A, B, C OR X, Y, Z ???

PTS FEEDBACK & Z-SCORE ANALYSIS REVISIONS

RPF

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CSIR Conference Centre

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Discussion to include…

- Overview of PTS todate
- Revised Methodology
- Bitumen
  - Provisional results
- Soils & gravels
  - Revised results
- Asphalt
  - Revised results
- Future plans

PTS undertaken todate

- This process of PT schemes is now in its 3rd year & 4th PTS
- 1st PTS – S&G
  - Grading analysis
  - Atterberg limits
- 2nd PTS - HMA
  - BRD, Rice, % Binder, Stability & Flow, ITS
- 3rd PTS – Binders (provisional results)
  - Pen, R&B, BV, RTFOT
- 4th PTS – S&G
  - Current
  - CBR (based on MDD & OMC from 1 lab)
- 5th PTS - proposed
  - HMA retest

Methodology – the z-score

- Procedure recommended in ISO13258 Annex A
  - enables treatment of ‘outliers’ at the same time as producing robust values of mean & SD
- Consensus value is representative of each sample
  - No standard material available
  - Can be that the mean is not that accurate
- PT scheme **NOT** done to point figures
  - If used correctly
  - it will assist in improving each individual labs ability to undertake test methods correctly

Methodology …2

- A Z-score is a normalised value which gives a "score" to each result, relative to other numbers in data set

$$Z_i = \frac{x_{i-\bar{x}}}{s}$$

recommendations of SANS 17043:2010 as follows:

- **|z| ≤ 2** **Satisfactory**
- **2 < |z| < 3** **Questionable**
- **|z| ≥ 3** **Unsatisfactory**

A different approach by AMRL

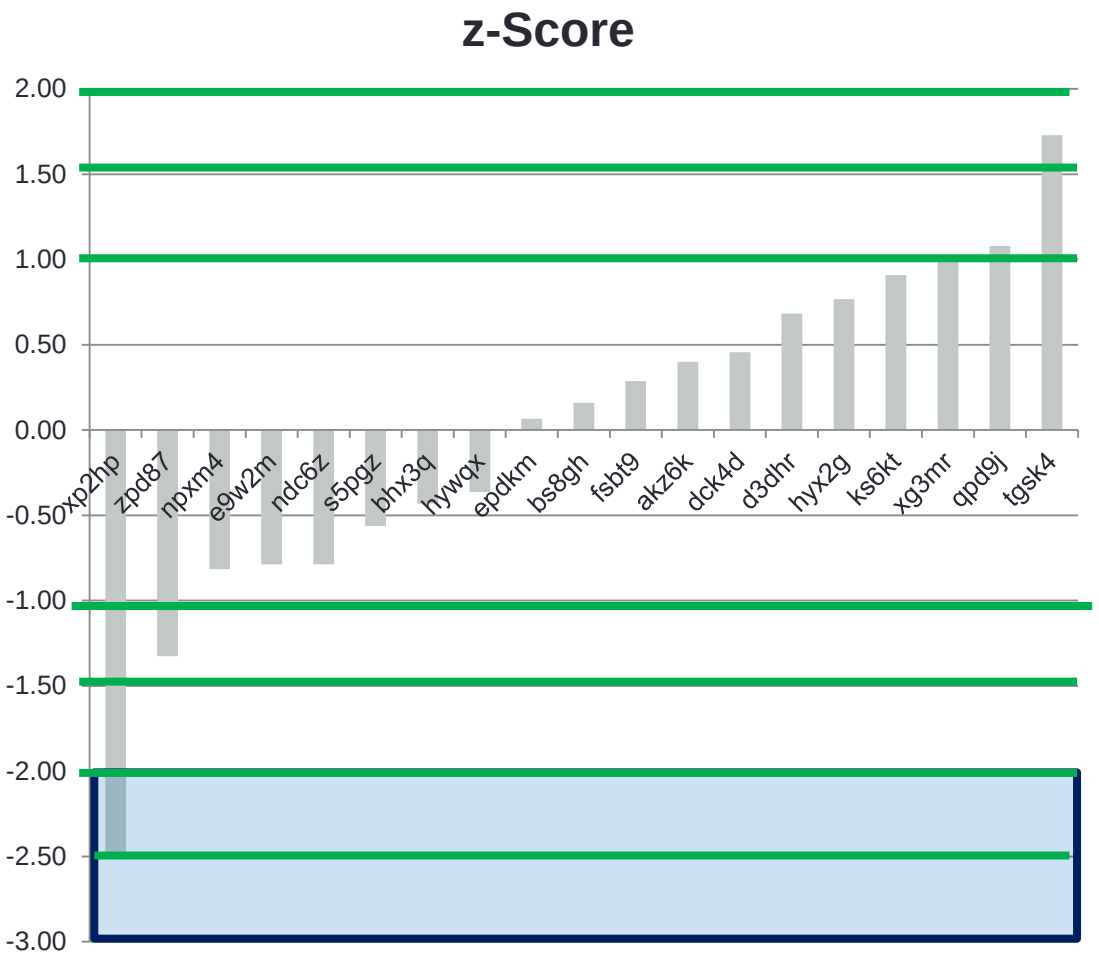
- AASHTO Materials Reference Laboratory
  - Z-Score <= 1 Rating = 5
  - Z-Score > 1 & <= 1.5 Rating = 4
  - Z-Score > 1.5 & <= 2 Rating = 3
  - Z-Score > 2 & <= 2.5 Rating = 2
  - Z-Score > 2.5 & <= 3 Rating = 1
  - Z-Score > 3 Rating = 0
- ASTM z-score more stringent than our current method
  - involves more labs
  - therefore better correlation
- Will shortly look at the graphical results with this system applied

PTS Bitumen results feedback

- Pen + R&B
  - Ok – sufficient participants
- RV
  - Ok but fewer participants
- RTFOT
  - Couldn’t make sense of results
  - Also way too few participants

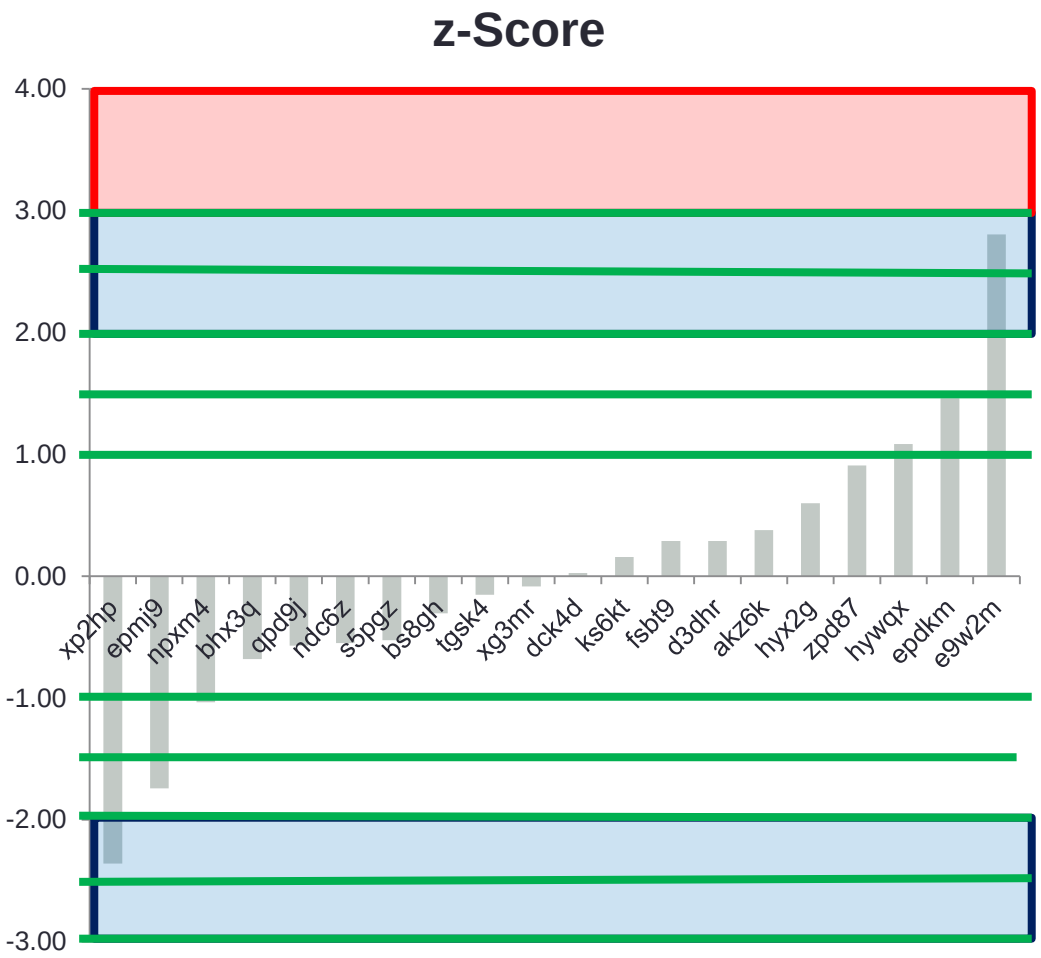
Bitumen PTS – Pen results

- Average = 60.3
- StdDev
  - **Spec = 5.0**
  - Calc = 5.89
  - Max = 70.5
  - Min = 45.7
  - Range = 24.8
- 19 labs
- 5 % (1) for std method
- 26 % (5) outside category >1



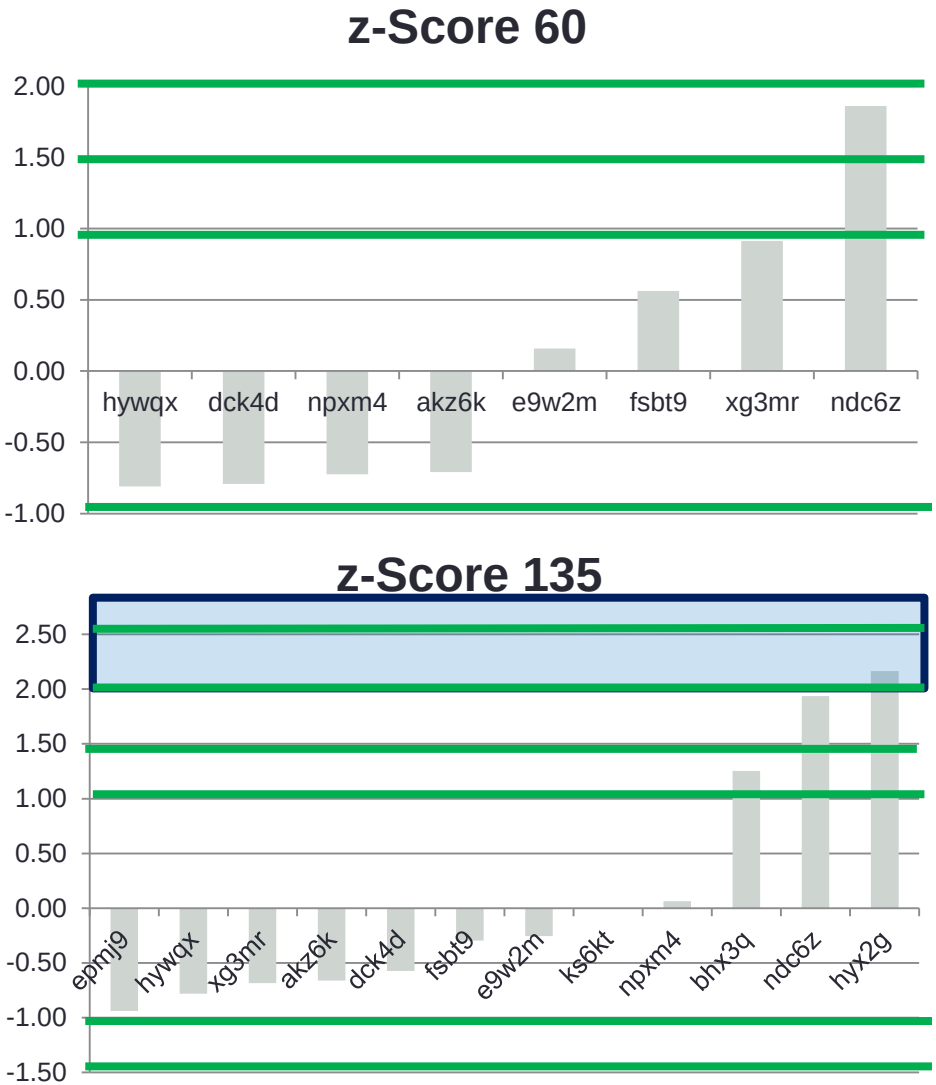
Bitumen PTS – Softening point

- Average = 50.7
- StdDev
  - **Spec = 5.0**
  - Calc = 1.13
  - Max = 53.9
  - Min = 48.0
  - Range = 5.8
- 20 labs
- 10 % (2) for std method
- 30 % (6) outside category >1



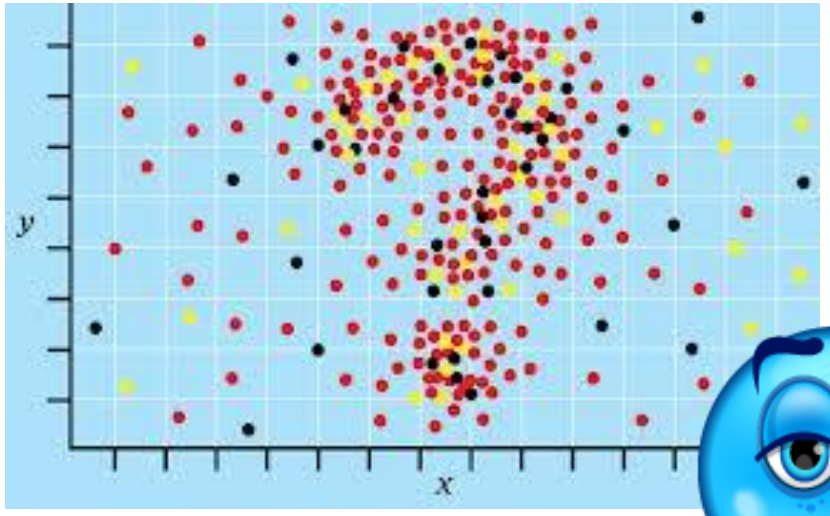
Bitumen PTS – Brookfield viscosity

- Average = 307 / 0.563
- StdDev
  - **Spec = 50 / 0.15**
  - Calc = 30.5 / 0.110
  - Max = 364 / 0.800
  - Min = 282 / 0.460
  - Range = 82 / 0.340
- 8 labs / 12 labs
- 0 % / 17% (0/2) for std method
- 1 / 3 outside category >1
  - 13 % / 25 % respectively



RTFOT

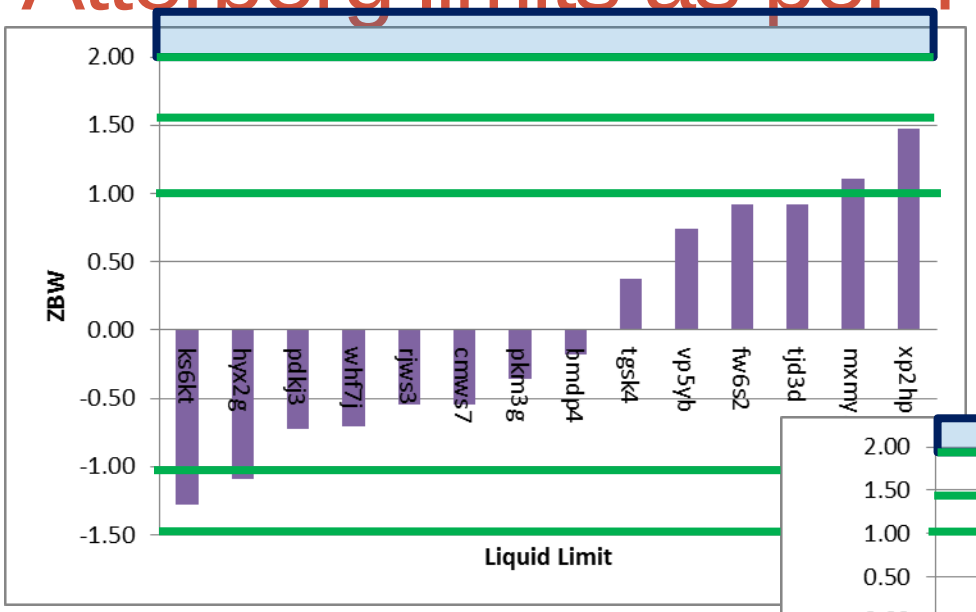
- No clear pattern
- Too few participants
- Information questionable at best



Applying revised analysis on Soils

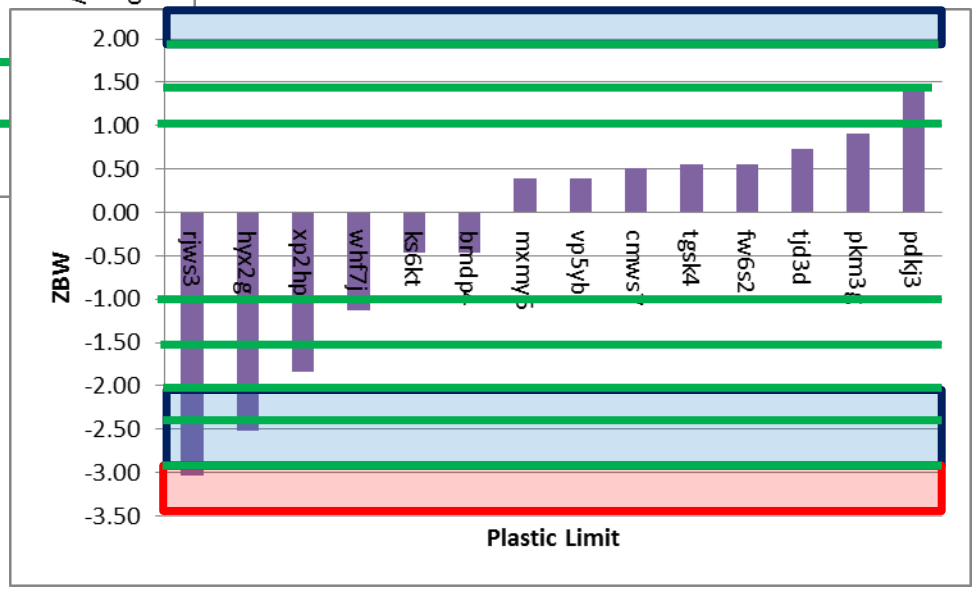
- A total of 15 samples for all tests analysed

Soils & gravels
Atterberg limits as per TMH 1

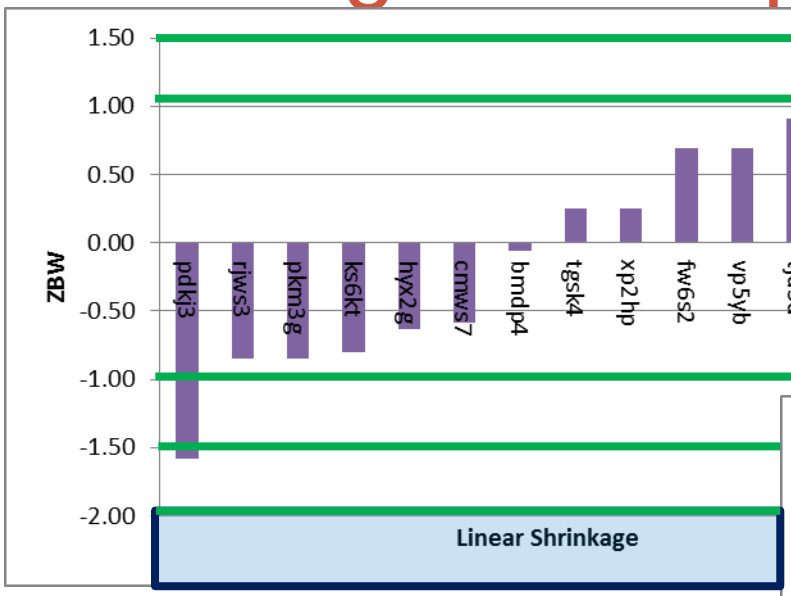


- All ok as per std analysis
- 27 % (4#) > 1

- 13 % (2#) outside std analysis
- 33 % (5#) > 1

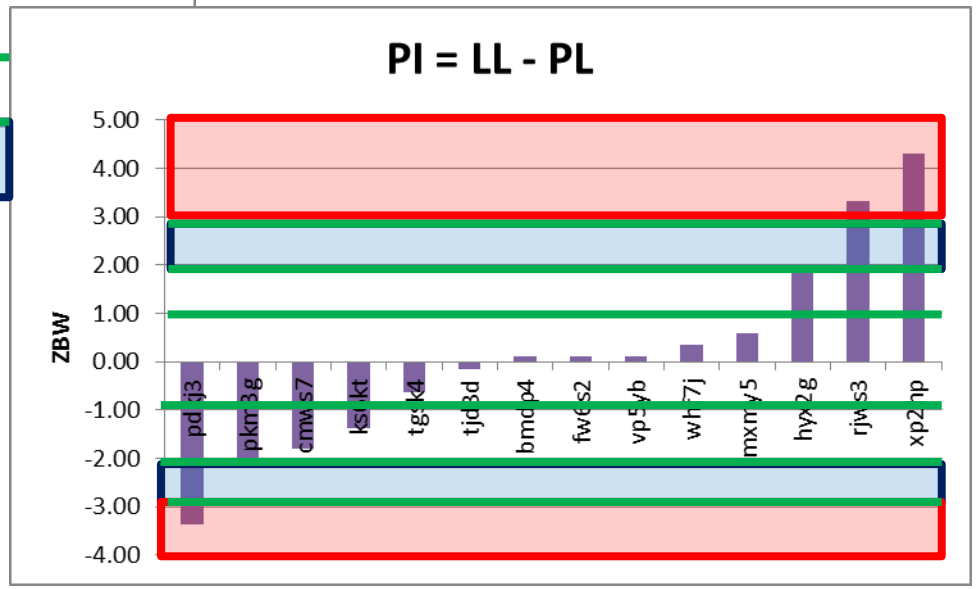


Soils & gravels
Atterberg limits as per TMH 1 …2



- All ok as per std analysis
- 20 % (3#) > 1

- 26 % (5#) outside std analysis
- 47 % (7#) > 1

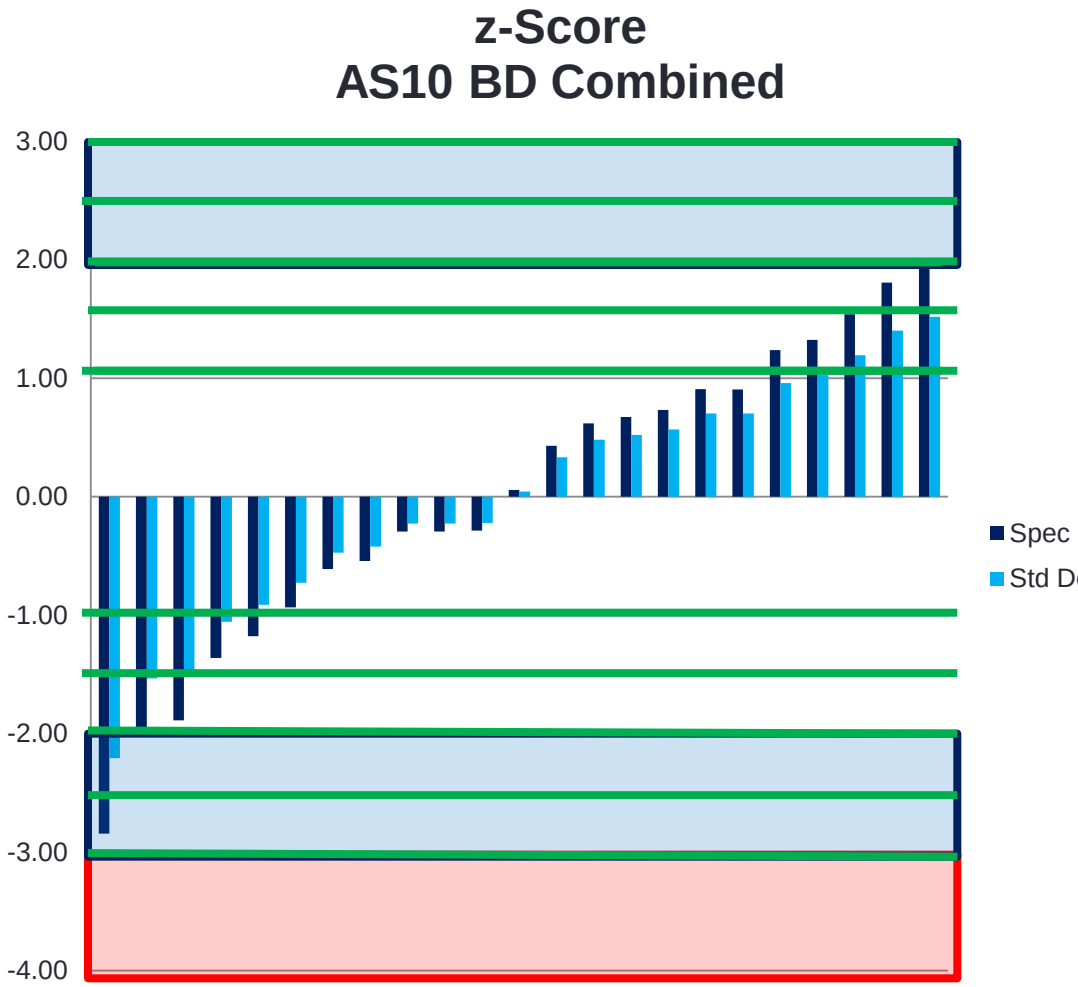


Applying revised analysis on Asphalt

- Between 23 – 27 results per test

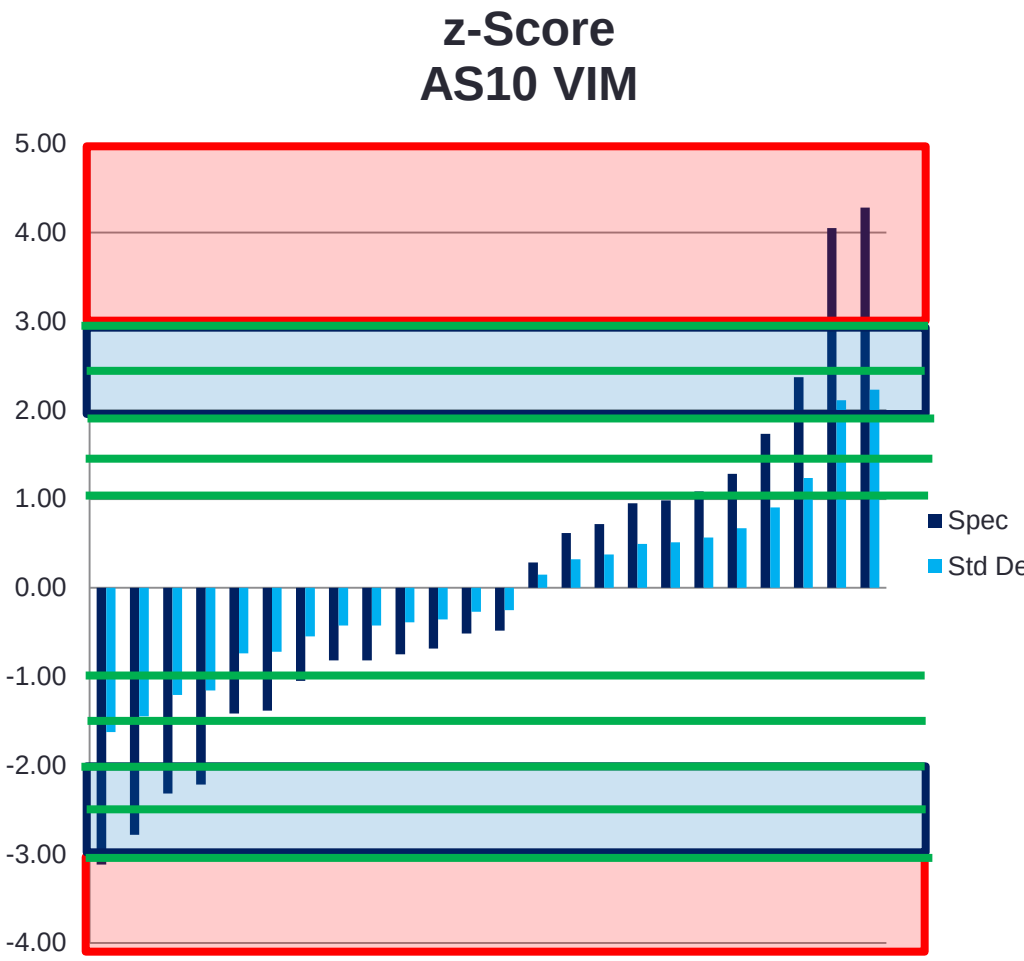
AS10 – BD (BRD)

- StdDev
  - **Spec = 0.020**
  - Calc = 0.258
- Range = 0.0960
- 23 labs
- 4 % (1#) outside std analysis
- 43 % (10#) > 1



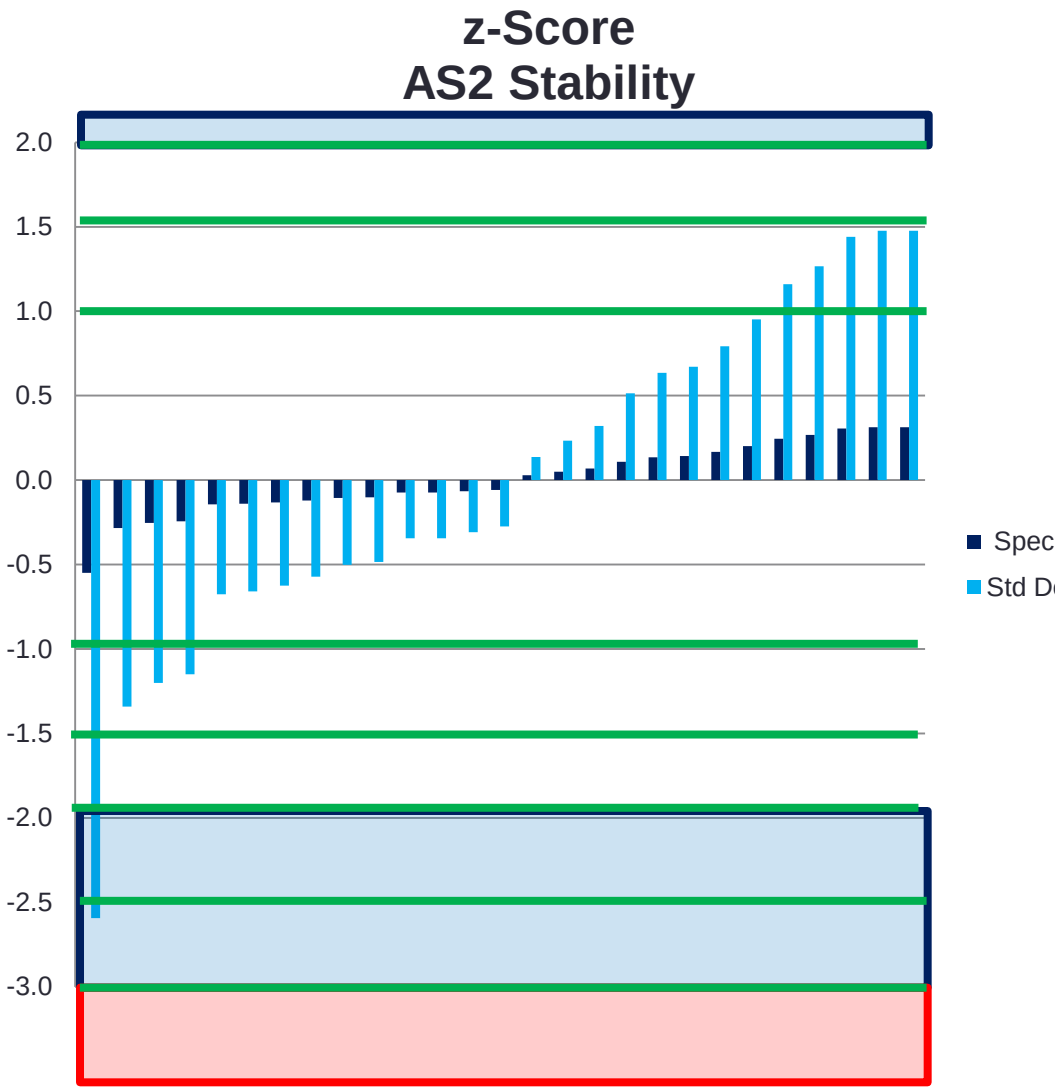
AS10 – VIM's

- StdDev
  - **Spec = 0.5**
  - Calc = 0.959
- Range = 3.7000
- 26 labs
- 27 % (7#) outside std analysis
- 46 % (12#) > 1



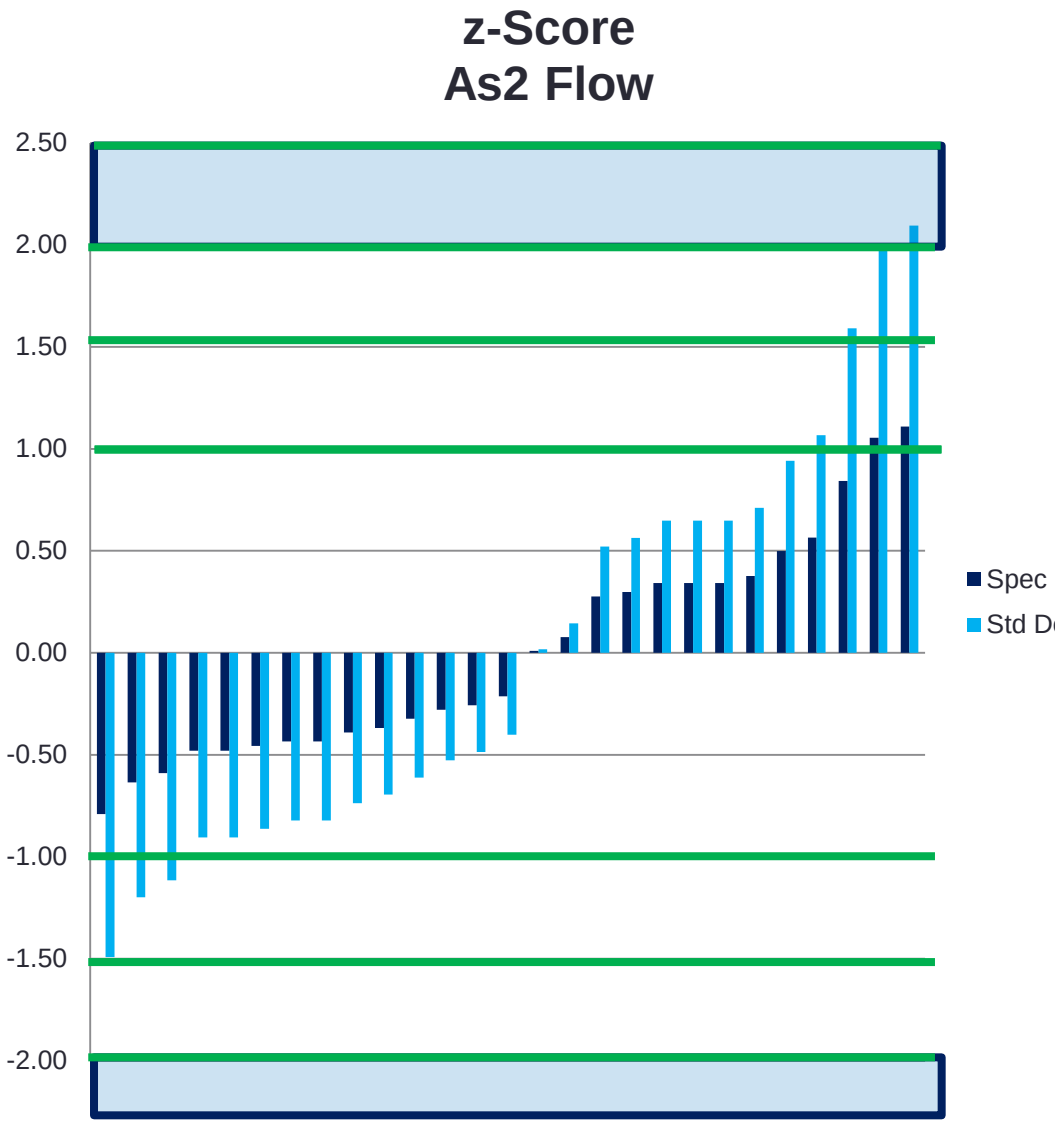
AS2 – Stab

- StdDev
  - **Spec = 9.0**
  - Calc = 1.905
- Range = 8.7
- 27 labs,
- 4 % (1#) outside std analysis
- 33 % (9#) > 1



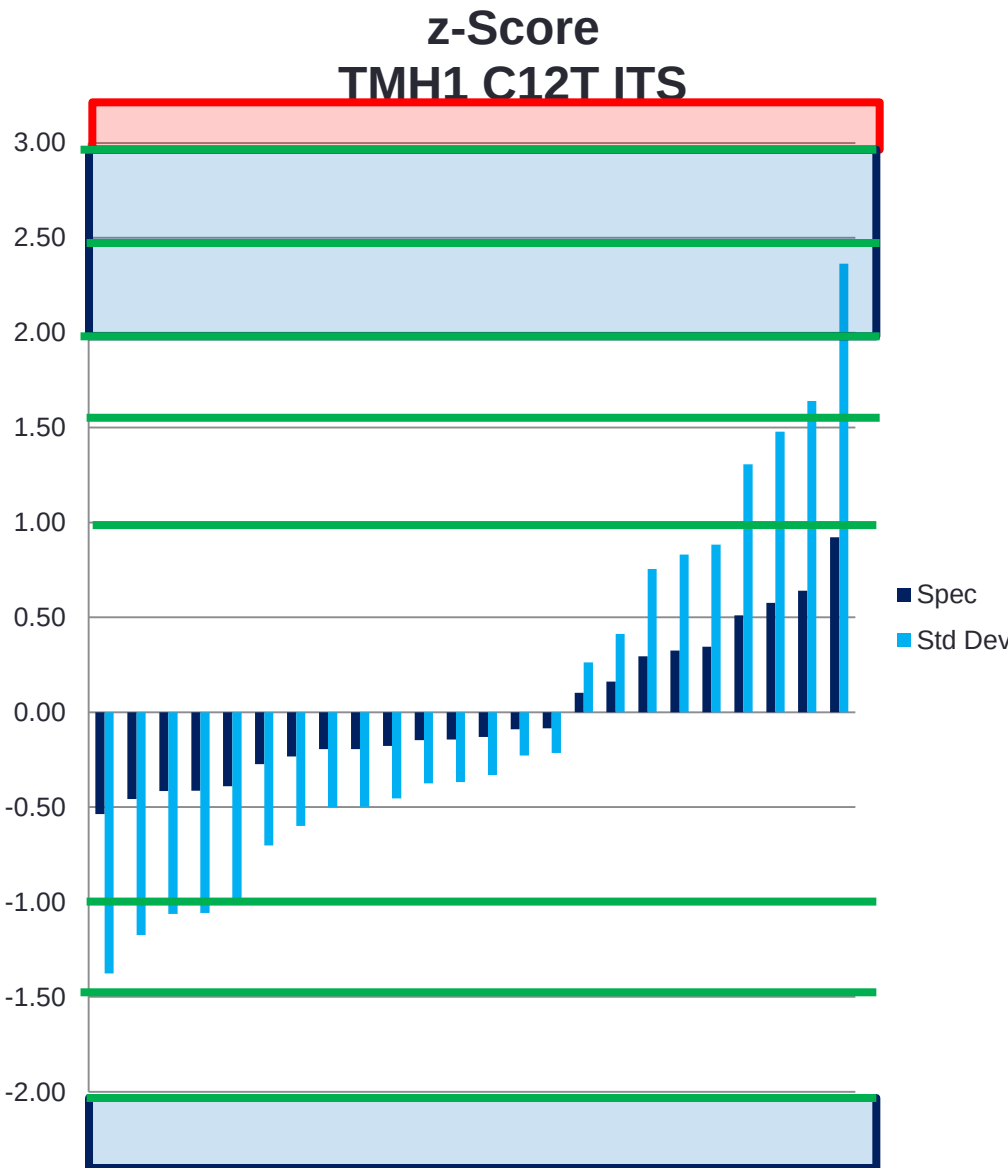
AS2 – Flow

- StdDev
  - **Spec = 1.5**
  - Calc = 0.79
- Range = 3.0
- 27 labs,
- 4 % (1#) outside std analysis
- 30 % (7#) > 1



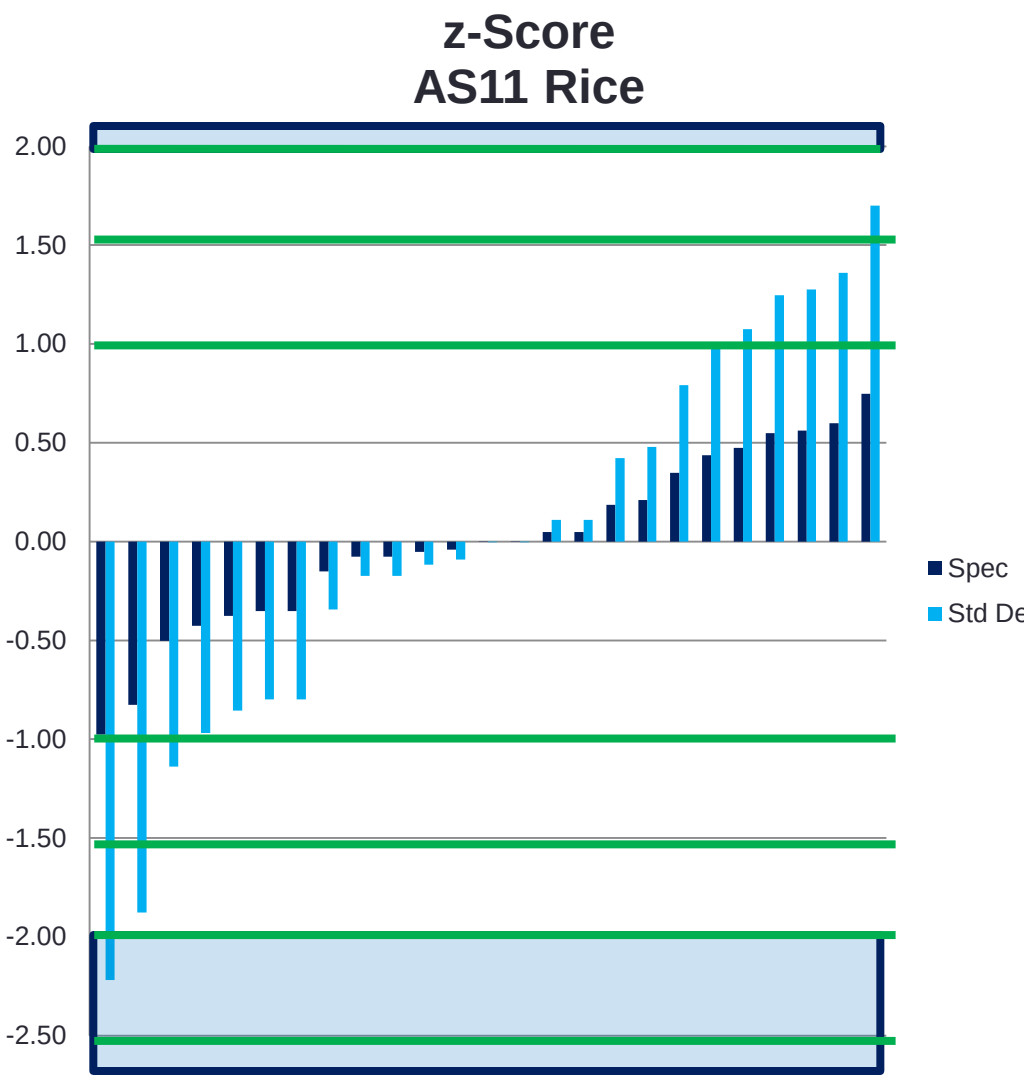
TMH1 C12T - ITS

- StdDev
  - **Spec = 900**
  - Calc = 351
- Range = 1 329
- 27 labs,
- 4 % (1#) outside std analysis
- 30 % (8#) > 1



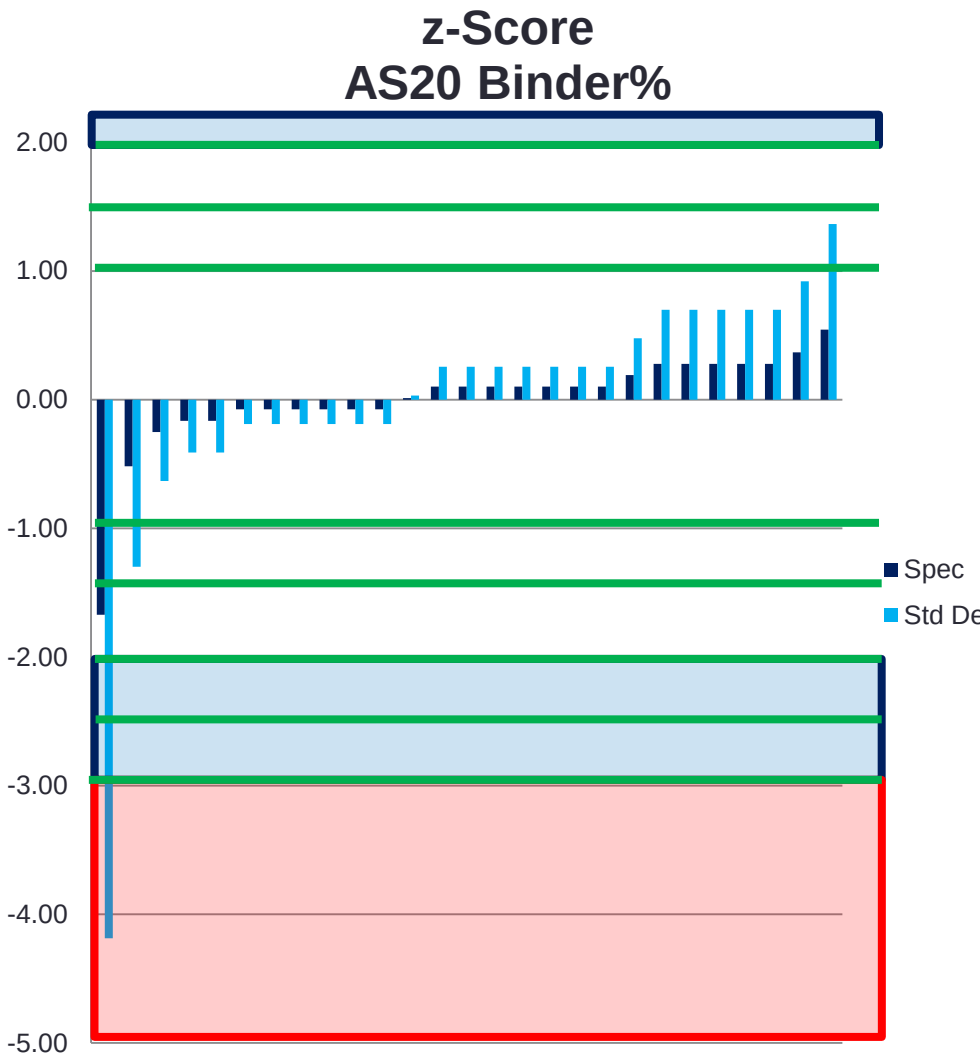
AS11 - Rice

- StdDev
  - **Spec = 0.020**
  - Calc = 0.009
- Range = 0.038
- 27 labs,
- 4 % (1#) outside std analysis
- 30 % (8#) > 1



AS20 – binder %

- StdDev
  - **Spec = 0.560**
  - Calc = 0.225
- Range = 1.4
- 27 labs
- 4 % (1#) outside std analysis
- 11 % (3#) > 1



So….. are we on the road or are we tying ourselves in knots?

- Looks like a good method to further sharpen up the results.
- Aiming for < 1
  - Indication that such labs need to pay a bit more attention to why their results fell outside the more stringent range
- Also need to cross-check spec ranges to ensure its still ok.
- Will also still evaluate & report on the standard z-score values

Future plans

- Binder report due out soon
- S&G CBR results
  - Aiming for before yearend 2013
- 2nd HMA early into 2014
- DSR protocols busy being developed
  - Very small sample
- Other PTS to added to HMA for 2014
  - Currently not detailed as yet

Revisions to be made

- Different approach to limit variability where possible
- HMA
  - Single lab to knock all briquettes for HMA
  - More consistent compaction envisaged
  - Stab&Flow, ITS, BRD should reduce stdev values
- S&G
  - MDD & OMC – 1 lab to determine values
    - CBR undertaken on these values
    - MDD & OMC done on its own without CBR into 2014

So are we making progress … ???

- Looks like we are heading in the right direction
- Everyone is still learning their way round the system
  - But looks like we're getting there
- For us in evaluating results
  - Still battling in getting the reports out timeous
- And for the labs in providing informatio
  - Particularly in the requested format & mann

In closing…

- **Purpose**
- to *improve consistency* of results between labs
- Assist in identifying your own internal areas that require attention
- addressing these issues
- Also a requirement for SANAS accreditation

- Still building towards a more *professional laboratory environment* that will be seen as being
- Trustworthy
- Honest
- Quality driven

- Keep at it – we'll get there!!

Thank folks…