



Cool Roadways Partnership

1500 Decatur St NW Washington DC 20011 • Email: Kurt@globalcoolcities.org • Phone: 202-550-5852

Cool Roadway Solutions - Request for Information Response Form

December 8, 2020

Please provide the requested information and feedback below. Responses should include input on the timeline to develop an innovative solution that meets the requested criteria and that can be integrated into roadway pavement operations within ten years. Please add your responses below each question and send the completed form in a Word file to Maria Koetter – maria@globalcoolcities.org.

Contact Name:	Chris Evers
Company:	Pavement Technology Inc. (PTI)
Email:	cevers@pavetechinc.com
Phone:	727-638-1699
Solution/Product Name:	PlusTi™

Describe how the proposed solution addresses the following (250 word maximum for each response):

1. What is the expected timeline to develop and commercialize the solution if it is not currently available?

PlusTi™ is commercially available today. To date Pavement Technology Inc. has already successfully applied PlusTi™ on projects for over a dozen agencies across the Country. Development of the technology began in 2016 with pilot projects spanning 2017 to 2019 and project implementation beginning in 2020. Ongoing research continues to take place at the Texas Transportation Institute located at Texas A&M. PTI is in the early stages of rolling out the technology and is prioritizing GCCA CRP participants as part of the roll out. The technology has been applied in:

A select list of PlusTi™ completed to date:

- ***Cincinnati, OH***
- ***Summit County, OH (Akron)***
- ***Austin, TX (TXDOT)***
- ***Raleigh, NC***
- ***Cary, NC***
- ***Charlotte, NC***
- ***Greenville, SC***
- ***Orlando, FL***
- ***Orlando International Airport (MCO)***
- ***Bartow, FL (FDOT Test Section)***



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- *Charlotte County, FL*
- *Delray Beach, FL (South Florida)*
- *St. Petersburg, FL (LEED project) under construction*

PTI is capable of rapidly scaling production and application capabilities to meet significant future demand over the next few years. We are committed to working with our Cool Roadways Partners at the Agency level to begin the process of evaluating and deploying the *PlusTi™* technology.

2. What surface and air temperature reductions resulting from the roadwaysolution, daytime and nighttime, have you identified?

Ongoing pilot projects are currently tracking UHI metrics including Solar Reflectance Index, Emissivity, Albedo, and pavement temperature changes. One of the primary benefits PTI expects to gain from being in the Cool Roadways Partnership is more field analysis of the positive effects of increasing SRI through more diverse geographically located projects using all of the aforementioned metrics. PTI has demonstrated consistent ability to increase SRI by between 350% to 450% (see attached case studies). Many recently resurfaced asphalt roads will have an SRI reading of between 5 and 10, *PlusTi™* targets an SRI value of 40 and consistently delivers results in the high 30's and low 40's on our projects on either asphalt or concrete pavements. Current pilot projects focus on meeting existing USGBC LEED criteria making this solution easily deployable immediately without extensive design standard or procurement procedure changes which might delay deployment. This enables the use of a standardized measurement that levels the playing field rather than focus on albedo which some technologies may not effect (*PlusTi™* does not affect albedo) to get positive results. Measuring SRI either in the field or lab is quick and doesn't require expensive instrumentation to gather. Fitting into an existing and widely accepted standard to measure UHI mitigation performance will enable more rapid deployment of viable solutions. Some academic estimates based on the dramatically higher SRI values the *PlusTi™* technology produces and assuming scale deployment, range air temperature improvement by 5-7 degrees.

3. How simply can the solution be integrated into existing roadway management and maintenance operations?

In a few words, *PlusTi™* can be integrated into any pavement preservation



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program quite easily. Utilizing proven pavement penetrating technology to deliver vital chemistries into a pavement matrix is a process thousands of Public Works Agencies have been deploying for over 50 years. The topical spray application offers cost and efficiency advantages for integrating highly specialized, plant-mixed molecular pavement preservation materials into existing pavement infrastructure. Application can occur as a part of new construction, rehabilitation projects or as a part of existing preventative maintenance operations. Significant cost advantage occurs from focusing on the top layers of roadways rather than incorporating expensive materials throughout pavement layers not impacted and hence not reacted by sunlight. The fact that the technology essentially piggybacks a proven preservation strategy enables agencies to deploy at scale which is critical in the fight on UHI. Without the ability to scale, cities face an uphill battle to significantly impact UHI. In addition, the added benefit of extended roadway life cycles at an economically feasible cost make *PlusTi™* an attractive solution for agencies impacted by tight budgets. For hundreds of agencies around the country who already use asphalt rejuvenation in their preservation programs, integration comes even easier as a simple shift to the photocatalytic capable application, *PlusTi™*.



Cary, North Carolina

4. What is the global warming potential associated with manufacturing the roadway solution in production and use phase?

Production of the *PlusTi™* technology does not appreciably contribute to global warming as it does not use a carbon intensive manufacturing process. Additionally one key benefit of this technology is the ability to leverage well-known photocatalytic science, previously unavailable for the roadway



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microenvironment, to directly reduce NOx emissions by 30-50% or greater at the point source, providing a previously unthinkable direct positive impact on urban air quality without having to alter our transportation infrastructure or impact consumer (free) choices. Retrofitting existing infrastructure to become part of the solution not the source of air pollution would be a monumental achievement. Mobile source emissions are the number one contributor to photochemical smog. NOx emissions carry a 298X GWP when compared to CO2. One mile of *PlusTi™* treated pavement is the approximate equivalent of planting a 20 acre forest. The other key benefit, of course, is the ability to meaningfully reduce the heat absorption of the pavement which promotes both tremendous community-wide health benefits; lowers electric utility (economic) stress; and extends pavement life/carbon footprint by reducing oxidative damage. Standard pavement preservation with asphalt rejuvenation already carries a 500 to 1 reduction in carbon emissions. When evaluated in total, the *PlusTi™* technology stands alone in roadway processes capable of being “carbon negative”.

5. Add any additional information for the proposed solution. Attach photos, videos or links to materials demonstrating application, installed condition, and relevant characteristics of the solution such as product material safety data sheets – **See Attached**



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Cost and Installation (50 word maximum for each response):

1. Can the solution be purchased and installed by in-house department staff (i.e. does not require a licensed installer):

No, the process is installed by qualified contractors with specialized equipment to ensure quality. A network of qualified applicators will be established throughout North America over the next several years.

2. What is the cost per square yard for material if installed by contractor: \$/SY

The installed cost is dependent on geography and project size, but ranges are \$2-\$2.50 per square yard (concrete application is \$3-\$3.50 per square yard) making *PlusTi™* a cost-effective solution. Existing funding from the FHWA Congestion Mitigation & Air Quality Improvement Program (CMAQ) can be accessed by Agencies that currently qualify.

3. What is the average installation rate: SY/Day?

The average production rate for *PlusTi™* depends on the surface type (asphalt vs. concrete) and the functional classification of the roadway (local, collector, arterial, highway) but can range from 20,000 to 40,000 S.Y. typically per day.

Use Cases (250 word maximum for each response)

1. What are the appropriate use cases for the solution (e.g., pavement type, age, condition, climate)? Please provide appropriate case studies, testing, and/or supporting research.

PTI and its manufacturing arm- D&D Emulsions, Inc. (D&D) are “turn-key” developers, manufacturers, distributors, and applicators of these promising “cool” roadway solutions. We have spent the last five years developing and perfecting this viable technology capable of retrofitting existing transportation infrastructure to become pollution-reducing and solar reflective. This solution has focused on asphalt and concrete roadways, runways and parking lots by harnessing the long-known photocatalytic properties of titanium dioxide (TiO₂) nanoparticles. PTI has continued the development of solutions for both asphalt and concrete of any functional classification. Agencies can immediately deploy, at scale, on pavements of varying age rated from 80 PCI and higher thereby preserving pavements that are in good condition. *PlusTi™* is naturally beneficial for pavements thus bypassing the traditional challenges facing new environmental technologies. The very same challenges that the



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GCCA correctly identifies and lists in the RFI are mostly solved by *PlusTi™* products. Use of this process is beneficial and economically feasible regardless of pavement owner and jurisdiction. We anticipate wide-scale adoption from DOT's, cities, counties, airports, private developers and any other environmentally conscious private businesses with pavement infrastructure to maintain.

Moreover, PTI has developed a process which achieves each of the stated deliverables with a technology that performs far better and much more efficiently than any existing roadway solution in the marketplace while utilizing existing US Green Building Council and Institute for Sustainable Infrastructure standards. Attached are a number of case studies and research for photocatalytic pavement treatments.

2. What are the safety, slipperiness, and friction characteristics (e.g. typical Surface Coefficient of Friction)?

***PlusTi™* is a very safe material (SDS attached) considered non-toxic. The photocatalytic TiO₂ used in *PlusTi™* technology is also used in household items such as paints and even an inactive ingredient in some toothpastes and sunscreens. Friction characteristics are not adversely impacted, current pilot projects are already showing results indicating safety and friction characteristics are actually improved with this solution due to the fact that TiO₂ is a material with super hydrophilic properties.**

3. What is the curing time including how quickly the road can open to traffic after installation given average temperatures, partly sunny, and non-humid conditions? How does this compare to existing relevant products?

Utilizing this technology typically enables traffic to be returned to the treated pavement in 60 minutes or less and requires very minimal disruption when compared to other treatments requiring longer curing times. Application typically only requires single lane closure. Emergency vehicles are always allowed access. The material is a penetrant and is not damaged should a vehicle need access during this curing period. It also will not damage citizens' vehicles or driveways should the resident prematurely drive on the treated pavement.



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Orlando International Airport, FedEx Ramp

4. Is it sensitive to placement in cool weather, i.e. 50° F and falling?

Yes, the material is emulsified with water and as such application recommendations are for the temperature to be 50° F and rising to ensure adequate penetration. Freezing conditions at time of application or shortly after application are to be avoided.

5. Is it sensitive to placement in high humidity or damp conditions?

Yes. It is recommended that application take place on dry pavements. High humidity can affect how quickly the treated pavement can be returned to traffic.

6. How long does this treatment typically last under average traffic conditions in years?
How does this compare to similar products?

PTI is currently monitoring real time long term aging results to determine longevity. From our current long term pilots we anticipate that the treatment will provide results for between 5 to 7 years before requiring additional treatment. The material is a penetrant and becomes an integral part of the roadway with no material on the surface to wear away. The performance specification addresses the quality control monitoring of the product at the time of application. To maximize the increase in SRI and NOx reduction the specification (attached) calls for minimum concentration of TiO2 in parts per million at or near the surface of the pavement.

7. Can it be re-applied over itself for renewal?



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Yes. Roadways treated with this material can be retreated after the initial application. Depending on long term testing data analysis, retreatment would be recommended 5 to 7 years after initial treatment for best results.

8. Is it recommended for heavy traffic conditions like urban arterials?

Yes. PTI has multiple products capable of being applied in all traffic conditions. Pavement materials type, roadway functional classification and traffic levels are taken into consideration pre-project to ensure proper materials selection.

9. Are standard MUTCD compliant white and yellow markings clearly visible?

Yes. One of the distinct advantages of using this technology, it does not obliterate the existing pavement markings nor change the retro-reflectivity of the pavement markings. Furthermore, the integrity of the pavements natural color is maintained and there are no visual distractions for motorists. (pictures of Orlando, Florida below)



Westmoreland Dr. - During, Orlando



Westmoreland Dr. – 1 month after