CITY OF PLANTATION

AGREEMENT

Between

THE CITY OF PLANTATION

And

PAVEMENT TECHNOLOGY, INC

For

ASPHALT REJUVENATION PROJECT- TERM CONTRACT

AGREEMENT NO. 072-22

AGREEMENT

Agreement
By and Between
City of Plantation
&
Pavement Technology, Inc.
for
Asphalt Rejuvenation Project – Term Contract
Agreement No. 072-22

1. PARTIES AND DATE.

This Agreement ("Agreement") is made and entered into this 17 day of April, 2023 by and between the CITY OF PLANTATION, a Florida Municipal Corporation with its principal place of business at 400 NW 73 AVENUE PLANTATION, FL 33317, ("City") and PAVEMENT TECHNOLOGY, INC, a Ohio Corporation with its principal place of business at 24144 Detroit Road, Westlake, OH 44145 ("Contractor"). City and Contractor are sometimes individually referred to as "Party" and collectively as "Parties" in this Agreement.

2. RECITALS.

2.1 Contractor.

The Contractor shall timely complete the required services to the City as set forth in the terms and conditions in this Agreement. The Contractor represents that it is experienced in providing and furnishing all labor, material, and equipment necessary to perform all operations for the application of an asphalt-rejuvenating agent to asphaltic concrete surface courses to public clients, is licensed and authorized to do business in the State of Florida, and is familiar with the requirements of the City.

2.2 Service

The City desires to engage the Contractor to provide and furnish all labor, material, and equipment necessary to perform all operations for the application of an asphalt-rejuvenating agent to asphaltic concrete surface courses. The Contractor represents and warrants that it is able to satisfactorily provide the service according to the Scope of Services, which are incorporated herein by reference as Exhibit "A".

The following Exhibits referenced herein are hereby incorporated into this Agreement- **Exhibit "A"** Scope of Services, **Exhibit "B"** documentation required by the City submitted by the Contractor during the solicitation period prior to Notice of Award, **Exhibit "C"** Front-End Documents, **Exhibit "D"** Insurance Requirements, **Exhibit "E"** Rates, **Exhibit "F"** General Terms and Conditions, **Exhibit "G"** Addenda.

2.3 Procurement

The City of Plantation electronically advertised an "Invitation to Bid" (ITB) for Asphalt Rejuvenation Project – Term Contract

The City of Plantation received one (1) bid response from Contractors stating they can perform/provide the aforementioned service.

The City of Plantation found Pavement Technology, Inc., to be the lowest responsive, responsible bidder and presented the recommendation of approval to the City Council for execution of an agreement.

AGREEMENT

The City of Plantation City Council approved the execution of an agreement Asphalt Rejuvenation Project – Term Contract on Consent Agenda Item No. 8 on March 29, 2023.

3. TERMS.

3.1 Term.

A. The initial agreement period shall be for one (1) year, commencing April 17, 2023 and expiring on April 16th, 2024. In addition, the City reserves the right to extend this Agreement for four (4) additional one (1) year renewal periods, provided the Contractor also agrees in writing to extension upon such terms as the City and Contractor agree. Prices shall remain firm and fixed for the initial term of the Agreement.

3.2 Responsibilities of Contractor.

A. Payment. Payment for work shall be authorized upon completion of all work specified in "Scope of Services" of this specification. Invoices will be subject to verification and approval by the department requesting the service. Each invoice shall be submitted in increments not greater than thirty (30) days. All invoices are required to be submitted within three (3) months, if invoices are not submitted within three (3) months, the City reserves the right not to pay due to delinquency.

B. Contractor's Compensation. At the completion of Services, the Contractor shall receive a compensation of the prices listed below and further specified in Exhibit C.

Rates:

Description	Per SQ YD Cost
Standard Specification – Reclamite	$1.21/per square yard

Description	Per SQ YD Cost
Bid Alternate #1 (A.R.A.-1 Ti Pollution-Remediating Maltene Asphalt Rejuvenator)	$2.49/per square yard

C. Control and Payment of Subordinates; Independent Contractor. The Services shall be performed by Contractor or under its supervision. Contractor shall determine the means, methods and details of performing the Services subject to the requirements of this Agreement. City retains Contractor on an independent contractor basis and not as an employee. Contractor retains the right to perform similar or different services for others during the Term. Any additional personnel performing the Services on behalf of Contractor shall also not be employees of City and shall at all times be under the Contractor's exclusive direction and control. Contractor shall pay all wages, salaries, and other amounts due such personnel in connection with their performance of Services and as required by law. Contractor shall be responsible for all reports and obligations respecting such additional personnel, including, but not limited to: social security taxes, income tax withholding, unemployment insurance, disability insurance, and workers' compensation insurance.

D. Control and Payment of Subcontractors. All work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier, which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of this Agreement for the benefit of the City. The Contractor shall be responsible for the payments to any Subcontractors, including any professional fees, or Suppliers and additional costs within 14 calendar days of City's payment to Contractor. The City shall not be responsible for any payments to Subcontractors or Suppliers. The City shall not be billed directly or indirectly for any professional fees or additional costs of the Subcontractors for the Project.

E. Schedule of Services. Contractor shall perform the Services expeditiously, within the Term, and in accordance with the Scope of Services set forth in Exhibit "A". Contractor represents that it has the professional and technical personnel required to perform the Services in conformance with such conditions. In order to facilitate the Contractor's conformance with the Schedule, City shall respond to Contractor's submittals in a timely manner. Upon request of City, Contractor shall provide a more detailed schedule of anticipated performance to meet the Scope of Services.

F. Conformance to Applicable Requirements. All work prepared by Contractor shall be subject to the approval of City.

G. Substitution of Key Personnel. Contractor has represented to City that certain key personnel will perform and coordinate the Services. Should one or more of such personnel become unavailable, Contractor may substitute other personnel of at least equal competence upon written approval of City. In the event that City and Contractor cannot agree as to the substitution of key personnel, City shall be entitled to terminate this Agreement for cause. As discussed below, any personnel who fail or refuse to perform the Services in a manner acceptable to the City, or who are determined by the City to be uncooperative, incompetent, a threat to the adequate or timely completion of the Project or a threat to the safety of persons or property, shall be promptly removed from the Project by the Contractor at the request of the City.

H. Coordination of Services. Contractor agrees to work closely with City staff in the performance of Services and shall be available to City's staff, Contractors, and other staff at all reasonable times.

I. Standard of Care; Performance of Employees. Contractor shall perform all Services in a skillful and competent manner, consistent with the standards generally recognized as being employed by professionals in the same discipline in the State of Florida. Contractor represents and warrants that it is skilled in the professional calling necessary to perform the Services. Contractor represents and warrants that all employees and Subcontractors shall have sufficient skill and experience to perform the Services assigned to them. Finally, Contractor represents and warrants that it, its employees, and Subcontractors have all licenses, permits, qualifications, and approvals of whatever nature that are legally required to perform the Services and that such licenses and approvals shall be maintained throughout the Term. As provided for in the indemnification provisions of this Agreement, Contractor shall perform, at its own cost and expense and without reimbursement from the City, any services necessary to correct errors or omissions which are caused by the Contractor's failure to comply with the standard of care provided for herein. Any employee of the Contractor or its Subcontractor who is determined by the City to be uncooperative, incompetent, a threat to the adequate or timely completion of the Project, a threat to the safety of persons or property, or any employee who fails or refuses to perform the Services in a manner acceptable to the City, shall be promptly removed from the Project by the

Contractor and shall not be re-employed to perform any of the Services or to work on the Project.

J. Excusable Delays. Neither Party shall be responsible for delays or lack of performance resulting from acts beyond the reasonable control of the Party or Parties. Such acts shall include, but not be limited to, acts of God, fire, strikes, pandemics, compliance with laws or regulations, riots, acts of war, or any other conditions beyond the reasonable control of a Party. Notwithstanding the foregoing, the City shall have no obligation to compensate Contractor for any Service that Contractor fails to perform, or otherwise has not performed.

K. Laws and Regulations; Employee/Labor Certifications. Contractor shall keep itself fully informed of and in compliance with all local, state and federal laws, rules and regulations in any manner affecting the performance of the Project or the Services, and shall give all notices required by law. Contractor warrants that it shall perform the Services in compliance with all applicable Federal and Florida employment laws, including, but not limited to, those laws related to minimum hours and wages; occupational health and safety; fair employment and employment practices; workers' compensation insurance and safety in employment; and all other Federal, State and local laws and ordinances applicable to the services required under this Agreement. Contractor shall indemnify and hold harmless City from and against all claims, demands, payments, suits, actions, proceedings, and judgments of every nature and description including attorneys' fees and costs, presented, brought, or recovered against City for, or on account of any liability under any of the above-mentioned laws, which may be incurred by reason of Contractor's performance under this Agreement. Contractor shall be liable for all violations of such laws and regulations in connection with the Services. If the Contractor performs any work knowing it to be contrary to such laws, rules and regulations and without giving written notice to the City, Contractor shall be solely responsible for all costs arising therefrom. Contractor shall defend, indemnify and hold City, its officials, directors, officers, employees, and agents free and harmless, pursuant to the indemnification provisions of this Agreement, from any claim or liability arising out of any failure or alleged failure to comply with such laws, rules or regulations.

i. Equal Opportunity Employment. Contractor represents and warrants that it is an equal opportunity employer and it shall not discriminate against any Subcontractor, employee or applicant for employment because of race, religion, color, national origin, handicap, ancestry, sex or age. Such non-discrimination shall include, but not be limited to, all activities related to initial employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination.

L. Insurance.

i. Time for Compliance. Contractor shall not commence Services until it has provided evidence satisfactory to the City that it has secured all insurance pursuant to Exhibit "D". In addition, Contractor shall not allow any Subcontractor to commence work on any subcontract until it has provided evidence satisfactory to the City that the Subcontractor has secured all insurance pursuant to Exhibit "D".

M. Safety. Contractor shall execute and maintain its work so as to avoid injury or damage to any person or property. In carrying out its Services, the Contractor shall at all times be in compliance with all applicable local, state and federal laws, rules and regulations, and shall exercise all necessary precautions for the safety of employees appropriate to the nature of the work and the conditions under which the work is to be performed. Safety precautions as applicable shall include, but shall not be limited to: (A) adequate life protection and lifesaving equipment and

procedures; (B) instructions in accident prevention for all employees and Subcontractors, such as safe walkways, scaffolds, fall protection ladders, bridges, gang planks, confined space procedures, trenching and shoring, equipment and other safety devices, equipment and wearing apparel as are necessary or lawfully required to prevent accidents or injuries; and (C) adequate facilities for the proper inspection and maintenance of all safety measures.

N. Accounting Records. Contractor shall maintain complete and accurate records with respect to all costs and expenses incurred under this Agreement. All such records shall be clearly identifiable. Contractor shall allow a representative of City during normal business hours to examine, audit, and make transcripts or copies of such records and any other documents created pursuant to this Agreement. Contractor shall allow inspection of all work, data, documents, proceedings, and activities related to this Agreement for a period of 3 years from the date of final payment under this Agreement.

3.3 Termination of Agreement.

A. For Convenience. City may, by written notice to Contractor, terminate the whole or any part of this Agreement at any time and without cause by giving written notice to Contractor of such termination, and specifying the effective date thereof, at least 30 calendar days before the effective date of such termination. Upon termination, Contractor shall be compensated only for those Services which have been adequately rendered to City, and Contractor shall be entitled to no further compensation. Contractor may not terminate this Agreement except for cause. The City may terminate this Agreement for convenience even if Contractor avails itself of the Dispute Resolution process set forth below in subsection 3.6C.

B. For Cause. City may, by written notice to Contractor, terminate the whole or any part of this Agreement at any time and with cause by giving written notice to Contractor of such termination, and specifying the effective date thereof, at least 21 calendar days before the effective date of such termination. The City may, but is not obligated to, provide Contractor with an opportunity to cure any breach prior to the effective date of any termination for cause. The Contractor may not terminate this Agreement except upon a breach by the City, which is not cured upon 21 calendar days notice to City. In case of the Contractor's termination for cause, the Contractor shall be paid for Services satisfactorily provided to such termination date, less any setoffs or adjustments City may claim arising out of the Contractor's breach, the remaining unperformed parts of this Agreement, and for that portion (if any) of the Contractor's performance which is unsatisfactory (the intent being that the Contractor be paid what is just and equitable compensation for the Contractors' performance of Services rendered to the satisfaction of the City). Upon termination, Contractor shall be compensated only for those Services which have been adequately rendered to City, and Contractor shall be entitled to no further compensation. Should the Contractor avail itself of the Dispute Resolution process set forth below in subsection 3.6C, then the City may not terminate this Agreement for Cause until the conclusion of the Dispute Resolution process.

C. Mutual Termination. This Agreement may also be terminated by mutual written agreement at any time and under any terms.

D. Effect of Termination. If this Agreement is terminated as provided herein, City may require Contractor to provide all finished or unfinished Documents and Data and other information of any kind prepared by Contractor in connection with the performance of Services. Contractor shall be required to provide such documents and other information within 21 calendar days of the request.

E. Additional Services. In the event this Agreement is terminated in whole or in part as provided herein, City may procure, upon such terms and in such manner as it may determine appropriate, Services similar to those terminated.

3.4 Ownership of Materials and Confidentiality.

A. Documents & Data; Licensing of Intellectual Property. This Agreement creates a non-exclusive and perpetual license for City to copy, use, modify, reuse, or sublicense any and all copyrights, designs, and other intellectual property embodied in plans, specifications, studies, drawings, estimates, and other documents or works of authorship fixed in any tangible medium of expression, including but not limited to, physical drawings or data in any form, which are prepared or caused to be prepared by Contractor under this Agreement ("Documents & Data"). All Documents & Data shall be and remains the property of City, and shall not be used in whole or in substantial part by Contractor on other projects without the City's express written permission. Within 21 calendar days following the completion, suspension, abandonment or termination of this Agreement, Contractor shall provide to City reproducible copies of all Documents & Data, in a form and amount required by City. City reserves the right to select the method of document reproduction and to establish where the reproduction will be accomplished. The reproduction expense shall be borne by City at the actual cost of duplication. In the event of a dispute regarding the amount of compensation to which the Contractor is entitled under the termination provisions of this Agreement, Contractor shall provide all Documents & Data to City upon payment of the undisputed amount. Contractor shall have no right to retain or fail to provide to City any such documents pending resolution of the dispute. In addition, Contractor shall retain copies of all Documents & Data on file for a minimum of 15 years following completion of the Project, and shall make copies available to City upon the payment of actual reasonable duplication costs. Before destroying the Documents & Data following this retention period, Contractor shall notify City and provide City with the opportunity to obtain the Documents & Data.

B. SubContractors. Contractor shall require all SubContractors to agree in writing that City is granted a non-exclusive and perpetual license for any Documents & Data the SubContractor prepares under this Agreement. Contractor represents and warrants that Contractor has the legal right to license any and all Documents & Data. Contractor makes no such representation and warranty in regard to Documents & Data which were prepared by design professionals other than Contractor or its SubContractors, or those provided to Contractor by the City.

C. Right to Use. City shall not be limited in any way in its use or reuse of the Documents and Data or any part of them at any time for purposes of this Project or another project, provided that any such use not within the purposes intended by this Agreement or on a project other than this Project without employing the services of Contractor shall be at City's sole risk. If City uses or reuses the Documents & Data on any project other than this Project, it shall remove the Contractor's seal from the Documents & Data. Contractor shall be responsible and liable for its Documents & Data, pursuant to the terms of this Agreement, only with respect to the condition of the Documents & Data at the time they are provided to the City upon completion, suspension, abandonment or termination. Contractor shall not be responsible or liable for any revisions to the Documents & Data made by any party other than Contractor, a party for whom the Contractor is legally responsible or liable, or anyone approved by the Contractor.

D. Indemnification. Contractor shall defend, indemnify and hold the City, its, officials, officers, employees, volunteers, and agents free and harmless, pursuant to the

indemnification provisions of this Agreement, for any alleged infringement of any patent, copyright, trade secret, trade name, trademark, or any other proprietary right of any person or entity in consequence of the use on the Project by City the Documents & Data, including any method, process, product, or concept specified or depicted. This subparagraph shall survive termination or expiration of this Agreement.

E. Confidentiality. To the maximum extent permitted by law, all Documents & Data, either created by or provided to Contractor in connection with the performance of this Agreement, shall be held confidential by Contractor. All Documents & Data shall not, without the prior written consent of City, be used or reproduced by Contractor for any purposes other than the performance of the Services. To the maximum extent permitted by law, Contractor shall not disclose, cause or facilitate the disclosure of the Documents & Data to any person or entity not connected with the performance of the Services or the Project. Nothing furnished to Contractor that is otherwise known to Contractor or is generally known, or has become known, to the related industry shall be deemed confidential. Contractor shall not use City's name or insignia, photographs of the Project, or any publicity pertaining to the Services or the Project in any magazine, trade paper, newspaper, television or radio production or other similar medium without the prior written consent of City.

3.5 General Provisions.

A. Delivery of Notices. All notices permitted or required under this Agreement shall be given to the respective Parties at the following address, or at such other address (physical or electronic) as the respective Parties may provide in writing for this purpose:

Contractor:

Pavement Technology, Inc
Colin M. Durante, President
24144 Detroit Road
Westgate, OH 44145

City:

Mayor Nick Sortal
400 NW 73rd Avenue
Plantation, FL 33317

With copies to:
Jason Nunemaker
Chief Administrative Officer
400 NW 73rd Avenue
Plantation, FL 33317

Kerry L. Ezrol, City Attorney
Goren Cherof, Doody & Ezrol, P.A.
3099 E Commercial Blvd., Ste. 200
Fort Lauderdale, FL 33308

Such notice shall be deemed made when personally delivered, or, if mailed, 48 hours after deposit in the U.S. Mail, first class postage prepaid and addressed to the Party at its applicable address, or delivered to such electronic mail address provided by the Parties for service of notices under this subsection when receipt is acknowledged by electronic written response by the receiving Party.

B. Indemnification.

i. Scope of Indemnity. To the fullest extent permitted by law, Contractor shall defend, indemnify and hold the City, its officials, officers, employees, volunteers, and agents free and harmless from any and all claims, demands, causes of action, costs, expenses, liability, loss, damage or injury of any kind, in law or equity, to property or persons, including wrongful death, in any manner arising out of, pertaining to, or incident to any alleged acts, errors or omissions of Contractor, its officials, officers, employees, subcontractors, contractors, or agents in connection with the performance of the Contractor's services, the Project or this Agreement, including without limitation the payment of all consequential damages, expert witness fees and attorney's fees and other related costs and expenses, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of the Contractor and other persons employed or utilized by the Contractor in the performance of this Agreement.

ii. Additional Indemnity Obligations. Payment of any amount due pursuant to the foregoing indemnity shall, after receipt of written notice by Contractor from the City that such amount is due, be made by Contractor prior to the City being required to pay same, or in the alternative, the City, at the City's option, may make payment of an amount so due and Contractor shall promptly reimburse the City for same, together with interest thereon at the statutory rate from the date of receipt by Contractor of written notice from the City that such payment is due. Contractor agrees, at Contractor's expense, after written notice from the City, to defend any action against the City that falls within the scope of this indemnity, or the City, at the City's option, may elect not to tender such defense and may elect instead to secure its own attorney to defend any such action and the reasonable costs and expenses of such attorney incurred in defending such action shall be payable by Contractor. Additionally, if Contractor, after receipt of written notices from the City, fails to make any payment due hereunder to the City, Contractor shall pay any reasonable attorney's fees or costs incurred by the City in securing any such payment from Contractor.

iii. Nothing contained herein is intended nor shall it be construed to waive the City's rights and immunities under the common law or Florida Statute §768.28 as amended from time to time. This obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist in the City's favor. Notwithstanding any other provision of this Agreement to which it is applicable, City shall not be liable or responsible to Contractor beyond the monetary limits and amounts specified in Ch. 768.28, Fla. Stat., regardless of whether said liability be based in tort, contract, indemnity or otherwise; and in no event shall City be liable to Contractor for punitive or exemplary damages or for lost profits or consequential damages.

iv. This paragraph shall survive termination or expiration of this Agreement.

C. Dispute Resolution

i. In the event that any dispute between the City and the Contractor concerning questions or issues arising under this Agreement that have not been resolved, a request for dispute resolution shall be submitted by the Contractor to the City for determination. Request for such determination shall be made in writing. The City's decision may be reached in accordance with assistance, as it may deem reasonably necessary or desirable. The City's decision shall be rendered in writing no more than 30 calendar days after receipt of a fully documented (to the extent that such documents are within the control of the Contractor) request for a determination. The decision shall be conclusive, final, and binding on all Parties, unless the Contractor shall seek a judicial determination in accordance with the provisions set forth below in subsection 3.6D.

ii. No later than 10 calendar Days after the Contractor's receipt of the City's determination, the Contractor shall respond to the City in writing, either accepting the determination or stating the Contractor's factual or legal objection to the determination. If the Contractor's response is an objection, the City shall respond in writing to the objection within 10 calendar days after receipt. No further response by either Party shall be required. Thereafter, the Contractor may seek a judicial determination of the dispute. In the event that the Contractor intends to seek judicial determination of a matter decided by the City, the Contractor shall notify the City of its intent to do so within 10 calendar days of the City's final decision.

iii. If required by City, the Contractor shall continue to perform the Services required under this Agreement during this resolution period, including any judicial resolution. The City's written determination shall be complied with pending final resolution, including judicial, of the dispute. If the Contractor complies with the City's written determination, the City shall continue to perform under this Agreement and make all payments due (other than those or the portions of payments in dispute, if any) during the resolution period. This payment provision shall not apply in the event that the Contractor fails to submit a dispute to the City as required by this subsection. The continued performance of this Agreement by either Party shall not constitute an admission as to any factual or legal position in connection with the dispute, or a waiver of its rights under this Agreement or at Law.

D. Governing Law; Judicial Review; Venue. This Agreement shall be governed by the laws of the State of Florida and venue shall be in Broward County without regard to its conflicts of law. The Parties hereby agree that in the event of any litigation between them, such proceeding shall be brought exclusively in the courts of the State of Florida, County of Broward or the Federal District Court with subject matter jurisdiction and encompassing the County of Broward, Florida. Each Party hereby irrevocably consents and submits to the jurisdiction of, and venue in, the aforementioned courts, and further waives any claim that a proceeding brought therein has been brought in an inconvenient forum. To the extent not prohibited by applicable law that cannot be waived, the City and Contractor hereby waive, and covenant that they will not assert (whether as plaintiff, defendant or otherwise), any right to trial by jury in any action arising in whole or in part under or in connection with this Agreement, whether now existing or hereafter arising, and whether sounding in contract, tort or otherwise.

E. Time of Essence. Time is of the essence for each and every provision of this Agreement.

F. City's Right to Employ Other Contractors. City reserves right employ other contractors in connection with this Project. Successors and Assigns.

G. Successors and Assigns, This Agreement shall be binding on the successors and assigns of the Parties.

H. Assignment or Transfer. Contractor shall not assign, hypothecate, or transfer, either directly or by operation of law, this Agreement or any interest herein without the prior written consent of the City. Any attempt to do so shall be null and void, and any assignees, hypothecates or transferees shall acquire no right or interest by reason of such attempted assignment, hypothecation or transfer.

I. Construction; References; Captions. Since the Parties or their agents have participated fully in the preparation of this Agreement, the language of this Agreement shall be construed simply, according to its fair meaning, and not strictly for or against any Party. Any term referencing time, days or period for performance shall be deemed calendar days and not work days. All references to Contractor include all personnel, employees, agents, and SubContractors of Contractor, except as otherwise specified in this Agreement. The captions of the various articles and paragraphs are for convenience and ease of reference only, and do not define, limit, augment, or describe the scope, content or intent of this Agreement.

J. Amendment; Modification. No supplement, modification or amendment of this Agreement shall be binding unless executed in writing and signed by both Parties.

K. Waiver. No waiver of any default shall constitute a waiver of any other default or breach, whether of the same or other covenant or condition. No waiver, benefit, privilege, or service voluntarily given or performed by a Party shall give the other Party any contractual rights by custom, estoppel or otherwise.

L. No Third-Party Beneficiaries. Except to the extent expressly provided for in this subsection, there are no intended third-party beneficiaries of any right or obligation assumed by the Parties. The City has three dependent districts (Plantation Midtown Development District, Plantation Gateway, and the City of Plantation Community Redevelopment Agency) hereinafter "Districts", all of which have the power to execute contracts, and all of which are served by City personnel for the purpose of Administration. Such Districts shall be intended third Party beneficiaries and shall be able to enforce the terms hereof for any Serves provided on behalf of the Districts.

M. Invalidity; Severability. If any portion of this Agreement is declared invalid, illegal, or otherwise unenforceable by a court of competent jurisdiction, the remaining provisions shall continue in full force and effect.

N. Prohibited Interests. The Contractor warrants and represents that no elected official, officer, agent or employee of the City has a financial interest directly or indirectly in this Agreement or the compensation to be paid under it, and further, that no City employee who acts in the City as a "purchasing agent" as defined by §112.312(20), Florida Statutes, as amended, nor any elected or appointed officer of the City, nor any spouse or child of such purchasing agent employee or elected or appointed officer, is a partner, officer, director, or proprietor of the Contractors, and further, that no such City employee purchasing agent, City elected or appointed officer, or the spouse or child of any of them, alone or in combination, has a material interest in the Contractors. Material interest means direct or indirect ownership of more than Five Percent (5%) of the total assets or capital stock of the Contractors.

O. Conflicts of Interest. Contractor covenants that no person under its employ who presently exercises any functions or responsibilities in connection with this Agreement has any personal financial interests, direct or indirect, with City. Contractor further covenants that, in

the performance of this Agreement, no person having such conflicting interest shall be employed, any such interests, on the part of Contractor or its employees, must be disclosed in writing to City. Contractor is aware of the conflict of interest laws of the State of Florida, Chapter 112, Florida Statues, as amended, and agrees that it will fully comply in all respects with the terms of said laws. Contractor warrants that it has not employed or retained any person employed by City to solicit or secure this Agreement and that it has not offered to pay, paid, or agreed to pay, any public official or person employed by City any fee, commission, percentage, brokerage fee or gift of any kind, contingent upon of resulting from the award of this privilege.

P. Convicted Vendor List. Contractor represents to City that it is not a person or affiliate as defined in §287.133, Florida Statutes, as amended, which has been placed on the convicted vendor list maintained by the Florida Department of Management Services following a conviction for a public entity crime. Contractor acknowledges and agrees that it may not submit a bid on a contract to provide any goods or services to the City, may not submit a bid on a contract with the City for the construction or repair of any public building or public work, may not submit bids on leases of real property with the City, may not be awarded an opportunity to perform work as a Contractor, supplier, SubContractor or Contractor under a contract with the City, and may not transact business with the City in an amount set forth in §287.017, Florida Statutes, as amended, for Category Two for a period of 36 months from the date of being placed on the convicted vendor list.

Q. Cooperation; Further Acts. The Parties shall fully cooperate with one another, and shall take any additional acts or sign any additional documents as may be necessary, appropriate or convenient to attain the purposes of this Agreement.

R. Authority to Enter Agreement. Contractor has all requisite power and authority to conduct its business and to execute, deliver, and perform this Agreement. Each Party warrants that the individuals who have signed this Agreement have the legal power, right, and authority to make this Agreement and bind each respective Party.

S. Counterparts. This Agreement may be signed in counterparts, each of which shall constitute an original, and it shall not be necessary in making proof of this Agreement to produce or account for more than one such counterpart.

T. Entire Agreement. This Agreement contains the entire agreement of the Parties with respect to the subject matter hereof, and supersedes all prior negotiations, understandings or agreements. This Agreement may only be modified by a writing signed by both Parties

THIS SECTION WAS INTENTIONALLY LEFT BLANK

AGREEMENT

IN WITNESS WHEREOF, CITY OF PLANTATION AND PAVEMENT TECHNOLOGY, INC have signed this Agreement in duplicate. One counterpart each has been delivered to the City and Contractor.

Attest: _____
April Beggerow, City Clerk

CITY OF PLANTATION

By: _____
Nick Sortal, Mayor

CITY OF PLANTATION Organized April 30, 1953 Broward County Florida

As to legal form: _____
Kerry L Ezrol, City Attorney

As to Procurement: _____
Charles Spencer, Procurement Director

Witness:
Kiamesha Ausmore-Reid
_____
Typed name of Witness

Witness:
Jessica Tran
_____
Typed name of Witness

STATE OF FLORIDA
COUNTY OF BROWARD

THE FOREGOING INSTRUMENT was acknowledged before me by means of ☒ physical presence or ☐ online notarization, this 17th day of April, 2023, by Nick Sortal, as Mayor of the City of Plantation, a Florida municipal corporation, on behalf of the municipal corporation. She is personally known to me or has produced _____ as identification.

My commission expires:

ELSA THOMPSON MY COMMISSION EXPIRES DECEMBER 20, 2023 #GG 933177 Bonded thru Notary Public Underwriters NOTARY PUBLIC, STATE OF FLORIDA

_____
NOTARY PUBLIC

AGREEMENT

Signed, Sealed in the presence of:

PAVEMENT TECHNOLOGY, INC
an Ohio Corporation

By: _____
Colin M. Durante, President

Witness: _____

Susan Durante
Typed name of Witness

Witness: _____

Debbie Cancelliere
Typed name of Witness

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or ☐ online notarization, this 4-10-2023 (*date*) by Colin M. Durante, as President, an Ohio Corporation, on behalf of the Corporation. They are personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires:

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

_____
NOTARY PUBLIC

OFFICE OF THE MAYOR
Nick Sortal
Mayor

PROCUREMENT DEPARTMENT
Charles Spencer, NIGP-CPP
Director

Plantation
the grass is greener®

March 30, 2023

Colin Durante
Pavement Technology, Inc
24144 Detroit Toad
Westlake, OH 44145
Email: dcancelliere@pavetechinc.com

RE: ITB No. 072-22; Asphalt Rejuvenation Project- Term Contract

Dear Colin Durante:

This letter is to inform you that the City of Plantation- City Council- authorized and approved the following on Consent Agenda Item No. 8 during their March 29, 2023 meeting.

- Approval to execute a term agreement between the City of Plantation and Pavement Technology, Inc., for "Asphalt Rejuvenation- Term Contract" in accordance with ITB No. 072-22. The contract/agreement initial term shall be for one (1) year with an option to renew/extend for four (4) additional one (1) year periods, provided Contractor also agrees in writing to extension upon such terms as the City and Contractor agree.

After the required protest period has passed (April 3, 2023 @4:30pm), a representative from the Procurement Department will be contacting you to execute a formal agreement.

Pricing Information:

Description	**Per SQ YD Cost**
Standard Specification – Reclamite	$1.21/per square yard

Description	**Per SQ YD Cost**
Bid Alternate #1 (A.R.A.-1 Ti Pollution-Remediating Maltene Asphalt Rejuvenator)	$2.49/per square yard

Please take this opportunity to obtain the required Certificate of Insurance (naming the City as additionally insured). In addition, if you have not already done so, please register as a City of Plantation vendor by visiting our website (www.plantation.org) and completing the proper application

Note: The City shall not be obligated to any Bidder to enter into a contract or issue a purchase order with the Bidder despite the City governing body prospectively awarding the Project to a successful Bidder. The City shall be obligated to any Bidder for the project if and only if the CITY enters into a contract or issues a purchase order for the Project with the Bidder, and further, no action will lie against the City to compel the City to execute any such contract or purchase order, or to recover from the City any damages, costs, lost profits, expenses, etc., that Bidder may incur if the City chooses not to sign such contract or issue a purchase order.

If you have any questions, please do not hesitate to contact me.

Respectfully,

Ezzard C. Spencer, Jr.
Charles Spencer, NIGP-CPP
Procurement Director
ESpencer@Plantation.org

Pavement Technology, Inc.

24144 Detroit Rd.
Westlake, Ohio 44145

Phone: 800-333-6309 440-892-1895
Fax: 440-892-0953

CORPORATE RESOLUTION

Pavement Technology, Inc.

I hereby certify that I am the Founder and President of PavementTechnology, Inc., a corporation duly organized and existing under the laws of the State of Ohio; that on this 2nd day of January, 2007, the board of directors of said Corporation authorized and approved the Secretary/Treasurer of said corporation to execute any proposals and contracts for and in behalf of said corporation; that said authority is not contrary to any provision in the articles of incorporation or code of regulations or code of bylaws of said corporation; that said authority has not been rescinded or modified and that Susan J. Durante is the duly elected and acting Secretary/Treasurer of said corporation.

IN WITNESS WHEREOF, I have hereunto subscribed my name on this 2nd day of January, 2007.

Colin M. Durante, President

EXHIBIT “A”
(SCOPE OF SERVICES/WORK)

I. Scope:

This work shall consist of furnishing all labor, material, and equipment necessary to perform all operations for the application of an asphalt-rejuvenating agent to asphaltic concrete surface courses. The rejuvenation of surface courses shall be by spray application of a maltene based cationic rejuvenating agent composed of petroleum oils and resins emulsified with water. All work shall be in accordance with the specifications, the applicable drawings, and subject to the terms and conditions of this contract.

We are bidding for a two-year initial contract term with renewal options for an additional three one-year terms providing both parties agree and that all terms and conditions remain the same. Rates shall remain firm and fixed for the initial contract term.

II. Material Specifications:

The asphalt-rejuvenating agent shall be an emulsion composed of a petroleum resin oil base uniformly emulsified with water. Each bidder must submit with his bid a certified statement from the asphalt rejuvenator manufacturer showing that the asphalt-rejuvenating emulsion conforms to the required physical and chemical requirements.

SPECIFICATIONS

	Test Method		Requirements	
Tests	ASTM	AASHTO	Min.	Max.
Tests on Emulsion:				
Viscosity @ 25°C, SFS	D-244	T-59	15	40
Residue, % W[1]	D-244(Mod.)	T-59(Mod)	60	65
Miscibility Test[2]	D-244(Mod.)	T-59(Mod)	No Coagulation	
Sieve Test, %W[3]	D-244(Mod.)	T-59(Mod)	-	0.1
Particle Charge Test	D-244	T-59	Positive	
Percent Light Transmittance[4]	GB	GB	-	30
Tests on Residue from Distillation:				
Flash Point, COC, °C	D-92	T-48	196	-
Viscosity @ 60°C, cSt	D-445	-	100	200
Asphaltenes, %w	D-2006-70	-	-	1.00
Maltene Dist. Ratio	D-2006-70	-	0.3	0.6
$\frac{PC + A_1}{S + A_2}$[5]				
PC/S Ratio[5]	D-2006-70	-	0.5	-
Saturated Hydrocarbons,S[5]	D-2006-70	-	21	28

---

[1] ASTM D-244 Modified Evaporation Test for percent of residue is made by heating 50-gram sample to 149 C (300 F) until foaming ceases, then cool immediately and calculate results.

[2] Test procedure identical with ASTM D-244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.

[3] Test procedures identical with ASTM D-244-60 except that distilled water shall be used in place of two percent sodium oleate solution.

[4] Test procedure is attached.

[5] Chemical composition by ASTM Method D-2006-70:
PC = Polar Compounds, A_1 = First Acidaffins
A_2 = Second Acidaffins, S = Saturated Hydrocarbons

PROCEDURE FOR DETERMINING PERCENT LIGHT TRANSMITTANCE ON ASPHALT REJUVENATING AGENT

A. **SCOPE**

This procedure covers the determination of percent light transmittance of the asphalt-rejuvenating agent.

B. **APPARATUS**

1) Container may be either glass, plastic or metal having a capacity of 6,000 ml.

2) Graduated cylinder, 1,000 ml, or greater

3) Light transmittance measuring apparatus, such as Bausch and Lomb or Lumetron spectrophotometer

4) Graduated pipette having 1 ml capacity to 0.01 ml accuracy

5) Suction bulb for use with pipette

6) Test tubes compatible with spectrophotometer, 3/4" X 6, Bausch and Lomb, Catalog No. 33-17-81, (B&L)

C. **CALIBRATION OF SPECTROPHOTOMETER**

1) Calibrate spectrophotometer as follows: (a) Set wavelength at 580 mu, (b) Allow spectrophotometer to warm-up thirty minutes, (c) Zero percent light transmittance (%LT) scale, (d) Rinse test tube three times with tap water and fill to top of circle marking on B&L test tube or approximately 2/3 full, (e) Place tube in spectrophotometer and set %LT scale at 100, and (f) repeat steps (c) and (e) two times or until no further adjustments are necessary.

D. **PROCEDURE**

1) Shake, stir, or otherwise thoroughly mix emulsion to be tested. Place sample of emulsion in beaker and allow to stand one minute.

2) Place 2,000 ml tap water in container.

3) Suck 1.00 ml emulsion into pipette using suction bulb. Wipe off outside of pipette.

4) Using suction bulb, blow emulsion into container.

5) Rinse pipette by sucking in diluted emulsion solution and blowing out.

6) Clean pipette with soap or solvent and water. Rinse with acetone.

7) Stir diluted emulsion thoroughly.

8) Rinse out tube to be used with the diluted emulsion three times and fill to top of circle.

9) Calibrate spectrophotometer.

10) Place diluted emulsion sample tube in spectrophotometer, cover, and read %LT to nearest tenth.
11) Repeat steps 9 and 10 until three identical consecutive readings are achieved.
12) The elapsed time between addition of emulsion to dilution of water and final %LT reading should not exceed 5 minutes.

III. Material Performance:

The asphalt-rejuvenating agent shall have the capability to penetrate the asphalt pavement surface and performing as follows. The asphalt-rejuvenating agent shall be absorbed and incorporated into the asphalt binder. Verification that said incorporation of the asphalt-rejuvenating agent into the asphalt binder has been affected shall be by analysis of the chemical properties of said asphalt binder i.e. viscosity shall be reduced by petroleum maltene fraction replacement method to the following extent. For pavements receiving the first or original application of rejuvenating agent, the viscosity shall be reduced by a minimum of thirty-five, (35%) percent as determined by dynamic shear rheometer (DSR) method for asphalt testing in accord with AASHTO T315-05. For retreated pavements after an initial treatment with the asphalt rejuvenator, the viscosity shall be reduced by petroleum maltene replacement method a minimum of twenty percent (20%) as determined by dynamic shear rheometer (DSR) method for testing in accord with AASHTO T315-05. In addition, the phase angle shall be increased. This analysis shall apply to extracted asphalt binder, taken from cores extracted fifteen to thirty days following application, in the upper three eights inch (3/8") of pavement. In addition, the treated areas shall be sealed in-depth to the intrusion of air and water.

The rejuvenating agent shall have a record of at least five years of satisfactory service as a petroleum maltene based emulsion asphalt-rejuvenating agent and in-depth sealer. Satisfactory service shall be based on the capability of the material to decrease the viscosity of the asphalt binder by petroleum maltene fraction replacement method, increase the phase angle, and provide an in-depth seal. Reclamite®, a Tricor Refiners, LLC product manufactured by D & D Emulsion, Inc., Mansfield, Ohio, is a product of know quality and accepted performance.

The bidder must submit with his bid the manufacturer's certification that the material proposed for use is in compliance with the specification requirements. The bidder must submit with his bid, previous use documentation and test data conclusively demonstrating the rejuvenating agent has been used successfully for a period of five years by government agencies such as Cities, Counties, etc. and that the asphalt-rejuvenating agent has been proven to perform, as heretofore required, through field testing by government agencies as to the required change in asphalt binder viscosity and phase angle. Prior testing data shall be submitted indicating such product performance on a sufficient number of projects to insure product consistency. In addition, prior testing data shall be submitted to indicate said product performance as heretofore described over a minimum testing period of three years to insure reasonable life expectancy.

RECLAMITE®, a Tricor Refiners, LLC product manufactured by D & D Emulsion Inc., Mansfield Ohio, is a product of known quality and accepted performance.

IV. Applicator Experience:

The asphalt-rejuvenating agent shall be applied by an experienced applicator of such material. The bidder shall have a minimum of three years' experience in applying the product proposed for use. He must submit with his bid a list of five projects on which he applied said rejuvenator. He shall indicate the project dates,

number of square yards treated in each and the name and phone number of the government official in charge of each project.

A project superintendent knowledgeable and experienced in application of the asphalt-rejuvenating agent must be in control of each day's work. The bidder shall submit a written experience outline of the project superintendent.

V. PRODUCT STANDARDS AND ALTERNATES:

The product "Reclamite"® for the asphalt-rejuvenating agent, a Tricor Refiners, LLC product manufactured by D & D emulsions,Inc. Mansfield, Ohio is the standard for these specifications and the prices quoted on the Bid Sheet Base Bid shall be for this standard. Should a bidder wish to submit a bid for alternates to the Standard, said prices shall be entered on the BID SHEET as the "Alternate Bid" for each item. In the event that the bidder submits no bid for the Standard, only the "Alternate Bids" should be completed.

Bidders may offer an ALTERNATE for the Standard specified in the Specifications provided the bidder adheres to the following and submits same with his bid.

(a) List the proposed alternate on the BID SHEET form giving the product name and price.

(b) Furnish complete specifications and descriptive literature for the alternate as well as a one-gallon sample of the material proposed for use. Such descriptive and detailed information shall be complete and at least equal in detail to the agency's requirements for the standard item for which the alternate is offered.

(c) Submit a current Safety Data Sheet for the alternate materials. The agency will give the alternate consideration. The Contractor may furnish only those alternate items included in his proposal and approved by the agency prior to award of a contract.

(d) Furnish all required test data and use documentation as heretofore required.

If no ALTERNATE is indicated on the BID SHEET, the Contractor shall furnish the STANDARD (brand) specified in the attached specifications.

Should the ALTERNATE offered be found unacceptable by the agency based on the data submitted with the bid and no bid is entered on the BID SHEET for the Standard, then said bid will be considered non-responsive.

VI. APPLICATION TEMPERATURE/WEATHER LIMITATIONS:

The temperature of the asphalt rejuvenating emulsion, at the time of application shall be as recommended by the manufacturer. The asphalt-rejuvenating agent shall be applied only when the existing surface to be treated is thoroughly dry and when it is not threatening to rain. The asphalt-rejuvenating agent shall not be applied when the ambient temperature is below 40°F.

VII. HANDLING OF ASPHALT REJUVENATING AGENT:

Contents in tank cars or storage tanks shall be circulated at least forty-five minutes before withdrawing any material for application. When loading the distributor, the asphalt-rejuvenating agent concentrate shall be

loaded first and then the required amount of water shall be added. The water shall be added into the distributor with enough force to cause agitation and thorough mixing of the two materials. To prevent foaming, the discharge end of the water hose or pipe shall be kept below the surface of the material in the distributor that shall be used as a spreader. The distributor truck will be cleaned of all of its asphalt materials, and washed out to the extent that no discoloration of the emulsion may be perceptible. Cleanliness of the spreading equipment shall be subject to the approval and satisfaction of the Engineer.

VIII. RESIDENT NOTIFICATION:

The contractor shall distribute by hand, a typed notice to all residences and businesses on the street to be treated. The notice will be delivered no more than 24 hours prior to the treatment of the road. The notice will have a local phone number that residents may call to ask questions. The notice shall be of the door hanger type that secures to the door handle of each dwelling. Unsecured notices will not be allowed. The contractor shall also place the notice on the windshield of any parked cars on the street. Hand distribution of this notice will be considered incidental to the contract.

IX. APPLICATING EQUIPMENT:

The distributor for spreading the emulsion shall be self-propelled, and shall have pneumatic tires. The distributor shall be designed and equipped to distribute the asphalt-rejuvenating agent uniformly on variable widths of surface at readily determined and controlled rates from 0.04 to 0.08 gallons per square yard of surface, and with an allowable variation from any specified rate not to exceed 5 percent of the specified rate.

Distributor equipment shall include full circulation spray bars, pump tachometer, volume-measuring device, and a hand hose attachment suitable for application of the emulsion manually to cover areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the emulsion within the tank. The distributor shall have a computerized system, acceptable to the Engineer that controls the rate of product application.

A check of distributor equipment as well as application rate accuracy and uniformity of distribution shall be made when directed by the Engineer.

The truck used for applying rock dust, or other aggregate when required and approved by the Engineer, shall be equipped with a spreader that allows the rock dust to be uniformly distributed onto the pavement. The spreader shall be able to apply 1/2 pound to 3 pounds of rock dust or other aggregate per square yard in a single pass. The spreader shall be adjustable so as not to broadcast the rock dust or other aggregate onto driveways or tree lawns.

The rock dust or other aggregate to be used shall be free flowing, without any leaves, dirt, stones, etc. Any wet rock dust shall be rejected from the job site.

Any equipment that is not maintained in full working order, or is proven inadequate to obtain the results prescribed, shall be repaired or replaced at the direction of the Engineer.

X. APPLICATION OF REJUVENATING AGENT:

The asphalt-rejuvenating agent shall be applied by a distributor truck at the temperature recommended by the manufacturer and at the pressure required for the proper distribution. The emulsion shall be so applied that uniform distribution is obtained at all points of the areas to be treated. Distribution shall be commenced with a running start to insure full rate of spread over the entire area to be treated. Areas inadvertently missed shall receive additional treatment as may be required by hand sprayer application.

Application of asphalt-rejuvenating agent shall be on one-half width of the pavement at a time. When the second half of the surface is treated, the distributor nozzle nearest the center of the road shall overlap the previous application by at least one-half the width of the nozzle spray. In any event, the centerline construction joint area of the pavement shall be treated in both application passes of the distributor truck.

Before spreading, the asphalt-rejuvenating agent shall be blended with water at the rate of two (2) parts rejuvenating agent to one (1) part water, by volume or as specified by the manufacturer for jobsite conditions. The combined mixture of asphalt-rejuvenating agent and water shall be spread at the rate of 0.04 to 0.08 gallons per square yard, or as approved by the Engineer following field testing.

Where more than one application is to be made, succeeding applications shall be made as soon as penetration of the preceding application has been completed and the Engineer grants approval for additional applications.

Grades or super elevations of surfaces that may cause excessive runoff, in the opinion of the Engineer, shall have the required amounts applied in two or more applications as directed.

After the rejuvenating emulsion has penetrated and when surface conditions require a light coating of dry rock dust, or other aggregate approved by the Engineer, shall be applied to the surface in sufficient amount to protect the traveling public as required by the Engineer. The rock dust or other approved aggregate shall be swept and removed from the streets and properly disposed of at the Contractor's expense within 24 hours of application.

The Contractor shall furnish a quality inspection report showing the source, manufacturer, and the date shipped, for each load of asphalt-rejuvenating agent. When directed by the Engineer, the Contractor shall take representative samples of material for testing.

XI. STREET SWEEPING:

The Contractor shall be responsible for sweeping and cleaning of the streets prior to, and after treatment.

Prior to treatment, the street will be cleaned of all standing water, dirt, leaves, foreign materials, etc. This work shall be accomplished by hand brooming, power blowing or other approved methods. If in the opinion of the Engineer, the hand cleaning is not sufficient, than a self-propelled street sweeper shall be used.

All rock dust or other approved material used during the treatment must be removed no later than 24 hours after treatment of the street. This shall be accomplished by a combination of hand and mechanical sweeping. All turnouts, cul-de-sacs, etc. must be cleaned of any material to the satisfaction of the Engineer. Street sweeping will be included in the price bid per square yard for asphalt-rejuvenating agent.

If, in the opinion of the Engineer, additional rock dust is required, said material shall be applied by the contractor. Said rock dust shall be swept up no later than 24 hours following reapplication. No additional compensation will be allowed for reapplication and removal of rock dust.

XII. TRAFFIC CONTROL:

The Contractor shall schedule his operations and carry out the work in a manner to cause the least disturbance and/or interference with the normal flow of traffic over the areas to be treated. Treated portions of the pavement surfaces shall be kept closed and free from traffic until penetration, in the opinion of the Engineer, has become complete and the area is suitable for traffic.

When, in the opinion of the Engineer, traffic must be maintained at all times on a particular street, then the Contractor shall apply asphalt-rejuvenating agent to one lane at a time. Traffic shall be maintained in the untreated lane until the traffic may be switched to the completed lane.

The Contractor shall be responsible for all traffic control and signing required to permit safe travel. The contractor shall notify the police and fire departments as to the streets that are to be treated each day.

If, in the opinion of the Engineer, proper signing is not being used, the Contractor shall stop all operations until safe signing and barricading is achieved.

XIII. METHOD OF MEASUREMENT:

Asphalt-rejuvenating agent will be measured by the square yard as provided for in the Contract Documents.

XIV. BASIS FOR PAYMENT:

The accepted quantities, measured as provided for above, will be paid for at the contract unit price for asphalt-rejuvenating agent.

Asphalt-rejuvenating agent shall be paid for PER SQUARE YARD, which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified and required.

END OF SECTION

EXHIBIT “B”

(Documentation required by the City and submitted by Contractor prior to Notice of Award)

NON-COLLUSION CERTIFICATION

TO BE RETURNED WITH BID

By signing and submitting this bid, the BIDDER certifies that this bid is made independently and free from collusion.

BIDDER shall disclose below, to their best knowledge, any City of Plantation officer or employee, or any relative of any such officer or employee as defined in Section 112.3135(1) (c), Florida Statutes (2014), who is an officer of director or, or has a material interest in, the BIDDER's business, who is in a position to influence this procurement. Any City of Plantation officer or employee who has any input into the writing of specifications or requirements, solicitation of offers, decision to award, evaluation of offers, or any other activity pertinent to this procurement is presumed, for purposes hereof, to be in a position to indirectly own any of the total assets or capital stock of any business entity owned or operated by the BIDDER, or if they otherwise stand to personally gain if the contract is awarded to this BIDDER.

Failure to submit this executed statement as part of the bid shall make the bid nonresponsive and not eligible for award consideration. In the event the BIDDER does not indicate any names, the CITY shall interpret this to mean that the BIDDER has indicated that no such relationships exist. Failure of a BIDDER to disclose any relationship described herein shall be reason for termination of bid or award, whichever is applicable, with no time to cure.

NAME	RELATIONSHIP
N/A	N/A

Witnesses:

Typed name: Susan Durante

Typed name: Debbie Cancelliere

BIDDER:

By: Colin Durante

Name: Colin Durante

Title: President

NON-COLLUSION CERTIFICATION

NOTARY BLOCK FOR AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of □ physical presence or □ online notarization, this _____ (*date*) by _____ (*name of personal acknowledging*), who is personally known to me or who has produced _____(*type of identification*) as identification.

My commission expires: _____

NOTARY PUBLIC

NOTARY BLOCK FOR A CORPORATION

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or □ online notarization, this 1/9/23 (*date*) by Colin Durante, President (*name of officer or agent, title of officer or agent*), of Pavement Technology, Inc. (*name of corporation acknowledging*), an Ohio (*state or place of incorporation*) corporation, on behalf of the corporation. He/she is personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires: Elizabeth Mielcusny

NOTARY PUBLIC

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

QUALIFICATION STATEMENT

Fill in Form

The undersigned certifies under oath the truth and correctness of all statements and of all answers to questions made hereinafter (Attach additional sheets with appropriate reference, if necessary). You must respond to all questions. **FAILURE TO DISCLOSE OR PROVIDE THE REQUESTED INFORMATION BELOW MAY RESULT IN THE BIDDER'S BID BEING DEEMED NON-RESPONSIVE AND THE BIDDER AS NOT QUALIFIED FOR AWARD.**

SUBMITTED TO: City of Plantation

ADDRESS: 400 NW 73rd Avenue
Plantation, FL 33317

SUBMITTED BY: Pavement Technology, Inc.

NAME: Colin Durante

ADDRESS: 24144 Detroit Road, Westlake, OH 44145

TELEPHONE NO.: 440-892-1895

FAX NO.: 440-892-0953

EMAIL ADDRESS: dcancelliere@pavetechinc.com

1. State the true, exact, correct and complete name of the partnership, corporation, trade or fictitious name under which you do business and the address of the place of business.

   The correct name of the BIDDER is: Pavement Technology, Inc.

   The address of the principal place of business is: 24144 Detroit Road, Westlake, OH 44145

   The business is a (Sole Proprietorship) _____ (Partnership) _____ (Corporation) ✓

2. If BIDDER is a corporation, answer the following:
   a. Date of Incorporation: 5/30/1972
   b. State of Incorporation: Ohio
   c. President's Name: Colin Durante
   d. Vice President's Name: John Schlegel
   e. Secretary's Name: Susan Durante
   f. Treasurer's Name: Susan Durante
   g. Name and address of Resident Agent: Business Filings Incorporated
      1200 S. Pine Island Rd., Plantation, FL 33324

3. If BIDDER is an individual or a partnership, answer the following:

   a. Date of organization: _____
   b. Name, address and ownership units of all partners: _____
   c. State whether general or limited partnership: _____

QUALIFICATION STATEMENT

4. If BIDDER is other than an individual, corporation or partnership, describe the organization and give the name and address of principals:
Bidder is a corporation.

5. If BIDDER is operating under a fictitious name, submit evidence of compliance with the Florida Fictitious Name Statute. N/A

6. How many years has your organization been in business under its present business name: 50

   a. Under what other former names has your organization operated?
   None.

7. Indicate registration, license numbers or certificate numbers for the business or professions that are the subject of this Proposal. Please attached certificate of competency and/or state registration. Please include the foregoing information for all parties to be assigned to the project.

   State of Florida - Certificate P12308

8. Have you personally inspected the site(s) of the proposed work? (Y) Yes (N)

9. Do you have a complete set of documents, including agenda? (Y) Yes (N) ___

10. Have you ever failed to complete any work awarded to you? If so, state when, where and why?

    No.

11. Within the five (5) years, has any officer of partner of your organization ever been an officer or partner of another organization when it failed to complete a contract? If so, explain fully.

    No.

12. State the names, telephone numbers and last known addresses of three (3) owners, individuals or representatives of owners with the most knowledge of work which you have performed or goods you have provided, and to which you refer (government owners are preferred as references).

    Please see page 29.

13. List the pertinent experience of the key individuals of your organization (continue on insert sheet, if necessary).

    Please see attached Key Individuals' Experience Records.

14. Provide a list of similar projects, which have been completed within the past five (5) years, including project description, owner's names, addresses and phone numbers.

    Please see attached Project Experience List.

15. Provide a list of work currently under contract.

    Please see attached Current Contracts List.

16. On Exhibit A, list all disputes, claims, mediations and litigation in which the bidding entity, a parent entity, an affiliate entity, a predecessor entity or other entities with which you were then associated or affiliated were involved in any contract disputes over the last five (5) years as of the solicitation response due date. If BIDDER is a joint venture, the information provided should encompass the joint venture and each of the entities forming the joint venture. For said claim, identify with particularity the nature of such dispute, the names and addresses of the other parties to such disputes, and whether or how such disputes were resolved, including any mediation, arbitration or litigation involved and dollar awards. [Do not include disputes, claims, mediations and litigation that involve only garnishment, auto negligence, personal injury, or a proof of claim filed by BIDDER]

N/A

17. List all disputes, claims, mediations and litigation between the Owner and any of the responding entity's subcontractors/subconsultants over the last five (5) years as of the solicitation response due date.

N/A

18. Has any governmental entity within the last five (5) years commenced proceedings to discipline any of the officers, partners, or principals of the BIDDER, or sought to revoke a license held by the BIDDER (or its qualifying agent)? If so, please describe in detail the proceedings and how the matter was resolved.

No.

19. Will you sublet any part of this work? If so, give details. (sub-contractor's name, address, phone number and contact)

No.

20. Provide a list of equipment available to be committed to perform the work contemplated under this contract.

Please see attached Equipment List.

21. Please list any objections to the text of the Contract Documents in the area below or on separate sheets of paper attached hereto, if necessary.

N/A

22. Please attach a copy of your latest financial statement.

Fill in Form

QUALIFICATION STATEMENT

NOTARY BLOCK FOR AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of □ physical presence or □ online notarization, this _____ (*date*) by _____ (*name of personal acknowledging*), who is personally known to me or who has produced _____(*type of identification*) as identification.

My commission expires: _____

NOTARY PUBLIC, STATE OF FLORIDA

NOTARY BLOCK FOR A CORPORATION

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or □ online notarization, this 1/9/23 (*date*) by Colin Durante, President (*name of officer or agent, title of officer or agent*), of Pavement Technology, Inc. (*name of corporation acknowledging*), an Ohio (*state or place of incorporation*) corporation, on behalf of the corporation. He/she is personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires: Elizabeth Mielcusny

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

NOTARY PUBLIC, STATE OF ~~FLORIDA~~ Ohio

Fill in Form

BIDDER'S CERTIFICATION

WHEN BIDDER IS A CORPORATION

IN WITNESS WHEREOF, the BIDDER hereto has executed this Form this 9th day of January, 2023.

Pavement Technology, Inc.
Printed Name of Corporation

Ohio
Printed State of Incorporation

By: _____
Signature of President or other authorized officer

Colin Durante, President
Printed Name of President or other authorized officer

24144 Detroit Road
Address of Corporation

Westlake, OH 44145
City/State/Zip

440-892-1895
Business Phone Number

(CORPORATE SEAL)

ATTEST

By _____
Secretary Susan Durante

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or ☐ online notarization, this 1/9/23 (*date*) by Colin Durante, President (*name of officer or agent, title of officer or agent*), of Pavement Technology, Inc. (*name of corporation acknowledging*), an Ohio (*state or place of incorporation*) corporation, on behalf of the corporation. He/she is personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires: Elizabeth Mielcusny Notary Public, State of Ohio My Commission Expires: February 27, 2025

_____
NOTARY PUBLIC

DRUG-FREE WORKPLACE

Fill in Form

STATEMENT UNDER SECTION 287.087
FLORIDA STATUES

TO BE RETURNED WITH FIRM

Preference must be given to FIRMS submitting certification with their bid or proposal, certifying they have a drug-free workplace in accordance with the Florida Statutes, Section 287.087. This requirement affects all public entities of the State and became effective January 1, 1991.

Preference shall be given to businesses with drug-free workplace programs. Whenever two or more bids, proposals, or replies that are equal with respect to price, quality and service are received by the State or by any political subdivision for the procurement of commodities or contractual services, a bid, proposal, or reply received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing the bids will be followed if none of the tied vendors have a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

1. Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the action that will be taken against employees for violations of such prohibition.

2. Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

3. Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).

4. In the statement specified in subsection (1), notify the employees that as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any convictions of, or plea of guilty or nolo contendere to, any violations of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occurring in the workplace, no later than five (5) days after such conviction.

5. Impose a sanction on, or require the satisfactory participation in, a drug abuse assistance or rehabilitation program if such is available in the employee's community, by an employee who is so convicted.

6. Make a good faith effort to continue to maintain a drug-free workplace through implementation of the above measures.

As the person authorized to sign this statement, I certify that this company complies with the above requirements.

Colin Durante
Signature

Colin Durante, President
Printed Name

Pavement Technology, Inc.
Firm Name

1/9/2023
Date

PUBLIC RECORDS

COMPLIANCE UNDER SECTION 119.0701
FLORIDA STATUTES

TO BE RETURNED WITH BID

The CONTRACTOR hereby certifies that it shall comply with public records laws, specifically to:

(a) Keep and maintain public records required by the public agency to perform the service.

(b) Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law.

(c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the CONTRACTOR does not transfer the records to the public agency.

(d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the contractor or keep and maintain public records required by the public agency to perform the service. If the CONTRACTOR transfers all public records to the public agency upon completion of the contract, the CONTRACTOR shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 954-797-2237, sslattery@plantation.org, 400 NW 73rd Avenue Plantation, FL 33317

As the person authorized to sign this statement, I certify that this FIRM agrees to comply with the above requirements.

CONTRACTOR: Pavement Technology, Inc.

By (sign): Colin Durante

Colin Durante, President 1/9/23

Print Name: _____

NOTARY BLOCK FOR AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of □ physical presence or □ online notarization, this _____ (*date*) by _____ (*name of personal acknowledging*), who is personally known to me or who has produced _____(*type of identification*) as identification.

My commission expires: _____

NOTARY PUBLIC

NOTARY BLOCK FOR A CORPORATION

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or □ online notarization, this 1/9/23 (*date*) by Colin Durante, President (*name of officer or agent, title of officer or agent*), of Pavement Technology, Inc. (*name of corporation acknowledging*), an Ohio (*state or place of incorporation*) corporation, on behalf of the corporation. He/she is personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires: Elizabeth Mielcusny

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

NOTARY PUBLIC

SCRUTINIZED COMPANY CERTIFICATION

Fill in Form

TO BE RETURNED WITH BID

CONTRACTOR Name: Pavement Technology, Inc.
CONTRACTOR FEIN: 34-1108308
CONTRACTOR Authorized Representative Name and Title: Colin Durante, President
Address: 24144 Detroit Road
City: Westlake State: OH Zip: 44145
Phone Number: 440-892-1895
Email Address: dcancelliere@pavetechinc.com

Section 287.135, Florida Statutes, prohibits agencies from contracting with companies for goods or services of any amount that are on the Scrutinized Companies that Boycott Israel List or that are participating in a boycott of Israel; or One million dollars or more if, at the time of bidding, FIRM is on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or has business operations in Cuba or Syria. The boycott Israel list is created pursuant to 215.4725 and the Sudan and Iran lists are created pursuant to section 215.473, Florida Statutes.

As the person authorized to sign on behalf of CONTRACTOR, I hereby certify that the undersigned company is not participating in a boycott of Israel, on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or that it does not have business operations in Cuba or Syria. I understand and agree that pursuant to section 287.135, Florida Statutes, the submission of a false certification; or being placed on the Scrutinized Companies that Boycott Israel List, or engaging in a boycott of Israel; or being placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List; or engaging in business operations in Cuba or Syria will be cause for the CITY to terminate this Agreement at the option of the CITY. In addition, FIRM may be subject to civil penalties, attorney's fees, and/or costs.

The scrutinized company list is maintained by the State Board of Administration and available at http://www.sbafla.com/.

Certified By: Colin Durante,
who is authorized to sign on behalf of the above referenced company.
Authorized Signature Print Name and Title: Colin Durante, President
Date: January 9, 2023

***This form is being provided to comply with Florida Statute 287.135.**

E-VERIFY FORM

CITY OF PLANTATION
E-VERIFY FORM UNDER SECTION 448.095, FLORIDA STATUTES

TO BE RETURNED WITH BID

Project Name: Asphalt Rejuvenation Project

Project No.: ITB No. 072-22

1. Definitions:

"Contractor" means a person or entity that has entered or is attempting to enter into a contract with a public employer to provide labor, supplies, or services to such employer in exchange for salary, wages, or other remuneration. "Contractor" includes, but is not limited to, a vendor or consultant.

"Subcontractor" means a person or entity that provides labor, supplies, or services to or for a contractor or another subcontractor in exchange for salary, wages, or other remuneration.

"E-Verify system" means an Internet-based system operated by the United States Department of Homeland Security that allows participating employers to electronically verify the employment eligibility of newly hired employees.

2. Effective January 1, 2021, Contractors, shall register with and use the E-verify system in order to verify the work authorization status of all newly hired employees. Contractor shall register for and utilize the U.S. Department of Homeland Security's E-Verify System to verify the employment eligibility of:

a) All persons employed by a Contractor to perform employment duties within Florida during the term of the contract; and

b) All persons (including subvendors/subconsultants/subcontractors) assigned by Contractor to perform work pursuant to the contract with the City of Plantation. The Contractor acknowledges and agrees that registration and use of the U.S. Department of Homeland

Security's E-Verify System during the term of the contract is a condition of the contract with the City of Plantation; and

c) Should vendor become the successful Contractor awarded for the above-named project, by entering into the contract, the Contractor shall comply with the provisions of Section 448.095, Fla. Stat., "Employment Eligibility," as amended from time to time. This includes, but is not limited to registration and utilization of the E-Verify System to verify the work authorization status of all newly hired employees. Contractor shall also require all subcontractors to provide an affidavit attesting that the subcontractor does not employ, contract with, or subcontract with, an unauthorized alien. The Contractor shall maintain a copy of such affidavit for the duration of the contract.

3. Contract Termination

a) If the City has a good faith belief that a person or entity with which it is contracting has knowingly violated s. 448.09 (1) Fla. Stat., the contract shall be terminated.

b) If the City has a good faith belief that a subcontractor knowingly violated s. 448.095 (2), but the Contractor otherwise complied with s. 448.095 (2) Fla. Stat., shall promptly notify the Contractor and order the Contractor to immediately terminate the contract with the subcontractor.

c) A contract terminated under subparagraph a) or b) is not a breach of contract and may not be considered as such.

d) Any challenge to termination under this provision must be filed in the Circuit Court no later than 20 calendar days after the date of termination.

e) If the contract is terminated for a violation of the statute by the Contractor, the Contractor may not be awarded a public contract for a period of 1 year after the date of termination.

E-VERIFY FORM

Fill in Form

CONTRACTOR: Pavement Technology, Inc.

By (sign): Colin Durante

Print Name: Colin Durante, President

NOTARY BLOCK FOR AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of □ physical presence or □ online notarization, this _____ (*date*) by _____ (*name of personal acknowledging*), who is personally known to me or who has produced _____(*type of identification*) as identification.

My commission expires: _____

NOTARY PUBLIC

NOTARY BLOCK FOR A CORPORATION

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me by means of ☑ physical presence or □ online notarization, this 1/9/23 (*date*) by Colin Durante, President (*name of officer or agent, title of officer or agent*), of Pavement Technology, Inc. (*name of corporation acknowledging*), an Ohio (*state or place of incorporation*) corporation, on behalf of the corporation. He/she is personally known to me or who has produced _____ (*type of identification*) as identification.

My commission expires: Elizabeth Mielcusny

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

NOTARY PUBLIC

COOPERATION WITH THE BROWARD COUNTY
OFFICE OF INSPECTOR GENERAL

TO BE RETURNED WITH BID

The Broward County Office of Inspector General ("OIG") has the authority to review and investigate how governmental contracts are performed and how BIDDERS and vendors (herein, "BIDDERS") are paid. To this end, BIDDER agrees to cooperate with the OIG in the event the BIDDER is contacted by the OIG. Such cooperation shall include, answering any questions that may be posed by the OIG, and allowing the OIG to review and copy any of BIDDER's written material, contract documentation, and financial records that may relate to the formulation, execution, and performance of this Contract. The BIDDER acknowledges and agrees that whatever work or effort is expended by BIDDER in interfacing with the OIG is part of the administrative or overhead or base costs of the services provided by the BIDDER to the CITY, and shall never be a basis for claiming extra or additional compensation under this Contract, or for requesting a change order.

The BIDDER's failure to cooperate fully with the OIG as required by the preceding clause shall be a basis for the City claiming the BIDDER is in default, and may, if not timely cured, allow the City to terminate this Contract for cause. Unless the BIDDER is instructed otherwise in a specific written and notarized Order signed by the Broward County Inspector General, BIDDER shall advise CITY, in writing and in the same manner as BIDDER gives the City formal notice under this Contract, each instance, if ever, that the BIDDER is contacted by the OIG, and shall supply the City with information necessary to allow the City to ensure that the BIDDER is fully performing the requirements of this Paragraph.

WITNESSES:

NAME: Susan Durante

NAME: Debbie Cancelliere

BIDDER: Colin Durante

NAME: Colin Durante

TITLE: President

NOTARY BLOCK FOR AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of □ physical presence or □ online notarization, this _____ (*date*) by _____ (*name of personal acknowledging*), who is personally known to me or who has produced _____(*type of identification*) as identification.

My commission expires: _____

NOTARY PUBLIC

NOTARY BLOCK FOR A CORPORATION

STATE OF Ohio

COUNTY OF Cuyahoga

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My commission expires: Elizabeth Mielcusny

NOTARY PUBLIC

Elizabeth Mielcusny
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

Bid Checklist and Summary Form

To comply with the City of Plantation's solicitation guidelines, this Bid Checklist Summary Form is **required for all solicitations exceeding $25,000.00 or more.**

This form must be signed and included with the bid submittal in addition to the required bid documents of this solicitation. Failure to do so may result in your bid submittal being considered non-responsive.

Bidder's Name: Pavement Technology, Inc. **Date:** 1/9/23

Base Bid Total: Base Bid A - $744,150.00
Base Bid B - $1,531,350.00

Plantation Local Business pursuant to Section 2-227 of City's Code: Yes ☐ or No ☑

Disadvantaged Business Enterprise: Yes ☐ or No ☑

Submitted Forms:

☑ Non-Collusion Certification Form

☑ General Terms and Conditions Form

☑ Insurance Requirements

☑ Bid Form

☑ References

☐ Federal Funding Requirements - N/A

☑ Drug Free Workplace

☑ Addendums

When bidding on an Alternative Product "or equal," bids must be accompanied with all descriptive information necessary for an evaluation of the proposed material or equipment such as the detailed drawings and specifications, certified operation and test data, and experience records. Failure of any bidder to furnish the data necessary to determine whether the product is equivalent, may be cause for rejection of the specific items(s) to which it pertains.

Are you submitting an equivalent product: Yes ☑ or No ☐

If Yes, please list the equivalent product(s) below:

A.R.A.-1 Ti® Pollution-Remediating Maltene Asphalt Rejuvenator

Signature: Colin Durante

Printed Name: Colin Durante, President

Reclamite®
Product Submittals

D & D EMULSIONS INC.

Quality Products and Dependable Service Since 1981

Licensed Manufacturer
Tricor Refining, LLC
Producers of Golden Bear® Preservation Products

CERTIFICATE OF COMPLIANCE

TO WHOM IT MAY CONCERN

PRODUCT: RECLAMITE®

IT IS HEREBY CERTIFIED THAT THE ABOVE PRODUCT DESIGNATED HEREON CONFORMS TO THE APPLICABLE SPECIFICATIONS FOR THE PRODUCT SO INDICATED, AND THAT PAVEMENT TECHNOLOGY, INCORPORATED HAS BEEN AN AUTHORIZED APPLICATOR FOR D & D EMULSIONS, INC., AN AUTHORIZED LICENSED MANUFACTURER FOR TRICOR REFINING, LLC.

Date: March 28, 2022

Approved by: Pres.
Title: President

TRICOR REFINING, LLC
Producers of GOLDEN BEAR PRESERVATION PRODUCTS

1134 Manor St. - Oildale, CA 93308 / P.O. Box 5877 - Bakersfield, CA 93388
Phone 661.393.7110 – Fax 661.393.1601

RECLAMITE® Asphalt Rejuvenating Agent

Specifications:

Tests	Test Method ASTM	Test Method AASHTO	Requirements Min.	Requirements Max.
Tests on Emulsion:				
Viscosity @ 25°C, SFS	D-244	T-59	15	40
Residue, % w[1]	D-244 (mod)	T-59 (mod)	60	65
Miscibility Test[2]	D-244 (mod)	T-59 (mod)	No Coagulation	
Sieve Test, % w[3]	D-244 (Mod)	T-59 (mod)	—	0.1
Particle Charge Test	D-244	T-59	Positive	
Percent Light Transmittance[4]	GB	GB	—	30
Cement Mixing	D-244			2.0
Tests on Residue from Distillation				
Flash Point, COC, °C	D-92	T-48	196	—
Viscosity @ 60°C, cSt	D-445	—	100	200
Asphaltenes, %w	D-2006-70	—		0.75
Maltene Distribution Ratio $\frac{PC + A_1}{S + A_2}$[5]	D-2006-70	—	0.3	0.6
PC/S Ratio[5]	D-2006-70	—	0.5	—
Saturate hydrocarbons, S[5]	D-2006-70	—	21	28

[1] ASTM D-244 Evaporation Test for percent of residue is made by heating 50 gram sample to 149°C (300°F) until foaming ceases, then cool immediately and calculate results.
[2] Test procedure identical with ASTM D-244 60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water..
[3] Test procedure identical with ASTM D-244 60 except that distilled water shall be used in place of two percent sodium oleate solution.
[4] Test procedure is attached.
[5] Chemical composition by ASTM Method D-2006-70:
PC = Polar Compounds, A_1 = First Acidaffins.
A_2 = Second Acidaffins, S = Saturated Hydrocarbons.

Note: For gal/ton conversion use 242 gal/ton.

Note: Data presented are typical. Slight variation may occur from lot to lot.

Evaluation of Seal Coat Runway 16-34 Lajes Field, Azores

by
J. E. Pickett

Geotechnical Laboratory
U.S. Army Engineer Waterways Experiment Station
P.O. Box 631
Vicksburg, Mississipi

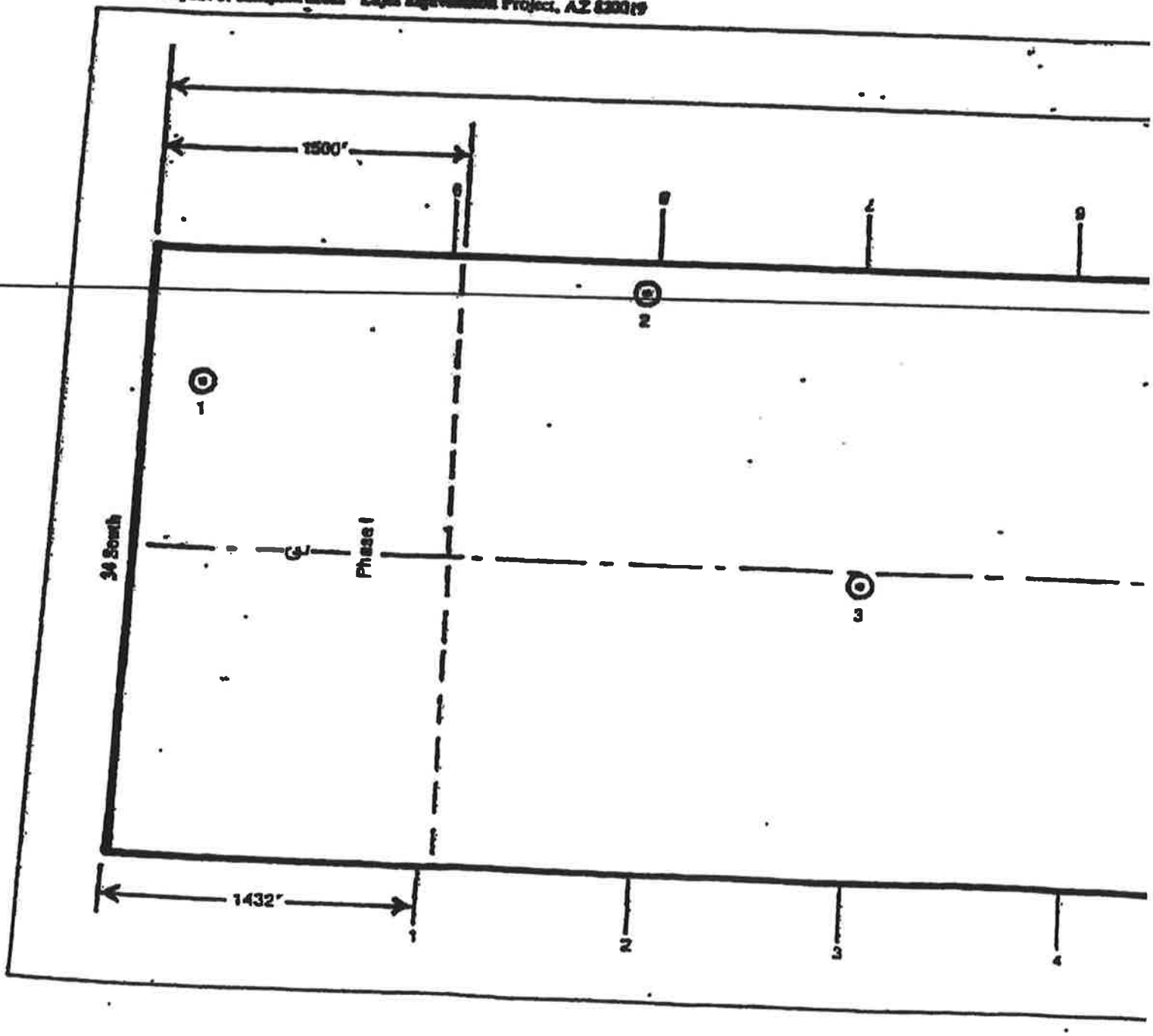
March 1983

1. In February 1983, the Pavement Systems Division, Geotechnical Laboratory, U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi, was requested by the 1605th Air Base Wing (MAC), Lajes Field, Azores, to provide technical assistance and construction inspection of the rejuvenator project on Runway 16–34, which included sampling and laboratory testing. Treatment of the runway was performed 10–15 March. An excess of Reclamit remaining from projects in 1979 and 1983 w used to treat some parking aprons and taxiwa

2. Messrs. Jack E. Pickett and James E Schoenberger traveled to Lajes Field on 28 February 1983 to take samples before and after treatment and to observe the rejuvenato application.

3. The 10,864–ft runway was divided in sections and treated in three phases. This was

Incl 1 Layout of sampled areas, Lajes Rejuvenation Project, AZ 8300[illegible]



done so the runway could remain open to traffic during treatment. Before treatment, one set of three 6–in. cores were taken at each of eight locations, selected at random throughout the runway, two sets from Phase I and three sets each from Phases II and III. Core locations are shown on Incl 1. After treatment, three additional cores were taken at each location within 2 to 4 ft of the original core locations and in the same construction lane.

The samples were processed by sawing 3/ of material from the upper surface. The asphalt was extracted from this 3/8–in.–t sample and recovered; untreated samples processed at the field laboratory at Lajes. recovered asphalt and treated samples wer returned to WES for processing and penet tion and viscosity testing. Results of these laboratory tests are summarized in Table I. Test results indicate the rejuvenation of

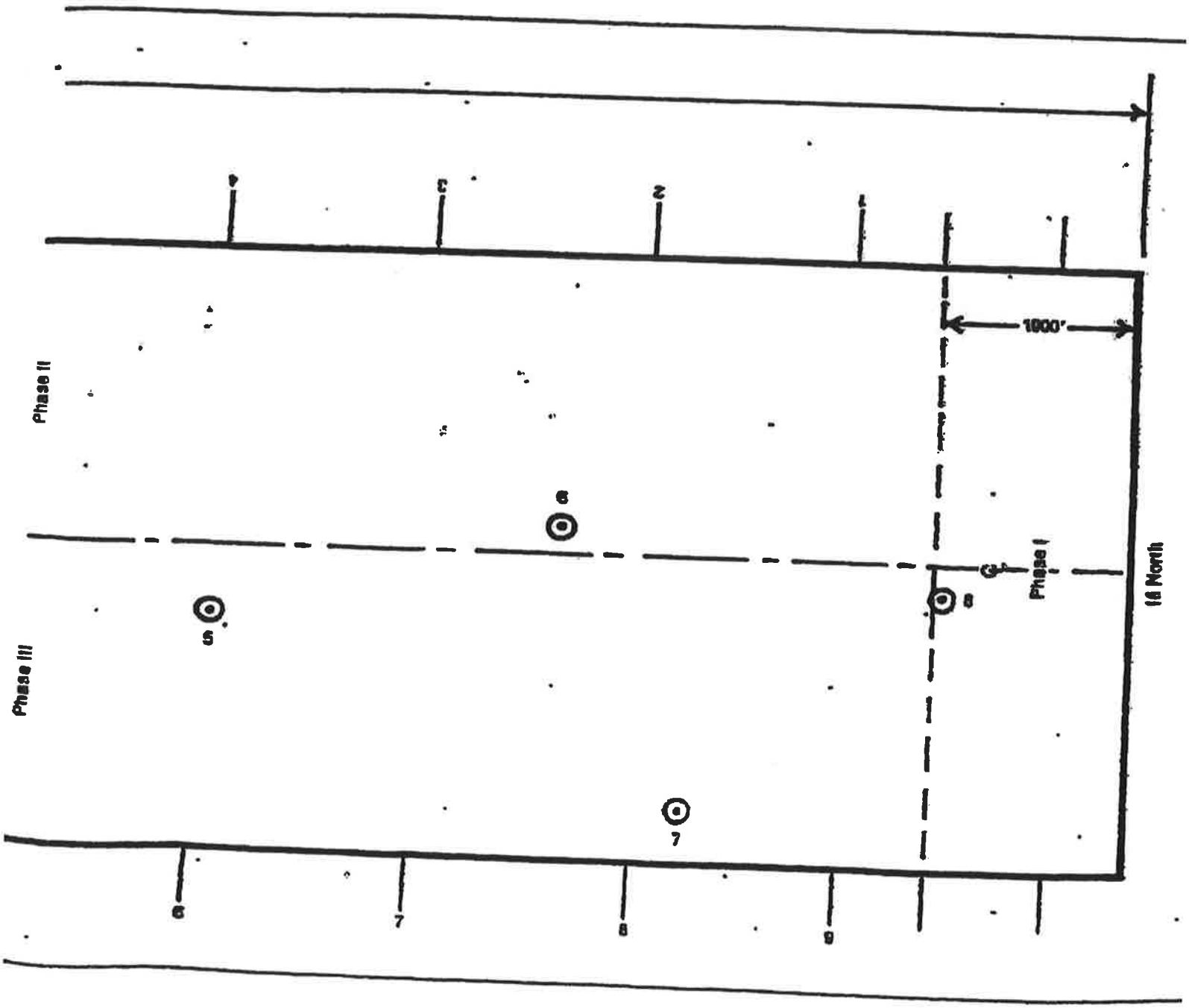


Table I

Lajes Rejuvenator, 1983

Sample Number	Station From South End R/W & C	Penetration 77°F (25°C) 100 g, 5 sec 0.1 mm		Absolute Viscosity 140°F (60°C) 300.0 mm Hg Vacuum, Poises	
		Untreated	Treated	Untreated	Treated
1	2+43, 83.7 ft W	11.00	20.00	401, 351	65, 420
2	23+55, 134.9 ft W	11.00	23.00	449, 520	62, 011
3	34+34, 5.1 ft E	13.00	31.00	242, 293	32, 860
4	52+07, 51.3 ft W	9.00	27.00	1, 852, 362	43, 497
5	64+36, 32.4 ft E	4.00	17.00	2, 774, 367	177, 941
6	80+67, 14.6 ft W	9.00	22.00	863, 971	62, 736
7	86+86, 121.4 ft E	6.00	34.00	1, 263, 880	23, 444
8	99+17, 17 ft E	6.00	29.00	1, 318, 687	41, 392
Average Change (%)		8.63 Penetration	25.38 194.00 Increase	1, 145, 804 Viscosity	63, 663 94.40 Decrease

Runway 16–34 was satisfactory. The penetration test shows an increase of approximately 194 percent and the viscosity test shows a decrease of approximately 94 percent. The specification requires the average penetration to be increased by 20 percent and the average viscosity to be decreased by 40 percent.

4. The contractor for the project was Mr. Colin M. Durante, Pavement Technology, Inc., 11260 Beret Road, Cleveland, Ohio 44102. He elected to use Reclamite, a proprietary material manufactured by the Golden Bear Division of Witco Chemical Corporation, Bakersfield, California, as a rejuvenator. Reclamite is a resin-based emulsion that leaves an oily residue and is applied with a bituminous distributor. The Reclamite material was mixed at the job site in a two to one ratio with water, two parts Reclamite to one part water. The Reclamite mixture at ambient temperature (60–70°F) was sprayed onto the runway pavement by using a 1140 gal bituminous distributor equipped with a 10-ft spray bar. Application rates were varied intentionally to avoid excess rejuvenator in areas, such as recently patched areas, and areas with rubber build-up. Areas outside regular traffic were sprayed heavier, which would not bother air traffic, in case of excess rejuvenator on the surface. Dates of treatment and application rates (gal/yd²) are shown in Table II. The remainder of the material was used to spray various taxiways and parking aprons.

Table II

Phase I	
Center 100-ft-wide area	0.053 gal/sq yd
All other areas	0.061 gal/sq yd
Phase II	
From center line runway out 50 ft	0.055 gal/sq yd
All other areas	0.066 gal/sq yd
Phase III	
From center line runway out 50 ft	0.058 gal/sq yd
All other areas	0.074 gal/sq yd

Jack E. Pickett
Materials Engineering Technician
Pavement Systems Division
Geotechnical Laboratory

Construction seal.

Reclamite was used as a construction seal. For comparison, the lower left area was not treated.

Penetration values of asphalt extracted from cores (New Mexico Highway Department).

Core	Depth	Value
Reclamite treated (2 years)		
1	Top ½"	52
2	Top ½"	48
3	Top ½"	40
Untreated		
4	Top ½"	17
5	Top ½"	23
6	Top ½"	22

Reclamite was used as a construction seal on the dry areas of the pavement. Untreated areas are still wet from water penetrating the surface.

Penetration values of asphalt extracted from cores (Douglas Street, Kern County, Calif.).

Depth	Reclamite treated 6 mos.	30 mos.
Top ½"	37	26
Untreated		
Top ½"	18	13

Reclamite was used as a construction seal on the dry areas of the pavement.

Penetration values of asphalt on cores taken at intervals over period of time (Day Street, Kern County, Calif.).

Depth	Reclamite treated 2 mos.	18 mos.	36 mos.
Top ½"	82	48	40
Untreated			
Top ½"	23	19	16

Report: 15-1229

January 8, 2016

Customer: Pavement Technology, Inc. - Colin Durante, John Schlegel

Project: Charleston County, South Carolina - 2015 Reclamite Application

Samples Submitted: Sixteen core samples (8 untreated and 8 treated with RECLAMITE®) identified as:

Forest Trail, Hulsey Boulevard, Patterson Avenue, South Rhett Avenue, Shadowmoss Parkway, Algon Quin Road, Queen Street, Wingo Way

Requested Testing:

Determine the Dynamic Shear Rheological properties at 60°C of the recovered asphalt binder from the top 3/8-inch layer of each core. These properties include viscosity, phase angle, complex, elastic, and viscous moduli.

Summary of Testing:

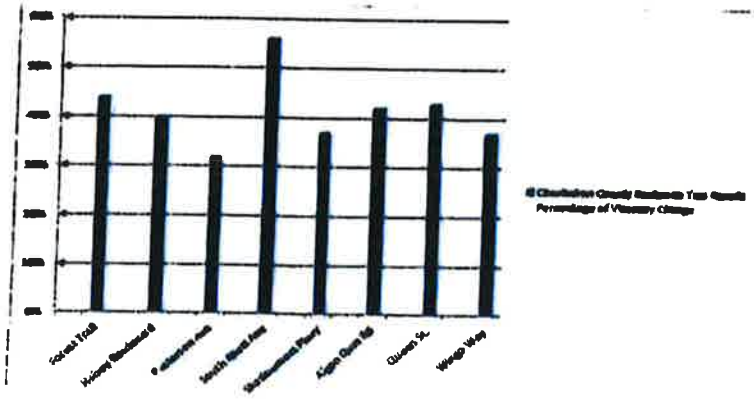
The top 3/8-inch of each core was removed for testing. The asphalt was extracted and recovered as prescribed by California Test Method 365. Viscosity and phase angle, as well as, complex, elastic, and viscous moduli were determined on the recovered asphalt binder using Dynamic Shear Rheology as prescribed by AASHTO T315. Test results are reported by Table 1.

Sample Identification	Viscosity 60°C, Poise	Phase Angle, °	MODULUS, 60°C, Pa		
			Complex	Elastic	Viscous
Forest Trail					
Untreated	110430	57.8	110730	59855	93463
Treated	61394	68.9	61566	22166	57427
	44% decrease				
Hulsey Boulevard					
Untreated	96417	65.8	96672	39719	88198
Treated	57459	69.1	57681	20972	53881
	40% decrease				
Patterson Avenue					
Untreated	108930	65.5	109220	45355	99359
Treated	74816	67.5	74911	28497	68646
	32% decrease				
South Rhett Avenue					
Untreated	87271	66.9	87501	34382	80498
Treated	38897	70.8	38999	12787	36748
	55% decrease				
Shadowmoss Parkway					
Untreated	85824	67.5	86034	37873	88729
Treated	53725	69.6	53892	23267	48586
	37% decrease				
Algon Quin Road					
Untreated	102180	64.7	102370	43770	92539
Treated	58971	68.4	59126	21781	54968
	42% decrease				
Queen Street					
Untreated	55747	59.9	55867	33013	49477
Treated	32020	70.2	32158	17667	29874
	42% decrease				
Wingo Way					
Untreated	68464	68.2	68624	22522	56786
Treated	37862	70.1	37962	18947	32896
	57% decrease				

Charleston County, South Carolina

Reclamite Application 2015

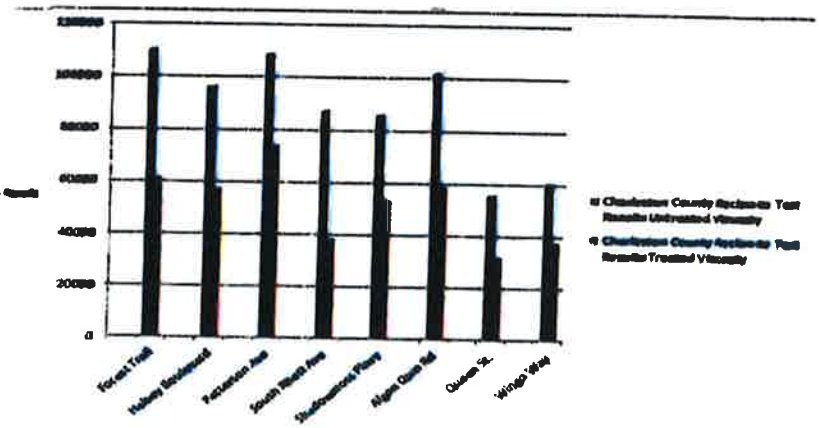
Change in Viscosity Results



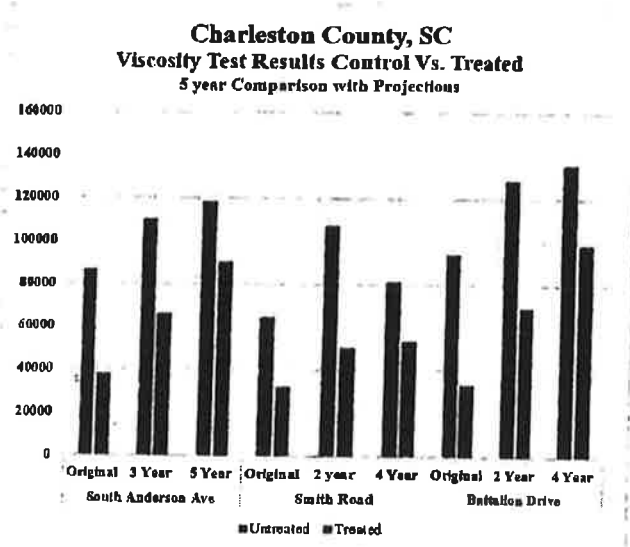
Charleston County, South Carolina

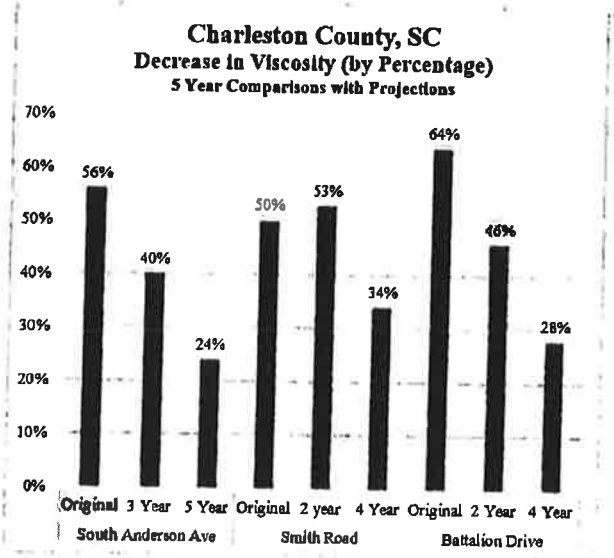
Reclamite Application 2015

Viscosity Test Results Control vs. Treated



Sample Identification	Viscosity 60° C, Poises		
	Original	3 Year	5 Year
South Anderson Avenue			
Untreated	86177	109950	118490
Treated	38220	66424	90198
Percentage Decrease	56%	40%	24%
	Original	2 Year	4 Year
Smith Road			
Untreated	64993	107220	81289
Treated	32426	50643	53746
Percentage Decrease	50%	53%	34%
	Original	2 Year	4 Year
Battalion Drive			
Untreated	94533	128750	136340
Treated	33743	69437	98896
Percentage Decrease	64%	46%	28%





Reclamite®
Safety Data Sheets

TRICOR

SAFETY DATA SHEET

1. Identification

Product identifier	**RECLAMITE® EMULSION**
Other means of identification	None.
Recommended use	Asphalt Rejuvenator
Recommended restrictions	Must be diluted with water following manufacturer's recommendations.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer:	Tricor Refining, LLC.
Address:	P.O. Box 5877 Bakersfield, CA 93388
24-hour Telephone Number:	(661) 393-7110
CHEMTREC:	1-800-424-9300 (North America) 1-703-527-3887 (International)

2. Hazard(s) identification

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
OSHA defined hazards	Not classified.

Label elements

Hazard symbol	None.
Signal word	None.
Hazard statement	Not available.
Precautionary statement	
Prevention	Not available.
Response	Not available.
Storage	Not available.
Disposal	Not available.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Not applicable.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
DISTILLATES (PETROLEUM), HYDROTREATED HEAVY NAPHTHENIC		64742-52-5	<=40
Extracts (petroleum), Heavy Naphthenic Distillate Solvent		64742-11-6	<=40
WATER		7732-18-5	<=40
PROPRIETARY INGREDIENTS		N/A	< 5

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.

Ingestion	Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Dry chemicals. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Cool containers exposed to heat with water spray and remove container, if no risk is involved. Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep upwind. Keep out of low areas. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Extinguish all flames in the vicinity. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Absorb in vermiculite, dry sand or earth and place into containers. Prevent entry into waterways, sewer, basements or confined areas. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use.
Environmental precautions	Contact local authorities in case of spillage to drain/aquatic environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Avoid prolonged or repeated contact with skin. Avoid prolonged exposure. Use only in well-ventilated areas.
Conditions for safe storage, including any incompatibilities	Keep away from heat and sources of ignition. Store in original tightly closed container.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED HEAVY NAPHTHENIC (CAS 64742-52-5)	PEL	5 mg/m3	Mist.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Extracts (petroleum), Heavy Naphthenic Distillate Solvent (CAS 64742-11-6)	PEL	5 mg/m3	Mist.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED HEAVY NAPHTHENIC (CAS 64742-52-5)	TWA	5 mg/m3	Inhalable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED HEAVY NAPHTHENIC (CAS 64742-52-5)	Ceiling	1800 mg/m3	
	STEL	10 mg/m3	Mist.
	TWA	350 mg/m3	
Extracts (petroleum), Heavy Naphthenic Distillate Solvent (CAS 64742-11-6)	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Other Wear appropriate chemical resistant clothing.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Liquid.

Color Not available.

Odor Not available.

Odor threshold Not available.

pH Not available.

Melting point/freezing point Not available.

Initial boiling point and boiling range > 212 °F (> 100 °C) IBP

Flash point	> 413.6 °F (> 212.0 °C)
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Readily Dispersible
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	500 °F (260 °C)
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Specific gravity	0.92 - 1.04

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Not available.

Information on toxicological effects

Acute toxicity	Not classified.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Not classified.
Respiratory or skin sensitization	
Respiratory sensitization	Not classified.
Skin sensitization	Not classified.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity

IARC Monographs. Overall Evaluation of Carcinogenicity

DISTILLATES (PETROLEUM), HYDROTREATED HEAVY NAPHTHENIC (CAS 64742-52-5) 3 Not classifiable as to carcinogenicity to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not classified.
Chronic effects	Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Contract with a disposal operator licensed by the Law on Disposal and Cleaning. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not discharge into drains, water courses or onto the ground. Dispose in accordance with all applicable regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

15. Regulatory information

US federal regulations All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 08-19-2021

Revision date 10-27-2021

Version # 02

NFPA ratings Health: 2
Flammability: 1
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Revision information

Hazard(s) identification: Response
Hazard(s) identification: Prevention
Hazard(s) identification: Disposal
Hazard(s) identification: Storage
Hazard(s) identification: Hazard statement
Hazard(s) identification: GHS Symbols
Hazard(s) identification: GHS Signal Words
Composition/information on ingredients: Composition comments
Composition/information on ingredients: Component information
Physical & Chemical Properties: Multiple Properties
Toxicological information: Carcinogenicity
HazReg Data: North America
GHS: Classification

A.R.A.-1Ti®
Product Submittals

A.R.A.-1 Ti® Pollution-Remediating Maltene Asphalt Rejuvenator

Pavement Technology, Inc.

December 2022

Hewlett-Packard Company

Pavement Technology, Inc.

24144 Detroit Rd.
Westlake, Ohio 44145
Phone: 800-333-6309

A.R.A.-1 Ti® Pollution-Remediating Maltene Asphalt Rejuvenator

Following five years of successful laboratory and field testing, Pavement Technology, Inc. (PTI) is delighted to announce the commercialization of our suite of state-of-the-art pollution-reducing, super-hydrophilic, and UV protective photocatalytic pavement solutions. The product stock represents PTI's next evolution of premium pavement preservation materials enhanced with photo-reactive titanium dioxide (TiO_2). **A.R.A.-1 Ti®** is our celebrated maltene asphalt rejuvenator[1], with five decades of proven pavement preservation accomplishment, strengthened with the environmental and ecological properties of TiO_2.

As a natural decomposition accelerant, TiO_2 is a multifaceted photo-responsive material[2] rapidly gaining increased scientific and commercial interest for near-roadway microenvironments (MEs) as it advances a host of positive environmental benefits, including:

- **Depolluting** near-pavement air (or water) cleaning applications, where TiO_2 reacted surfaces oxidize a variety of pollutants and contaminants such as those emitted by vehicles, especially NO_x and VOCs, reducing ozone pollution and mitigating acid rain formation
- **"Cool Pavements"** where TiO_2 treated surfaces provide a solar-reflective top boundary, which lessens pavement heat absorption and related radiative forcing (RF) by materially reducing the convective re-release of UV radiation that leads to the undesired heat island effects in our cities while extending the life-cycle assessment of pavements by slowing-down pavement oxidation[3]
- **Super-Hydrophilic** surfaces, which provide a rapid water-desorbing pavement to reduce saturation and prevent water intrusion damage. Super-hydrophilic pavements are also self-cleaning to remove

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[1] See Maltene Replacement Technology (MRT) discussion Section 3.7, Page 32.

[2] *Polymers, Light and the Science of TiO2*, DuPont™ Ti-Pure® Titanium Dioxide, DowDuPont, www.dow-dupont.com.

[3] Gopalakrishnan K, et al.

contaminants (e.g., mold) and staining and are indicated for inclement weather-related safety (rain displacing; ice inhibiting) improvements for roads[4]

Lead by **A.R.A.-1 Ti®**, our suite of pollution-remediating solutions creates a perpetual air-purifying roadway microenvironment (ME) that can mitigate the effects of Urban Heat islands and contribute to an agency's compliance with the Clean Air Act (CAA) and the U.S. EPA's stringent National Ambient Air Quality Standard (NAAQS).

The Texas A&M Transportation Institute (TTI) is PTI's research partner for our TiO_2 enhanced products and all applications include standard verification testing perfected by TTI for pollution-reduction efficiency, Urban Heat Island (UHI) mitigation and water displacement effectiveness.

TTI standard photocatalytic property testing includes:

- **Titanium Dioxide Penetration and Load:** XRF (fluorescent X-ray) analysis
- **Nitrogen Oxide Removal:** Japanese Industrial Standard (JIS) TR Z 0018 *Photocatalytic Materials – Air Purification Test Procedure* (as adapted to ASTM)
- **UHI Mitigation:** U.S. Green Building Council USGBC), LEED V4 Heat Island Reduction (HIR) via Solar Reflectance Index (SRI) - ASTM E1980 - 11 *Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces*
- **Hydrophilic Properties:** ASTM D7334 - 08(2013) *Standard Practice for Surface Wettability of Coatings, Substrates and Pigments by Advancing Contact Angle Measurement*

The verification testing results can be used for preparation for environmental grants and programs, including the Federal Highway Administration's Congestion Mitigation and Air Quality Improvement Program (CMAQ) as provided under the CAA and administered by the Federal Highway Administration (FHWA) with matching funds of 80% to 100%; [5] and the Federal Transit Administration's Urbanized Area Formula Program Grants (UAFPG), which match fund up to 80% for "technical transportation-related studies" and up to 90% for capital investment in "associated transit improvements" attributable to compliance with the CAA.[6] Other eligible sources include the Voluntary Airport Low Emissions Program (VALE) through the Federal Aviation Administration (FAA) and the FAA's Aviation Research Grants Program (FAA-12-01).

Contact: Michael Durante
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[4] Arainpour F and Farzaneh M, On Hydrophobic and Icephobic Properties of TiO2-Doped Silicon Rubber Coatings, Department of Applied Sciences, Universite du Quebec, *International Journal of Theoretical and Applied Nanotechnology*, 2012.

[5] U.S. Department of Transportation, Federal Highway Administration: Congestion Mitigation and Air Quality Improvement Program (CMAQ) (U.S.C. 149 / FAST Act Section 1114), www.fhwa.dot.gov.

[6] U.S. Department of Transportation, Federal Transit Administration: Urbanized Area Formula Program Grants (49 U.S.C. Chapter 53, Sections 5307 and 5340 / FAST Act Sections 3004, 3016), www.transit.dot.gov.

A.R.A.-1 Ti® Pollution-Remediating Maltene Asphalt Rejuvenator

- Maltene Asphalt Rejuvenating Agent
- Enhanced with Photocatalytic Grade Titanium Dioxide (TiO_2)
- Captures and Removes up to 60% of Toxic Airborne Vehicular Emissions
- Replenishes Exact Molecular Components Lost to Manufacturing and In-Service Oxidation
- Restores and Improves Pavement Density and Durability
- Creates a UV Protected Pavement that meets USGBC LEED for Urban Heat Island Mitigation
- Presents a 'Quick Drying' Super-Hydrophilic Surface
- Reduces Water Intrusion Damage
- Extends Pavement Life Cycle by as much as Twofold
- Self-Cleaning; Anti Mold; and Anti-Microbial
- Promotes Safer Inclement Weather Pavements

Urban Scaling for the Benefits of Pollution Remediation, Heat Island Reduction and Pavement Preservation with Durable Photocatalytic Pavements

Research Support

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List of Drawings and Figures

List of Tables

List of Acronyms

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ABD	Atmospheric Boundary Layer
AMTIC	Ambient Monitoring Technology Information Center
APEX	Air Pollutants Exposure Model
APWA	American Public Works Association
ARA	Asphalt Rejuvenating Agent
ASR	Alkali-Silica Reaction
ASTM	American Society for Testing and Materials
BTU	British Thermal Units
°C	Celsius
CAA	Clean Air Act 1990 (amended)
CAFE	Corporate Average Fuel Economy
CAP	Criteria Air Pollutant
CIR	Center for Infrastructure Renewal
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO_2e	Carbon Dioxide Equivalent
CsT	Centistokes
D&D	D&D Emulsions, Inc.
ECF	Electrochemical Energy Field
EPA	U.S. Environmental Protection Agency
ENV	Envision Framework for Sustainable and Resilient Infrastructure
EV	Electric Vehicle
°F	Fahrenheit
FAST	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FRM	Federal Reference Method
GSY	Gallons Per Square Yard
GHG	Greenhouse Gas
GWP	Global Warming Potential
H_2O	Water
HAP	Hazardous Air Pollutant
HIR	Heat Island Reduction
HIRP	Heat Island Reduction Program
HNO_3	Nitrate Salt
HUD	U.S. Department of Housing and Urban Development
ICV	Internal Combustion Vehicle
IRI	International Roughness Index
ISI	Institute for Sustainable Infrastructure
JIS	Japanese Industrial Standard
LCA	Life Cycle Assessment
LEED	Leadership in Energy and Environmental Design
LF	Lineal Feet
M^2	Meters Squared
ME	Microenvironment
MJ	Megajoule
MM	Millimeter
MOT	Maintenance of Traffic
MPG	Miles Per Gallon
MPO	Metropolitan Planning Organization
MRT	Maltene Replacement Technology
MSRP	Manufacturer's Suggested Retail Price
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NREL	National Renewable Energy Laboratory
NAWQA	National Water-Quality Assessment Program
NVFEL	National Vehicle and Fuel Emissions Laboratory
NEV	New Energy Vehicle
NM	Nanometers
NNE	Nitrite-Nitrate Exchange Indexing
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NO_x	Nitrogen Oxides
O_3	Ozone
OGFC	Open Graded Friction Course
OTIC	Ohio Turnpike and Infrastructure Commission
P	Poise
PCC	Portland Cement Concrete
$PM_{2.5}$	Particulate Matter <2.5 µm (micron)
PPB	Parts Per Billion
PPM	Parts Per Million
PPMC	PPM Consultants, Inc.
PSH	Photoinduced Superhydrophilicity State
PTI	Pavement Technology, Inc.
PCO	Photocatalytic Oxidation
Redox	Oxidation-Reduction
RF	Radiative Forcing
ROI	Return on Investment
SCAQMD	South Coast Air Quality Management District
SCM	State, County, and Municipal
SCR	Selective Catalytic Reduction
SCRP	Sustainable Communities Regional Planning Grant
So_x	Sulfur Oxides
Sq/Yd	Square Yard(s)
SR	Solar Reflectivity
SRI	Solar Reflectance Index
TTI	Texas A&M Transportation Institute
TiO_2	Titanium Dioxide
IUC	University of Illinois Urbana-Champaign
UAFPG	Urbanized Area Formula Program Grant
UHI	Urban Heat Island effect
USD	U.S. Dollars
USGBC	U.S. Green Building Council
UV	Ultraviolet Light
VALE	Voluntary Airport Low Emissions Program
VOC	Volatile Organic Compound
W	Weight of Residue
WCA	Water Contact Angle
WHO	World Health Organization
XRF	X-ray Fluorescence

1 SUMMARY AND TESTING

The background, methods, application and testing for PTI's photocatalytic pavement solutions for pollution removal, pavement lifecycle extension and urban heat management are described herein.

PTI is into its fifth decade serving government agencies and was an early advocate for asphalt rejuvenation nanoscience using Maltene Replacement Technology (MRT) [7] to extend the life cycle assessment (LCA) of asphalt pavements. Thousands of agencies (SCMs) have employed MRT for many decades as part of their roadway planning and maintenance protocols to reduce costs and lower their community's carbon footprint. Pavement preservation solutions enhanced with the trifecta of photocatalytic properties, from depollution to heat-reducing and life cycle extending, are a natural advancement in environmental and sustainability solutions from PTI.

These next generation products are proving valuable to SCMs and other transportation infrastructure authorities, such as airports, seeking to manage compliance with the Clean Air Act (CAA), the National Ambient Air Quality Standards (NAAQS) for airborne pollution inventory minimums, and Urban Heat Island effect (UHI).

The near-road microenvironment (ME) is a significant area of policy and practice concern for modern urban planners, regulators, and sustainability managers. Emissions from cars and trucks are a major source of greenhouse gases (GHGs) and the primary source for anthropogenic airborne toxins, such as nitrogen oxides (NO_x) and volatile organic compounds (VOCs), that form the nucleus of unhealthy photochemical smog.

The combined action of urbanization (change in land use) and sharp increase in vehicular emissions intensifies both the build-up of GHGs in the air we breathe and the impact of heat sinks. The circular impacts from air pollution and UHI amplify related economic stresses on communities. In turn, GHG inventories accumulate, exaggerating linked atopic and other human disease.[8]

National Emissions Inventory (NEI) Data [9] indicate motor vehicles operating on roadways emit on average 60% of ozone pollution (O_3), principally NO_x in the United States. In more densely populated areas, vehicle-based emissions inventory trend closer to 75%, while total vehicle emissions in rapidly growing metropolitan areas have skyrocketed over 80% since 1990.[10]

In addition to poorer air quality and the escalating health burden, mobile-sourced pollution is contributing to the "western impacts", including rising sea levels and warmer climates. For example, intensified El Niño effects are resulting in exaggerated precipitation and incidence of flooding in the Southeastern United States and droughts in the West.

NO_x is the primary component of O_3 or "urban smog". It is a class of gaseous pollutants generated during high temperature processes of internal combustion engines and consists of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is considered among the most dangerous air pollutants impacting human health and the environment and is one of six Criteria Air Pollutants (CAPs) as defined under the NAAQS.

Photocatalytic oxidation (PCO) of NO_x using topical spray materials containing **titanium dioxide (TiO_2)** for roadway applications is a novel, yet proven technology for mitigating urban smog. It has been researched and tested broadly,

[7] Pavement Technology, Inc., www.pavetechinc.com/got-maltenes/.

[8] Swamy G, et al., *Urban Heat Island (UHI) Influence on Secondary Pollutant Formation in a Tropical Humid Environment*, www.PubMed.gov.

[9] U.S. Environmental Protection Agency (EPA): National Emissions Inventory (NEI), www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei.

[10] Boston University: Database of Road Transportation Emissions and *The New York Times*, October 2019.

especially in Europe. While the success rate for PCO efficiency of TiO_2 solutions has been consistently encouraging,[11] [12] prevailing techniques for both the development and application of TiO_2 compounds have proven not durable or economical.

That now has changed.

In 2017 (and 2018), PTI applied the first field tests for *durable* TiO_2 solutions in Greenville (SC) and Orlando (FL). The technological breakthrough combined proven surface penetrating pavement preservation compounds, long utilized by conservation minded SCMs, fortified with photocatalyst grade TiO_2, to impregnate pavements with the natural pollution-reducing and heat reflecting material. The PTI technique provides both a method for sustainable TiO_2 delivery into pavement wearing-course depth and at cost-effective "retrofit" economics. The practice promotes an efficient and scalable application for solar-based, direct capture technology for O_3 precursors in the near-road environment.

Titanium is an amazing material. It is as strong as steel, yet a fraction of its weight and much more durable. TiO_2 is a natural mineral whose atypical chemical properties have led to a diverse range of commercial and industrial uses from whitening additives in paints to food coloring, candy coatings, toothpaste, and reflective sunscreens, etc.

Or as surface 'wetting' (i.e., hydrophilic) and anti-fogging agents and as photo-reactive chemical catalysts.[13]

With a half century of experience introducing nanotechnologies to pavements, PTI's photocatalytic solutions are designed to deeply penetrate pavement surfaces to deliver nanoparticle, photocatalyst TiO_2 into depth at optimal load for sustained PCO and UHI mitigation. The product stock can be applied to almost any asphalt or concrete substrate using PTI's advanced application apparatus and at a fraction of the costs to more archival means to clean air, reduce heat build and extend infrastructure life cycle.

Based on the Greenville and Orlando successes **(Table 1.1)**, [14] more refined applications of these new solutions have been deployed in the field as pilot projects in Austin (TX), Charlotte County (FL), Greater (Cary) Raleigh (NC), Bartow (FL) [FDOT test], Akron (Summit County) (OH) and at Orlando International Airport (MCO).

Recently, Cincinnati (OH) and Raleigh (NC) placed the first ever public bid and RFP for these materials. They will be used on the first photocatalytic pavement related project to receive LEED in St. Petersburgh (FL) and piloted at the Kennedy Space Center by NASA later in summer 2020.

1.2 Field Testing – Vehicular Pollution Removal

The Texas A&M Transportation Institute (TTI) has tested field cores from the pilot sites using standardized photocatalytic materials testing protocols for PCO. [15] TTI testing indicates consistently strong NO_x reduction at all sites tested and over multiple years on the oldest sites **(Tables 1.1-1.4)**.

[11] Dios J, et al., *Decontamination through Photocatalytic TiO_2 Additions – Past, Present and Future,* International Conference on Emerging Trends in Engineering and Technology (ICETET), London 2014.

[12] Gopalakrishnan K, et al., *Climate Change, Energy, Sustainability, and Pavements*, Springer, 2014.

[13] Gopalakrishnan K, et al., *Climate Change, Energy, Sustainability, and Pavements*, Springer, 2014.

[14] Zollinger DG and Joshaghani A, *Laboratory Investigation of the Effect of TiO2 Topical Treatments on Concrete and Asphalt Samples*, Texas A&M Transportation Institute, September 2018.

[15] Japanese Industrial Standard (JIS) TR Z 0018 *Photocatalytic Materials – Air Purification Test Procedure*.

Table 1.1 Multi-year NO_x Reduction Testing – Orlando (FL) and Greenville (SC)

A.R.A.-1 Ti®

Site	NO Reduction Efficiency (%)				
0.04 – 0.05 gsy Light TiO_2	Control Sample	Y1 Sample A	Y2 Sample A	Y1 Sample B	Y2 Sample B
Orlando (FL)	NEGL	28%	33%	34%	30%
Greenville (SC)	NEGL	38%	35%	43%	38%

Source: Texas A&M Transportation Institute (TTI)

Table 1.2 NO_x Reduction – Orlando International Airport and Charlotte County (FL)

Site	NO Reduction Efficiency (%)				
0.08 gsy > TiO_2	Control Sample	A.R.A.-1 Ti® Sample A	A.R.A.-1 Ti® Sample B	Litho1000Ti® Sample A	Litho1000Ti® Sample B
Orlando International	NEGL	45%	43%	53%	57%
Charlotte Co. (FL)	NEGL			42%	46%

		Ti-introCME™ Concrete Sample A	Ti-introCME™ Concrete Sample B	Ti-introCME™ Asphalt Sample A	Ti-introCME™ Asphalt Sample B
Charlotte Co. (FL)	NEGL	48%	47%	49%	50%

Source: Texas A&M Transportation Institute (TTI)

Table 1.3 NO_x Reduction – Greater Raleigh [Cary] (NC)

Site	NO Reduction Efficiency (%)				
A.R.A.-1 Ti®	Control Sample	0.08 gsy Sample A	0.08 gsy Sample B	0.07 gsy Sample A	0.07 gsy Sample B
Cary, NC	NEGL	46%	45%	42%	44%

Source: Texas A&M Transportation Institute (TTI)

Table 1.4 NO_x Reduction – TTI Test at the Center for Infrastructure Renewal (CIR)

Compound	NO Reduction Efficiency (%)					
Application Rate	Control Sample	0.05 gsy	0.06 gsy	0.08 gsy	0.10 gsy	0.12 gsy
A.R.A.-1 Ti®	NEGL	53%	57%	61%	53%	48%
Ti-introCME™	NEGL	48%	52%	55%	58%	53%

Application Rate		0.04 gsy	0.06 gsy	0.10 gsy
Litho1000 Ti®	NEGL	46%	55%	48%

Source: Texas A&M Transportation Institute (TTI)

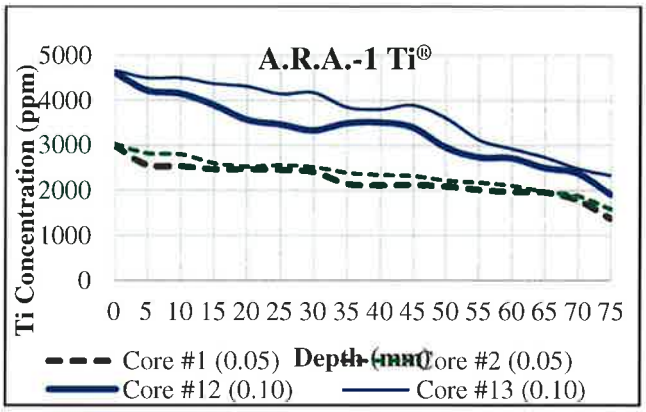
Texas A&M also has tested the pilot sites for TiO_2 penetration (durability) and load optimization (PCO efficiency) through 'wearing-course' depth (0 to 6 mm) [16] using x-ray fluorescence analysis **(Figure 1.1)**.[17] [18]

Due, in large part, to previously proven penetrant technology, PTI test sites consistently indicate deep penetration of the photocatalyst material at efficient PCO concentrations (> 2000 ppm) as deep as 50 mm (2 inches) or 8x AASHTO wearing-course depth.

The high TiO_2 presence at wearing-course depth is why the NO_x reduction figures are consistently strong. Penetration and reliable load optimization of the TiO_2 is the key to the significant technological advancement with Pavement Technology's photocatalytic pavement solutions. This was achieved by combining two proven nanotechnologies – known pavement preservation penetrating agents (e.g., MRT) and photocatalysis using photoreactive grade nanoparticle titanium dioxide.

Road-level NO_x capture and sequestration or "NO_x Capture" has been the principal advantage of PTI's photocatalytic pavement solutions, with a product stock including **A.R.A.-1 Ti®** for asphalt surface courses, **Litho1000$^{Ti®}$** for concrete surface courses, **JOINTBOND$^{Ti®}$** (longitudinal joints) and **Ti-introCME®** (all substrates), which cover most or all transportation infrastructures and needs.

Figure 1.1 TiO_2 Penetration – Orlando International Airport



Source: Texas A&M Transportation Institute (TTI)

[16] The American Association of State Highway and Transportation Officials (AASHTO) sets pavement wearing course depth at 0.25 inches.

[17] Zollinger DG and Joshaghani A, September 2018.

[18] Zollinger DG and Joshaghani A, Follow-up, May 2019.

1.3 Acid Rain Mitigation with TiO_2 Treated Roads

Atmospheric deposition of nitrogen is a major source of nitrate found in watersheds and is addressed by various water-quality legislation. Specifically, because almost all of the sources of nitrogen contaminations are point sources, this form of pollution is best controlled by directly reducing nitrogen oxide emissions.

Commonly, these point sources are located outside of the political boundaries of watersheds that inherit this atmospheric deposited nitrogen and, therefore, may not be controlled through SCM regulations nor governance. Recent amendments to the CAA have mandated reductions to NO_x, including from mobile sources, as they are a critical factor in managing nitrogen levels impacting lakes, reservoirs, rivers, and other estuarial expanses.

Vehicular emissions are the second largest source of nitrogen builds in watersheds, after agricultural sources, and can contribute as much as 40% [19] of nitrate levels in dense urban settings.

The U.S. Geological Survey (USGS) recommends direct reduction strategies for mobile-sourced NO_x be employed to reduce such water contaminations. So, photocatalytic pavements provide a preferred strategy for acid rain mitigation and direct reduction of watershed nitrogen builds.

Table 1.5 Solar Reflectance – (a) Orlando International Airport and (b) Charlotte County (FL)

Compound / Substrate	Solar Reflectance Index Values (SRI)					
Application Rate (a)	Control Sample	Control Sample	0.10 gsy	0.10 gsy	0.08 gsy	0.08 gsy
A.R.A.-1 Ti® / Asphalt	9	8	40	39		
Litho1000 Ti® / Concrete	24	24			38	38
Application Rate (b)	Control Sample	0.03 gsy	0.06 gsy			
Ti-introCME™ / Asphalt	11	30	34			
Ti-introCME™ / Concrete	20	37	42			
Litho1000 Ti® / Concrete	25	41	46			

Source: Texas A&M Transportation Institute (TTI)

[19] U.S. Geological Survey's National Water-Quality Assessment Program (NAWQA), www.usgs.com.

1.4 Field Testing - Cool Pavements with TiO_2

In 2019, TTI added testing for solar reflectance (UHI mitigation effectiveness), showing PTI test sites consistently exceed the threshold for **U.S. Green Building Council LEED** for heat island reduction **(Table 1.5)**.[20] [21]

At Orlando International Airport, PTI solutions turned an almost perfectly absorptive asphalt parking ramp (FedEx terminal) with a **Solar Reflectance Index (SRI)** of 9 (out of 100) into a 39-40 or 40% more reflective than LEED requirements and **> 4x as heat energy displacing** as original, untreated asphalt.

As a heat mitigator, photocatalytic grade TiO_2 simultaneously absorbs solar radiation away from the pavement substrate and efficiently redirects the energy back into the atmosphere, thereby protecting the pavement from oxidative deterioration (LCA extension) and eliminating excess pavement emissivity (especially in asphalts), creating a so-called – **"cool pavement"** which greatly helps reduce UHI.[22]

1.5 Field Testing – Super-Hydrophilic Pavements

TiO_2-bearing pavements exhibit a **Photoinduced Superhydrophilicity State** (PSH) when exposed to UV radiation, which enables water to disperse and desorb across a TiO2-treated surface much more efficiently. [23] [24] This **greatly reduces water intrusion risk** to pavements and critical for longitudinal joints.

PSH pavements also promote significant **highway safety** improvement implications including reduced hydroplaning, less windshield visibility impairment, and possibly ice formation mitigation. It also is why TiO_2 treated surfaces are mechanically "self-cleaning" and both anti-mold and antimicrobial. [25]

[20] Zollinger DG and Joshaghani A, *Solar Reflectance Analysis of TiO2 Penetrant Treatments on Concrete and Asphalt Samples*, Texas A&M Transportation Institute, August 2019.

[21] U.S. Green Building Council USGBC), LEED V4 Heat Island Reduction (HIR) via Solar Reflectance Index (SRI) ≥ 50% 29, www.usgbc.org.

[22] EPA, *Reducing Urban Heat Islands: Compendium of Strategies, Urban Heat Island Basics*, www.epa.org.

[23] Mechanism of Photoinduced Superhydrophilicity on the Photocatalyst Surface, *The Journal of Physical Chemistry*, American Chemistry Society, 2005, Masato T, et al.

[24] Vassilia Z, *Hydrophilic TiO2 Surface Without Photocatalytic Activation*, Lawrence Berkeley National Laboratory, University of California at Berkeley.

[25] Kubacka A, Suarez Diez M, et al., Understanding the Antimicrobial Mechanism of TiO2- based Nanocomposite Films in a Pathogenic Bacterium, *Nature Journal*, 2014.

For example, the PTI test site at Orlando International exhibited significant mold removal within the first few months on the previously mentioned FedEx ramp treated with **A.R.A.-1 Ti®**.

Light energized TiO_2 strongly attracts water, which is naturally polarized, where the water molecules are split by the activated surface, resulting in vastly improved disposal of H_2O as it is transformed into thin films across the surface, not allowing droplets (and ponding) to form **(Drawing 1.2)**.

Drawing 1.2 Super-Hydrophilic Surfaces Can Rapidly Displace Water

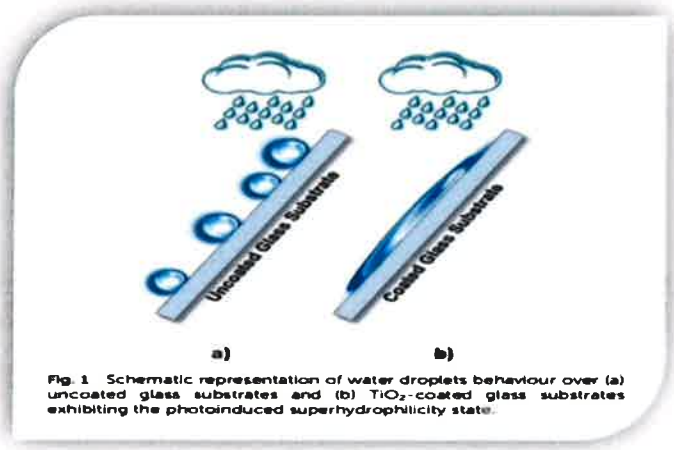


Fig. 1 Schematic representation of water droplets behaviour over (a) uncoated glass substrates and (b) TiO_2-coated glass substrates exhibiting the photoinduced superhydrophilicity state.

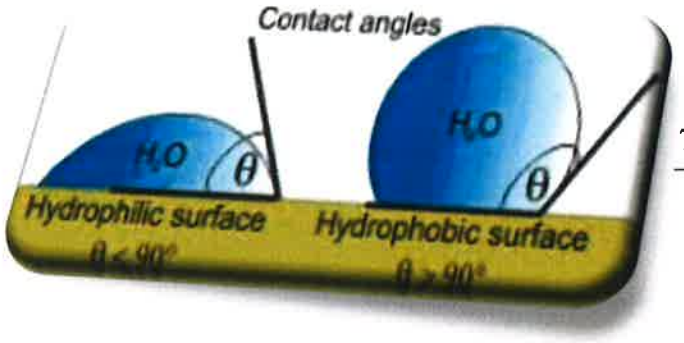
Source: Universidade do Porto (Portugal)

This PSH or **"quick drying"** transition of a photocatalytic pavement surface can be observed by measuring water contact angle (WCA) before and after UV illumination,[26] where a TiO_2-bearing surface presents a **contact angle** considerably **lower** when irradiated. This **accelerates the dispersion** of water across the surface by as much as **5x** a non TiO_2-bearing or "inactive" surface.[27] [28]

As with NO_x reduction, the "fully hydroxylated" TiO_2-bearing pavement [29] during photocatalysis causes powerful oxidants to combine with the adsorbed water molecules (e.g., rain) to form new hydrogen bonding with the H_2O clusters. This forces the distribution of these bonds within the water droplets to decrease, resulting in a **reduction** of **surface tension** between the water and the photoreactive TiO_2 surface.[30] [31]

A WCA of less than 90 degrees is considered "hydrophilic" and will increasingly (with lower contact angle) speed-up the displacement of water **(Drawing 1.3)**.

Drawing 1.3 Hydrophilic vs Hydrophobic Contact Angles



Source: London South Bank University

For example, in highway design, an open graded friction course (OGFC) is designed specifically to **physically reduce** water contact angle as **surface roughness** has a strong effect on wettability.

[26] ASTM D7334 - 08(2013) *Standard Practice for Surface Wettability of Coatings, Substrates and Pigments by Advancing Contact Angle Measurement*.

[27] Research Institute of Toto Ltd., Tokyo, Japan, 1995.

[28] Banerjee S, et al., *Self-Cleaning Applications of TiO_2 by Photo-Induced Hydrophilicity and Photocatalysis*, 2015.

[29] Hydroxylation is a chemical process that introduces a hydroxyl group (-OH) into an organic compound and is the first step in oxidative degradation.

[30] Transparent Superhydrophobic/Superhydrophilic TiO_2-based Coatings for Self-Cleaning and Anti-fogging, *Journal of Materials Chemistry*, Royal Society of Chemistry, 2012.

[31] Masato T, Sakamoto K, et al., *Mechanism of Photoinduced Superhydrophilicity on the TiO_2 for Photocatalytic Surface*, Department of Chemistry, Graduate School of Engineering, Osaka Prefecture University, February 2005.

A photocatalytic pavement will be even more efficient at producing a hydrophilic outcome through its high electro-chemical energy transformation of water molecules as described, providing a measurable upgrade to the water desorbing efficiency of any pavement substrate.

PTI tested **A.R.A.-1 Ti®** on an OGFC in Bartow (FL) for the Florida Department of Transportation (FDOT) in 2019. As indicated in **(Table 1.6)**, the TiO_2 enhanced test section observed a material decline in WCA from 81-82 degrees to 50-51 degrees for a nearly 40% improvement in water displacement capability.

Table 1.6 Water Contact Angle – FDOT OGFC Test Bartow (FL)

Site	Water Contact Angle°				
A.R.A.-1 Ti®	Control Sample	TiO2 1 Visible Light	TiO2 1 UV Light	TiO2 2 Visible Light	TiO2 2 UV Light
FDOT Test	81°	82°	51°	81°	50°

Source: Texas A&M Transportation Institute (TTI)

In the Charlotte County (FL) trials, PTI tested both **Litho1000$^{Ti®}$** and **Ti-introCME®** across test sections for skid resistance (friction) under the standard testing protocol [32] which was executed by International Cybernetics **(Table 1.7)**. The primary purpose for which was to determine skid resistance safety when applying TiO_2 enhanced products to high speed thoroughfares. But what also was observed was clear indications of the instantaneous hydrophilic *effect* the TiO_2 imparted to the surface of the pavement.

[32] ASTM E247 / E274M-15 *Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire.*

Table 1.7 TiO_2 Impact on Skid Resistance and Hydrophilic Implications

Litho1000 Ti®

Location / Rate gsy	Pre-Application	Post 20 Minutes	Post 24 Hours
Indian Trail WB / 0.03	43	41	44
Indian Trail WB / 0.06	43	47	50

Ti-introCME®

Location / Rate gsy	Pre-Application	Post 20 Minutes	Post 24 Hours
Alicante Drive EB / 0.03	58	61	61
Alicante Drive WB / 0.06	59	64	64
Indian Trail WB / 0.03	42	43	45
Indian Trail WB / 0.06	42	51	51

Source: International Cybernetics, Charlotte County (FL) March 2019

As exhibited, the surfaces treated with both **Litho1000$^{Ti®}$** and **Ti-introCME®** showed that friction was not adversely impacted in any of the tests and that in all six tests, skid resistance improved meaningfully. That friction results improved immediately (tested after just 20 minutes following application) and continued was insightful as it indicates the clear presence of the TiO_2 and a PSH.

To some, this may appear to be a startling outcome, especially considering the rather small amount of water used in the standardized friction test. But it is direct evidence of improved hydrophilic tendency of a road impregnated with photocatalyst grade TiO_2. While more expanded research is concurrent, under actual inclement weather conditions, one should expect the improved (relative) skid resistance for a TiO_2-bearing pavement to be even greater, hence the safety improvements realizable.

PTI's photocatalytic pavement solutions provide the Public Works profession the first method for sustainable TiO_2 delivery into pavement wearing-course depth and at cost-effective "retrofit" economics. The technique promotes an efficient, durable, and scalable application for solar-based, **"NO_x Capture"** technology for the systematic removal of O_3 precursors, UHI mitigation, pavement infrastructure LCA extension, and improved roadway safety in the critical near-road environment.

PERFORMANCE SPECIFICATION

2 Pollution-Remediating Polymerized Maltene Asphalt Rejuvenator

2.1 Description: TiO_2 Enhanced Asphalt Rejuvenating Agent

The work specified in this section shall consist of furnishing all labor, material, and equipment necessary to perform all operations for the application of a penetrating polymerized asphalt rejuvenating agent to asphaltic concrete surface courses. The asphalt binder rejuvenation shall be affected through the petroleum Maltene Replacement Technology method. In addition, and with the same penetrating carrier liquid, apply photocatalytic-grade titanium dioxide (TiO_2) to create a pollution reducing pavement microenvironment. The rejuvenation of surface courses shall be by spray application of a polymerized maltene based cationic rejuvenating agent composed of petroleum oils and resins emulsified with water and containing photocatalytic titanium dioxide in a minimum parts per million at a minimum depth as hereafter specified.

All work shall be in accordance with the specifications, the applicable drawings, and subject to the terms and conditions of this contract.

Figure 2.1 A.R.A.-1 Ti® Application

Source: Pavement Technology, Inc.; Cary, NC 2019

2.2 Materials and Performance: TiO_2 Enhanced Asphalt Rejuvenating Agent

The TiO_2 Enhanced Asphalt Rejuvenating Agent shall be a cationic emulsion composed of a petroleum resin oil base uniformly emulsified with water. Each bidder must submit a bid with a certified statement from the TiO_2 enhanced asphalt rejuvenating agent manufacturer showing that the asphalt rejuvenating emulsion conforms to the required physical and chemical requirements.

Table 2.1 Test of Emulsion and on Residue

	Test Methods		Requirements	
	ASTM	AASHTO	Min	Max
Tests on Emulsion				
Viscosity @ 25°C, SFS	**D-244**	**T-59**	**15**	**40**
Residue, %W[1]	**D-244(Mod.)**	**T-59(Mod)**	**60**	**65**
Miscibility Test[2]	**D-244(Mod.)**	**T-59(Mod)**	**No Coagulation**	
Sieve Test, %W[3]	**D-244(Mod.)**	**T-59(Mod)**		**0.1**
Particle Charge Test	**D-244**	**T-59**	**Positive**	
Percent Light Transmittance[4]				**80**
Tests on Residue from Distillation:				
Flash Point, COC, °C	**D-92**	**T-48**	**196**	
Viscosity @ 60°C, cSt	**D-445**	**-**	**100**	**200**
Asphaltenes, %w	**D-2006-70**	**-**		**1.00**
Maltene Dist. Ratio[5]	**D-2006-70**	**-**	**0.3**	**0.6**
PC/S Ratio[5]	**D-2006-70**	**-**	**0.5**	
Saturated Hydrocarbons, S[5]	**D-2006-70**	**-**	**21**	**28**

[1] ASTM D-244 Modified Evaporation Test for percent of residue is made by heating 50-gram sample to 149°C (300°F) until foaming ceases, then cool immediately and calculate results.

[2] Test procedure identical with ASTM D-244-60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.

[3] Test procedure identical with ASTM D-244 except that distilled water shall be used in place of two percent sodium oleate solution.

[4] Procedure for Determining Percent Light Transmittance on Asphalt Rejuvenating Agent:

a. Scope: This procedure covers the determination of percent light transmittance of the asphalt rejuvenating agent.

b. Apparatus:

1. Container may be glass, plastic or metal having a capacity of 6,000 ml.
2. Graduated cylinder, 1,000 ml, or greater
3. Light transmittance measuring apparatus, such as Bausch and Lomb or Lumberton spectrophotometer
4. Graduated pipette having 1 ml capacity to 0.01 ml accuracy
5. Suction bulb for use with pipette
6. Test tubes compatible with spectrophotometer, 3/4" X 6, Bausch and Lomb, Catalog No. 33-17- 81, (B&L)

c. Calibration of spectrophotometer:

1. Calibrate spectrophotometer as follows:
   a. Set wavelength at 580 mu,

b. Allow spectrophotometer to warm-up thirty minutes,
c. Zero percent light transmittance (%LT) scale,
d. Rinse test tube three times with tap water and fill to top of circle marking on B&L test tube or approximately 2/3 full,
e. Place tube in spectrophotometer and set %LT scale at 100, and,
f. Repeat steps (c) (e) two times or until no further adjustments necessary.

d. Procedure:

1. Shake, stir or otherwise thoroughly mix emulsion to be tested. Place sample of emulsion in beaker and allow to stand one minute.
2. Place 2,000 ml tap water in container.
3. Suck 1.00 ml emulsion into pipette using suction bulb. Wipe off outside of pipette.
4. Using suction bulb, blow emulsion into container.
5. Rinse pipette by sucking in diluted emulsion solution and blowing out.
6. Clean pipette with soap or solvent and water. Rinse with acetone.
7. Stir diluted emulsion thoroughly.
8. Rinse out tube to be used with the diluted emulsion three times and fill to top of circle.
9. Calibrate spectrophotometer.
10. Place diluted emulsion sample tube in spectrophotometer, cover and read %LT to nearest tenth.
11. Repeat steps 9 and 10 until three identical consecutive readings are achieved.
12. The elapsed time between addition of emulsion to dilution of water and final %LT reading should not exceed 5 minutes.

[5] Chemical Composition by ASTM Method D-2006-70 -- (Free) Maltene Distribution Ratio (MDR) can be defined as:

$$\frac{PC + A_1}{S + A_2}$$

Where:

PC = Polar Compounds A_1 = First Acidaffins
A_2 = Second Acidaffins S = Saturated Hydrocarbons

2.3 Maltene Replacement ("Rejuvenation") Test

The TiO_2 Enhanced Asphalt Rejuvenating Agent shall have the capability to penetrate the asphalt pavement surface and shall be absorbed and incorporated into the asphalt binder. Verification that said incorporation of the TiO_2 Enhanced Asphalt Rejuvenating Agent into the asphalt binder has been effected shall be by the petroleum maltene fraction replacement method and analysis of the chemical properties of said asphalt binder therein i.e., viscosity shall be reduced by said method.

For pavements less than two-years old and receiving the original application of TiO_2 Enhanced Asphalt Rejuvenating Agent, the viscosity shall be reduced by a minimum of twenty (20%) percent as determined by the dynamic shear rheometer (DSR) method for asphalt testing in accord with AASHTO T315-05. For treatments of pavements older than two-years and/or after an initial treatment with a petroleum maltene asphalt rejuvenator, the viscosity shall be reduced by petroleum maltene replacement method a minimum of thirty percent (30%) in accord with same. This analysis shall apply to extracted asphalt binder, taken from cores extracted fifteen to thirty days following application, in the upper 3/8" of pavement. The treated areas shall be densified or resistant in depth to the intrusion of air and water.

The TiO_2 Enhanced Asphalt Rejuvenating Agent shall have a record of at least two years of satisfactory service as a TiO_2 enhanced petroleum maltene based emulsion asphalt rejuvenating agent and in-depth densifier. Satisfactory service shall be based on the capability of the material to decrease the viscosity of the asphalt binder by the petroleum maltene replacement method and provide an in-depth seal. A.R.A.-1 Ti®, a Pavement Technology, Inc. product manufactured by D&D Emulsions, Inc., Mansfield, Ohio, is a product of know quality and accepted performance.

The bidder must submit with his bid the manufacturer's certification that the material proposed for use is in compliance with the specification requirements. The bidder must submit with his bid previous use documentation and test data conclusively demonstrating that; the TiO_2 Enhanced Asphalt Rejuvenating Agent has been used successfully for a period of two years by government agencies such as state, county and municipal governments or "SCMs", etc.; and that the enhanced rejuvenating agent has been proven to perform, as heretofore required, through field testing by government agencies as to the required change in asphalt binder rheology and photocatalytic properties as hereinafter detailed. Testing data shall be submitted indicating such product performance on a sufficient number of projects to insure product consistency. In addition, field testing data shall be submitted to indicate said product performance over a minimum testing period of two years to insure reasonable sustainability.

The Engineer may require that untreated and treated core samples, a minimum of four inches in diameter, be removed by the Contractor at locations indicated by the Engineer. The treated core sample shall be taken in the same lane in close proximity to each untreated sample. A minimum of one untreated and treated core sample shall be taken for each pavement group or one per 50,000 square yards of treated pavement in each pavement group.

2.4 Photocatalytic Properties Testing

2.4.1 TiO_2 Penetration Test: The TiO_2 Enhanced Asphalt Rejuvenating Agent shall have a non-destructive analytical procedure applied to determine the percent of Titanium Dioxide nanoparticles present in each two-millimeter (2mm) layer of the field core sample matrix for a minimum depth of six millimeters (6mm) from the top of the treated sample core. The method of measurement shall be by fluorescent X-ray emitted from the surface when excited by a principal X-ray source that is exceptional for the given element. A hand-held XRF analyzer is acceptable for this testing.

The minimum required concentration of Titanium Dioxide nanoparticles per each two-millimeter (2mm) section up to the minimum depth of 6mm shall average 2000 parts per million (ppm).

2.4.2 NO_2 Reduction Effectiveness: The TiO_2 Enhanced Asphalt Rejuvenating Agent shall be verified for the effectiveness of the air pollution remediation of the Titanium Dioxide nanoparticle portion by laboratory analysis of core samples extracted from the treated pavement as directed and required by the Engineer. The cores shall be a minimum of four inches (4") in diameter and in pairs at each location directed by the Engineer. The cores shall be tested by an accredited laboratory or university with the equipment and capability to perform the following test procedures.

2.4.3 NO_2 Reduction Test: A photo reactor test chamber shall be employed that allow for the evaluation of the efficient photocatalytic reduction of introduced NO_x gas of a known and controlled concentration within the chambers volume. The chamber light source shall be a UV lamp having a wavelength of 375 nanometers. The interior chamber environment shall be at 77°F with a constant humidity of 55% ±5%. The test total duration shall be five hours. The analysis test system shall be based on a Japanese Industrial Standard (JIS) TR Z0018 "Photocatalytic Materials-Air purification test procedure". NO removal

efficiency shall be measured using a Model 42i Chemiluminescence NO-NO_2-NO_x Analyzer (Thermo Fisher Scientific Inc.).

The minimum NO reduction following the heretofore outlined test procedure evaluating field core samples shall average 25% for all cores tested.

2.4.4 Solar Reflectance Effectiveness: Verification of the effectiveness of the solar reflectivity the Titanium Dioxide nano-particle portion of the TiO_2 Enhanced Asphalt Rejuvenating Agent shall be by laboratory analysis of core samples extracted from the treated pavement as directed and required by the Engineer. The cores shall be a minimum of four inches (4") in diameter and in pairs at each location directed by the Engineer. The cores shall be tested by an accredited laboratory or university with the equipment and capability to perform the following test procedures.

2.4.5 Solar Reflectance Test(s): Solar reflectivity shall be determined by measuring the treated core samples for a Solar Reflectance Index (SRI) value. SRI is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (reflectance 0.80, emittance 0.90) is 100. The relevant standards for measuring solar reflectance are:

Table 2.2 Test of Solar Reflectance

Value	Test Method
Solar Reflectance	**ASTM C1549 – Standard Test Method for Determination of Solar Reflectance**
Solar Reflectance Index	**ASTM E 1980 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces**

Based on these standards, the SRI is a measure of the relative steady-state temperature of a surface with respect to a standard white surface (SRI=100) and a standard black surface (SRI=0) under standard solar and ambient conditions.

Under normal ambient conditions, the steady-state temperature for the black and white reference surfaces is 355.61 kelvin (K) or 180°F and 317.76 K (110°F), respectively.
A Solar Reflectance Index (SRI) can be defined as:

$$SRI = \frac{T_b - T_s}{T_b - T_w}$$

Where:

- Steady-state Surface Temperature (Ts)—the temperature of the surface, in K, under the standard solar conditions. The surface temperature Ts (°C)=Ts (K)-273
- Reference Black Surface Temperature (Tb)—the steady-state temperature of a black surface with a solar reflectance of 0.05 and infrared emittance of 0.9, under the standard solar and ambient conditions
- Reference White Surface Temperature (Tw)—the steady-state temperature of a white surface with a solar reflectance of 0.80 and infrared emittance of 0.9, under the standard solar and ambient conditions
- Sky Temperature (Tsky)—the temperature of a black body that would radiate the same power in the thermal infrared spectrum (5 to 40 nm) toward the earth as does the sky

The minimum SRI value following the heretofore outlined test procedure(s) evaluating field core samples shall average 29 (or 0.29) for all cores tested, which meet the minimum standard (≥50% 29 SRI) for the U.S. Green Building Council (USGBC) hardscape threshold for Leadership in Energy and Environmental Design (LEED) credit or the minimum standard for the American Public Works Association (APWA) / Institute for Sustainable Infrastructure (ISI) Envision Superior (≥60% 29 SRI) level of achievement credit.

2.4.6 Hydrophilic Improvement: Verification of the improvement in hydrophilic property of the Titanium Dioxide nano-particle portion of the TiO_2 Enhanced Asphalt Rejuvenating Agent shall be by laboratory analysis of core samples extracted from the treated pavement as directed and required by the Engineer. The cores shall be a minimum of four inches (4") in diameter and in pairs at each location directed by the Engineer. The cores shall be tested by an accredited laboratory or university with the equipment and capability to perform the following test procedures.

2.4.7 Wettability Test: Hydrophilic improvement shall be determined by measuring the treated core samples for Water Contact Angle (WCA). WCA is a common measurement of a constructed surface's ability to improve wettability or the ability of water to develop a stronger boundary (less resistance) with the surface as shown by a decline in water contact angle. A WCA of $> 90^0$ is considered hydrophobic or high resistance while a WCA $<90^0$ is considered hydrophilic or low resistance. The relevant standard for measuring WCA is:

Table 2.3 Test of Water Contact Angle

Value	Test Method
Water Contact Angle	**ASTM D7334 - 08(2013) Standard Practice for Surface Wettability of Coatings, Substrates and Pigments by Advancing Contact Angle Measurement**

The minimum WCA reduction following the heretofore outlined test procedure evaluating field core samples shall average 20% for all cores tested.

2.5 Equipment

2.5.1 Distributor: The distributor for spreading the emulsion shall be self-propelled and shall have pneumatic tires. The distributor shall be designed and equipped to distribute the asphalt rejuvenating agent uniformly on variable widths of surface at readily determined and controlled rates from 0.04 to 0.10 gallons per square yard of surface, and with an allowable variation from any specified rate not to exceed 5% of the specified rate.

Distributor equipment shall include full circulation spray bars, pump tachometer, volume measuring device and a hand hose attachment suitable for application of the emulsion manually to cover areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the emulsion within the tank.

The rate of application shall be controlled by an onboard computer control system designed to control the selected application rate uniformly and consistently in gallons per square yard regardless of the forward speed of the distributor truck.

A check of distributor equipment as well as application rate accuracy and uniformity of distribution shall be made when directed by the Engineer.

2.5.2 Aggregate Cover Truck: The truck used for cover aggregate application shall be equipped with a spreader that allows the aggregate to be uniformly distributed onto the pavement. The spreader shall be able to apply 1/2 pound to 3 pounds of cover aggregate per square yard in a single pass. The spreader shall be adjustable so as not to broadcast cover aggregate onto driveways or to lawns.

The cover aggregate to be used shall be free flowing, without any leaves, dirt, stones, etc. Any wet aggregate shall be rejected from the job site.

Any equipment that is not maintained in full working order, or is proven inadequate to obtain the results prescribed, shall be repaired, or replaced at the direction of the Engineer.

2.5.3 Calibration: Distributor- prior to construction, calibrate the distributor in accordance with ASTM D2995-99 in the presence of the Engineer. The distributor shall be moving forward at the proper application speed at the time the spray bar is opened. If at any time a nozzle becomes clogged or not spraying a proper pattern, the operation shall be immediately halted until repairs are made.

2.6 Construction

2.6.1 Layout: The Contractor will be responsible for the lay out of the roadway and project planning and sequencing to meet traffic control requirements prior to paving.

2.6.2 Weather and Seasonal Limitations: The TiO_2 Enhanced Asphalt Rejuvenating Agent shall not be applied to a wet surface or when rain is occurring, or the threat of rain is present immediately before placement. The surface treatment shall not be applied when the temperature is less than 40° in the shade. When applying emulsions, the temperature of the surface shall be a minimum of 45°F, and no more than 150°F.

If unexpected rain occurs prior to material penetration and cover aggregate application, the agent shall be reapplied at no cost to the agency. Further, the contractor's traffic control and project monitoring shall continue until the application has penetrated, area has been sanded and the resultant surface is acceptable to the Engineer for vehicular travel.

2.6.3 Preparation of Surface: The contractor will be responsible for blowing or sweeping the road immediately ahead of the application operation to make sure the road is free of standing water, dirt, loose aggregate, and other debris. The surface shall be clean and dry prior to the application.

2.6.4 Application of TiO_2 Enhanced Asphalt Rejuvenating Agent: The TiO_2 Enhanced Asphalt Rejuvenating Agent shall be applied by a distributor truck at the temperature recommended by the manufacturer and at the pressure required for the proper distribution. The emulsion shall be so applied that uniform distribution is obtained at all points of the areas to be treated. Distribution shall be commenced with a running start to ensure full rate of spread over the entire area to be treated. Areas inadvertently missed shall receive additional treatment as may be required by hand sprayer application.

2.6.5 Material Placement of TiO_2 Enhanced Asphalt Rejuvenating Agent: Application of TiO_2 Enhanced Asphalt Rejuvenating Agent shall be on one-half width of the pavement at a time. When the second half of the surface is treated, the distributor nozzle nearest the center of the road shall overlap the previous application by at least one-half the width of the nozzle spray. In any event the centerline construction joint of the pavement shall be treated in both application passes of the distributor truck.

Before spreading, the TiO_2 Enhanced Asphalt Rejuvenating Agent shall be blended with water at the rate of two parts rejuvenating agent to one-part water, by volume or as specified by the manufacturer. The combined mixture of asphalt rejuvenating agent and water shall be spread at the rate of 0.04 to 0.10 gallons per square yard, or as approved by the Engineer following field testing.

Where more than one application is to be made, succeeding applications shall be made as soon as penetration of the preceding application has been completed and the Engineer grants approval for additional applications. Grades or super elevations of surfaces that may cause excessive runoff, in the opinion of the Engineer, shall have the required amounts applied in two or more applications as directed.

The Contractor shall furnish a quality inspection report showing the source, manufacturer, and the date shipped, for each load of TiO_2 Enhanced Asphalt Rejuvenating Agent. When directed by the Engineer, the Contractor shall take representative samples of material for testing.

2.6.6 Test Strip for Application Rate: Prior to start of the project, the contractor shall perform test strip applications as directed by the engineer. Test strips shall be performed for each pavement group of similar age and type within the project area.

The test strips shall be applied at a minimum width of 6 feet and for a length of 50 feet. A total of three test strips shall be applied at application rates of 0.04, 0.08 and 0.10 gallons per square yard, respectively. The time, in minutes, for essentially complete absorption of the asphalt rejuvenating emulsion shall be recorded for each test strip. The optimal rate to be used in a given area shall be that rate essentially absorbed within 20 minutes.

In the event that all three of the standard test rates are absorbed completely within the 20-minute timeframe, then the Contractor and the Engineer shall agree on a fourth test strip application rate.

Upon completion of the test strips for each pavement group, the Engineer will determine the final application rate to be applied to each pavement group.

2.6.7 Cover Aggregate Application: After the TiO_2 Enhanced Asphalt Rejuvenating Agent emulsion has penetrated, and when recommended by the Contractor and approved by the Engineer, a coating of dry cover aggregate shall be applied to the surface in sufficient amount to protect the traveling public as required.

All cover aggregate used during the treatment must be removed no later than 24 hours after treatment of a roadway. This shall be accomplished by a combination of hand and mechanical sweeping. All turnouts, cul-de-sacs, etc. must be cleaned of any material to the satisfaction of the Engineer. Street sweeping will be included in the price bid per square yard for asphalt rejuvenating emulsion.

If, after the cover aggregate is swept and in the opinion of the Engineer a hazardous condition exists on the roadway, the contractor must apply additional cover aggregate and sweep same no later than 24 hours following reapplication. No additional compensation will be allowed for reapplication and removal of materials.

2.6.8 Handling of TiO_2 Enhanced Asphalt Rejuvenating Agent: Contents in tank cars or storage tanks shall be circulated at least 45 minutes before withdrawing any material for application. The distributor truck will be cleaned of all of its asphalt materials and washed out to the extent that no discoloration of the emulsion may be perceptible. Cleanliness of the spreading equipment shall be subject to the approval of the Engineer.

2.6.9 Street Sweeping: The Contractor shall be responsible for sweeping and cleaning the streets after treatment. All cover aggregate used during the treatment must be removed no later than 24 hours after treatment of the street. This shall be accomplished by a combination of hand and mechanical sweeping. All turnouts, cul-de-sacs, etc. must be cleaned of any material to the satisfaction of the Engineer.

If, after cover aggregate is swept and in the opinion of the Engineer a hazardous condition exists on the roadway, the contractor must apply additional cover aggregate and sweep same no later than 24 hours following reapplication. No additional compensation will be allowed for reapplication and removal of cover aggregate.

2.6.10 Resident Notification: The contractor shall distribute by hand, a typed notice to all residences and businesses on the street to be treated. The notice will be delivered no more than 24 hours prior to the treatment of the road. The notice will have a local phone number that residents may call to ask questions. The notice shall be of the door hanger type, which secures to the door handle of each dwelling. Unsecured notices will not be allowed. The contractor shall also place the notice on the windshield of any parked cars on the street. Hand distribution of this notice will be considered incidental to the contract.

2.6.11 Traffic Control: The Contractor shall furnish all necessary traffic control, barricades, signs, and flagmen, to ensure the safety of the traveling public and to all working personnel. Traffic shall not travel on fresh TiO_2 Enhanced Asphalt Rejuvenating Agent until penetration, in the opinion of the Engineer, has become complete and the area is suitable for traffic. The Contractor shall submit an M.O.T plan indicating all facets of traffic control for the project area. The M.O.T. plan must be approved in writing by the Engineer prior to commencing any work. All traffic control shall be in accordance with the DOT Roadway Design Standards (most current edition). Traffic control devices shall be checked daily and periodically throughout the project for compliance; and where adjustments or corrections are needed, prompt revisions shall be made.

2.6.12 Method of Measurement: The TiO_2 Enhanced Asphalt Rejuvenating Agent emulsion shall be paid at the Contract bid unit prices for the actual square yards of pavement treated as field measured. Said payment is compensation in full for all costs of furnishing and applying the material as specified, including cleaning the existing pavement, purchase of cover aggregate, delivery of cover aggregate, all labor, equipment, and materials necessary for the placement of the TiO_2 Enhanced Asphalt Rejuvenating Agent emulsion, sweeping of any loose material after construction and other requirements as specified. Traffic control for maintaining traffic for constructing TiO_2 Enhanced Asphalt Rejuvenating Agent emulsion shall be considered incidental.

Payment for removal of untreated and treated cores shall be paid for as each at the unit price bid for Test Core Removal.

2.6.13 Basis of Payment:

Pay Item	Unit
• TiO_2 Enhanced Asphalt Rejuvenating Agent	Per Sq/Yd
• Field Core Removal*	Each
• Field Core Laboratory Analysis – Viscosity*	Each
• Field Core Laboratory Analysis -Titanium Dioxide Penetration*	Each
• Field Core Laboratory Analysis - Titanium Dioxide NO_2 Reduction*	Each
• Field Core Laboratory Analysis - Titanium Dioxide Solar Reflectance Index (SRI)*	Each
• Field Core Laboratory Analysis - Titanium Dioxide Water Contact Angle (WCA)*	Each
• Mobilization	Per Project

*When required by the Engineer

ADDENDUM

3 BACKGROUND

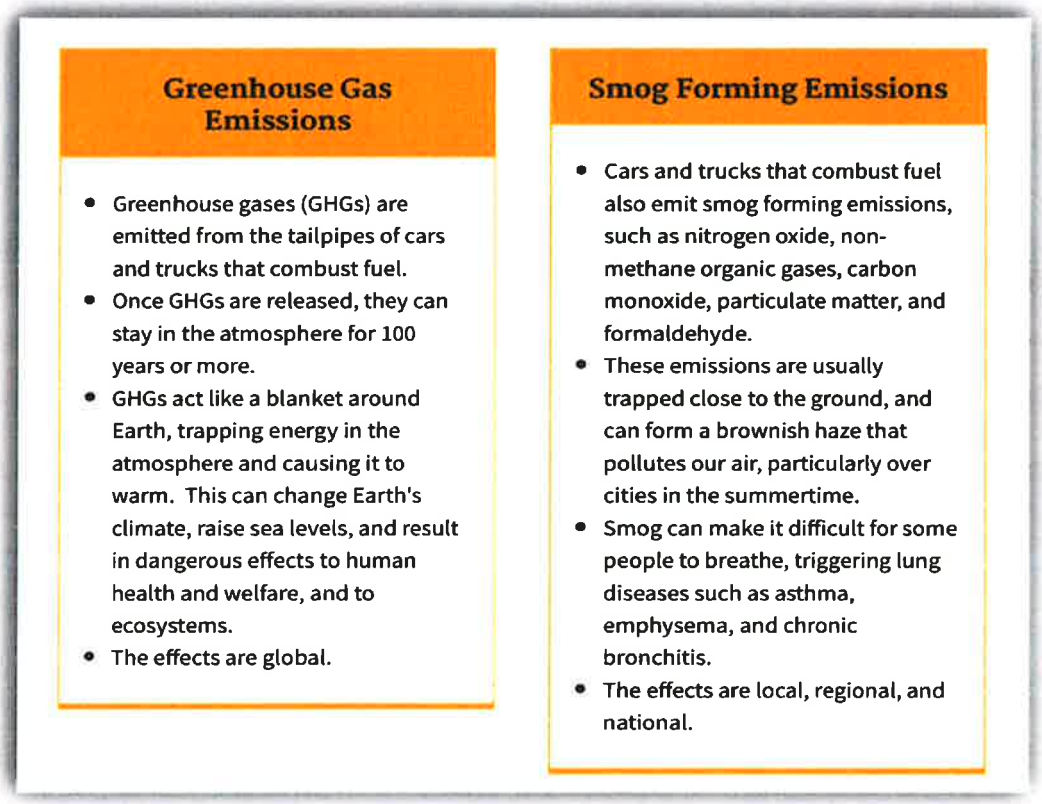
3.1 Mobile Source Pollution and Tropospheric Ozone

Ozone, sometimes referred to as **"smog"**, is a toxic gas that is formed in the atmosphere when three atoms of oxygen combine (i.e., O_3). The chemical structure of ozone is the same wherever it is found; however, as shown **(Figure 3.1)** there are two categories of ozone.

Stratospheric Ozone is found naturally in the Earth's upper atmosphere - 6 to 30 miles above the Earth's surface - where it forms a protective layer that shields us from the sun's harmful ultraviolet rays.[33] This sometimes is referred to as "good ozone".

Ground-Level Ozone is found near ground level, naturally (sometimes called "tropospheric ozone"). It is created by chemical reactions between nitrous oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. Emissions from industrial facilities can contribute as much 15% of tropospheric ozone, electric utilities 20% and motor vehicle exhaust contributes 60% or more **(Figure 3.2)**.[34] They are the major sources of noxious gas formations in the air humans breathe ("bad ozone").

Figure 3.1 Greenhouse Gases & Smog Forming Emissions

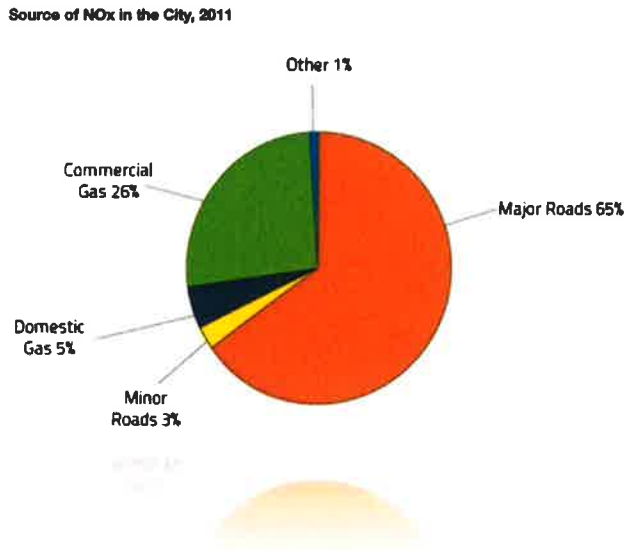


Source: Environmental Protection Agency (EPA) www.epa.gov

[33] Texas Commission on Air Quality, www.tceq.texas.gov.

[34] Environmental Protection Agency (EPA), www.epa.gov.

Figure 3.2 Major City Sources of NO_x



Source: City of London Air Quality Strategy 2011-2015

Climate scientists and healthcare experts have concluded that ground-level pollution or photochemical smog in densely populated, urban environments has developed into a human health crisis.

The World Health Organization's (WHO) most recent survey of 4300+ cities worldwide indicate only 20% of urban populations live in cities that comply with WHO air quality guideline levels for fine particulate matter ($PM_{2.5}$), which includes NO_x as the major contributor.[35] [36]

The poor showing includes American cities, where all of our major urban hubs are near, already at or above WHO limits.[37]

Further, WHO scientists believe the impact of inner-city air pollution on the development of respiratory and atopic disease in childhood, in particular, has reached epidemic proportion.[38] Air pollution may contribute to as many as 9 million premature deaths annually,[39] including 43% of lung diseases and cancer, 25% of heart disease and 24% of strokes.[40]

The American Lung Association has concluded:

"The burden of air pollution is not evenly shared. Poorer people and some racial and ethnic groups are among those who often face higher exposure to pollutants..." [41] owing, in no small part, to their sheer proximity to major point-sources (industry and traffic) for anthropogenic pollution.

3.2 Air Quality and Resident Health

Creation of Hazardous Photochemical Smog Caused by Vehicle Emissions: Detrimental gas emissions, such as NO_x and sulfur oxides (SO_x), are formed during the combustion process from burning fossil fuels. Vehicle emissions introduce one of those oxides – nitrogen dioxide, into the environment, increasing O_3 concentrations. As the ozone concentrates, the percentage of nitrogen undergoing oxidization also increases, resulting in an increasingly higher percentage of NO_2 in the atmosphere, especially in the troposphere to create ground-level pollution harmful to humans and damaging to ecological systems.

Researchers have identified a clear association between these serious environmental, ecological and health dangers with the presence of photochemical smog, acid rain, and rising NO_2 concentrations. The EPA classifies NO_2 as an "extremely hazardous" criteria toxin [42] and has set stringent limits on its ozone inventory under the NAAQS. [43] The ratio of NO_2 to total gas emissions has been rising over the years due to increasing urbanization and associated traffic and

[35] World Health Organization (WHO), *Ambient (Outdoor) Air Quality and Health*, May 2018.

[36] WHO: 10µg/m³ annual mean and 25µg/m³ 24-hour mean for $PM_{2.5}$, www.who.int.

[37] EPA: Air Quality Statistics by City 2017, www.epa.gov.

[38] WHO, *Ambient (Outdoor) Air Quality and Health*

[39] *The Lancet* Commission on Pollution and Health, October 2017.

[40] WHO, Global Health Observatory (GHO) data 2016, www.who.int.

[41] American Lung Association, *Disparities in the Impact of Air Pollution*, www.lung.org.

[42] EPA: List of Extremely Hazardous Substances, www.epa.gov.

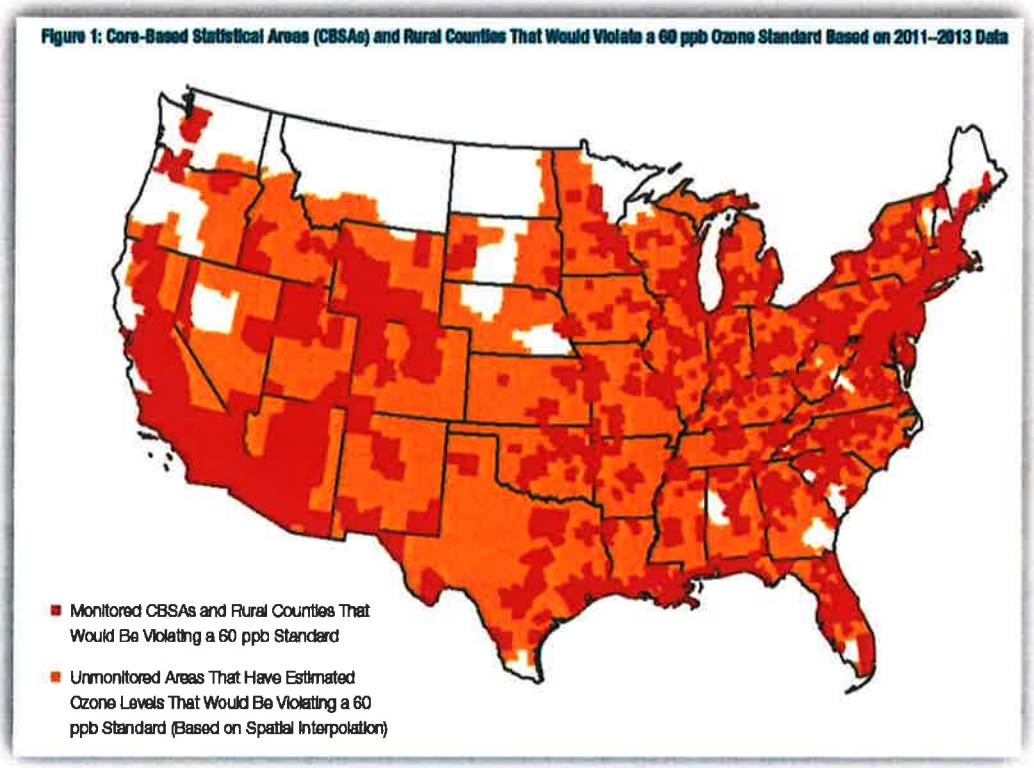
[43] EPA: NAAQS Table, Criteria Air Pollutants, www.epa.gov.

has resulted in a corresponding increase in O_3 ``build-up.[44]

EPA technical data shows that as much as two-thirds of atmospheric NO_2 is emitted from mobile sources.[45] And nearly half of all Americans live within 'maximum exposure' to near-roadway pollution or within 500 meters of high AADT volume roads, according to the most recent U.S. Census.[46]

Airborne nitrous oxides (nitrites) have a half-life ranging 100 to 150 years.[47] The EPA also believes NO_2 concentrations from vehicles and near roadways are appreciably higher than those measured at monitors in the current EPA network. In fact, **near-road concentrations can be 2–3 times higher than measured at nearby area-wide monitors**,[48] making road-level **"breathing zones"** uniquely attractive targets for managing NO_2 contaminations.

Figure 3.3 Ozone Nonattainment at 60 ppb



Source: U.S. Environmental Protection Agency www.epa.gov

[44] Richmond-Bryant J and Owen RC et al., Estimation of On-road NO_2 Concentrations, NO_2/NO_x Ratios, and Related Roadway Gradients from Near-road Monitoring Data, *Air Quality, Atmosphere & Health*, January 2017.

[45] EPA: List of Extremely Hazardous Substances, www.epa.gov.

[46] U.S. Census Blocks 2010, U.S. Census Bureau, www.censes.gov; and U.S. Department of Transportation, Federal Highway Administration (FHWA), Average Annual Daily Traffic Data (AADT), www.fhwa.dot.gov.

[47] EPA, Technical Bulletin: *Nitrogen Oxides (NO_x), Why and How They are Controlled*, November 1999.

[48] EPA: Near Roadway Air Pollution and Health, Frequently Asked Questions EPA-420-F-14-014, www.epa.gov.

EPA estimates [49] **(Figure 3.3)** indicate all major U.S. cities and much of the country's populated areas in general would breach O_3 concentrations at a 60ppb (parts per billion) threshold. The current limit is just 65ppb [50] and most health and environmental experts expect the "nonattainment" limit to be lowered in the near future.

So, agencies need to be both preemptive and proactive. Most do not have adequate strategies in-place, however. [51]

3.3 On-Road Vehicular Emissions

The Good News is that vehicles are getting more efficient. Average new vehicle fuel economy for internal combustion engine (ICV) passenger cars has increased from 13 mpg in 1975 to 25 mpg today,[52] and it's expected to steadily rise to 40 mpg in the coming decade.[53] Many ICV models already exceed 35 mpg. [54]

EPA scientists and engineers at the National Vehicle and Fuel Emissions Laboratory (NVFEL) at the University of Michigan (Ann Arbor) are working closely with our automotive industry ("Detroit") to continue to improve current vehicular technology *in-use* to meet higher MPGs.

The Bad News is that our urban centers and accompanying vehicle ownership are growing far faster than emissions technology can pace.

America alone has seen annual new vehicle registrations nearly triple since 1975,[55] far outpacing gains in fuel efficiency. And while new energy vehicle (NEV) growth has been steady, wide adoption has been greatly limited by steep cost prohibitions, lackluster consumer enthusiasm and other constraints.[56] [57] [58] The electric vehicle (EV) market e.g., appears to be centered exclusively on the super-luxury market, with average MSRPs exceeding 67,000 USD.[59]

The National Renewable Energy Laboratory (NREL) predicts that energy demand would skyrocket by over 60% [60] from current capacity limits if EVs were widely adopted. But where would we get more electricity today, tomorrow, or even fifty years from now to meet such an enormous increase in electricity demand?

By most estimates, we'd need as many as 10 billion solar panels in the United States alone just to handle electric cars, creating substantial financial, logistic and land use issues.[61] And that, of course, assumes the panels will be able to constantly (steadily) produce the electricity we will need, while future technology actually will develop to store it. These are big "ifs".

Reasoned analysis suggests that even if such limitations for renewable energy sources are solved, in part or in whole, estimates for overhauling the country's electric grid and energy infrastructure for ***new energies*** are rounded in the ***tens*** **of trillions** USD.[62] [63] [64] So, alternative energy

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[49] EPA: 2015 (update) NAAQS for Ozone, Ground-level Ozone Pollution, www.epa.gov.

[50] EPA: Fact Sheet - Overview of EPA's Updates to Air Quality Standards for Ground-level Ozone, www.epa.gov.

[51] National Association of Home Builders (NAHB), *Cities Still Miss the Mark on Ozone Standards*, September 2015.

[52] EPA: National Vehicle and Fuel Emissions Laboratory (NVFEL), www.epa.gov.

[53] EPA: Environmental Ratings on the Label, Vehicle Emissions, www.epa.gov.

[54] EPA: Office of Transportation and Air Quality (OTAQ) / National Vehicle and Fuel Emissions Laboratory NVFEL), University of Michigan, www.lsa.umich.edu.

[55] US Department of Transportation, Federal Highway Administration (FHWA), www.fwha.gov.

[56] MIT Sloan School of Management, *The Real Barriers to Electric Vehicle Adoption*, August 2017.

[57] MediaVillage, *Five Reasons Why Electric Car Sales Fail at the Dealer Level*, June 2019.

[58] Forbes, *Prediction: Auto Industry Headed for Financial Pile-up as EV Sales Disappoint*, June 2018.

[59] Edmonds, www.edmonds.com.

[60] National Renewable Energy Laboratory (NREL), www.nrel.gov.

[61] Glenn H and Ost I, www.pick-my-solar.com; Herron D, www.greentransportation.info.

[62] The Republican Study Committee, *A Greedy New Steel*, February 2019.

[63] The University of Texas at Austin Energy Institute.

[64] Stanford University, School of Earth, Energy & Environment.

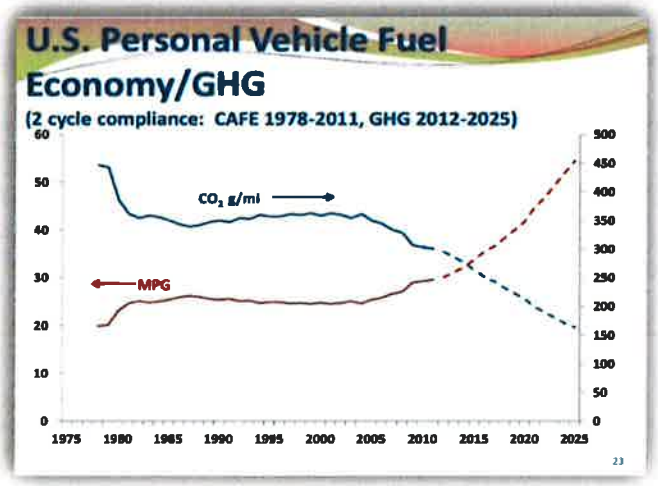
sources are proving more difficult to scale, store or even afford than expected. [65] [66]

For now, GHG emissions from an EV are 50% higher than the improving fuel economy ICVs.[67] So, the need for more commercially practicable solutions today, tomorrow, and perhaps for a lot longer for vehicular emissions management are presenting themselves.

In PTI's on-gong discussions with the Federal Highway Administration's (FHWA) Environment, Air Quality, and Realty Team (which oversees CMAQ), improvements in existing transportation systems remain the highest priority and are consistent with the EPA's NVFEL view.

Any technology which promotes reduced CO_2e from vehicles, including photocatalytic roads, is viewed as a *de facto* improvement or acceleration in vehicular MPG efficiency towards meeting Corporate Average Fuel Economy (CAFE) standards **(Figure 3.4)**.

Figure 3.4 Vehicle MPG vs CO_2e



Source: EPA: National Vehicle and Fuel Emission Laboratory

The global trend to reduce pollution and energy consumption is a most critical cause, but poses unquestionable challenges (as highlighted), as numerous as they are complex for governments and industry. How we adapt products, services, and governance to play a scalable role in reducing pollution and energy consumption and our associated carbon footprint is key. These questions are becoming more urgent as legislative and environmental guidelines drive us towards more efficient energy usage, including and especially for on-road concentrations.[68]

In considering the response and beyond the immense economic costs, one must also consider consumer expectations. While most consumers are aware of the balance between the cost and environmental benefits of reduced energy consumption, many may be reluctant to accept energy-reducing products that compromise other criteria e.g., product or behavior choice or even aesthetics.

3.4 Surface Chemistries & Catalytic Pollution Removal Systems

The photocatalytic effect of TiO_2 applied to pavements and other structures can remove pollutants from the air, so that so-called **"photocatalytic pavements"** can be installed for two primary applications - air pollutant removal and heat management. And critically - without significant cost nor change to transportation infrastructure or effect on consumer choice or behavior.

Several approaches utilizing photocatalysis have been studied as methods for successfully counteracting noxious emissions.

[65] Finkler T and Hannon K, *Renewable Energy: Status and Struggles*, Stanford University.

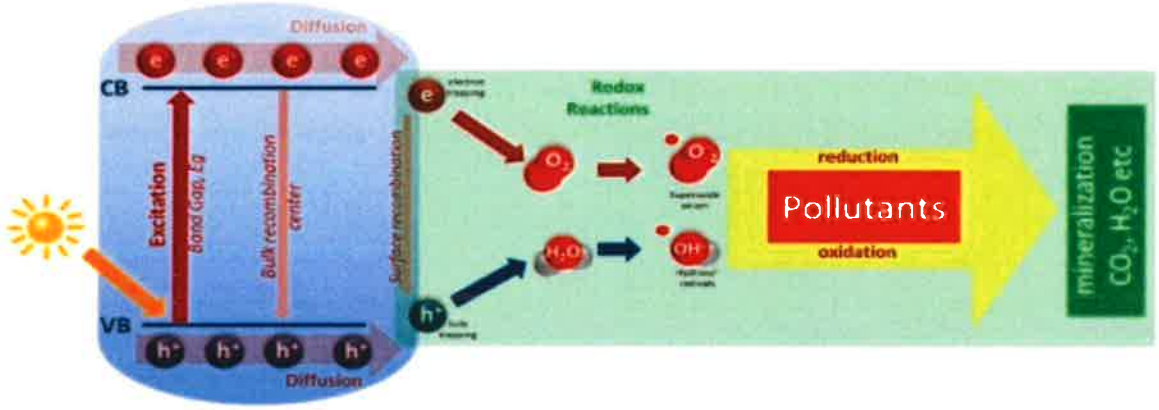
[66] The Wharton School, University of Pennsylvania, *Can the World Run on Renewable Energy?*, April 2015.

[67] Tsinghua University, *Applied Energy* (Journal), May 2018.

[68] U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA): Corporate Average Fuel Economy (CAFE) standards, www.nhtsa.gov.

Photocatalysis or PCO is the acceleration of a photoreaction in the presence of a semiconductor. When the catalyst is activated by ultraviolet (UV) light with wavelengths less than 380nm, hydroxyl radicals and superoxide are created via band gap excitation,[69] [70] forming an electrochemical energy field (ECF) **(Drawing 3.5)**.

Drawing 3.5 TiO_2 Based Photocatalysis – Band Gap Excitation



Source: Journal of Materiomics

The ECF naturally and efficiently decomposes transient molecules traveling near or through the field, including primary O_3 precursors such as NO_x and VOCs as discussed. So, commercial photocatalyst grade TiO_2 <1μm (micron) is widely used as a photocatalyst material for several reasons, including as an effective pollution remediate:

- TiO_2 fulfills the requirements for **effective photo-activity** under the solar irradiance levels experienced on Earth
- Photoreactive TiO_2 is chemically **inert**; physically **stable**; **non-toxic**; **non-exhaustive**; **economical**; and widely (commercially) **available**
- TiO_2 has **strong oxidizing strength**, in particular at the ambient conditions near the Earth surface given that TiO_2's wide band gap (minimum energy required to excite and mobilize electrons) [71] in the solid state enables it to be very efficient in the UV range of the light spectrum
- TiO_2 also promotes **super-hydrophilic** (i.e., water-desorbing) as well as **solar-reflectivity** (SR) advantages to building materials

TiO_2 hence promotes numerous advantages useful to science and engineering including de-polluting; self-cleaning; light-remitting; and heat reducing properties.

3.5 Solar Reflective Properties of TiO_2

The growth in urbanization and changing land use coupled with ever rising vehicular emissions intensifies the UHI effects in cities.

The heat-build exaggerates heat-related stresses such as O_3 levels and accompanying disease in humans. And though UHI intensity depends on many factors including wind speed, direction, and solar flux, the thermodynamic properties of surface materials can greatly exaggerate the temperature profiles at the local scale.

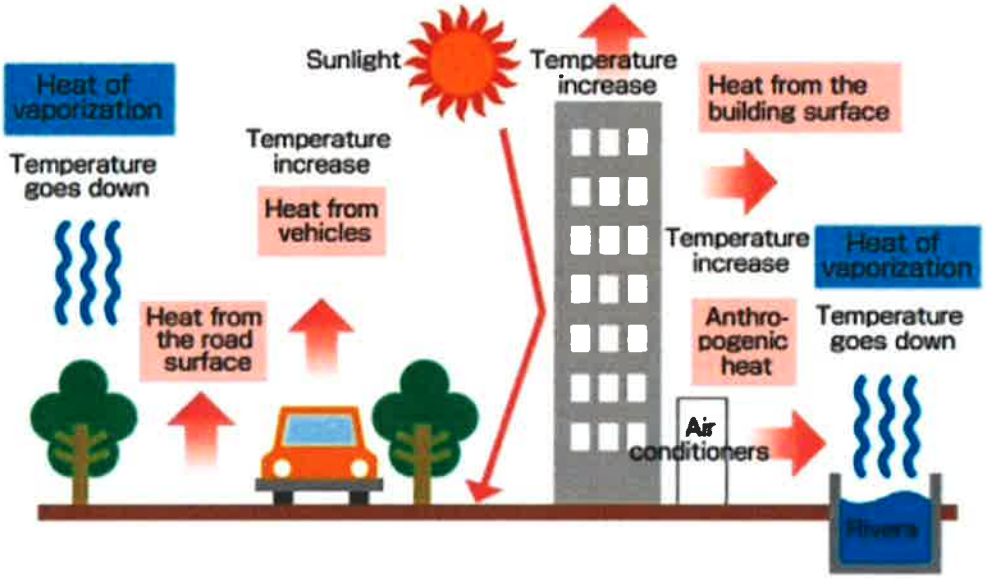
[69] Zollinger DG and Joshaghani A, *Laboratory Investigation of the Effect of TiO2*, September 2018.

[70] Binas V, et al., Modified TiO_2 Based Photocatalysts for Improved Air and Health Quality, *Journal of Materiomics*, November 2016.

[71] The electronic band structure of solids refers to the energy difference (in electron volts) between the top of the valence band and the bottom of the conduction band in insulators and semiconductors.

In the southeastern U.S. alone, data indicates the "hot season" now lasts one to three weeks longer than 30 years ago, exaggerating UHI. [72] Heat-builds modify the atmospheric boundary layer (ABL), impacting air flow and mixing height (creates stagnant air) in urban environments, further deteriorating local air quality. So, UHI intensity itself, is highly correlated to air pollution levels.[73]

Drawing 3.6 How the Heat Island Effect Occurs



Source: Green Ribbon Toronto

Pollution-induced climate change is a circular problem and comes with other direct and indirect environmental, ecological and health impacts included in the growing phenomena now just universally described as the **Urban Heat Island** effect **(Drawing 3.6)**.

When humans are exposed to extreme or prolonged heat, many of the crippling and even deadly diseases aforementioned are exacerbated. Low-income populations and the elderly are particularly vulnerable. The EPA has estimated that for every 1.5°F rise in temperatures, net demand for electricity used for cooling/heating would increase by as much 5% or more, impacting consumer behavior and even severely limiting their choices between other essentials for living.[74]

Reduced water quality also is a factor from UHI. The extremely high temperatures of pavement structures, especially asphalt, can measurably increase the temperature of stormwater runoff, escalating additional ecological and health concerns as these warmer waters drain into sewers and eventually into lakes, rivers, ponds, and streams etc.

UHI and climate change interact in many critical and circulative ways:

- **Increased Energy Demand**
- **Increased Air Pollution and Gas Emissions**
- **Reduced Human Health and Comfort**
- **Poor Water Quality and Ecology**

[72] Florida State University, Florida Climate Center, www.climatecenter.fsu.edu.

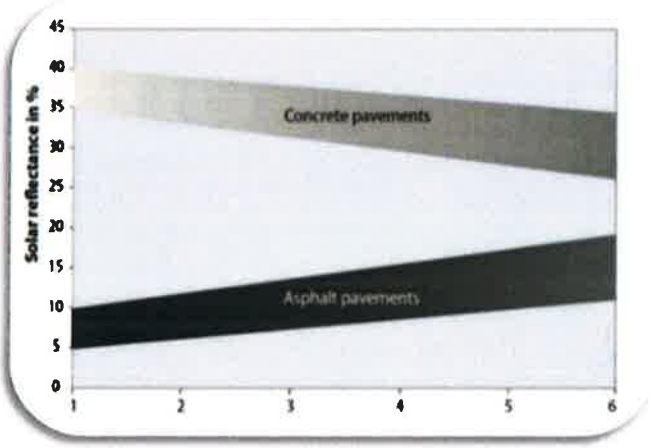
[73] Swamy G, et al., *Urban Heat Island (UHI) Influence on Secondary Pollutant Formation in a Tropical Humid Environment*, www.PubMed.gov.

[74] EPA: Climate Change and Heat Islands, www.epa.gov.

In general, white surfaces will **reflect** as much as 75% of solar energy (strong hiding power) [75] and stay relatively ***cool***, while black surfaces will **absorb** as much as 90% and will get extremely hot, of course.[76]

Research has shown that the impact from improving the solar reflectance of urban infrastructure on UHI can range as high 100 tons CO_2e per lane mile per year of pavement and a global adoption of both cool roofs and pavements could lead to a potential offset of over 40 gigatons CO_2e annually.[77] [78] [79]

Drawing 3.7 Pavement Reflectivity and Time



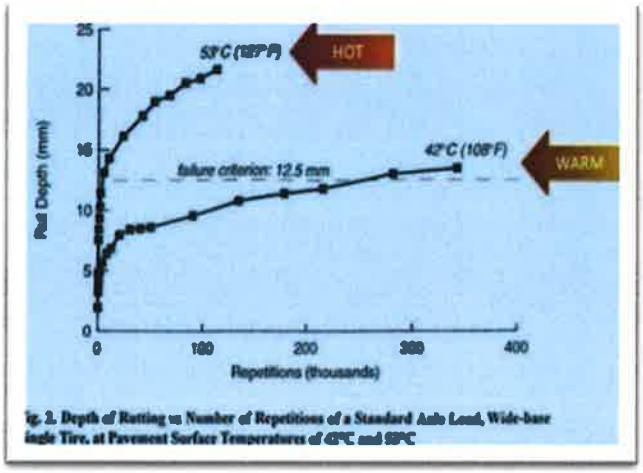
Source: EPA: Heat Island Reduction Program (HIRP)

Asphalt is a particularly good target. New asphalt, according to the EPA Heat Island Reduction Program (HIRP), has an SRI of 5 which slowly rises with age, but remains very heat-absorbing throughout its life cycle **(Drawing 3.7)**.

An SRI of 5 at 72°F would register a surface temperature of the asphalt at 140°F over 8 hours of solar irradiation, according to HIRP testing. And each 10 SRI would reduce the pavement's temperature by 7°F to 10°F.[80]
Conventional paving materials can reach peak summertime temperatures of 150°F [81] or more, transferring excess heat to the air above them and heating stormwater as it runs off the pavement into waterways, effecting watershed ecology.

Pavements in urban centers can be as much as 50% of land cover in major cities.[82] As such, pavements are a critical element in environmental planning and UHI mitigation consideration.

Figure 3.8 Heat Shortens Pavement Life



Source: EPA: Heat Island Reduction Program (HIRP)

Further, asphalt binder begins to photodegrade at 120°F,[83] with exponential damage as the temperature rises. Studies have shown that even modest improvement in asphalt temeperature can

[75] *Polymers, Light and the Science of TiO2*, DuPont™ Ti-Pure® Titanium Dioxide, DowDuPont, www.dow-dupont.com.

[76] BASF SE, www.dispersions-pigments.basf.com.

[77] Zhous a, et al., *Enhanced Solar Reflectance of Thermal Coatings through Inorganic Additives*; City University of Hong Kong; Massachusetts Institute of Technology, Hong Kong / Boston, 2016.

[78] Xu X, et al., *The Impacts of Surface Albedo on Climate and Building Energy Consumption: Review and Comparative and Comparative Analysis*, Transportation Research Board (TRB), 2016.

[79] Qin Y, Urban Canyon Albedo and Its Implication on the Use of Reflective Cool Pavements, *Energy and Buildings*, 2015.

[80] EPA HIRP, *Cool Fixes for Hot Cities*.

[81] EPA HIRP: Using Cool Pavements.

[82] Lawrence Berkeley National Laboratory, Cool Pavements, www.heatisland.lbl.gov.

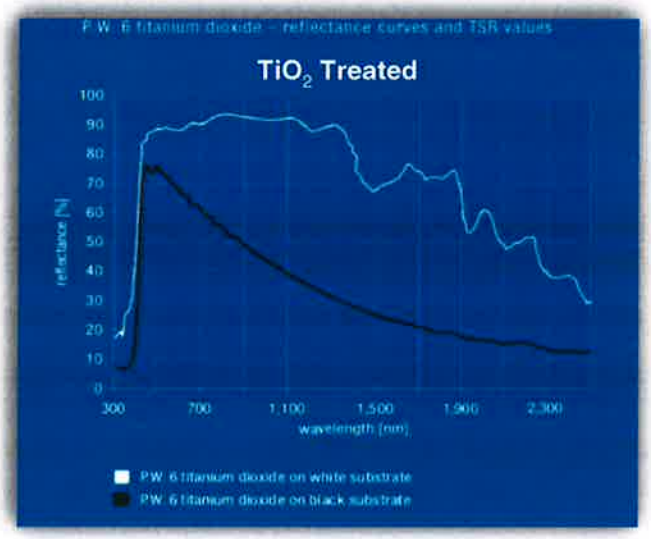
[83] Hossain K and Karakas AS, *Effect of Ultraviolet Aging on Rheological Properties of Asphalt Cement*, Memorial University of Newfoundland and University of Illinois, Urbana-Champaign, June 2018.

materially extend the service life of the asset **(Figure 3.8)**.[84]

Cooler pavements can be created with existing paving technologies including newer approaches such as the use of coatings or spray applied penetrants with SRI reducing materials to create pavements with strong light scattering efficiency.

For example, chemical giant BASF extensively has tested paint pigments for their solar reflectance properties, in large part, to improve weatherability (UV protection). As a result, BASF has developed paint additives, utilizing photocatalyst TiO_2, it markets as **"paint it cool!"** pigments for solar heat management in paints; DuPont similarly.

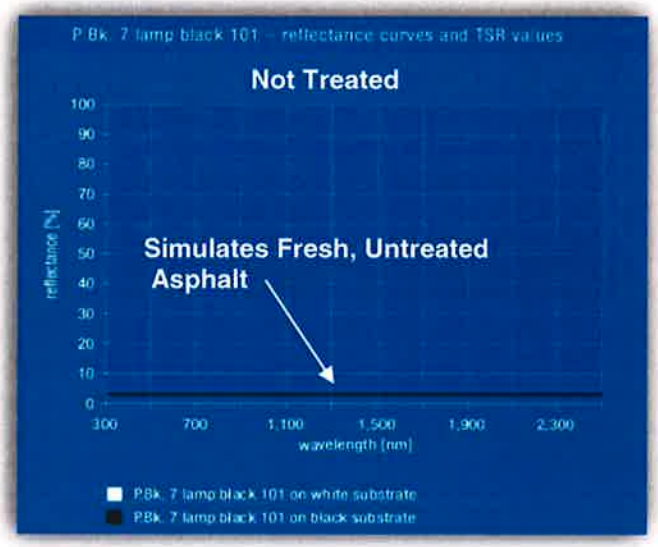
Figure 3.9 Solar Reflectance (%) - Treated



Source: BASF SE

BASF researchers tested TiO_2 presented in both white and black substrates **(Figure 3.9)**. When TIO_2 was added to a white substrate, the surface indicated roughly 90% reflectance from the UVA spectrum (315 to 400 nm in wavelength) all the way past visible light (400 to 700 nm) and even into infrared.

Figure 3.10 Reflectance (%) - Untreated

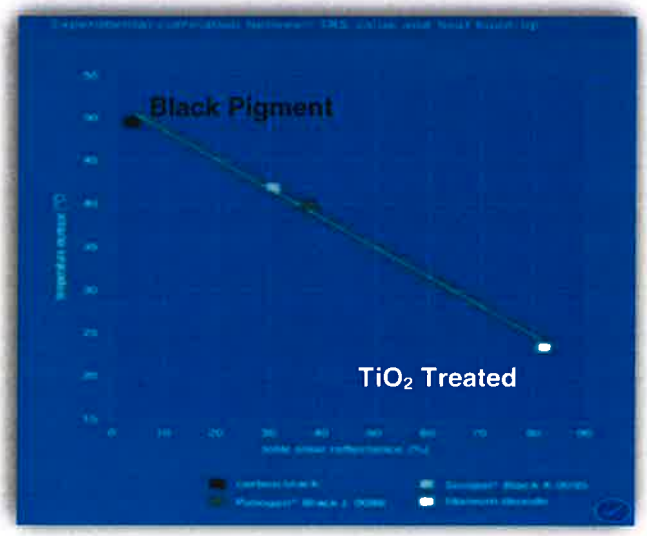


Source: BASF SE

For the control **(Figure 3.10)**, BASF tested black pigment against both color surfaces, which indicated only 5% reflectance, consistent with EPA HIRP testing.

But, the TiO_2 added to the black substrate **(back to Figure 3.9)** showed remarkable results with roughly 75% reflectance in the UVA spectrum or much higher (14x) than the control all the way through the visible spectrum (ranging 60% to 70% reflectance).[85]

Figure 3.11 Heat-Build vs Pigment Color



Source: BASF SE

[84] EPA HIRP: Using Cool Pavements.

[85] BASF SE.

BASF scientists also tested UHI *style* heat build-up against multiple pigments and TiO_2. As indicated **(Figure 3.11)**, the heat-build in black pigment was materially more than the highly reflective TiO_2. The black pigment, with just 5% reflectivity, accumulated more than twice the heat-build of the TiO_2 enhanced pigment.

Over half of the solar energy experienced at the Earth's surface falls within the UV and visible light spectrum.[86] So, these results give one a clear idea of how a TiO_2-bearing pavement would perform to reduce radiative forcing (RF) [87] in the ambient environment.

What can be learned from BASF's testing can be applied to TiO_2-bearing pavements:

Nanoparticle TiO_2 has high light refraction properties,[88] improving a pavement's ability to diffuse thermal loading and to lower emissivity.

Understanding heat management can play a significant role in both ecology and pavement life-cycle assessment, which impacts the evaluation and appraisal for pavements on the environment through materials, construction, use, maintenance, and end-of-life phases.

UHI specifically can play a crucial role in the **use-phase** of pavement LCAs and hence can become a major tool in a community's ability to reduce its carbon footprint without disrupting infrastructure and resident utility.[89]

Yet, cool pavement technologies are not as required (adopted) by agencies as other heat island mitigation strategies (e.g., roofs) and there is no official standard or labeling program to designate cool paving materials in highway construction practices per se. But one can project as much is coming.

Our interviews with the EPA's HIRP staff indicate strong interest in and base knowledge of photocatalytic pavement solutions.

HIRP is especially interested in solutions for asphalts that do not impugn asphalt recyclability (sustainability) as most prevailing UHI mitigation strategies (e.g., "white pavements") and common pavement preservation materials alike risk because they are **adsorbed** and themselves unsustainable.

Photocatalytic pavement solutions for asphalt such as PTI's **A.R.A.-1 Ti®** offer great promise in this regard because the penetrant replaces exact chemicals (true conservation) lost to UHI and the solution is translucent and fully **absorbed** into the substrate. This preserves *full* recyclability of the asphalt while delivering the advantaged solar reflectance properties from the photocatalyst material imbedded.

The American Society for Testing Materials (ASTM) has formed a **'cool construction materials'** subcommittee in recent years to develop standard practices for measuring, rating, and labeling cool construction materials.

The subcommittee also undertook the development of a standard practice for calculating an SRI for horizontal and low-sloped surfaces (like a road), [90] which now can and should be applied to road construction **'best practices'**.

3.6 Pavement Preservation and GHG Mitigation

Asphalt remains the most durable and efficient material for roadway construction, dating back to the Romans and earlier. More than 90% of our roadways are built with asphalt.[91] The manufacturing of asphalts and construction of asphalt roads, however, have a meaningful impact

[86] *Solar Radiation and the Earth's Energy Balance*, EESC Lectures Columbia University, 2007.

[87] Radiative Forcing (RF) or Climate Forcing is the difference between insolation absorbed by the Earth and energy radiated back into space.

[88] DowDuPont, www.dow-dupont.com.

[89] Killingsworth B, et al., Concrete's Role in Reducing Urban Heat Islands, *Concrete Sustainability Report*, July 2014.

[90] ASTM E1980 - 11 *Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.*

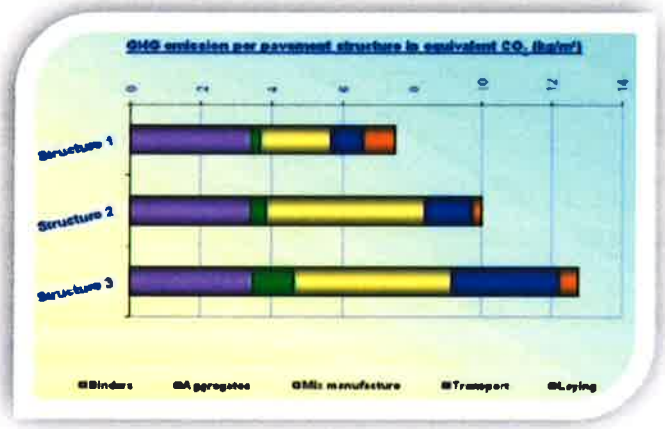
[91] Asphalt Institute, www.asphaltinstitute.org.

on the environment, energy use and GHG emissions.

Pavement reconstruction and most forms of rehabilitation consume significant amounts of energy. From the negative RF in obtaining and processing raw materials, to mixing, transporting, and finally paving (applying), the global warming potential (GWP) of building and maintaining roads is of considerable importance to sustainable urban planning and maintenance **(Figure 3.12)**.

Employing pavement preservation requires significantly less energy than in part or whole rebuild, of course. Fog sealing, which includes molecular replacement strategies such as MRT, uses the least amount of energy per year of extended pavement life at as little as 250 BTU/yd^2-yr (0.4 MJ/m^2-yr).[92]

Figure 3.12 CO_2e Emission by Asphalt Pavement Input



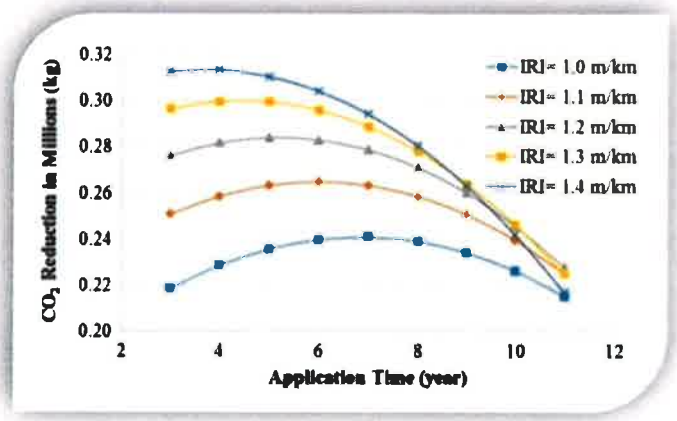
Source: Colas Group SA

Compare that to the energy consumption of a pavement **rebuild** consuming as much as 1.5 million BTUs or 200 MJ/m^2-yr [93] or roughly **500x the CO_2e** of pavement preservation strategies.

Beyond the enormous carbon footprint savings, the significant cost differential for preservation techniques over rebuilds provides returns on investment (ROI) typically exceeding 250%.[94]

One study conducted by Rutgers University [95] compared initial International Roughness Index (IRI), fuel consumption [96] and application year for pavement preservation implementation **(Figure 3.13)**. The results indicated that early pavement preservation can have a materially positive impact on CO_2e reductions.[97]

Figure 3.13 Pavement Preservation Impact on CO_2e Reduction



Source: Rutgers University

The implication for proactive early and recurring pavement preservation strategies clearly support significant GHG mitigation against multiple points of fossil fuel consumption causally related to our critical city infrastructure, including roadways.

3.7 Deterioration of Asphalt Pavements Due to Manufacturing and Environmental Factors

Asphalt pavements are vulnerable to many factors, thermal loading (excess heat) being the

[92] Chehovits J and Galehouse L, *Energy Usage and Greenhouse Gas Emissions of Pavement Preservation Processes for Asphalt Pavements, Transportation Research Board*, 2010.

[93] Chaignon F, *Pavement Preservation: What About Energy and GHG*, Colas Group SA.

[94] For Pavement Preservation (FP^2), www.fp2.org.

[95] Wang H, Al-Saadi I, et al., Quantifying Greenhouse Gas Emission of Asphalt Pavement Preservation at Construction and Use Stages using Life-Cycle Assessment, *International Journal of Sustainable Transportation*, January 2019.

[96] EPA: Motor Vehicle Emission Simulator (MOVES) and other Mobile Source Emission Models, www.epa.gov.

[97] Wang H, Al-Saadi I, et al.

most damaging.[98] As noted, conventional paving materials can reach peak summertime temperatures exceeding 150°F.[99] And asphalt binder begins to photodegrade (oxidizes) at 120°F,[100] with exponential damage as the temperature rises.

Excessive heat required during manufacturing, typically 300°F to 350°F[101] or higher, is especially destructive, which leads to the volatilization or rapid loss of critical molecular components of asphalt binder that are responsible for durability and ductility (plasticity). These are commonly and scientifically referred to as **"maltene fractions"**.

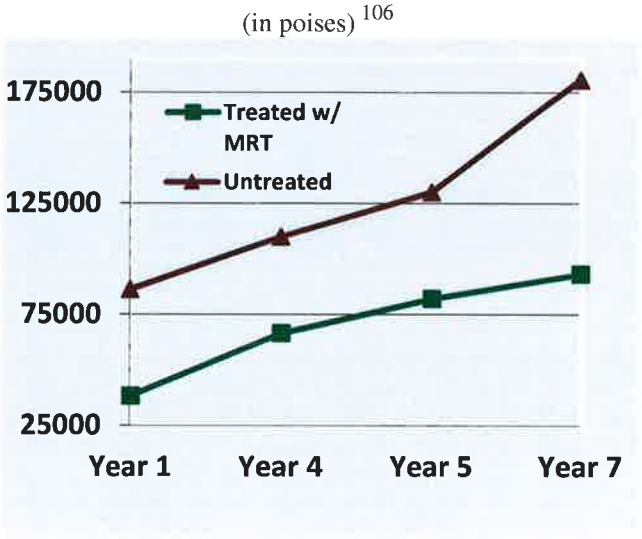
As much as a third of maltene molecular content may be lost during asphalt production,[102] leaving asphalts prematurely aged by the impaired binder. Maltenes are the "media" that enable asphalt binder to impart flexibility, fluidity, and adhesion properties to paved roads. They are largely responsible for the resilience of asphalts to withstand considerable environmental and traffic stresses.

Asphalts with depleted binder chemistry become embrittled, leading to cracking and raveling stress and accelerated repair and rebuild demands.

In-service, heat continues its extortionate role in depleting maltene content in asphalt binder due to the oxidative effect of irradiation (UHI), as asphalts are highly solar energy absorptive.[103] In combination, volatilization and UHI stress are the primary factors responsible for binder-centric failure of asphalt pavements and premature rebuild needs.[104]

A proven remedy for restoring damaged or aged asphalt binder to proper performance properties is to **chemically replace** the maltenes lost during manufacturing and in-service weathering through maltene replacement therapy. MRT, effectively, establishes a molecular **"second curve"** to the LCAs of asphalt pavements.

Figure 3.14 Maltene Rejuvenator Study: Seven Year Oxidation Rate Curves in Charleston County (SC) [105]



Source: Pavement Technology, Inc.; APART

(Figure 3.14) is an abstract from a multi-year study on asphalt pavements in Charleston County (SC) treated with Reclamite®, a petroleum maltene-based rejuvenator.

[98] Alkaissi ZA, Effect of High Temperature and Traffic Loading on Rutting Performance of Flexible Pavement, *Journal of King Saud University- Engineering Sciences*, April 2018.

[99] EPA Heat Island Reduction Program (HIRP): Using Cool Pavements to Reduce Heat Islands, www.epa.gov.

[100] Hossain K and Karakas AS, *Effect of Ultraviolet Aging on Rheological Properties of Asphalt Cement*, Memorial University of Newfoundland and University of Illinois, Urbana-Champaign, June 2018.

[101] Texas Asphalt Pavement Association, www.texasasphalt.org.

[102] U.S. Department of Transportation, Federal Highway Administration, Superpave Asphalt Mixture Design Workshop, Version 8.0, Updated January 2002 www.fhwa.dot.gov.

[103] EPA Heat Island Reduction Program (HIRP), *Cool Fixes for Hot Cities Part 2: Los Angeles*, September 2002.

[104] Lolly R, *Evaluation of Short Term Aging Effect of Hot Mix Asphalt Due to Elevated Temperatures and Extended Aging Time*, Arizona State University, May 2013.

[105] Reclamite® is a trademark of Ergon, Inc.

[106] The poise (symbol P) is the unit of dynamic viscosity (absolute viscosity) in the centimeter-gram-second system of units.

The maltene rejuvenator not only was able to reduce the initial viscosity (improve resilience) of the pavement (by over 50%), it effectively **reset the oxidation curve** for the pavement over the following seven years, dramatically extending the LCA of the pavement.

MRT has been widely tested over the past half century with consistent excellent results. The method employs delivering an emulsified penetrating compound consisting of a near-pure maltene rich petroleum resin, a compatible surfactant, and water directly into the roadway surface.

The surfactant and water help deliver the fresh maltene fractions ratably and deeply into wearing-course depth. The result is a revitalized or "rejuvenated" asphalt binder which can be tested for measurably and sustainably improved rheology, as the Charleston data proves.

MRT has shown, with repeat treatments every three to five years, to extend the life cycle of asphalt pavements by two-fold and at a fraction of the cumulative cost of repaving, reducing reliance on petroleum feedstocks and cutting energy, maintenance and replacement costs.

MRT is the asphalt pavement preservation base found in PTI's **A.R.A.-1 Ti®**.

Combining a proven pavement LCA extending technology with a photocatalytic enhancement has shown great results and synergies beneficial to multiple level CO_2e reductions for pavement infrastructures.

3.8 Road-Level Air Quality Reference Testing

There are key unknown relationships between NO_x, the soluble nitrates (HNO_3) that result from PCO and variant atmospheric conditions.

Capturing and measuring ambient air quality in real-time is very difficult owing to the multitude of meteorological variables, including but not limited to—temperature; air speed; humidity; atmospheric pressure; precipitation; and air composition contamination related to testing area configuration and scale limitations. Roadway "breathing zone" analysis also includes traffic variables, of course.

The EPA sets strict standards for such measurement and guides industry on accepted methods and procedures, including equipment under the **Federal Reference Method (FRM)** and administered by the EPA's **Ambient Monitoring Technology Information Center (AMTIC)**.[107]

Equipment that are "designated" or meet the requirements are prohibitively expensive, with set-ups ranging in the hundreds of thousands USD. And the EPA stated protocol calls for multiple FRM level equipment used in any testing for redundancy and consistency.

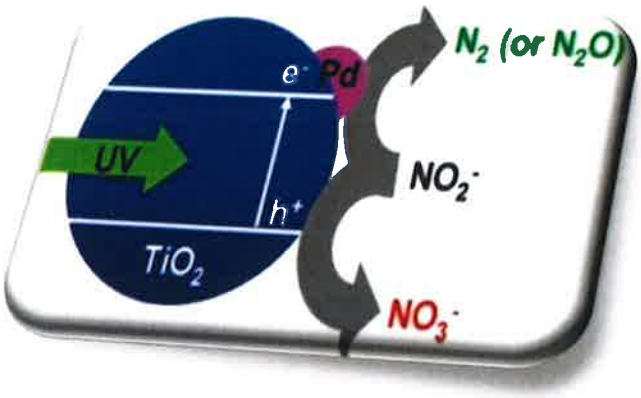
The EPA "reference" requirements are supported by the Agency's computerized simulation (regression) modeling, referred to as the **Air Pollutants Exposure Model (APEX)**.[108] So, the EPA combines advanced field monitoring with very sophisticated data-driven simulation software to predict human exposure risks to anthropogenic pollution.

Additionally, the EPA believes near-road concentrations of pollutants can be 2–3 times higher than measured at nearby area-wide monitors,[109] as previously noted, making "breathing zone" identification critical in estimating human exposure to mobile-sourced criteria toxins such as NO_x.
Conforming to air quality monitoring and human hazard measurement under FRM is logistically difficult and economically infeasible in most circumstances, while non-conforming testing creates an unavoidable data "reference gap".

[107] EPA: Air Quality Methods – Criteria Pollutants, www.epa.gov.
[108] EPA: Human Exposure Modeling – Air Pollutants Exposure Model, www.epa.gov.
[109] EPA: Near Roadway Air Pollution and Health, Frequently Asked Questions, www.epa.gov.

The gap potentially could be mitigated through additional near-field PCO testing to promote correlative significance to non-reference air quality data collected. And this is among the on-going research initiatives with TTI, including potentially advancing future performance specifications for photocatalyst pavements.

Drawing 3.15 Photocatalytic Disproportionation of Nitrite Gas (NO_2) into Nitrate (NO_3)



Source: Royal Society of Chemistry

One approach to promote better field data efficacy is to establish a verifiable NO_x – nitrate exchange rate **("nitrite-nitrate exchange indexing")** in order to ensure more dependable field monitoring of pollution reduction sites using non-conforming sources **(Drawing 3.15)**. [110] [111]

The relationships primarily relate to the efficiency of the NO_x - nitrate exchange rates under varying pollution exposure levels and air masses and movement. The objective of establishing such relationships would be to ascertain how field instrumentation would need to be properly configured in order effectively monitor and characterize the effect of the NO_x - nitrate exchange process under PCO.

The **priori** under such a protocol would be:

- **Step 1: Establish the NO_x - Nitrate Exchange Rates for Fixed NO_x Levels**
- **Step 2: Establish the NO_x - Nitrate Exchange Rates for Variable NO_x Levels**
- **Step 3: Large-Scale Sample Testing to Validate Findings from 1 and 2**

The effectiveness of photocatalytic conversion on treated asphalt and concrete specimens can be tested with respect to a variation of NO_x gas concentration by varying the air flow stream the gas is moving in. And against variant atmospheric conditions.

In the field, NO_x reductions can be measured indirectly based on either quantifying nitrate levels observed directly throughout the testing area or by comparing the **dielectric constant** across the treated surfaces to nitrate levels observed in the laboratory on extracted cores, to determine nitrate evaporation rate and nitrate concentrations in the field.

These testing procedures could provide rapid methods for determining NO_x reduction efficiency against the established NNE, which then could be compared to experimental (non FRM) air quality monitoring for correlations.

Both then would be compared against the established baseline verification [112] to draw an empirical relationship between PCO testing with a high degree of accuracy with those increasingly more developmental at scale. This would be the base pollution capture relationship used to develop a **full-scale econometric model**, to include other traffic and weather variables, for exceptionally reliable ME pollution removal efficiency predictability.

[110] Hassan M and Dylla HL et al., *Durability and Performance of Titanium Dioxide in Photocatalytic Pavements.*

[111] Wang L and Wang Q, Selective Determination of Nitrite/Nitrate Based on Photo-induced Redox Activity of Titanium Dioxide, Journal of Separation Science, August 2018.

[112] Japanese Industrial Standard (JIS) TR Z 0018 *Photocatalytic Materials – Air Purification Test Procedure.*

3.9 The Road of the Future is Ready

In short, human achievement, for all it is great benefits, is overwhelming *Mother Nature's* ability to self-clean our planet. This is not debatable.

Photocatalysis is a natural solution, using the immense energy of the Sun, which helps accelerate inherent, organic mechanisms for managing rising GHG inventories effecting ground-level pollution and exaggerating the impacts of heat islands and climate change.

The technology is available today and it is both scalable and economical.

Real Science. Real Results.

www.SmogEatingRoads.com

A.R.A.-1Ti®
Safety Data Sheets

SAFETY DATA SHEET

1. Identification

Product identifier	**A.R.A. -1 Ti®**
Other means of identification	Not available
Recommended use	Dust control emulsion
Recommended restrictions	Follow the manufacturer's instructions.
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	
Manufacturer:	D & D Emulsions, Inc.
Address:	270 Park Avenue East P.O. Box 1706 Mansfield, OH 44901
24- Hour Telephone Number:	
CHEMTREC:	1-800-424-9300 (USA and Canada) CCN794154

2. Hazard(s) identification

Physical hazards	Not classified	
Health hazards	Carcinogenicity	Category 1B
Environmental hazards	Not classified	
OSHA defined hazards	Not classified	
Label elements		

Signal word	Danger
Hazard statement	May cause cancer.
Prevention	Obtain special instructions before use. Wear protective gloves/protective clothing/eye protection/face protection. Do not handle until all safety precautions have been read and understood.
Response	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting. IF exposed or concerned: Get medical advice/attention.
Storage	Store in accordance with international regulations. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known
Supplemental information	Not applicable

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
EXTRACTS (PETROLEUM), HEAVY NAPHTHENIC DISTILLATE SOLVENT		64742-11-6	60 - 65
WATER		7732-18-5	35 - 40
PROPRIETARY INGREDIENTS		N/A	<5

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Do not induce vomiting without advise from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Most important symptoms /effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Dry chemicals. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/ instructions	Cool containers exposed to heat with water spray and remove container, if no risk is involved.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water sources or onto the ground.

7. Handling and storage

Precautions for safe handling	Avoid prolonged or repeated contact with skin. Avoid prolonged exposure. Use only in well- ventilated areas.
Conditions for safe storage, including any incompatibilities	Keep away from heat and sources of ignition. Store in original tightly closed container. Store away from incompatible materials (see section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CRF 1910.1000)

Components	Type	Value	Form
EXTRACTS (PETROLEUM), HEAVY NAPHTHENIC DISTILLATE SOLVENT (CAS 64742-11-6)	PEL	5 mg/m3	Mist.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
EXTRACTS (PETROLEUM), HEAVY NAPHTHENIC DISTILLATE SOLVENT (CAS 64742-11-6)	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Hand protection	Wear protective gloves.
Skin protection	
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	Not available
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Opaque Liquid
Physical state	Liquid
Form	Liquid
Color	Yellow
Odor	Mild Odor
Odor threshold	Not available
pH	4.5 – 7.2
Melting point/freezing point	Not available
Initial boiling point and boiling range	> 212 °F (> 100 °C) estimated
Flash point	Not available
Evaporation rate	< 1
Flammability (solid, gas)	Not available
Upper/lower flammability or explosive limits	
Flammability limit – lower (%)	Not available
Flammability limit - upper (%)	Not available
Explosive limit – lower (%)	Not available
Explosive limit – upper (%)	Not available
Vapor pressure	Not available
Vapor density	Not available
Relative density	1 g/cm3
Solubility (ies)	
Solubility (water)	Readily Dispersible
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	500 °F (260 °C) estimated
Decomposition temperature	Not available
Viscosity	Not available
Other information	
Percent volatile	37.5 % estimated < 2 %
VOC (Weight %)	2.5 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.

Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure	
Ingestion	Expected to be a low ingestion hazard.
Inhalation	Prolonged inhalation may be harmful.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.
Information on toxicological effects	
Acute toxicity	Not available
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization	Not available
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Contains a substance/a group of substances which may cause cancer. Contains polycyclic aromatic compounds (PACs). Prolonged and/or repeated skin contact with certain PACs has been shown to cause skin cancer. Prolonged and/or repeated exposures by inhalation of certain PACs may also cause cancer of the lung and of other sites of the body.

US. OSHA Specifically Regulated Substances (29 CRF 1910.1001-1050)

Not Listed

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified
Specific target organ toxicity - repeated exposure	Not classified
Aspiration hazard	Not available
Chronic effects	Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available
Mobility in soil	No data available
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues/unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions)

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not available

15. Regulatory information

US federal regulations All components are on the U.S. EPA TSCA Inventory list.

TSCA Section 12 (b) Export Notification (40 CRF 707, Subpt. D)

Not regulated

CERCLA Hazardous Substance List (40 CRF 302.4)

Not listed

US. OSHA Specifically Regulated Substances (29 CRF 1910.1001-1050)

Not listed

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard – No
Delayed Hazard – Yes
Fire Hazard – No
Pressure Hazard – No
Reactivity Hazard – No

SARA 302 Extremely hazardous substance

Not listed

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) list

Not regulated

Clean Air Act (CAA) Section 112 (r) Accidental Release Prevention (40 CRF 68.130)

Not regulated

Safe Drinking Water Act (SDWA) Not regulated

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

US. Massachusetts RTK – Substance List

EXTRACTS (PETROLEUM), HEAVY NAPHTHENIC DISTILLATE SOLVENT (CAS 64742-11-6)

US. New Jersey Worker and Community Right-to-Know Act

Not regulated

US. Pennsylvania RTK – Hazardous Substances

EXTRACTS (PETROLEUM), HEAVY NAPHTHENIC DISTILLATE SOLVENT (CAS 64742-11-6)

US. Rhode Island RTK

Not regulated

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

International Inventories

Country (s) or region	Inventory name	On inventory (yes / no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from this listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 10-31-2014

Version # 01

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Florida State Certificate

State of Florida
Department of State

I certify from the records of this office that PAVEMENT TECHNOLOGY, INC. is an Ohio corporation authorized to transact business in the State of Florida, qualified on November 26, 1986.

The document number of this corporation is P12308.

I further certify that said corporation has paid all fees due this office through December 31, 2019, that its most recent annual report/uniform business report was filed on February 21, 2019, and that its status is active.

I further certify that said corporation has not filed a Certificate of Withdrawal.

Given under my hand and the Great Seal of the State of Florida at Tallahassee, the Capital, this the Twenty-first day of February, 2019

Secretary of State

Tracking Number: 1924710495CC

To authenticate this certificate,visit the following site,enter this number, and then follow the instructions displayed.

https://services.sunbiz.org/Filings/CertificateOfStatus/CertificateAuthentication

Corporate Resolution

Pavement Technology, Inc.

24144 Detroit Rd.
Westlake, Ohio 44145

Phone: 800-333-6309 440-892-1895
Fax: 440-892-0953

CORPORATE RESOLUTION

Pavement Technology, Inc.

I hereby certify that I am the Founder and President of PavementTechnology, Inc., a corporation duly organized and existing under the laws of the State of Ohio; that on this 2nd day of January, 2007, the board of directors of said Corporation authorized and approved the Secretary/Treasurer of said corporation to execute any proposals and contracts for and in behalf of said corporation; that said authority is not contrary to any provision in the articles of incorporation or code of regulations or code of bylaws of said corporation; that said authority has not been rescinded or modified and that Susan J. Durante is the duly elected and acting Secretary/Treasurer of said corporation.

IN WITNESS WHEREOF, I have hereunto subscribed my name on this 2nd day of January, 2007.

Colin M. Durante, President

EXHIBIT “C”

(Front-End Documents/Instructions to Bidders)

1. Defined Terms:

The following terms have the meanings indicated which are applicable to both the singular and plural thereof.

1.1 BIDDER: One who submits a Bid directly to CITY, as distinct from a sub-Bidder, who submits a bid to a BIDDER

1.2 CITY REP: City of Plantation, Procurement Agent

1.3 CITY: The City of Plantation, a Florida municipal corporation

1.4 CONTRACTOR: The BIDDER with whom CITY enters into a Contract for the Work.

1.5 The words 'proposal" and "bid" for this proposal are considered interchangeable.

2. Copies of Bidding Documents:

2.1 Complete sets of the Solicitation Documents shall be obtained electronically from the Demand Star website https://www.demandstar.com/app/agencies/florida/city-of-plantation-procurement-division/procurement-opportunities/9b6d13fb-3874-4291-9605-81cf63387a40/

2.2 Complete sets of Bid Documents shall be used in preparing Bids, neither CITY nor the CITY REP that prepared or assisted in the preparation of the Bid Documents assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

3. Qualifications of Bidders:

No bid will be accepted from, nor will any Contract be awarded to, any person or firm who is in arrears to CITY, upon any debt or contract, or who is a defaulter, as surety or otherwise, upon any obligation to said CITY, or who is deemed irresponsible or unreliable by CITY. The CITY shall have no liability to any Successful BIDDER unless and until the CITY executes a contract with such Successful BIDDER.

CITY shall also have the right, unless prohibited by law, to meet with one or more BIDDER after bids are opened to ensure that all CITY's expectations with respect to performance can be met and that the requirements and scope of the Contract Work are clearly understood.

4. Examination of Bid Documents and Site:

4.1 Before submitting a Bid, each BIDDER(s) must (a) examine the Bid Documents thoroughly; (b) visit the site to familiarize themselves with local conditions that may in any manner affect performance, cost, progress or furnishing of the Work as required by the solicitation; (c) familiarize themselves with Federal, State, and local laws, ordinances, Florida Building Code or other applicable construction codes, rules and regulations affecting the performance, cost, progress, or furnishing of the Work; (d) study and carefully correlate their observations with the requirements of Contract Documents, and (e) notify CITY REP of all conflicts, errors or discrepancies in the Contract Documents.

4.2 BIDDERS should also note any references made to the Specifications for identification of those surveys and investigation reports of subsurface and latent physical conditions at the site or otherwise affecting performance, cost, progress or furnishing of the Work which have been relied upon by CITY REP in preparing the Drawings and Specifications, if any. CITY will make copies of such surveys and reports, which are not bound into these documents, available to any BIDDER requesting them. These reports are not guaranteed as to accuracy or completeness, nor are they part of the Bid Documents.

4.3 The submission of a Bid will constitute an incontrovertible representation by the BIDDER that they have complied with every requirement of this Article 4 and that the Bid Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.

4.4 Any information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to CITY and CITY REP by owners of such Underground Facilities or others, and neither CITY nor CITY REP assumes responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in SUPPLEMENTARY CONDITIONS.

4.5 SUPPLEMENTARY CONDITIONS, if any, may identify for limited reliance by the CONTRACTOR certain specified technical data. These (as well as other documents) should be reviewed.

4.6 Before submitting a Bid, each BIDDER will, at its own expense, make or obtain any additional examinations, investigations, explorations, surveys, tests and studies and obtain any additional information or data which pertains to the physical conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work and which BIDDER deems necessary to determine their Bid price for performance and furnishing of the Work in accordance with the time, price and other terms and conditions of the Bid Documents.

4.7 On request in advance, CITY will provide each BIDDER access to the site to conduct explorations and tests as each BIDDER deems necessary for submission of a Bid. Bidder shall fill all holes, clean up and restore the site to its former condition upon completion of such explorations.

4.8 The lands upon which the Work is to be performed, and the right-of-ways and easements for access thereto and other lands designated for use in performing the Work are identified in the Bid Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment or construction operations are to be provided by the CONTRACTOR.

5. Interpretations and Addenda:

All questions about the meaning or intent of the Bid Documents shall be submitted to CITY REP in writing. Interpretations or clarifications considered necessary by CITY REP in response to such questions will be issued by Addenda and posted to the Demand Star website by CITY'S Procurement Department. Questions received less than ten (10) days prior to the date for opening of Bids will be answered at the option of the CITY. Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

In the event of conflict between the Notice to Bidders and the terms written within the Scope of Services and/or Specifications contained within Bid documents, the terms within the Scope of Services and/or Specifications shall control.

6. Subcontractors, Suppliers and Others:

6.1 CITY requires the identity of major Subcontractors working on the project and Suppliers of unique material or products to be submitted to CITY in advance of the Notice of Award the apparent Successful BIDDER. Any other BIDDER requested by City in writing will, within seven (7) calendar days, submit to CITY a list of all Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment) proposed for portions of this Project. An experience statement shall accompany such list with pertinent information as to similar projects and other evidence of qualifications for each identified Subcontractor, Supplier, person and organization.

6.2 If CITY or CITY REP after due investigation has reasonable objection any proposed Subcontractor, Supplier or other person or organization, may before giving the Notice of Award request the apparent Successful BIDDER to submit an acceptable substitute without an increase in Bid price. If the apparent Successful BIDDER declines to make any such substitution, CITY may award the contract to the next lowest BIDDER whose bid is determined to be the most advantageous to the CITY taking into consideration the evaluation factors and criteria set forth in the INVITATION TO BID or the code if none are provided in the INVITATION

TO BID that proposes to use acceptable Subcontractors, Suppliers and other persons and organizations. The BIDDER declining to make requested substitutions would not constitute grounds for sacrificing the Bid Security of any BIDDER.

6.3 No BIDDER shall be required to employ any Subcontractor, other person or organization against whom BIDDER has reasonable objection.

7. Bid Form:

7.1 The Bid Form is included with the Solicitation Documents.

7.2 All blanks on the Bid Forms must be completed in ink or be typed. The bid price of each item on the form must be stated in words and numerals: in case of conflict, words will take precedence. Whiteout of prices or words and numerals on Bid Form is not permitted.

7.3 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate office accompanied by evidence of authority to sign). The corporate seal must be affixed and attested by the secretary or an assistant secretary or notarized by a licensed Notary together with a corporate Resolution authorizing the submittal of the bid. The corporate address and state of incorporation must be shown below the signature.

7.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

7.5 All names must be typed or printed below the signature. The signer shall date all signatures.

7.6 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

7.7 The address and telephone number for communications regarding the Bid must be shown.

8. SUBMISSION OF BIDS:

8.1 Bids shall be submitted before the time and at the place indicated in the Notice to Bidders.

8.2 All Bids will be received electronically via the Demand Star website. Bid Documents may be obtained electronically at:

https://www.demandstar.com/app/agencies/florida/city-of-plantation-procurement-division/procurement-opportunities/9b6d13fb-3874-4291-9605-81cf63387a40/.

Bids will not be considered and cannot be entered online after the above referenced date.

8.3 More than one Bid received for the same work from an individual, firm or partnership, a Corporation or Association under the same or different names will not be considered. Reasonable grounds for believing that any BIDDERS is interested in more than one Bid for the same work will cause the rejection of all such Bids in which the Bidders is interested. If there are reasonable grounds for believing that collusion exists among the BIDDER, the Bids of participants in such collusion will not be considered.

9. Modification and Withdrawal of Bids:

9.1 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

9.2 If within twenty-four (24) hours after Bids are opened, any BIDDER files a duly signed, written notice with CITY and promptly thereafter demonstrates to the reasonable satisfaction of CITY that there was a material and substantial mistake in the preparation of its Bid, that BIDDER may withdraw its Bid and the Bid security will be returned. Thereafter, that BIDDER will be disqualified from further bidding on the Work to be provided under the Bid Documents.

10. Opening of Bids:

Bids will be opened, read and recorded pursuant to State of Florida Law and City of Plantation code.

11. Bids to Remain Subject to Acceptance:

11.1 All bids MAY remain subject to acceptance for ninety (90) days after the day of the Bid opening, but CITY may, in its sole discretion, release any Bid and return any Bid security prior to that date.

11.2 Extension of time when Bids shall remain open beyond the original period may be made only by mutual agreement between CITY, the Successful BIDDER, and the surety, if any, for the Successful BIDDER.

12. Award of Contract:

12.1 CITY reserves the right to reject any and all Bids, to waive any and all informalities, incompleteness, or irregularities not involving price, time or material changes in the Work, and to negotiate contract terms with the Successful BIDDER, and the right to disregard all nonconforming, nonresponsive, unbalanced, incomplete, irregular, or conditional Bids. Also, CITY reserves the right to reject the Bid of any BIDDER if CITY believes that it would not be in the best interest of the Project to make an award to that BIDDER, whether because the Bid is not responsible or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by CITY. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

12.2 CITY may conduct such investigations as CITY deems necessary to assist in the evaluation of any BIDDER and to establish the responsibility, reputation, work load, qualifications and financial ability of BIDDER, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to CITY's satisfaction within the prescribed time.

12.3 The CITY shall not be obligated to any BIDDER to enter into a contract with the BIDDER despite the CITY governing body prospectively awarding the contract to a successful BIDDER. The CITY shall be obligated to any Bidder for the project if and only if the CITY enters into a contract for the project with the Bidder, and further, no action will lie against the CITY to compel CITY to execute any such contract, or to recover from the CITY any damages, costs, lost profits, expenses, etc., that BIDDER may incur if the CITY chooses not to sign such contract. By bidding on this project, all BIDDERS acknowledge and agree that no enforceable contractual relationship arises until the CITY signs the contract, and that no action shall lie to require CITY to sign such contract at any time, and that Bidder waives all claims to damages, lost profits, costs, expenses, etc., as a result of the CITY not signing such contract.

12.4 If the contract is to be awarded, CITY will give the Successful BIDDER a Notice of Award.

12.5 Bid prices will be compared after adjusting for differences in the time designated in the Bid for Substantial Completion. The adjusting amount will be determined at the rate set forth in the Contract Documents for liquidated damages indicated for Substantial Completion for each day after the desired date appearing in Article 19 of this Document.

13. Taxes:

The CONTRACTOR shall pay all applicable sales, consumer, use and other similar taxes required by law. The CONTRACTOR is responsible for reviewing the pertinent state statutes involving the sales tax and complying with all requirements.

14. Insurance Requirements:

All Bond and Insurance requirements are described in a separate document included with this solicitation (if applicable).

15. Equal Employment Opportunity Clause

City of Plantation, Florida, in accordance with the provisions of Title VII of the Civil Rights Act of 1964 (78 Stat. 252) and the Regulations of the Department of Commerce (15 CFR, Part 8) issued pursuant to such Act, hereby notifies all BIDDERS that it will ensure that in any contract entered into pursuant to this advertisement, minority business enterprises will be afforded full opportunity to submit proposals in response to this advertisement and will not be discriminated against on the ground of race, color or national origin in consideration for an award.

16. Regulations

Violation of any local, state or federal law in the performance of this Contract shall constitute a material breach of this Contract.

17. Fiscal Non-Funding Clause

In the event sufficient funds are not budgeted for a new fiscal period, the CITY shall notify the successful BIDDER of such occurrence and the contract shall terminate on the last day of the current fiscal year without penalty or expense to the CITY.

18. Amendment

The awarded BIDDER understands and agrees the contract constitutes the sole and complete understanding between the parties and supersedes all agreements between them, whether oral or written with respect to the subject matter. No amendment, change, or addendum to this Contract is enforceable unless agreed to in writing by both parties and incorporated into the Contract.

19. Assignment

The awarded BIDDER shall not assign any interest in this Contract and shall not transfer any interest in same (whether by assignment or novation) without prior written consent of the CITY except that claims for the money due or to become due the awarded BIDDER from the CITY under this Contract may be assigned to a financial institution or to a trustee in Bankruptcy without such

approval from the CITY. Notice of such transfer or assignment due to Bankruptcy shall be promptly given to the CITY.

20. Cone of Silence:

Once the Solicitation has been issued, a Cone of Silence will be implemented. At that time communication with the CITY is limited to Deidre Bain, Procurement Agent (email address: DBain@plantation.org). During the solicitation advertising, review and evaluation process no person shall make any private or separate delivery of marketing information concerning any BIDDER to any elected officers of the CITY, members of the CITY staff or members of the Evaluation Committee.

Cone of Silence shall terminate at the time the CITY makes an award to a BIDDERS(S) that becomes final as a result of no procurement protest being filed or takes other action that ends this solicitation.

Any action of a BIDDER in violation of this may be cause for disqualification of the BIDDER.

21. Alternative Products:

When bidding on an Alternative Product "or equal," Bids must be accompanied with all descriptive information necessary for an evaluation of the proposed material or equipment such as the detailed drawings and specifications, certified operation and test data, and experience records. Failure of any bidder to furnish the data necessary to determine whether the product is equivalent, may be cause for rejection of the specific items(s) to which it pertains. All deviations from the specifications must be noted in detail by the BIDDER. Any deviation from the specifications as written and accepted by the CITY may be grounds for rejection of the material and/or equipment when delivered.

22. Equal Product:

Manufacturer's brand name and model number are used in these specifications for the purpose of establishing minimum requirement level of quality and standards of performance and design required. This is in no way intended to prohibit the proposing of other manufacturer's items of equal material and function, unless otherwise indicated. Equal (substitution) may be bid, providing the product bid is found to be equal in quality, standards of performance, design, etc. to item specified, unless otherwise indicated. Where equal is proposed, bid must be accompanied by complete factory information sheets (specifications, brochures, etc.) documenting the equipment bid as equal. The CITY, after evaluation of the documentation submitted, will determine if products is approved as equal to the specified request.

END OF DOCUMENT

EXHIBIT “D”

(Insurance Requirements)

INSURANCE REQUIREMENTS

Statement

Contractors shall not commence any work until they have obtained and satisfied the city's insurance requirements under written contract with the city and such insurance has been approved by the City of Plantation Risk Management Department. Contractors shall not allow any subcontractor to commence work until all insurance requirements have been so obtained and approved. All insurance policies shall be with insurers qualified and doing business in the State of Florida. All insurance companies shall have a Financial Rating of no less than "A-" and Class X respectively, in the latest edition of A.M. Best Rating Guide. The types and amounts of insurance shall not be less than the amounts specified in this agreement.

Insurance

The required insurance coverage's shall be written in accordance with the hazards and magnitude of the project, but in no circumstances a lesser coverage amount, nor more restrictive than the limits of liability and schedule of hazards described herein.

Contractors shall be responsible to purchase and maintain required insurance policies during the term of the contract agreement. If the Contractor fails to procure and maintain such insurance, the City of Plantation shall have the right, but not the obligation, to purchase and maintain said insurance for and in the name of the Contractor, and the Contractor will pay the premium cost thereof and shall furnish all necessary information to the city in order to make effective and maintain such insurance.

Additional Insured

Certificates of Insurance and insurance policies shall also be endorsed to name the City of Plantation "**Additional Insured**" on the Commercial General Liability with the following or similar endorsements providing equal or broader Additional Insured coverage, such as the basic CG2026 07 04 Additional Insured--Designated Person or Organization endorsement, or the CG2010 10 01 Additional Insured-Owners Lessees, or Contractors endorsement, or the CG2010 07 04 Owners, Lessees or Contractors endorsement, including the additional endorsement of CG2037 10 01-Additional Insured- Owners, Leases have Contractors Operations endorsement. Endorsements shall be required to provide back coverage for the contractors **"Your Work"** as defined in the insurance policy and liability arising out of the products & completed operations hazard.

Commercial General Liability

Contractor will agree to maintain Commercial General Liability at a minimum limit of liability not less than **$1,000,000** Each Occurrence, and **$2,000,000** Annual Aggregate unless the particular contract calls for specific limits of insurance. Coverage shall not contain any endorsement(s) excluding nor limiting Product/Completed Operations, Contractual Liability or Cross Liability. When a self-insured retention (SIR) or deductible exceeds **$25,000**, the City reserves the right, but not the obligation, to review and request a copy of Contractor's most recent annual report or audited financial statement.

Business Automobile Liability

Contractor will agree to maintain Business Automobile Liability at a limit of liability not less than **$1,000,000** Each Occurrence. Coverage shall include liability for Owned, Non-Owned & Hired automobiles. In the event Contractor does not own automobiles, Contractor agrees to maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Liability policy.

Workers Compensation & Employers Liability

The Workers Compensation and Employers' Liability insurance shall be in accordance with Florida State Statutes 440.

Umbrella Excess Liability

If required by contract will be no more restricted than the underlying insurance policies.
City of Plantation must be added and endorsed separately as additional insured on umbrella policies.

Professional Liability

If required by contract will be a minimum of 1,000,000.

Waiver of Subrogation

The Contractor will agree that each required policy will contain Waivers of Subrogation in favor the City of Plantation. Should an insurance policy condition **not** permit Contractor to enter into a pre-loss agreement to waive subrogation without an endorsement, then the Contractor will agree to notify the insurer and request the policy be endorsed with a waiver of Transfer of Rights of Recovery against others, or its equivalent. This waiver of subrogation shall not apply to any policy, which includes a condition specifically prohibiting such an endorsement, or voids coverage should contractor enter into such an agreement on a pre-loss basis.

Certificate(s) of Insurance

The Contractor will agree to provide City a Certificate of Insurance evidencing that all coverage's, limits and endorsements required herein are maintained and in full force and effect, and certificates of insurance shall provide a minimum thirty **(30)** days to notify, when available by Contractors insurer. If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify the City by fax within five **(5)** business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. Certificates of Insurance shall be in the form as approved by Insurance Standards Office (ISO) and such certificates shall clearly state all of the coverage's required in this section.

INSURANCE

Commercial General Liability insurance will cover liability bodily injury and property damage. Exposures to be covered are premises, operations, products/completed operations, and contracts. Coverage must be written on an occurrence basis, with the following **examples** of insurance.

Schedule	**Limits**
Commercial General Liability	$1,000,000 Each Occurrence
Blanket Contractual Liability	$2,000,000 Each Occurrence
Independent Contractors	Premises-Operations
Products & Completed Operations	Personal /Advertising Injury
Blanket Contractual Liability	Independent Contractors
Automobile Liability	
Any auto including Hired & Non-owned	$1,000,000 Combined Single Limit
Broad Form Property Damage	$1,000,000 Each Occurrence
Blanket X,C,U Hazards	If required (Included)
Workers' Compensation	Florida 440 Statutory Coverage
Employers Liability	$1,000,000 Each Accident
Disease Policy Limit	$1,000,000

INSURANCE REQUIREMENTS

Bonds:

A surety bond maybe required equal to the value of the job to guarantee the work will be done per the specifications on a timely basis.

Insurance Summary:

A. Violation of the terms of this agreement and its subparts shall constitute a breach of the written contract and so the city at its sole discretion, may cancel the contract and all rights, title and interest of the contractor shall thereupon cease and terminate.

B. The City reserves the right to require or adjust any of the insurance coverage's it deems necessary depending upon the company, the project and the potential hazard exposures.

C. The city requires being named **"Additional Insured"** on all certificates of insurance. Certificates of Insurance can only be endorsed by an insurance agency or insurance company.

D. No work is to be performed pursuant to a mutually agreed upon written contract between the City of Plantation and the Contractor. The city will have the right to amend such contract to conform to City of Plantation guidelines for contract work.

E. The City requires a "thirty (30) day notice of cancellation" on all certificates of insurance.

F. The City requires a "wavier of subrogation" for all Workers Compensation Coverages

THE UNDERSIGNED CONTRACTOR HAS READ All THE FOREGOING REQUIREMENTS AND AGREES TO THE TERMS.

WITNESS Susan Durante, Secretary/Treasurer

CONTRACTOR Colin Durante, President

January 9, 2023
DATE

CITY OF PLANTATION

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 4/11/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
McGowan & Company, Inc.
20595 Lorain Rd
Fairview Park OH 44126

CONTACT NAME: Frances Lyons
PHONE (A/C, No, Ext): 440.895.4359 **FAX (A/C, No):** 440-333-3214
E-MAIL ADDRESS: flyons@mcgowaninsurance.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Travelers Property Casualty Co of America	36161
INSURER B : Phoenix Insurance Company	25623
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED PAVETEC-01
Pavement Technology, Inc
24144 Detroit Rd
Westlake OH 44145

COVERAGES **CERTIFICATE NUMBER:** 1758485299 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY [X] PRO-JECT [ ] LOC OTHER:	Y	Y	DTCO324N6425	3/1/2023	3/1/2024	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$ 1,000,000 $ 500,000 $ 10,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $
B	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY	Y	Y	8108L678293	3/1/2023	3/1/2024	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$ 1,000,000 $ $ $ $
A	X UMBRELLA LIAB [X] OCCUR EXCESS LIAB [ ] CLAIMS-MADE DED [X] RETENTION $ 10,000	Y	Y	CUP2J391570	3/1/2023	3/1/2024	EACH OCCURRENCE AGGREGATE $	$ 5,000,000 $ 5,000,000 $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [ ] N / A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below		Y	UB0K349145	3/1/2023	3/1/2024	[ ] PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Project: Asphalt Rejuvenation Project – Term Contract Agreement No. 072-22
The City of Plantation is included as an additional insured with respects to the General Liability and Automobile Liability when required by written contract. Waiver of Subrogation is included in favor of the additional insured where permissible by state law when required by written contract. 10 day notice of cancellation for non-payment of premium, 30 day notice for all other reasons applies.

CERTIFICATE HOLDER
City of Plantation
400 NW 73 Avenue
Plantation FL 33317

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

EXHIBIT “E”

(Unit prices identified and agreed to under this Agreement)

BID FORM (REVISED)

Bidding Company's Name: Pavement Technology, Inc.

Address: 24144 Detroit Road, Westlake, OH 44145

Phone: 440-892-1895

Email: dcancelliere@pavetechinc.com

To furnish and deliver all materials and to do and perform all work in accordance with the Contract Documents for the Project entitled:

SOLICITATION NAME: Asphalt Rejuvenation Project – Term Contract
ITB No. 072-22
City of Plantation

TO: City of Plantation
400 NW 73rd Avenue
Plantation, FL 33317

The Undersigned BIDDER proposes and agrees if this bid is accepted, to enter an agreement with the CITY to complete all work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation. This bid will remain open for ninety (90) days after the day of Bid Opening.

A. BIDDER has examined copies of all the Contract Documents and of the following Addenda: (if any addenda have been issued)

DATE:	ADDENDA NUMBER:
[ ]11/18/22	[1]
[ ]12/14/22	[2]
[ ]12/21/22	[3]

(receipt of all of which is hereby acknowledged) and also copies of the Advertisement or Notice to Contractors and the Instruction to Bidder.

B. This bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreements or rules of any group, association, organization or corporation. BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham bid; BIDDER has not solicited or induced any person, firm, or a corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other BIDDER or over CITY.

C. BIDDER shall complete/furnish the work/equipment for the following price. It is the CITY'S intent to award a contract to the lowest, responsive, and responsible BIDDER for Base Bid A or Base Bid B.

BID FORM (REVISED)

TOTAL BASE BID AMOUNT:

BASE BID A

Description	Per SQ YD Cost	Total Cost
Standard Specification – Reclamite Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	$ 1.21 SY One dollar & twenty-one cents per sq. yd.	$ 744,150.00

BASE BID B

Description	Per SQ YD Cost	Total Cost
Bid Alternate #1 Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	$ 2.49 SY Two dollars & forty-nine cents per sq. yd.	$1,531,350.00

***The City reserves the right to award either Base Bid A or Base Bid B**
***Prices shall remain firm for ninety (90) days.**

Safety Data Sheets enclosed? Yes ✓ No____

Specification Sheets/Brochures? Yes ✓ No____

Communications concerning this Bid shall be addressed to the address of BIDDER indicated below.

The undersigned also agrees as follows:

To do any extra work not covered by the foregoing Schedule of Price which may be ordered by the CITY, and to accept as full compensation therefore, such prices may be agreed upon in writing by the CITY and

the BIDDER SUBMITTED ON 1/9 20 23

SIGNATURE OF BIDDER: Colin Durante

PRINT NAME: Colin Durante

TITLE (if any): President

ADDRESS: 24144 Detroit Road, Westlake, OH 44145
Incorporated under the laws of the State of Florida.

EXHIBIT “F”

(General Terms and Conditions)

A. Warranty

The Contractor warrants to the City that materials and equipment furnished under the Agreement will be of good quality and new unless otherwise required or permitted by the City; that the Work will be free from defects not inherent in the quality required or permitted; and that the Work will conform with the applicable standard construction details and requirements. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty shall be for a period of one (1) year from acceptance by the City and excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. The Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All manufacturers' product warranties shall be registered in the City's name and for its sole benefit.

B. Safety Precautions and Programs

1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Agreement.

2. In the event the Contractor encounters on the Project site any material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) that has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the City in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the City and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the City and Contractor.

3. The Contractor shall not be required to work in an area on the Project site that contains asbestos or polychlorinated biphenyl (PCB).

C. Safety of Persons and Property

1. The Contractor shall take responsible precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

    a. employees at the Project site and other persons who may be affected thereby;

    b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Subsubcontractors; and

    c. other property at the Project site or adjacent thereto, such as trees, shrubs, lawns, walks, relocation or replacement in the course of construction

2. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property for their protection from damage, injury or loss.

3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible except damage or loss attributable to acts or omissions of the City or Consultant or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

6. When applicable, the Contractor shall designate a responsible member of the Contractor's organization at the Project site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated by the Contractor in writing to the City and Consultant.

7. The Contractor shall not load or permit any part of the construction site to be loaded so as to endanger its safety.

D. Uncovering of Work

1. If a portion of the Work is covered contrary to the City's request, it must, if required in writing by the City, be uncovered for the City's inspection and be replaced at the Contractor's expense.

E. Correction of Work

1. The Contactor shall promptly, in a technically appropriate time period, correct Work rejected by the City or failing to conform to the applicable standard detail requirements. The Contactor shall bear costs of correcting such rejected work, including additional testing and inspections and compensation for the City services and expenses made necessary thereby.

2. If, within one year after the date of completion of the Work, any of the Work is found to be not in accordance with the standard detail requirements or to have failed, the Contractor shall

correct it promptly, in a technically appropriate time period, after receipt of written notice from the City unless the City has previously given the Contractor a written acceptance of such condition. The City shall give such notice after discovery of the condition.

3. The Contractor shall remove from the work/project site portions of the Work that are not in accordance with the Work requirements and are neither corrected by the Contractor nor accepted by the City.

4. If the Contractor fails to correct nonconforming Work within a reasonable time, the City may correct it at the Contractor's expense. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the City, the City may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the City may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the City's services and expenses made necessary thereby. If such proceeds of sale do not cover costs, which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the City.

5. The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the City or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the Work requirements.

F. Cleaning Up

1. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by Work operations. At completion of the Work the Contractor shall remove from and around the Project site waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

2. If the Contractor fails to clean up as directed, the City may do so and the cost thereof shall be charged to the Contractor.

3. The Contractor shall be responsible for the safe, neat and secure on-site retention of solid waste generated during the course of construction.

4. The Work Site includes the immediate area of the Site, ingress and egress routes through City's property (City Limits). Proper care shall be taken to avoid debris, trash, soil, gravel, rock, liquid or other materials from being deposited on roads or common areas of the City's adjacent property. The Contractor is responsible for providing a method of cleaning and or removing such debris or spillage as part of its Site responsibilities. In the event the City provides the means to clean or remove such debris or spillage from ingress or egress routes, the Contractor will be responsible for reasonable reimbursement to the City.

5. IF requested by the City, temporary restoration of asphalt pavement and other surfaces disturbed by the work shall occur within 24 hours that work has been completed within the disturbed area.

6. Permanent restoration of paved areas shall not occur prior to repairs being completed, tested for leaks, the construction within the disturbed pavement area has been completed, and inspections approved; but not later than 10 working days after completion of these items. For a project with multiple sites throughout the City, the requirement for permanent restoration work within 10 working days shall apply to each site independently unless otherwise directed.

7. If directed by the City, all other areas disturbed by the Work shall be restored, within 10 working days of completion of construction at the Contractor's expense, to a condition equal to or better than that of the surrounding adjacent areas, with materials matching the surrounding adjacent materials. For a project with multiple sites throughout the City, the requirement for permanent restoration work within 10 working days shall apply to each site independently unless otherwise directed.

G. Project Closeout

1. When Contractor considers the Work to be completed at the end of each Work assignment, Contractor shall submit written certification to the City that the Work is completed and ready for final inspection. Include the following:

    a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

    b. Submit an updated final statement, accounting for final additional changes to the amount approved for the completed Work assignment.

H. Final Cleaning

1. Remove any temporary protection and facilities installed for protection of the work area or equipment during general electrical repair work.

2. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.

3. Where extra materials of value remaining after completion of associated Work have become the City's property, arrange for disposition of these materials as directed.

I. Changes in Quantities

1. The City reserves the right to increase or decrease the amount of any class of unit price work that may be deemed necessary.

J. Permits, Fees and Notices (If Applicable)

1. Permit fees required by the Work shall be eligible for reimbursement by the City to the Contractor upon presentation of receipts by the Contractor.

2. It is the Contractor's responsibility to have and maintain appropriate Certificate(s) of Competency and submit state registration (if required) for the work to be performed and valid for the jurisdiction in which the work is to be performed for all persons (including subcontractors) working on the project for whom a Certificate of Competency is required.

K. Public Construction Bond(s)

1. Contractor may be required to ensure a Public Construction Bond equal to one hundred (100) percent of the authorized work. The unit pricing provided by the Contractor in the bid form shall include the bonding cost. The Bond must be written through a company licensed to do business in the State of Florida and be rated at least "A", Class X, in the latest edition of "Best's Key Rating Guide", published by A.M. Best Company.

L. Completion of Work:

1. The Work shall be performed on an as needed basis and completed within the time frames established by the City and the Contractor over the life of the Agreement.

M. Contractor Services and Responsibilities

1. The Contractor shall assist the City or City's Representative in filing documents required to obtain necessary approvals of governmental authorities having jurisdiction over the project.

2. Materials: Unless otherwise specified herein, Contractor shall furnish, pay for and assume full responsibility for all materials, equipment, transportation, machinery, tools, appliances, water, heat, utilities and all other facilities and services necessary for the furnishing, performance, testing, startup and proper completion of the Work.

   Contractor warrants that all materials and equipment shall be of good quality and new, unless otherwise provided in the Bid Documents and that the Work will be free from defects whether patent or latent in nature. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable supplier except as otherwise provided in the Bid Documents.

3. The Contractor shall be responsible for and shall coordinate all construction means, methods, techniques, sequences, and procedures.

4. The Contractor shall keep the City and City's Representative (if applicable) informed of the progress and quality of the Work.

5. If requested in writing by the City, the Contractor, with reasonable promptness and in accordance with time limits agreed upon, shall interpret the requirements of the Bid Documents and shall decide, subject to determination by the Architect or Engineer (if applicable), subject to demand for arbitration, claims, disputes and other matters in question relating to performance thereunder by both City and Contractor. Such interpretations and decisions shall be in writing, shall not be presumed to be correct, and shall be given such weight as the arbitrator(s) or the court shall determine.

6. The Contractor shall correct Work which does not conform to the Bid Documents.

7. Contractor shall comply with and give all notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to the performance of the Work. City shall not be responsible for monitoring Contractor's compliance with any laws and regulations. Contractor shall promptly notify City if the Bid Documents are observed by Contractor to be at variance therewith.

8. The Contractor shall pay royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the City harmless from loss on account thereof, except that the City shall be responsible for such loss when a particular design, process or product of a particular manufacturer is required by the City. However, if the Contractor has reason to believe the use of a required design process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly given to the City.

9. The Contractor shall be responsible to the City for acts and omissions of the Contractor's employees and parties in privity of Contract with the Contractor to perform a portion of the Work, including their agents and employees.

10. The Contractor shall keep the premises free from accumulation of waste materials or rubbish caused by the Contractor's operation. At the completion of the Work, the Contractor shall remove from the project site the Contractor's tools, construction equipment, machinery, surplus materials, waste materials, and rubbish.

11. The Contractor shall prepare Change Orders for the City or City Representative's approval and execution in accordance with this Agreement and shall have authority to make minor changes in the design and construction consistent with the intent of this Agreement not involving an adjustment in the contract sum or an extension of the contract time. The Contractor shall promptly inform the City or City's Representative in writing, of minor changes in the design and construction.

12. The Contractor shall notify the City or City's Representative when the Work or an agreed upon portion thereof is substantially completed by issuing a Certificate of Substantial Completion which shall establish the Date of Substantial Completion; shall state the responsibility of each party for security, maintenance, heat, utilities, damage to the Work and insurance; shall include a list of items to be completed or corrected; and shall fix the time within which the Contractor shall complete items listed therein.

13. Contractor shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying Contractor's best skill, attention and expertise. Contractor shall be solely responsible for and have control over the means, methods, techniques, sequences and procedures of construction. Contractor shall be responsible to see that the finished Work complies accurately with the Bid Documents.

14. Contractor shall be fully responsible to City for all acts and omissions of the Contractor's employees, subcontractors, suppliers and other persons directly or indirectly employed by his subcontractors, suppliers and of persons for whose acts any of them may be liable and any other persons and organizations performing or furnishing of the Work under a direct or indirect Contract with Contractor. Nothing in the Bid Documents shall create any Contractual relationship between City and any such subcontractor, supplier or other person or organization, nor shall it create any obligation on the part of City to pay or to see to the payment of any moneys due any such subcontractor, supplier or other person or organization except as may otherwise be required by laws and regulations. All Work performed for Contractor by a subcontractor will be pursuant to an appropriate agreement between Contractor and the subcontractor which specifically binds the subcontractor to the applicable terms and conditions of the Bid Documents for the benefit of City.

15. Contractor shall obtain and pay for all permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary.

16. Within seven (7) calendar days after execution of the Contract and in any event prior to the commencement of any Work hereunder, Contractor shall furnish, in writing to City, the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. City shall advise Contractor, in writing, of any proposed person or entity to which City has a reasonable objection. Failure of City to reply promptly shall constitute notice of no reasonable objection. Contractor shall not contract with a proposed person or entity to whom City has made a reasonable and timely objection. If City has reasonable objection to a person or entity proposed by Contractor, Contractor shall propose another to whom City has no reasonable objection. Contractor shall not change a subcontractor, person or entity previously selected if City makes reasonable objection to such change.

17. Contractor shall be fully responsible to City for all acts and omissions of the Contractor's employees, subcontractors, suppliers and other persons directly or indirectly employed by his subcontractors, suppliers and of persons for whose acts any of them may be liable and any other

persons and organizations performing or furnishing of the Work under a direct or indirect contract with Contractor. Nothing in the Contract Documents shall create any contractual relationship between City and any such subcontractor, supplier or other person or organization, nor shall it create any obligation on the part of City to pay or to see to the payment of any moneys due any such subcontractor, supplier or other person or organization except as may otherwise be required by laws and regulations.

18. All Work performed for Contractor by a subcontractor will be pursuant to an appropriate agreement between Contractor and the subcontractor which specifically binds the subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of City.

N. **Risk of Loss; Title:** The risk of loss, injury, or destruction shall be on Contractor until acceptance of the Work by City. Title to the Work shall pass to City upon acceptance of the Work by City.

O. **Use of Premises**: Contractor shall confine equipment, the storage of materials and equipment and the operations of Workers to the project site and areas identified in and permitted by the Bid Documents and shall not unreasonably encumber the premises with equipment or other materials. Contractor shall assume full responsibility for any damage to any such land or area, or to the City or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against City by any such occupant because of the performance of the Work, Contractor shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim. The general indemnification provided elsewhere in this document specifically applies to claims arising out of Contractor's use of the premises. During the progress of the Work, Contractor shall keep the premises free from accumulation of waste materials, rubbish, and other debris resulting from the Work. At the completion of the Work, Contractor shall remove all waste materials, rubbish and debris from and about the premises, as well as all tools, appliances, equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by City. Contractor shall restore to original condition all property not designated for alteration by the Bid Documents. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

P. **Access to Work**: Contractor shall provide City, City's consultants, representatives and personnel, independent testing laboratories and governmental agencies with jurisdictional interests with access to the Work at reasonable times for their observation, inspection and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's site safety procedures and programs so that they may comply therewith.

Q. **Survival of Obligations**: All representations, indemnifications, warranties and guarantees made in, required by, or given in accordance with this Agreement, as well as all continuing obligations indicated in the Bid Documents, shall survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

R. Work by City or City's Contractors

1. The City reserves the right to perform Work related to, but not part of, the Project and to award separate contracts in connection with other Work at the site. If the Contractor claims that delay or additional cost is involved because of such action by the City, the Contractor shall make such claims to the City or City's Representative in writing.

2. The Contractor shall afford the City's separate contractors' reasonable opportunity for introduction and storage of their materials and equipment for execution of their Work. The Contractor shall incorporate and coordinate the Contractor's Work with the Work of the City's separate contractors as required by the Bid Documents.

3. Costs caused by defective or ill-timed Work shall be borne by the party responsible.

END OF SECTION

EXHIBIT “G”

(Addendums)

OFFICE OF THE MAYOR
Lynn Stoner
Mayor

PROCUREMENT DEPARTMENT
Charles Spencer, NIGP-CPP
Director

Plantation
the grass is greener

CITY COUNCIL
Erik Anderson, President
Jennifer Andreu, President Pro Tem
Timothy J. Fadgen
Denise Horland
Nick Sortal

ADDENDUM NO. 1

ITB No. 072-22

Asphalt Rejuvenation Project – Term Contract

DATE OF ADDENDUM: November 18, 2022

TO ALL PROSPECTIVE BIDDERS:

The following clarification, changes, additions and/or deletions are hereby made part of the Contract Documents for ITB No. 072-22.

Questions and Answers

Question No. 1 - On page 14, paragraph 2, it states that the initial contract term is two years, with three optional one-year renewal terms, but on page 64, it states that the initial term is for one year, with four optional one-year renewal periods. Can you please tell me which is correct?

Response No. 1 – A two-year initial contract term with renewal options for an additional three one-year terms.

Question No. 2 - Also, page 4, the second paragraph describes elevator work. I know that was just left in by mistake, if you could please confirm?

Response No. 2 – Please disregard that paragraph and refer to the scope beginning on page 14 for a description of work to be performed under this project.

Bids **must** be submitted on or before **January 10, 2023 11:00 A.M**. Bids must be submitted electronically ONLY via the Demand Star website.

https://www.demandstar.com/app/agencies/florida/city-of-plantation-procurement-division/procurement-opportunities/9b6d13fb-3874-4291-9605-81cf63387a40/

All other terms, conditions and specifications remain unchanged for ITB No. 072-22.

Please acknowledge receipt of this Addendum No. 1 by returning it and/or acknowledging it in your bid.

BIDDER'S NAME: Pavement Technology, Inc.

OFFICE OF THE MAYOR
Nick Sortal
Mayor

PROCUREMENT DEPARTMENT
Charles Spencer, NIGP-CPP
Director

Plantation
the grass is greener®

CITY COUNCIL
Jennifer Andreu, President
Timothy J. Fadgen, President Pro Tem
Erik Anderson
Denise Horland
Louis Reinstien

ADDENDUM NO. 2

ITB No. 072-22

Asphalt Rejuvenation Project – Term Contract

DATE OF ADDENDUM: December 14, 2022

TO ALL PROSPECTIVE BIDDERS:

The following clarification, changes, additions and/or deletions are hereby made part of the Contract Documents for ITB No. 072-22.

Questions and Answers

Question No. 1 - The previous contract used by the City was on the South Florida Purchasing Cooperative, will this contract similarly allow for other agencies to piggyback by adding language to that end?

Response No. 1 – The City will allow for other agencies to piggyback by excluding language in the contract that may prohibit it.

Question No. 2 - With the extreme volatility of petroleum-based materials, longer term contracts around the state have added escalation clauses (such as the Producer Price Index or the FDOT Fuel and Bituminous Average Price Index). Would the City of Plantation consider adding such a clause to this contract?

Response No. 2 – Please make the appropriate assumptions for the initial term of the contract. After the initial term, the City will consider the aforementioned escalation clauses.

Bids **must** be submitted on or before **January 10, 2023 11:00 A.M**. Bids must be submitted electronically ONLY via the Demand Star website.

https://www.demandstar.com/app/agencies/florida/city-of-plantation-procurement-division/procurement-opportunities/9b6d13fb-3874-4291-9605-81cf63387a40/

All other terms, conditions and specifications remain unchanged for ITB No. 072-22.

Please acknowledge receipt of this Addendum No. 2 by returning it and/or acknowledging it in your bid.

BIDDER'S NAME: Pavement Technology, Inc.

OFFICE OF THE MAYOR
Nick Sortal
Mayor

PROCUREMENT DEPARTMENT
Charles Spencer, NIGP-CPP
Director

Plantation
the grass is greener

CITY COUNCIL
Jennifer Andreu, President
Timothy J. Fadgen, President Pro Tem
Erik Anderson
Denise Horland
Louis Reinstien

ADDENDUM NO. 3

ITB No. 072-22

Asphalt Rejuvenation Project – Term Contract

DATE OF ADDENDUM: December 21, 2022

TO ALL PROSPECTIVE BIDDERS:

The following clarification, changes, additions and/or deletions are hereby made part of the Contract Documents for ITB No. 072-22.

Changes

Please see the attached revised bid form.

Questions and Answers

Question No. 1 - On page 53, the checklist lists "Federal Funding Requirements" as a submitted form, but that won't apply, correct?

Response No. 1 – Please disregard this checklist item as it does not apply.

Question No. 2 - If we are submitting a price for the standard spec product, Reclamite®, and we are also providing pricing for an alternate product, then would the Grand Total be those two totals added together, or would the Grand Total be the total amount for the standard spec product?

Response No. 2 – Please see the attached revised bid form.

Question No. 3 - In regard to the Base Bid Total on page 53: Is this the total for the standard spec product plus the total for the alternate product, added together, or if it would be the total for the standard spec product, only?

Response No. 3 – Please provide two different totals and make a clear distinction between the standard and alternate bid price.

Bids **must** be submitted on or before **January 10, 2023 11:00 A.M.** Bids must be submitted electronically ONLY via the Demand Star website.

https://www.demandstar.com/app/agencies/florida/city-of-plantation-procurement-division/procurement-opportunities/9b6d13fb-3874-4291-9605-81cf63387a40/

All other terms, conditions and specifications remain unchanged for ITB No. 072-22.

Please acknowledge receipt of this Addendum No. 3 by returning it and/or acknowledging it in your bid.

BIDDER'S NAME: Pavement Technology, Inc.

9559

AMENDMENT

FIRST AMENDMENT TO AGREEMENT BETWEEN THE CITY OF PLANTATION AND PAVEMENT TECHNOLOGY, INC. FOR ASPHALT REJUVENATION PROJECT

THIS FIRST AMENDMENT to Agreement No. 072-22 For Asphalt Rejuvenation Project dated this 11th day of March, 2024, by and between:

CITY OF PLANTATION, FLORIDA
a Municipal Corporation
400 North West 70th Avenue
Plantation, Florida 33317
(Hereinafter referred to as "CITY")

and

PAVEMENT TECHNOLOGY, INC.
a Florida Corporation
24144 Detroit Road,
Westlake, OH 44145
(Hereinafter referred to as "CONTRACTOR")

WHEREAS, on April 17, 2023, CITY entered into an Agreement (072-22) with CONTRACTOR for Continuing Service for Agreement For: Asphalt Rejuvenation Project; and

WHEREAS, the initial term of this Agreement was for one (1) year beginning April 17, 2023 and expiring on April 16, 2024; and

WHEREAS, this Agreement contains an option to renew for four (4) additional one (1) year periods, under the same terms and conditions; and

WHEREAS, the current Agreement is set to expire on April 16, 2024 if not renewed or extended; and

WHEREAS, the CITY has determined that CONTRACTOR has performed in accordance with requirements of the Agreement and wishes to exercise/execute the first (1st) of (4) four (1) one-year options;

WHEREAS, both Parties concur with amending the Agreement to extend the term of the Agreement through April 16, 2025.

WHEREAS, under this Amendment the CITY will also modify this Agreement, to include additional language(s) to align with current Florida Law(s) and City's business practices.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, and other good and valuable consideration, the receipt and adequacy of which are acknowledged, the parties agree as follows:

SECTION 1. **RECITALS**

The foregoing recitals are true and correct and are hereby incorporated into this Agreement.

SECTION 2. **SECTION 3, 3.1 (A) TERM OF AGREEMENT**

The term of this Agreement shall be extended through **April 16, 2025**.

SECTION 3. **SECTION 3, 3.2 (B) CONTRACTOR'S COMPENSATION**

(SEE EXHIBIT E)

BASED BID A

Description	Per SQ YD Cost
Standard Specification – Reclamite Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	$1.21 SY

BASED BID B

Description	Per SQ YD Cost
Bid Alternate #1 Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	$2.49 SY

THIS SECTION WAS INTENTIONALLY LEFT BLANK

SECTION 4. PUBLIC AGENCY CONTRACTING

This section is hereby incorporated into this Agreement by execution of this Amendment.

CONTRACTOR certifies that it is aware of and complies with the requirements of §448.095, Florida Statues, as may be amended from time to time and briefly described herein below.

(a) A public agency must require in any contract that CONTRACTOR, and any subcontractor thereof, register with and use the E-Verify system to verify the work authorization status of all new employees of the contractor or subcontractor. A public agency or CONTRACTOR or subcontractor thereof may not enter into a contract unless each party to the contract registers with and uses the E-Verify system.

(b) If CONTRACTOR enters into a contract with a subcontractor, the subcontractor must provide the CONTRACTOR with an affidavit stating that the subcontractor does not employ, contract with, or subcontract with an unauthorized alien. CONTRACTOR shall maintain a copy of such affidavit for the duration of the contract.

(c) 1. A public agency, CONTRACTOR, or subcontractor who has a good faith belief that a person or an entity with which it is contracting has knowingly violated s. 448.09(1) shall terminate the contract with the person or entity.

2. A public agency that has a good faith belief that a subcontractor knowingly violated this subsection, but the CONTRACTOR otherwise complied with this subsection, shall promptly notify the contractor and order the contractor to immediately terminate the contract with the subcontractor.

3. A contract terminated under this paragraph is not a breach of contract and may not be considered as such. If a public agency terminates a contract with CONTRACTOR under this paragraph, CONTRACTOR may not be awarded a public contract for at least 1 year after the date on which the contract was terminated. CONTRACTOR is liable for any additional costs incurred by a public agency as a result of the termination of a contract.

(d) A public agency, contractor, or subcontractor may file a cause of action with a circuit or county court to challenge a termination under paragraph (c) no later than 20 calendar days after the date on which the contract was terminated.

THIS SECTION WAS INTENTIONALLY LEFT BLANK

SECTION 5. PROHIBITION AGAINST CONSIDERATION OF SOCIAL, POLITICAL OR IDEOLOGICAL INTERESTS

This section is hereby incorporated into this Agreement by execution of this Amendment.

CONTRACTOR is hereby notified of the provisions of section 287.05701, Florida Statutes, as amended, and that the CITY did not consider the CONTRACTOR's social, political, or ideological interests when determining if the CONTRACTOR was a responsible CONTRACTOR. CONTRACTOR is further notified that the CITY's governing body did not give any preference to the CONTRACTOR based on the CONTRACTOR's social, political, or ideological interests.

SECTION 6. COMPLIANCE WITH FOREIGN ENTITY LAWS

This section is hereby incorporated into this Agreement by execution of this Amendment

By entering into this Agreement CONTRACTOR is hereby certifying the following:

A. Entity is not owned by the government of a foreign country of concern as defined in Section 287.138, Florida Statutes. (Source: § 287.138(2)(a), Florida Statutes)

B. The government of a foreign country of concern does not have a controlling interest in Entity. (Source: § 287.138(2)(b), Florida Statutes).

C. Entity is not owned or controlled by the government of a foreign country of concern, as defined in Section 692.201, Florida Statutes. (Source: § 288.007(2), Florida Statutes).

D. Entity is not a partnership, association, corporation, organization, or other combination of persons organized under the laws of or having its principal place of business in a foreign country of concern, as defined in Section 692.201, Florida Statutes, or a subsidiary of such entity. (Source: § 288.007(2), Florida Statutes)

E. Entity is not a foreign principal, as defined in Section 692.201, Florida Statutes. (Source: § 692.202(5)(a)(1), Florida Statutes).

F. Entity is in compliance with all applicable requirements of Sections 692.202, 692.203, and 692.204, Florida Statutes.

G. (Only applicable if purchasing real property) Entity is not a foreign principal prohibited from purchasing the subject real property. Entity is either (a) not a person or entity described in Section 692.204(1)(a), Florida Statutes, or (b) authorized under Section 692.204(2), Florida Statutes, to purchase the subject

property. Entity is in compliance with the requirements of Section 692.204, Florida Statutes. (Source: §§ 692.203(6)(a), 692.204(6)(a), Florida Statutes).

SECTION 7. In all other respects, the terms and conditions of the Agreement, as amended, not specifically amended herein remain in full force and effect. In the event of any conflict, this First Amendment will supersede all other terms. In the event of ambiguity, the most conservative interpretation consistent with the public interest is intended.

SECTION 8. This First Amendment shall become effective on April 16, 2024.

THIS SECTION WAS INTENTIONALLY LEFT BLANK

AMENDMENT

IN WITNESS WHEREOF, CITY OF PLANTATION AND PAVEMENT TECHNOLOGY, INC. have signed this Amendment in duplicate. One counterpart each has been delivered to the CITY and CONTRACTOR

Attest: _____
April Beggerow, City Clerk

CITY OF PLANTATION

By: _____
Nick Sortal, Mayor

As to Procurement: _____
Charles Spencer, Procurement Director

Signed, Sealed in the presence of:

(Corporate Seal)

PAVEMENT TECHNOLOGY, INC.
a Florida Corporation

By: _____
Colin Durante / President

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me, by means of ☒ physical presence or ☐ online notarization, this 4th day of March, 2024, by Colin Durante, as President for Pavement Technology, Inc., who is personally known to me or who has produced _____ as identification.

Notary Public Signature: _____ State of Florida at Large (Seal)

Print Name: _____ My commission expires: _____

Elizabeth Miolcuany
Notary Public, State of Ohio
My Commission Expires: February 27, 2025

AMENDMENT

SECOND AMENDMENT TO AGREEMENT BETWEEN THE CITY OF PLANTATION AND PAVEMENT TECHNOLOGY, INC. FOR ASPHALT REJUVENATION PROJECT

THIS SECOND AMENDMENT to Agreement No. 072-22 For Asphalt Rejuvenation Project dated this 28th day of March, 2025, by and between:

CITY OF PLANTATION, FLORIDA
a Municipal Corporation
400 North West 70th Avenue
Plantation, Florida 33317
(Hereinafter referred to as "CITY")

and

PAVEMENT TECHNOLOGY, INC.
a Ohio Corporation
24144 Detroit Road,
Westlake, OH 44145
(Hereinafter referred to as "CONTRACTOR")

WHEREAS, on April 17, 2023, CITY entered into an Agreement (072-22) with CONTRACTOR for: Asphalt Rejuvenation Project; and

WHEREAS, the initial term of this Agreement was for one (1) year beginning April 17, 2023 and expiring on April 16, 2024; and

WHEREAS, this Agreement contains an option to renew for four (4) additional one (1) year periods, under the same terms and conditions; and

WHEREAS, on March 11, 2024, the Parties exercised the first option to renew the Agreement for an additional one (1) year period extending the Agreement expiration to April 16, 2025; and

WHEREAS, the current Agreement is set to expire on April 16, 2025 if not renewed or extended; and

WHEREAS, the City entered into negotiations with the Consultant and negotiated a price increase of 2.5% and terms that were as fair and reasonable; and

WHEREAS, the CITY has determined that CONTRACTOR has performed in accordance with requirements of the Agreement and wishes to exercise/execute the second (2nd) of (4) four (1) one-year options;

WHEREAS, both Parties concur with amending the Agreement to extend the term of the Agreement through April 16, 2026.

AMENDMENT

WHEREAS, under this Amendment the CITY will also modify this Agreement, to include additional language(s) to align with current Florida Law(s) and City's business practices.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, and other good and valuable consideration, the receipt and adequacy of which are acknowledged, the parties agree as follows:

SECTION 1. **RECITALS**

The foregoing recitals are true and correct and are hereby incorporated into this Agreement.

SECTION 2. **SECTION 3, 3.1 (A) TERM OF AGREEMENT**

The term of this Agreement shall be extended through **April 16, 2026**.

SECTION 3. **SECTION 3, 3.2 (B) CONTRACTOR'S COMPENSATION**

The mentioned section shall remain unchanged during this extension/renewal period and is being provided herein as reference to the original executed agreement, with the exception of pricing which has increased by 2.5%.

(SEE EXHIBIT E OF ORIGINAL AGREEMENT)

BASED BID A

Description	Per SQ YD Cost
Standard Specification – Reclamite Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	~~$1.21~~ $1.24 SY

BASED BID B

Description	Per SQ YD Cost
Bid Alternate #1 Approximately 615,000 square yards annually construction sealing with asphalt-rejuvenating agent furnished and applied.	~~$2.49~~ $2.55 SY

SECTION 4. In all other respects, the terms and conditions of the Agreement, as amended, not specifically amended herein remain in full force and effect. In the event of any conflict, this Second Amendment will supersede all other terms. In the event of ambiguity, the most conservative interpretation consistent with the public interest is intended.

THIS SECTION WAS INTENTIONALLY LEFT BLANK

SECTION 5. AFFIDAVIT OF COMPLIANCE WITH ANTI-HUMAN TRAFFICKING LAWS

This section is hereby incorporated into this Agreement by execution of this Amendment

In accordance with section 787.06(13), Florida Statutes, the undersigned, on behalf of the entity listed below ("Entity"), hereby attests under penalty of perjury that:

A. The Entity does not use coercion for labor or services as defined in Section 787.06, Florida Statutes, entitled "Human Trafficking".

B. I understand that I am swearing or affirming under oath to the truthfulness of the claims made in this affidavit and that the punishment for knowingly making a false statement includes fines and/or imprisonment.

SECTION 6. This Second Amendment shall become effective on April 16, 2025.

THIS SECTION WAS INTENTIONALLY LEFT BLANK

AMENDMENT

IN WITNESS WHEREOF, CITY OF PLANTATION AND PAVEMENT TECHNOLOGY, INC. have signed this Amendment in duplicate. One counterpart each has been delivered to the CITY and CONTRACTOR

Attest: _____
April Beggerow, City Clerk

CITY OF PLANTATION
Organized April 30, 1953
Broward County • Florida

CITY OF PLANTATION

By: _____
Nick Sortal, Mayor

As to Procurement: _____
Charles Spencer, Procurement Director

Signed, Sealed in the presence of:

(Corporate Seal)

PAVEMENT TECHNOLOGY, INC.
a Ohio Corporation

By: _____
Colin Durante, President

STATE OF Ohio

COUNTY OF Cuyahoga

The foregoing instrument was acknowledged before me, by means of ☒ physical presence or ☐ online notarization, this 27th day of February, 2025, by Colin Durante, as President of Pavement Technology, Inc., for _____, who is personally known to me or who has produced _____ as identification.

Notary Public Signature: _____ State of Florida at Large (Seal)

Print Name: Barbara Ann Wolf-Modic

My commission expires: _____

Barbara Ann Wolf-Modic
Notary Public, State of Ohio
My Commission Expires: March 01, 2030