]:

> RCC is placed with asphalt-type pavers, not with the typical slip-form concrete paving machines or vibrating screeds.

#### **GUIDE FOR ROLLER-COMPACTED CONCRETE PAVEMENTS**

AUGUST 2010



IOWA STATE UNIVERSITY Institute for Transportation

PCA

#### **RCC EXPLORER**





#### **RCCPAVEMENTCOUNCIL.ORG**



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