# FREQUENTLY ASKED QUESTIONS

## *Can you provide thickness of structural layers and/or corrosion barrier at individual reading locations?*

Because the sonic velocity varies significantly (up to 15% variation within the same laminate) we take a number of readings to determine an amalgamated thickness measurement. We are unable to provide highly accurate thickness values at any single measurement point. The sonic velocity varies along the entire thickness, including the corrosion barrier and at this time we would have even less certainty regarding the corrosion barrier thickness at any single measurement point. We are able to provide our thickness calculation at each point; however, it should be noted that this is derived. There would be an additional cost for this work.

Note that the thickness of both the corrosion barrier and the structural layers has hardly any effect on life of service. In the vast majority of our inspections they don't change over time. What does affect life of service is the varying diffusion of chemical damage to the corrosion barrier which is not linear from the contact surface to the bonded surface to the structural layer and it doesn't change the thickness of the corrosion barrier at all.

## *Can you provide PDS at individual reading locations?*

Because of the variation in individual readings and FRP condition, we aim to collect a minimum of 30 data points for a statistically significant PDS value. We do not generally report PDS at individual reading locations due to the low degree of certainty for a single sample.

## *Can you calculate actual flexural modulus?*

Calculation of current flexural modulus, if sufficient information is available for it to be determined, is beyond the scope of our MI reports. In cases where PDS has decreased to a dangerous level, we recommend in-depth Engineering Review to determine actual safety factor given current PDS, design conditions, material parameters etc. We have found that we don't need to know the current flexural modulus to comment on suitability for as we work back to current PDS instead.

## *For repeat inspections, why don't you predict RSL based on the measured change over time?*

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We are developing updates to our RSL prediction based on improved learning about how FRP changes over time. In the meantime, we continue to take the conservative approach of a linear rule from baseline of 100% for a conservative result of estimated RSL.

### *How can PDS values (or repad bonding values) increase over time?*

This can be due to variations in reading location (which often depends on access), improvements to the accuracy of the calculation in the software (moving from a conservative analysis to a more accurate analysis), or simply to variation in the data. If the variation is within about 15% of the original readings, they could be considered to be the same.

### *What does the bonding percentage mean practically? What corresponds to a value of 100% and 50%?*

Percentage of Bonding is used to indicate where defects exist or are developing. Bond value is a function of surface preparation and lamination quality, as well as changes to the laminate over time.

A bond value of 100% corresponds to no visible interface between the underlying structural layers and the reinforcing pad. At this time, the threshold of 50% represents a threshold for bond acceptance which is based on values drawn from ASME RTP-1 where bond shear strength is stipulated to be 2000 psi (14 MPa) and the “allowable” value of 7 MPa is to be used for design.

### *What is the difference between ‘damage’ and ‘minor damage’ to the corrosion barrier?*

We classify damage as minor if it is only observed in a small percentage of readings or appears to only affect the inner surface layers.

### *Can you specify the nature of corrosion barrier damage (e.g. permeation, softening, delamination)?*

We can detect the effect of the fluid on the corrosion barrier or thermoplastic liner throughout the whole thickness and whether it has affected the structural layer.

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### *How does corrosion barrier condition affect suitability for service and remaining service life?*

Damage to the corrosion barrier will often reduce the PDS before any damage has occurred to the resin in the structural layers. This allows UltraAnalytix™ to identify issues at an early stage, even when there is no indication within the reading to allow us to determine where resin damage has occurred. FRP with these changes is included in the correlation data that has been presented. The approach used by UltraAnalytix™ is to consider the FRP as a system, so that significant CB damage has the same effect as mechanical damage.

### *Is there a file size limit for the file upload site?*

No. Any limits on file upload size are set by the local Internet Service Provider, not by the UTComp® upload site.

### *Do you have calibration blocks?*

No. Our research has proven that calibration blocks are not required. Our non-destructive results are correlated to destructive results for a large number of FRP samples. This correlation is confirmed by independent third parties at University of Alabama and York University, as well as a number of clients that have performed direct comparisons. Within UltraAnalytix™ files, we take calibration readings at the start and close of each file.

### *How is the Critical PDS value of 40% determined?*

Our experience has shown that FRP assets with PDS in this range are at risk of failure. At 40% PDS, we recommend that the vessel be replaced, or an in-depth Engineering Review be conducted to determine actual current factors of safety for as-built thickness and current modulus, in order to more accurately assess remaining service life. We have learned this because of failures that educated us.