Compacted Concrete Paving

"The Improved RCC"

A new pavement for a new millennium

Faster installations, lower initial costs, lower life cycle costs, and the most sustainable available. We construct long-lasting pavements with the highest quality.

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ANDALE CONSTRUCTION INC.

What Does CCP Offer ?

In today's environment how do we add **value, longevity and strength** to a project, while at the same time reduce construction costs, schedule and maintenance expenses for the customer? The answer is simple… by adding the engineering and costs benefits through the use of cement treated bases and Compacted Concrete Pavement (CCP). Andale Construction is able to accomplish these goals for you.

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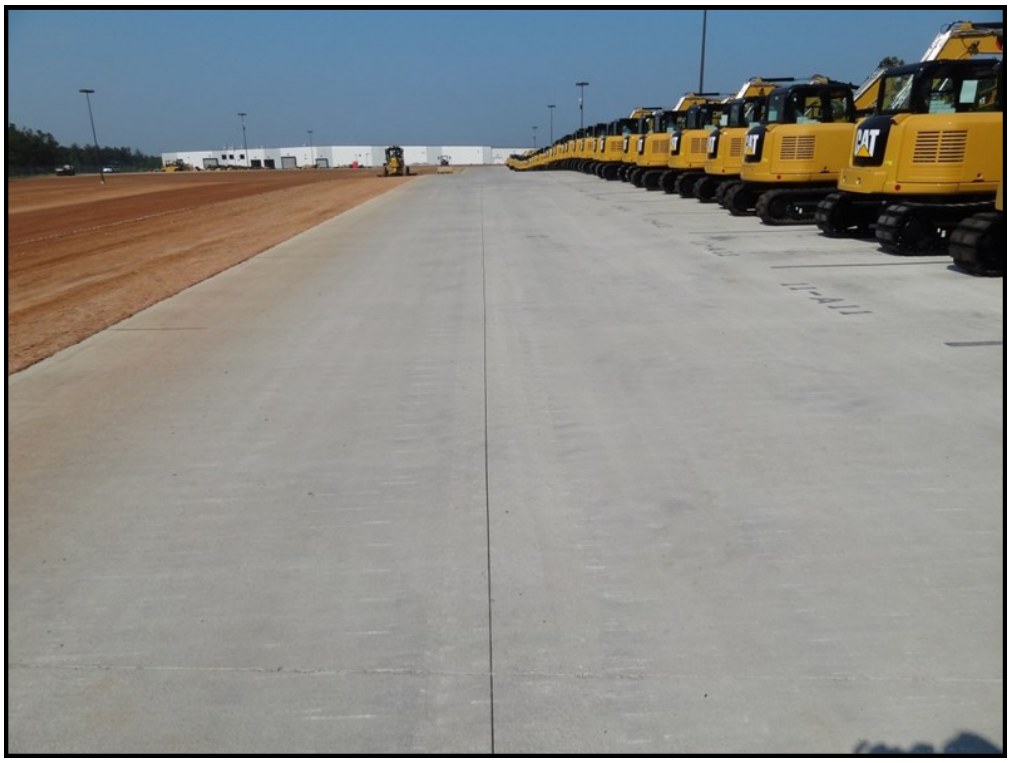
What is CCP?

CCP (Compacted Concrete Pavement) is an advanced form of RCC (Roller Compacted Concrete). CCP differs from RCC in that it requires less compactive effort, can be finished in texture and is easier to construct.

CCP has zero slump and a similar unit weight as a typical RCC mix and is produced and constructed with the same specifications. The major differences in construction are that CCP has a longer “fresh” or “green” period and requires little or no rolling. Another distinct difference is that we do not finish the surface with a roller. In its place we use a trowel machine to make the surface more uniform and consistent. Using our patent pending finishing process, along with the ACEiT admix, we can now construct a textured surface on the pavement that is indistinguishable from conventional concrete.



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Where does RCC come from?

RCC became well-known in Canadian log sorting yards in the early 1970's.

RCC was recognized as the "go-to" pavement of choice in intermodal and port facilities, as well as in military installations for it's speed of installation, reliability, consistent mass production, resilience to a wide variety of weather conditions, heavy repetitive loading without premature failure, and lower cost.

Now the next step in the evolution of RCC is upon us. RCC has taken a technological leap in it's appearance, constructability and engineering properties. RCC has evolved to **CCP (Compacted Concrete Pavement)** and its uses are growing by leaps and bounds

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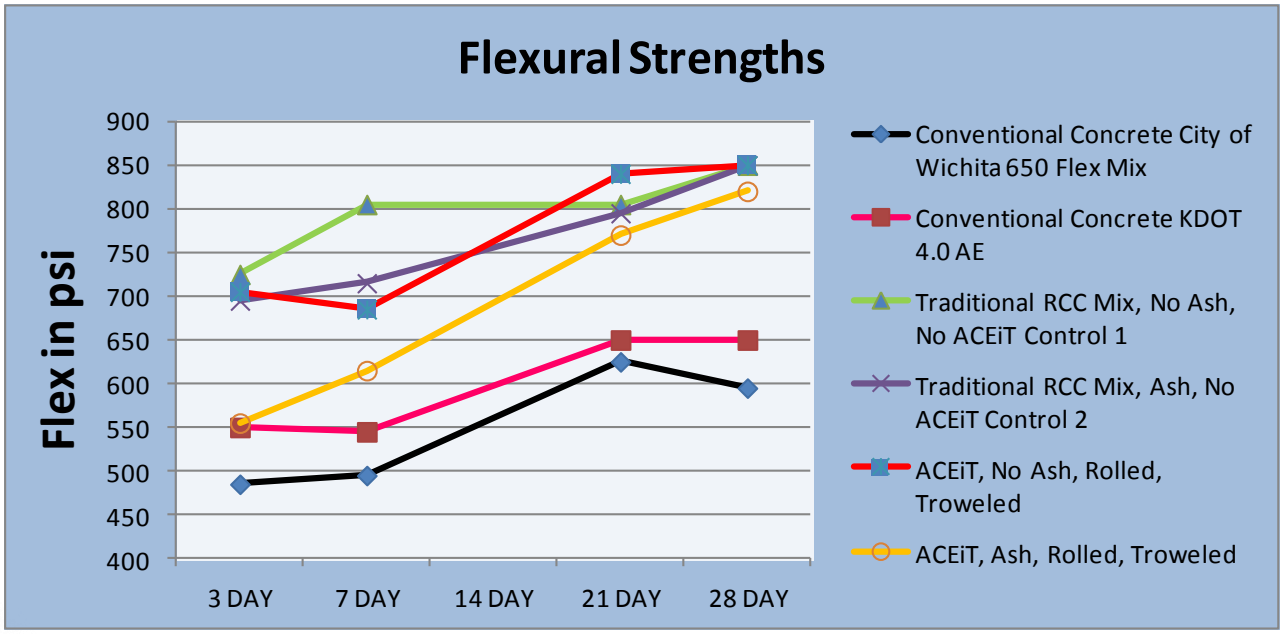
How strong is CCP?

CCP (Compacted Concrete Pavement) can make your dollars go much farther when compared to traditional pavements. A properly designed CCP section with an appropriate subgrade can easily achieve several decades of service without any maintenance and will not be affected by an increase in daily loading or overall loading.

CCP is the only pavement in which you can place up to10” in one pass and allow traffic on the roadway within days of installation. Superior compressive and flexural strengths are unmatched with conventional pavements. Daily production quantities of up to a half mile by 24 feet wide are common.



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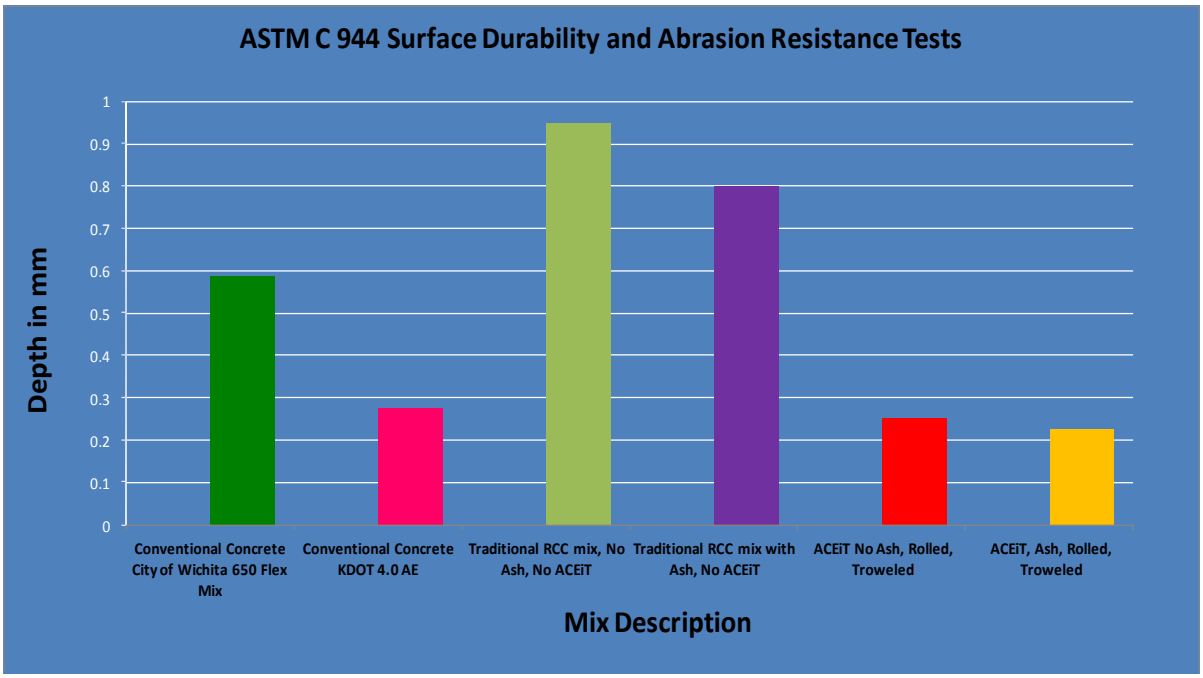
How Durable is CCP?

The graph below shows the surface durability/abrasion results from running ASTM C 944-Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method. The University of North Carolina-Charlotte ran these tests in 2015. The tests verified ACEiT and troweling had positive affects on the surface of the pavement. CCP with the ACEiT additive increases the surface durability and resists abrasion by a factor of over 200%, and is comparable or better than conventional concrete mixes. This is beneficial for the industrial use of CCP as well as CCP in Northern climates where the pavement may be exposed to freeze, thaw and snow plowing. It is also a great indication for long term serviceability and high durability in harsh environments, as well as abusive use.



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Where is CCP used?

- Local Streets and roads and new sub-divisions
- Reconstruction of old deteriorated roads
- Commercial Developments
- Industrial/Manufacturing Plants
- Military Facilities
- Intermodal Facilities
- Port Terminals

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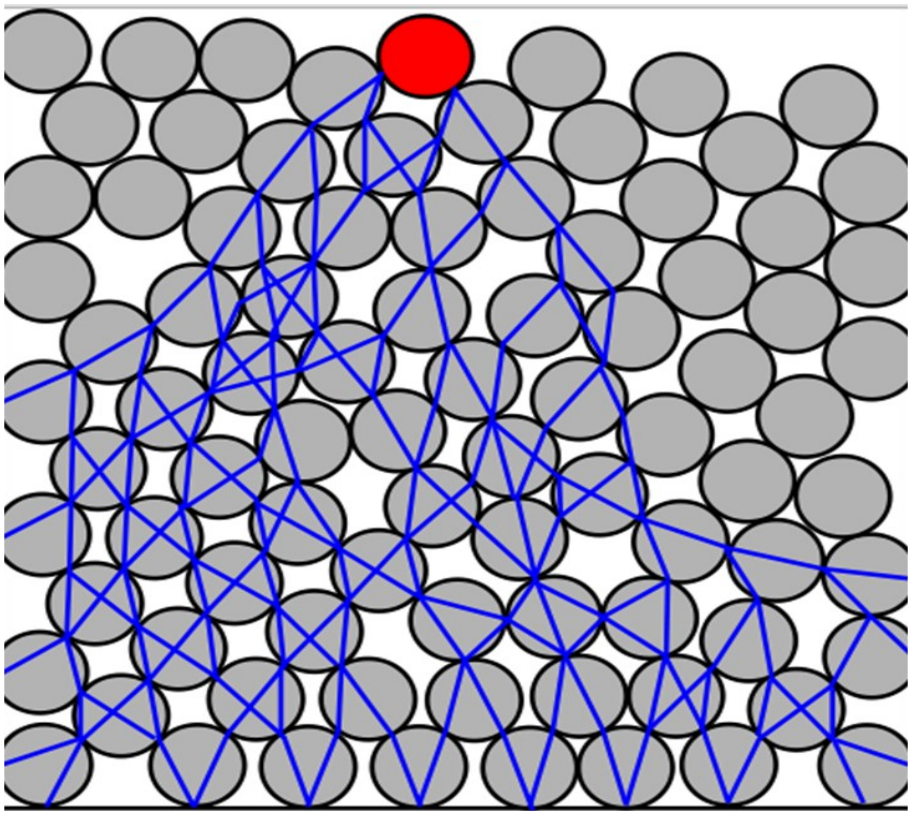
CCP is a Granular Solid



- Compressive strength (f'_c)
  - 4,000 to 10,000 psi
- Flexural strength (MR)
  - 500 to 1,000 psi
  - $MR = C(f'_c)^{1/2}$ where C = 9 (up to 11)
- Modulus of elasticity
  - 3,000,000 to 5,500,000 psi
  - $E = C_E(f'_c)^{1/2}$ where C_E = 57,000 (up to 67,000)

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Sustainability of CCP

Lower Heat Island Effect. It's a cooler pavement.

Greater Solar Reflectivity, therefore you need less night time lighting.

Ability to use recycled aggregates and more fly ash than conventional concrete.

Less initial cement than conventional concrete which lowers carbon foot print to construct and maintain. (No repetitive milling and repaving).

We can achieve up to 8 LEED points by using CCP.

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CCP Pavement Requirements

Based On:

- Twin Shaft Mixer or Pug Mill Plant
- High Density Screed Paver
- Appropriate Mix Design
- Smoothness (IRI)
- Concrete Density (for durability, frost, permeability)
- Concrete Strength (for fatigue)
- Uniformity of Product (Density, Strength)
- Surface Texture (for smoothness, appearance, friction):

Class 1— High Specification
Class 2—Moderate Specification
Class 3— Low Specification

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What is the Freeze/Thaw Durability of CCP ?

Terracon
912 Morris Street
Charleston, WV 25301
P: 304.344.0821
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Freeze-Thaw Durability of Solid Concrete Interlocking Paving Units Report
ASTM C 1645 Modified

Client: Andale Ready Mix
Project No. 01151042
Type of Unit: RCC Test Strip
Air Curing Condition @ 48hrs
Relative Humidity, (%): 64.8
Temperature, (°F): 73.4
Specimens: Andale RCC Test Strip
Solution: Saline (3% NaCl)

Freeze-Thaw Cycle Start Date: June 15, 2015
Chamber Freeze Temperature Setting, (°F): 23 ± 5 (last 7-12hrs)
Chamber Thaw Temperature Setting, (°F): Min.40 (last 1 hr) not greater than 86
Freeze Time Interval, (hrs): 16 ± 1
Thaw Time Interval, (hrs): 8 ± 1
Total Number of Cycles: 28, avg mass > allowable continue to 49 cycles
Residue Collection Cycle: 7, 28 and 49 (if necessary)

Specimen Identification	Top Surface Area ft²	Areas 2-6 ft²	Total Area ft²	Air Dry Mass g	Test Mass, W_p g	Initial 24hr Absorption %	Allowable Total Loss g @ 28 cycles	Allowable Total Loss C% @ 28 cycles
Control 1A	0.211	0.975	1.19	5908.10	5965.20	0.97	24.91	0.433
Control 2A	0.210	0.968	1.18	5769.90	5825.10	0.96	24.74	0.441
ARAT	0.212	0.977	1.19	5737.80	5814.00	1.33	24.97	0.448
ARNAT	0.214	1.002	1.22	5960.80	6063.90	1.39	25.52	0.438

Specimen Identification	Calculated $\frac{W_{final} + W_{residue}}{W_{initial}}$	Final Dry Mass of Sample, g W_{final}	Final Dry Mass of Residue, g $W_{residue}$	$W_{residue19}$ Dry Mass of Residue, g 7 Cycles 06/22/15	Accumulative Total Mass Residue, g 7 Cycles	% Cumulative Weight Loss of Sample 7 Cycles	$W_{residue20}$ Dry Mass of Residue, g 28 Cycles 07/13/15	Accumulative Total Mass Residue, g 28 Cycles	% Cumulative Weight Loss of Sample 28 Cycles
Control 1A	5747.17	5738.90	8.27	4.34	4.34	0.076	3.93	8.27	0.144
Control 2A	5615.18	5607.50	7.68	3.99	3.99	0.071	3.69	7.68	0.137
ARAT	5579.49	5571.50	7.99	4.50	4.50	0.081	3.49	7.99	0.143
ARNAT	5828.14	5820.00	8.14	4.45	4.45	0.076	3.69	8.14	0.140

Specimen Identification	$W_{residue30}$ Dry Mass of Residue, g 49 Cycles 08/03/15	Accumulative Total Mass Residue, g 49 Cycles	% Cumulative Weight Loss of Sample 49 Cycles
Control 1A	0.00	-	-
Control 2A	0.00	-	-
ARAT	0.00	-	-
ARNAT	0.00	-	-

Remarks: Termination of test: Loss did not exceed allowable at 28 cycles for continuation, ASTM C1645, Section 7.5.3.

Reviewed By:
Brian Place
Laboratory Department Manager

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicableto the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

One of the tests that we chose to run on CCP with ACEiT was ASTM C 1645 -2006 standard test method for freeze-thaw and de-icing salt durability of solid concrete interlocking paving units. This test was chosen because RCC or CCP is more closely related to interlocking pavers because of the gradation and low slump characteristics of the pavers. As you can see, the de-icing salts and freeze thaw cycles have little affect on CCP.

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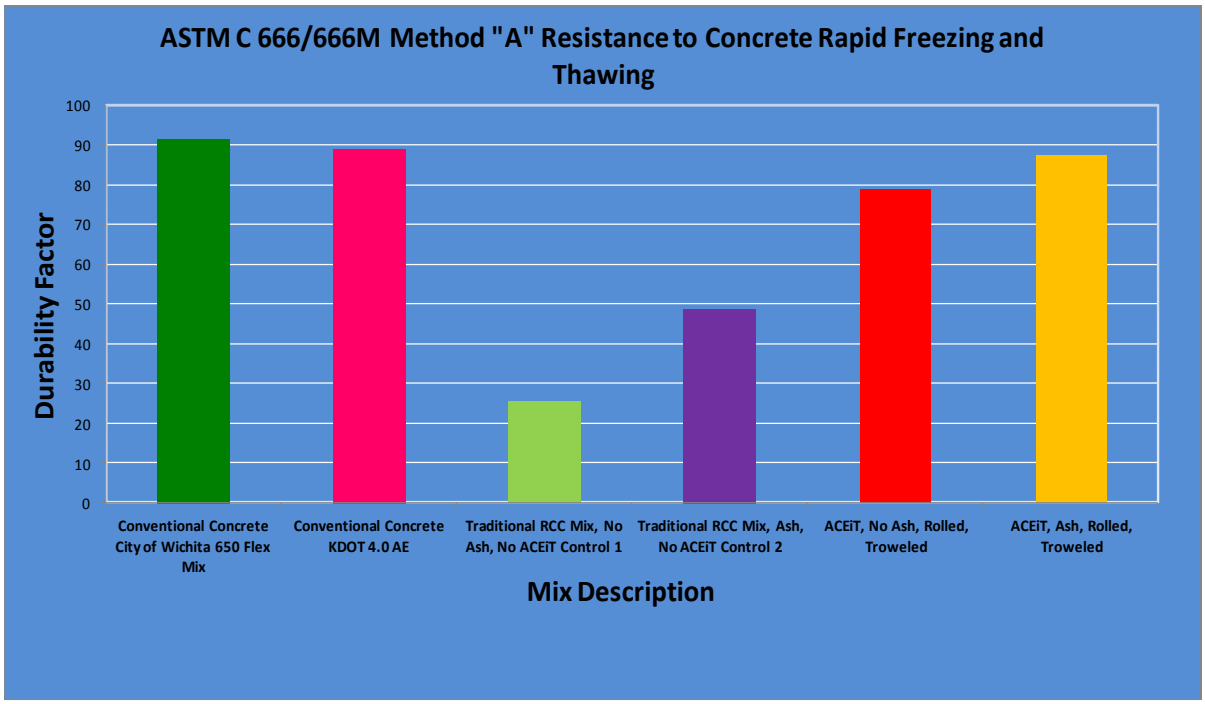
ASTM 666 is not typically used to test the freeze/thaw durability of a CCP pavement. RCC traditionally has an inherent lower water and cement content and has historically not passed the ASTM 666 test with a durability higher than 60. As you can see from the results below, ACEiT improves the freeze/thaw durability immensely and CCP performed extremely well.

This is unprecedented in the RCC industry and proves even further that by selecting an appropriate mix, we can take RCC to the next level and have a pavement that is not only stronger and more durable, but also more resistant to the most severe climates.



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3170 N. Ohio Street, Wichita, Kansas 67219

For more information on how Andale Construction can help build a better project for you and add value to your site, please contact us for additional information, a quote, or project evaluation

We provide the following services:

- **Consulting**
- **Design Build Services**
- **Super Slurry Cement Stabilization**
- **Concrete Paving**
- **Complete Civil Construction Services**

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