AFGROW Workshop 2026

AFGROW Current Release and Release 5.5 Overview

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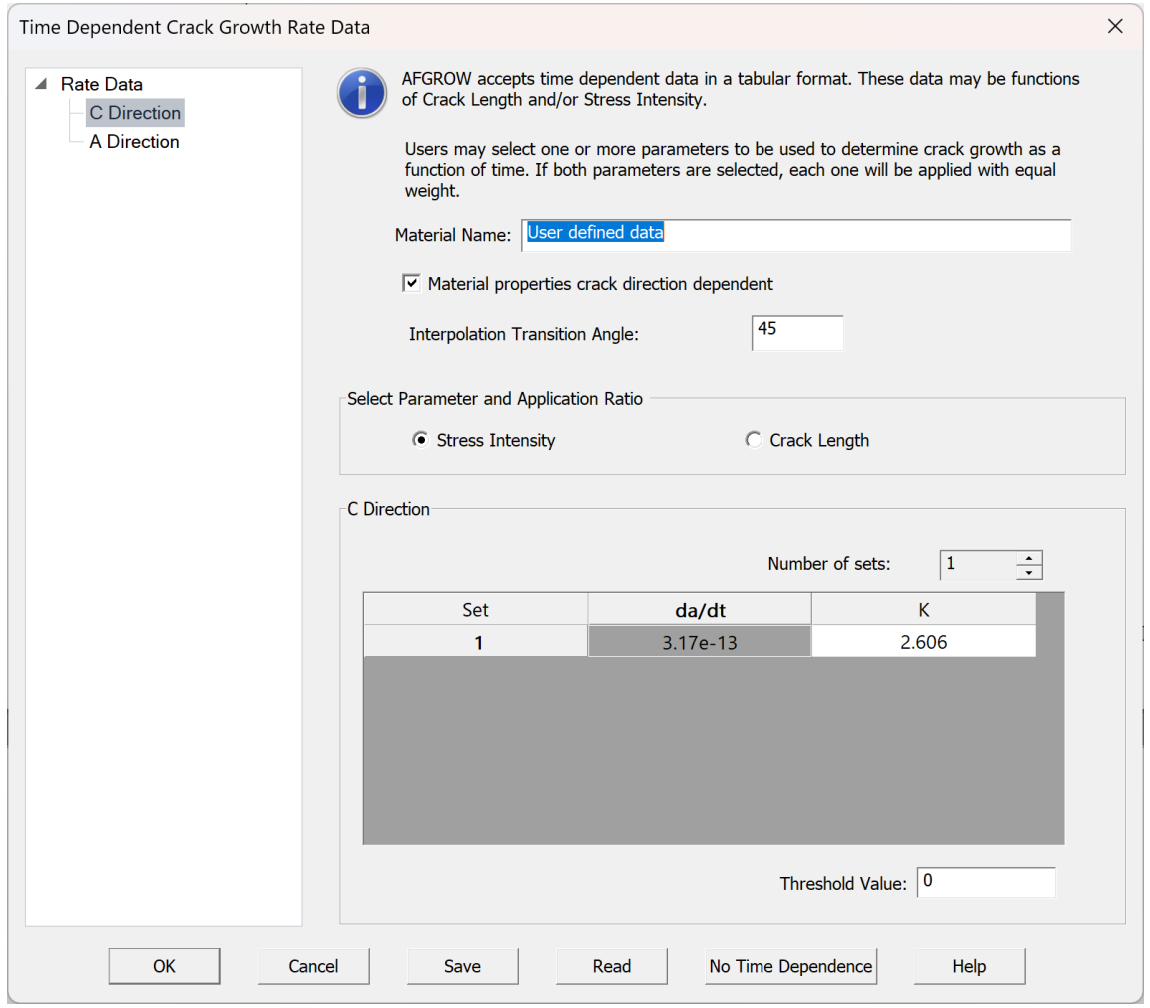
Agenda

1. Overview AFGROW version 5.5 intermediate releases
2. AFGROW release 5.6 feature description
3. AFGROW web base post processor overview and future

Release 5.05.03.25 (December 1, 2025)

- Enhancement: Added the ability to have different time-dependent crack growth for two directions
- Enhancement: Added a COM API function to set to the COM Preferences interface: Synchronize beta calculation increment with the through crack UserDefined beta length entries
- Enhancement : The XML output now includes a time parameter
- Enhancement: Added the ability to disable/enables properties to the IAfgrowBetaPluginInt interface
- Enhancement: Added a tag to XML output that indicates whether the loaded spectrum is time dependent
- Bug: With AFGROW in metric units, a new model created using the COM interface had default geometric parameters in English units
- Bug: Loading a NASGRO material data file through COM while Metric units are selected resulted in slightly different results vs English units
- Bug: COM function ModelHasPartThroughCrack may return incorrect value after user changes the model
- Bug: AFGROW displays the wrong frame header in Beta correction dialog
- Bug: AFGROW crashed when user runs prediction and then tries to enter "hours per pass" value in preferences
- Bug: Advanced model output did not display whether AFGROW failed due to the K max or K residual stress requirement
- Bug: In COM API when crack transitions to a slot the TransitionInfo event was sent after the transition was completed instead of before causing the information about the transitioning crack direction to be missing
- Bug: Impossible to set BetaCorrection for cracks at Countersunk Hole through COM API

Time-Dependent Crack Growth in Two Directions



Time dependent crack growth rate data may be entered to be used for all growth directions, or the user may select the option to enter time dependent material properties for each growth direction separately.

In the latter case, the time dependent data for the a-direction and c-direction will be entered into two different tables which are selected under the Rate data column on the left side of the dialog box. All values entered in this dialog must be > 0.

Release 5.05.03.25 (December 1, 2025) (Continued)

- Bug: When a plugin model was selected, AFGROW reported garbage values when printing enumerated parameter values in the Status View
- Bug: The UpdateProperties function of the IAfgrowBetaPluginNotifyInt worked only with double values
- Bug: When plugin drop down control new value was rejected, the selection in controls visually changed from string to enumerated value
- Bug: Flow stress calculation option "yield stress plus 10" was not working properly when metric units were being used
- Bug: API 579 models did not work correctly with initiation, because initiation requires stress, not pressure
- Bug: Prediction slowed significantly when MAT-8 was enabled and the A crack direction approached the thickness
- Bug: When delta K is zero due to negative loading in the spectrum, API-579 Level-2 assessment AFGROW crashed
- Bug: AFGROW reports notification that MAT-8 burst model is out of the range even when it was not selected as the transition preference

Release 5.05.04.25 (January 27, 2026)

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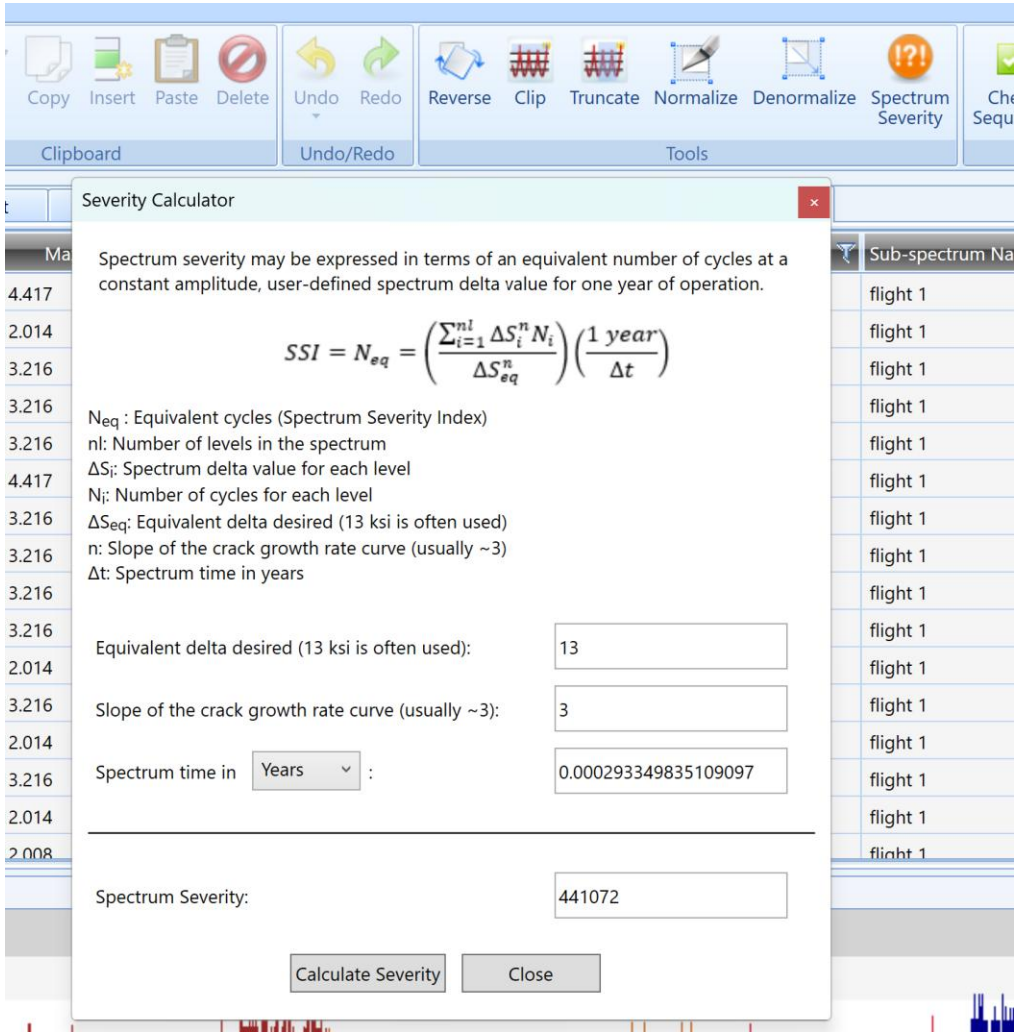
- Bug: AFGROW incorrectly converted tabular lookup material data from English to Metric units when AFGROW was set to Metric units at startup
- Bug: The new property *nCrackPositionID* of the *iOutputInfo* Interface sometimes reported incorrect values
- Bug: XML output always reported units as English
- Bug: Final output event was not printed unless the *"Kmax Failure Criteria"* of the *Stop Crack Propagation* preference was selected
- Bug: API-579 Level 2 Assessment and MAT-8 Burst Mode ignored the residual strength requirement
- Bug: Errors converting units for several AFGROW models

Spectrum Manager

- Enhancement: Added a Spectrum Severity Calculator

Spectrum Manager - Spectrum Severity Calculator



The spectrum severity tool provides a metric that allows the user to assess the severity of a spectrum by estimating the equivalent number of constant amplitude cycles with a user-specified delta (cyclic range) value.

The SSI (Spectrum Severity Index) calculator shown above is commonly used by the pipeline industry. The calculation doesn't include stress ratio effects, so **the result should not be interpreted as an accurate estimate of the expected number of constant amplitude cycles for 1-year of service. It should be seen as a relative severity estimation when comparing different spectra.**

Release 5.05.05.25 (July 28, 2026)

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- Bug: Advanced model for combinations of part-through/through cracks required corrections for duplicated table entries
- Bug: Final through crack length reported incorrectly for Internal through cracks for rare cases when the crack grows beyond the plate width
- Bug: Incorrect data was being used for Symmetric Oblique Cracks under bearing load for the Ct direction
- Bug: When using the API 579 Level 2 transition criteria, output files had erroneous values for Lr, Kr, and estimated failure pressure
- Bug: In-Plane Bending Constraint for Advanced Models through COM could not be set unless there was a slot or an edge crack in the model
- Bug: Added an option to the COM API to set the minimum required crack growth per pass
- Bug: Visualization bug when width was changed for Advanced Models with a slot
- Bug: C-dimension was incorrectly used when API 579 Level 2 Procedure calculated stress state for A-dimension
- Bug: Corrected a bug in COM Output for crack length (reported length greater than the max width of the specimen)
- Bug: In COM output, when an offset through crack at a hole was selected, AFGROW reported half of the through crack length for both directions instead of the length based on the original crack offset

Spectrum Manager

Bug: AFGROW crashes when user opened a reversals file in cycle counting dialog when this file was being used by other applications
Bug: Spectrum Manager reports an error when user first associates the spectrum file with the Spectrum Manager and then tries to open the file with a double click
Bug: Spectrum Manager crashes silently when copy operation is interrupted
Bug: The '#' and 'cycle' columns sometimes display incorrect information in the Spectrum Data Grid

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AFGROW 5.5 development

Scale: 10 most important

- Countersunk hole solution (10)
- Oblique/Part Through Corner Cracks at Hole (10)
- ~~Set stress state separately for~~ each crack direction (10)
- Find a way for AFGROW not to open data in the same instance, when user clicks on the input file. Possible ask user to save work, or have an option to ignore the click if prediction is running (10)
- ~~Make changes to allow the use of~~ spectra with three load channels (9.7)
- ~~Save spectrum location by relative not full path (9)~~
- ~~Short cracks and plastic~~ zone investigation (9)
- ~~New bearing part-through crack width correction (8.5)~~
- New hole offset correction that should be used with the Harter Width correction (8.5)
- ~~Add a new a classic single oblique crack at hole solution based on using the most recent wide plate tabular database (8)~~
- Update advanced double corner crack solution with the latest FE data (7)
- Add an option to have customizable initial property values for the new advanced model objects, such as crack length, hole diameter (7)
- Add option to have multiple analyses open in a single AFGROW instance (7)

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Updated Classic Solution for Single Oblique Cracks at a Hole

- This solution was generated using a subset of BARE's Corner and Oblique crack data set
- The new solution includes a wider range of model dimensions
- The new solution data exhibits more consistent behavior when plotted across its parameters

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Single Oblique Crack at Hole - Vertex Calculation

- The C vertex was calculated by finding the local maximum near the surface of the crack in the C direction
- The A vertex was calculated with an analytic formula provided by BARE that provides a K value at 1% of the thickness of the specimen
- The analytic solution allows for consistent Ks even when the crack front Ks go to infinity when reaching the surface of the specimen.

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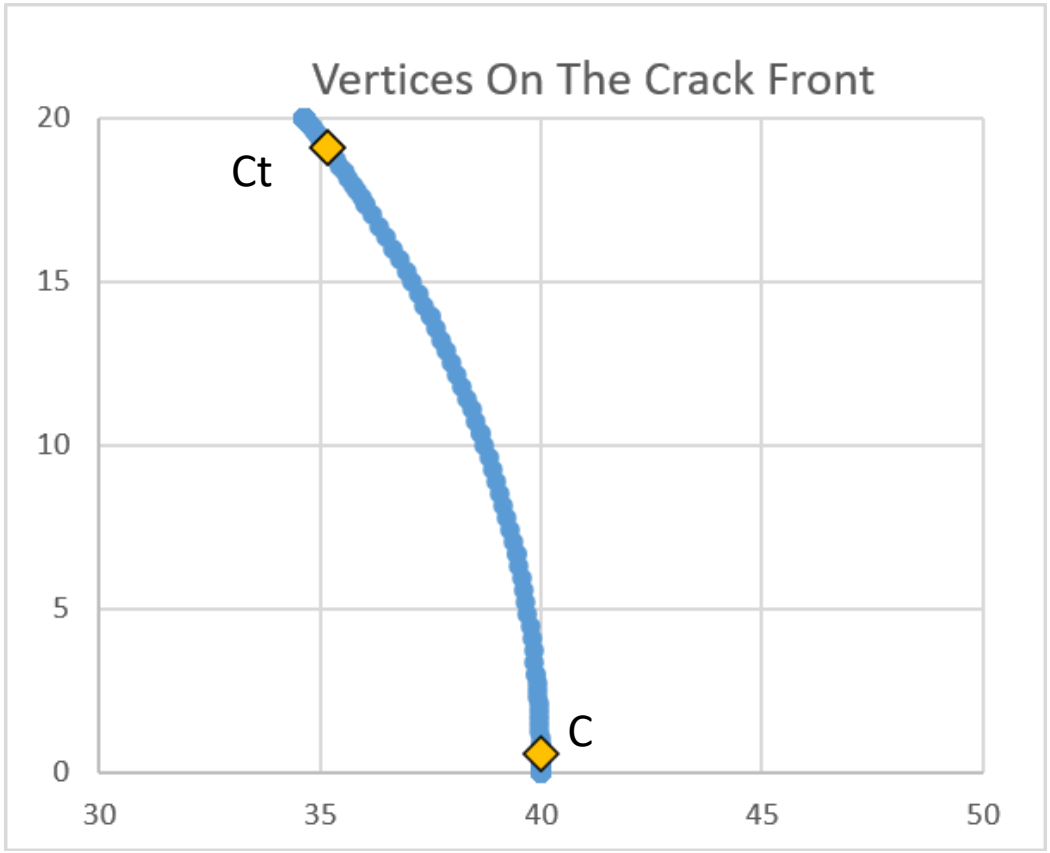
Single Oblique Valid Ranges

- New Single Oblique Solution Limits
  - 0.1 <= r/t <= 10.0
  - 1.05 <= a/t <= 10.0
  - 0.1 <= a/c <= 10.0
- Old Single Oblique Solution Limits (Shah correction from symmetric double corner crack at hole)
  - 0.2 <= a/c <= 2.0
  - 1.05 <= a/t <= 10.0
  - 0.5 <= r/t <= 2.0

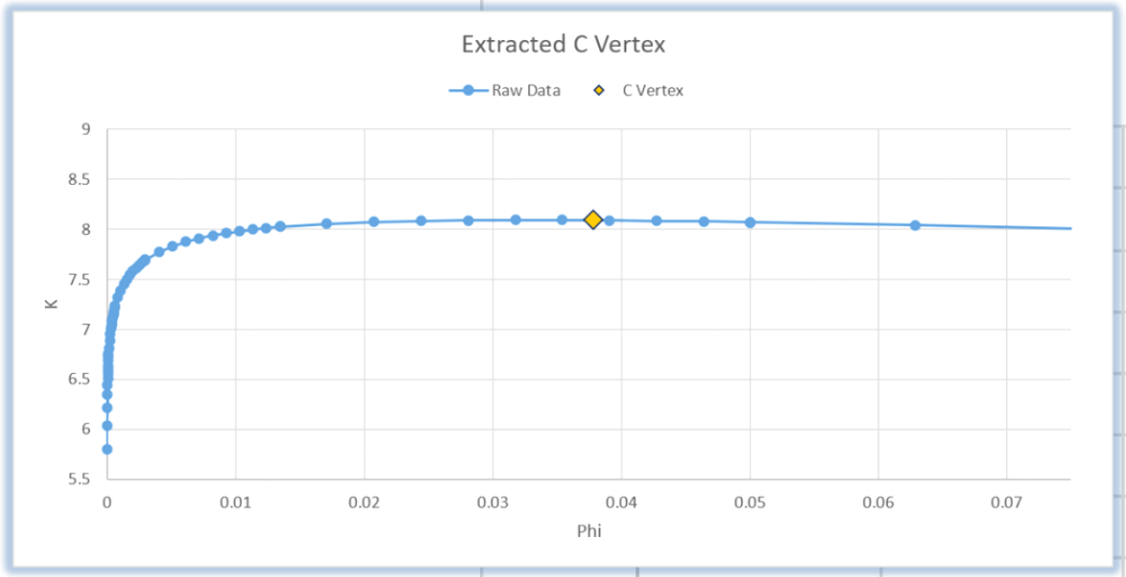
Example of the Crack Front K distribution for an Oblique Crack

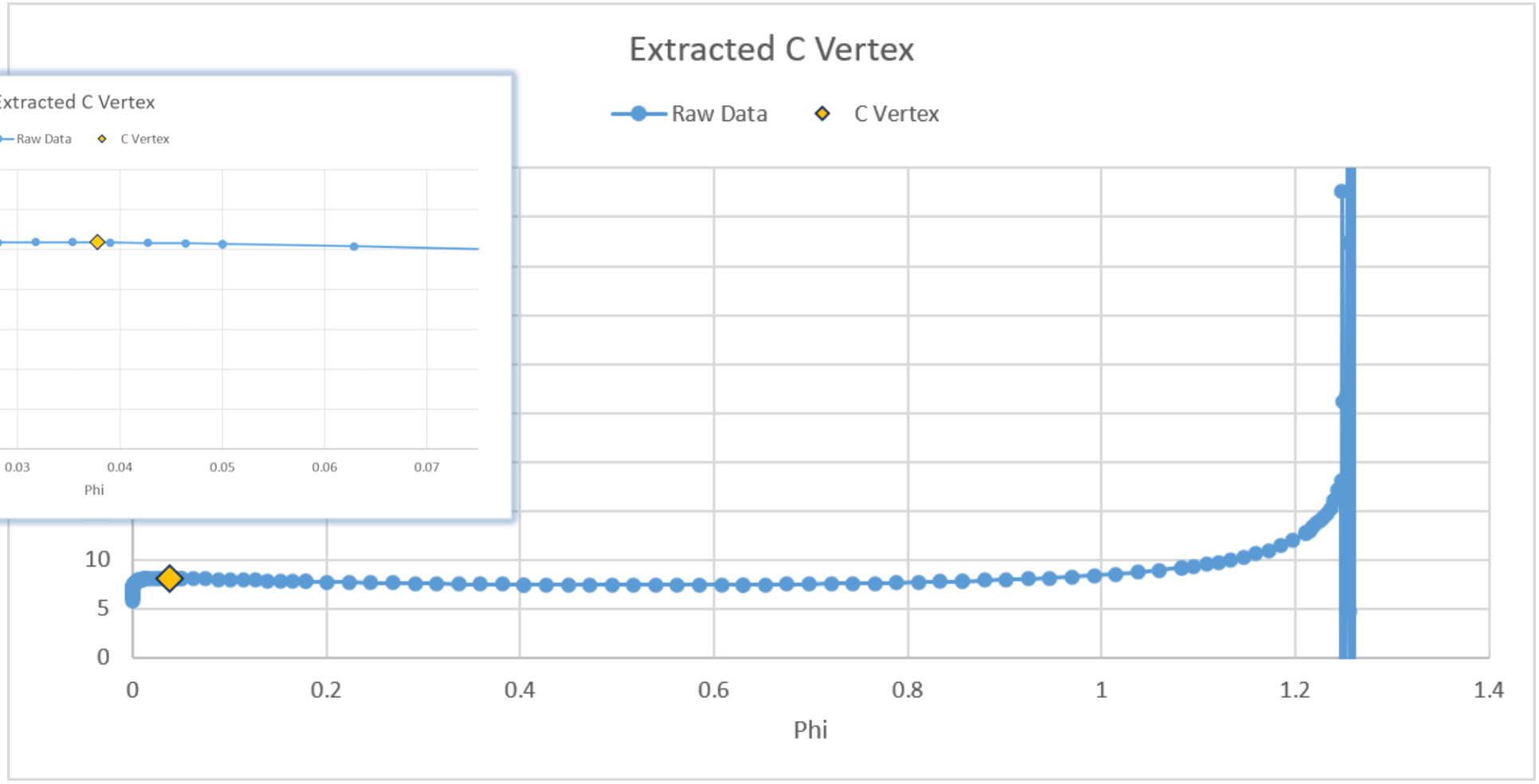


C direction – local maximum
Ct Direction – fixed angle

C direction

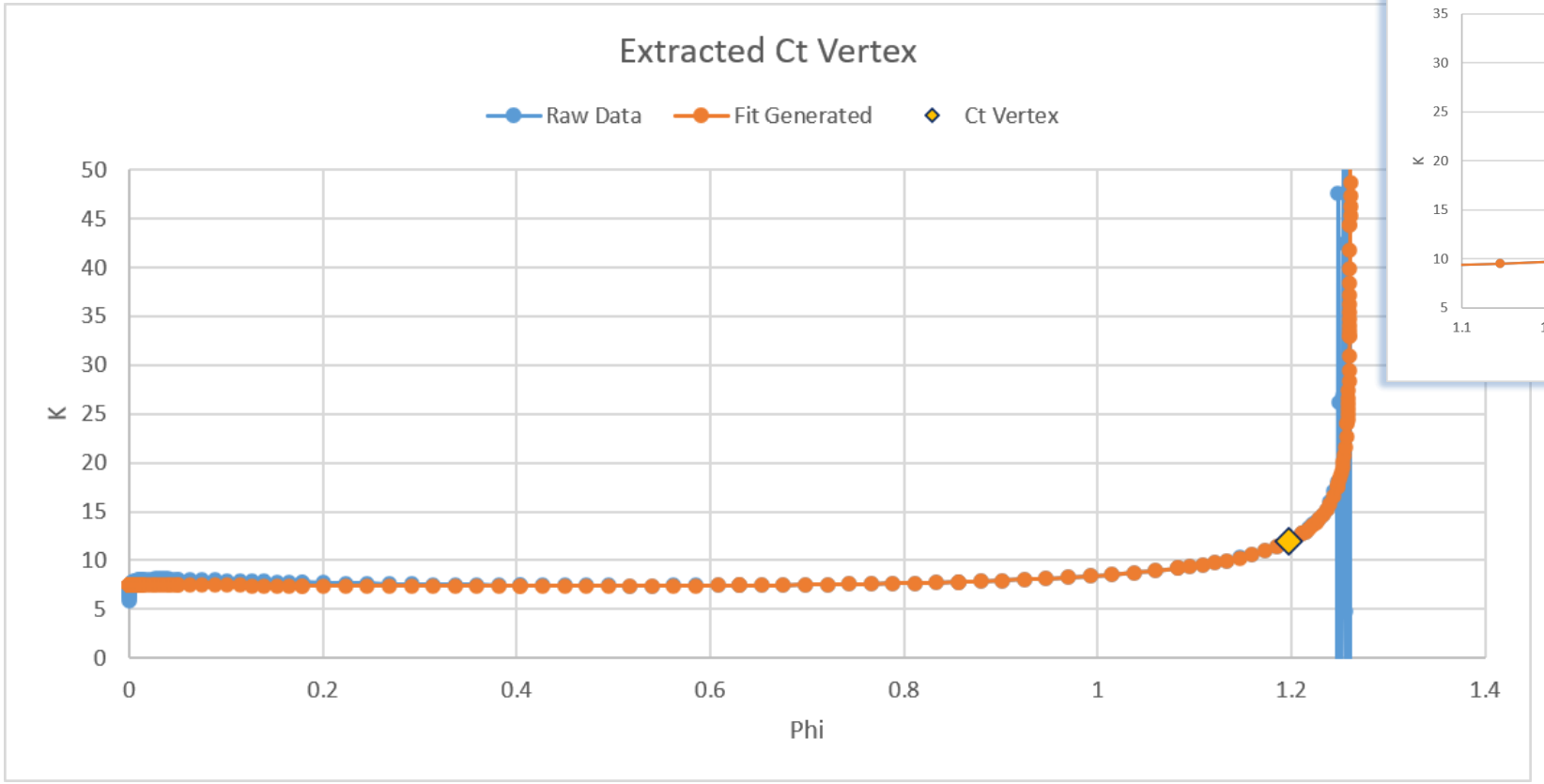
Generated by locating the local maximum within the portion of the curve that is close to the C edge

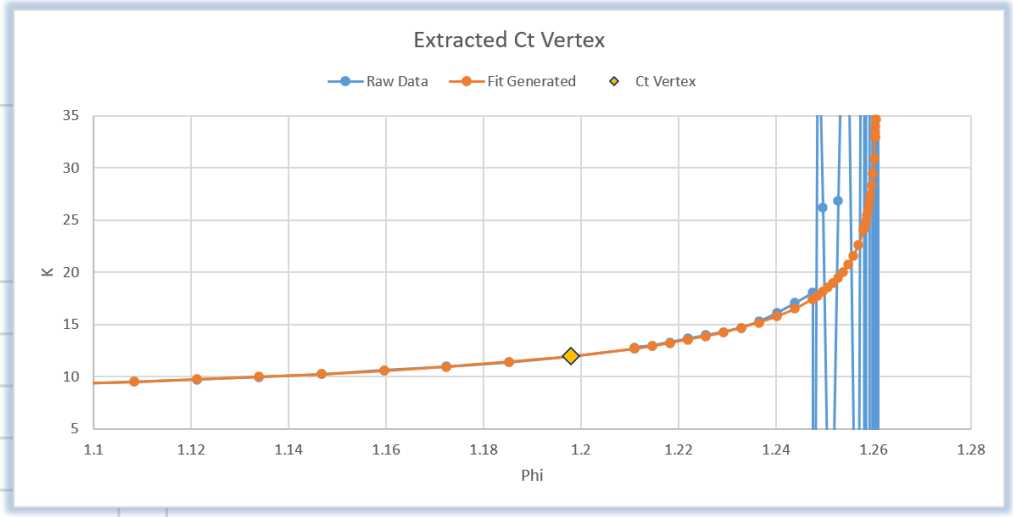




Ct direction

1. Fit is generated based on equations developed by Börje Andersson - BARE, AB Sweden
2. The vertex is located at 5% of phi from the edge





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New Bearing Part-Through Crack at Hole Width Correction

- The previous bearing part-through crack width correction in AFGROW was known to be overly conservative
- A new correction was developed using the 2023 BARE Corner-Crack-at-Hole finite-width database
- Several K_I values for certain R/t ratios under bearing loading were identified as erroneous; low-ratio values (e.g., R/t = 0.1) were temporarily extrapolated.
- Advanced spline interpolation and machine-learning curve-fitting were applied to generate a new bearing width correction.

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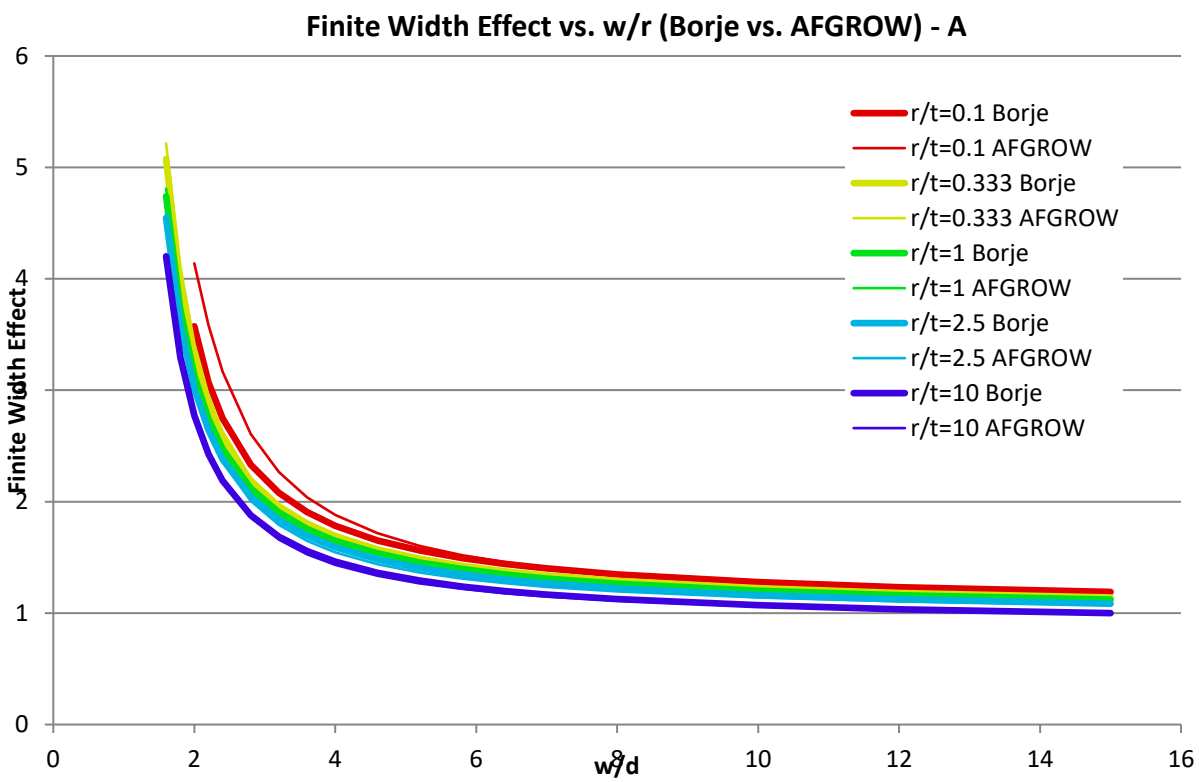
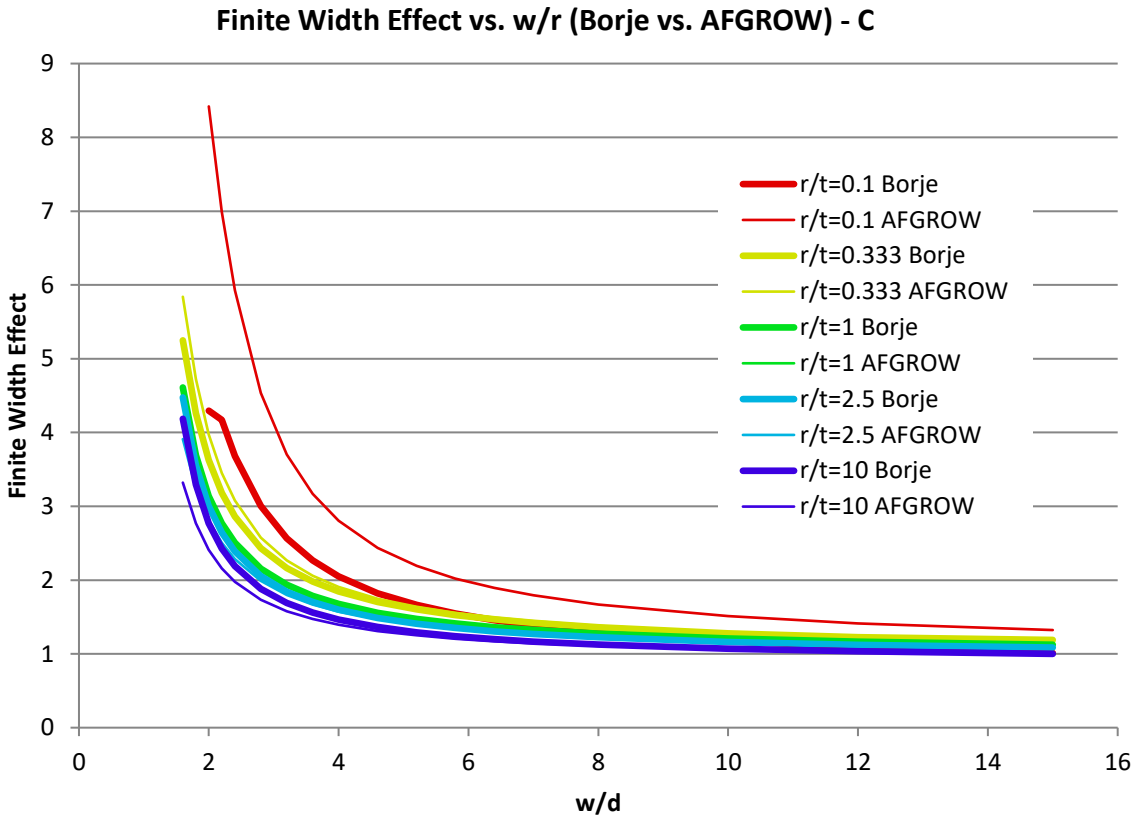
Comparison Between Current and New Bearing Width Corrections

- New bearing width correction is still work in progress
- The values at the low R/t rations are still under review
- New width correction is calculated using the 2023 BARE Corner-Crack-at-Hole infinite width data
- Current width correction applied on latest (2018?) BARE's Corner and Oblique infinite width crack dataset

Width Correction : A/C – 1, A/T – 0.1

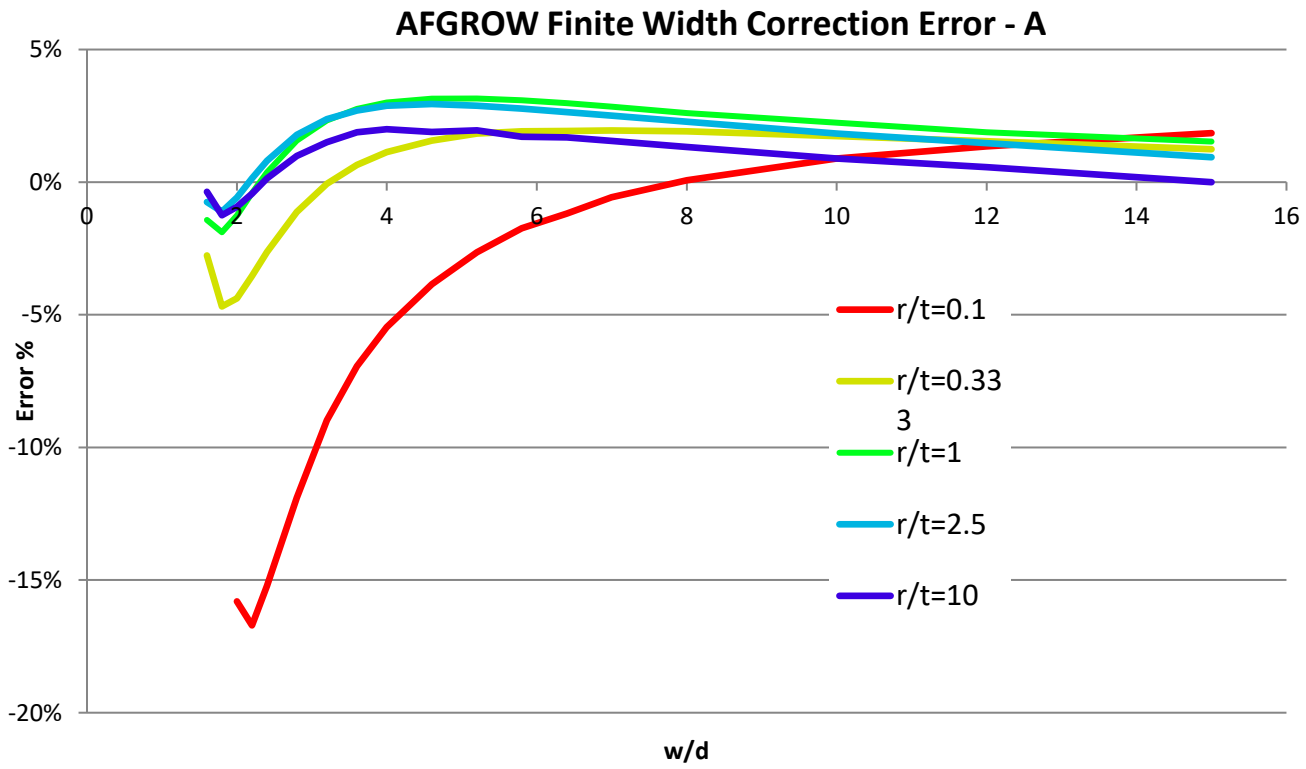
a/c	a/t
1	0.1

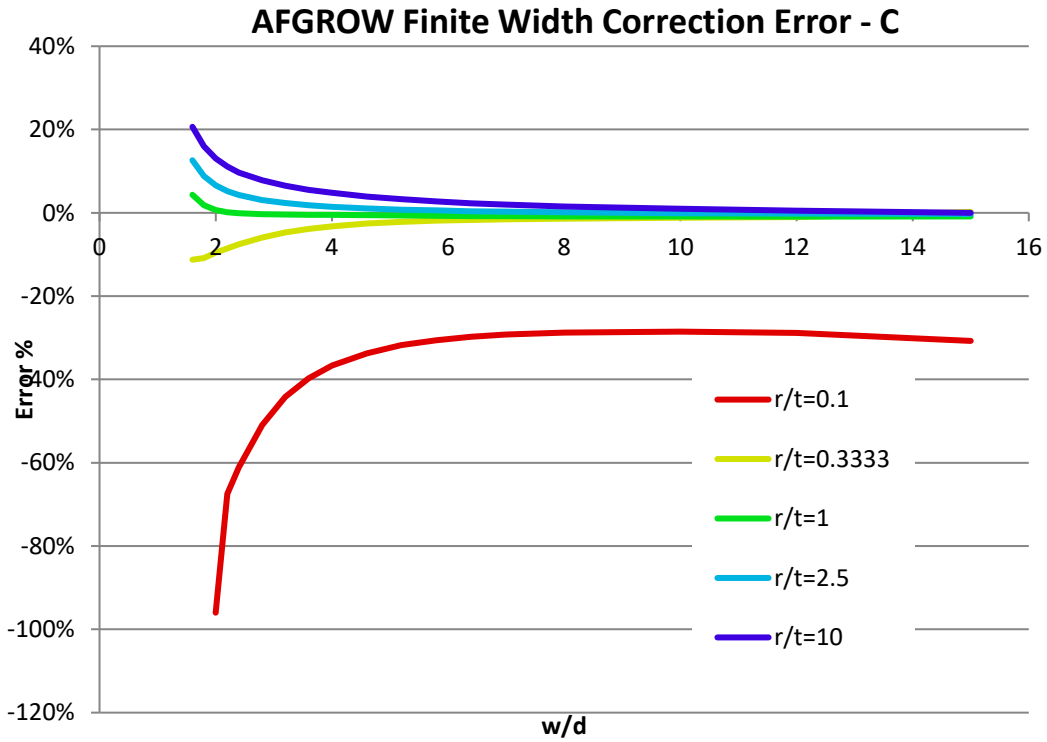




Width Correction Error: A/C – 1, A/T – 0.1

a/c	a/t
1	0.1





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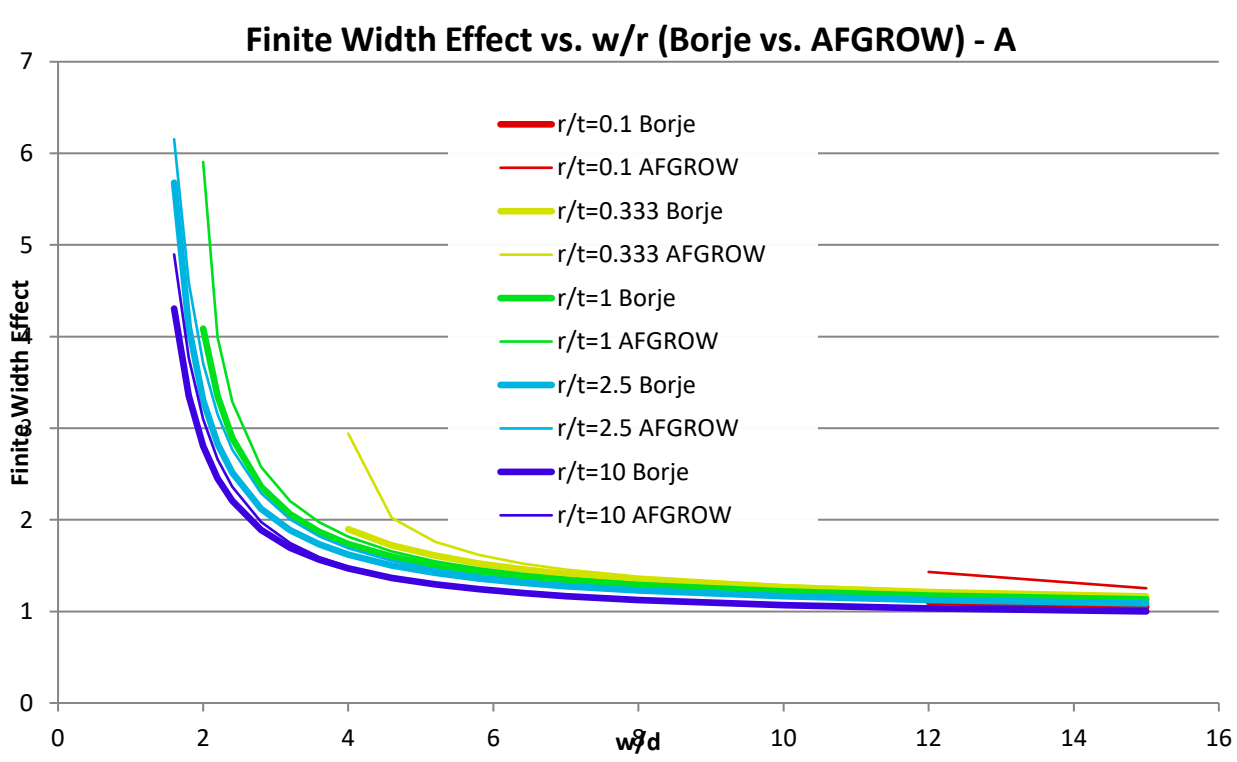
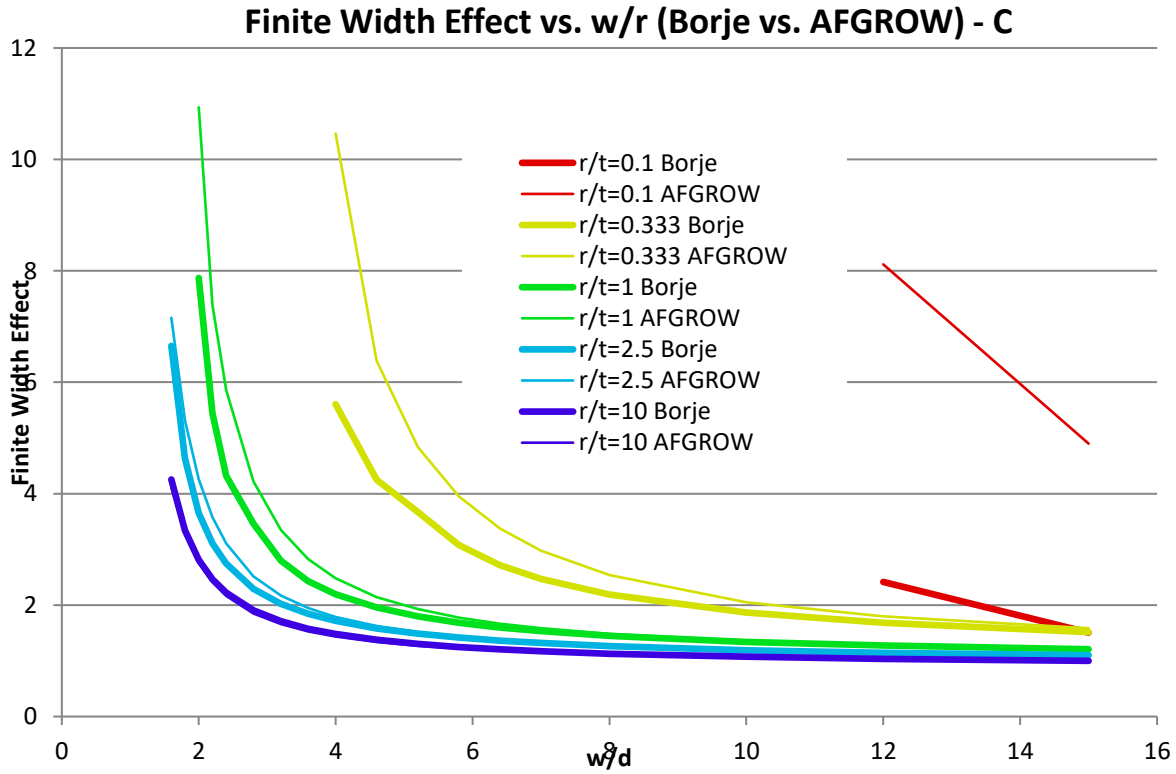
Width Correction : A/C – 1, A/T – 0.95

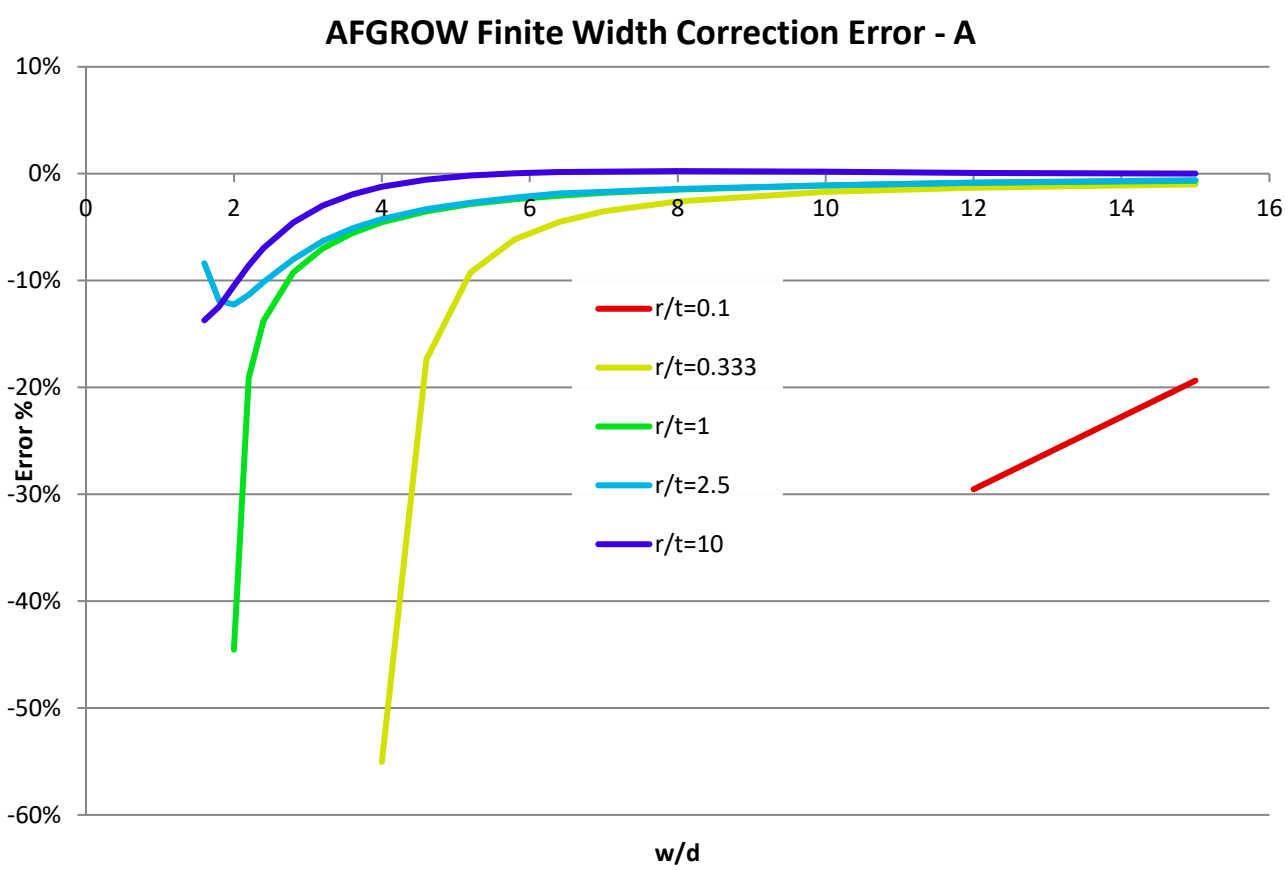
a/c	a/t
1	0.95

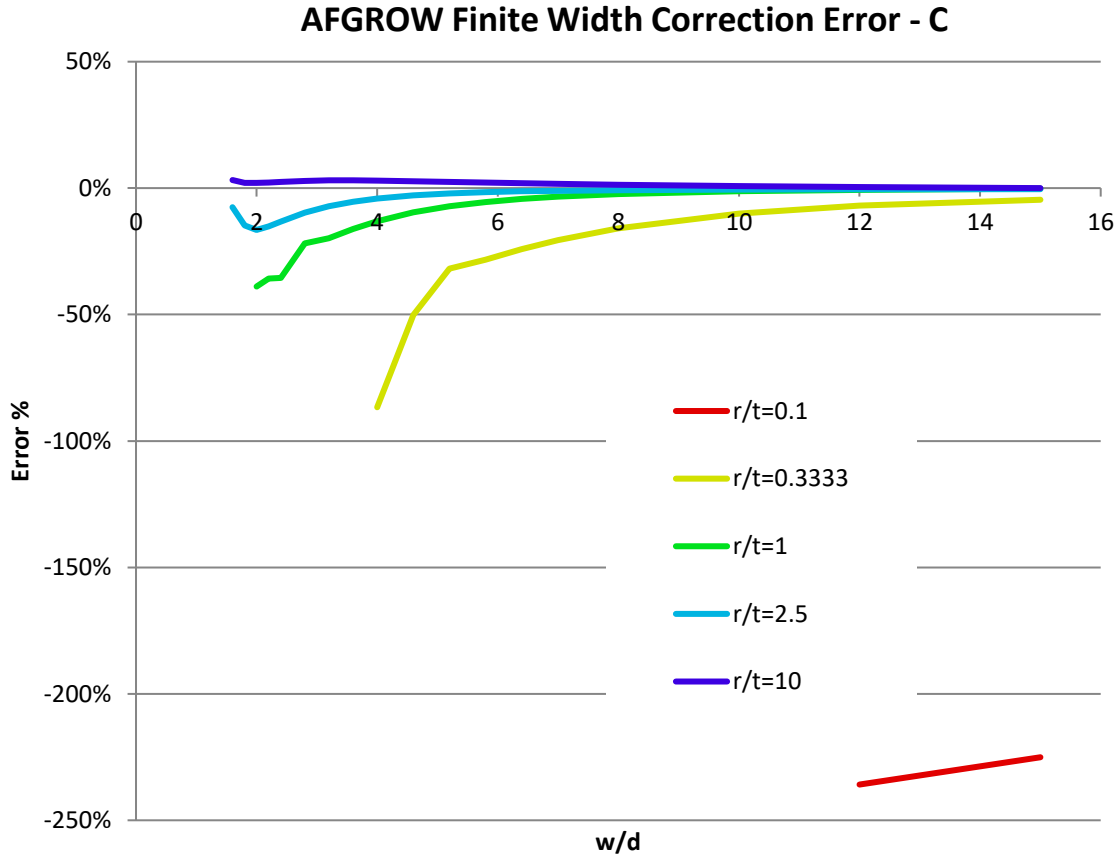




Width Correction Error: A/C – 1, A/T – 0.95

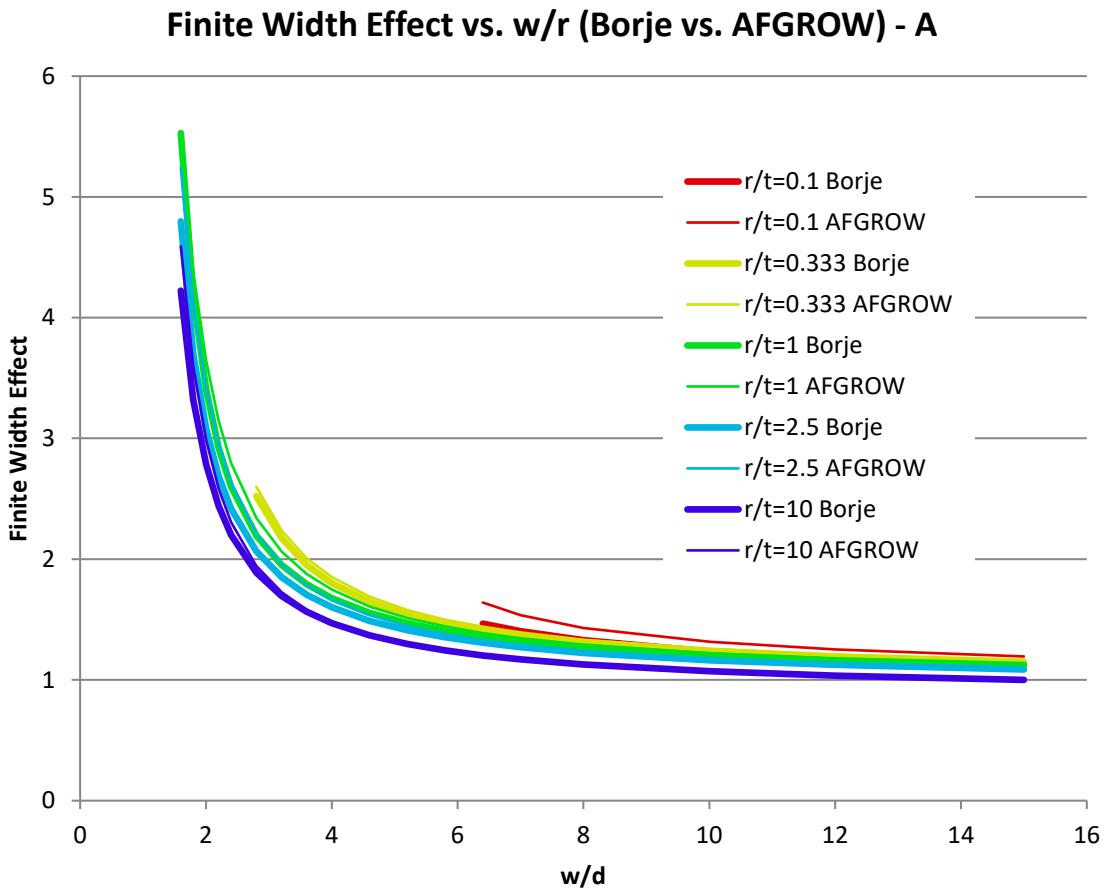
a/c	a/t
1	0.95

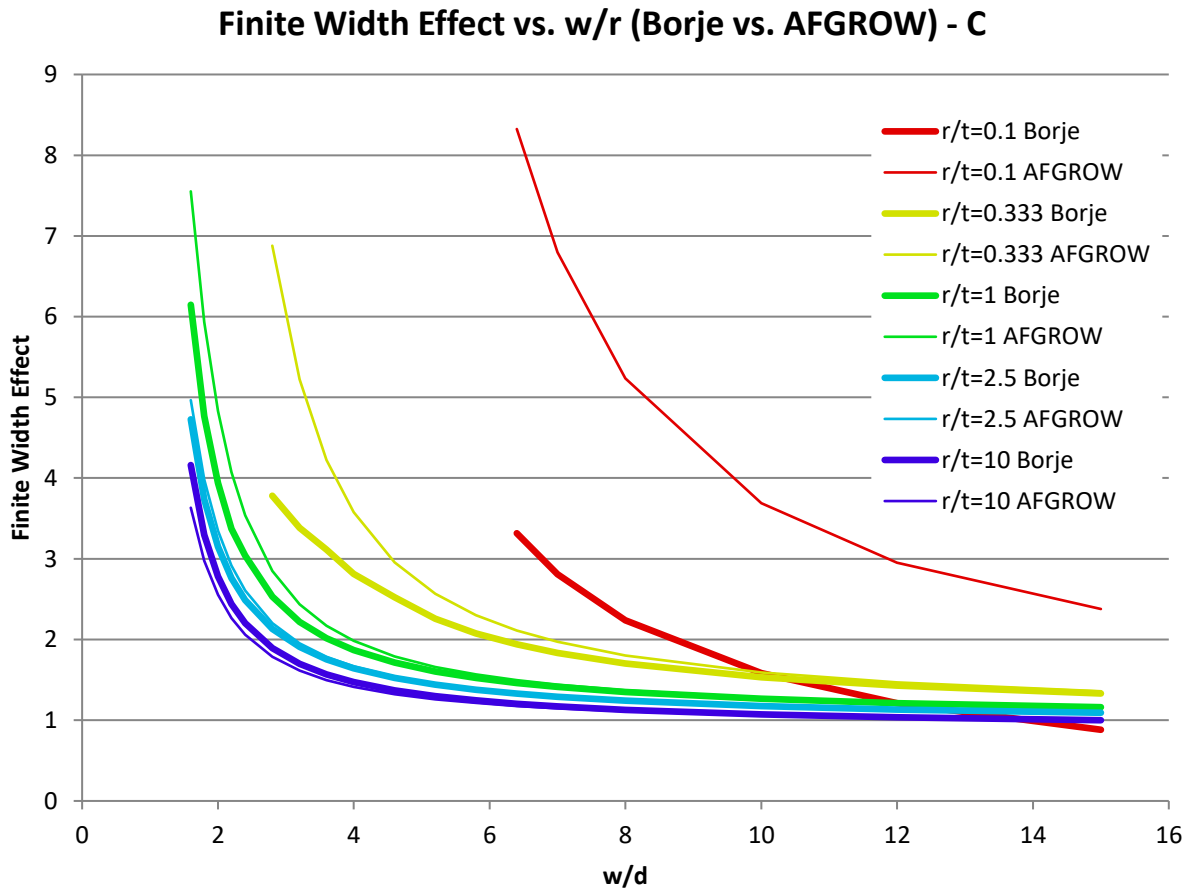




Width Correction : A/C – 1, A/T – 0. 5

a/c	a/t
1	0.5





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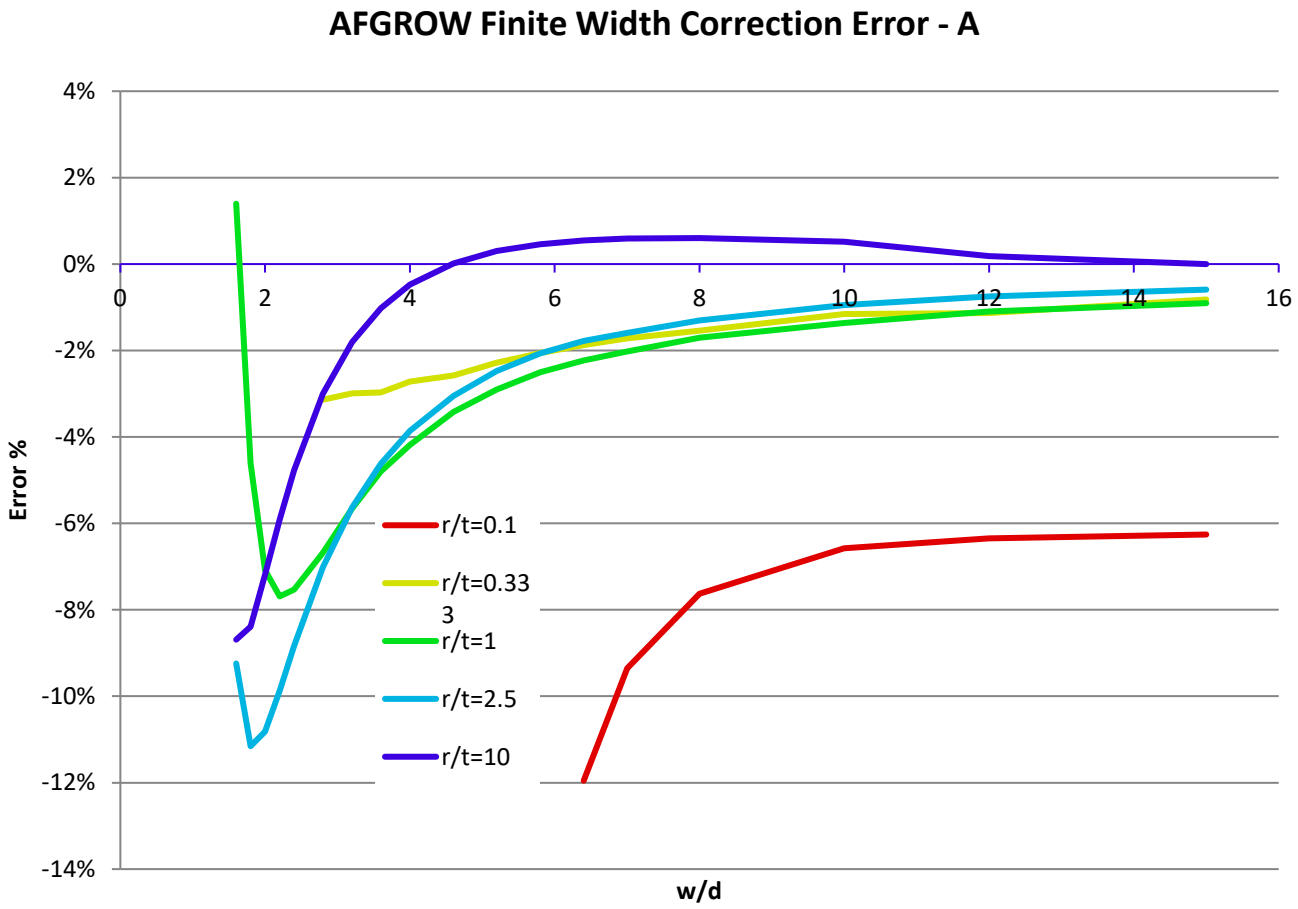
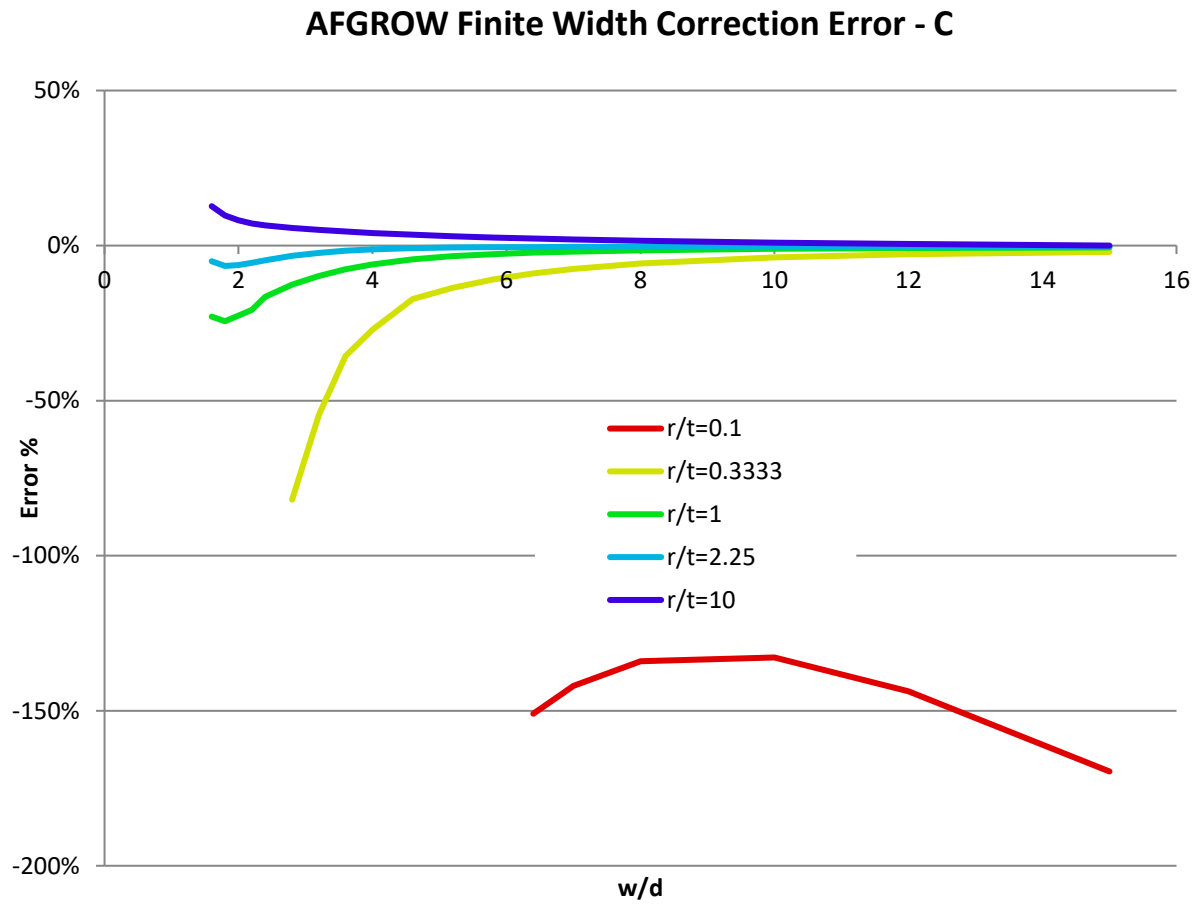
Width Correction Error: A/C – 1, A/T – 0.5

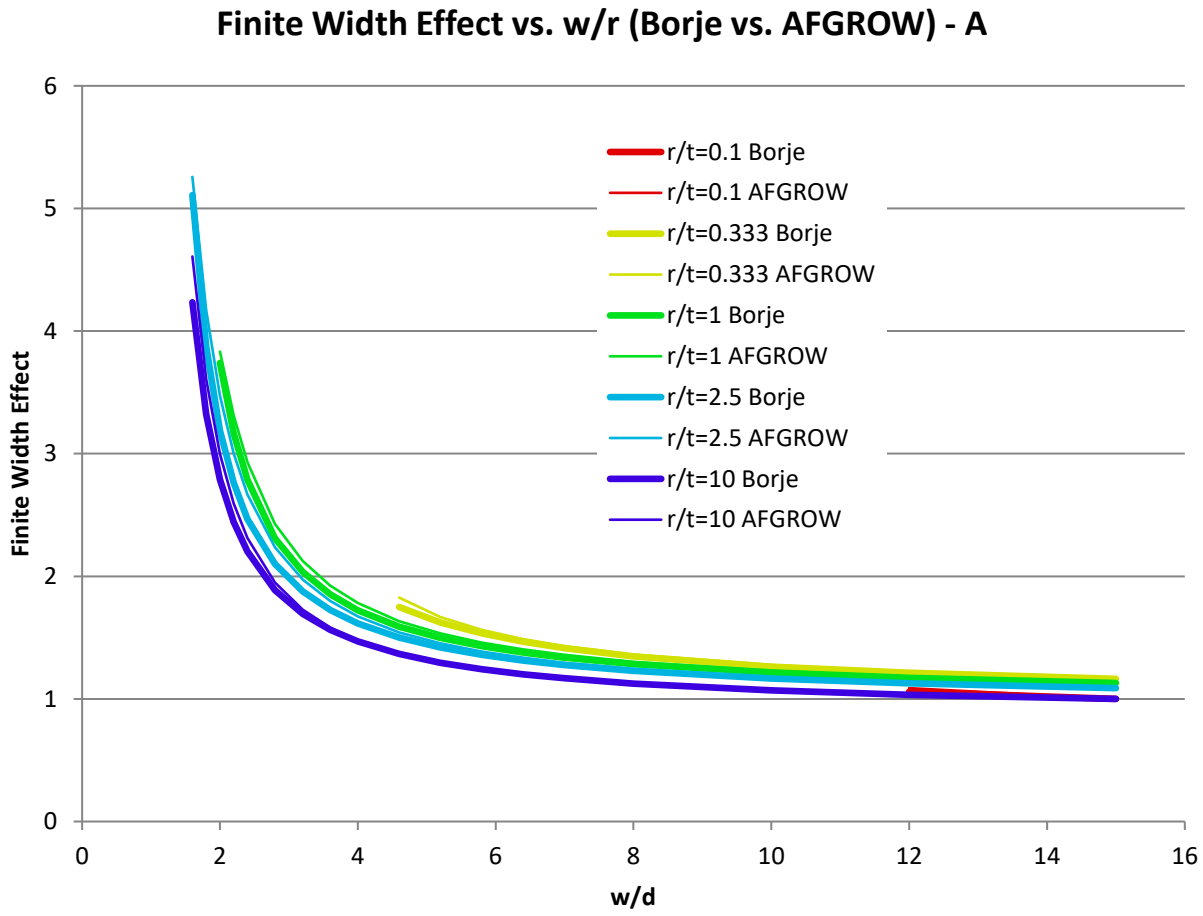
a/c	a/t
1	0.5

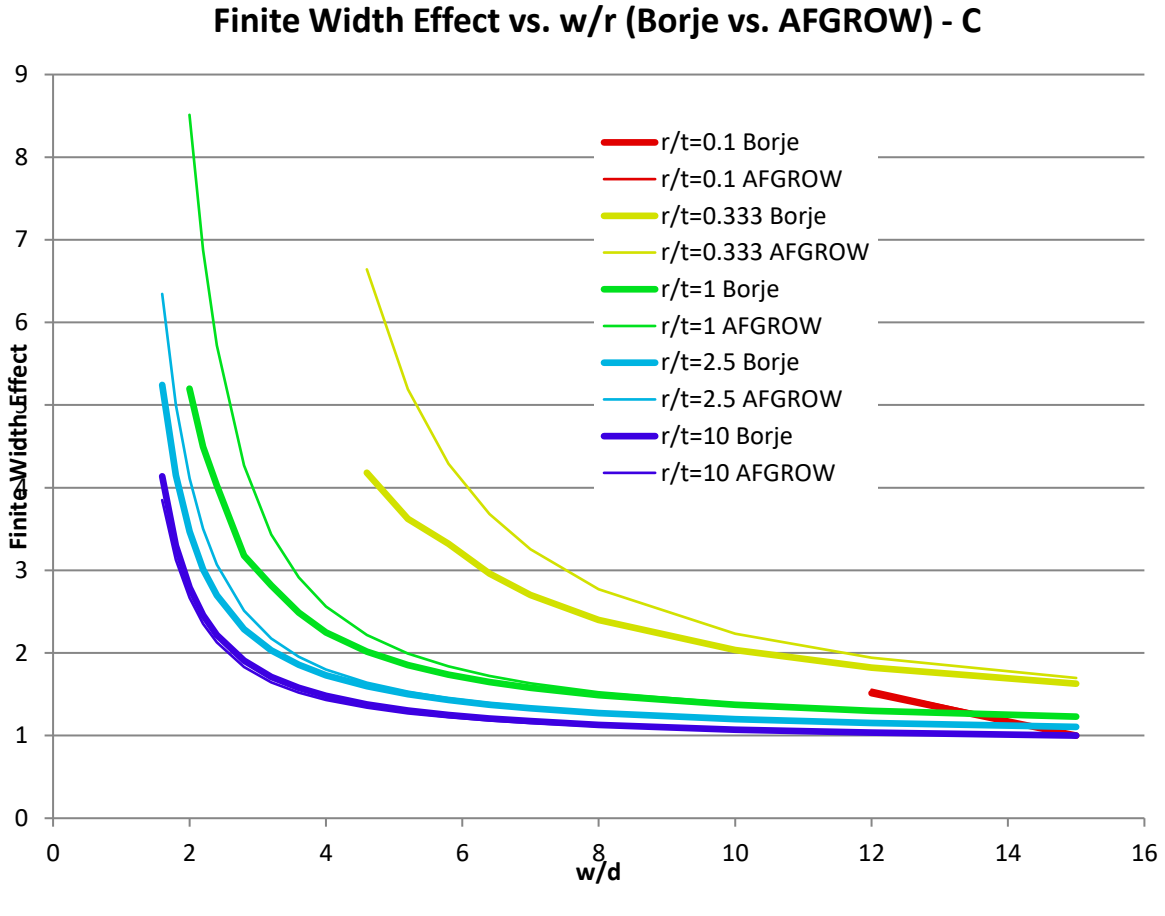




Width Correction : A/C – 0.5, A/T – 0.5

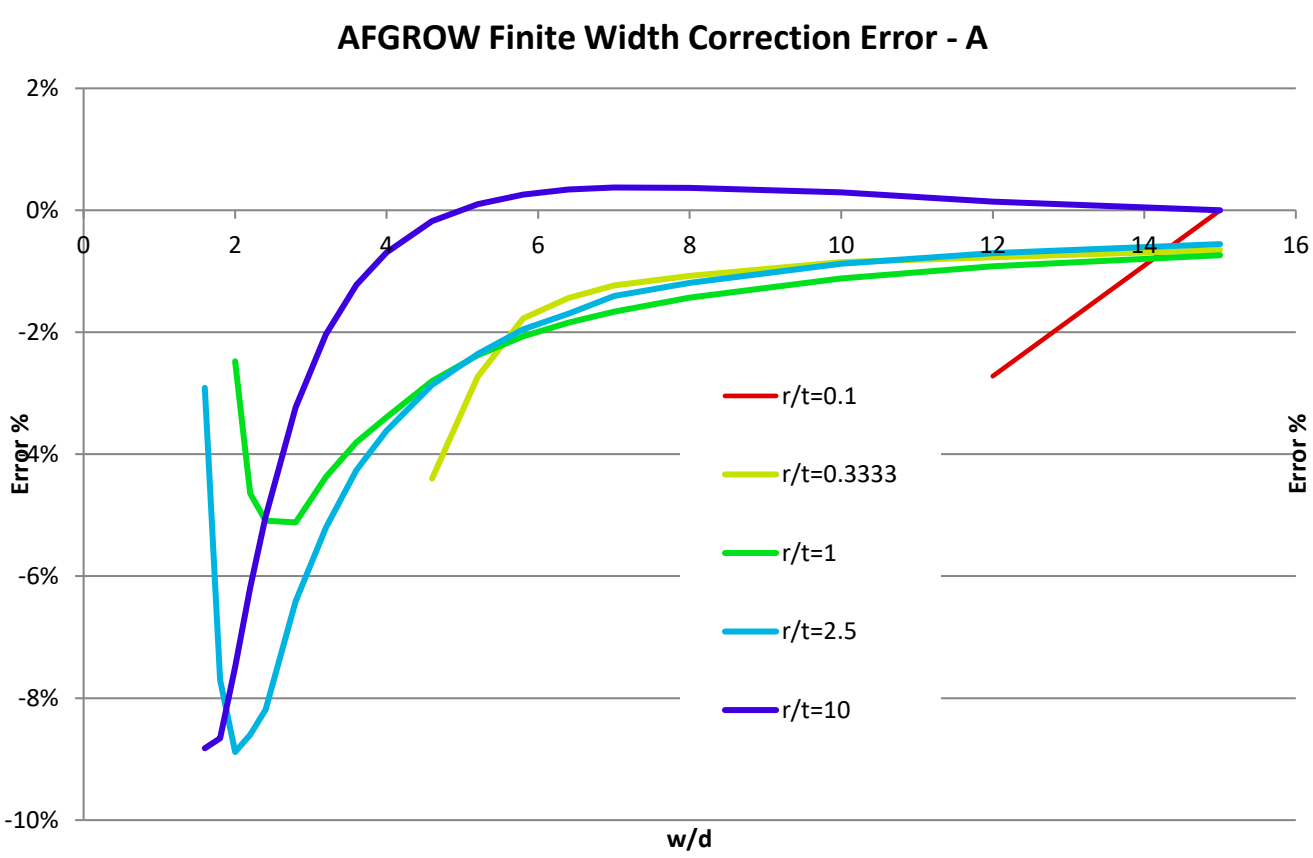
a/c	a/t
0.5	0.5

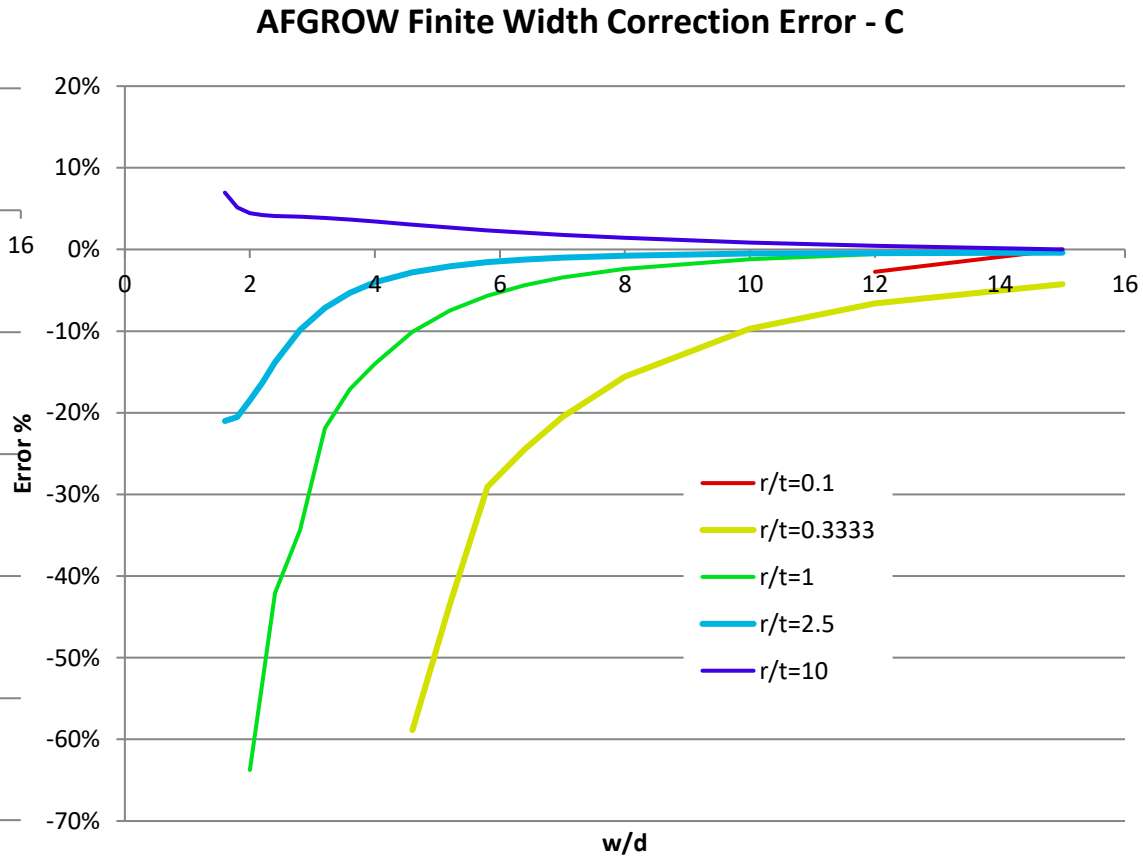




Width Correction Error: A/C – 0.5, A/T – 0.5

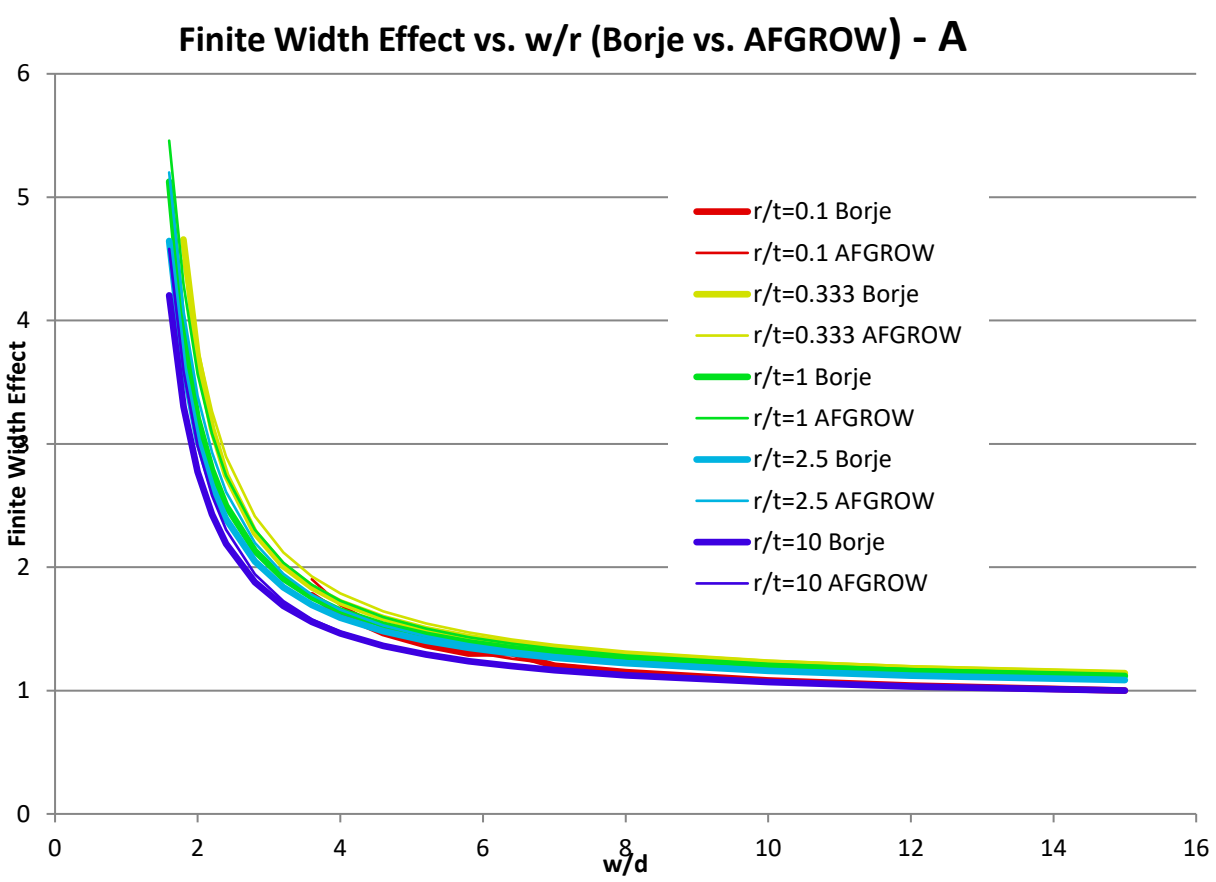
a/c	a/t
0.5	0.5

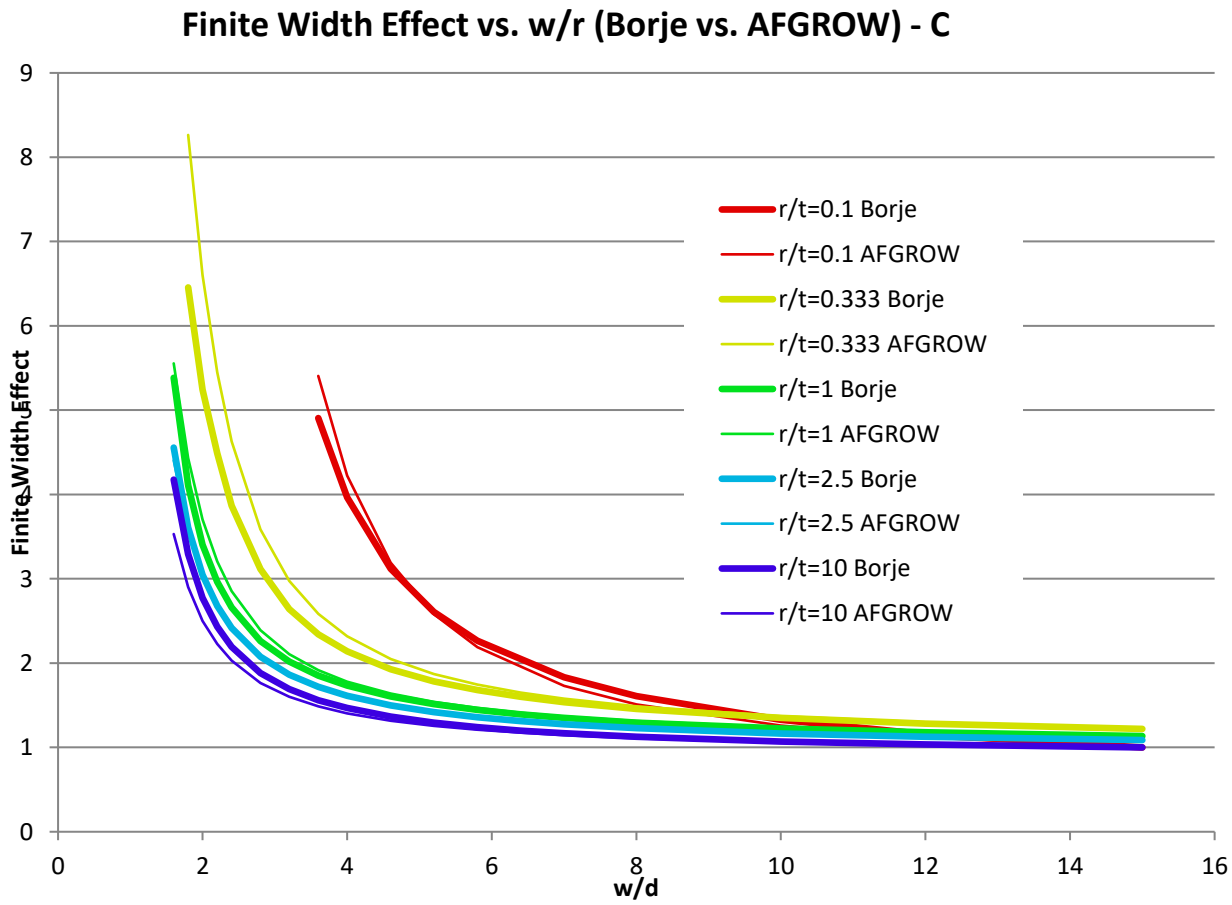




Width Correction : A/C – 2, A/T – 0.5

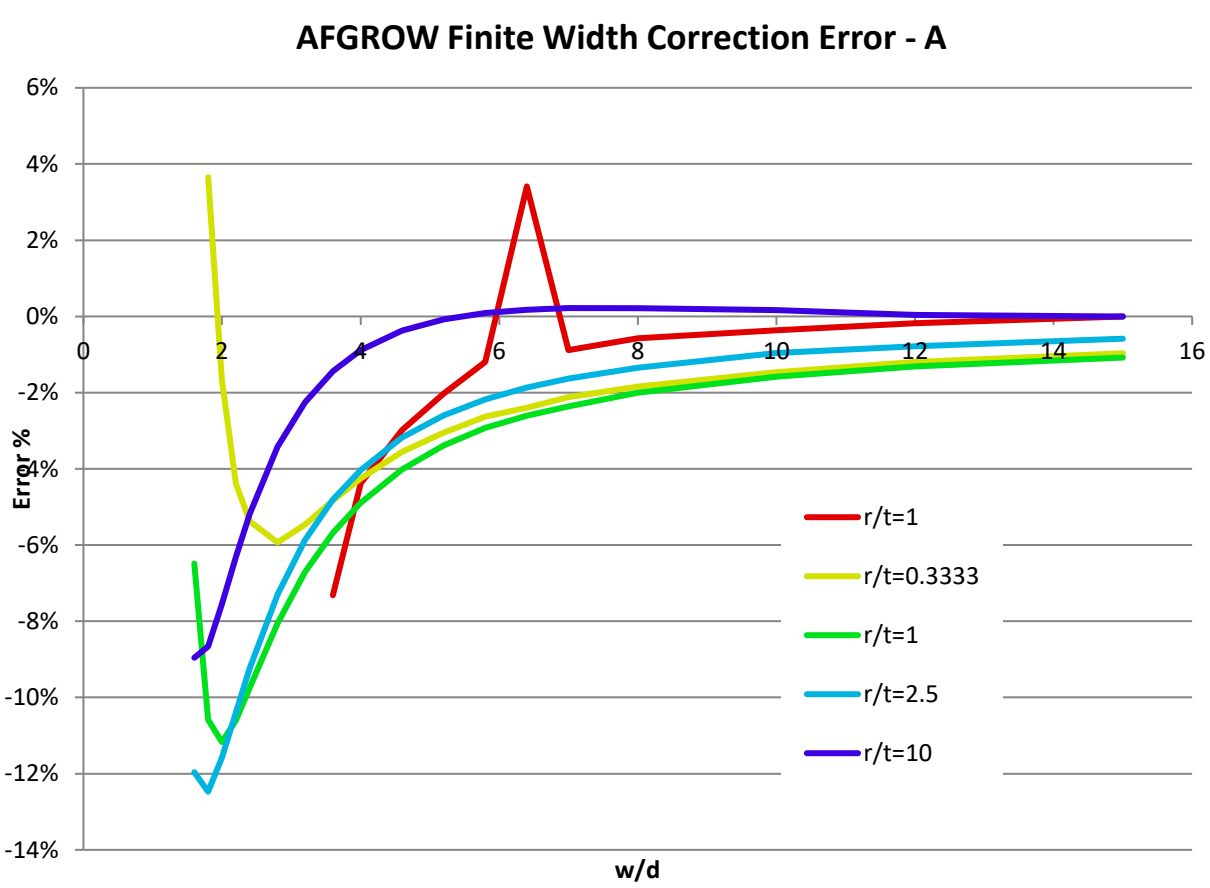
a/c	a/t
2	0.5

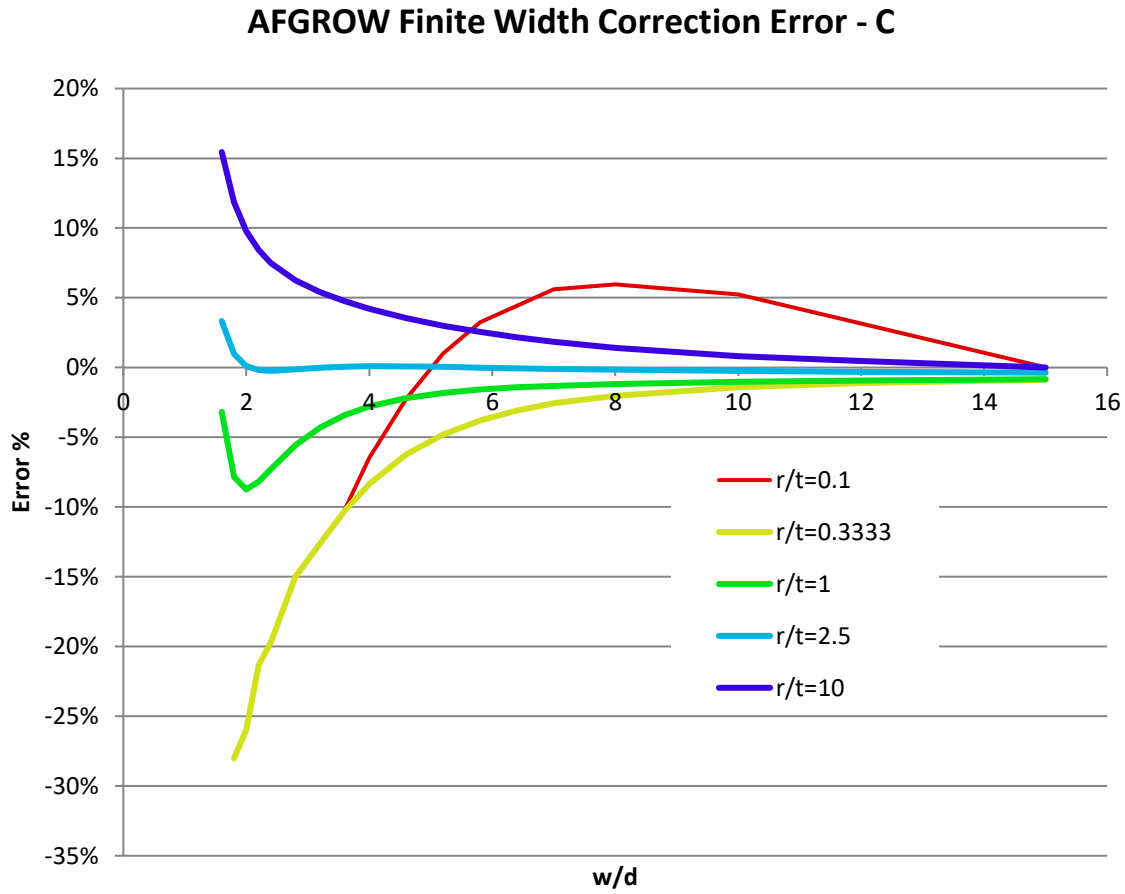




Width Correction Error: A/C – 2, A/T – 0.5

a/c	a/t
2	0.5



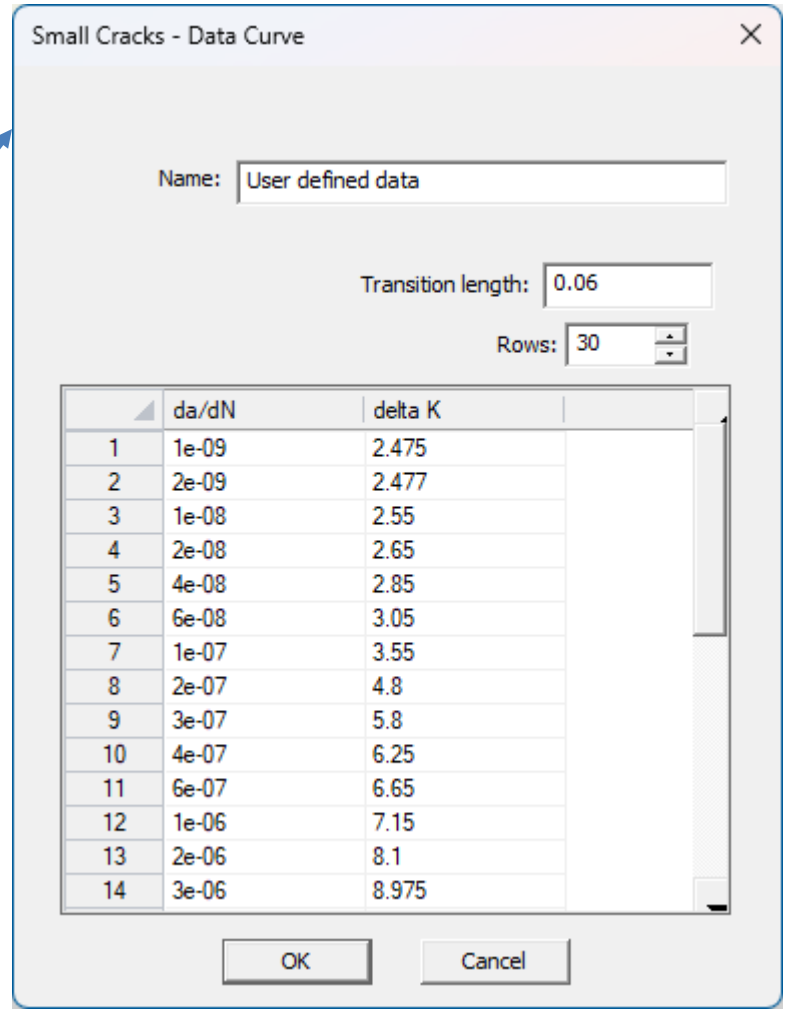


“Short Cracks” and Plastic Zone Investigation

Using crack growth analysis of short “cracks” with the use of currently available material data can lead to unrealistically long life. AFGROW team proposed 2 different solutions to handle growth of the “short” cracks

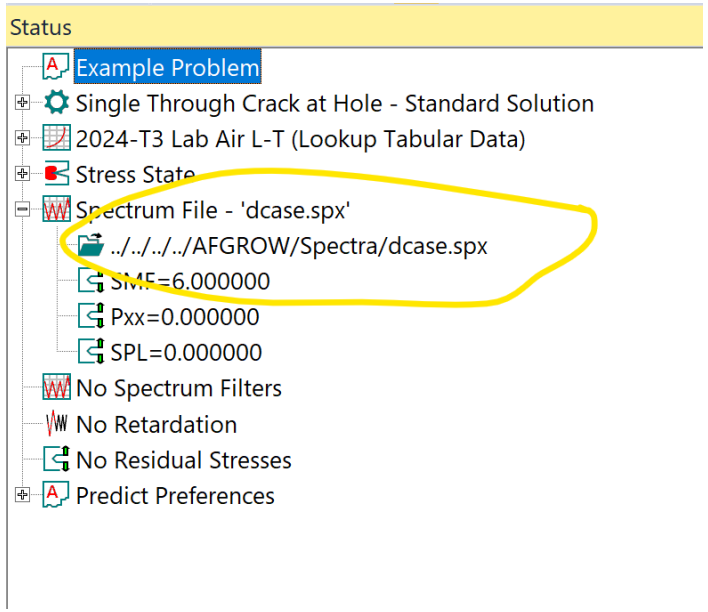
1. Universal short crack data curve that is applicable for all stress ratios and can be used with all AFGROW material models. The analysis is performed based on 2 sets of material data depending on crack length C_{tr} that governs transition from ”short” to “long” crack data. (*Presented at the ASIP Conference 2022 by Thiery Stehlin*)

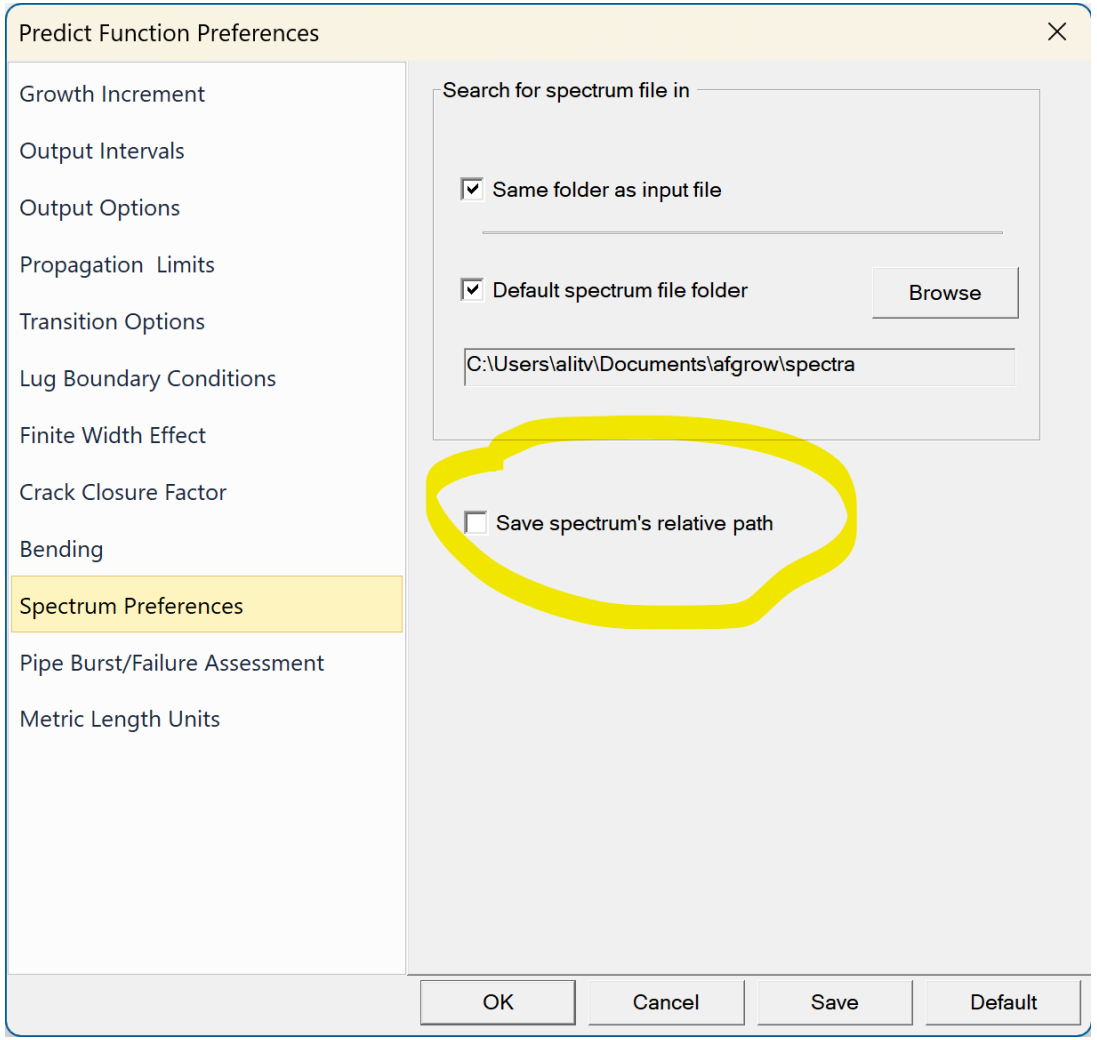
2. Use of a single set of crack growth rate curves with lower threshold data obtained from crack growth rate tests using compression pre-cracking techniques.



Save Spectrum Location by a Relative not a Full Path

- Added option to **Save spectrum's relative path** to the spectrum preferences
- This preference is local, AFGROW will not save this preference in the .dax file
- AFGROW will show the relative path in the status view is this option is selected and the location of the .dax file in known
- The full spectrum's file path will not be saved if this option is selected





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AFGROW Post-Processing Web Application

What is the AFGROW Post-processing Application?

- The AFGROW Post-processing Application is a web app that can be accessed from your browser which organizes data from AFGROW .xml output files. After uploading a file, the application generates several tables and plots that can assist the user in evaluating AFGROW crack growth prediction results.
- When you securely upload an AFGROW xml output file to our server, the web application processes the results to create helpful graphs and tables in your browser. We do not save any user submitted data or generated reports.
- Is not authorized for the storage, processing, or transmission of Controlled Unclassified Information (CUI).
- It is still in beta development stage

How To Access and Use the Post-processing Application

The AFGROW Post-processing Web Application is live now. You can access it at https://www.afgrow.net/post-processing. To upload your file, click *File Upload* or Drug and Drop your file in the upload designated area. Then, click *Choose File* and select the file you wish to upload and evaluate with the app. After selecting a file, its name will be visible next to the *Choose File* button. Finally, Click *Generate Report*. A page should now be loaded with your post-processing results.

Post-processing: Application Features

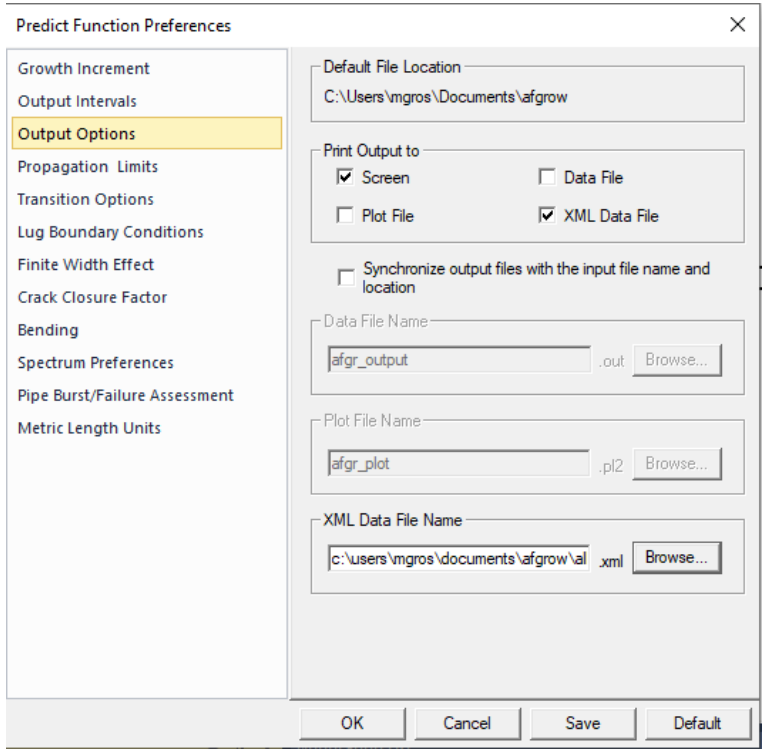
The Post-processing Application has several sections, each of which present information related to the different components of the analysis. All plots and data tables display the units of the reported data. All the reported data can be exported and a text of as a picture, when it is appropriate. The complete report page can be saved as pdf file.

You may see even more sections than those listed below. These sections can be used to give additional perspective about the prediction results. As we improve this tool, more sections will become available. It is still work in progress.

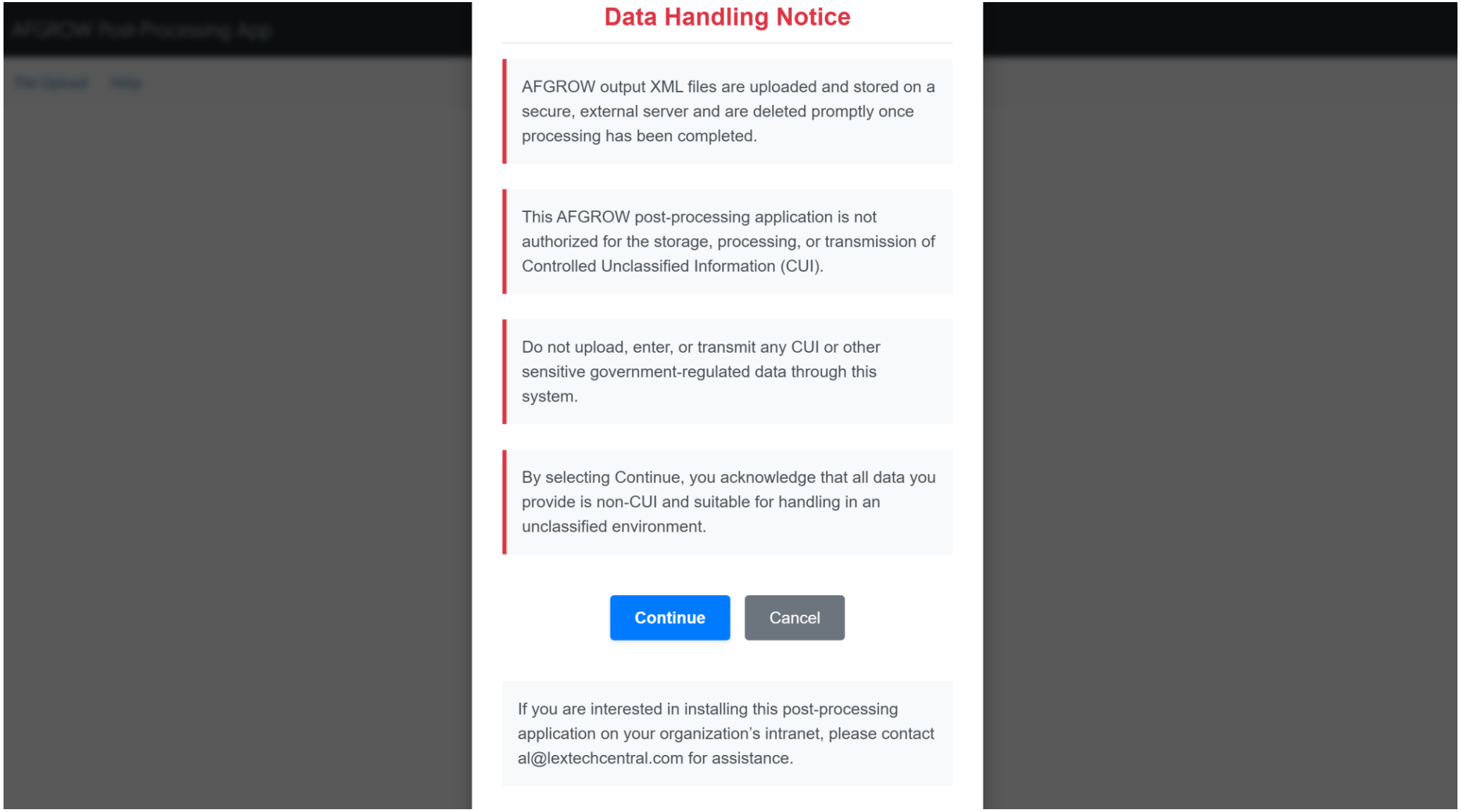
- Model Description
- Spectrum Information
- Crack Growth Output
- Crack Length vs Life Sections
- Beta vs Life Sections
- Multiple Pipeline Related sections including FAD diagram
- K vs Crack Length
- Beta vs Crack Length
- AoC vs Life (cycles or hours)
- AoT vs Life (cycles or hours)
- Crack Growth Rate Summary
- Damage Tag Summary
- Residual Strength Diagram

AFGROW Preferences

- Save your output from AFGROW to an XML file
  - Predict Preferences -> Output Options -> check the “XML Data File” box -> specify XML file name
  - After running the analysis, the xml file will be created in your designated location with the calculated results



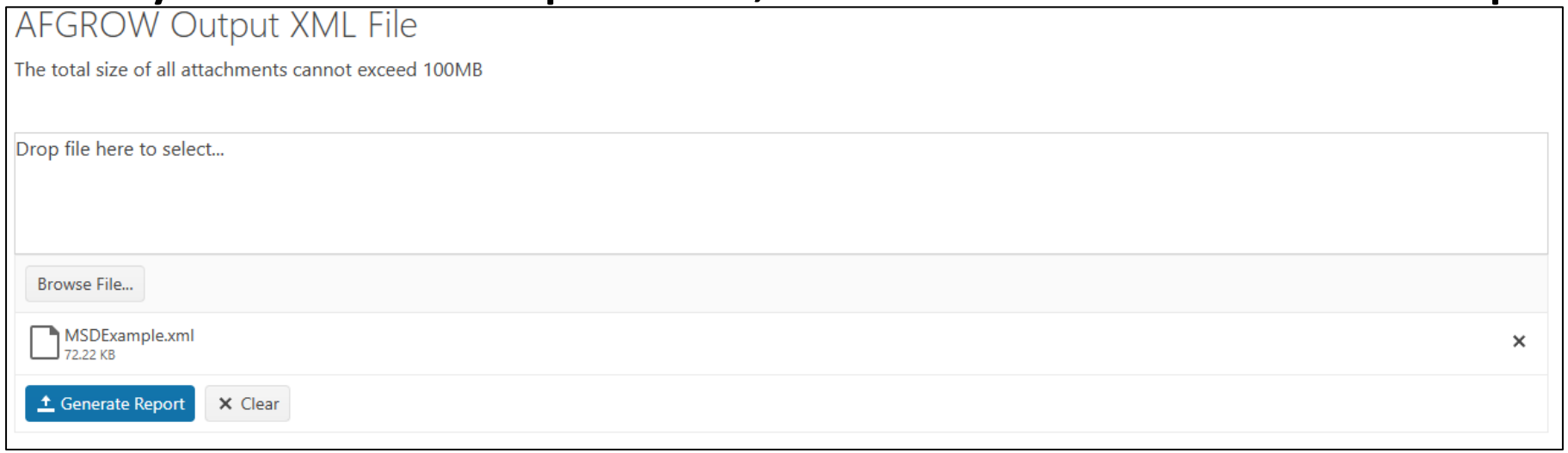
Controlled Unclassified Information (CUI) Acknowledgement



Uploading XML File

- Visit the Post Processor page (https://www.afgrow.net/post-processing)

- Upload your .xml output file, then click “Generate Report”



Notification Summary

Notification List

	Model	Condition	Cycle	Description
⚠	5101	0.03125 <= a/c <= 2.0	0	a/c ratio [0.01] is outside of the valid range
⚠	5101	0.01 < t/Do <= 1.0	0	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model
⚠	5101	0.03125 <= a/c <= 2.0	100	a/c ratio [0.01] is outside of the valid range
⚠	5101	0.01 < t/Do <= 1.0	100	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model
⚠	5101	0.03125 <= a/c <= 2.0	200	a/c ratio [0.013
⚠	5101	0.01 < t/Do <= 1.0	200	t/Do ratio [0.07
⚠	5101	0.03125 <= a/c <= 2.0	300	a/c ratio [0.018
⚠	5101	0.01 < t/Do <= 1.0	300	t/Do ratio [0.07
⚠	5101	0.03125 <= a/c <= 2.0	400	a/c ratio [0.026
⚠	5101	0.01 < t/Do <= 1.0	400	t/Do ratio [0.07

Notifications

Export to Excel

Search...

Model	Cycle	Message
5101	0	a/c ratio [0.01] is outside of the valid range (0.03125 <= a/c <= 2.0)
5101	0	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model (0.01 < t/Do <= 1.0)
5101	100	a/c ratio [0.01] is outside of the valid range (0.03125 <= a/c <= 2.0)
5101	100	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model (0.01 < t/Do <= 1.0)
5101	200	a/c ratio [0.0133856] is outside of the valid range (0.03125 <= a/c <= 2.0)
5101	200	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model (0.01 < t/Do <= 1.0)
5101	300	a/c ratio [0.0185868] is outside of the valid range (0.03125 <= a/c <= 2.0)
5101	300	t/Do ratio [0.075] is outside of the valid range for the MAT-8 Burst Model (0.01 < t/Do <= 1.0)
5101	400	a/c ratio [0.026936] is outside of the valid range (0.03125 <= a/c <= 2.0)

1 10 items per page 1 - 10 of 10 items

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Summary

- New Post-Processing tool available online at AFGROW.net

(https://www.afgrow.net/post-processing)

- Currently can use regardless of maintenance status to use/access
- Still a beta version, more features and capabilities cold/will be added in the future
- Is not authorized for the storage, processing, or transmission of Controlled Unclassified Information (CUI)
- How useful is the current web-based implementation?

Acknowledgements

- A-10 and T-38 Structural Integrity and Analysis Group
- ASIMIS
- AFGROW Customers and Consortium Members

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Questions