

**Center for  
Energy Systems  
Research  
Service Rates**



## MEMORANDUM

**TO:** Dr. Francis Otuonye, Associate Vice President for Research *otuonye*  
**VIA:** Dr. Vahid Motevalli, Associate Dean for Research and Innovation *Motevalli*  
**FROM:** Dr. Satish M. Mahajan, Director, Center for Energy Systems Research *Satish M. Mahajan*  
**DATE:** May 3, 2019  
**SUBJECT:** Proposed Service Rates for the CESR Testing/Service Projects, Index 538597

Based on the cost analysis conducted and attached, the proposed service rates for the CESR Testing/Service Projects are as follows:

- |                                 |                    |
|---------------------------------|--------------------|
| 1. Solar Survey Service         | \$2,594 per survey |
| 2. Cylinder Break Tests         | \$17 per test      |
| 3. Abrasion Tests for Aggregate | \$1,000 per test   |

Please let me know if additional information is needed.

Thank you.

Attachments

## **Justification for Solar Survey Service Fee**

### **Background**

A USDA funded project to provide technical assistance to small businesses in the upper Cumberland regarding Solar power and other energy related questions resulted in 20 solar surveys being conducted in the Upper Cumberland. This document reflects decisions made for coming up with a service fee to continue providing this service from the Center for Energy Systems Research here at Tennessee Tech University. These costs reflect real world estimates based on experience and can be adjusted periodically to ensure it is not a "for profit" service, nor a losing service (on average).

### **Estimated Travel**

Table 1 shows estimates for travel based on the location of previous solar survey customers. These estimates are based on both mileage and employee pay costs for the time spent travelling. They are not the actual costs charged during the project but reflect 2 trips per customer. In actuality some customers only required 1 trip while others required 3 or 4 (not many).

### **Supplies**

This cost is based on periodic need to purchase:

- Paper templates for the Solar Pathfinder.
- Stakes for marking locations in the field
- Replacement tape measures (field survey grade).
- Laser range finders and batteries for estimating roof heights.
- Notebooks and pencils for field sketches

### **Equipment Replacement Fee**

Whereas there is currently a Solar Pathfinder, Computer, and Software for conducting solar surveys, they will not last forever so an estimate of future replacement cost of \$100 is added to the total. As more data is collected in the future, this fee will be adjusted accordingly.

### **Service Description**

Service starts with an initial questionnaire provided to the customer including requests for electric bills for a year's period (or estimate thereof if not available), location of the proposed solar panels, and other pertinent questions. Meetings with the client. Actual travel to site for surveys (may require more than one survey). Creating survey configurations in the Solar Pathfinder Software. Creating reports including cost estimates and return on investment. Estimates are based on the successful completion of a USDA grant project where 19 surveys were completed.

The primary service offered: To determine the suitability of a proposed spot for solar power conversion into electrical energy by conducting solar survey and other tools.

- Potential amount of electrical energy (units) that can be generated on your location.

- Potential savings (\$)
- Potential revenue (\$) if electricity is fed back in to the grid
- Estimation of installation cost
- Availability of discounts and subsidies from the federal/ state governments
- Actual Solar Radiation w/ & w/o shading (kw/m2/day)
- Actual AC Energy w/ & w/o shading (KWH)
- Payback period
- Actual/Ideal site Efficiency %
- Total Solar Resource Fraction (TSRF)

Table 1 Travel estimates based on previous solar survey customers

| Site         | Distance (miles) | x2 trips x2 both ways (miles) | mileage cost (*0.47) (\$) | Travel Time (min) | x2 trips x2 both ways (mins) | salary cost for travel time                 |                              |   |
|--------------|------------------|-------------------------------|---------------------------|-------------------|------------------------------|---|------------------------------|---|
|              |                  |                               |                           |                   |                              | R&D Engineer (\$50.28/hr includes benefits) | Student Researcher (\$12/hr) | Travel cost for budgeting purposes (\$) |
| 1            | 45.2             | 180.8                         | 86.78                     | 62                | 248                          | 207.82                                      | 49.60                        | 344.21                                  |
| 2            | 41.6             | 166.4                         | 79.87                     | 58                | 232                          | 194.42                                      | 46.40                        | 320.69                                  |
| 3            | 41.9             | 167.6                         | 80.45                     | 56                | 224                          | 187.71                                      | 44.80                        | 312.96                                  |
| 4            | 57               | 228                           | 109.44                    | 54                | 216                          | 181.01                                      | 43.20                        | 333.65                                  |
| 5            | 40.5             | 162                           | 77.76                     | 56                | 224                          | 187.71                                      | 44.80                        | 310.27                                  |
| 6            | 51.5             | 206                           | 98.88                     | 60                | 240                          | 201.12                                      | 48.00                        | 348.00                                  |
| 7            | 12.9             | 51.6                          | 24.77                     | 22                | 88                           | 73.74                                       | 17.60                        | 116.11                                  |
| 8            | 14.1             | 56.4                          | 27.07                     | 25                | 100                          | 83.80                                       | 20.00                        | 130.87                                  |
| 9            | 14               | 56                            | 26.88                     | 20                | 80                           | 67.04                                       | 16.00                        | 109.92                                  |
| 10           | 18.4             | 73.6                          | 35.33                     | 25                | 100                          | 83.80                                       | 20.00                        | 139.13                                  |
| 11           | 21.3             | 85.2                          | 40.90                     | 27                | 108                          | 90.50                                       | 21.60                        | 153.00                                  |
| 12           | 31.9             | 127.6                         | 61.25                     | 45                | 180                          | 150.84                                      | 36.00                        | 248.09                                  |
| 13           | 2.9              | 11.6                          | 5.57                      | 9                 | 36                           | 30.17                                       | 7.20                         | 42.94                                   |
| 14           | 7.1              | 28.4                          | 13.63                     | 14                | 56                           | 46.93                                       | 11.20                        | 71.76                                   |
| 15           | 15.3             | 61.2                          | 29.38                     | 22                | 88                           | 73.74                                       | 17.60                        | 120.72                                  |
| 16           | 24.5             | 98                            | 47.04                     | 44                | 176                          | 147.49                                      | 35.20                        | 229.73                                  |
| 17           | 29.9             | 119.6                         | 57.41                     | 39                | 156                          | 130.73                                      | 31.20                        | 219.34                                  |
| 18           | 44.2             | 176.8                         | 84.86                     | 55                | 220                          | 184.36                                      | 44.00                        | 313.22                                  |
| 19           | 43.6             | 174.4                         | 83.71                     | 53                | 212                          | 177.66                                      | 42.40                        | 303.77                                  |
| 20           | 51.5             | 206                           | 98.88                     | 61                | 244                          | 204.47                                      | 48.80                        | 352.15                                  |
| <b>Total</b> |                  |                               |                           |                   |                              |   |                              | 4520.52                                 |
| <b>Ave</b>   |                  |                               |                           |                   |                              |   |                              | 226.03                                  |

## Budget

| Description                          | Cost/Hr | Est Hrs | Cost    | Comments   |
|--------------------------------------|---------|---------|---------|--|
| Robert Craven                        | 50.28   | 22.5    | 1131.00 | Incl. benefits at 28%                                  |
| Undergraduate Student<br>Researcher  | 12      | 22.5    | 270.00  |  |
| Travel                               |         |         | 226.00  | Est. based on 20 surveys<br>completed for USDA project |
| Supplies                             |         |         | 100.00  |  |
| Reserve for equipment<br>replacement |         |         | 100.00  |  |
| Subtotal                             |         |         | 1827.00 |  |
| CESR 42% Overhead Fee                |         |         | 767.00  |  |
| Total                                |         |         | 2594.00 |  |

Dr. Crouch does cylinder testing and aggregate testing through the Power-Test-Service account.

**Costs for Cylinder Breaks (Testing):**

\$12/cylinder + CESR 42% = \$17/cylinder

He determined the costs as follows. He checked with companies in private industry and the \$12 per cylinder rate is similar to what they are charging. A 42% Facilities and Administrative Cost rate is included to bring the total to \$17 per cylinder break.

**It is planned to review the rate once a year as to whether the rate should be changed.**

After the cylinder breaks are completed, Dr. Crouch sends an email to the CESR asking for an invoice to be submitted from Grant Accounting to the Sponsor. The email is forwarded to Grant Accounting. Grant Accounting prepares and sends an invoice to the Sponsor.

**Cost to Test Aggregate for abrasion, sieve analysis, and absorption:**

\$1,000 per aggregate tested

Dr. Crouch has a contract with AASHTO/NETPEP that was approved through the Office of Research for 5 years until July 2021 for the rate of \$1,000 per aggregate tested. NETPEP requires that a local partner be included. TDOT is the local partner for this testing project. TDOT suggested the \$1,000 rate per aggregate tested.

**The contract is effective until July 2021. The rate will be reviewed after this date as to whether it should be changed if another contract is needed.**

After the aggregates are tested, Dr. Crouch sends an email to the CESR asking for an invoice to be submitted from Grant Accounting to the Sponsor. The email is forwarded to Grant Accounting. Grant Accounting prepares and sends an invoice to the Sponsor.

**AASHTO**  
**CONTRACTUAL AGREEMENT # AS 17-0006**

This Agreement is made by and between the American Association of State Highway and Transportation Officials, Inc. a corporation of the District of Columbia, with offices at 444 N. Capitol St. N.W., Suite 249, Washington, D.C. 20001, hereinafter referred to as "AASHTO," and Tennessee Technological University, with offices at 1 William L Jones Drive, Cookeville, Tennessee 38505, hereinafter referred to as the "CONSULTANT."

**WITNESSETH**

Whereas, AASHTO is operating the National Transportation Product Evaluation Program, hereinafter referred to as the NTPEP, which requires that testing of certain materials, products and devices be carried out and reported in a prescribed manner approved by AASHTO; and

Whereas, the CONSULTANT is willing to carry out testing of certain materials, products and devices as specified herein, in accordance with the procedures established by AASHTO for the NTPEP:

Now, therefore, in consideration of the mutual covenants and agreements hereinafter set forth, the sufficiency of which is hereby acknowledged, AASHTO and the CONSULTANT agree as follows:

**1. Technical Assistance**

- (a) The CONSULTANT shall perform laboratory evaluations for the aggregate used with the polymer binder of the high friction and thin overlays and report test data. The work performed shall be in accordance with laboratory requirements for the aggregate set forth in the "Standard Practice for NTPEP Evaluation of High Friction and Thin Overlays for Bridges and Pavements" (2016 revision) (copy available online at [www.NTPEP.org](http://www.NTPEP.org)) identified therein, which Project Work Plan is hereby incorporated into this Agreement, and shall hereinafter be identified as the "Project Work Plan".
- (b) The CONSULTANT is equipped and qualified to do laboratory work and enter data as described in the Project Work Plan.
- (c) The CONSULTANT shall furnish all necessary personnel, materials, facilities, equipment, service and all other resources and capabilities necessary or desirable to complete the work identified in Section 1.a.
- (d) The CONSULTANT agrees that in the performance of and reporting of the results of the work described in Section 1.a, it will perform the work in an acceptable workman like manner, as determined by AASHTO and in conformance with general practice as recognized by member departments that comprise AASHTO.

**2. Period of Performance**

- (a) The CONSULTANT shall complete the work described in the Project Work Plan in accordance with the following general schedule:

1. Laboratory work will be conducted exclusively by CONSULTANT. Laboratory testing of the aggregate should commence as soon as practical after receiving products.
  2. The data collected by CONSULTANT for the aggregate shall be posted to NTPEP Data Mine.
- (b) Whenever the CONSULTANT knows, or reasonably should know or anticipates, that any condition beyond its control is delaying or threatens to delay the timely performance of the testing work and the making of timely reports, it shall advise AASHTO of the actual or expected delay, the cause thereof, and the then expected completion date of the testing work and reports.
- (c) The term of this Agreement shall be five years from the date of the final signature.

**3. Costs and Payments**

- (a) The cost per sample to test and evaluate under this Agreement and the Project Work Plan shall be as follows:

|  | <b>Fee per Aggregate<br/>Sample Submitted</b> |
|--|---|
| <b>Laboratory Testing of Aggregate Used<br/>in the Evaluation of High Friction and Thin Overlays</b> | <b>\$1,000</b>                                |

This amount is a fixed price per product submitted to the program. This fee is inclusive of laboratory testing and reporting. The total amount to be paid under this Agreement and the attached Project Work Plan shall not exceed the unit amounts described above times the number of samples furnished by the NTPEP Coordinator. It is agreed that in no event will AASHTO pay the CONSULTANT for costs incurred in excess of the fixed price per sample and the total amount described in this paragraph, unless a mutually acceptable separate written agreement is entered into between the parties.

- (b) If testing work under this Agreement is terminated by AASHTO without cause, the amount payable to the CONSULTANT will be in proportion to the percentage of completion of the testing work as described in the Project Work Plan, as of the effective date of such termination or suspension.
- (c) AASHTO shall make payments to the CONSULTANT in accordance with the following procedure:
1. The CONSULTANT shall submit an invoice to AASHTO for reimbursement for the laboratory evaluation when it has completed all the evaluations on the samples and furnished data for all the products as identified by the NTPEP Coordinator at the fee schedule outlined in (a) above, payable to the CONSULTANT under this Agreement, and the invoice being supported with accepted accounting principles and procedures.
  2. Upon written request by and at the expense of AASHTO, the CONSULTANT shall permit a designated representative of AASHTO to inspect, copy, and audit the CONSULTANT's books and records relating to the performance of this Agreement.

**4. Stop Work Order**

AASHTO may, upon not less than a ten day written notice to the CONSULTANT, require the



CONSULTANT to stop all, or any part of the work called for by this Agreement. Upon receipt of such a stop work order, the CONSULTANT agrees to comply with its terms and take all reasonable steps to minimize the incurring of additional costs allocated to the work covered by the stop work order during the period of work stoppage.

#### **5. Termination**

- (a) This Agreement may be terminated by AASHTO with a 30-day written notice to the CONSULTANT. In the event of termination by AASHTO without cause, the CONSULTANT shall be paid all costs and obligations incurred in accordance with this Agreement prior to the date of termination. Such reimbursement, together with other payments already made, shall not exceed the per sample cost times the number of samples approved for testing by the NTPEP Coordinator.
- (b) This Agreement may be terminated by the CONSULTANT with a 30-day written notice to AASHTO.
- (c) Upon termination of the Agreement prior to its full term, the CONSULTANT agrees to provide to AASHTO all data collected up to the time of termination, and to provide required reports through such termination date.

#### **6. Reports**

- (a) After completion of the testing work, or upon termination of this Agreement under Section 5, the CONSULTANT shall make a final data release in the manner described in the Project Work Plan.

#### **7. Indemnification**

- (a) To the extent provided by law, the CONSULTANT hereby assumes its responsibilities for any loss resulting from bodily injuries (including death) or damages to property, arising out of any act or failure to act on the CONSULTANT's part, or the part of any employee of the CONSULTANT in the performance of the work undertaken under this agreement and contract.
- (b) To the extent provided by law, AASHTO hereby assumes its responsibilities from bodily injuries (including death) or damages to property, arising out of any act of failure to act on the AASHTO's part, or the part of any employee of AASHTO in the performance of the work undertaken under this agreement and contract.

#### **8. Proprietary Rights to Data**

- (a) It is agreed that AASHTO shall be the owner of and shall have the exclusive proprietary rights, to the exclusion of the CONSULTANT, to all data and reports resulting from this Agreement, shall hold copyright thereto, and have the exclusive right to publish, disclose, disseminate and use in whole or in part any data and information received or developed under this Agreement.

#### **9. Term of the Agreement**

- (a) The term of this Agreement shall be for the period as described in Section 2, measured from the effective date of the Agreement.

#### 10. Effective Date

This Agreement shall become binding on the parties hereto and of full force and effect upon the signing thereof by the duly authorized officials for AASHTO and the CONSULTANT, the effective date being that upon which the last party hereto executes the Agreement as stated below.

#### 11. Jurisdiction

This Agreement shall be construed in accordance with and governed by the laws of the State of Tennessee.

#### 12. Interpretation

Where interpretation of the attached PROJECT WORK PLAN and the terms of this Agreement becomes necessary, recourse shall first be had to the operating procedures established by AASHTO for the NTPEP, including the appeals process thereof.

#### 13. Completeness

This Agreement is the complete and exclusive statement of the arrangement between the parties, and supersedes all proposals, oral or written, and all other communications between the parties relating to the subject matter thereof. It may be amended from time to time in writing by the mutual consent of the parties hereto.

#### 14. Communications

All communications concerning this Agreement, including invoices and reports, shall be sent to:

For AASHTO:

Katheryn L. Malusky  
Program Manager, NTPEP  
AASHTO  
444 North Capitol Street, NW, Suite 249  
Washington, D.C. 20001  
Telephone: (202) 624-3695  
E-mail: [kmalusky@aaashto.org](mailto:kmalusky@aaashto.org)

For the CONSULTANT:

Lewis Crouch, PhD  
Professor  
Civil & Environmental Engineering Department  
Tennessee Technology University  
Prescott Hall (PRSC) 316  
PO Box: 5015  
1 William L Jones Drive  
Cookeville, TN 38505  
Telephone: (931) 372-3196  
E-mail: [LCrouch@tntech.edu](mailto:LCrouch@tntech.edu)

In Witness Whereof, the parties have set their hands and seals by their duly authorized agents and representative on the day and year below written:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

Witnessed by:     JTT Cas    

By:     [Signature]    

Date:     7/15/16    

Title:     Executive Director    

Date:     7/15/16    

TENNESSEE TECHNOLOGY UNIVERSITY

Witnessed by:     [Signature]      
Sammie Sparks, Contract Compliance Assistant

By:     [Signature]    

Date:     7-20-16    

Title:     Francis Otuonye, Ph.D.  
Associate VP for Research  
(Chief Engineer or Designate)    

Date:     7-20-16