*DESIGNED FOR QUALITY OR PENALTY?

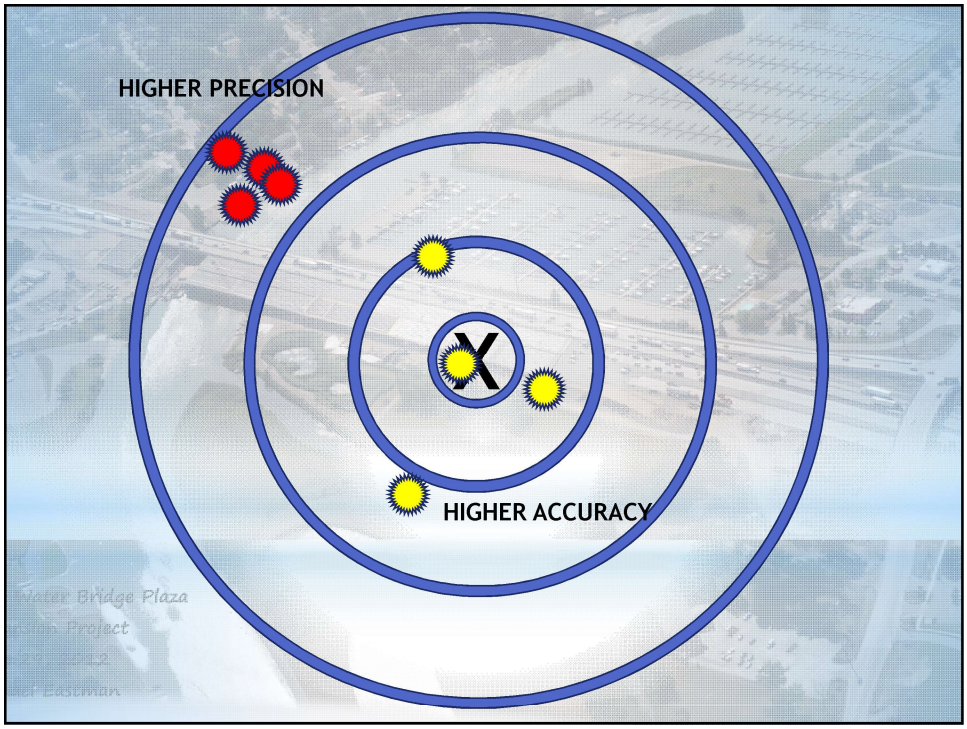
MDOT 12SP-604B-07 – Non PWL for Air When Pumping

*Questions

*WHY DO PENALTIES OCCUR?
  *15 year technician at the plant reporting 6.0% - 7.0% air…

*HOW OFTEN WILL PENALTIES OCCUR?
  *Can penalties be forecasted?

*WHAT CAN BE DONE TO REDUCE PENALTY FREQUENCY?



*Inherent Variability

*DATA MEASUREMENTS, EVEN WHEN GENERATED UNDER SIMILAR CONDITIONS MAY YIELD DISSIMALR RESULTS.

*THIS LACK OF PRECISION IS CALLED VARIABILITY.

*INHERENT VARIABILITY IS **THE REASON WHY** MY VETERAN'S AIR MEASUREMENT MAY BE DISSIMALAR TO OTHERS.

Air Meter Inherent Variability

- 12SP-604B-07 ALLOWS FOR VARIABILITY OF +/- 0.8%
  - QC TO QA AIR METER CORRELATION RANGE.
- +/- 0.8% IS PRECISION STATEMENT FROM C-231 FOR TYPE A (ACME) AIR METER.
- PRECISION STATEMENT FOR TYPE B AIR METER HAS NOT YET BEEN RATIFIED BY ACI.

Air Meter Inherent Variability

- **ACI SUBCOMMITTEE C09 – Interlaboratory study to establish precision statements for C231/C231M.**
- X2.2 *Air content in the range of 3% to 8%--*The multilaboratory standard deviation was found to increase with air content as shown in Table A. Therefore, results of two properly conducted tests by different laboratories on the same material are not expected to differ from each other by more than the value shown in the last column of the lower-half of Table A.

TABLE A Indexes of Precision for Air Contents Between 3 % and 8 %[B]

Air Content	Standard Deviation[A], %	Acceptable Difference Between Two Results[A], %
Single-operator precision:		
3%	0.12	0.33
4%	0.16	0.44
5%	0.19	0.55
6%	0.23	0.66
7%	0.27	0.77
8%	0.31	0.88
Multilaboratory precision:		
3%	0.17	0.49
4%	0.23	0.65
5%	0.29	0.81
6%	0.35	0.98
7%	0.40	1.14
8%	0.46	1.30

[A]These numbers represent the difference limits (d2s) as described in Practice C670.

*Pumped Concrete Variability

Sample Locations Investigated:

1) End of the chute
2) End of the pump – vertical configuration & no flow restrictions
3) End of the pump – vertical configuration, 5" to 4" line with "S" bend pipe
4) End of the pump – horizontal configuration, 5" to 4" line with "S" bend pipe
5) Horizontal configuration, 5" to 4" line with "S" bend pipe – 10 seconds of vibration
6) Horizontal configuration, 5" to 4" line with "S" bend pipe – 60 seconds of vibration

Sampling Location	Air Content (%)	Air Loss (%)	Air Loss as % of Chute Value	Paste Content (%)	Specific Surface (mm-1)	Air Void Content (%)	Spacing Factor (mm)
1 – Chute	7.4	--	--	20.2	23	7.7	0.114
2 – Vertical no restriction	2.4	5	67.6	--	--	--	--
3 – Vertical with restriction	3.8	3.6	48.6	--	--	--	--
4 – Horizontal with restriction	4.7	2.7	36.5	--	--	--	--
5 – Case 4 + 10 sec. vibration	3.6	3.8	51.4	23	27.6	2.7	0.214
6 – Case 4 + 60 sec. vibration	2.1	5.3	71.6	23.1	17.4	2.1	0.38

Best Regards,
Sherry

BUT - AIR LOSS IS NOT THE SAME FROM TEST TO TEST. IT VARIES

SHERRY SULLIVAN MASc, PEng, LEED AP
Director, Transportation & Built Environment

AIR ADJUSTMENT TABLE
(ALL POSSIBLE CHANGES TO INITIAL AIR CONTENT ALLOWABLE BY SPEC)

AIR LOSS VIA PUMP \ AIR METER CORRELATION	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	-2.3%	-2.2%	-2.1%	-2.0%	-1.9%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%
-1.4%	-2.2%	-2.1%	-2.0%	-1.9%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%
-1.3%	-2.1%	-2.0%	-1.9%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%
-1.2%	-2.0%	-1.9%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%
-1.1%	-1.9%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%
-1.0%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%
-0.9%	-1.7%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%
-0.8%	-1.6%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%
-0.7%	-1.5%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%
-0.6%	-1.4%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%
-0.5%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%
-0.4%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%
-0.3%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%
-0.2%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
-0.1%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%
0.0%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

5.50%

AIR LOSS VIA PUMP \ AIR METER CORRELATION	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	3.2%	3.3%	3.4%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%
-1.4%	3.3%	3.4%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%
-1.3%	3.4%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%
-1.2%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%
-1.1%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%
-1.0%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%
-0.9%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%
-0.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%
-0.7%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%
-0.6%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%
-0.5%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
-0.4%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%
-0.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%
-0.2%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%
-0.1%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%
0.0%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%

Total Chances	272
Passing Chances	45
Passing Chances	0

Percent Chance of Being in Spec. 16.5%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

6.00%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%
-1.4%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%
-1.3%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%
-1.2%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%
-1.1%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%
-1.0%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
-0.9%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%
-0.8%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%
-0.7%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%
-0.6%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%
-0.5%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%
-0.4%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%
-0.3%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%
-0.2%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%
-0.1%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%
0.0%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%

Total Chances	272
Passing Chances	105
Passing Chances	0

Percent Chance of Being in Spec. 38.6%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

6.40%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%
-1.4%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
-1.3%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%
-1.2%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%
-1.1%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%
-1.0%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%
-0.9%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%
-0.8%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%
-0.7%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%
-0.6%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%
-0.5%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%
-0.4%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%
-0.3%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%
-0.2%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%
-0.1%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%
0.0%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%

Total Chances	272
Passing Chances	167
Passing Chances	0

Percent Chance of Being in Spec. 61.4%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

7.10%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%
-1.4%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%
-1.3%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%
-1.2%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%
-1.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%
-1.0%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%
-0.9%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%
-0.8%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%
-0.7%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%
-0.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%
-0.5%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%
-0.4%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%
-0.3%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%
-0.2%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%
-0.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%
0.0%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%

Total Chances	272
Passing Chances	244
Passing Chances	0

Percent Chance of Being in Spec. 89.7%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

7.50%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%
-1.4%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%
-1.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%
-1.2%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%
-1.1%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%
-1.0%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%
-0.9%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%
-0.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%
-0.7%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%
-0.6%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%
-0.5%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%
-0.4%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%
-0.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%
-0.2%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%
-0.1%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%
0.0%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%

Total Chances	272
Passing Chances	266
Passing Chances	6

Percent Chance of Being in Spec. 95.6%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

7.80%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%
-1.4%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%
-1.3%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%
-1.2%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%
-1.1%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%
-1.0%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%
-0.9%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%
-0.8%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%
-0.7%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%
-0.6%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%
-0.5%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%
-0.4%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%
-0.3%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%
-0.2%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%
-0.1%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%
0.0%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%

Total Chances 272
Passing Chances 272
Passing Chances 21

Percent Chance of Being in Spec. 92.3%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

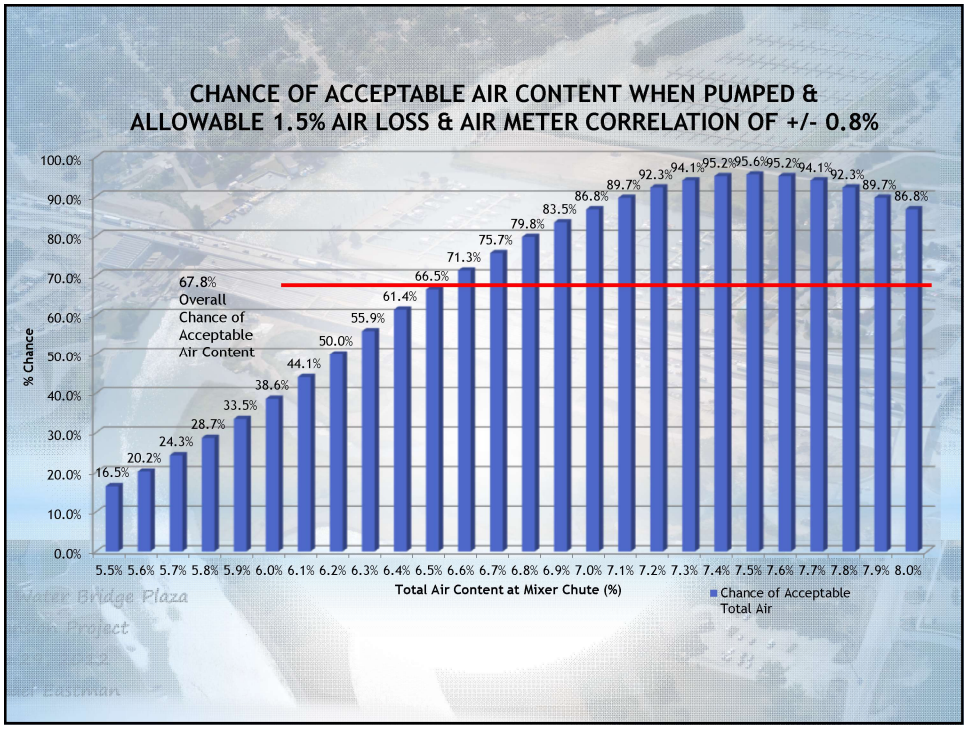
8.00%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-1.5%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%
-1.4%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%
-1.3%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%
-1.2%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%
-1.1%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%
-1.0%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%
-0.9%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%
-0.8%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%
-0.7%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%
-0.6%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%
-0.5%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%
-0.4%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%
-0.3%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%
-0.2%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%
-0.1%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%	8.7%
0.0%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%	8.7%	8.8%

Total Chances 272
Passing Chances 272
Passing Chances 36

Percent Chance of Being in Spec. 86.8%



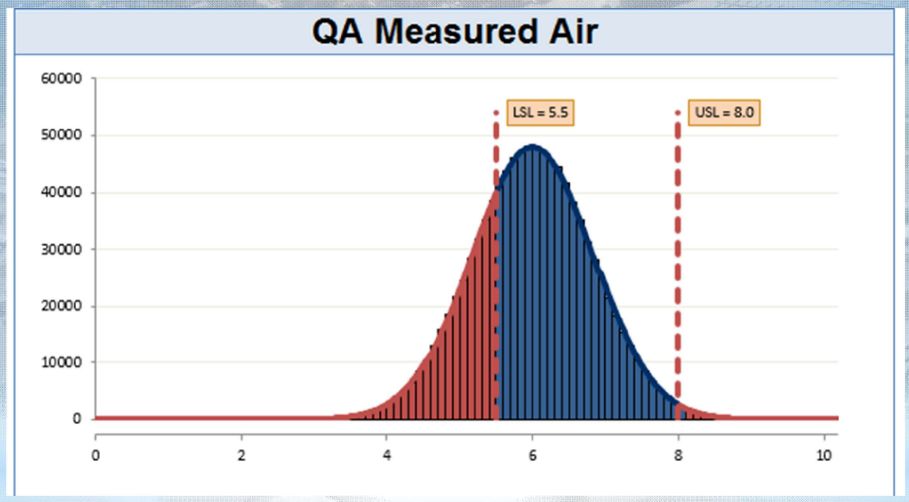
*Statistician Vetting

*Estimate the likelihood of meeting 5.5% - 8.0% air content at POP when pumped per 12SP-604B-07.

*Givens:

- *The measured/tested air content before the pump is 5.5% to 8.0%.
  - *Air is normally distributed with a mean of 6.75% and standard deviation of 0.625%. This equates to air content of 5.5% - 8.0% 95% of the time.
- *Air loss due to pumping may be between 0.0% to -1.5%.
  - *Loss is normally distributed with a mean of 0.75% and standard deviation of 0.375%. This equates to air loss between 0% - (-1.5%) 95% of the time.
- *Difference between QA and QC air meters may be -0.8% to +0.8%.
  - *Difference is normally distributed with a mean of 0% and standard deviation of 0.4%. This equates to difference between -0.8% and +0.8% 95% of the time.

* A Monte Carlo (computer) simulation was performed to estimate the likelihood of having the QA air content OUT OF SPECIFICATION per previous three variables/givens.
* The simulated process output is the variable of interest and defined as:
  * QA measured air = (QC air content) – (pump air loss) + (difference between meters)
* An expected value analysis (EVA) based on 1,000,000 simulated values was used to estimate the likelihood of having concrete results at the job site fall inside and outside 5.5% to 8.0%.



* Results of EVA show a high percentage of QA measurements that would be expected to fail Mdot air specification.

	QA Measured Air
Process Outputs	
# of Simulations	1,000,000
Mean	6.00
Standard Deviation	0.83
Median	6.00
Lower Specification Limit	5.5
Upper Specification Limit	8
Percentile Statistics	
Maximum	10.19
99%	7.94
95%	7.37
90%	7.07
80%	6.70
75%	6.56
70%	6.43
60%	6.21
50%	6.00
40%	5.79
30%	5.56
25%	5.44
20%	5.30
10%	4.93
5%	4.64
1%	4.07
Minimum	1.94

Observed Defect Statistics	
Simulations outside of air content specification	281,930

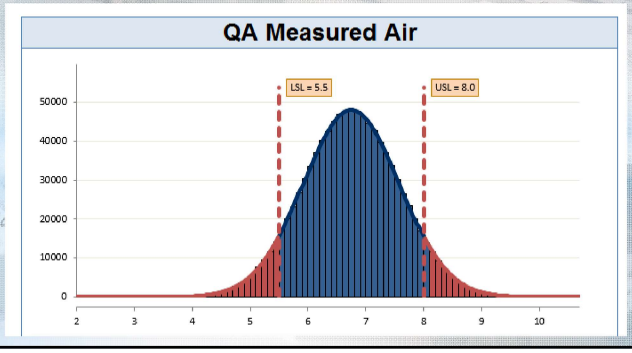
The graph and order statistics both reveal that the likelihood of falling outside 5.5% - 8.0% air range is 28%.

Most of the failed measurements are below 5.5%.

*OptimumTarget Air

*Increasing the target air content (before pumping & correlation) from 6.75% to 7.5% (~ +1.0 sigma) would reduce the likelihood of out of spec concrete to 14%.

*14% implies that one out of every six trucks would still fall outside the limits set by Mdot, even if the producer is making within spec concrete before pump/correlation.



AIR ADJUSTMENT TABLE
ALL POSSIBLE CHANGES TO INITIAL AIR CONTENT ALLOWABLE BY CHANGED SPEC - 0.5% PUMP AIR LOSS & +/-0.8% METER VARIABILITY

AIR LOSS VIA PUMP	AIR METER CORRELATION																
	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-0.5%	-1.3%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%
-0.4%	-1.2%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%
-0.3%	-1.1%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%
-0.2%	-1.0%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
-0.1%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%
0.0%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%

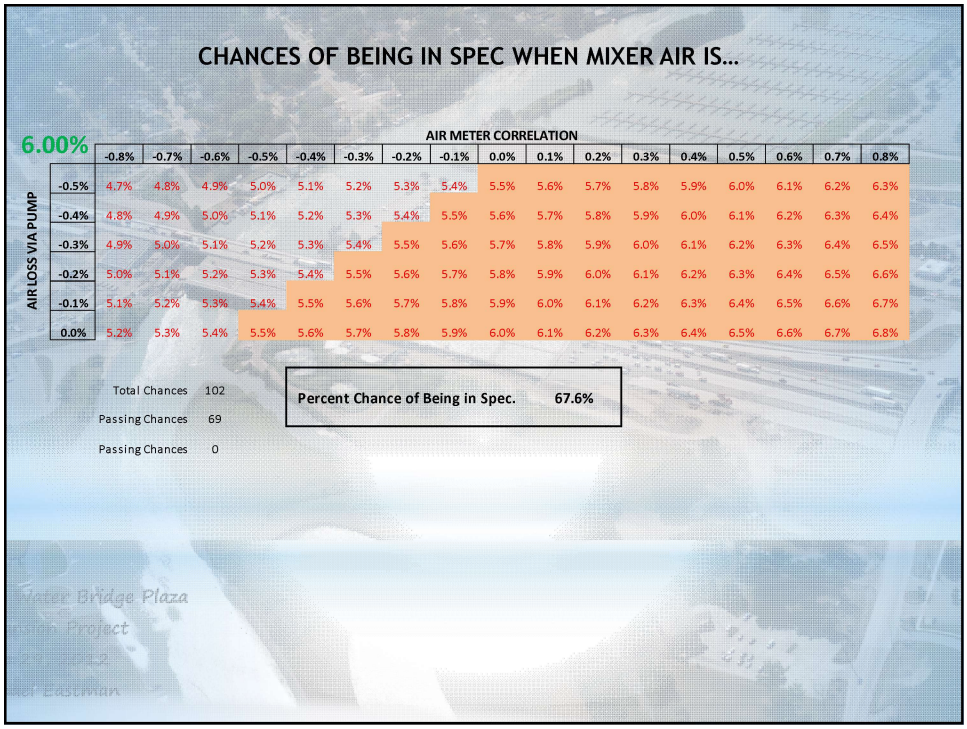
CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

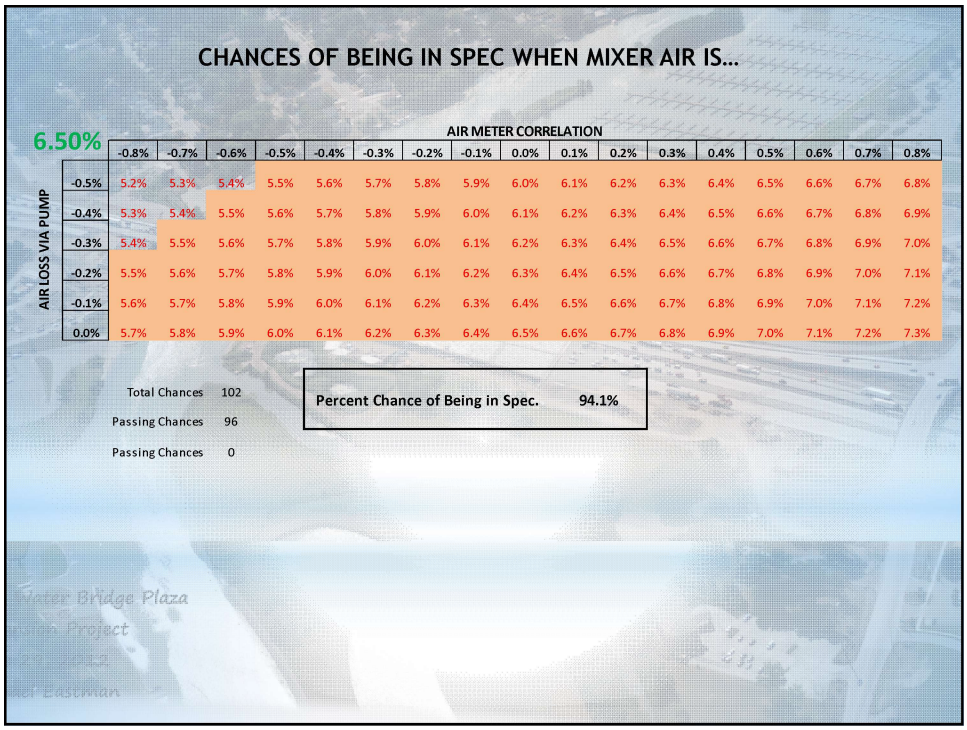
5.50%

AIR LOSS VIA PUMP	AIR METER CORRELATION																
	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-0.5%	4.2%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
-0.4%	4.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%
-0.3%	4.4%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%
-0.2%	4.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%
-0.1%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%
0.0%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%

Total Chances	102
Passing Chances	39
Passing Chances	0

Percent Chance of Being in Spec. 38.2%


CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...
6.00%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.8% -0.7% -0.6% -0.5% -0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4% 0.5% 0.6% 0.7% 0.8%
-0.5% 4.7% 4.8% 4.9% 5.0% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3%
-0.4% 4.8% 4.9% 5.0% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4%
-0.3% 4.9% 5.0% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5%
-0.2% 5.0% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6%
-0.1% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7%
0.0% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8%
Total Chances 102
Passing Chances 69
Passing Chances 0
Percent Chance of Being in Spec. 67.6%


CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...
6.50%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.8% -0.7% -0.6% -0.5% -0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4% 0.5% 0.6% 0.7% 0.8%
-0.5% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8%
-0.4% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9%
-0.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0%
-0.2% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1%
-0.1% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2%
0.0% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3%
Total Chances 102
Passing Chances 96
Passing Chances 0
Percent Chance of Being in Spec. 94.1%

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

7.00%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-0.5%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%
-0.4%	5.8%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%
-0.3%	5.9%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%
-0.2%	6.0%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%
-0.1%	6.1%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%
0.0%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%

Total Chances	102
Passing Chances	102
Passing Chances	0

Percent Chance of Being in Spec. 100.0%

Water Bridge Plaza
Project
Eastman

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

7.50%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-0.5%	6.2%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%
-0.4%	6.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%
-0.3%	6.4%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%
-0.2%	6.5%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%
-0.1%	6.6%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%
0.0%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%

Total Chances	102
Passing Chances	102
Passing Chances	6

Percent Chance of Being in Spec. 94.1%

Water Bridge Plaza
Project
Eastman

CHANCES OF BEING IN SPEC WHEN MIXER AIR IS...

8.00%

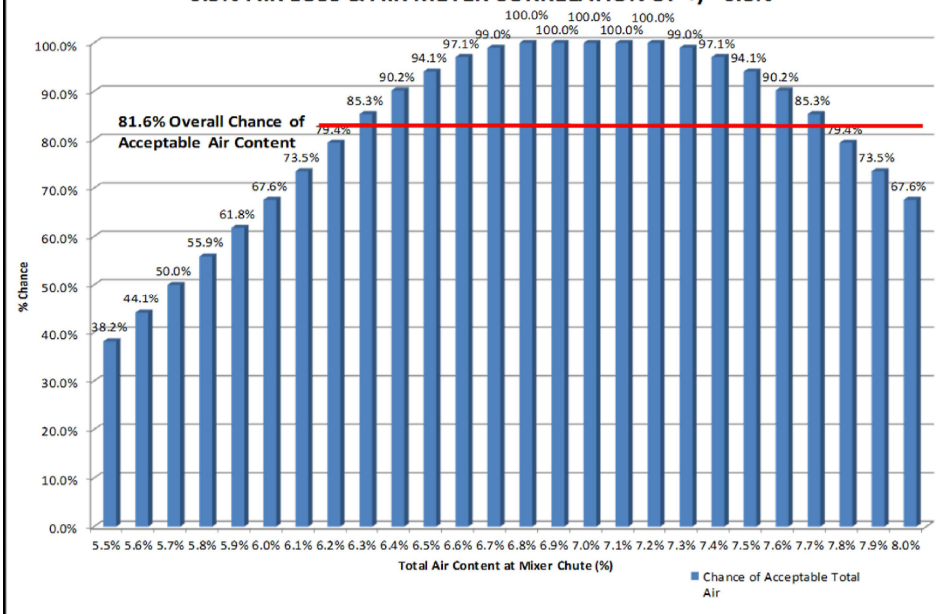
AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%
-0.5%	6.7%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%
-0.4%	6.8%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%
-0.3%	6.9%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%
-0.2%	7.0%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%
-0.1%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%	8.7%
0.0%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%	8.5%	8.6%	8.7%	8.8%

Total Chances	102
Passing Chances	102
Passing Chances	33

Percent Chance of Being in Spec. 67.6%

CHANCE OF ACCEPTABLE AIR CONTENT WHEN PUMPED & ALLOWABLE 0.5% AIR LOSS & AIR METER CORRELATION OF +/- 0.8%



AIR ADJUSTMENT TABLE
ALL POSSIBLE CHANGES TO INITIAL AIR CONTENT ALLOWABLE BY CHANGED SPEC - 0.5% PUMP AIR LOSS & +/-0.4% METER VARIABILITY

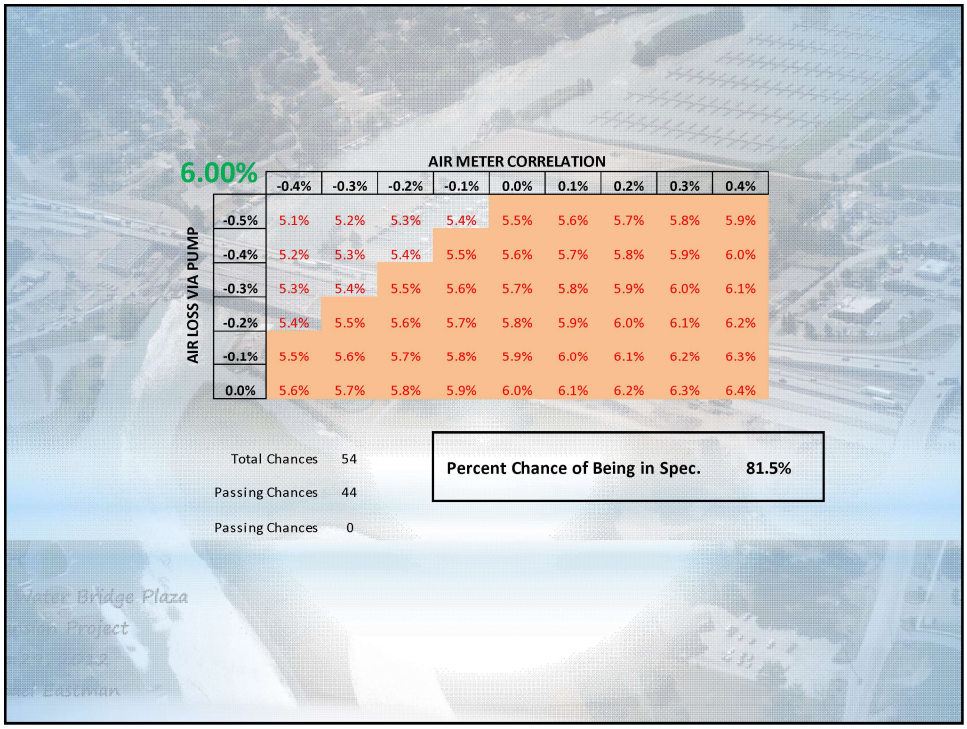
AIR LOSS VIA PUMP \ AIR METER CORRELATION	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%
-0.5%	-0.9%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%
-0.4%	-0.8%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%
-0.3%	-0.7%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%
-0.2%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%
-0.1%	-0.5%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%
0.0%	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%

5.50%

AIR LOSS VIA PUMP \ AIR METER CORRELATION	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%
-0.5%	4.6%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%
-0.4%	4.7%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%
-0.3%	4.8%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%
-0.2%	4.9%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%
-0.1%	5.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%
0.0%	5.1%	5.2%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%

Total Chances	54
Passing Chances	15
Passing Chances	0

Percent Chance of Being in Spec. 27.8%


6.00%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4%
-0.5% 5.1% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9%
-0.4% 5.2% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0%
-0.3% 5.3% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1%
-0.2% 5.4% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2%
-0.1% 5.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3%
0.0% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4%
Total Chances 54
Passing Chances 44
Passing Chances 0
Percent Chance of Being in Spec. 81.5%


6.50%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4%
-0.5% 5.6% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4%
-0.4% 5.7% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5%
-0.3% 5.8% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6%
-0.2% 5.9% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7%
-0.1% 6.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8%
0.0% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9%
Total Chances 54
Passing Chances 54
Passing Chances 0
Percent Chance of Being in Spec. 100.0%


7.00%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4%
-0.5% 6.1% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9%
-0.4% 6.2% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0%
-0.3% 6.3% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1%
-0.2% 6.4% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2%
-0.1% 6.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3%
0.0% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3% 7.4%
Total Chances 54
Passing Chances 54
Passing Chances 0
Percent Chance of Being in Spec. 100.0%


7.50%
AIR METER CORRELATION
AIR LOSS VIA PUMP
-0.4% -0.3% -0.2% -0.1% 0.0% 0.1% 0.2% 0.3% 0.4%
-0.5% 6.6% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3% 7.4%
-0.4% 6.7% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3% 7.4% 7.5%
-0.3% 6.8% 6.9% 7.0% 7.1% 7.2% 7.3% 7.4% 7.5% 7.6%
-0.2% 6.9% 7.0% 7.1% 7.2% 7.3% 7.4% 7.5% 7.6% 7.7%
-0.1% 7.0% 7.1% 7.2% 7.3% 7.4% 7.5% 7.6% 7.7% 7.8%
0.0% 7.1% 7.2% 7.3% 7.4% 7.5% 7.6% 7.7% 7.8% 7.9%
Total Chances 54
Passing Chances 54
Passing Chances 0
Percent Chance of Being in Spec. 100.0%

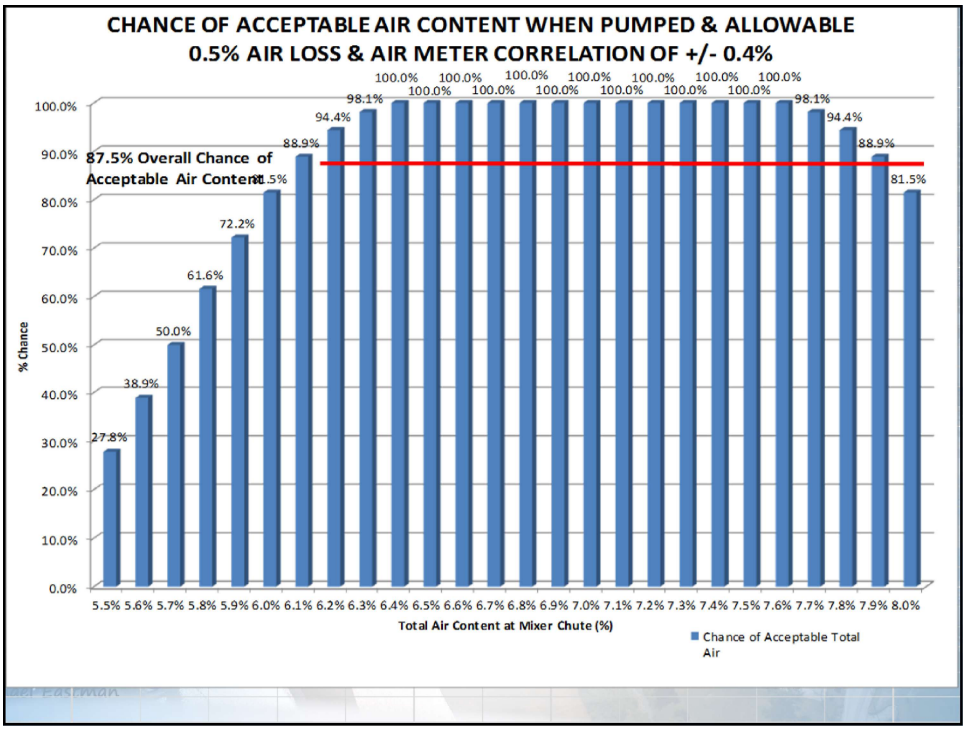
8.00%

AIR METER CORRELATION

AIR LOSS VIA PUMP	-0.4%	-0.3%	-0.2%	-0.1%	0.0%	0.1%	0.2%	0.3%	0.4%
-0.5%	7.1%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%
-0.4%	7.2%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%
-0.3%	7.3%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%
-0.2%	7.4%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%
-0.1%	7.5%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%
0.0%	7.6%	7.7%	7.8%	7.9%	8.0%	8.1%	8.2%	8.3%	8.4%

Total Chances	54
Passing Chances	54
Passing Chances	10

Percent Chance of Being in Spec. 81.5%



*Conclusion

- *Inherent variability between air meters and pumped concrete will result in penalties.
  - *ITS IS NOT POSSIBLE TO REDUCE AIR METER PRECISION FROM 1.3% TO 0.4%!*
  - *PUMPED CONCRETE INHERENT VARIABILITY OF -1.5% IS A REASONALBLE ASSUMPTION.*
- *At optimum initial air content, one out of six trucks will contain an out of spec air content (14%).
- *Per ACI-329, this inherent variability must be accounted for in the interest of fairness, ***BECAUSE IT CAN NOT BE MITIGATED***.