NIST Civil Infrastructure Showcase

3-14-14 Gaithersburg, MD

Development of High-Toughness, Low-Viscosity Resin for Reinforcing Pothole Patching Materials

BruinPatch, Inc.

A UCLA Startup for Improving National Infrastructure

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Product

Product:

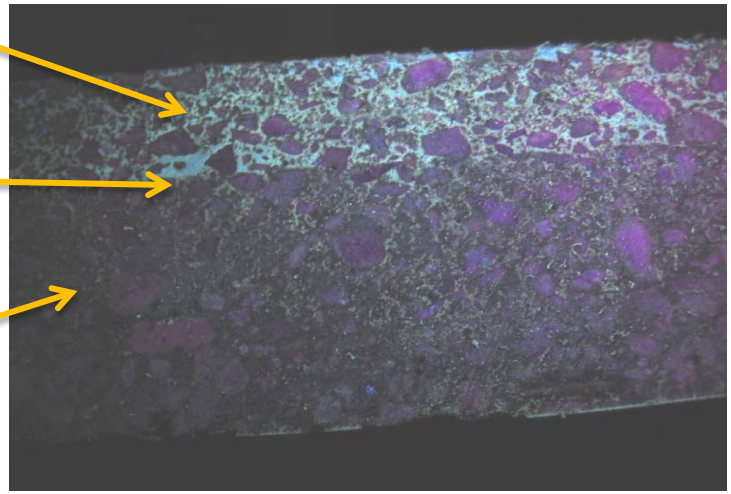
A long lasting pothole repair method that utilizes a low viscosity resin, a patented catalyst and UCLA's patented approach

Integrated Dual Phase Approach

Porous asphalt with infiltrated DCPD layer

Interface

Densely compacted asphalt layer



Cross-section

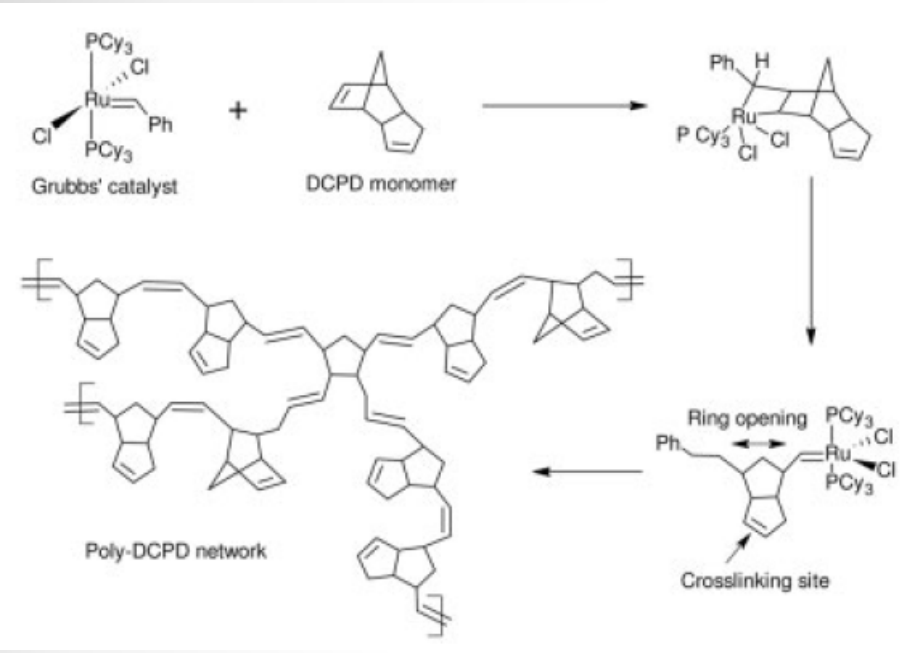
Top Phase:

- Moisture resistant
- High toughness
- Durable, rutting resistant

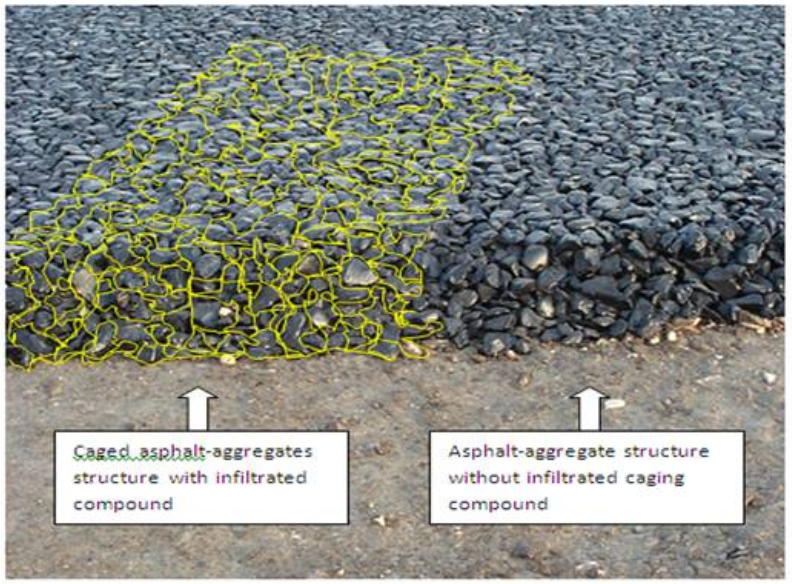
Bottom Phase:

- Compacted standard materials
- Low Cost

DCPD Resin Curing



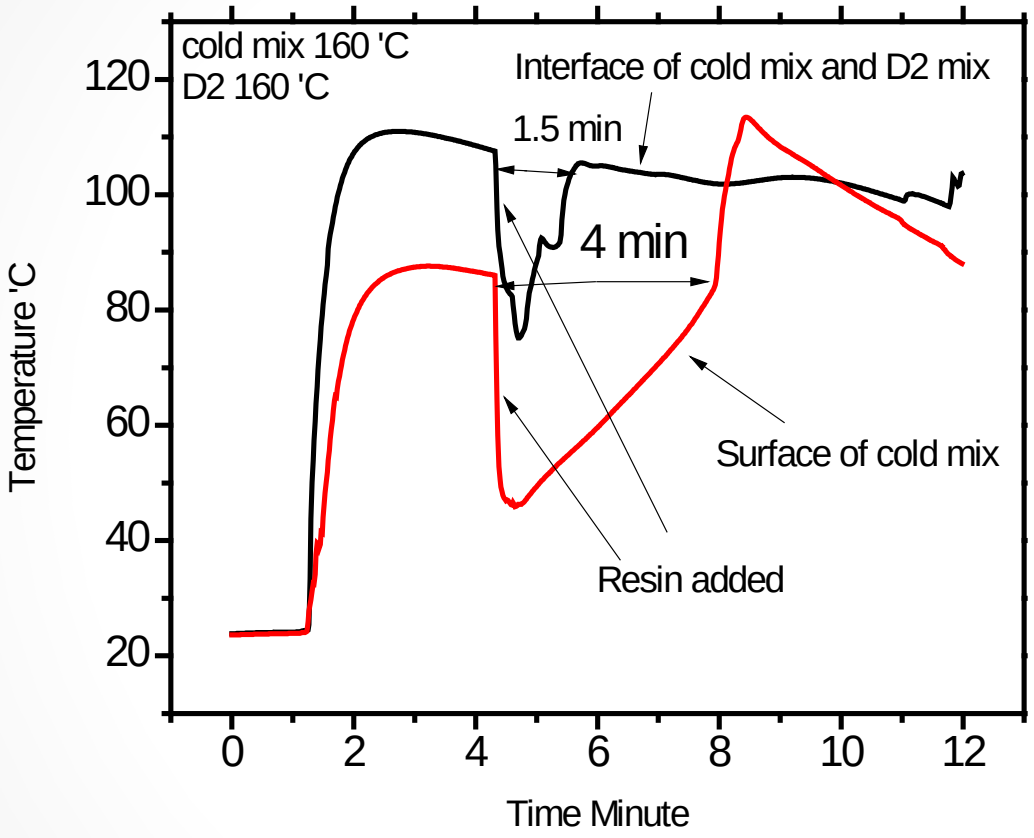
Ring-opening Metathesis Polymerization



Schematic illustration of aggregate-asphalt mix infiltrated with DCPD and formed a hardened continuous network within

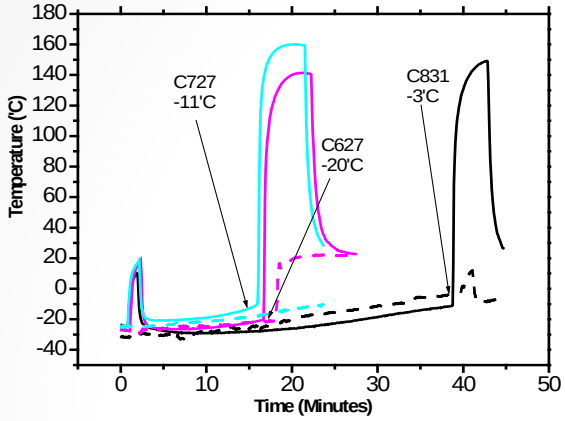
- **Capable of infiltrating into the voids, and Reduction of continuous and interconnected voids**
- **Reinforce the continuous phase of the aggregate composites**

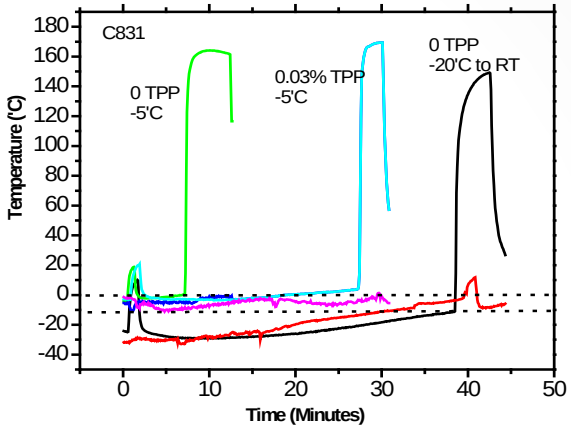
Curing Profile



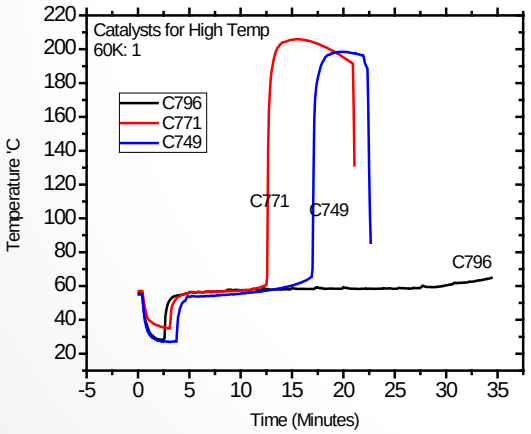
Curing profiles were recorded by measuring temperature profile on the surface and at the interface of the porous mix and dense mix.

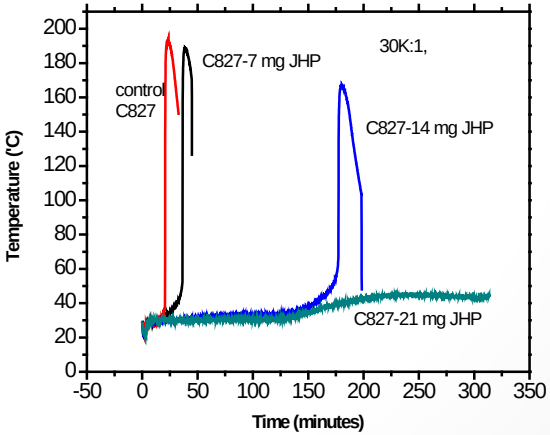
Catalyst Development





New catalysts C727, C627, C831 with inhibitor A, formulated for cold weather application

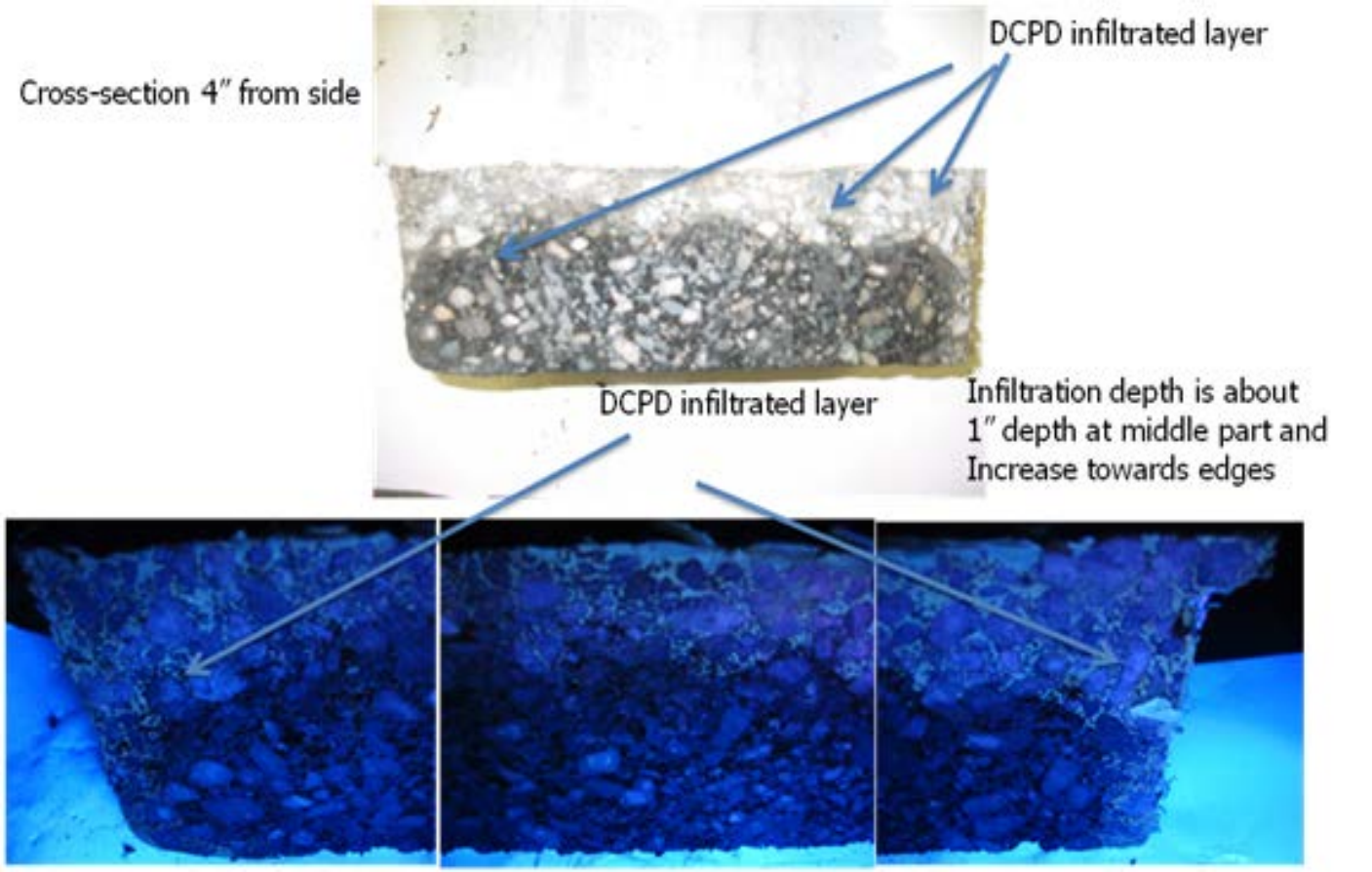




New catalysts C771 and C749 with inhibitor B, formulated for hot weather application

The selection of catalysts and inhibitors for different locations and seasonal requirements

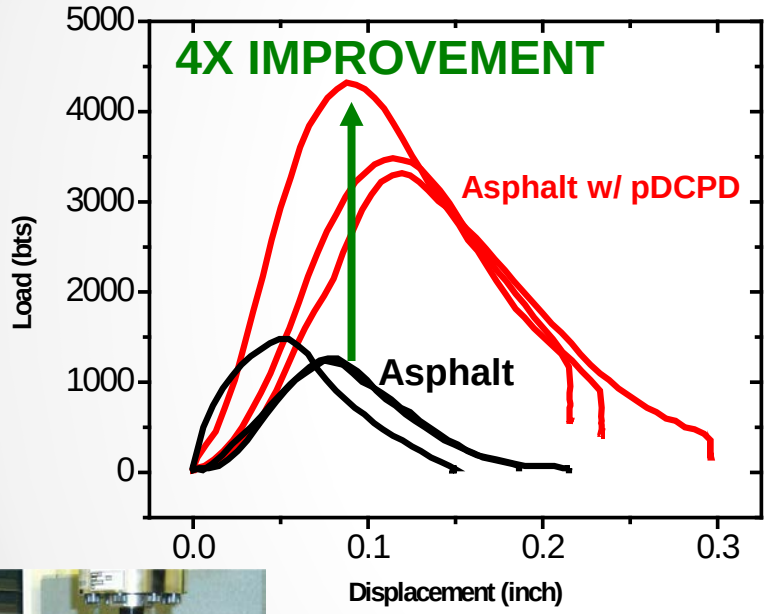
Example: Infiltration Profile with C827 Catalyst



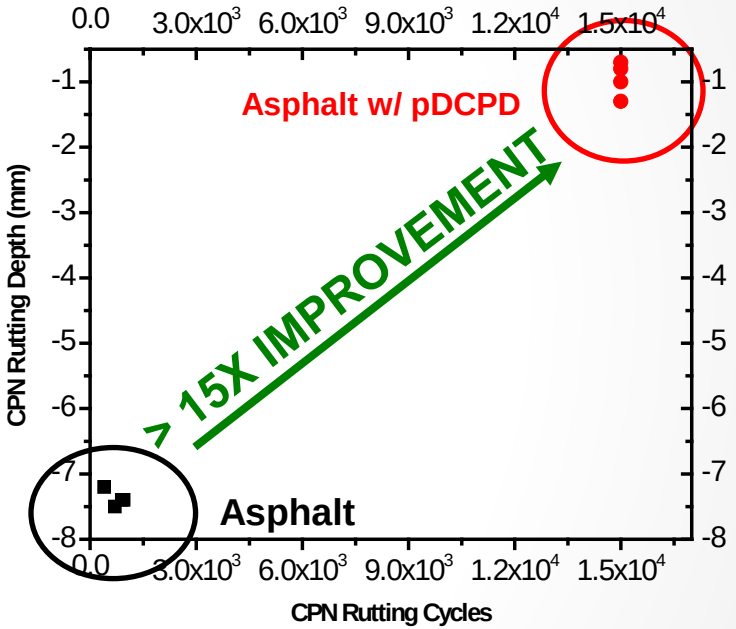
The resin wrapped the hot mix from the top surface and two sides, with deeper penetration along the edges.

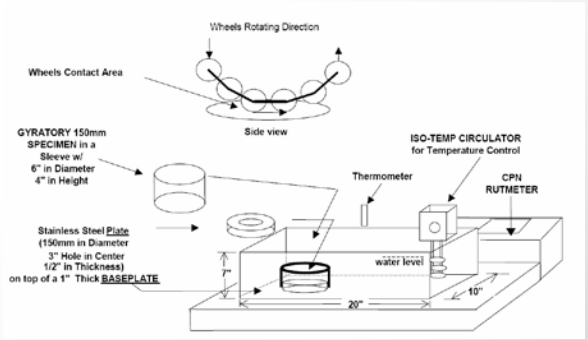
Proof of Concept

TENSILE STRENGTH



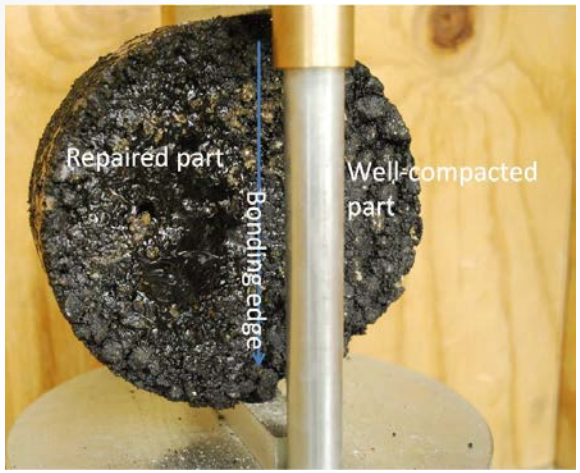
RUTTING RESISTANCE



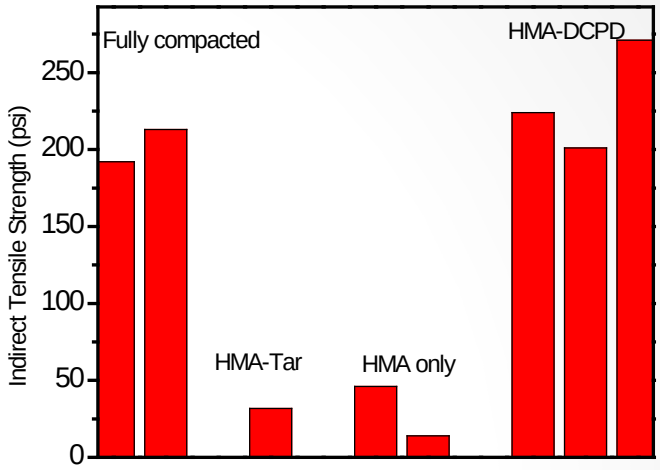


RESULT: Stronger and longer life

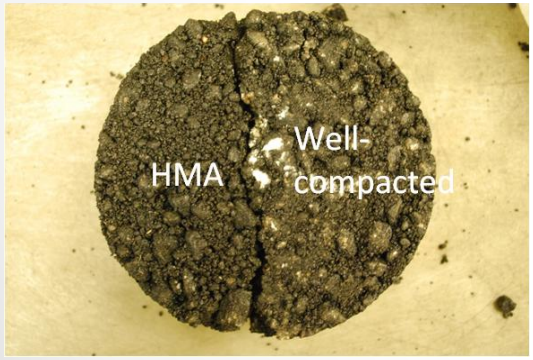
Edge Bonding Improvement



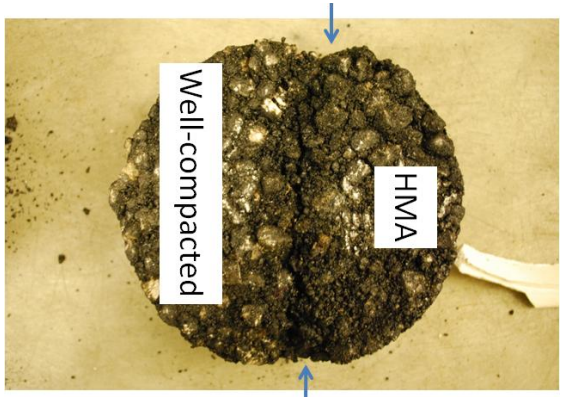
Indirect tensile test for interface bonding



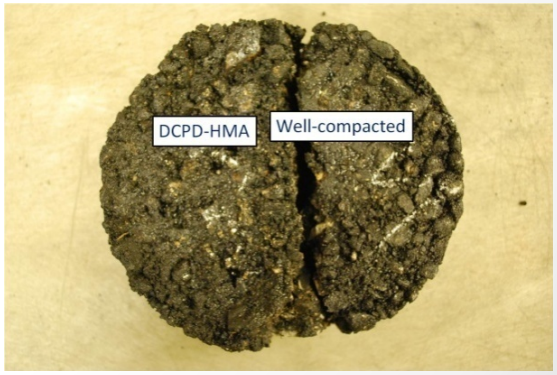
Indirect tensile strength



HMA (Hot Mix Asphalt) only



HMA-Tar



HMA-DCPD

The resin strongly reinforced the interface bond between the repair materials and the road, compared with standard hot-mix asphalt and tar.

Deployment Equipment

Resin dispensing system for pothole repair, can mounted on flatbed, pickup or dump truck

Dispensing wand with mixing head for easy deployment and cleaning

Competitive Advantage

Cold-Mix Material	Curing Time (min)	Shelf Life (yr)	Est. Fix Lifespan (yr)	Unit Size	Price Per Pothole	Yearly Pothole Cost
Standard Asphalt	3 days	15 Days	0.25	2200lb	$2.01	$8.02
DuraPave	<60	1	1	60lb	$28.40	$28.40
EZ Street	<60	1	1	50lb	$9.13	$9.13
Instant Road Repair	<60	1	1	50lb	$15.72	$15.72
Perma-Patch	<60	>1	1	60lb	$10.99	$10.99
QPR-2000	<60	1	1	50lb	$5.48	$5.48
UPM	<60	1	1	50lb	$12.7	$12.7
BruinPatch, Inc.	<20	>2	4	2lb	$16.07	$4.01

Company Status: BruinPatch, Inc.

- **Company Formation**
  - Incorporated 6/5/13 as S-Corp
  - Initial capitalization from five BruinPatch founders

- **Intellectual Property**
  - UCLA holds exclusive rights to use catalyst for pothole applications
  - UCLA filed application patents in the US and China for Pothole Repair
  - Materia, Inc. holds a patent on the catalyst used in the end-solution

- **Ongoing Investment discussions**

- **5 Year Projected IRR is 29%**

Development and Funding

- **Undergoing field trials**
  - Currently in US
  - Potential expansion to China and Taiwan
- **NIST sponsored $3.1 million, cost-shared development**
  - Established basic technology over a wide range of conditions
  - Key to retiring product and deployment risk
  - Partnered with City of LA (GSD) for testing, and Materia, Inc. as supplier
  - Patents pending in US and China
- **Technology expansion:**
  - Quick structures for ballistic and blast protection with on-site materials (Partner: Sully Power, funding: US Army)
  - Smart roads and sidewalks with load-sensing capability (Partners: Group HI, BSG; funding: pending with several agencies)
  - Resin infusion concept is expandable to concrete surfacing/ protection

Summary

BruinPatch, Inc.

- ✓ **Meets a major unsatisfied need in improving national and municipal infrastructure**
- ✓ **Saves customers millions in not continually replacing potholes**
- ✓ **Helps environment by reducing materials, trucks, and processing on roads**

We are seeking investors who want to be a part of improving our infrastructure

Acknowledgement

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We'd also like to thank Nelson Gibson and Gang Zhang at the Turner-Fairbank Highway Research Center for the CT inspection.