

**APPENDIX 6b**

**SUMMARY REPORT FOR SIX-SIGMA PILOT STUDY**

**MAGNAMOLE CABLE THREADER**

**April 2007**

**CONFIDENTIAL**

- **SUMMARY OF METRICS**
  - **SUMMARY OF DMAIC STEPS**
  - **DATA ANALYSIS**
-

# SUMMARY OF METRICS:

## HEALTH & SAFETY

METRIC	CURRENT PROCESS		WITH MAGNAMOLE	
	(FIELD)	(CONTROL)	(FIELD)	(CONTROL)
NOISE VARIABLES CONTRIBUTING TO RISK OF ELECTRIC SHOCK	<b>13</b>		<b>0</b>	
SITES THAT USED AN UNSAFE THREADING AID	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>
ENGINEERS THAT USED AN UNSAFE THREADING AID	<b>12</b>	<b>7</b>	<b>0</b>	<b>0</b>
JOB COMPLETED WITH AN UNSAFE THREADING AID	<b>41</b>	<b>7</b>	<b>0</b>	<b>0</b>
TYPES OF UNSAFE AIDS	<b>2</b>	<b>4</b>	<b>0</b>	<b>0</b>
MOST COMMONLY USED UNSAFE AID	<b>COATHANGER (78%)</b>	<b>COATHANGER (43%)</b>	<b>-</b>	<b>-</b>
PROCESS SIGMA FOR SAFE THREADING	<b>1.84</b>	<b>2.69</b>	<b>6+</b>	<b>6+</b>

# SUMMARY OF METRICS:

## THREADING TIME

METRIC	CURRENT PROCESS		WITH MAGNAMOLE	
	(FIELD)	(CONTROL)	(FIELD)	(CONTROL)
SAMPLE DISTRIBUTION	<b>Non-Normal</b>		<b>Normal</b>	
OUTLIERS	<b>Yes</b>		<b>No</b>	
MIN. THREADING TIME (seconds)	<b>5</b>	<b>10</b>	<b>5</b>	<b>4</b>
MAX. THREADING TIME (minutes)	<b>44</b>	<b>12.17</b>	<b>20 sec</b>	<b>7 sec</b>
MEAN THREADING TIME (minutes)	<b>5.049</b>	<b>4.72</b>	<b>11.4 sec</b>	<b>4.4 sec</b>
PROCESS CYCLE EFFICIENCY *	<b>1.64%</b>		<b>43.86%</b>	
PROCESS SIGMA FOR THREADING TIME	<b>1.66</b>	<b>1.72</b>	<b>6+</b>	<b>6+</b>

\* Process Cycle Efficiency = VA / Cycle Time

Acceptable minimum = 25%

# SUMMARY OF METRICS:

## NUMBER OF ATTEMPTS TO THREAD

METRIC	CURRENT PROCESS		WITH MAGNAMOLE	
	(FIELD)	(CONTROL)	(FIELD)	(CONTROL)
SAMPLE DISTRIBUTION	<b>Non-Normal</b>		<b>Normal</b>	
OUTLIERS	<b>Yes</b>		<b>No</b>	
MIN. NUMBER OF ATTEMPTS	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
MAX. NUMBER OF ATTEMPTS	<b>15</b>	<b>34</b>	<b>1</b>	<b>1</b>
MEDIAN NUMBER OF ATTEMPTS	<b>2</b>	<b>8</b>	<b>1</b>	<b>1</b>
PROCESS SIGMA FOR No. OF ATTEMPTS	<b>1.20</b>	<b>&lt; 1</b>	<b>6+</b>	<b>6+</b>

# PROCESS SIGMA PERFORMANCE

ESTIMATE FOR CURRENT  
PROCESS: (USL = 5 mins.)  
1.20 No. OF ATTEMPTS  
1.66 TIME TO THREAD  
1.84 No. UNSAFE ACTS

TARGET FOR A STABLE  
PROCESS: 3 SIGMA MIN.  
FOR SOME INDUSTRIES,  
4 SIGMA MIN., TYPICAL

ESTIMATE FOR  
MAGNAMOLE: 6 SIGMA +

Short term data (sample batch)				Long term data (annual)			
Sigma (Zst)	Cpk	Defect rate %	defect rate ppm	Zlt	Ppk	Defect rate %	defect rate ppm
0	0.00	50.00%	500000	-1.5	-0.50	93.32%	933193
0.2	0.07	42.07%	420740	-1.3	-0.43	90.32%	903199
0.4	0.13	34.46%	344578	-1.1	-0.37	86.43%	864334
0.6	0.20	27.43%	274253	-0.9	-0.30	81.59%	815940
0.8	0.27	21.19%	211855	-0.7	-0.23	75.80%	758036
1	0.33	15.87%	158655	-0.5	-0.17	69.15%	691462
1.2	0.40	11.51%	115070	-0.3	-0.10	61.79%	617911
1.4	0.47	8.08%	80757	-0.1	-0.03	53.98%	539828
1.6	0.53	5.48%	54799	0.1	0.03	46.02%	460172
1.8	0.60	3.59%	35930	0.3	0.10	38.21%	382089
2	0.67	2.28%	22760	0.5	0.17	30.85%	308538
2.2	0.73	1.39%	13903	0.7	0.23	24.20%	241964
2.4	0.80	0.82%	8198	0.9	0.30	18.41%	184060
2.6	0.87	0.47%	4661	1.1	0.37	13.57%	135666
2.8	0.93	0.26%	2555	1.3	0.43	9.68%	96801
3	1.00	0.13%	1350	1.5	0.50	6.68%	66807
3.2	1.07	0.07%	687	1.7	0.57	4.46%	44565
3.4	1.13	0.03%	337	1.9	0.63	2.87%	28716
3.6	1.20	0.02%	169	2.1	0.70	1.78%	17684
3.8	1.27	0.01%	72	2.3	0.77	1.07%	10724
4	1.33	0.00%	32	2.5	0.83	0.62%	6210
4.2	1.40	0.00%	13	2.7	0.90	0.35%	3467
4.4	1.47	0.00%	5	2.9	0.97	0.19%	1866
4.6	1.53	0.00%	2	3.1	1.03	0.10%	968
4.8	1.60	0.00%	1	3.3	1.10	0.05%	483
5	1.67	0.00%	0	3.5	1.17	0.02%	233
5.2	1.73	0.00%	0	3.7	1.23	0.01%	108
5.4	1.80	0.00%	0	3.9	1.30	0.00%	48
5.6	1.87	0.00%	0	4.1	1.37	0.00%	21
5.8	1.93	0.00%	0	4.3	1.43	0.00%	9
6	2.00	0.00%	0	4.5	1.50	0.00%	3.4

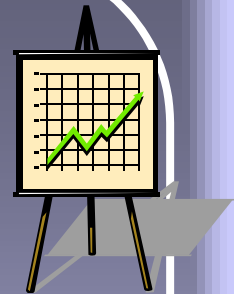
## **ROI : POTENTIAL FOR ANNUAL COST AVOIDANCE FROM DEPLOYMENT OF MAGNAMOLE**

- ESTIMATE FROM FIELD STUDY OF TIME SAVED PER JOB = 4.85 minutes
- AVERAGE NUMBER OF JOBS PER ENGINEER PER WEEK FROM SURVEY DATA = 4
- POPULATION = 18,500, THREADING 46 WKS / YEAR @ £24 / HR

**TOTAL COST AVOIDANCE = £6,603,760**

# ROI : POTENTIAL ADDITIONAL BENEFITS FROM DEPLOYMENT OF MAGNAMOLE

- RISK OF ELECTRIC SHOCK AND LIABILITY GOES AWAY
- SMALLER HOLES CAN BE DRILLED FOR A NEATER JOB WITH NO INCREASE IN THREADING TIME
- DISCONTENT FROM CUSTOMERS OVER LONG THREADING TIMES GOES AWAY
- WASTEAGE OF INTERNAL CABLE THROUGH DIFFICULTY OF THREADING DUE TO 'MEMORY' GOES AWAY
- TOOL IS ROBUST TO SOURCES OF VARIATION – USER, ENVIRONMENT, SITE & LOCATION
- STABLE, QUICK PROCESS MEANS NO FRUSTRATION FOR ENGINEER AND IMPROVED SCHEDULING & CAPACITY FOR MANAGEMENT
- **RAPID IMPROVEMENT IS ACHIEVABLE WITH SUSTAINED RESULTS**



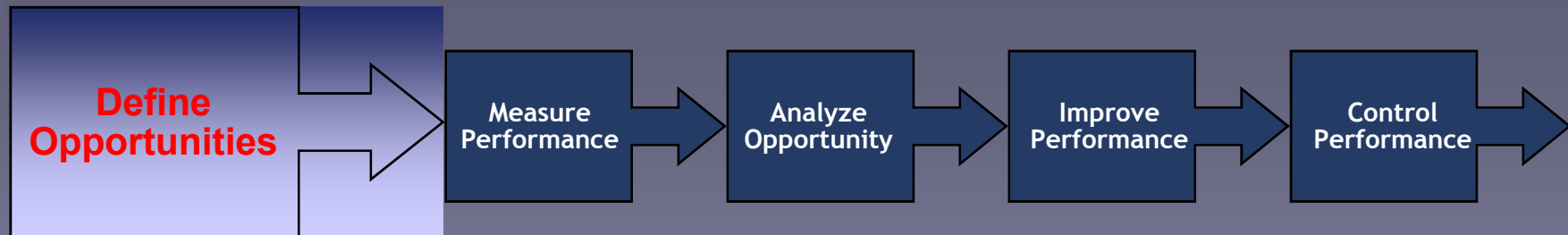


## VOICE OF THE CUSTOMER:

### *SOME OF THE PROBLEMS EXPERIENCED WITH THE CURRENT PROCESS (ACTUAL DATA TRANSCRIBED FROM FIELD DATA SHEETS)*

- 'CABLE KEPT BENDING AND HITTING OTHER SIDE OF CAVITY WALL (FRUSTRATING)' **8 MINUTES 5 ATTEMPTS**
- 'COAT HANGER PUSHED THROUGH WALL, TAPED ON AND PULLED BACK THROUGH HOLE FROM INSIDE - TAPE PULLED OFF ON FIRST ATTEMPT' **3 MINUTES 3 ATTEMPTS**
- '2<sup>nd</sup> FLOOR FLAT - UNABLE TO THREAD FROM OUTSIDE BY HAND, WENT BACK TO FLAT FED CABLE FROM INSIDE TO OUTSIDE, STRIPPED CABLE & FASTENED DW ON TO CABLE, WENT BACK INTO FLAT AND PULLED CABLE THROUGH' **13 MINUTES 2 ATTEMPTS**
- 'SNOWING' **5 MINUTES 8 ATTEMPTS**
- 'DRILLED THROUGH FLOOR, NOT MUCH ROOM TO FISH OUT CABLE' **7 MINUTES 1 ATTEMPT**

## 'DEFINE'



- **BUSINESS OPPORTUNITY VALIDATED FOR 6-SIGMA POTENTIAL, VOICE OF CUSTOMER TRANSLATED INTO KEY PROCESS METRICS:**

- **KEY PROCESS OUTPUTS ( Y's )**

**KPO Y1 – TIME TO THREAD CABLE**

**KPO Y2 – NUMBER OF ATTEMPTS TO THREAD CABLE**

**KPO Y3 – NUMBER OF UNSAFE ACTS THREADING CABLE**

- **KEY PROCESS INPUTS ( X's ) – ENGINEER & No. YRS EXPERIENCE, CABLE TYPE, DRILL BIT SIZE, THREADING LOCATION (FROM INSIDE OR OUTSIDE), SITE**

- **ACTION PLAN PRODUCED AND TEAM PREPARED**

# 'MEASURE'



- DATA COLLECTION PLAN AGREED AND FORMS ISSUED TO 3 SITES

SCUNTHORPE

LINCOLN

SHEFFIELD

- DATA COLLECTED BY 10 ENGINEERS AT EACH SITE, KEY PROCESS OUTPUTS AND INPUTS RECORDED AGAINST DATE, TIME AND JOB NUMBER
- PROVISION INCLUDED FOR RECORDING USE OF THREADING AIDS AND ANY PROBLEMS ENCOUNTERED
- DATA PLOTTED AND BASELINE PERFORMANCE OF EXISTING PROCESS ESTABLISHED
- ADDITIONAL 'CONTROL' SAMPLE DATA RECORDED FOR EACH ENGINEER

## ‘ANALYZE’



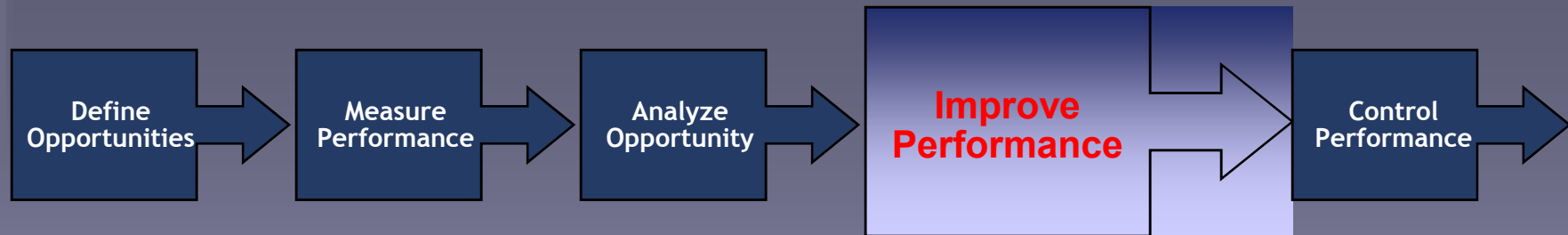
- **PROCESS DATA STRATIFIED TO IDENTIFY SOURCES OF VARIATION**

$$Y = f(x_1, x_2, x_3 \dots)$$

**WHICH KEY PROCESS INPUTS DETERMINE THE PERFORMANCE OF THE OUTPUTS? (ROOT CAUSE OF PROBLEM)**

- **ANALYSIS CONDUCTED USING MINITAB STATISTICAL SOFTWARE**
- **ANALYSIS DRILLED DOWN TO ROOT CAUSE OF PROBLEM**

# 'IMPROVE'



- DATA COLLECTION REPEATED USING THE MAGNAMOLE

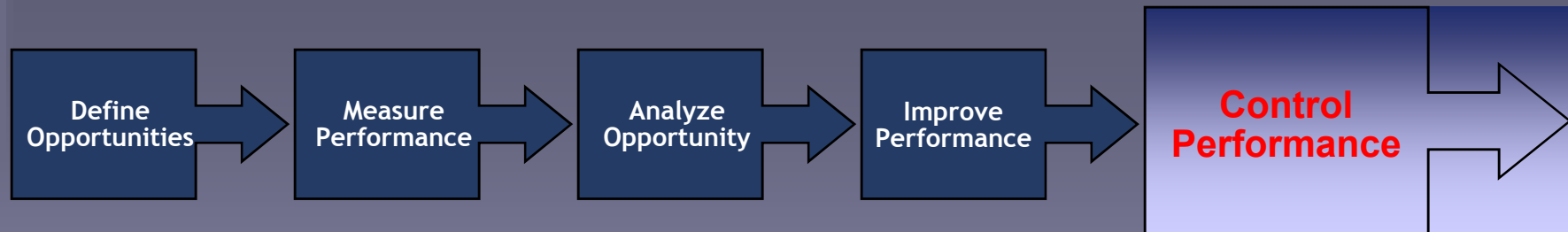
SCUNTHORPE

LINCOLN

SHEFFIELD

- EACH ENGINEER GIVEN A PROTOTYPE VERSION, DEVELOPED FROM ORIGINAL DESIGN TO TAKE INTO ACCOUNT COMMENTS FROM FIELD AND MANAGEMENT
- DATA PLOTTED AND BASELINE PERFORMANCE OF MAGNAMOLE ESTABLISHED
- IMPROVEMENT AND POTENTIAL FOR SIX-SIGMA PERFORMANCE VERIFIED
- IMPROVEMENT OBSERVED FROM DATA WAS SUPPORTED BY SURVEY QUESTIONNAIRE RESPONSE FROM FIELD ENGINEERS & MANAGEMENT

# 'CONTROL'



- **RECOMMEND PURCHASE OF TOOL AS A STOCK ITEM, AND MAKING ITS USE MANDATORY AS DEFINED IN A STANDARD OPERATING PROCEDURE**
- **BUT PEOPLE WILL ONLY USE THE TOOL IF THEY CAN SEE THE BENEFITS FOR THEMSELVES**
- **29 OF THE 30 ENGINEERS IN THE STUDY WHEN ASKED, STATED THAT THEY WANTED TO KEEP THE TOOL (MOST ASKED FIRST)**
- **ALL 3 MANAGERS IN THE STUDY WERE VERY POSITIVE IN THEIR SUMMING UP OF THE TOOLS POTENTIAL:**

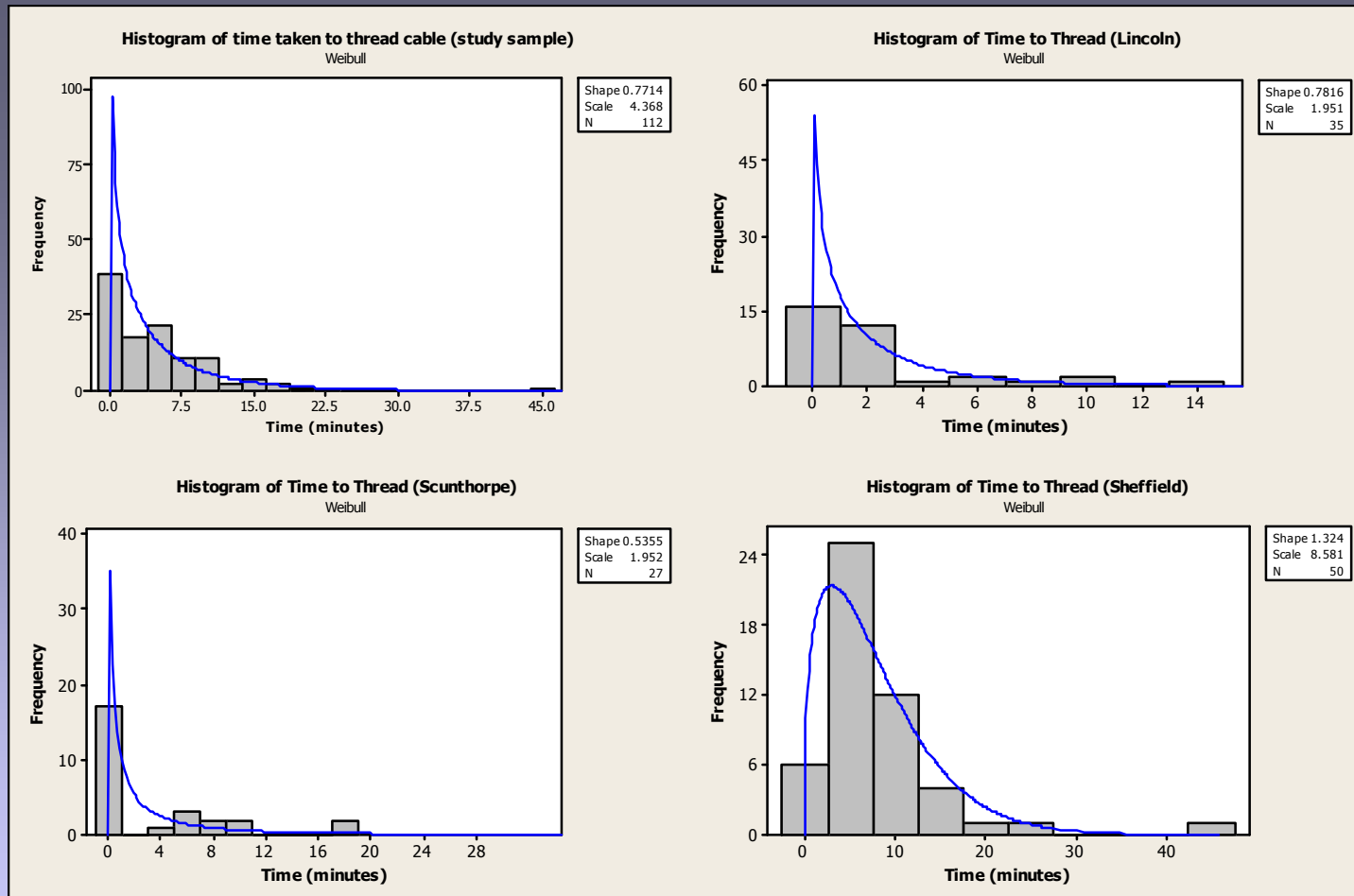


## **SITE MANAGERS' VERDICT ON THE TOOL**

- **'A SIMPLE BUT EFFECTIVE IDEA MADE INTO A GOOD PRODUCT'**
- **'I WOULD RECOMMEND THE TOOL FOR ALL ENGINEERS CARRYING OUT CABLE THREADING. IT WON'T SAVE TIME ON EVERY OPERATION BUT OVER THE LONG TERM I AM CONVINCED IT WILL SAVE TIME'**
- **'I WISH I HAD THOUGHT OF THE IDEA'**

# Analysis of Field Study Data: **KPO(Y) No.1**

## Time in minutes taken to Thread (per job), current process

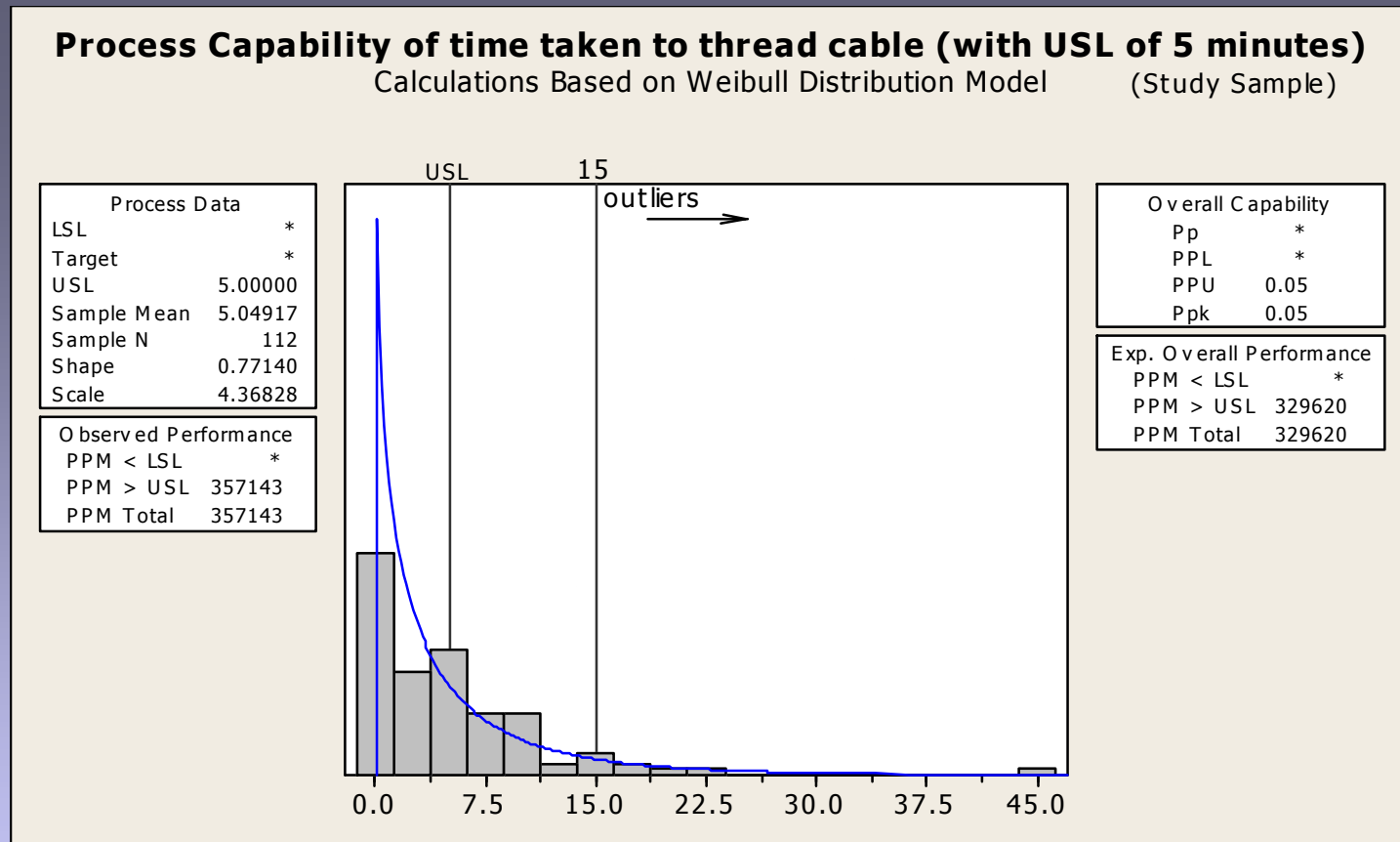


- Histogram Data of Cable Threading Time, pooled study sample and individual BT sites



# Analysis of Field Study Data: **KPO(Y) No.1**

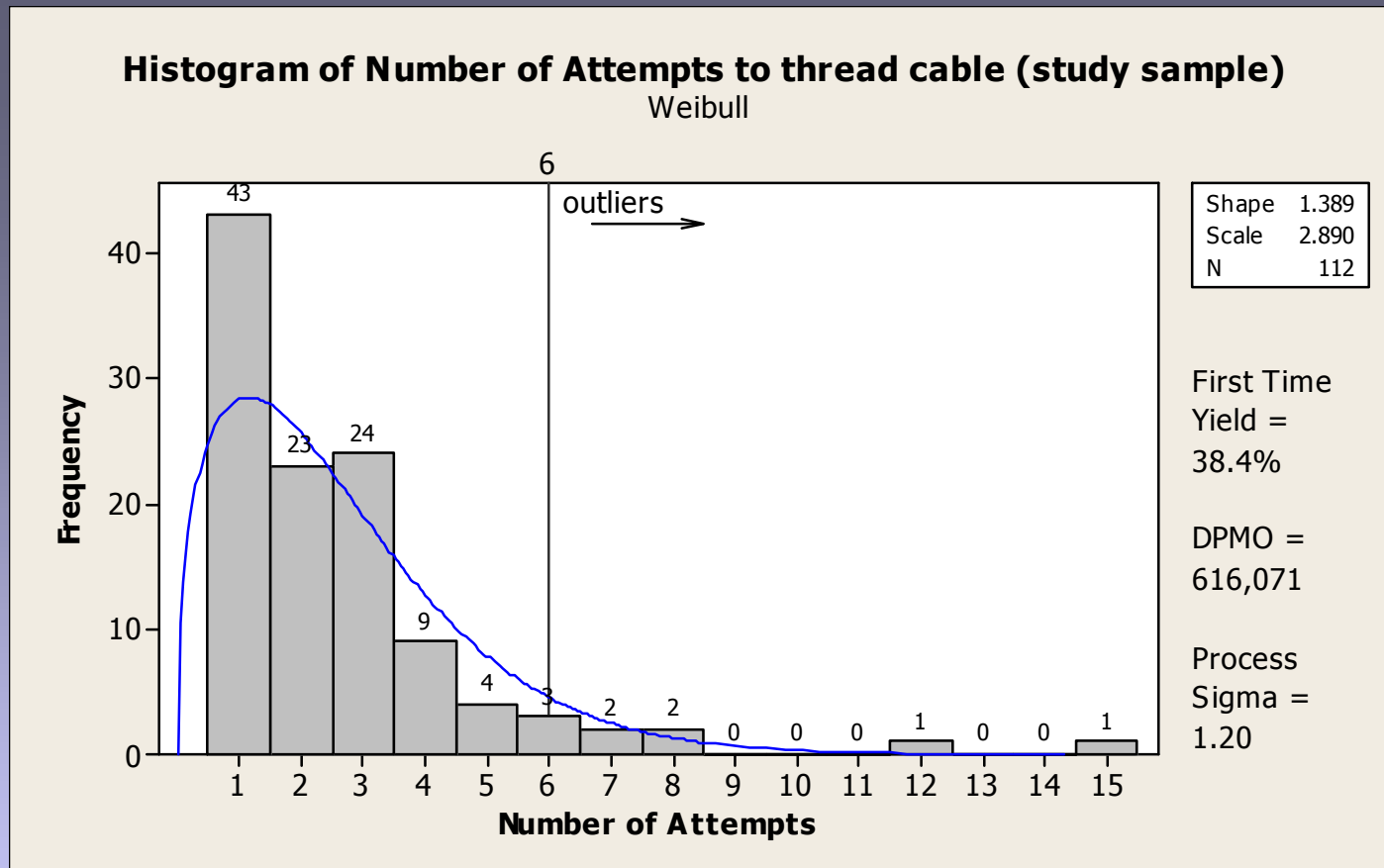
## Time in minutes taken to Thread (per job), current process



- Typical variation of 5 seconds to 15 minutes, with outliers of up to 44 minutes
- Positively skewed non-normal distribution
- Process Capability unreliable for non-normal data, would require rational subgrouping from a large sample to normalize
- Estimate of overall capability  $Ppk = 0.05$ , based on 'best fit' Weibull Distribution and nominal Upper Specification Limit of 5 minutes: Target  $Ppk = 1.50$

## Analysis of Field Study Data: **KPO(Y) No.2**

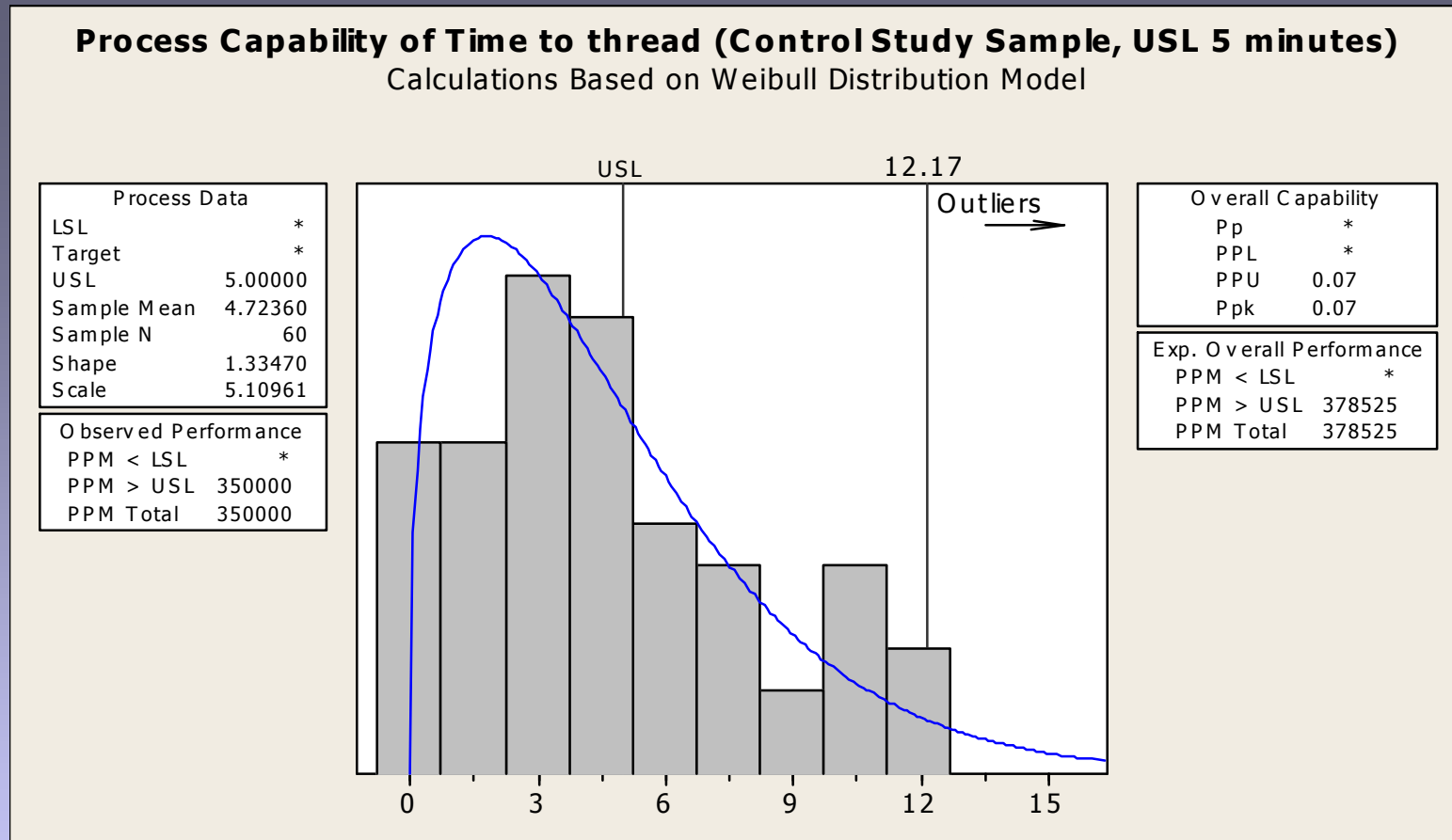
### No. of Attempts taken to Thread (per job), current process



- Typical variation of 1 to 6 attempts, with outliers of up to 15 attempts
- Positively skewed non-normal distribution
- First Time Yield of 38.4%, estimate of Process Sigma ( $Z_{st}$ ) = 1.20: Target = 6
- Over half the jobs with 2 or more attempts completed with an unsafe aid (56%)
- 5% of jobs threaded on 1<sup>st</sup> attempt completed with an unsafe aid

# Analysis of Control Sample Data: **KPO(Y) No.1**

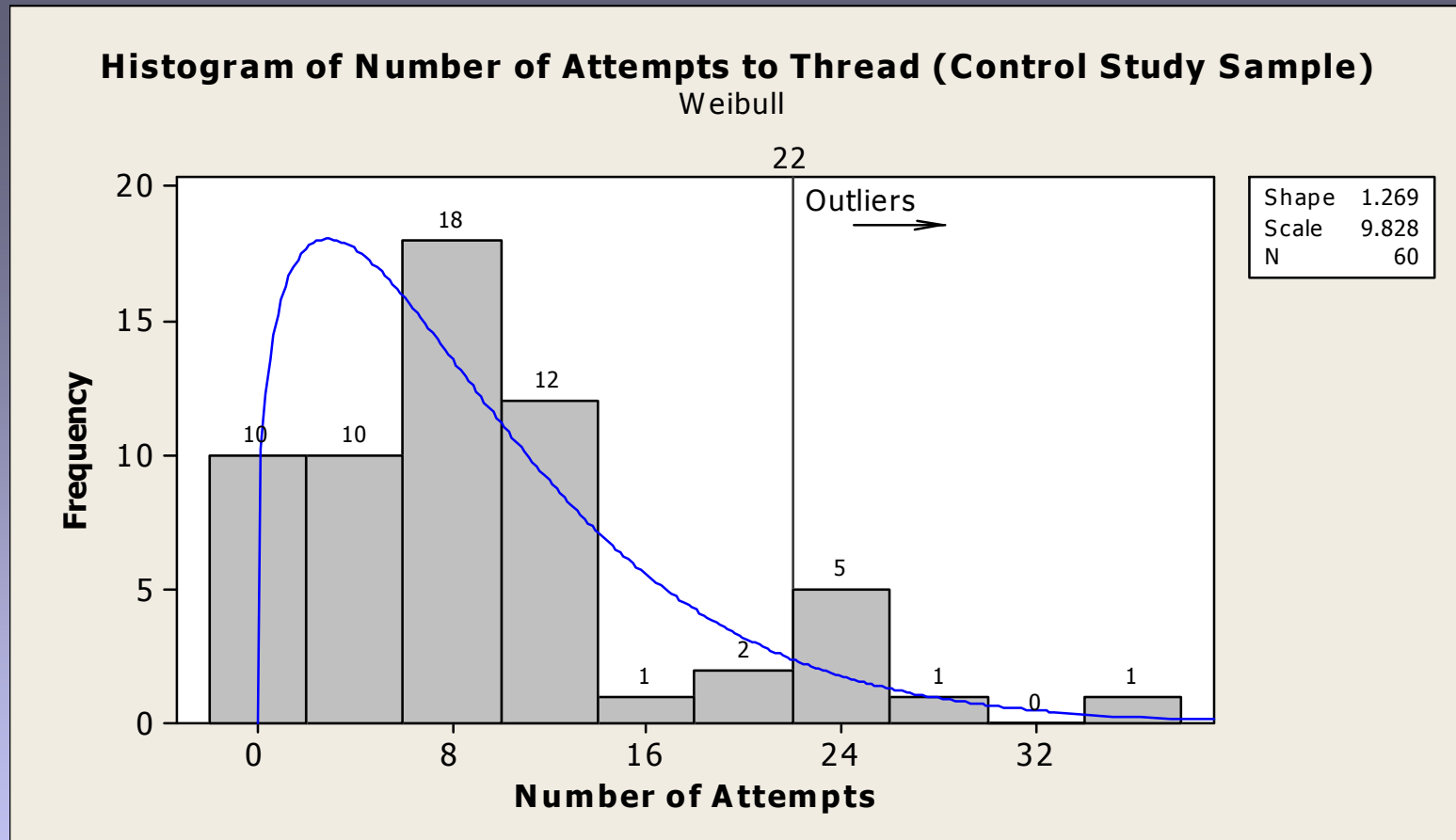
## Time in minutes taken to Thread (without Magnamole)



- Typical variation of 10 seconds to 12.17 minutes, no outliers
- Positively skewed non-normal distribution
- Process Capability unreliable for non-normal data, would require rational subgrouping from a large sample to normalize
- Estimate of overall capability  $Ppk = 0.07$ , based on 'best fit' Weibull Distribution and nominal Upper Specification Limit of 5 minutes: Target  $Ppk = 1.50$

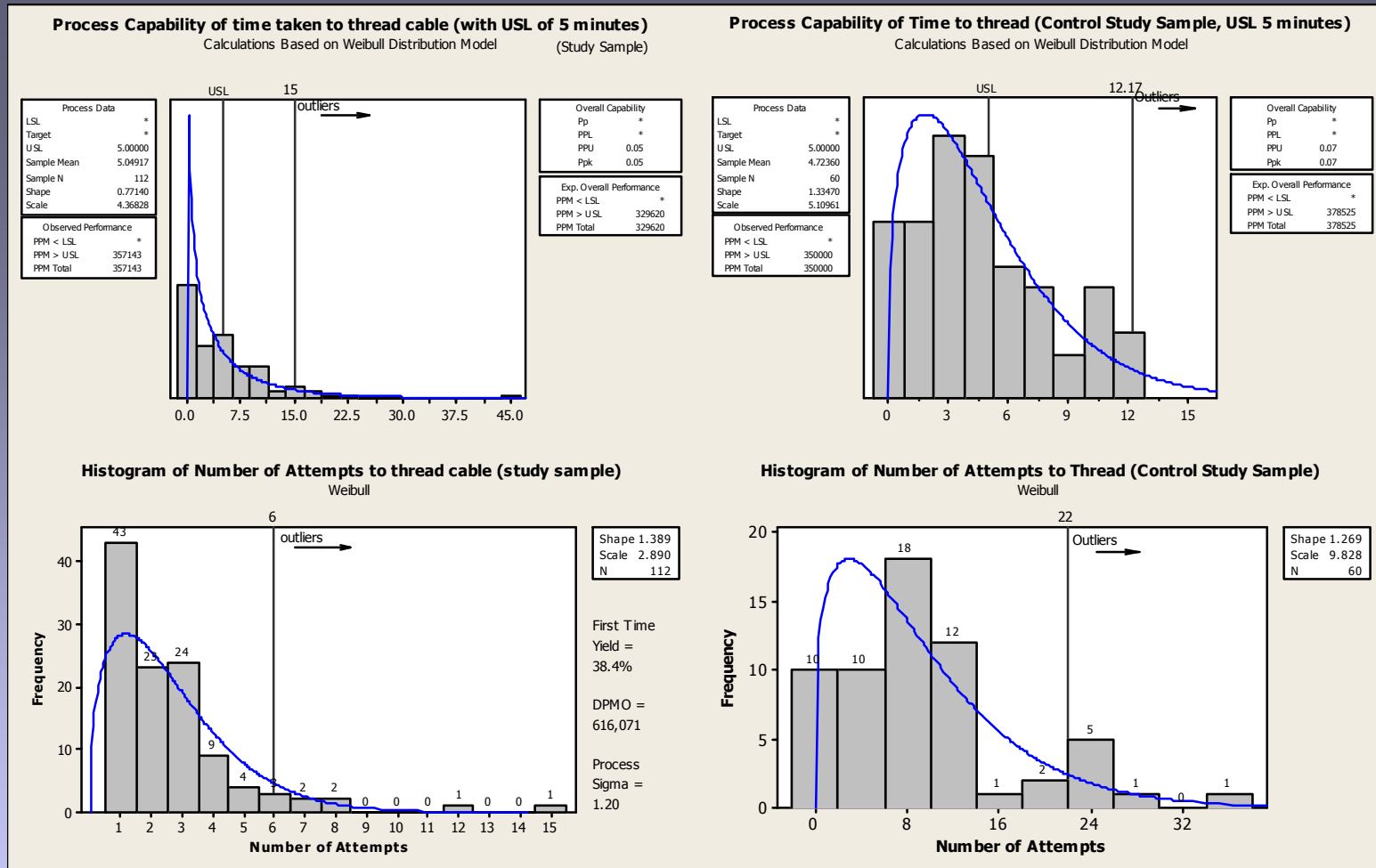
# Analysis of Control Sample Data: **KPO(Y) No.2**

## No. of Attempts taken to Thread (without Magnamole)



- Typical variation of 1 to 22 attempts, with outliers up to 34 attempts
- Positively skewed non-normal distribution
- First Time Yield of 16.7%, estimate of Process Sigma ( $Z_{st}$ ) = <1: Target = 6
- 11.7% of sample threading completed using unsafe aids
- 1.67% of samples threaded on 1<sup>st</sup> attempt completed with an unsafe aid

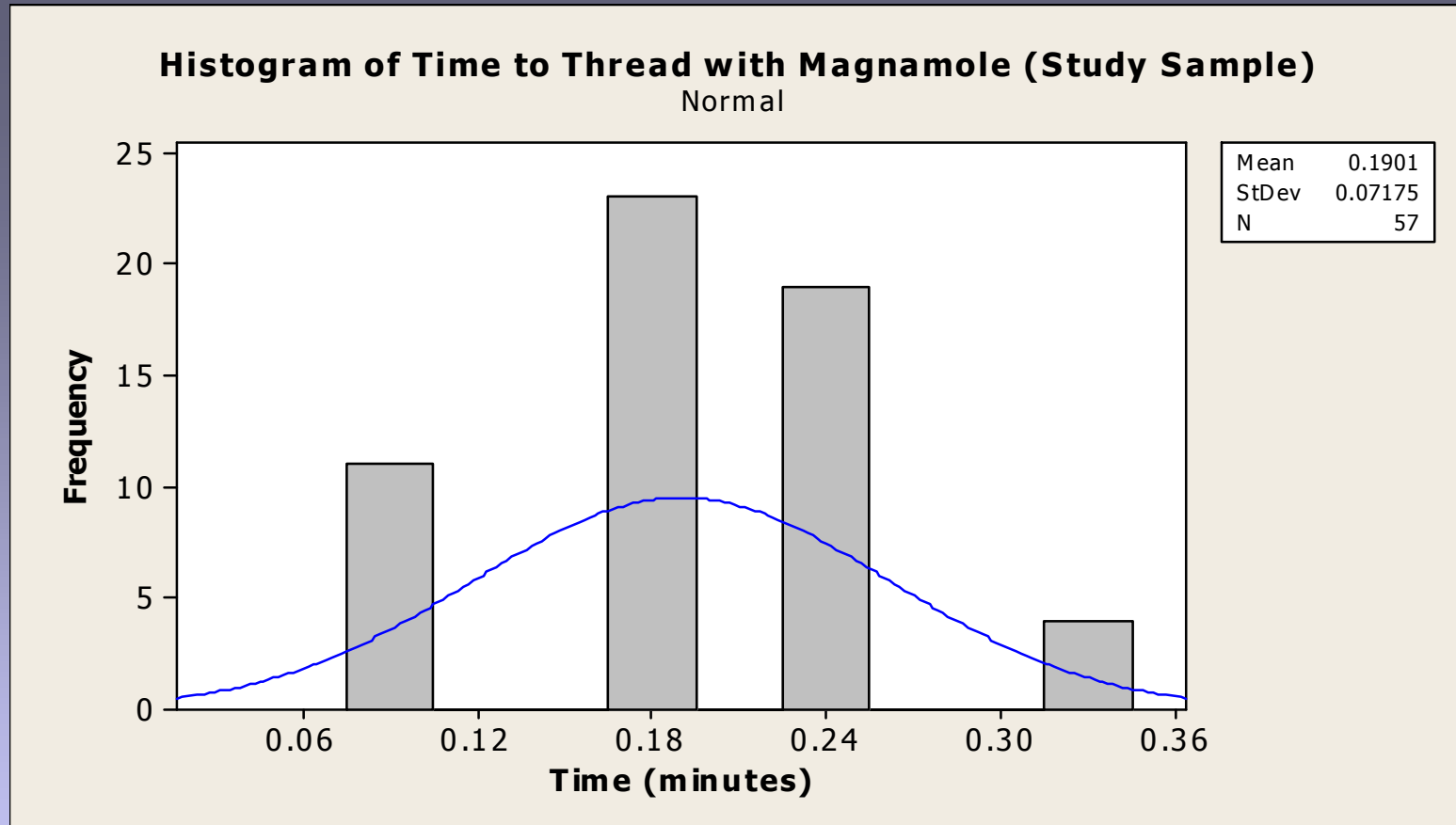
# Study Sample summary, Field vs. Control



- Distributions are very similar
- Typical range of Threading Time very similar
- Field data curve predicts more samples at 1.25 minutes or less – why?
- No. of Attempts for Control Data reflects reduced use of threading aids (& need!)

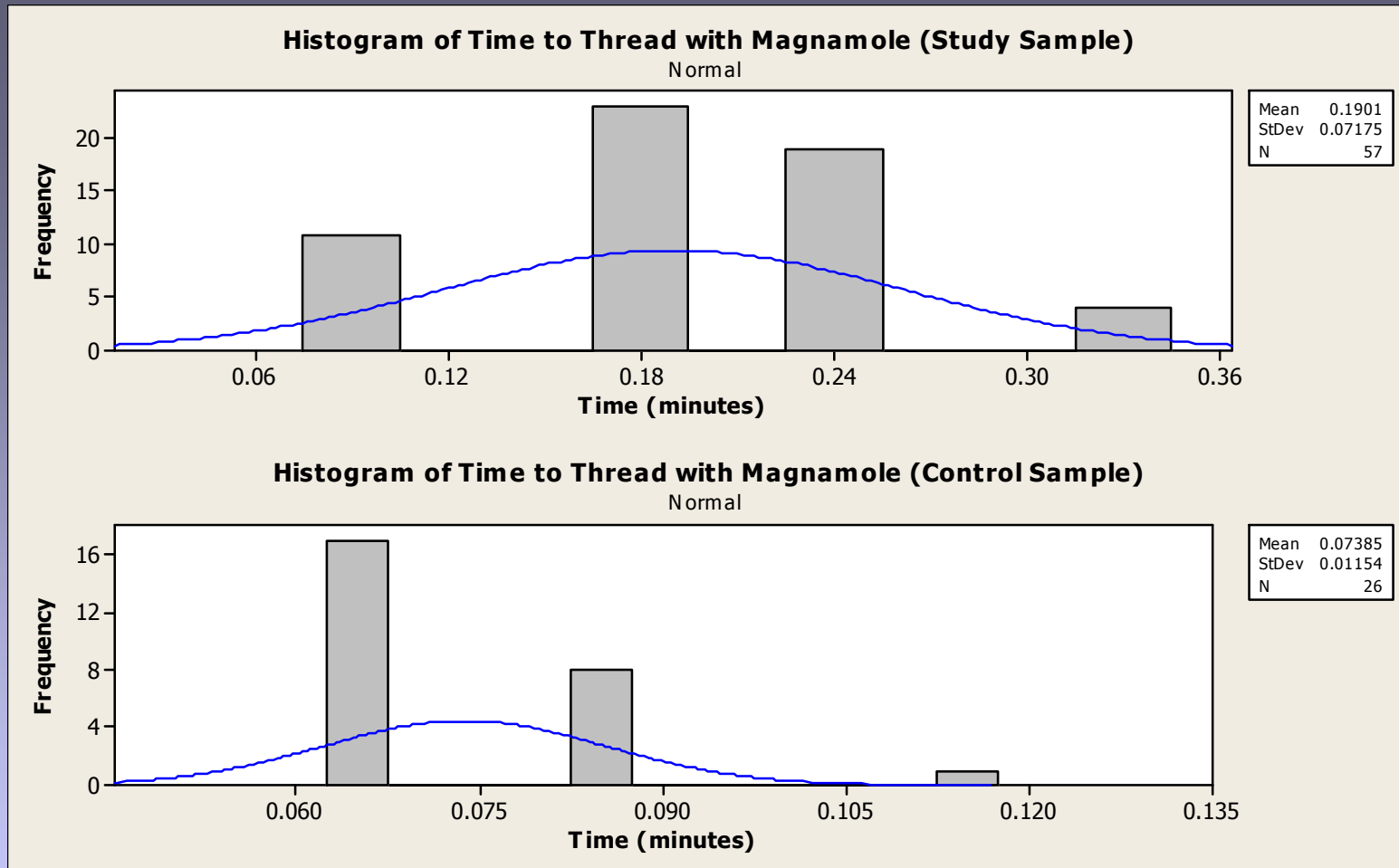
# Analysis of Field Study Data: **KPO(Y) No.1**

## Time in minutes taken to Thread (per job), **with Magnamole**



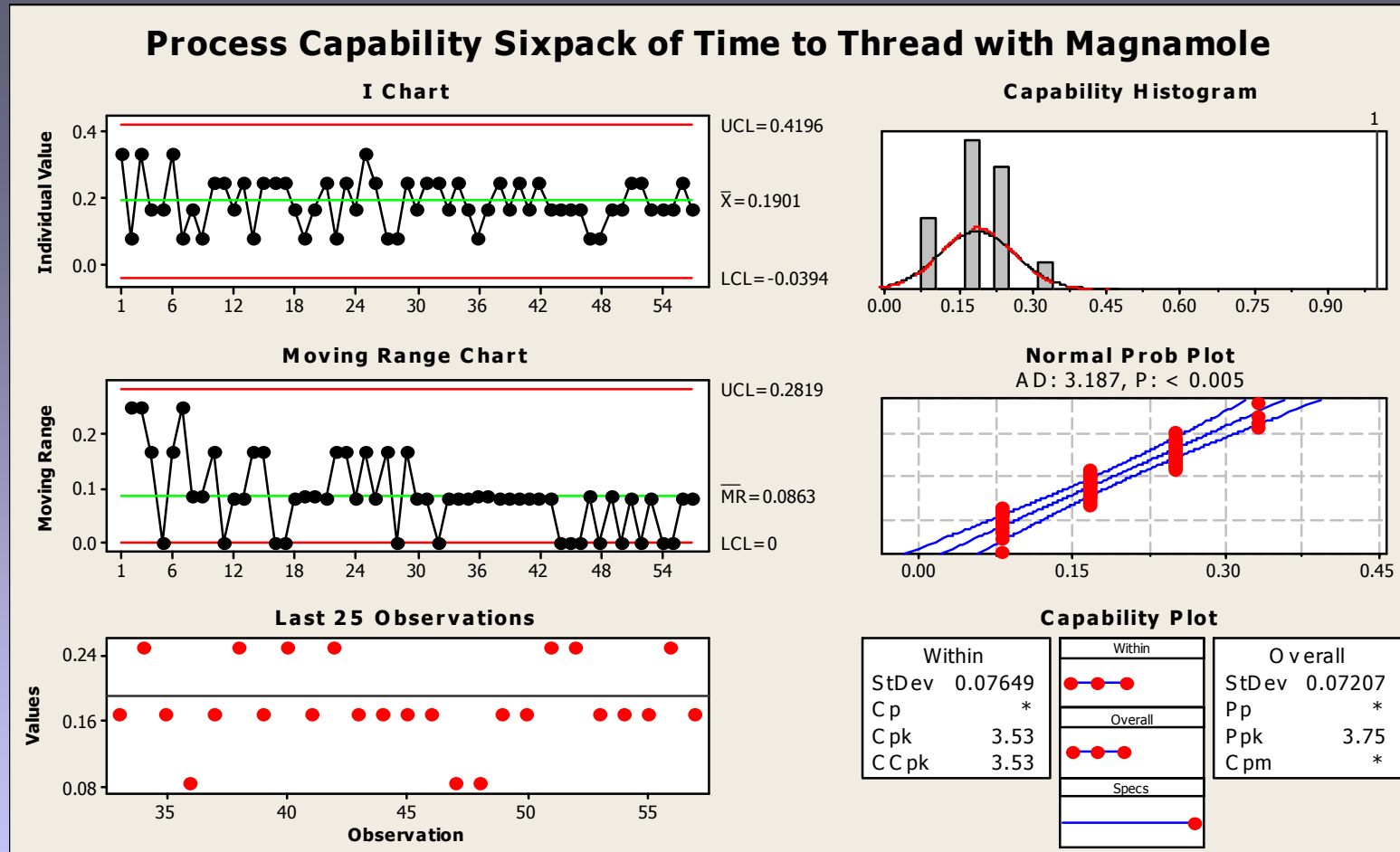
- Typical variation of 5 to 20 seconds, no outliers
- Mean threading time of 11.4 seconds with standard deviation of 4.3 seconds
- Data resolution poor due to speed of process – engineers timing to the nearest 5 seconds as per ‘quick’ threads on field study for current process
- Normal distribution can be observed from Histogram curve
- Threading completed in 1 Attempt for all 57 samples

# Time in minutes taken to Thread **with Magnamole**, Field vs. Control



- Control samples threaded in 4 to 7 seconds
- Same 'binning' of data resolution due to speed of process
- Control data fitted to normal distribution curve
- Threading completed in 1 Attempt for all 26 samples

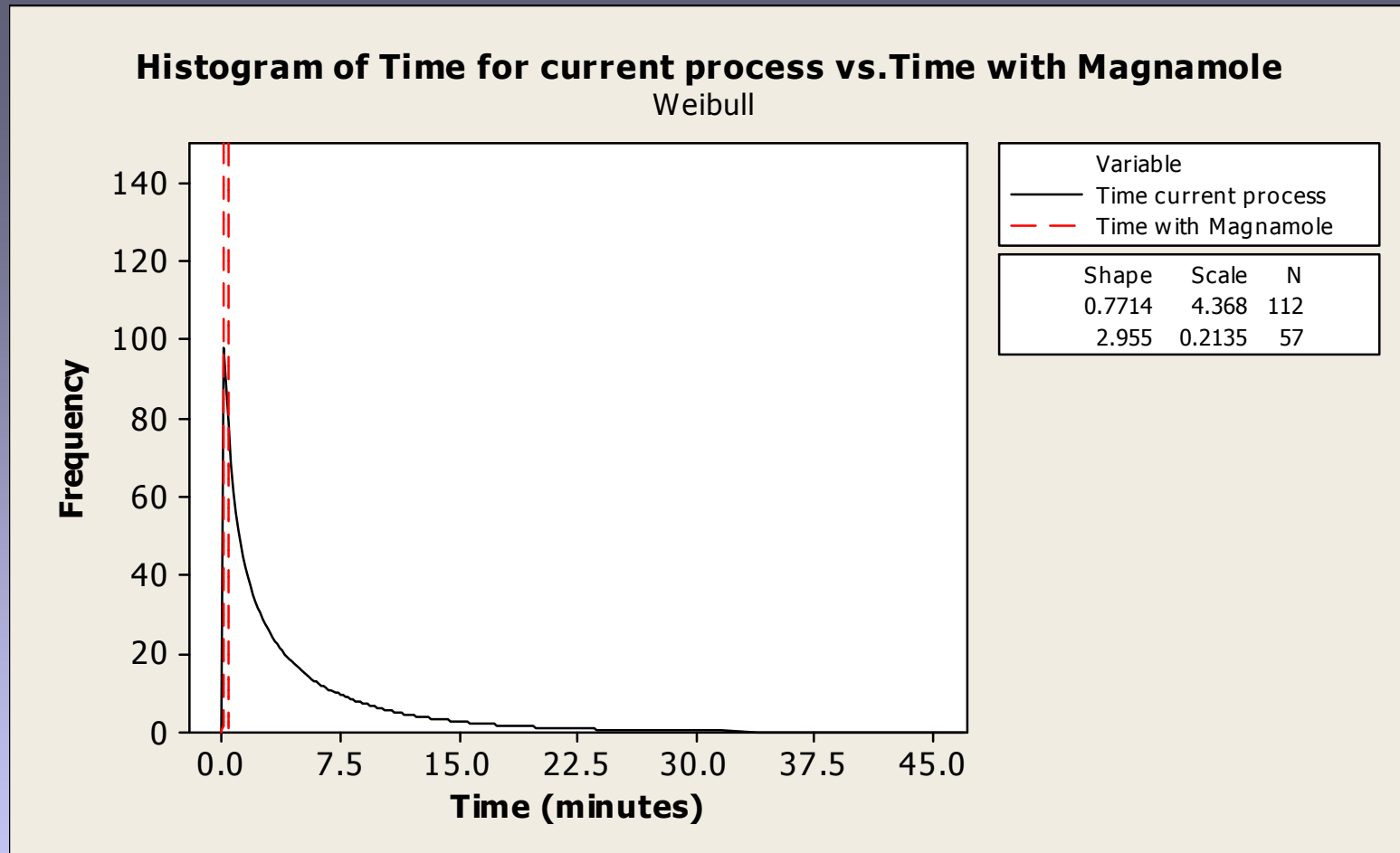
# Analysis of Field Study Data: **KPO(Y) No.1** Time in minutes taken to Thread (per job), **with Magnamole**



- **Stable process, no special cause variation detected**
- **Common cause variation defined by Upper & Lower statistical Control Limits (LCL, UCL) - 99.7% of the time data points will fall below 25.2 seconds**
- **Process with Magnamole is robust to sources of variation**
- **6 – Sigma performance exceeded for an Upper Spec. Limit of 1 minute**

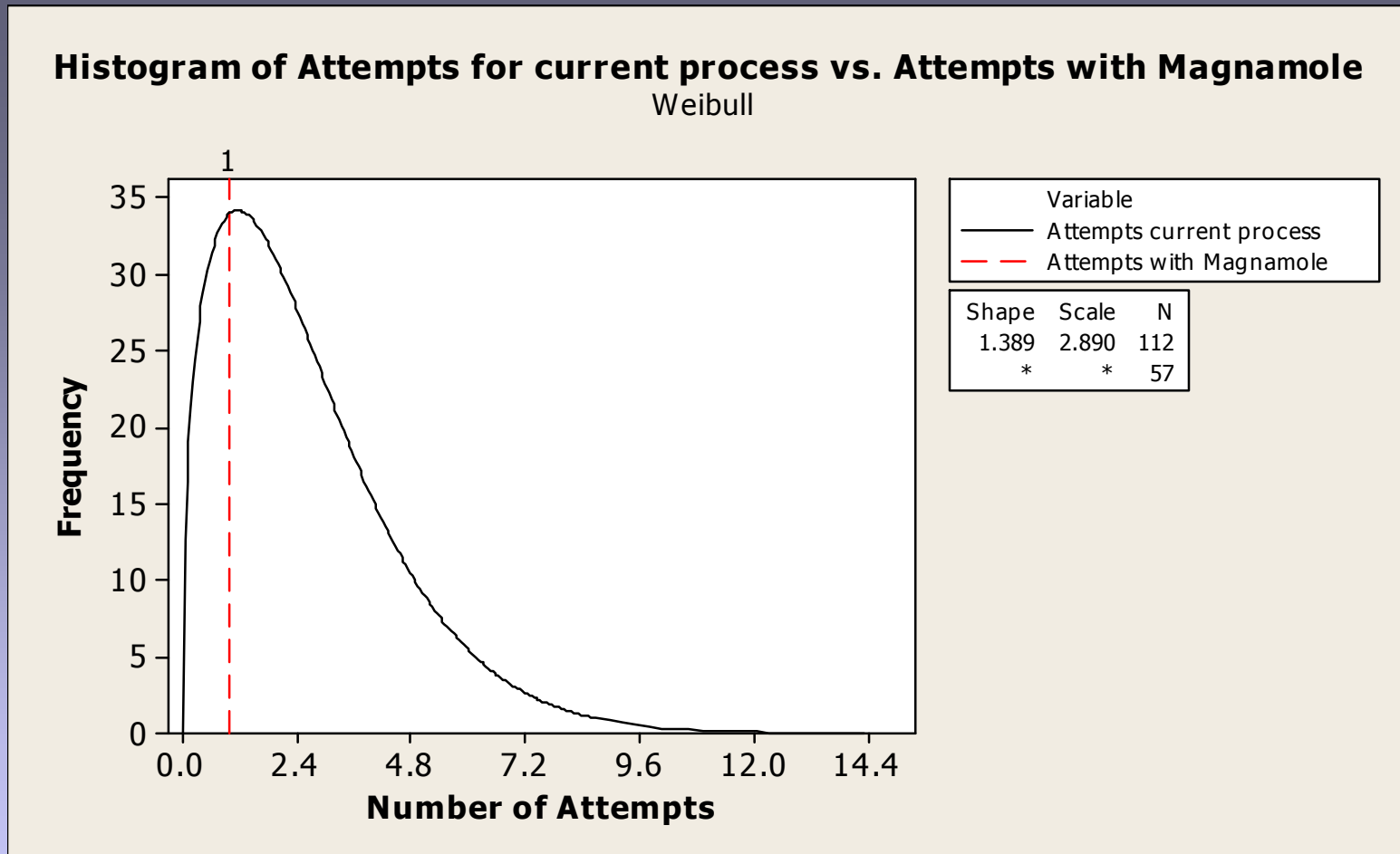


# Analysis of **KPO(Y) No.1**, Time in minutes taken to Thread: comparison of current process to process **with Magnamole**



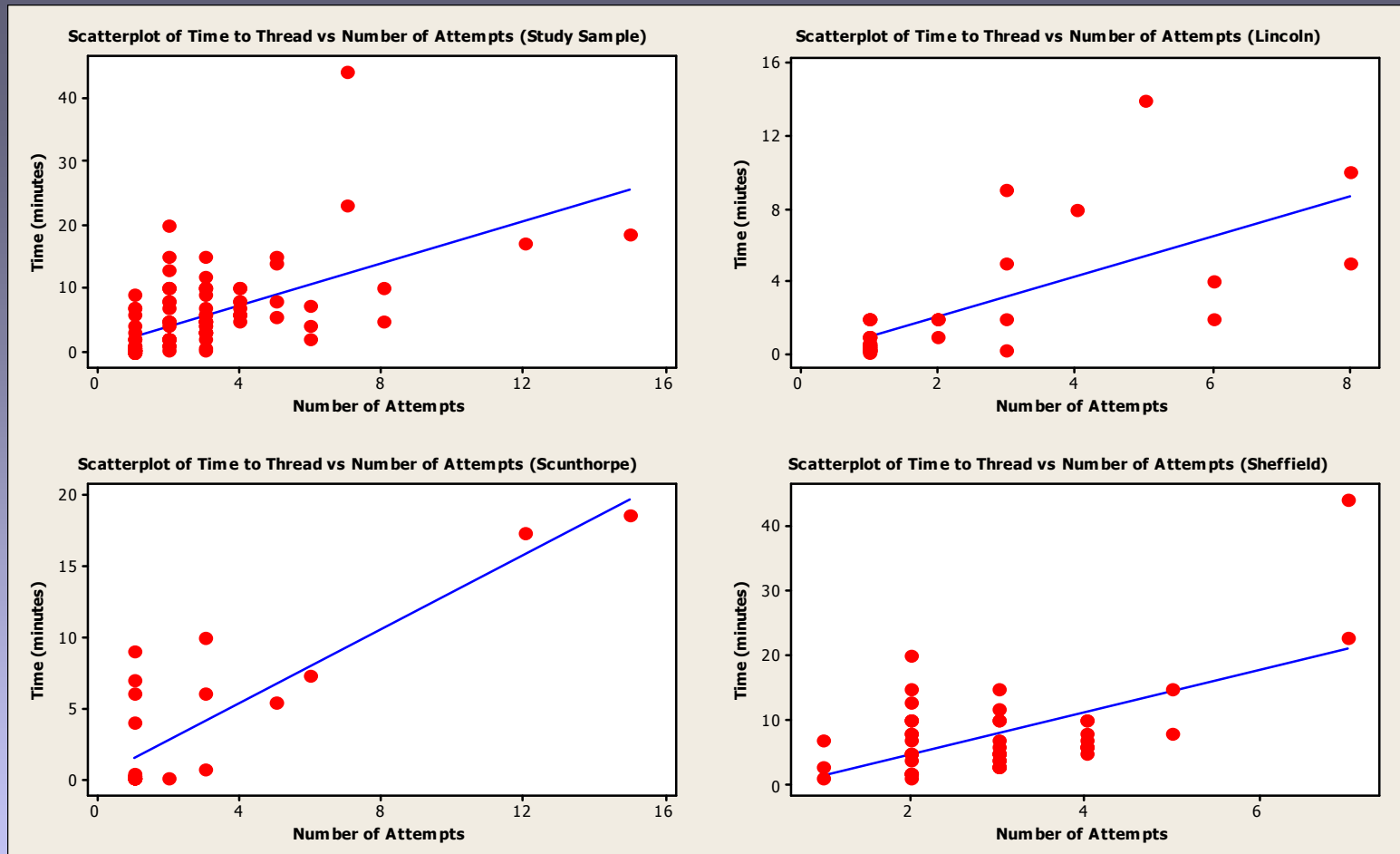
- **Magnamole eliminates the non – normal variation in the current process**

# Analysis of **KPO(Y) No.2**, No. of Attempts taken to Thread: comparison of current process to process **with Magnamole**



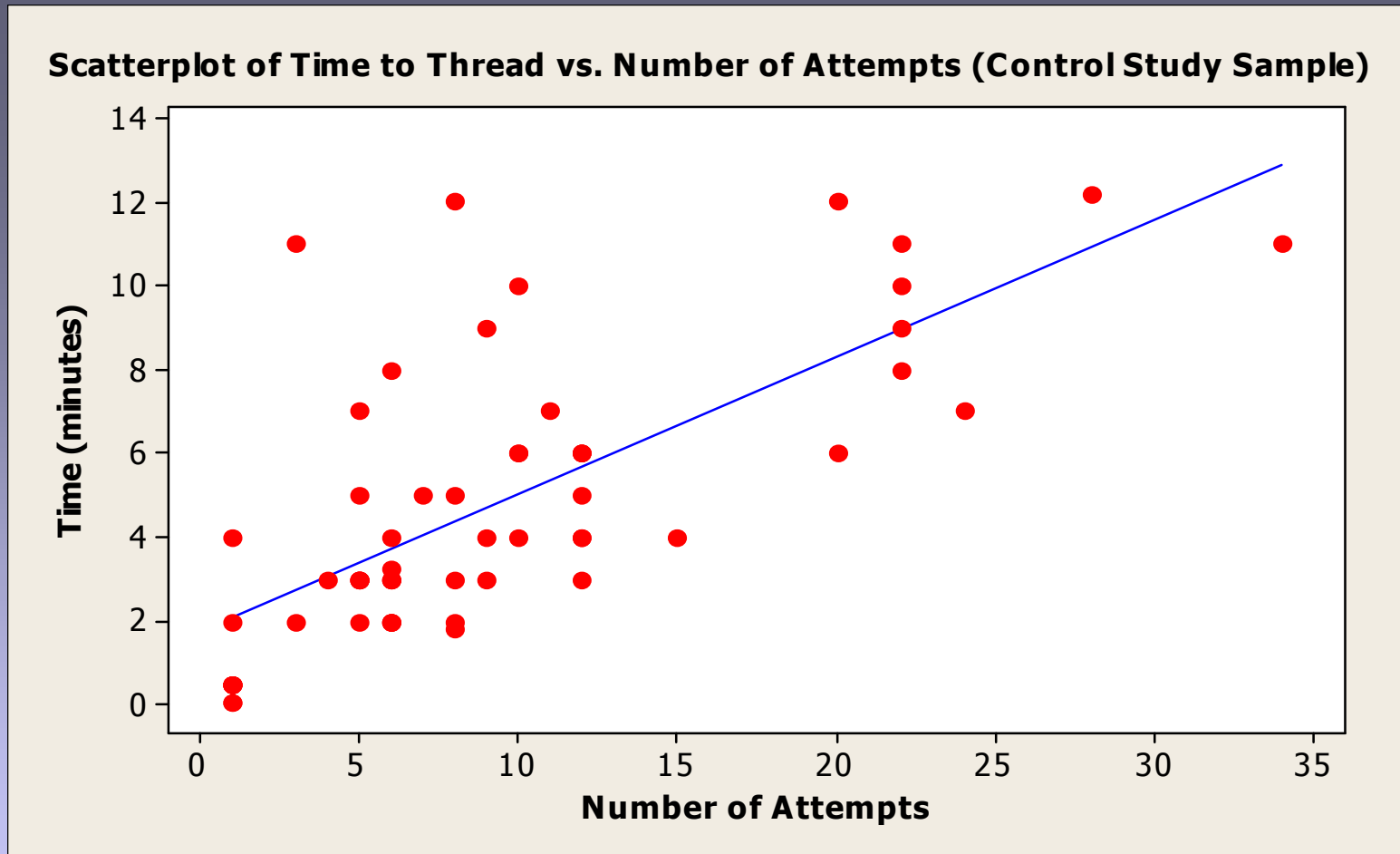
- **Magnamole eliminates the non – normal variation in the current process**

# Scatter Plots of Threading Time vs. Number of Attempts, Field Data current process by site



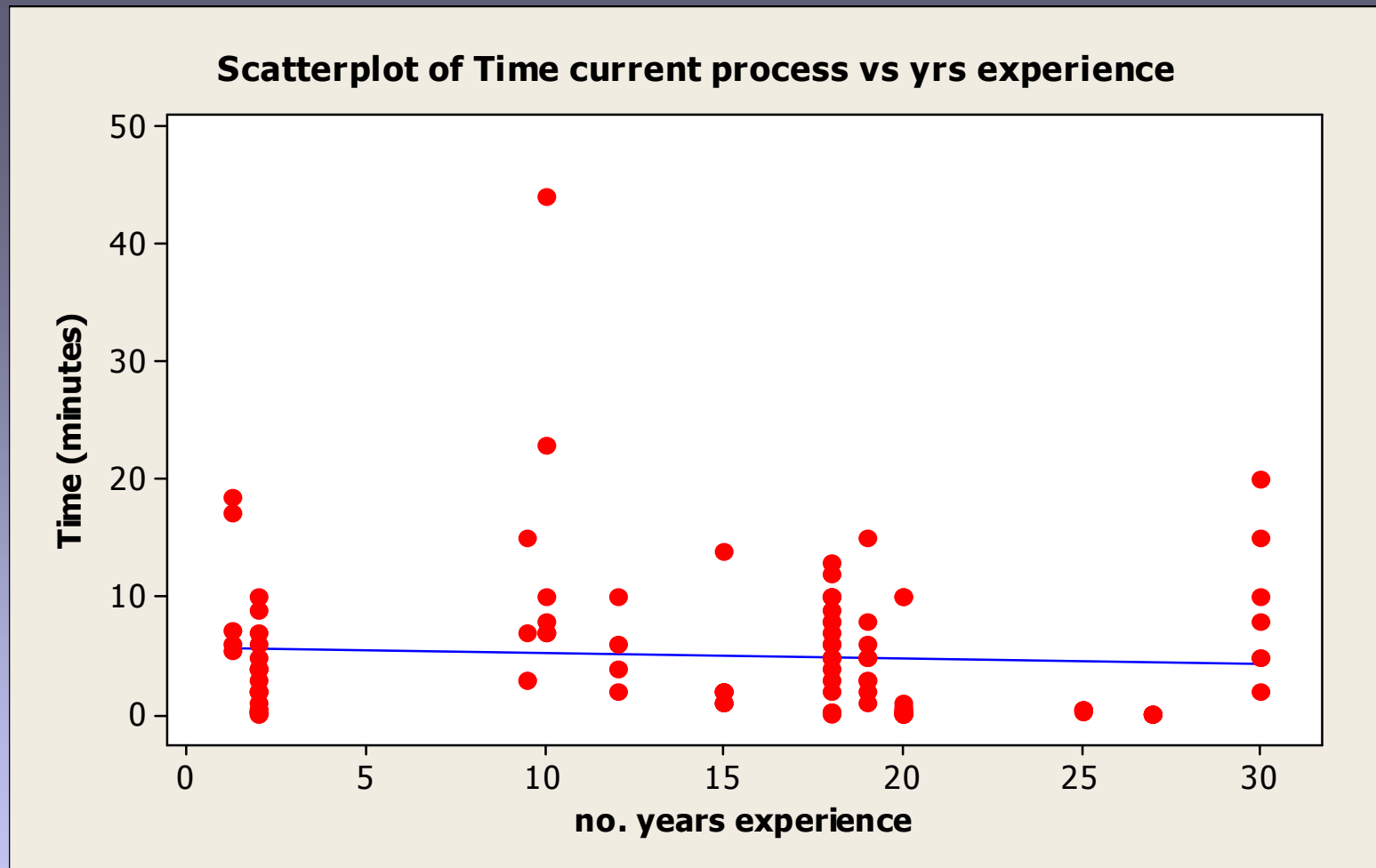
- Plots confirm a weak positive correlation between Threading Time and corresponding Number of Attempts
- Strength of correlation usually determinable by Pearson Co-efficient but in this case unreliable, as data distributions are non-normal

# Scatter Plots of Threading Time vs. Number of Attempts, Control Study Sample



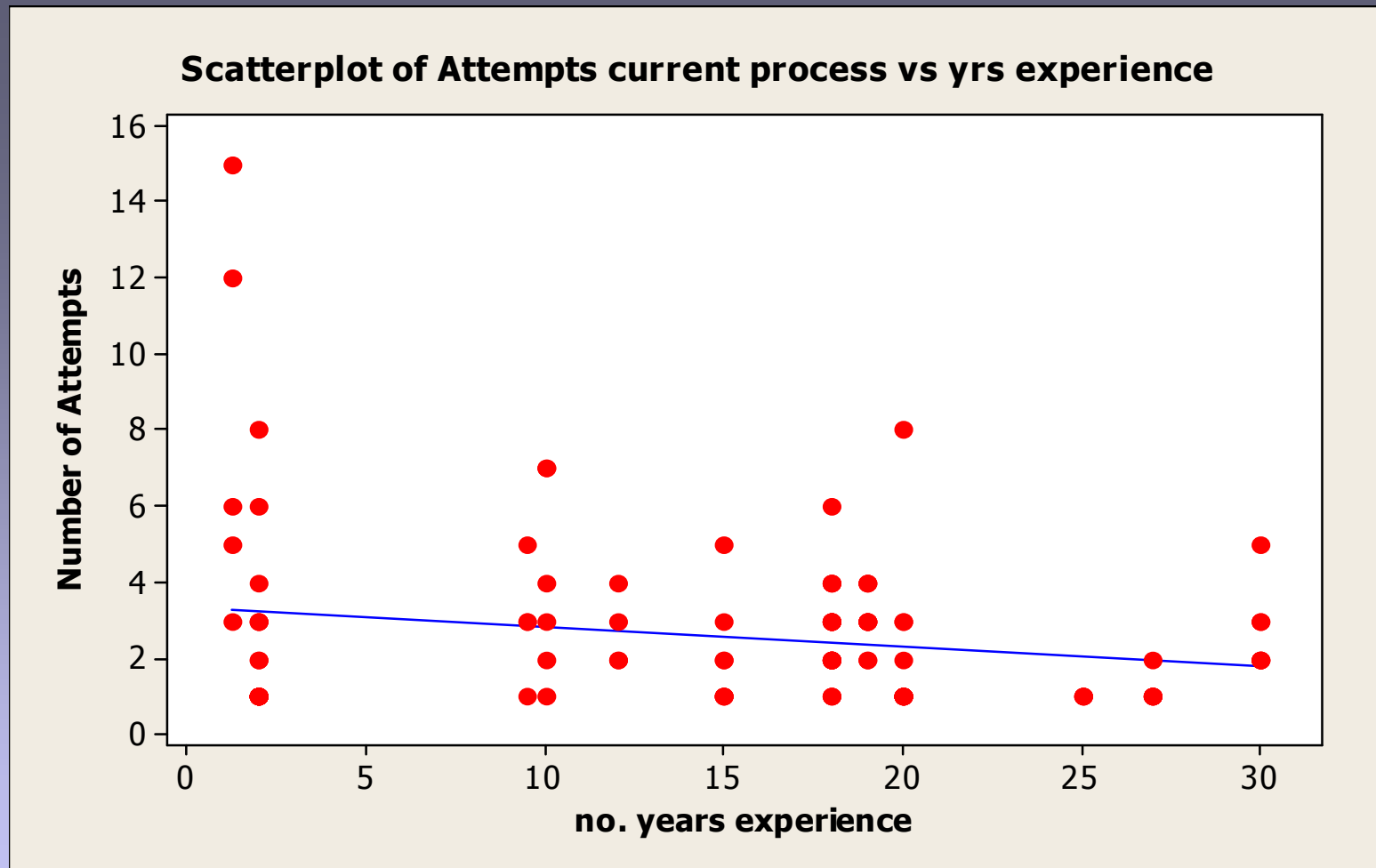
- Plot confirms a moderate positive correlation between Threading Time and corresponding Number of Attempts
- Expected due to consistent inputs – 6 Wire cable, 10mm hole in same mock wall / cavity

## Scatter Plots of Threading Time vs. Experience (Study Sample)



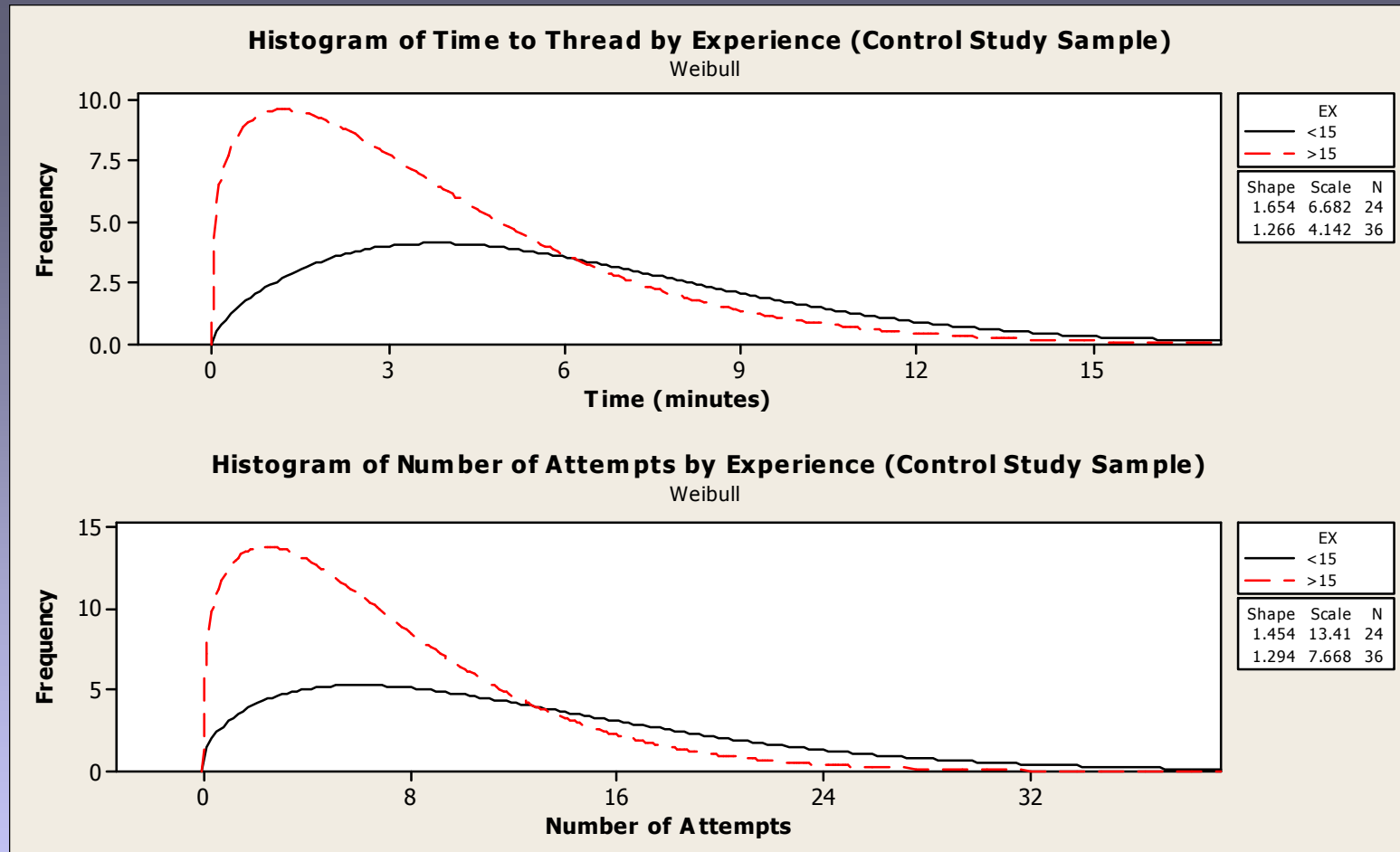
- Study Sample data indicates no correlation between time & experience
- Indicates a need for the Magnamole for the population as a whole

# Scatter Plots of No. of Attempts vs. Experience (Study Sample)



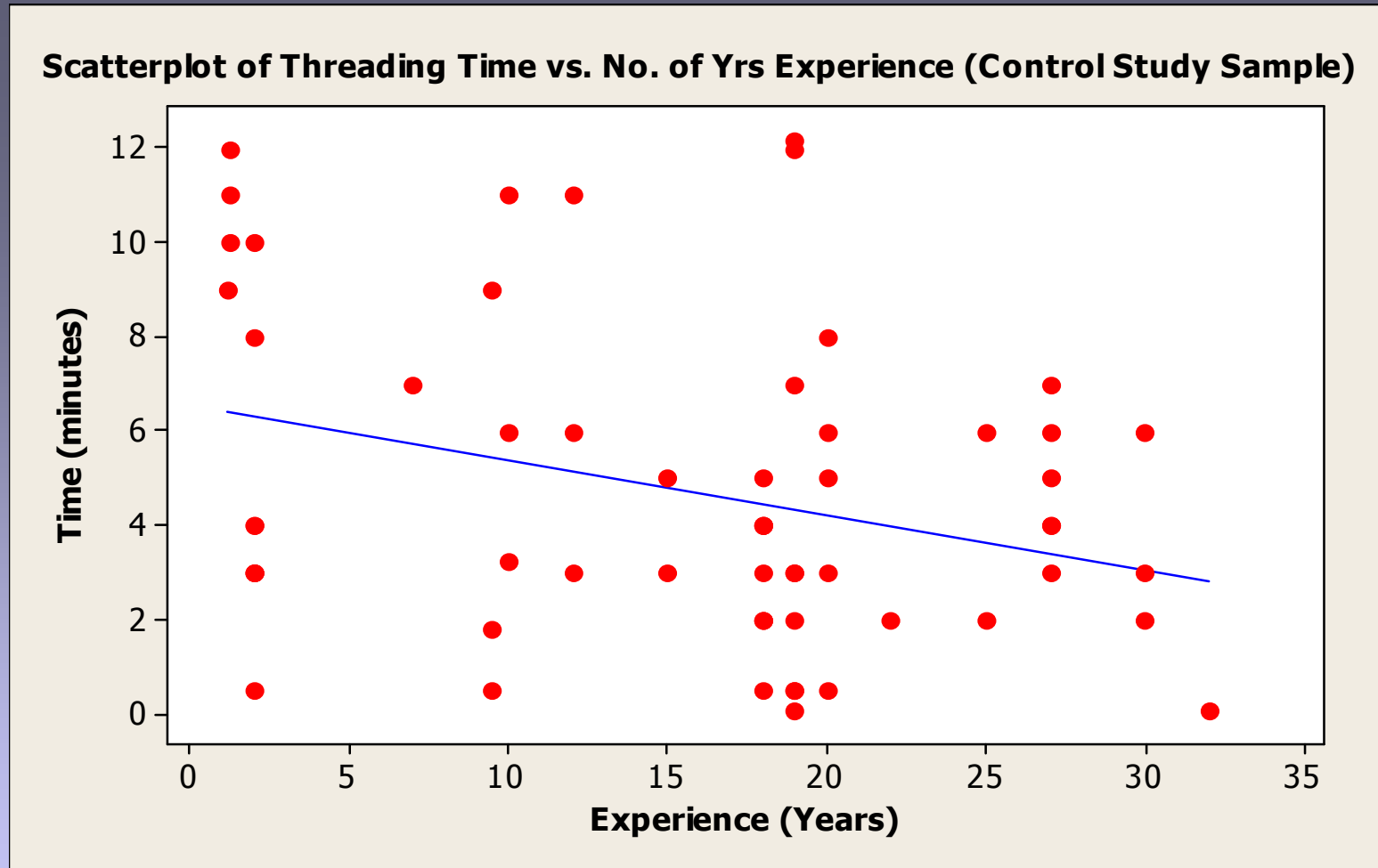
- Study Sample data indicates no correlation between time & experience
- Indicates a need for the Magnamole for the population as a whole

# Histograms of Threading Time and No. of Attempts vs. Experience (Control Sample)



- Less data points for engineers with <15 yrs experience – distributions could be the same with equal data points

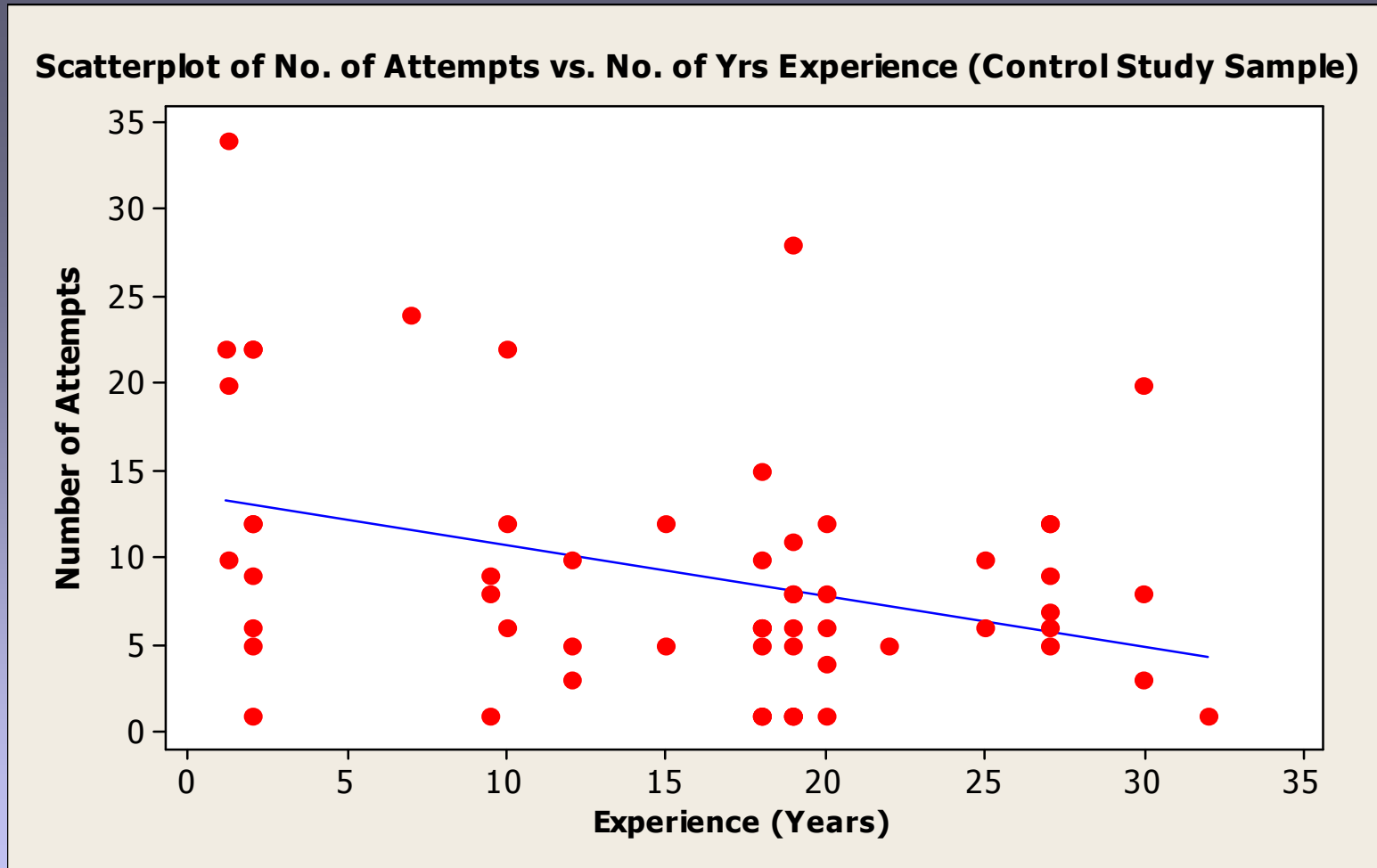
# Scatter Plots of Threading Time vs. Experience (Control Sample)



- Study Sample data indicates no correlation between time & experience
- Indicates a need for the Magnamole for the population as a whole

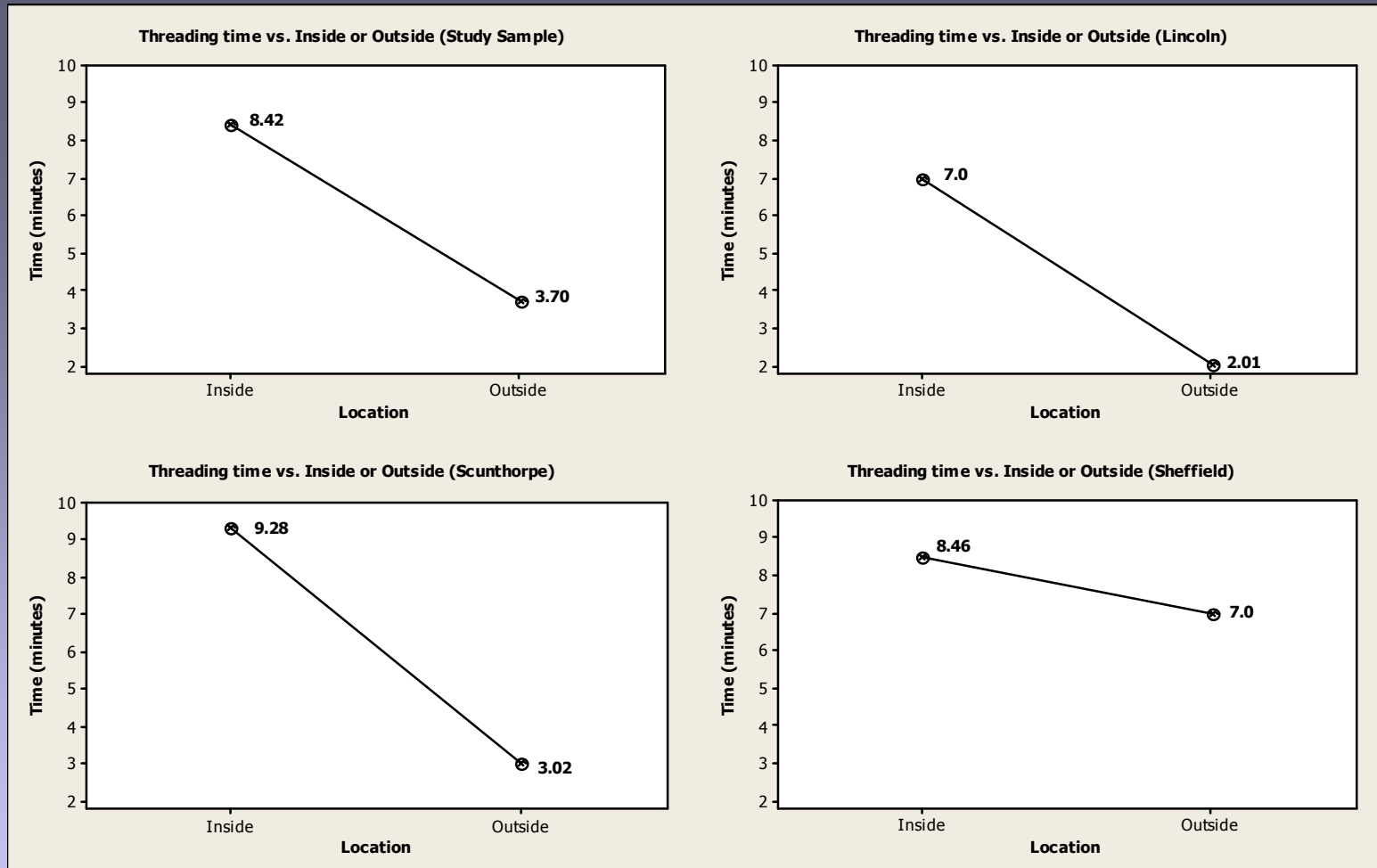


# Scatter Plots of No. of Attempts vs. Experience (Control Sample)



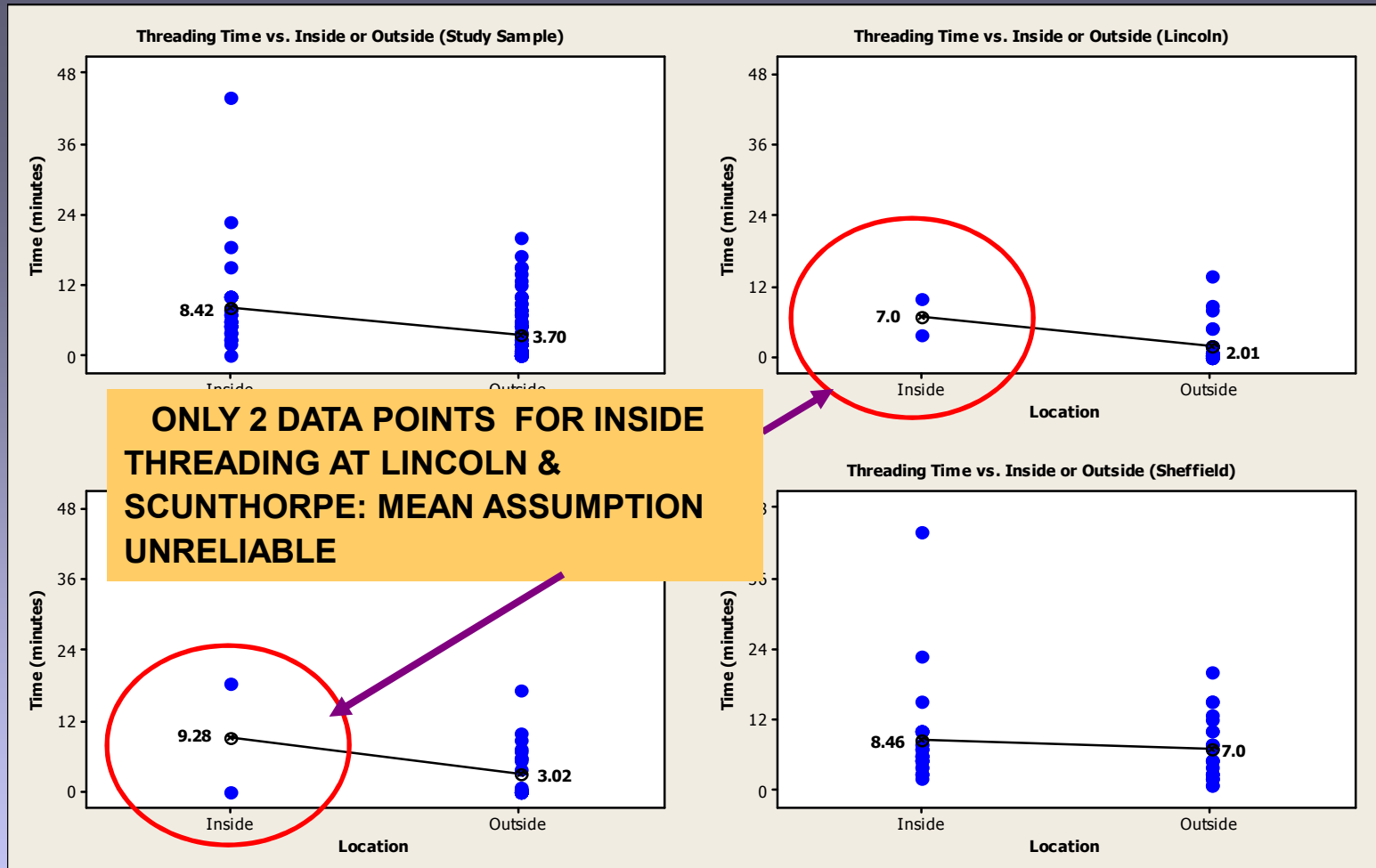
- Study Sample data indicates no correlation between time & experience
- Indicates a need for the Magnamole for the population as a whole

# Average Threading Time vs. threading from Inside or Outside



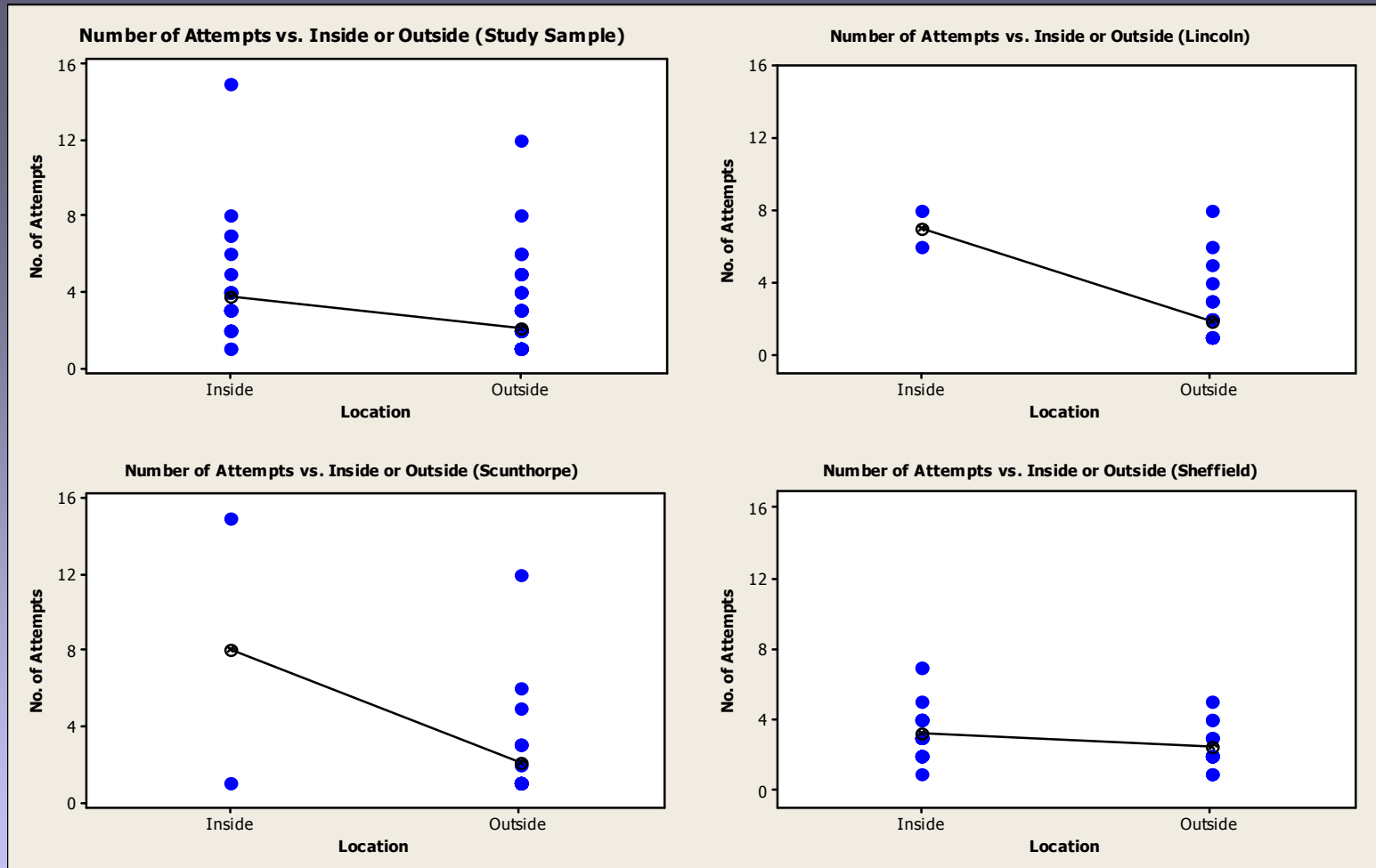
- Average Time to thread from the Inside was higher than threading from the Outside, at all 3 sites
- Average Time to thread from the Outside was higher at Sheffield, compared to Lincoln and Scunthorpe – **WHY?**

# Threading Time vs. threading from Inside or Outside



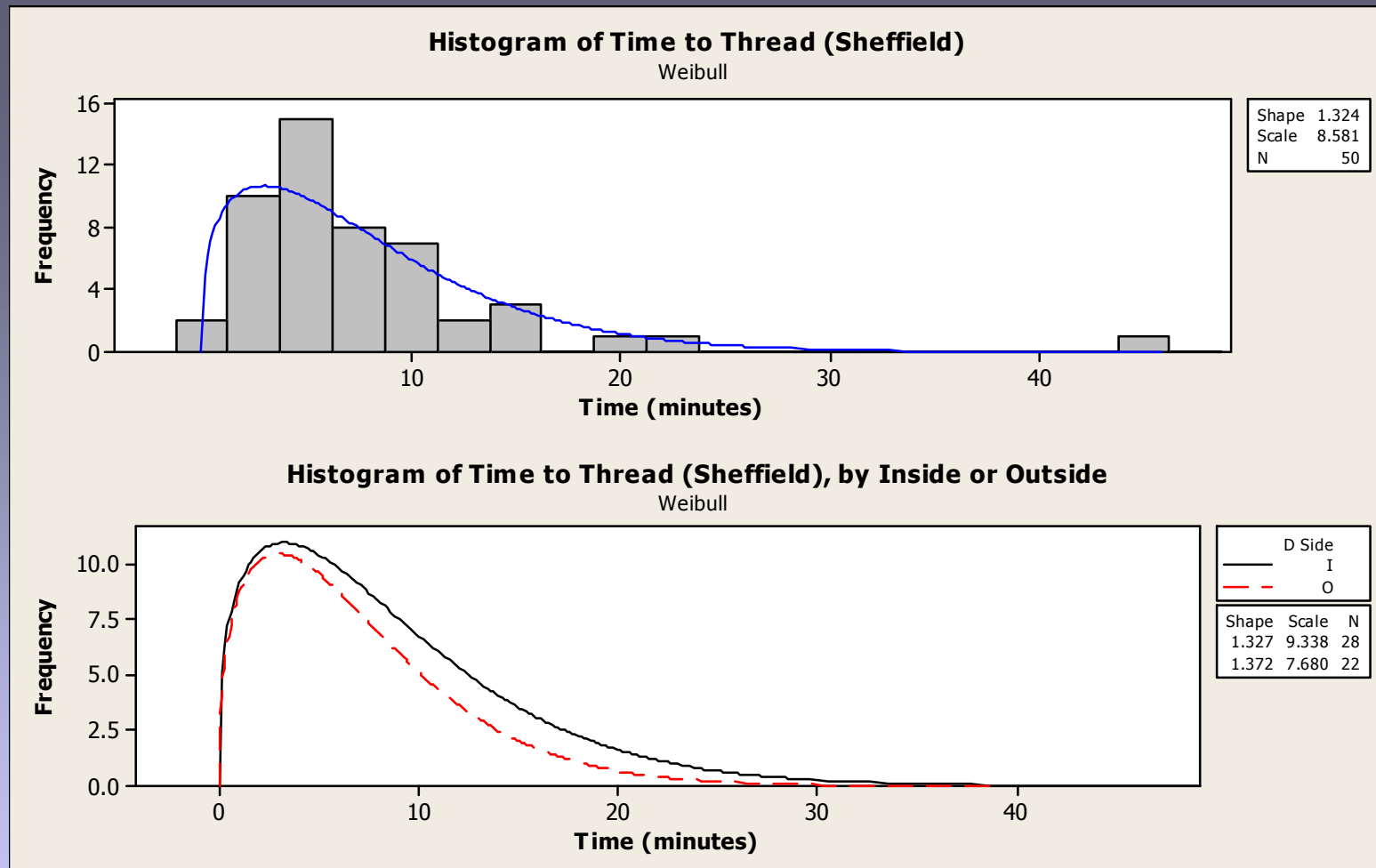
- Charts show Average Time as per previous slide, but also full range of data
- Data points show that although averages for threading from Outside are lower, range of results is similar to threading from Inside – indicates need for tool for both threading locations

# Number of Attempts vs. threading from Inside or Outside



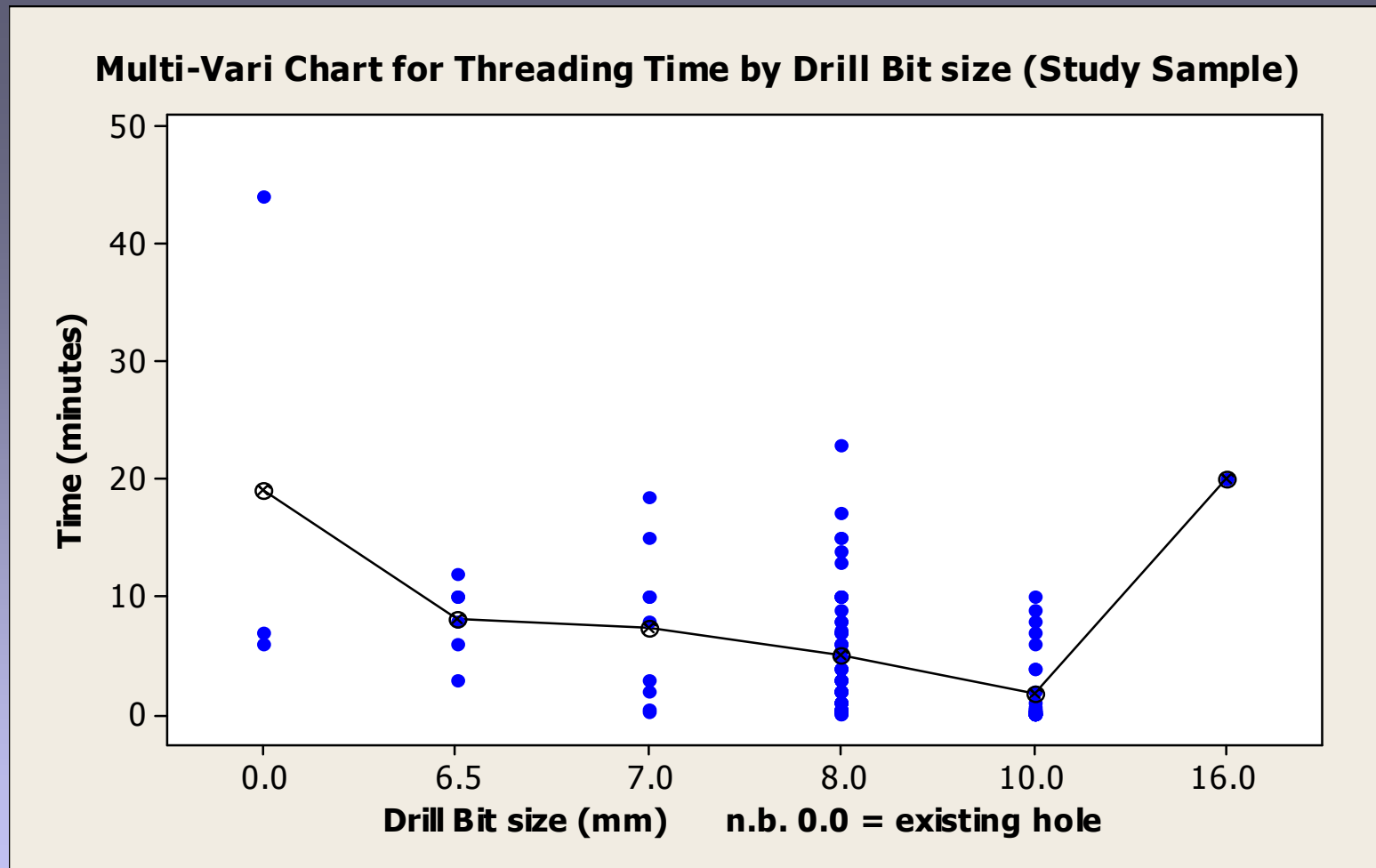
- Average Number of Attempts to thread from the Inside higher than threading from the Outside, at all 3 sites – follows trend for Time
- Data points show that although averages for threading from Outside are lower, range of results is similar to threading from Inside

# Threading Time for Sheffield



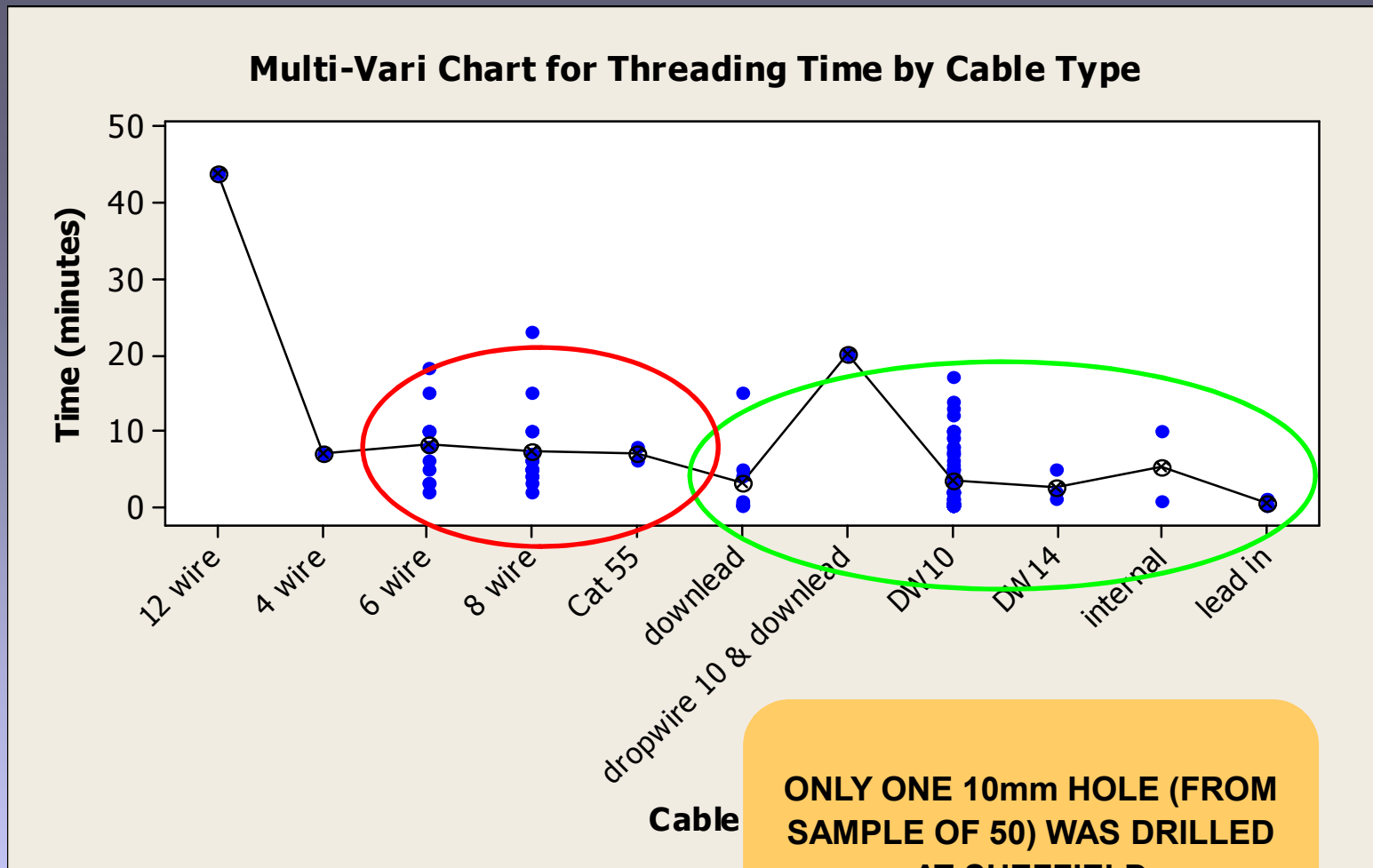
- Sheffield has the largest subset of data,  $N = 50$
- Distribution shape and Times are almost the same for threading from Inside and Outside
- **WHY?**

# Threading Time by Drill Bit size (Study Sample)



- Range of threading time lower for 10mm hole than 8mm hole at all 3 sites – smaller hole size is a key source of variation

# Threading Time by Cable Type (Study Sample)

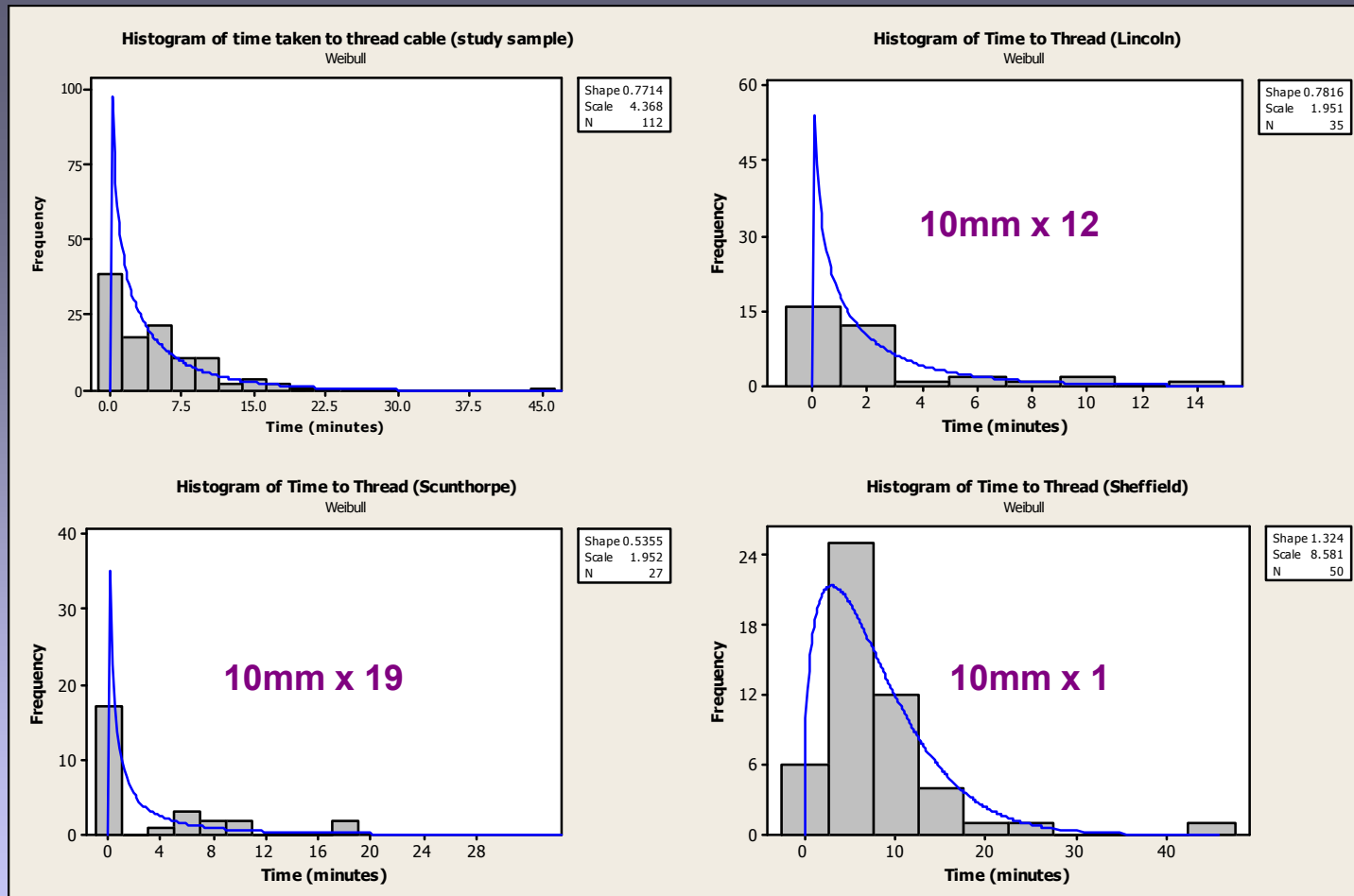


**ONLY ONE 10mm HOLE (FROM SAMPLE OF 50) WAS DRILLED AT SHEFFIELD**

- 6 – wire, 8- wire and Cat 55 all through 10mm holes (32 data points)
- Download, DW10, DW14, internal & lead in all have samples threaded through 10 mm holes, 41% overall (32 out of 78 data points)
- Average times for samples including 10mm holes are lower

# Analysis of Field Study Data: **KPO(Y) No.1**

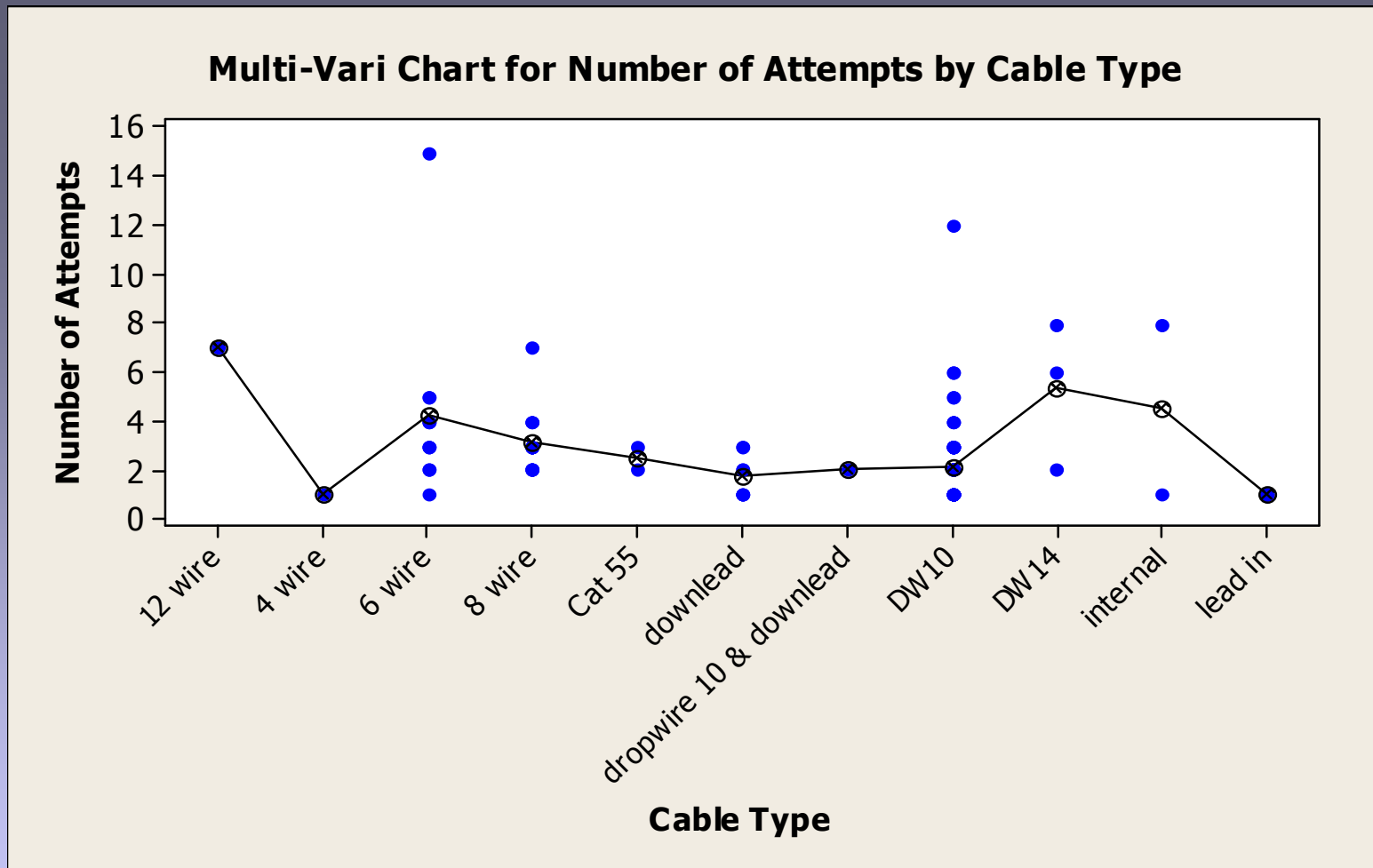
## Time in minutes taken to Thread (per job), current process



- Drill Bit Size explains the difference in the observed distributions
- Drill Bit Size is the Root Cause of variation seen between sites in the Study Sample

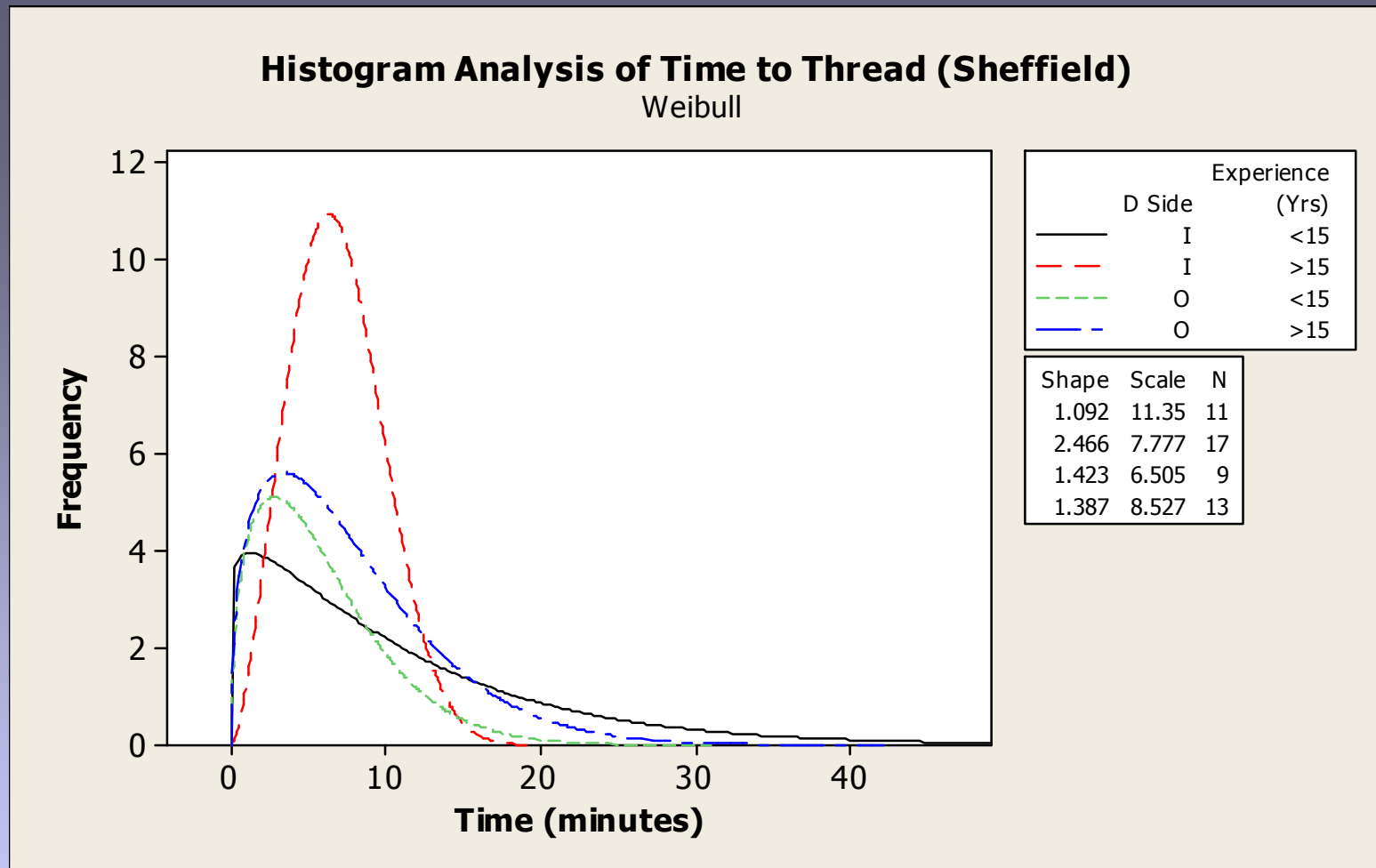


# Number of Attempts by Cable Type (Study Sample)



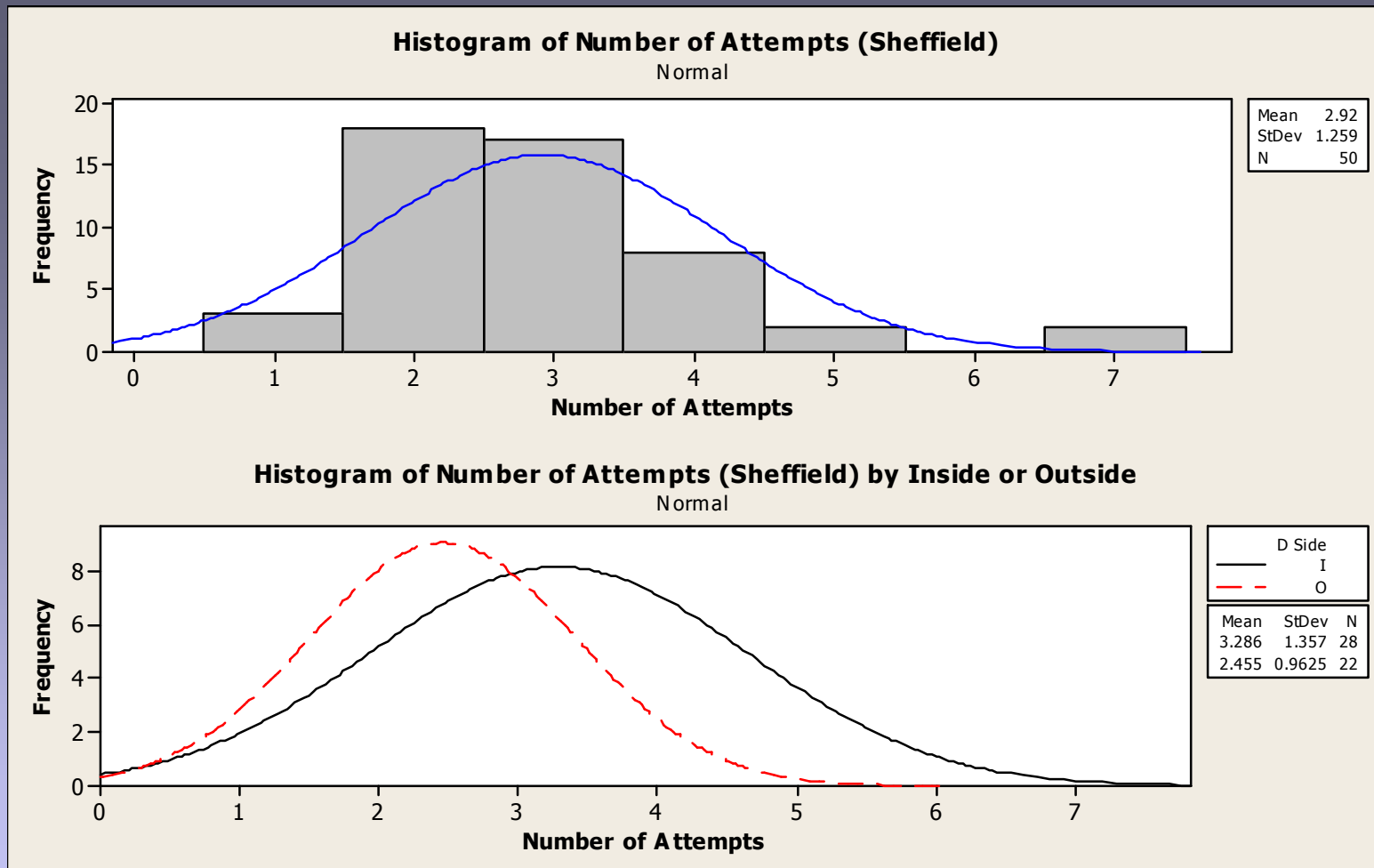
- Comparison of 6 wire, 8 wire & DW10 similar to chart for time

# Threading Time for Sheffield by Yrs. Experience



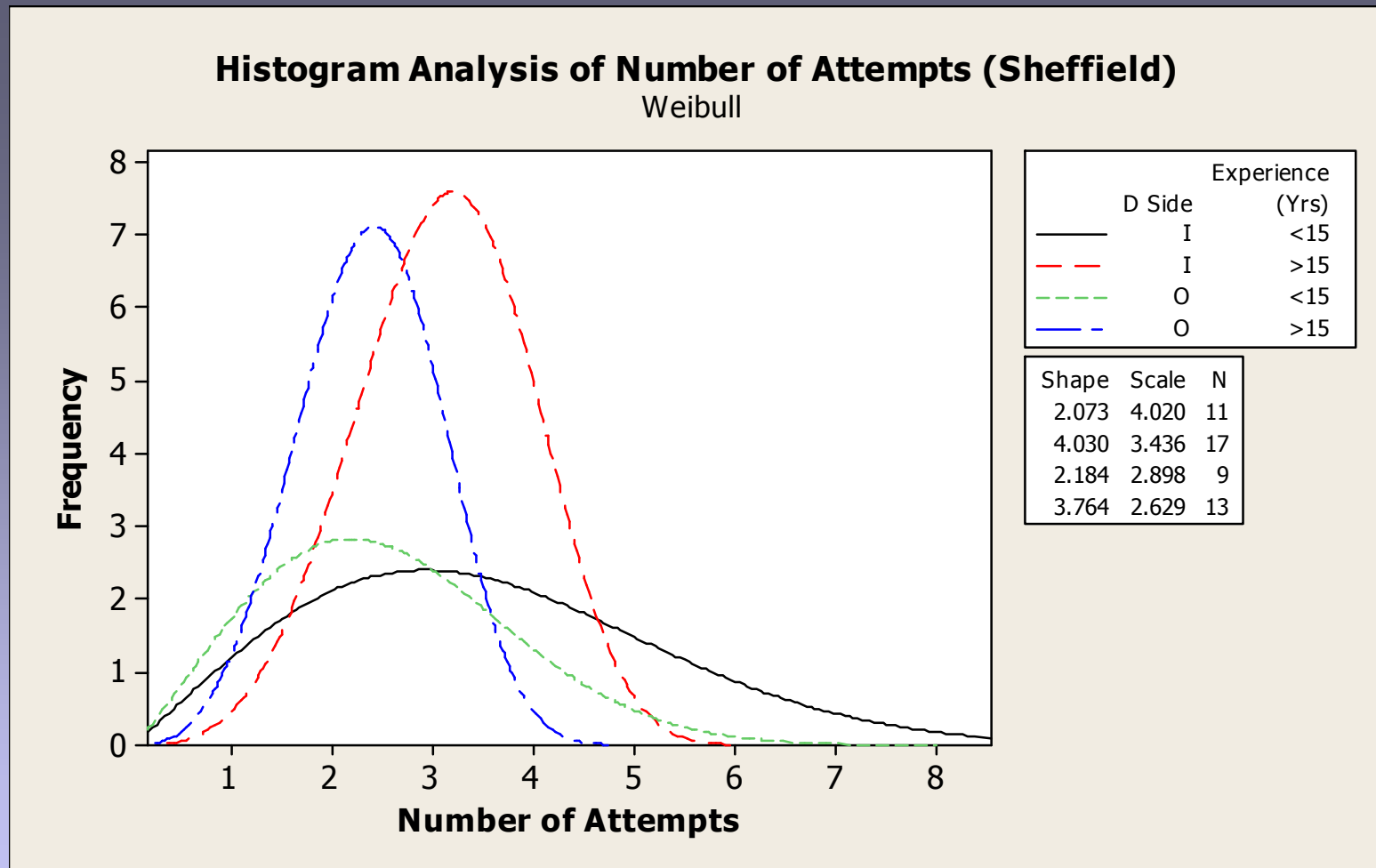
- Distribution shape analysed by more than / less than 15 years experience
- For Outside threading, distributions are still similar (blue & green)
- For Inside threading, distribution is almost normal for >15 yrs experience
- Distribution is worst for Inside threading, < 15 yrs experience

# Number of Attempts for Sheffield



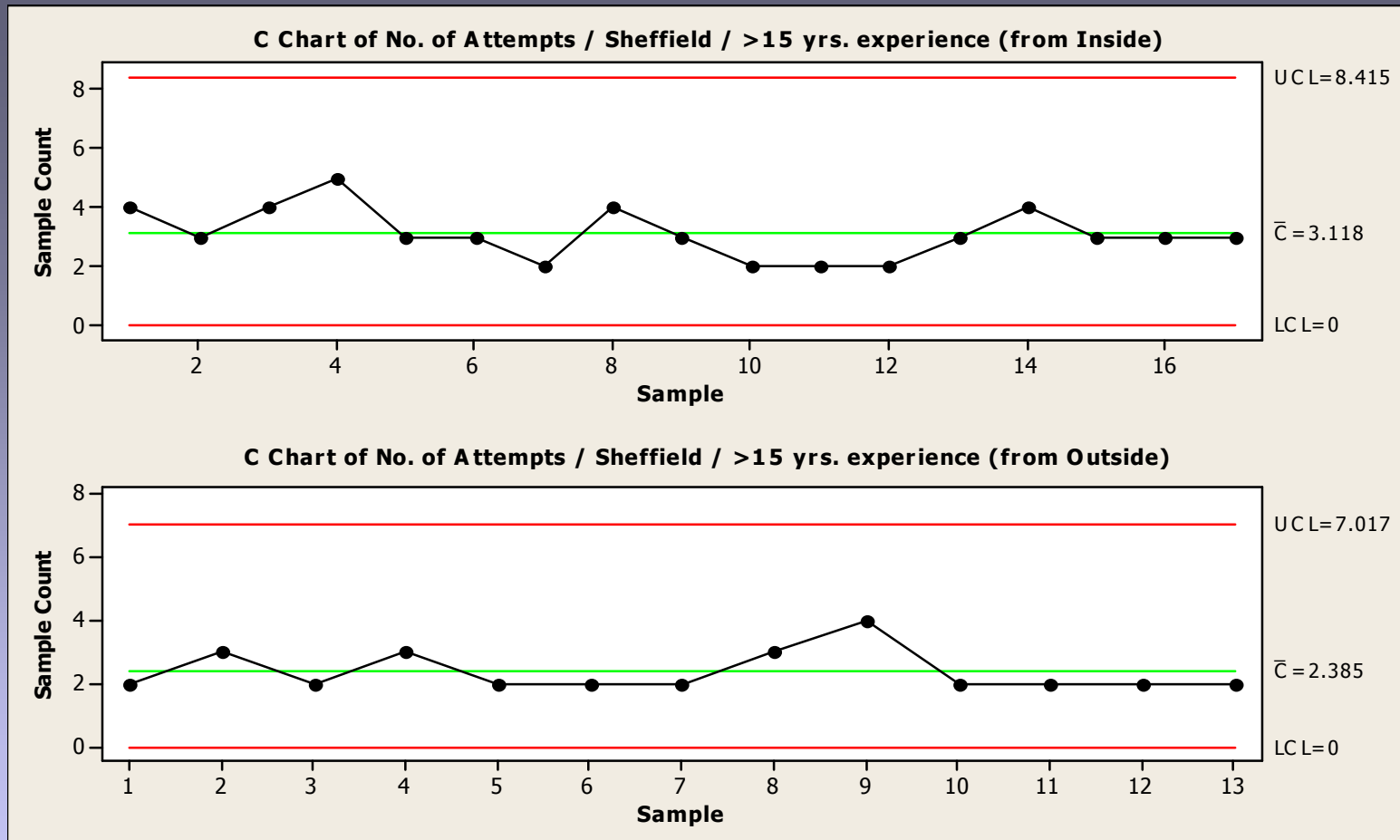
- Distribution shape is almost 'Normal' for threading from Inside and Outside
- **WHY?**

# Number of Attempts for Sheffield by Yrs. Experience



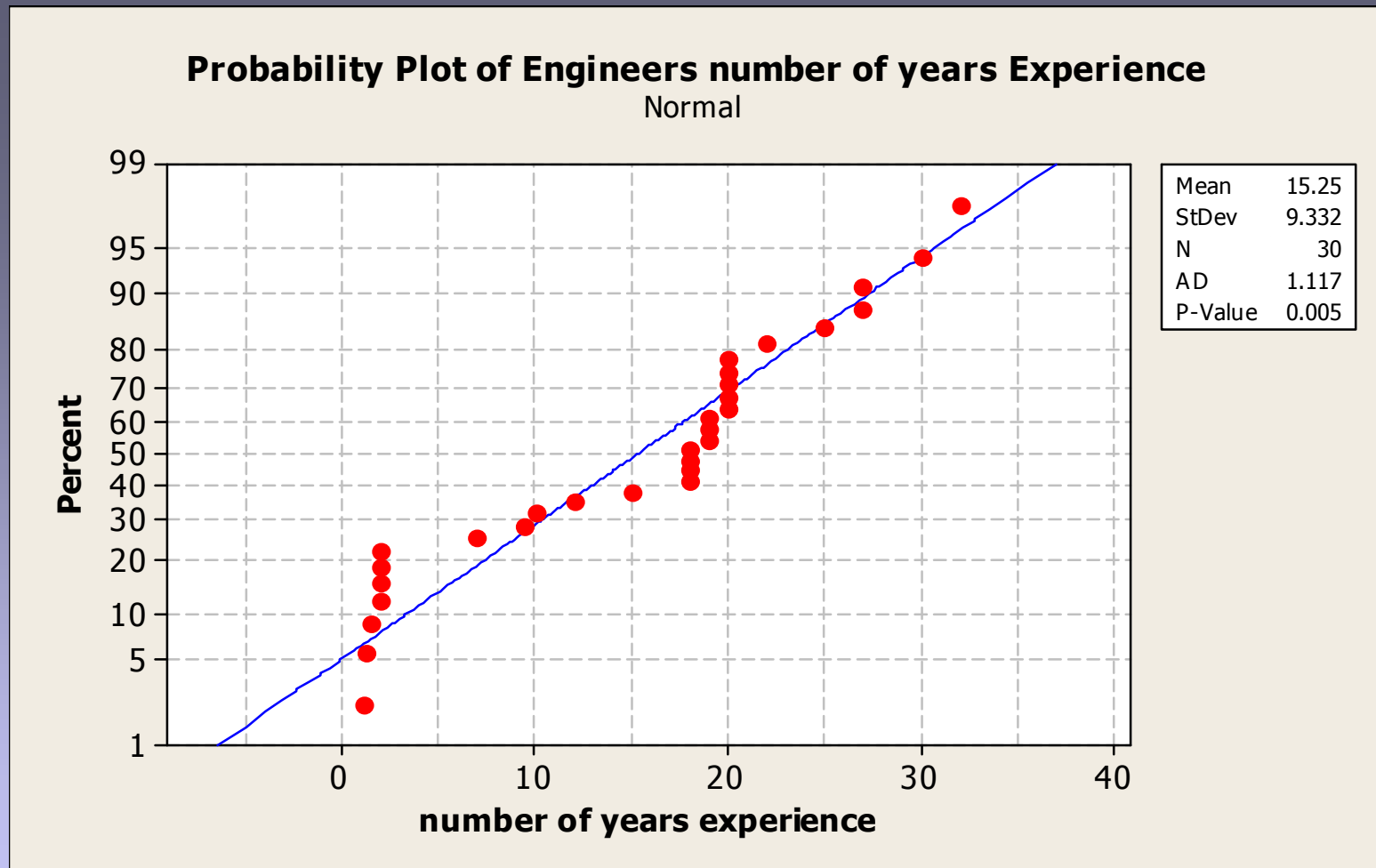
- Distribution shapes ARE NORMAL for engineers with > 15 yrs experience, both Inside and Outside threading (blue & red)
- Distributions are skewed (non – normal) for engineers with < 15 yrs experience

# C Charts (Attributes control charts) for Sheffield, > 15 yrs. Experience



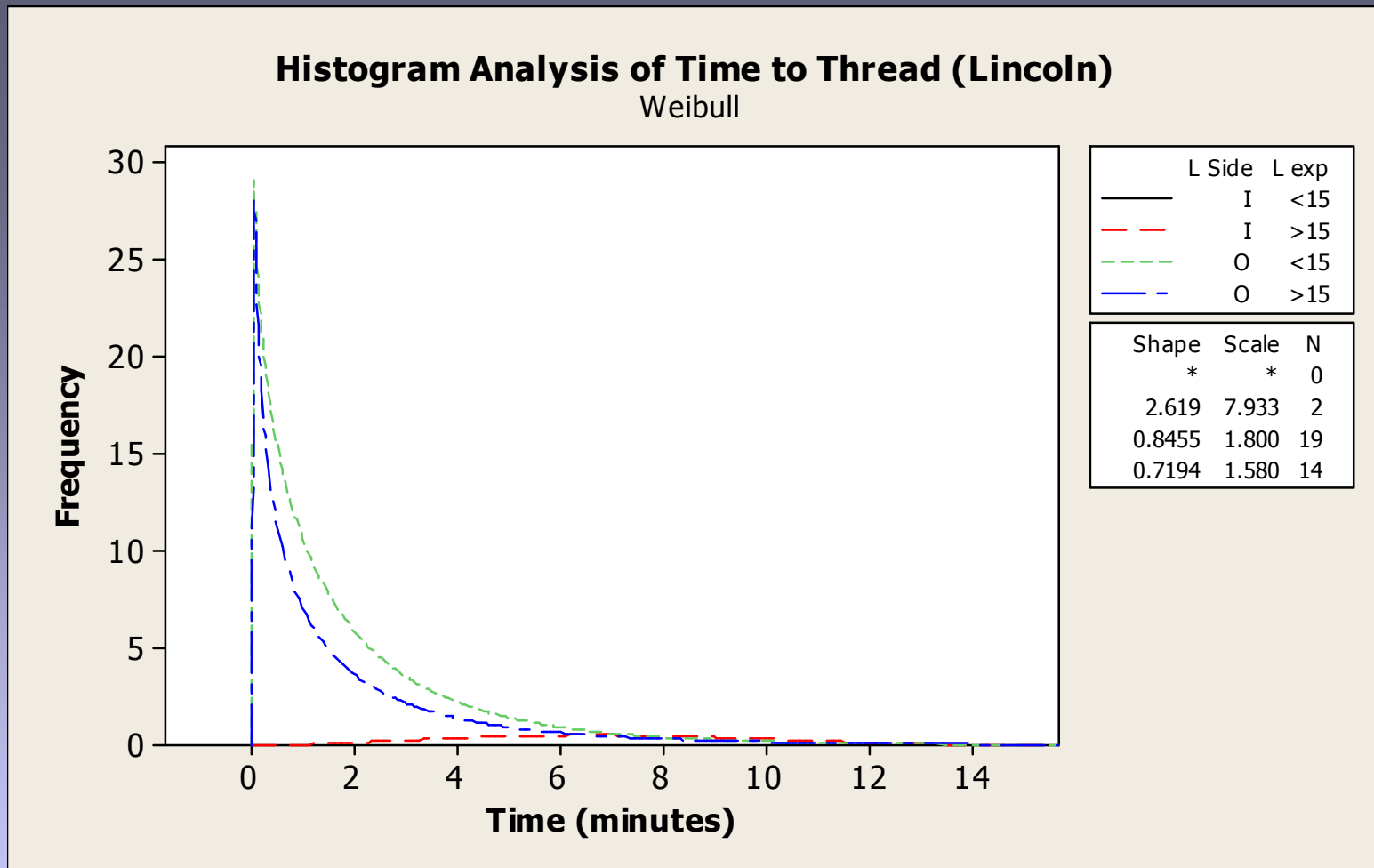
- Both charts pass the 8 statistical tests for absence of special cause variation
- Common cause variation defined by Upper & Lower statistical Control Limits (LCL, UCL) - 99.7% of the time data points will fall inside the limits

# Probability Plot for Engineers Experience (Study Sample)



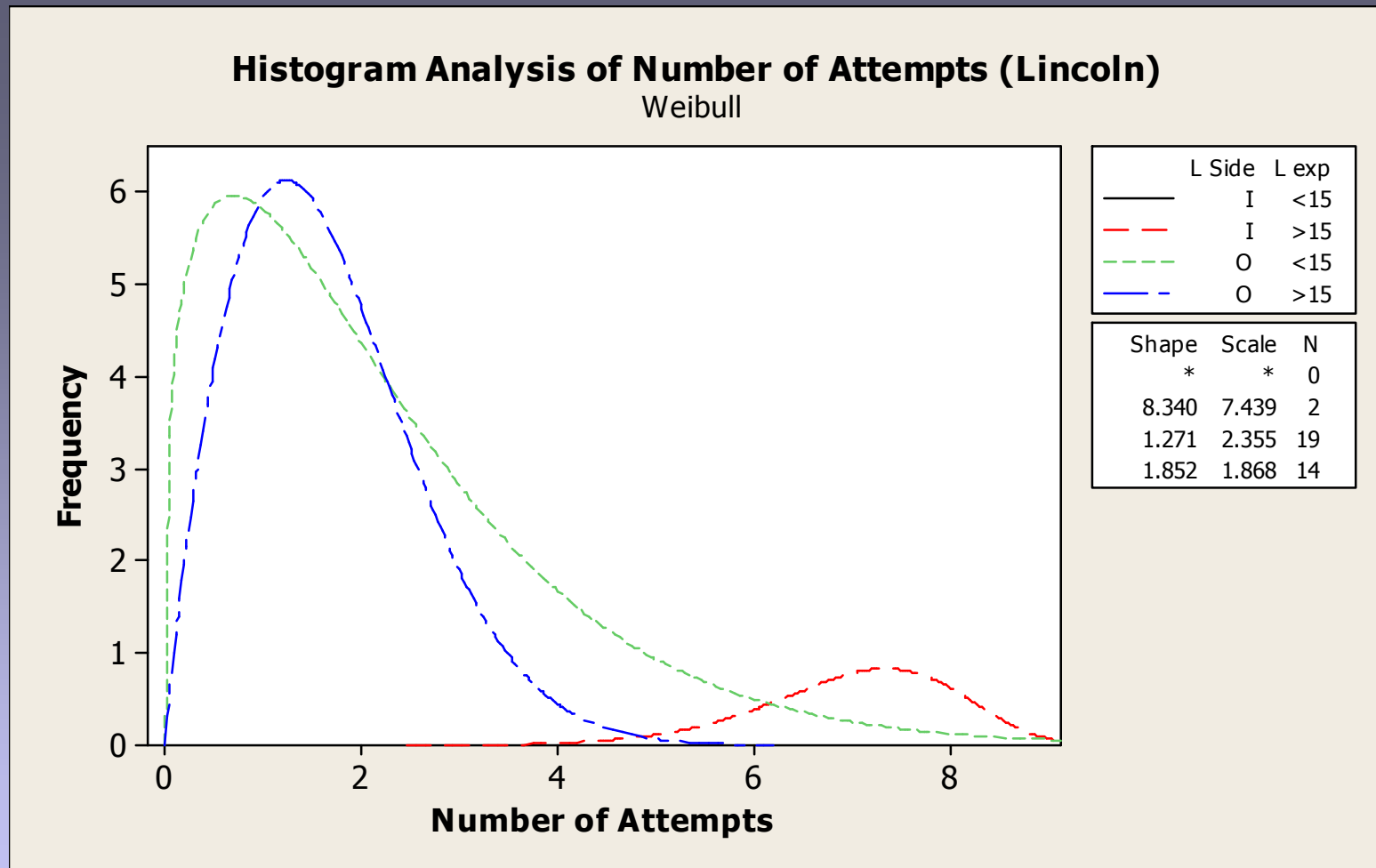
- Normal Probability Plot has a P-Value of less than 0.05, which indicates that the distribution of Engineers experience is non-normal
- Random selection of Engineers was a requirement of the study – distribution of population not known

# Threading Time for Lincoln by Yrs. Experience



- Distribution shapes for Outside threading similar, non-normal
- Only 2 data points for Inside threading, both >15 yrs

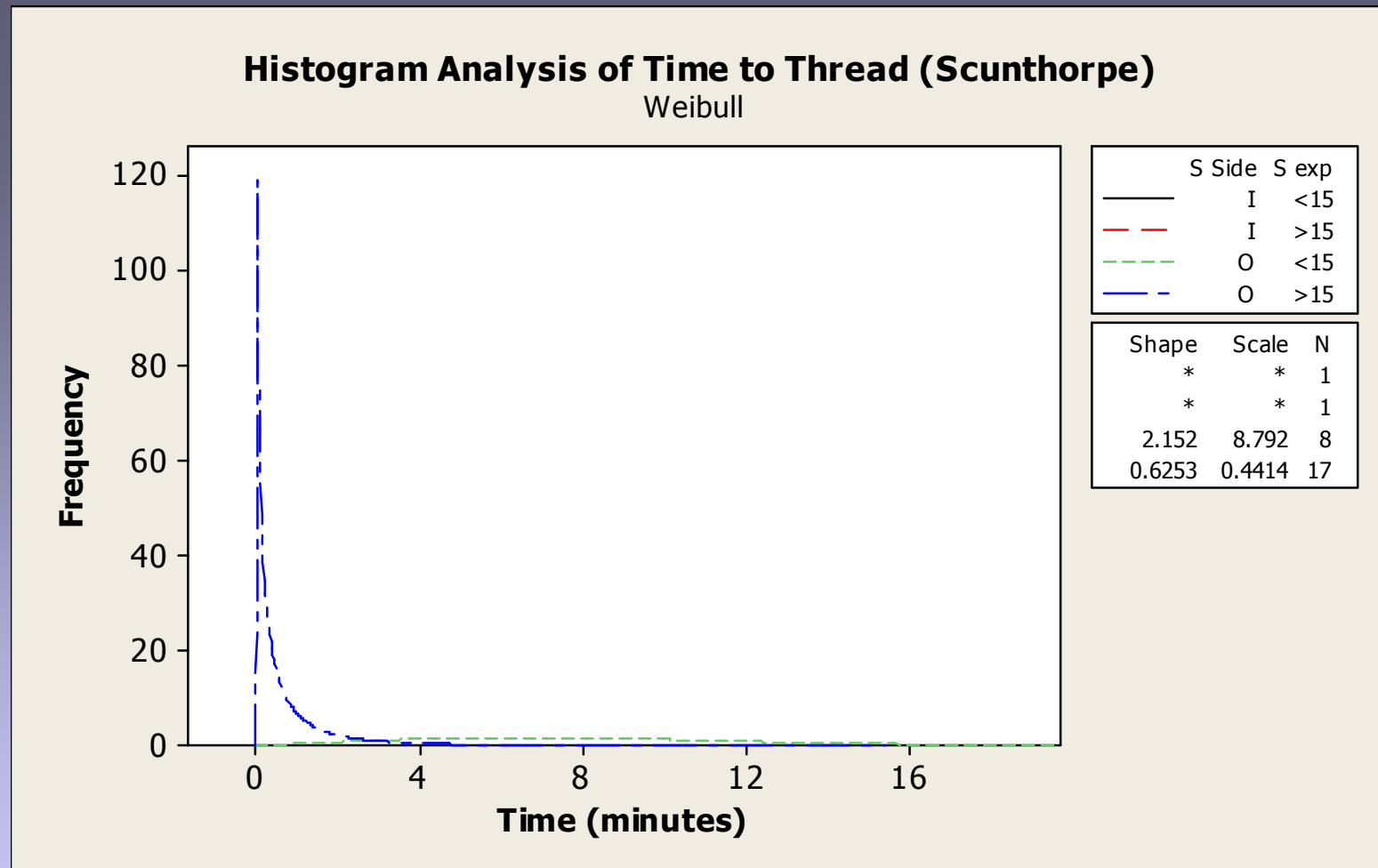
# Number of Attempts for Lincoln by Yrs. Experience



- Again distributions are non-normal
- >15 yrs less non-normal than <15 yrs

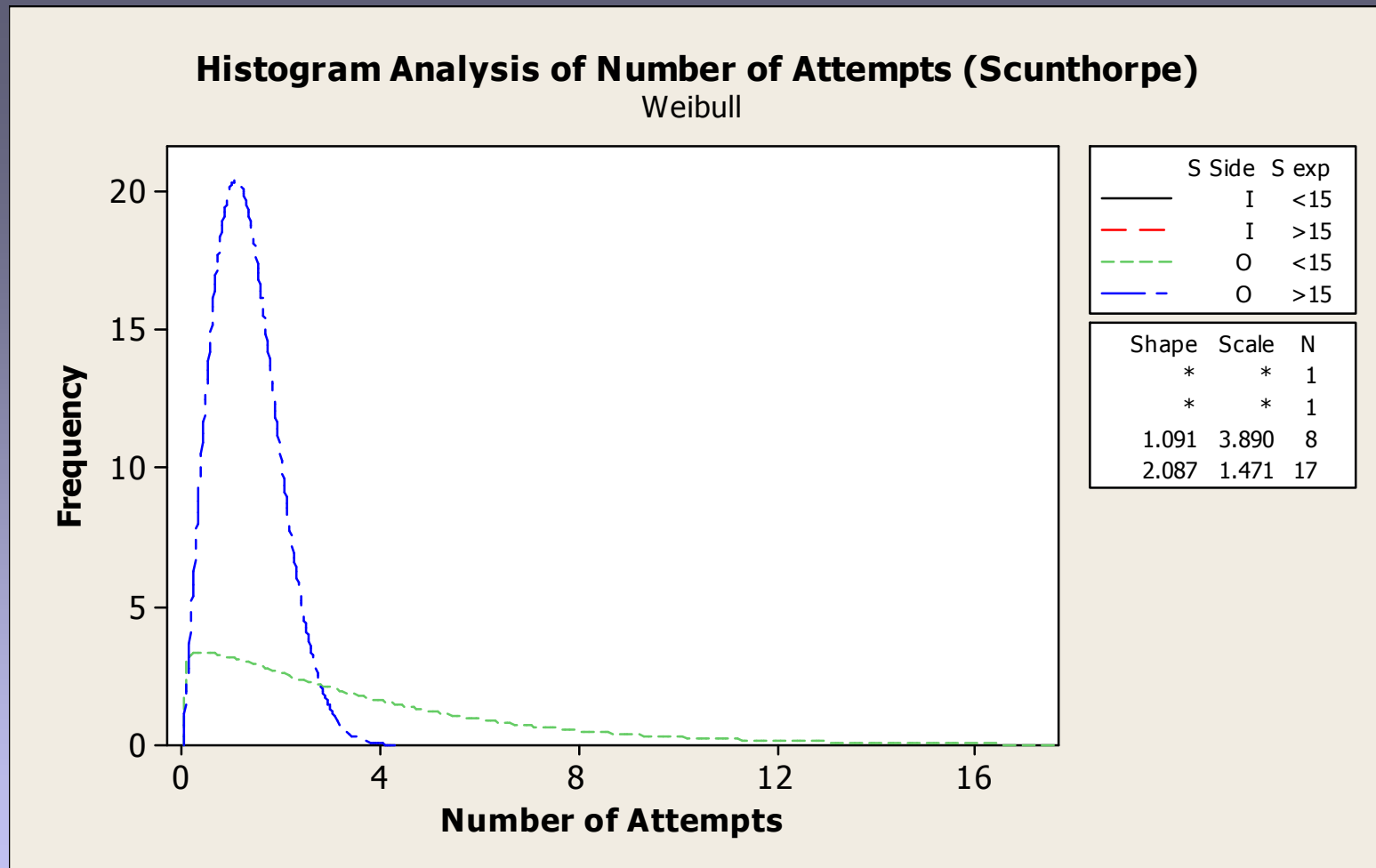


# Threading Time for Scunthorpe by Yrs. Experience



- Only 2 data points for Inside threading, 1 for each group of engineers
- Very wide spread for outside threading by <15 yrs – **WHY?**
- The 8 data points are from 2 engineers with less than 2 yrs experience, the least experience in the study sample

# Number of Attempts for Scunthorpe by Yrs. Experience



- Again distributions are non-normal
- Distribution for <15 yrs very poor

# HSE Data – Safety and Enforcement Statistics Unit

**ACCIDENT KIND:** GROUP 13 – ELECTRICITY  
CONTACT WITH ELECTRICITY OR ELECTRICAL DISCHARGE

**ACCIDENT OCCUPATION:**  
GROUP 524 ELECTRICAL TRADES

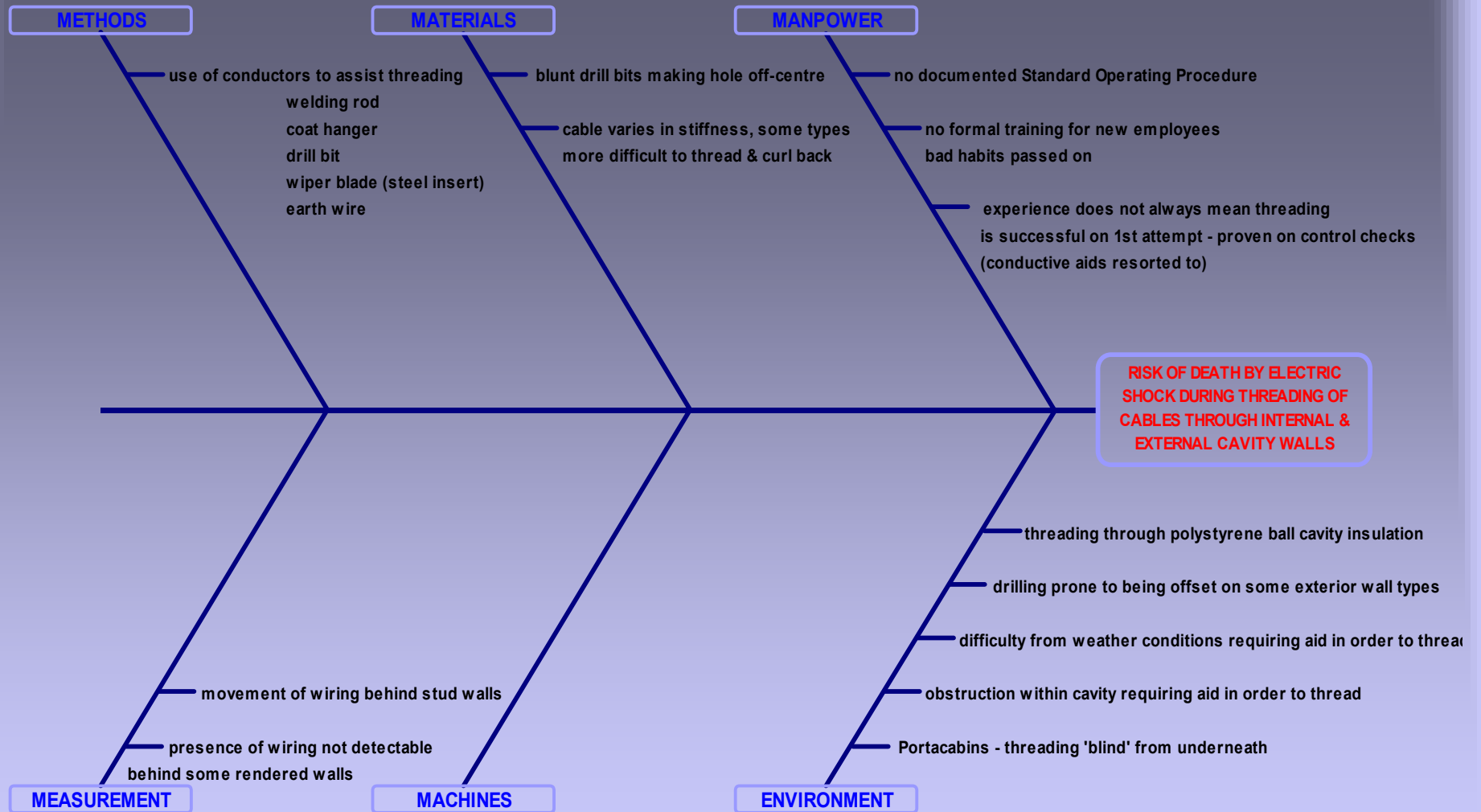
CODE 5242 – TELECOMMUNICATION ENGINEERS

	Fatal	Major	> 3 Days
2002/3	0	0	1
2003/4	0	4	3
2004/5	0	0	4
2005/6	0	2	2
<b>TOTAL</b>	0	6	10

16  
reportable  
accidents,  
6 of them  
'Major'

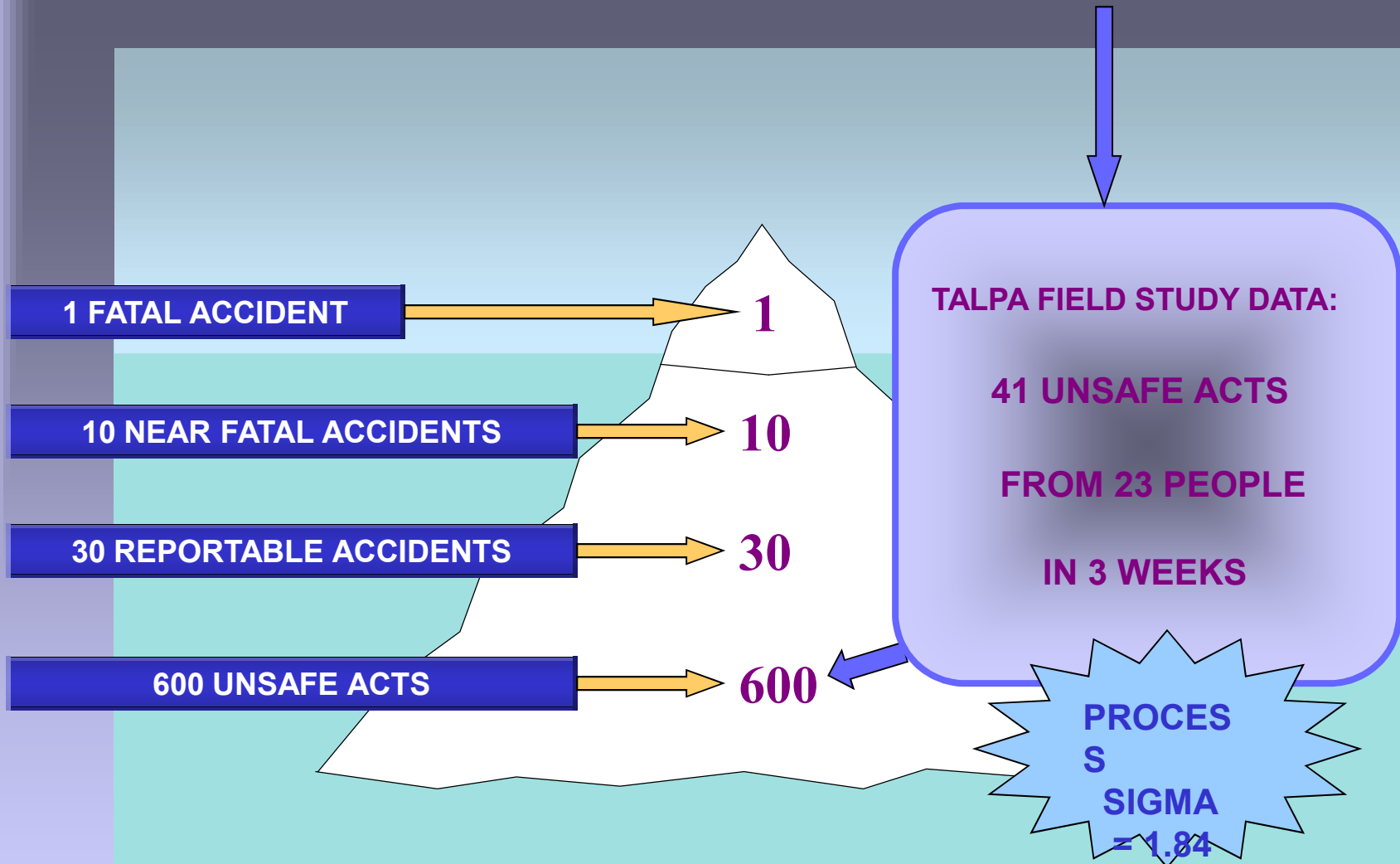
**RIDDOR definition of a reportable major injury for 'electricity':**  
'injury resulting from an electric shock or electrical burn leading to unconsciousness or requiring resuscitation or admittance to hospital for more than 24 hours'

# Current State Cause-and-Effect Diagram for Electric Shock



At least 13 Noise Variables which BT does not have control over today

# The 'Error Iceberg' / **KPO(Y) No.3**



**= MORE THAN 600 UNSAFE ACTS ANNUALLY FROM 3 SITES ALONE**

# **PILOT STUDY SUMMARY AND STATEMENT OF ROOT CAUSE**

**The current cabling process has a non-normal, positively skewed distribution which is very common for measurements of time, this distribution is matched by that of the number of attempts to thread, which shows correlation with threading time.**

**Overall there was no statistical correlation found between the threading time and engineers' experience, however there was evidence to show that outliers for time and no. of attempts are more likely to occur for engineers with less than 15 years experience.**

**The magnamole, having a normal distribution and greatly reduced average time / 100% first time yield, is therefore universal in its potential to improve engineers' overall performance, and of particular use to those with lesser experience.**

**Analysis of threading time for Inside and Outside revealed that this in itself was not a major cause of variation in the overall sample, the root cause seen for a lower average time to thread from the outside was due to the higher incidence of 10mm holes at Scunthorpe and Lincoln compared to Sheffield. Use of the magnamole allows 10mm drilling to be reduced to 8mm drilling thereby improving the visual aspect preferred by customers, with no adverse impact on the threading time.**

**The potential for safety and prevention of electric shock speaks for itself, a 'no-brainer' in today's workplace and culture.**

# THE END

## OR IS IT JUST THE BEGINNING?

WE LOOKED INTO THE FUTURE AND LIKED WHAT WE SAW

# MAGNAMOLE

- **THREAD SAFE**
- **THREAD SURE**
- **THREAD EASY**

**(DON'T GO TO THREAD WITHOUT ONE)**