2023 NRRA Call for Innovation

Title: Standardization of SIP Calculation for Hamburg Wheel Tracking Test

Contact: Fan Yin (f-yin@auburn.edu) & Chen Chen (czc0105@auburn.edu),
National Center for Asphalt Technology at Auburn University

Budget: $70,000 (NRRA+Partnership)
NRRA funds = $47,500
Partnership (donated) funds = $22,500

Submission Date: May 2, 2023

Type of Submission: (use one that applies from below on this line and delete the rest)

- ☐ Call for Construction
- ☐ Research/Implementation Need
- ☒ NRRA Project Proposal
- ☐ Other

Research/Implementation Impact:

The Hamburg Wheel Tracking Test (HWTT) is one of the most popular laboratory tests used by state highway agencies (SHAs) to evaluate the rutting resistance of asphalt mixtures. Because the test is conducted in water, it also allows the evaluation of moisture susceptibility based on the stripping inflection point (SIP). According to AASHTO T 324, SIP is determined graphically as the intersection of slopes of the two fitted lines to the creep and stripping phases of the HWTT curve. Although the definition of SIP is straightforward, accurately determining SIP can be challenging because HWTT data do not always provide well-defined SIP, especially those with a marginal stripping failure. Over the years, HWTT equipment manufacturers and asphalt practitioners have developed different methods for calculating SIP, but they do not always yield the same results. The lack of standardization for SIP calculation could cause unnecessary disputes for SHAs when evaluating the HWTT results for mix design approval and production acceptance. This proposed project aims to develop HWTT analysis software to standardize and automate the calculation of SIP, which allows SHAs to make the most informed and undisputable decisions on the HWTT results. The software will be compatible with different HWTT devices to enable direct reading and processing of the raw data files without subjective data manipulation and interpretation.

Objective and Scope:

The objective of the project is to develop HWTT analysis software to standardize and automate the calculation of SIP for evaluating the moisture susceptibility of asphalt mixtures. This software will be highly beneficial to SHAs currently using HWTT or considering implementing the HWTT for asphalt mix design and production acceptance. To facilitate research implementation, an *NRRA Research Pays Off* webinar will be conducted to introduce the software and user manual upon project completion.

Tasks:

Task 1. Information Gathering

- Description: A survey of SHAs and HWTT equipment manufacturers will be conducted to summarize the different SIP calculation methods. Each method will be critically reviewed to identify its advantages and disadvantages. Based on the review results, the most robust SIP calculation method (in terms of calculation accuracy, consistency, and practicality) will be selected to proceed with software development in Task 2.
- Deliverable: A progress report documenting the survey responses and review results of different SIP calculation methods.
- Cost: $7,500

Task 2. Software Development

- Description: Up to 100 existing data files will be collected from HWTT equipment manufacturers participating in the study. The files will be divided into three groups: results with a notable stripping failure; results with a marginal stripping failure; and results without a stripping failure. Each data file will be manually processed to calculate the SIP using the method selected in Task 1, and the results will be used as the reference to cross-check the software calculation results. In addition to the software, a user manual containing step-by-step instructions and illustrative calculation examples will also be developed.
- Deliverable: An online meeting with the Technical Advisory Panel (TAP) to demonstrate the software and user manual.
- Cost: $36,000

Task 3. Software Beta Testing

- Description: The software and the user manual developed in Task 2 will be distributed to NRRA agency members using HWTT (including the California, Iowa, Illinois, Missouri, Montana, North Dakota, and Wisconsin DOTs) for beta testing. A web meeting will then be conducted with these agencies to collect their feedback, which will be used to finetune and troubleshoot the software for improvement.
- Deliverables: An online meeting with the TAP to demonstrate the updated software after beta testing.
- Cost: $18,500

Task 4. Software Release, Final Report, and NRRA Webinar

- Description: Upon TAP approval, the updated software after beta testing in Task 3 will be released for public use. The software is anticipated to be operated on the Auburn University network, with access permission managed by NCAT and NRRA. A final report will be submitted to document the project's research efforts and outcome. Finally, an *NRRA Research Pays Off* webinar will be conducted to introduce the software and user manual.
- Deliverables: 1) software release, 2) a final report, and 3) an *NRRA Research Pays Off* webinar.
- Cost: $8,000

Schedule:

Duration: 12 months
Start date: July 1, 2023 (anticipated)

Budget/Partnerships:

Expected from NRRA: $47,500
Expected from InstroTek: $7,500
Expected from Troxler: $7,500
Expected from PTI: $7,500
InstroTek, Troxler, and PTI have committed to supporting the proposed project with a cash contribution of $7,500 each to be used as a cost share to NRRA funding. Their letters of support are attached.

Implementation of Results:

This proposed research has a high implementation potential for SHAs, especially those currently using or are considering using the HWTT for asphalt mix design and production acceptance. Because the software allows direct reading and standardized processing of the raw data files without subjective data manipulation and interpretation, it will help SHAs make the most informed and undisputable decisions on the HWTT results for evaluating the rutting and moisture resistance of asphalt mixtures.

innovators in instrumentation technology

March 3, 2023

Dr. Fan Yin
National Center for Asphalt Technology (NCAT)
Auburn University
277 Technology Parkway, Auburn, AL 36830

RE: NCAT Proposal – Standardization of SIP Calculation for Hamburg Wheel Tracking Test

Dear Dr. Yin,

I am writing this letter of support for the above-referenced NCAT proposal for the 2023 National Road Research Alliance (NRRA) Call for Innovation.

InstroTek is a global leader in products and technology development for the construction and raw materials industry. We have been setting new standards for testing and quality control around the world since 1997. We offer a wide range of laboratory equipment for the asphalt pavement industry, including the SmarTracker™ Hamburg Wheel that can perform the Hamburg Wheel Tracking Test (HWTT) per AASTHO T 324. We recognize the importance of this proposed research to standardize the calculation of stripping inflection point (SIP) for HWTT and thus, are happy to support your proposal with a cash contribution of $7,500 to be used as a cost share.

We appreciate the opportunity to work with you on this research. To the best of our knowledge, our participation will cause no conflicts of interest. If additional information is required, please do not hesitate to contact us.

Sincerely,

Ali Regimand
President

InstroTek® Inc.

One Triangle Drive, P.O. Box 13944, Research Triangle Park, NC 27709 | *tel:* (919) 875-8371 | www.instrotek.com

PAVEMENT TECHNOLOGY, INC.

March 2, 2023

Dr. Fan Yin
National Center for Asphalt Technology (NCAT)
Auburn University
277 Technology Parkway, Auburn, AL 36830

RE: NCAT Proposal – Standardization of SIP Calculation for Hamburg Wheel Tracking Test

Dear Dr. Yin,

I am writing this letter of support for the above-referenced NCAT proposal for the 2023 National Road Research Alliance (NRRA) Call for Innovation.

Pavement Technology Inc. is a laboratory equipment manufacturer aiming to develop innovative asphalt and aggregate sampling and testing equipment for the hot-mix asphalt and aggregate industries. We currently supply the Asphalt Pavement Analyzer (APA) and APA-Junior that are capable of performing the Hamburg Wheel Tracking Test (HWTT) per AASTHO T 324. We recognize the importance of this proposed research to standardize the calculation of stripping inflection point (SIP) for HWTT and thus, are happy to support your proposal with a cash contribution of $7,500 to be used as a cost share.

We appreciate the opportunity to work with you on this research. To the best of our knowledge, our participation will cause no conflicts of interest. If additional information is required, please do not hesitate to contact us.

Sincerely,

Wade Collins

Wade Collins
President
Pavement Technology Inc.

Pavement Technology, Inc. 7129 Wheat Street NE Covington, GA 30014
TELEPHONE (770) 388-0909 - Fax (770) 388-0149

TROXLER®

March 23, 2023

Dr. Fan Yin
National Center for Asphalt Technology (NCAT)
Auburn University
277 Technology Parkway, Auburn, AL 36830

RE: NCAT Proposal – Standardization of SIP Calculation for Hamburg Wheel Tracking Test

Dear Dr. Yin,

I am writing this letter of support for the above-referenced NCAT proposal for the 2023 National Road Research Alliance (NRRA) Call for Innovation.
Troxler Electronic Laboratories, Inc. is a world leader in the manufacturing of testing/quality control measurement equipment for the construction industry. We provide a wide range of field, plant, and laboratory equipment for the asphalt pavement industry, including our Flagship Wheel Tracker that is capable of performing the Hamburg Wheel Tracking Test (HWTT) per AASTHO T 324. We recognize the importance of this proposed research to standardize the calculation of stripping inflection point (SIP) for HWTT and thus, are happy to support your proposal with a cash contribution of $7,500 to be used as a cost share.

We appreciate the opportunity to work with you on this research. To the best of our knowledge, our participation will cause no conflicts of interest. If additional information is required, please do not hesitate to contact us.

Sincerely,

W. Finch Troxler III

W. Finch Troxler III
Chief Operations Officer
Troxler Electronic Labs, Inc.

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