**ASHRAE Standard 140 Weather Drivers Test Suite – Field Trial #1**

Thank you for agreeing to participate in the field trials for the new Weather Drivers test suite.

This document outlines the test suite information and the process of the field trial.

The files for the field trial are being managed with a shared Box.com folder:

https://anl.box.com/s/b3gbuwn3zkkqc9cph7zwpi1xs31t658a

Access to this folder is limited by invitation and we have invited the participant email addresses that we have at this point. If you need someone else in your organization to have access, please email mcdowell@tess-inc.com.

Files in the shared folder:

- Test spec (Weather Drivers Test Spec.pdf)
- Weather Files for Input (TMY3, EPW, CLM, and JSON)
- Output template (WeatherDriversResultsSubmittal.xlsx and WeatherDriversResultsSubmittal.json)
- Modeler's Report (S140outNotes.txt)
- Participant Questionnaire (Weather Drivers Field Trial Questionnaire.docx)

These files are detailed below.

The field trial information and folder links will be sent to the participants at the beginning of March. Results are due at the end of March, but earlier results will be accepted with pleasure. We realize that this is all volunteer effort on your part and hope that these tests are easy to implement. Once we have the results, we will compare the results of the different programs and reach out to the individual program developers if any clarification is needed. If the review results in test spec changes or additions, we will then proceed to a second round of field trials.

All results and files will be kept confidential without permission to share them. We will anonymize any results sent to the group until such time as all participants agree to making program names and results public. Please send all result output files to the field trial organizers directly rather than sharing on the shared drive to protect anonymity.

If you have any comments or questions on the field trial process or the test spec, please email Tim McDowell at mcdowell@tess-inc.com.

**Shared File Details**

Test Spec:

There are currently 6 test cases in the test spec named WD100 through WD600. Test cases WD100 through WD500 are the same with only the weather file for the test case different. Test WD600 is the same as WD100 but the ground reflectance is changed. The test spec outlines the inputs for the test cases and the outputs that will be used for comparison.

Weather Files for Input:

There are five different weather file locations used in the test suite. The files are provided in 4 different formats: TMY3, EPW, CLM, and JSON text file. The files included in the shared drive have been checked for consistency of common data. If your software uses a different data file format check the consistency after any file conversion. (If you want the field trial organizers to provide the consistency check please contact them with details of the required data file format.)

Output Template:

While there are only 6 test cases in the test suite, they each require a large amount of output data for comparison (much of it time series data). It will be necessary for the field trial organizers to compare the output from all the participating programs to locate areas of disagreement. As much as possible this process will be automated and thus it is necessary to have the output data in similar formats. Two different output template formats have been provided. One is an Excel spreadsheet format and the other is a JSON file format. (If you are using the JSON file format and have suggestions on better formatting please contact the field trial organizers.) If neither of these formats is convenient for your output, you can propose an alternative format that is easy for the field trial organizers to process.

Because much of the output data is timeseries output, it is necessary to clearly define the time for each data value. Software outputs are usually of two types: instantaneous at a specific time or average over a time period (timestep). If your output is instantaneous enter the time for the value at the specific time. If you output is average over a time period enter the time for the value at the midpoint of the time period. (See example below)

| Values are instantaneous at the end of the hour | | Values are average over the hour | |
|---|---|---|---|
| Time | Value | Time | Value |
| 1 | 2 | 0.5 | 1.5 |
| 2 | 3 | 1.5 | 2.5 |
| 3 | 4 | 2.5 | 3.5 |
| 4 | 5 | 3.5 | 4.5 |
| 5 | 6 | 4.5 | 5.5 |
| 6 | 7 | 5.5 | 6.5 |

Modeler's Report:

This is a document where you can document the different options that you used in your software to complete the test cases. This information Is helpful for users of your software that try to recreate (and verify) your results. As well as, helping in discussions of the causes of differences in results between programs. An example of an entry in the Modeler's Report is below.

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NOTE 8 - Solar radiation model - Tilted surface mode
(Section 5-2)

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8.1 Describe the Effect Being Simulated:
Solar radiation model - Tilted surface mode
8.2 Optional Settings or Modeling Capabilities:
Isotropic Sky Model
Hay and Davies Model
Reindl Model
Perez 1988 Model
Perez 1999 Model
8.2.1 Isotropic Sky Model
Physical Meaning: The isotropic sky model assumes that the diffuse radiation is uniformly distributed over the complete sky dome.
8.2.2 Hay and Davies Model
Physical Meaning: The Hay and Davies model accounts for both circumsolar and isotropic diffuse radiation. Under clear sky conditions, there is an increased intensity of diffuse radiation in the area around the sun (circumsolar diffuse). Hay and Davies weight the amount of circumsolar diffuse by using an anisotropy index;
8.2.3 Reindl Model
Physical Meaning: This model adds a horizon brightening diffuse term to the Hay and Davies model. The horizon brightening is lumped with the isotropic diffuse term and its magnitude is controlled by a modulating factor, f.
8.2.4 Perez 1988 Model
Physical Meaning: This model accounts for circumsolar, horizon brightening, and isotropic diffuse radiation by empirically derived "reduced brightness coefficients". The reduced brightness coefficients are functions of sky clearness and sky brightness parameters.
8.2.4 Perez 1999 Model
Physical Meaning: The Perez 1999 model is identical in formulation to the Perez 1988 model. It differs only in the curve fit coefficients.
8.3 Setting or Capability Used:
Perez 1999 Model

Participant Questionnaire:

In order to better understand the programs being used in the field trial, the field trial organizers developed a few questions. The answer to the questions will help in analyzing differences in the results between programs and assess the state of the industry. If you can think of any clarifying questions that should be a part of the questionnaire, please send these to the organizers.