Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavements

Final Report
May 2009

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The preparation of this (report, document, etc.) was financed in part through funds provided by the Iowa Department of Transportation through its "Agreement for the Management of Research Conducted by Iowa State University for the Iowa Department of Transportation," and its amendments.

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Technical Report Documentation Page

1. Report No. IHRB Project TR-576	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavements		5. Report Date May 2009 6. Performing Organization Code	
7. Author(s) Matt Mason, R. Christopher Williams		8. Performing Organization Report No. InTrans 07-302	
9. Performing Organization Name and Address Institute for Transportation Iowa State University 2711 South Loop Drive, Suite 4700 Ames, IA 50010-8664		10. Work Unit No. (TRAIS) 11. Contract or Grant No.	
12. Sponsoring Organization Name and Address Iowa Highway Research Board Iowa Department of Transportation 800 Lincoln Way Ames, IA 50010		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code	
15. Supplementary Notes Visit www.intrans.iastate.edu for color PDF files of this and other research reports.			

16. Abstract

This study evaluated the use of electromagnetic gauges to determine the adjusted densities of HMA pavements. Field measurements were taken with two electromagnetic gauges, the Pavement Quality Indicator (PQI) 301 and the Pavetracker Plus 2701B. Seven projects were included in the study with 3 to 5 consecutive paving days. For each day/lot 20 randomly selected locations were tested along with seven core locations. The analysis of PaveTracker and PQI density consisted of determining which factors are statistically significant, and core density residuals and a regression analysis of core as a function of PaveTracker and PQI readings. The following key conclusions can be stated: 1.Core density, traffic and binder content were all found to be significant for both electromagnetic gauges studied, 2. Core density residuals are normally distributed and centered at zero for both electromagnetic gauges, 3. For PaveTracker readings, statistically one third of the lots do not have an intercept that is zero and two thirds of the lots do not rule out a scaler correction factor of zero, 4. For PQI readings, statistically the 95% confidence interval rules out the intercept being zero for all seven projects and six of the seven projects do not rule out the scaler correction factor being zero, 5. The PQI 301 gauge should not be used for quality control or quality assurance, and 6. The Pavetracker 2701B gauge can be used for quality control but not quality assurance.

This study has found that with the limited sample size, the adjusted density equations for both electromagnetic gauges were determined to be inadequate. The PaveTracker Plus 2701B was determined to be better than the PQI 301. The PaveTracker 2701B could still be applicable for quality assurance if the number of core locations per day is reduced and supplemented with additional PaveTracker 2701B readings. Further research should be done to determine the minimum number of core locations to calibrate the gauges each day/lot and the number of additional PaveTracker 2701B readings required.

17. Key Words asphalt pavements—density—non-destructive testing—quality assurance testing—electromagnetic gauges		18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified.	20. Security Classification (of this page) Unclassified.	21. No. of Pages 150	22. Price NA

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

INVESTIGATION OF ELECTROMAGNETIC GAUGES FOR DETERMINATION ON IN-PLACE DENSITY OF HMA PAVEMENTS

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Sponsored by
the Iowa Highway Research Board
(IHRB Project TR-576)

Preparation of this report was financed in part
through funds provided by the Iowa Department of Transportation
through its research management agreement with the
Institute for Transportation,
InTrans Project 07-302.

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EXECUTIVE SUMMARY

This study evaluated the use of electromagnetic gauges to determine the adjusted densities. Field measurements were taken with two electromagnetic gauges, the Pavement Quality Indicator (PQI) 301 and the Pavetracker Plus 2701B. Seven projects were included in the study with 3 to 5 consecutive paving days. For each day/lot 20 randomly selected locations were tested along with seven core locations.

The analysis of PaveTracker and PQI density consisted of determining which factors are statistically significant, and core density residuals and a regression analysis of core as a function of PaveTracker and PQI readings. The following key conclusions can be stated:

- Core density, traffic and binder content were all found to be significant for both electromagnetic gauges.
- Core density residuals are normally distributed and centered at zero for both electromagnetic gauges.
- For PaveTracker readings, statistically one third of the lots do not have b = 0 and two thirds of the lots do not rule out m = 0.
- For PQI readings, statistically the 95% confidence interval rules out b = 0 for all seven projects and six of the seven projects do not rule out m = 0.
- The PQI 301 gauge should not be used for quality control or quality assurance
- The Pavetracker 2701B gauge can be used for quality control but not quality assurance

This study has found that with the limited sample size, the adjusted density equations for both electromagnetic gauges were determined to be inadequate. The PaveTracker Plus 2701B was determined to be better then PQI 301. The PaveTracker 2701B could still be applicable for quality assurance if the number of core locations per day is reduced and supplemented with additional PaveTracker 2701B readings. Further research should be done to determine the minimum number of core locations to calibrate the gauges each day/lot and the number of additional PaveTracker 2701B readings required.

1. INTRODUCTION

Electromagnetic gauge technology has been found to be promising for determining density of intermediate and surface course mixtures in the first phase of this research project. The following study was done to determine if the correction factor for the first day of paving operations for a specific mix is applicable to use for ensuing paving days under the same paving operation and conditions. Another objective of this study is to determine which adjustment method is most suitable for determining the pavement density. The intercept method, slope method and slope & intercept method were used to develop adjustment factors.

2. BACKGROUND

The first phase of this research was to establish the accuracy and precision of the PQI 301 and PaveTracker 2701 as compared to core testing. Another subsequent objective for the first phase is to determine which gauge, if either, should be considered for quality control and quality assurance in Iowa. Test data was collected in the field during and after paving operations and also in a laboratory on field mixes compacted in the lab. Both electromagnetic gauges are sensitive to density changes due to roller passes. This is favorable since it indicates that both gauges could be used for quality control.

The variables affecting electromagnetic gauge readings are shown in Table 1 and Table 2. From Table 1, both station and roller pass are significant for all three electromagnetic gauge readings. Transverse pavement location is also significant for both PQI data sets. For the regression analysis, there are no variables that are considered statistically significant for all three electromagnetic gauge datasets but both the PaveTracker and multi-mode PQI readings are significantly affected by contractor, aggregate type, binder content and roller pass.

Table 1. Summary of class variables affecting electromagnetic gauges

	PaveTracker		PQI Single Mode		PQI Multi Mode	
Source	**SSI**	**SSIII**	**SSI**	**SSIII**	**SSI**	**SSIII**
Site	•		•		•	
Station		•	•	•	•	•
Pavement Width		•				
Pavement Condition			N/A	N/A	•	
Contractor						
Aggregate Type						
NMAS						
Traffic Level						
Roller	•	•	•	•	•	•
Distance Across Pavement Width			•	•	•	•

Table 2. Summary of regression analysis for electromagnetic gauges

	PaveTracker		PQI Single Mode		PQI Multi Mode	
Variable	**Paramter Estimate**	**Pr > |t|**	**Parameter Estimate**	**Pr > |t|**	**Parameter Estimate**	**Pr > |t|**
Intercept	155.0308	<.0001	125.21560	0.0049	152.79259	<.0001
Site	-0.10602	0.4913	-0.67661	0.0676	1.72543	<.0001
Station	1.10806	0.0369	2.68108	0.1471	-0.54766	0.3012
Width	0.03274	0.8469	-1.02782	0.661	-0.50271	0.0082
Condition	-13.084	0.0237	N/A	N/A	2.22136	0.233
Contractor	-1.56077	<.0001	5.9159	0.2058	-2.67693	<.0001
Aggregate Type	-6.38087	<.0001	-0.81495	0.0595	10.33595	<.0001
Binder Content	7.38617	0.0017	3.73E-07	0.0909	-3.98782	0.0287
NMAS	-1.68917	<.0001	1.57909	0.0024	0.57366	0.2228
Traffic Level	-1.56E-07	0.2021	0.98876	0.0431	1.45E-07	0.0541
Roller Pass	-4.53788	<.0001	-0.86985	0.4475	-4.88213	<.0001
Distance Across Pavement	0.07371	0.4830	0.2423	0.0166	-0.89696	<.0001
Temperature	N/A	N/A	-0.06728	0.0016	N/A	N/A

3. LITERATURE REVIEW

There are two electromagnetic gauges manufactured today. The first is the Pavement Quality Indicator (PQI) manufactured by TransTech and the second is the PaveTracker manufactured by Troxler. The two gauges have similar technology that measure dielectric properties of the hot mix asphalt (HMA) and then relate the increase or decrease of the dielectric properties to density changes. A material may be classified has a conductor, semiconductor and a dielectric or insulator (Elliott, 1993). HMA would be classified as a dielectric since it does not conduct electricity. An ideal dielectric would be a material which has no free charges and thus resists the passage of steady electric current (Elliott, 1993). Typical dielectric constant values for materials found present in HMA is shown in Table 3. For a relatively homogenous asphalt material, the dielectric constant will increase as the asphalt is compacted. This increase in dielectric constant is reflected as an increase in density (Troxler, 2005). Also if water is present on the surface, from the compaction process, this will increase the dielectric constant which leads to an incorrect assessment in an increase in density.

Table 3. Typical dielectric constant values for HMA (K-Tek, 2008)

Material	Dielectric Constant
Air	1
Asphalt	2.5 - 3.2
Sand	5.0
Quartz	4.2
Calcite	8.0
Dolomite	6.8 - 8.0
Gypsum	2.5 - 6.0
Water	4 - 88
Steam	1.01
80 F	80
32 F	88

In the PQI gauge, the electrical field measures the changes in electrical impedance of the material matrix and then relates the electrical impedance to bulk density (NCHRP-IDEA, 1999). The electrical impedance is a function of the composite resistivity and the dielectric constant of the material (NCHRP-IDEA, 1999). Figure 1 shows the schematic of the PQI sensing plate. The data processor computes the relative density from the electrical impedance with corrections for surface moisture, temperature variation, and sensor impedance (Glagola, 2003).

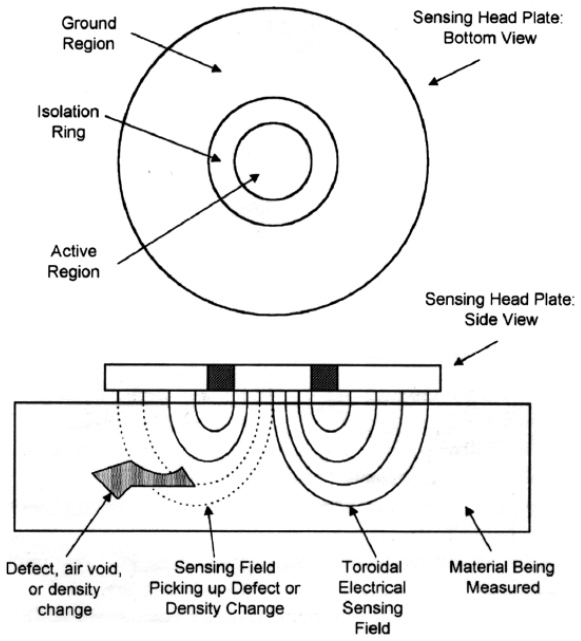

Figure 1. Schematic of PQI sensing plate (NCHRP-IDEA, 1999)

The Pavetracker 2701B does not require correction factors to adjust for temperature or moisture changes. The Pavetracker measures to a maximum depth of 1.25 inches (Troxler, 2005).

Robert Schmitt from the University of Wisconsin – Platteville researched the effects of different adjustment factors to try to determine the optimum adjustment factor. The adjustment factors were the intercept, slope and slope & intercept method (Schmitt, 2006). The Intercept method, Slope method and Slope & Intercept method are shown in equations 1, 2 and 3, respectively. The y term represents the corrected electromagnetic gauge density. The x term represents the raw or uncorrected electromagnetic gauge density. The terms m and b are linear regression constants. Ideally the intercept coefficient, b, would be equal to zero and the slope coefficient, m, would be equal to 1 for the Slope & Intercept Method. This ideal case would represent the line of equality (y=x). The electromagnetic gauges need to have a high R^2 value and also must be originated close to the line of equality. For example an equation could have a high R^2 value but the origination about the line of equality is in the opposite direction as shown in Figure 2.

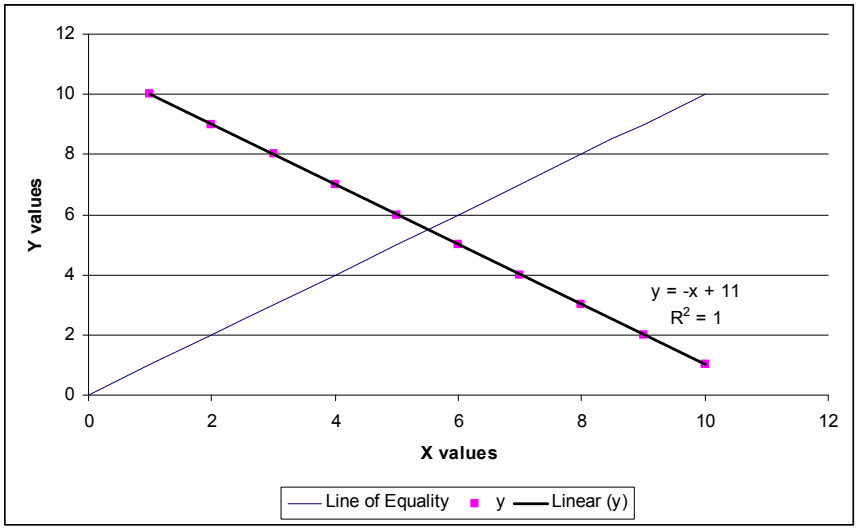

Figure 2. Example of line of equality

(Intercept Method)	y = x + b	(Equation 1)
(Slope Method)	y = mx	(Equation 2)
(Slope & Intercept Method)	y = mx +b	(Equation 3)

The electromagnetic gauges have been extensively researched with both positive and negative results. The PQI has been available the longest and have had many improvements over the life of the product. The first working successful model for the PQI was model number 300 which was the third generation of the product. The first research completed for the PQI 300 was a pooled fund study by Pedro Romero (2000). This research was initiated by the Maryland State Highway Administration with participation from Pennsylvania, Connecticut, New York, Minnesota and Oregon Departments of Transportation. The results showed that the H2O number above five affects the accuracy of the PQI 300 readings. The PQI 300 needs to be calibrated for individual mixtures with a slope and intercept component (Romero, 2000). The continuation of the pooled fund study was a field evaluation that showed low correlations between the PQI and core density and that a nuclear gauge performed better than the PQI (Romero, 2001). The density from the PQI 300 and PT 2701 should be evaluated with caution (Romero et. al., 2002).

Another study determined for the PQI 300 that the results are repeatable but have low correlations between core density and corelok (Prowell et. al., 2002). The first study to recommend the PQI 300 for quality control but not quality assurance stated that both the two PQI gauges and nuclear gauge had greater standard deviations then the standard deviations attained from core density (Allen et. al., 2003). In another study both the PQI 300 and PT 2701 are influenced by temperature and moisture. The PQI 300 performed well with respect to nuclear gauges even when not calibrated. On the other hand, the PT 2701 should always be calibrated (Sebesta et. al., 2003). Another study determined that the PQI 300 and core density were statically the same (Killingsworth, 2004). The PQI 301 and the PT 2701 were recommended for quality control with care and stated that the PQI 301 was improved over the

previous model PQI 300 (Hurley et. al., 2004). The PQI 300 was recommended for both quality control and quality assurance if the gauge is calibrated with core density. The PT 2701 was only recommended for quality control (Sargand et. al., 2005). In another study the PQI 300 was found to be less sensitive to density changes then the nuclear gauge (Shuler, 2005). The PT 2701 was found to perform better on fine mixes than coarse mixes and internal moisture increased gauge readings. When compared to core density and nuclear density results, the PT 2701 was found to be statistically different (Liao, 2006). In a study for the Wisconsin Department of Transportation, the PT 2701B, PQI 300 and PQI 301 determined that the gauges need to be calibrated with ten test points and using the Slope method (Schmitt, 2006).

4. COLLECTION OF ELECTROMAGNETIC FIELD DATA

Electromagnetic density measurements were collected for seven projects for a period of three to five days for each project throughout the State of Iowa. The Pavement Quality Indicator (PQI) 301 and PaveTracker Plus 2701B were used to collect the electromagnetic field data. A summary of the project locations is shown in Table 4 and a summary of the mix design for each project is shown in Table 5. In the field, twenty randomly selected locations were tested with the electromagnetic gauges, accordingly to ASTM D 3665 each day (2006). ASTM D 3665 is a random sampling table that includes every numerical value from 0 to 1 accurate to four decimal places. Also the electromagnetic gauges were tested at seven additional core locations per lot/day, which were marked by the Iowa Department of Transportation (DOT). For Project 1, the contractor was allowed by the Iowa DOT to combine days 2 and 3 into one lot as the production for each day was limited, so a combined total of seven cores were taken for these days (4 for day 2 and 3 for day 3 is more representative of the tonnage for one lot). For most of the projects, the cores were marked the same day as paving and for others the cores were marked the following morning. For most of the projects, cores were extracted by the contractor after the electromagnetic gauge readings were obtained and recorded. If this ideal case did not occur, then the readings were taken as close to the extracted core as possible while avoiding any water runoff or surface defects caused from coring. To minimize the effect of segregation across a lane (transverse to the paving lane), the electromagnetic gauge readings were obtained either in front or behind the extracted core.

Table 4. Summary of project locations

Project	Days	City	Route	Contractor
1	3	Des Moines	US 6	DSM Asphalt
2	3	Grundy Center	County 14	Mathy
3	5	Grundy Center	County 14	Mathy
4	5	Grundy Center	County 14	Mathy
5	3	Sioux City	US 376 south	Knife River
6	3	Correctionville	US 20	Henningsen
7	3	Alden	County D20	Manatts

Table 5. Summary of project mix designs

Project	Day/Lot	Mix Design	Binder content (%)	NMAS* (mm)	Traffic (ESALs x 10^6)
1	1	Intermediate	5.41	1/2	3.0
	2		5.41		
	3		5.21		
2	1	Intermediate-Shoulder	6.48	1/2	1.0
	2		6.57		
	3		6.63		
3	1	Intermediate	6.48	1/2	3.0
	2		6.60		
	3		6.74		
	4		6.50		
	5		6.62		
4	1	Surface	6.54	1/2	3.0
	2		6.61		
	3		6.51		
	4		6.31		
	5		6.23		
5	1	Surface	5.86	1/2	10.0
	2		6.06		
	3		6.05		
6	1	Surface	5.06	1/2	10.0
	2		4.89		
	3		5.01		
7	1	Surface	5.69	1/2	0.3
	2		5.70		
	3		5.88		

The manufacturers' recommendation for using the PaveTracker Plus were followed in making all gauge measurements. The PaveTracker case comes with a reference standard and Troxler recommends that a reference reading be taken each time the gauge is turned on (Troxler, 2006). A reference reading for the PaveTracker Plus was taken each day, before any density measurements were obtained. The density measurement at one location consisted of four gauge readings in the pattern as shown in Figure 3 (New York State DOT, 2003). The PaveTracker Plus was operated in continuous mode. In addition to the density measurements, the temperature of the pavement was also recorded.

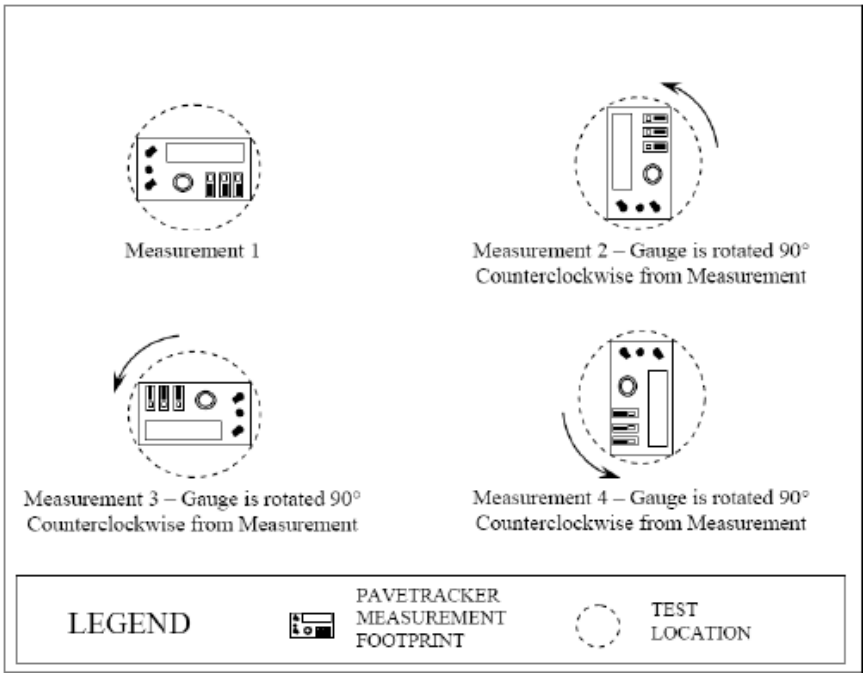

Figure 3. PaveTracker Plus data collection pattern (New York State DOT, 2003)

The manufacturer recommendations for using the PQI 301 were followed in recording all gauge measurements. The density measurement at one location consisted of five gauge readings in the pattern shown in Figure 4 (New York State DOT, 2003). The PQI 301 was operated in single mode. A water number greater than 5 is an indication that the density measurement is affected by water (Henault 2001, TransTech 2002). Water affects the electromagnetic gauge readings because the dielectric constant of water is a lot greater then the other materials in HMA so can cause an incorrect increase in density. When water was present on the surface, a dry towel was used to wipe the area dry.

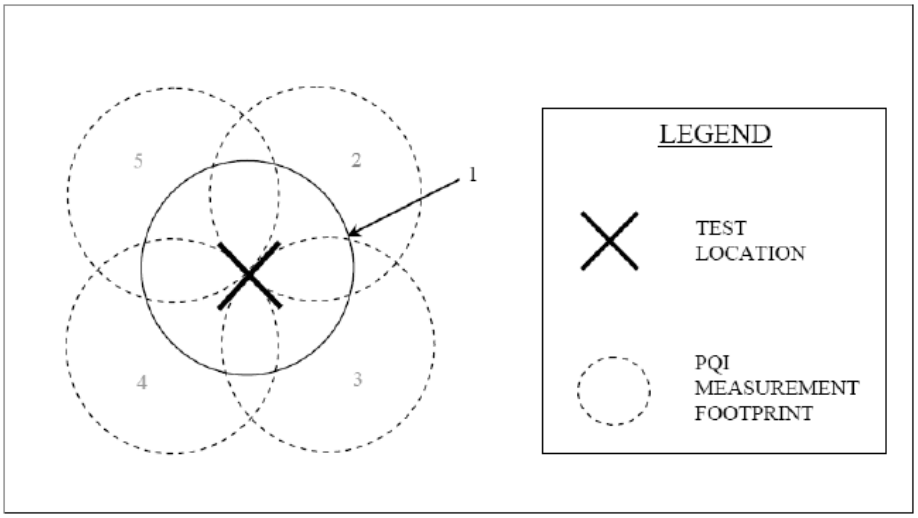

Figure 4. PQI data collection pattern (New York State DOT, 2003)

The field data for all of the PQI and Pavetracker readings as well as the corresponding core density values are contained in Tables A1 through A50 of the Appendix.

5. ANALYSIS OF DATA

5.1 Graphical Analysis of Unadjusted Data

The unadjusted density from the PQI and PT devices is plotted against temperature for each day of the project and is shown in Appendix A, Figures A105 to A129. Figures 5 and 6 are representative examples of the layout of the data. Project 1 to Project 4 for Day 1 is similar to Figure 5 and Project 4 for Day 2 to Project 7 is similar to Figure 6. The main difference between these two figures is the location and variance of the PQI data. With the exception of Projects 5 and 6, the PT data is generally located around the range 140 – 150 pcf. In Figure 5, the PQI values are also located in this range from 140 – 150 pcf. The PQI values tended to become much greater then the PT values and more variable after Project 4 for Day 1. In Figure 5, the PQI gauge was turned on and off more frequently to try to obtain a more reasonable value, when compared to the paving days after Project 4 for Day 1. This could be attributed to operator error for the PQI gauge because if the gauge was not turned on and off a different adjusted density value may have been attained. This would have resulted in a different calibration equation. This was not noticed with the PT gauge.

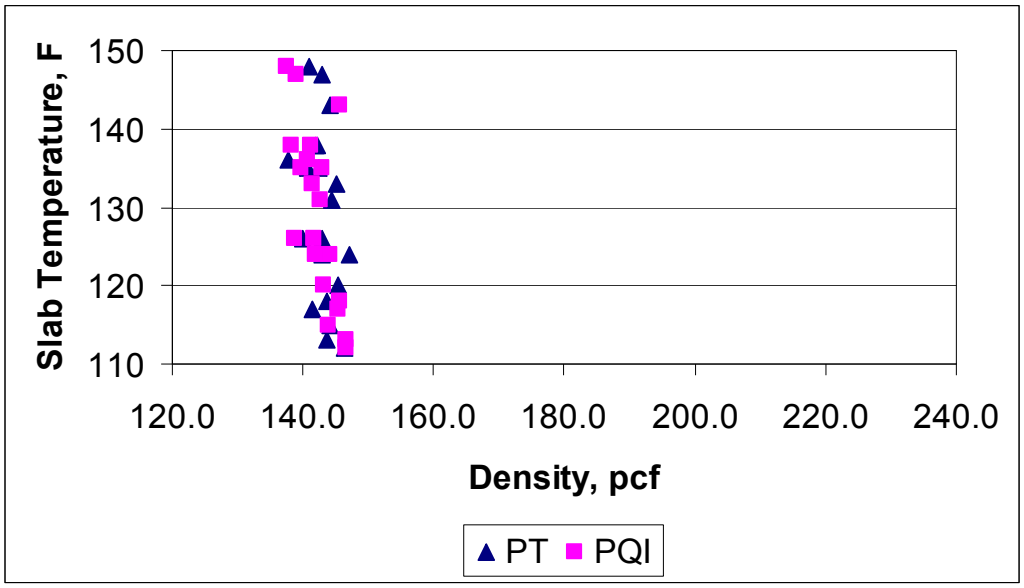

Figure 5. Project 3 day 1 unadjusted data vs. slab temperature

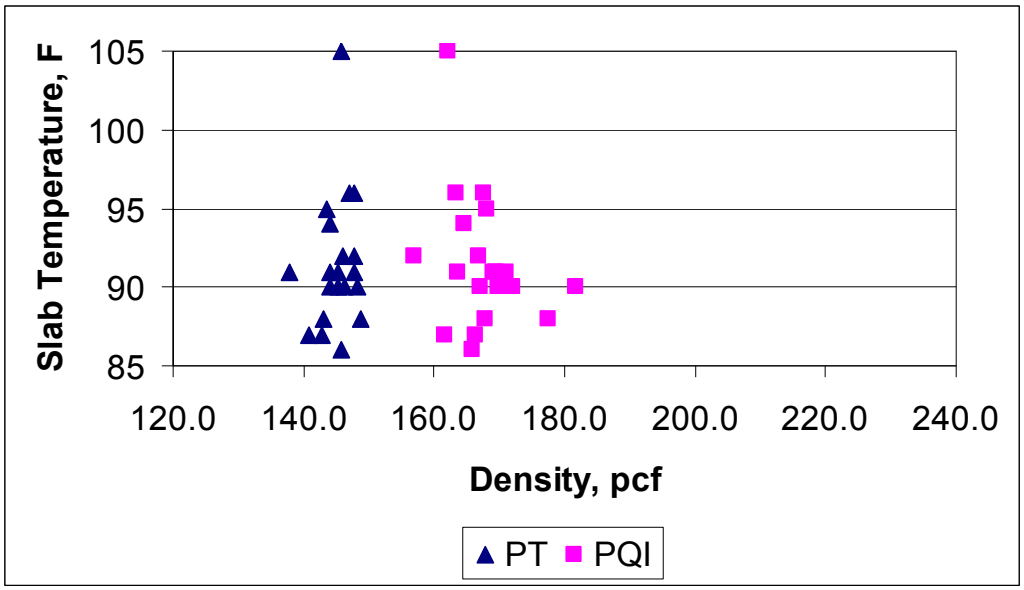

Figure 6. Project 7 day 1 unadjusted data vs. slab temperature

The unadjusted electromagnetic gauge density was plotted against core density for each day of the seven projects and is shown in Appendix A. The average coefficient of determination, R^2 for PQI and PT is 0.236 and 0.424, respectively. The 95% confidence interval for the mean of the coefficient of determination, R^2 for PQI and PT is (0.114, 0.359) and (0.327, 0.520), respectively.

5.2 Graphical Analysis of Adjusted Data

To improve the origination about the equality line, the data was adjusted by using the intercept, slope and slope & intercept method. These methods do not change the R^2 values. The adjusted electromagnetic gauge density is plotted against core density and is shown in Appendix A for each day of the seven projects. The average squared error for the PQI gauge for the intercept, slope and slope & intercept method is 62.9, 49.9 and 1.1, respectively. The average squared error for the PT gauge, for the intercept, slope and slope & intercept method is 8.0, 8.2 and 0.9, respectively. The PQI gauge improves in accuracy more then the PT gauge when going from the intercept method to the slope method. In terms of average squared error, the slope & intercept method is the best. The slopes for the PQI gauge are so small with the slope & intercept method that it results in a straight vertical line. This vertical line corresponds to the average core density value. An example of this is shown in Figure 7. The minimum slope required to prevent the electromagnetic gauges from converging to the average density value is 0.10 based on the results from these 7 projects.

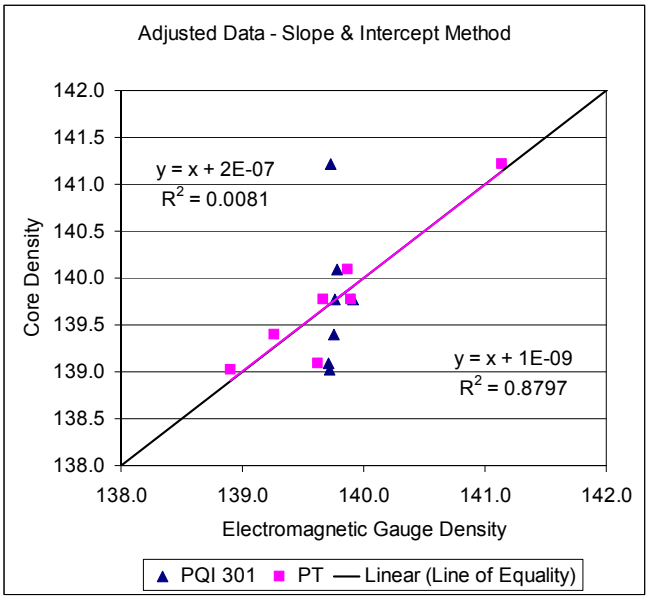

Figure 7. Project 4 for day 1 adjusted data – slope & intercept method

5.3 Pavetracker Statistical Analysis

The Pavetracker statistical analysis consists of a regression analysis of Pavetracker readings as a function of project, day, location sequence, temperature, core density, traffic and binder content. A regression equation of core as a function of Pavetracker readings was also analyzed to determine if the residuals equal zero. Then a regression analysis of core as a function of Pavetracker readings were analyzed for day 1 and the same regression equation was used for the occurring days. An alpha level of 0.05 was employed for all the analyses.

5.3.1 Significant Factors Affecting Pavetracker Readings

Table 4 summarizes the factors that significantly affect Pavetracker readings. A dot in a cell indicates that a factor is deemed statistically significant. Unadjusted data is Pavetracker readings with no adjustment criteria. First day data is Pavetracker readings that are adjusted using the first day's regression equation. Each subsequent day's data is Pavetracker readings that are adjusted using the corresponding regression equation for that day. First day is preferred over each day because it saves sampling and testing costs and provides quality assurance data more quickly.

The analysis indicates that core density and traffic are significant for both adjusted and unadjusted data. A reason why traffic is significant is that traffic level is a major component in pavement design. A high volume roadway should behave different than a low volume roadway. A high volume roadway will general have better quality aggregates in the mix design then a low volume roadway. Since the Pavetracker measures the dielectric constant of the asphalt, the dielectric constant will be different for a high volume roadway then a low volume roadway. As shown in Figure 7, the regression equation for unadjusted data shows that the high volume roadway results in a lower Pavetracker unadjusted density value.

Binder content is also significant for the adjusted data as shown in Table 6. A reason why binder content is significant is that the dielectric constant of the asphalt will increase when the percent binder is increased.

Table 6. Significant factors affecting PT readings

Parameter	Unadjusted	First Day	Each Day
Project			
Day			
Location Sequence			
Temperature			
Core Density	●	●	●
Traffic	●	●	●
Binder Content		●	●

Equation 4 and Figure 8 shows the regression equation for the unadjusted density. The R squared value is highly correlated with core density (R squared = 0.86). Figure 9 shows the residuals of the regression equation for the unadjusted density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

$$PT = 46.9 + 8.5*Traffic(0.3) + 2.8*Traffic(1) + 5.5*Traffic(3) + 0.6*Core \quad \text{(Equation 4)}$$

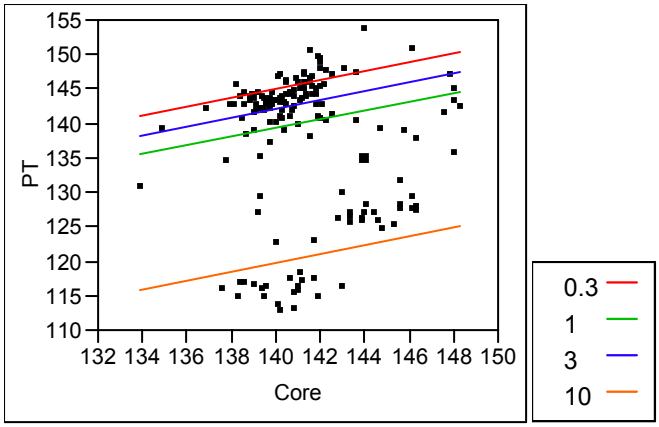

Figure 8. Scatter plot of Pavetracker unadjusted density

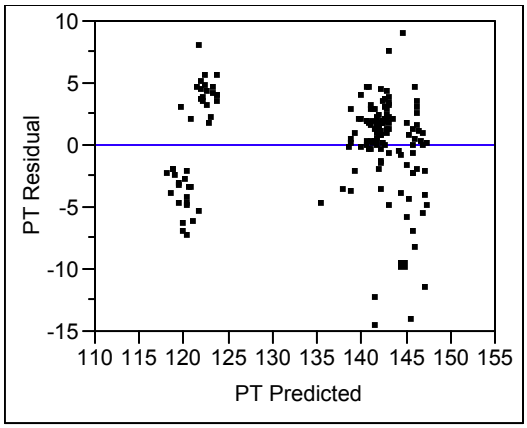

Figure 9. Scatter plot of Pavetracker residuals

Equation 5 and Figure 10 shows the regression equation for the Pavetracker adjusted each day density. The R squared value is highly correlated with core density (R squared = 0.89). Figure 11 shows the residuals of the regression equation for the adjusted each day density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

PT = 64.5 + 0.6*Core – 0.4*Traffic(0.3) + 0.5*Traffic(1) (Equation 5)
+ 0.5*Traffic(3) -1.8*Binder content

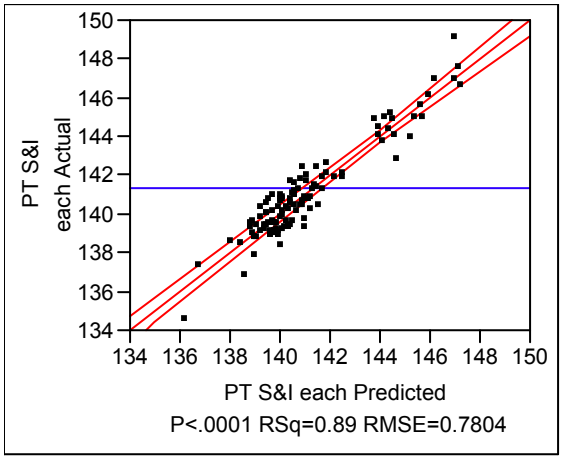

Figure 10. Scatter plot of Pavetracker adjusted each day density

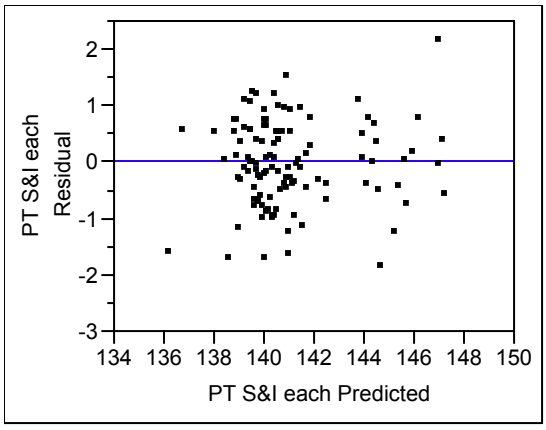

Figure 11. Scatter plot of Pavetracker residuals

Equation 6 and Figure 12 shows the regression equation for the Pavetracker adjusted first day density. The R squared value is highly correlated with core density (R squared = 0.80). Figure 13 shows the residuals of the regression equation for the adjusted first day density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

PT = 99.3 + 0.4*Core -1.1*Traffic(0.3) +0.7*Traffic(1) (Equation 6)
+ 0.5*Traffic(3) – 1.9*Binder content

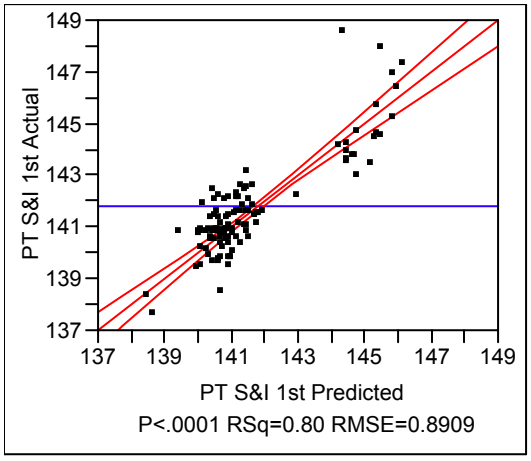

Figure 12. Scatter plot of Pavetracker adjusted first day density

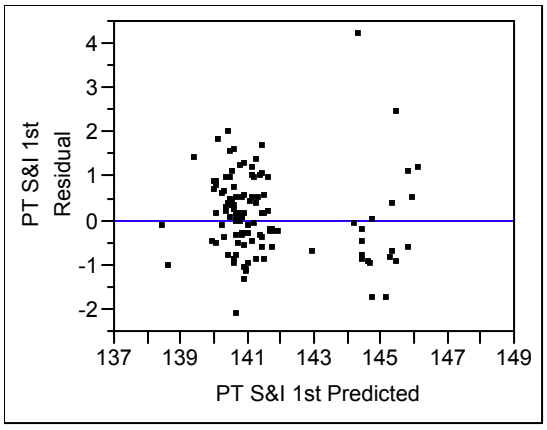

Figure 13. Scatter plot of Pavetracker residuals

5.3.2 Analysis of Core density residuals for Pavetracker Readings

A regression equation of core density as a function of project, day, location sequence, temperature, Pavetracker readings, traffic and binder content was analyzed. The residuals or the actual core density minus the predicted core density was analyzed with a t-test to determine if the residuals equal zero. From the regression equation, Pavetracker readings and binder content were determined to be significant. The regression equation is shown in Equation 7 and Figure 14.

$$\text{Core} = 153.9 + 0.06*\text{PT} - 3.5*\text{Binder content} \qquad \text{(Equation 7)}$$

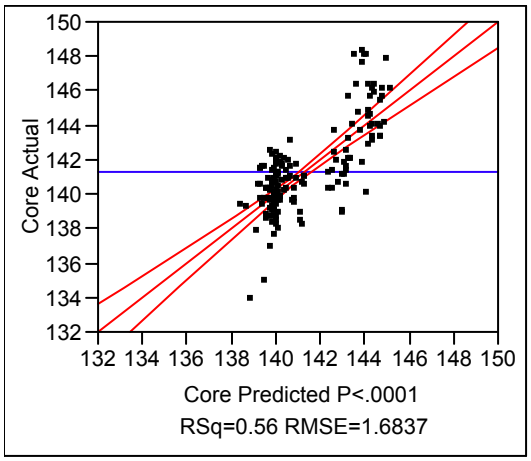

Figure 14. Scatter plot of core density for Pavetracker readings

The frequency histogram and stem and leaf plot of core density residuals is shown in Figure 14. The 95% confidence interval is (-0.26, 0.26). The actual estimate of the mean of the residuals is 1.5×10^{-13} with 161 degrees of freedom with a standard deviation of 1.67. As shown in Figure 15 the residuals values are normally distributed and centered at 0.

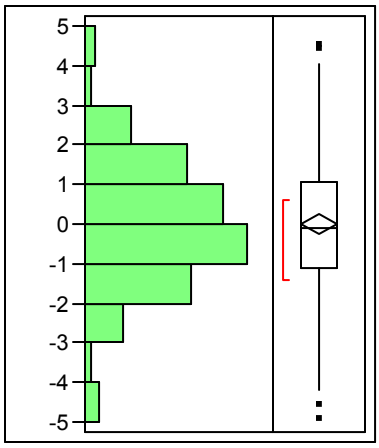

Figure 15. Frequency histogram and stem and leaf plot of Core density residuals

5.3.3 Regression Analysis for Pavetracker readings

A regression analysis of core density as a function of Pavetracker readings were analyzed for the first day and the same regression equation was used for the subsequent paving. The regression graphs and the corresponding residuals by predicted plot for each day/lot of the 7 projects is shown in Appendix A, Figures A182 to A229. The regression coefficients for equation 8 are shown in Table 7 and Table 8 for Pavetracker readings. In equation 4, y represents the core density and x represents the unadjusted Pavetracker density. Ideally the intercept coefficient, b, would be equal to zero and the slope coefficient, m, would be equal to 1. As shown in Table 5 about one third of the lots do not have b = 0 since zero is not included in the 95% confidence interval. As shown in Table 6 a little more than two thirds of the lots have m = 0 since zero is included in the 95% confidence interval. So only a little less than one third of the lots allow for m = 1 in the confidence interval. In contrast with the estimate the standard error of the mean (SEM) is large which makes the 95% confidence interval large. A larger sample size could improve the precision of the results.

$$y = mx + b \qquad \text{(Equation 8)}$$

Table 7. Intercept estimate from regression analysis

Project	Lot/Day	n	Estimate	SEM	t ratio	Prob>t	95% Confidence Interval	b= 0
1	1	7	120.1	23.9	5.03	0.004	(58.7,181.4)	N
1	2 & 3	7	259.5	74.2	3.5	0.0174	(68.7,450.2)	N
2	1	7	97.8	28.2	3.47	0.0179	(25.3,170.4)	N
2	2	7	39.1	74.9	0.52	0.6236	(-153.3,231.6)	Y
2	3	3	-140.7	91.9	-1.53	0.3686	(-1308.9,1027.6)	Y
3	1	7	134.9	18.1	7.44	0.0007	(88.3,181.5)	N
3	2	7	-993.3	770.2	-1.29	0.2536	(-2973.2,986.7)	Y
3	3	7	-224.5	126.4	-1.78	0.1358	(-549.3,100.3)	Y
3	4	7	506.1	446.2	1.13	0.3081	(-640.8,1653.1)	Y
3	5	7	-197.6	169.9	-1.16	0.2974	(-634.3,239.2)	Y
4	1	7	53.5	14.2	3.77	0.013	(17.1,89.9)	N
4	2	7	-19.0	56.3	-0.34	0.7491	(-163.6,125.6)	Y
4	3	7	-41.9	59.3	-0.71	0.511	(-194.4,110.5)	Y
4	4	6	-78.7	53.2	-1.48	0.2132	(-226.4,69.0)	Y
4	5	7	-21.5	109.3	-0.2	0.8518	(-302.4,259.5)	Y
5	1	6	87.5	28.2	3.1	0.0362	(9.1,165.9)	N
5	2	7	15.3	92.0	0.17	0.8741	(-221.2,251.9)	Y
5	3	7	-229.5	138.3	-1.66	0.1579	(-585.0,126.0)	Y
6	1	7	84.9	37.1	2.29	0.0708	(-10.5,180.3)	Y
6	2	7	21.1	130.7	0.16	0.8781	(-314.9,357.1)	Y
6	3	7	-117.6	100.2	-1.17	0.2936	(-375.3,140.1)	Y
7	1	7	101.7	32.2	3.16	0.025	(19.0,184.4)	N
7	2	7	-42.1	78.7	-0.53	0.6161	(-244.4,160.3)	Y
7	3	7	-2.8	112.5	-0.02	0.9812	(-291.9,286.4)	Y

Table 8. Slope estimate from regression analysis

Project	Lot/Day	n	Estimate	SEM	t ratio	Prob>t	95% Confidence Interval	m= 0
1	1	7	0.19	0.17	1.07	0.3316	(-0.26,0.63)	Y
1	2 & 3	7	-0.77	0.51	-1.52	0.1896	(-2.06,0.53)	Y
2	1	7	0.31	0.20	1.55	0.1827	(-0.20,0.82)	Y
2	2	7	0.72	0.53	1.35	0.2352	(-0.65,2.08)	Y
2	3	3	1.99	0.66	3.02	0.2035	(-6.38,10.36)	Y
3	1	7	0.04	0.12	0.34	0.7511	(-0.28,0.36)	Y
3	2	7	8.04	5.47	1.47	0.2015	(-6.02,22.10)	Y
3	3	7	2.59	0.90	2.89	0.0342	(0.29,4.90)	N
3	4	7	-2.60	3.17	-0.82	0.4486	(-10.8,5.5)	Y
3	5	7	2.40	1.21	1.99	0.1032	(-0.70,5.51)	Y
4	1	7	0.60	0.10	6.09	0.0017	(0.35,0.86)	N
4	2	7	1.14	0.40	2.82	0.037	(0.10,2.17)	N
4	3	7	1.30	0.42	3.07	0.0279	(0.21,2.38)	N
4	4	6	1.56	0.38	4.11	0.0147	(0.51,2.61)	N
4	5	7	1.14	0.77	1.48	0.2001	(-0.85,3.13)	Y
5	1	6	0.47	0.25	3.1	0.0362	(-0.21,1.15)	Y
5	2	7	0.88	0.65	1.35	0.234	(-0.79,2.55)	Y
5	3	7	2.59	0.97	2.67	0.0444	(0.10,5.09)	N
6	1	7	0.47	0.29	1.6	0.1705	(-0.28,1.22)	Y
6	2	7	0.86	0.91	0.94	0.3885	(-1.48,3.19)	Y
6	3	7	1.82	0.70	2.61	0.0478	(0.03,3.61)	N
7	1	7	0.27	0.22	1.22	0.2771	(-0.30,0.84)	Y
7	2	7	1.30	0.56	2.33	0.0671	(-0.13,2.73)	Y
7	3	7	1.02	0.80	1.28	0.2558	(-1.03,3.07)	Y

5.3.4 PaveTracker Conclusions

An analysis of unadjusted Pavetracker density was done to determine which factors statistically affect Pavetracker readings. Core density and traffic are significant for both adjusted and unadjusted data. Binder content is also significant for the adjusted data. An analysis of core density residuals for Pavetracker readings showed that the residual values are normally distributed and centered at zero. The regression analysis of core as a function of Pavetracker readings showed that statistically one third of the lots do not have b = 0 and two thirds of the lots do not rule out m = 0.

5.4 PQI Statistical Analysis

The PQI statistical analysis consists of regression analysis of PQI readings as a function of project, day, location sequence, temperature, core density, traffic and binder content. A regression equation of core as a function of PQI readings was also analyzed to determine if the residuals equal zero. Then regression analyses of core as a function of PQI readings were analyzed for day 1 of the seven projects. An alpha value of 0.05 was employed for all analyses.

5.4.1 Significant Factors Affecting PQI Readings

Table 9 summarizes the factors that significantly affect PQI readings. A dot in a cell indicates that a factor is deemed statistically significant. Unadjusted data is PQI readings with no adjusted criteria. First day data is PQI readings that are adjusted using the first day's regression equation. Each subsequent day's data is PQI readings that are adjusted using the corresponding regression equation for that day. First day is preferred over each day because it saves sampling and testing costs and provides quality assurance data more quickly.

Table 9. Significant factors affecting PQI readings

Parameter	Unadjusted	First Day	Each Day
Project			
Day			
Location Sequence			
Temperature			
Core Density	●	●	●
Traffic		●	●
Binder Content		●	●

The analysis indicates that core density is significant for both adjusted and unadjusted data.

Traffic and binder content is also significant for the adjusted data as shown in Table 7. Equation 9 and Figure 16 shows the regression equation for the unadjusted density. The R squared value is not correlated with core density very well (R squared = 0.08). Figure 17 shows the residuals of the regression equation for the unadjusted density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

$$PQI = -117.9 + 1.9*Core \qquad \text{(Equation 9)}$$

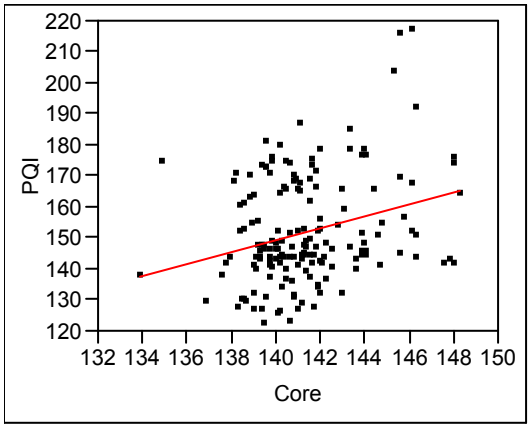

Figure 16. Scatter plot of PQI unadjusted density versus core density

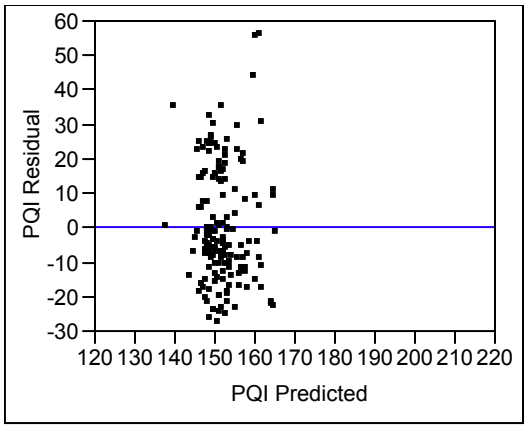

Figure 17. Scatter plot of PQI residuals

Equation 10 and Figure 18 shows the regression equation for the adjusted each day density. The R squared value is highly correlated with core density (R squared = 0.89). Figure 19 shows the residuals of the regression equation for the adjusted data each day's density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

PQI = 84.3 + 0.5*Core – 0.6*Traffic(0.3) + 0.7*Traffic(1) + 0.6*Traffic(3) – 2.3*Binder Content (Equation 10)

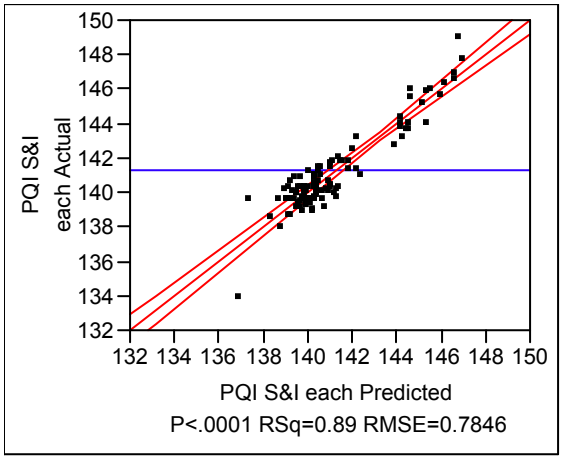

Figure 18. Scatter plot of PQI adjusted each day density

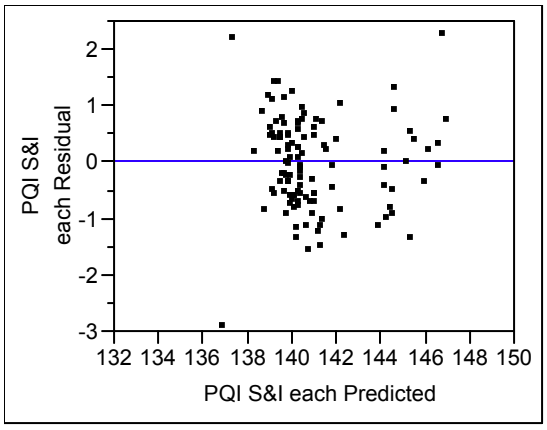

Figure 19. Scatter plot of PQI residuals

Equation 11 and Figure 20 shows the regression equation for the adjusted first day density. The R squared value is correlated with core density (R squared = 0.66). Figure 21 shows the residuals of the regression equation for the adjusted first day density. There is no distinct pattern with the residuals so there is no indication that a nonlinear model is warranted.

PQI = 122.6 + 0.2*Core -2.1*Traffic(0.3) +1.6*Traffic 1 (Equation 11)
+0.5*Traffic (3) -2.6*Binder Content

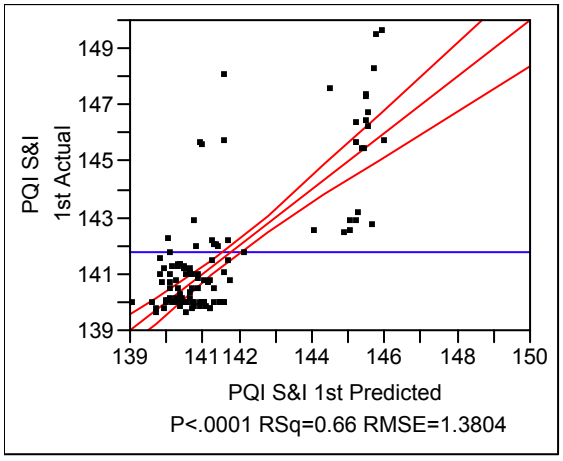

Figure 20. Scatter plot of PQI adjusted first day density

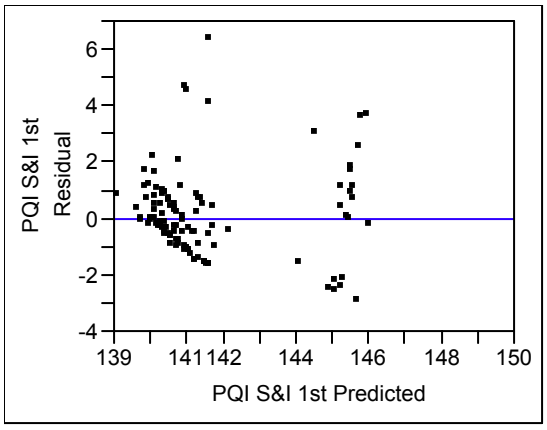

Figure 21. Scatter plot of PQI residuals

5.4.2 Analysis of Core Density Residuals for PQI Readings

A regression equation of core as a function of project, day, location sequence, temperature, PQI readings, traffic and binder content was analyzed. The residuals or the actual core density minus the predicted core density was analyzed with a t-test to determine if the residuals equal zero. From the regression equation, PQI readings were determined to be significant. The regression equation of core density for PQI readings is shown in Equation 12. The regression scatter plot of core density for PQI readings is shown in Figure 22.

Core = 135.3 +0.04*PQI (Equation 12)

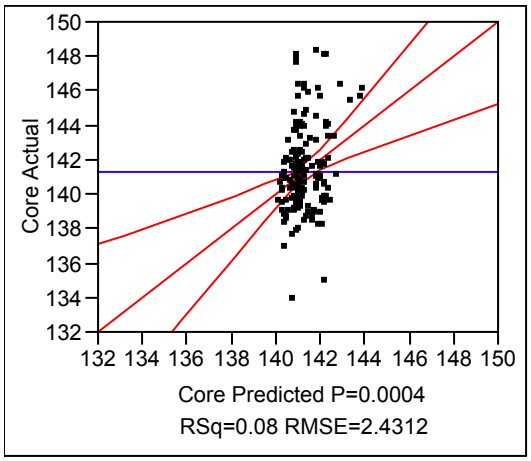

Figure 22. Scatter plot of core density for PQI readings

The frequency histogram and stem and leaf plot of core density residuals is shown in Figure 22. The 95% confidence interval is (-0.38, 0.38). The actual estimate of the mean of the residuals is 1.2×10^{-13} with 161 degrees of freedom with a standard deviation of 2.42. As shown in Figure 23, the residuals are normally distributed and centered at zero. It should be noted that the PQI standard deviation of 2.42 is larger then the Pavetracker standard deviation of 1.67.

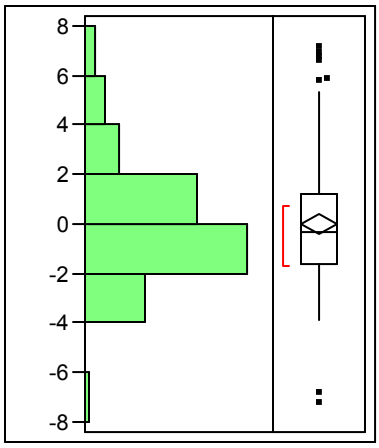

Figure 23. Frequency Histogram and stem and leaf plot of core density residuals

5.4.3 Regression Analysis for PQI readings

A regression analysis of core as a function of PQI readings were analyzed for day 1 of the seven projects and shown in Appendix A, Figures A230 to A241. The regression equation was not used for the subsequent days as done for the Pavetracker readings because the regression equations were inadequate. The slopes in the regression equations were so small that it resulted in a straight vertical line that corresponds to the average value as shown in Figure 24 and Figure 25. The plot of the residuals in Figure 25 shows that an average value would be more appropriate than the regression equation.

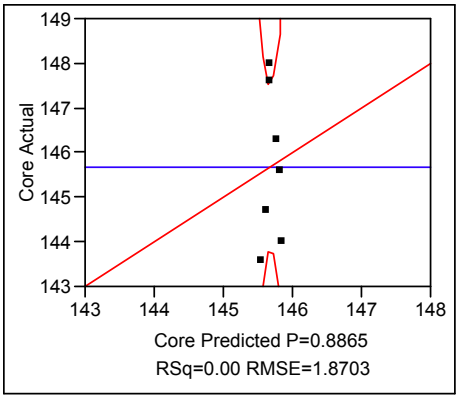

Figure 24. Project 1 Day 1 PQI regression equation

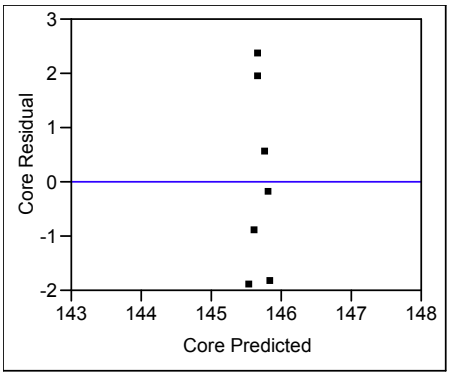

Figure 25. Project 1 Day 1 PQI residuals

The regression coefficients for equation 8 are shown in Table 10 and Table 11 for the PQI readings. The 95% confidence interval rules out b=0 for all seven projects. Also the 95% confidence interval does not rule out m=0 for six of the seven projects.

Table 10. Intercept estimate from regression analysis

Project	Day	n	Estimate	SEM	t ratio	Prob>t	95% Confidence Interval	b=0
1	1	7	132.8	8.1	16.33	<.0001	(111.9,153.7)	N
2	1	7	129.1	14.4	8.95	0.0003	(92.0,166.2)	N
3	1	7	131.1	19.5	6.73	0.0011	(81.0,181.1)	N
4	1	7	138.8	4.0	34.32	<.0001	(128.4,149.2)	N
5	1	6	116.3	15.5	7.5	0.0017	(73.2,159.4)	N
6	1	7	127.3	5.0	25.37	<.0001	(114.4,140.2)	N
7	1	7	132.8	8.1	16.33	<.0001	(111.9,153.7)	N

Table 11. Slope estimate from regression analysis

Project	Day	n	Estimate	SEM	t ratio	Prob>t	95% Confidence Interval	m=0
1	1	7	0.05	0.05	1.01	0.3591	(-0.07,0.17)	Y
2	1	7	0.09	0.11	0.86	0.4303	(-0.18,0.36)	Y
3	1	7	0.07	0.14	0.51	0.6328	(-0.28,0.42)	Y
4	1	7	0.01	0.03	0.23	0.8248	(-0.06,0.08)	Y
5	1	6	0.19	0.12	1.61	0.1827	(-0.14,0.52)	Y
6	1	7	0.10	0.03	3.39	0.0194	(0.02,0.18)	N
7	1	7	0.05	0.05	1.01	0.3591	(-0.07,0.17)	Y

5.4.4 PQI Conclusions

An analysis of unadjusted PQI density was done to determine which factors statistically affect PQI readings. Core density is significant for both adjusted and unadjusted data. Also traffic level and binder content is significant for the adjusted data. An analysis of core density residuals

for Pavetracker readings showed that the residual values are normally distributed and centered at zero. The regression analysis of core as a function of Pavetracker readings showed that the 95% confidence interval rules out b=0 for all seven projects and six of the seven projects do not rule out m=0.

5.5 Integration into Iowa DOT PWL Specification

The running average of the electromagnetic gauge density and standard deviation is plotted against number of test locations and is shown in Appendix A, Figure A130 to A181. On average the standard deviations of the electromagnetic gauge readings are lower than the standard deviations of the core test results. The few exceptions for the PT gauge are that the standard deviations are slightly higher or equal to the core standard deviations. For the few exceptions for the PQI gauge, the standard deviation was double or equal to the core standard deviation.

To determine the number of electromagnetic gauge readings required, the running average of the standard deviation curve versus the number of test locations was plotted as shown in Appendix A. The PT and PQI average for all projects was 11.2 and 12.8 readings, respectively.

6. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The analysis of PaveTracker and PQI density consisted of determining which factors are statistically significant, core density residuals and a regression analysis of core as a function of PaveTracker and PQI readings. The following key conclusions can be stated:

- Core density, traffic and binder content were all found to be significant for both electromagnetic gauges.
- Core density residuals are normally distributed and centered at zero for both electromagnetic gauges.
- For PaveTracker readings, statistically one third of the lots do not have b = 0 and two thirds of the lots do not rule out m = 0.
- For PQI readings, statistically the 95% confidence interval rules out b = 0 for all seven projects and six of the seven projects do not rule out m = 0.

Quality control and quality assurance is the ultimate objective for the electromagnetic gauges. To be accurate enough for quality control, the electromagnetic gauges need to be able to correlate with core density. To be accurate enough for quality assurance, the electromagnetic gauges need to be able to correlate with core density by eliminating some of the core density testing to be cost effective. Based on the results of this study, the PQI 301 gauge should not be used for quality control or quality assurance. The Pavetracker 2701B gauge can be used for quality control but not quality assurance. The Pavetracker 2701B correlates well with core density but does not provide any additional benefit because the gauge would need to be calibrated with core density every day.

The PaveTracker 2701B may still be applicable for quality assurance if the number of core locations per day is reduced and supplemented with additional PaveTracker 2701B readings. Further research should be done to determine the minimum number of core locations to calibrate the gauges each day/lot.

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APPENDIX A. ANALYSIS OF DATA

Table A.1. Field Data for PQI readings for Project 1 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	148.5	141.5	143.8	144.4	145.0	144.6	2.5	144.0
Core 2	143	137.6	138.5	149	148.4	143.3	5.3	146.3
Core 3	139.2	135.2	142.5	146	139.6	140.5	4.0	144.7
Core 4	141.2	138.5	141.2	147.2	138.8	141.4	3.5	148.0
Core 5	134.9	141.7	139.8	139.1	140.3	139.2	2.6	143.6
Core 6	141.3	146.9	139.9	140.4	139.7	141.6	3.0	147.6
Core 7	145.9	143.4	148	144.4	140	144.3	3.0	145.6
1	145.5	145.4	145	144.7	145.2	145.2	0.3	
2	146.6	138.9	144.4	145.8	137.9	142.7	4.0	
3	140.7	147.9	141.1	140.3	138.1	141.6	3.7	
4	144.2	141.2	150.5	143.3	141.9	144.2	3.7	
5	143.5	140.0	139.0	140.0	139.2	140.3	1.8	
6	139.7	140.6	136.2	138.7	141.5	139.3	2.0	
7	143.4	142.4	142.4	141	143.4	142.5	1.0	
8	142.7	143.9	139.0	138.6	144.4	141.7	2.7	
9	141.8	138.8	142.7	142.9	139.8	141.2	1.8	
10	140.5	141.2	139.7	140.9	141.7	140.8	0.8	
11	134.4	132.2	135.6	137.9	131.4	134.3	2.6	
12	140.4	139.4	141.5	141.2	139.5	140.4	1.0	
13	142	142.7	138.7	139.3	142.7	141.1	1.9	
14	139.2	138.1	139.3	139.5	137.6	138.7	0.8	
15	141.4	141.0	141.7	141.5	143.2	141.8	0.8	
16	136.4	132.3	133.5	136.4	133.8	134.5	1.8	
17	135.8	138.2	138.3	139.2	139.4	138.2	1.4	
18	138	138.1	139.5	138.4	137.9	138.4	0.7	
19	141.3	139.6	139.4	139.3	139.2	139.8	0.9	
20	145.8	140.6	139	138	139.5	140.6	3.1	
21	142.4	144.4	141.7	141.8	144.8	143.0	1.5	

Table A.2. Field Data for PQI readings for Project 1 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	140.7	182.6	186.5	186.2	180.0	175.2	19.5	148.0
Core 2	184.5	181.6	181.3	172.5	170.7	178.1	6.1	144.0
Core 3	165.7	171.4	174.8	180.2	174.6	173.3	5.3	148.0
Core 4	150.6	157.7	167.8	161.4	180.3	163.6	11.2	148.3
1	142.4	138.4	139.4	140.7	138.4	139.9	1.7	
2	142.3	144.9	141.8	140.9	142.2	142.4	1.5	
3	142.4	140.9	142.6	143.9	140.3	142.0	1.4	
4	144.2	142.1	147.4	140.9	147.9	144.5	3.1	
5	139.3	130.3	139.5	138.2	132.9	136.0	4.2	
6	135.8	134.5	138.5	138.3	132.9	136.0	2.4	
7	138.5	138.6	131.3	133.5	137	135.8	3.2	
8	144.5	147.2	144.4	143.2	143.8	144.6	1.5	
9	168.2	159.9	157.5	157.2	161.3	160.8	4.5	
10	144.2	141.1	138.6	141.8	141.9	141.5	2.0	
11	147.3	154.9	144.2	150.4	143.1	148.0	4.8	
12	146.7	143.5	156.4	151.4	144.1	148.4	5.4	
13	145.4	144	148.1	153.6	156.7	149.6	5.4	
14	161.3	156.4	167.4	150	158.9	158.8	6.4	
15	147.4	141.6	143.6	140.1	140.6	142.7	3.0	
16	155.1	153.5	139.7	144.1	145	147.5	6.6	
17	163.7	164.4	148.8	157.7	149.5	156.8	7.5	
18	141.1	142.2	166.3	168.1	162.4	156.0	13.3	
19	160.4	143.7	144.1	162.3	143.4	150.8	9.7	
20	164.5	167.3	142.1	141	145.9	152.2	12.7	

Table A.3. Field Data for PQI readings for Project 1 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	140.7	182.6	186.5	186.2	180.0	175.2	19.5	148.0
Core 2	184.5	181.6	181.3	172.5	170.7	178.1	6.1	144.0
Core 3	165.7	171.4	174.8	180.2	174.6	173.3	5.3	148.0
Core 4	150.6	157.7	167.8	161.4	180.3	163.6	11.2	148.3
1	142.4	138.4	139.4	140.7	138.4	139.9	1.7	
2	142.3	144.9	141.8	140.9	142.2	142.4	1.5	
3	142.4	140.9	142.6	143.9	140.3	142.0	1.4	
4	144.2	142.1	147.4	140.9	147.9	144.5	3.1	
5	139.3	130.3	139.5	138.2	132.9	136.0	4.2	
6	135.8	134.5	138.5	138.3	132.9	136.0	2.4	
7	138.5	138.6	131.3	133.5	137	135.8	3.2	
8	144.5	147.2	144.4	143.2	143.8	144.6	1.5	
9	168.2	159.9	157.5	157.2	161.3	160.8	4.5	
10	144.2	141.1	138.6	141.8	141.9	141.5	2.0	
11	147.3	154.9	144.2	150.4	143.1	148.0	4.8	
12	146.7	143.5	156.4	151.4	144.1	148.4	5.4	
13	145.4	144	148.1	153.6	156.7	149.6	5.4	
14	161.3	156.4	167.4	150	158.9	158.8	6.4	
15	147.4	141.6	143.6	140.1	140.6	142.7	3.0	
16	155.1	153.5	139.7	144.1	145	147.5	6.6	
17	163.7	164.4	148.8	157.7	149.5	156.8	7.5	
18	141.1	142.2	166.3	168.1	162.4	156.0	13.3	
19	160.4	143.7	144.1	162.3	143.4	150.8	9.7	
20	164.5	167.3	142.1	141	145.9	152.2	12.7	

Table A.4. Field Data for PQI readings for Project 2 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	131.2	134.1	132.7	136.7	133.2	133.6	2.0	141.9
Core 2	135.5	131.2	131	131.1	130.6	131.9	2.0	139.0
Core 3	141.8	141.3	143.2	147.4	136.9	142.1	3.8	142.0
Core 4	143.6	139.7	141.1	137.5	140.3	140.4	2.2	141.0
Core 5	133.7	132.2	142.9	137.5	135.6	136.4	4.2	142.3
Core 6	143	140	146.7	138.4	139.3	141.5	3.4	142.1
Core 7	132	133.2	129.7	129.3	132.4	131.3	1.7	142.0
1	128.2	125.8	129.1	129.1	125.9	127.6	1.7	
2	128.7	126.8	127.7	127.3	126.7	127.4	0.8	
3	129.5	128.6	130.4	130.3	128.5	129.5	0.9	
4	126.4	141.3	146.2	140.7	139.7	138.9	7.4	
5	130.5	140.1	139.4	139.5	137.7	137.4	4.0	
6	142.3	141.9	143.3	145	141.3	142.8	1.4	
7	143.9	143.7	144.3	145	145.7	144.5	0.8	
8	142.4	142.1	144.6	146.2	142.8	143.6	1.7	
9	146	137.2	146	134	142.8	141.2	5.4	
10	145.6	144.6	147.9	145.4	145.3	145.8	1.3	
11	147.3	149.7	144.1	146.2	145.9	146.6	2.1	
12	143.2	142.4	147.5	146	145.1	144.8	2.1	
13	148.7	147.6	147.9	147.6	144.9	147.3	1.4	
14	143.9	143.1	140.6	140.3	143.1	142.2	1.6	
15	144.3	142.6	139.4	143.8	140.1	142.0	2.2	
16	142.6	141.6	142.4	141.6	139.6	141.6	1.2	
17	145.8	144.5	143.2	146.3	143.9	144.7	1.3	
18	128.3	137.8	138.9	139	138.1	136.4	4.6	
19	148.6	145.4	146.6	144.5	143.4	145.7	2.0	
20	145.8	143.6	145.1	138.2	144.7	143.5	3.1	

Table A.5. Field Data for PQI readings for Project 2 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	138.9	144.1	142	132.6	141.9	139.9	4.5	142.5
Core 2	145	141.5	137.4	144.2	144	142.4	3.1	139.3
Core 3	143.8	143.4	145.7	133.3	143.2	141.9	4.9	139.7
Core 4	146.2	137.9	132	130.6	132.5	135.8	6.4	140.7
Core 5	141.7	140.2	146.7	141.9	145.7	143.2	2.8	140.8
Core 6	144.8	143.2	143.7	143.8	139.9	143.1	1.9	139.1
Core 7	128.2	127.1	130.5	131.7	127.6	129.0	2.0	138.7
1	147.1	136.5	143.2	145.4	145.1	143.5	4.1	
2	136.4	131	133.8	133.2	129.7	132.8	2.6	
3	145.6	144.6	135.6	141.5	140.5	141.6	3.9	
4	140.8	141.5	141.7	141.3	139.6	141.0	0.8	
5	146.4	147.7	146.8	146.5	146.5	146.8	0.5	
6	146	145.4	143.6	143.5	146.4	145.0	1.4	
7	145.7	141.1	135.6	134.7	137.3	138.9	4.5	
8	138.5	142.5	132.1	146	141.9	140.2	5.3	
9	136.9	136.2	141.4	145.6	136.7	139.4	4.1	
10	139.3	141.6	134.7	135	141.2	138.4	3.3	
11	133.9	134.8	131.5	145.3	144.6	138.0	6.4	
12	145.8	144.3	131.7	131.1	129.7	136.5	7.8	
13	138.5	146.1	143.6	144.1	145	143.5	2.9	
14	129.7	129.1	130.5	130.1	141.9	132.3	5.4	
15	142.7	141.5	141.3	142	141.7	141.8	0.5	
16	147.1	145.5	143.5	148	146.7	146.2	1.7	
17	137	131.4	138.8	141.8	146.3	139.1	5.5	
18	143.5	134.4	146.2	141.1	144.9	142.0	4.7	
19	128.8	128.1	142.5	140.4	146.1	137.2	8.2	
20	133.7	134.8	138.1	142.1	142.9	138.3	4.2	

Table A.6. Field Data for PQI readings for Project 2 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 5	140.7	131.2	138.1	138.8	139.1	137.6	3.7	133.9
Core 6	145.6	144	135.5	146.2	144.7	143.2	4.4	139.7
Core 7	142.9	136	142.7	144	141.7	141.5	3.2	137.8
1	129	126.2	129.7	129.6	125.6	128.0	2.0	
2	145.6	130.3	140.4	144.8	143.4	140.9	6.2	
3	146.4	145.3	145.7	145.4	144.6	145.5	0.7	
4	144.6	143.4	145	143.4	142.7	143.8	0.9	
5	142.2	141.1	144.1	142.2	141.2	142.2	1.2	
6	144.3	142.6	143.1	143.8	136.4	142.0	3.2	
7	144.3	142.4	143.7	143.8	143.9	143.6	0.7	
8	139.4	137.8	149.6	139.4	137.4	140.7	5.0	
9	142.5	132.6	143.1	139.8	143	140.2	4.5	
10	131.9	131.7	131.8	132.9	136.5	133.0	2.0	
11	129.9	134	133.6	133	132.1	132.5	1.6	
12	143.4	142.6	140.9	143.4	142.4	142.5	1.0	
13	144.4	142.7	141.3	144.6	143.4	143.3	1.3	
14	134.2	144	146.1	144.8	142.4	142.3	4.7	
15	131.7	139.2	142.1	141.8	140.6	139.1	4.3	
16	143.8	132.8	145.8	142.5	141.4	141.3	5.0	
17	143.6	144.1	142.9	145	144.5	144.0	0.8	
18	146.1	141.7	143	140.8	138.6	142.0	2.8	
19	144.6	145.2	142.7	141.8	149	144.7	2.8	
20	142.1	137.7	142.4	135.9	138.9	139.4	2.8	

Table A.7. Field Data for PQI readings for Project 3 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	144.4	149.3	141.7	141.9	140.9	143.6	3.4	141.3
Core 2	147.2	147.2	146.3	140.8	147.6	145.8	2.8	140.1
Core 3	143.7	144.5	143.7	143.5	144.4	144.0	0.5	141.5
Core 4	141	140.1	142.2	142.4	140.8	141.3	1.0	141.6
Core 5	147.1	146.5	146.7	145.7	146	146.4	0.6	141.8
Core 6	146	146.2	145.6	147.2	146.8	146.4	0.6	140.7
Core 7	131.7	142.3	140.9	142.2	142.9	140.0	4.7	139.8
1	139.5	135.5	137.6	139.8	138.7	138.2	1.7	
2	140.2	140.2	139.8	139.5	138.9	139.7	0.5	
3	137.6	138.2	137.7	140.3	141.1	139.0	1.6	
4	143.8	135	134.7	138.2	135.9	137.5	3.8	
5	144.1	146.3	146.3	145.9	145.9	145.7	0.9	
6	143.2	143.9	137.6	140.3	138	140.6	2.9	
7	141.8	145	142.1	144.9	132.4	141.2	5.2	
8	141.6	140.2	146.7	145.4	139.6	142.7	3.2	
9	137.7	142.2	145	144.2	138.9	141.6	3.2	
10	134.5	135.2	146.1	145.9	145	141.3	5.9	
11	145.5	138.4	144.2	144.8	141.7	142.9	2.9	
12	142.4	142.7	145.5	142.4	148.1	144.2	2.5	
13	135.7	144.5	144.8	144.4	139.8	141.8	4.0	
14	135.9	133.5	139.3	140.4	144.1	138.6	4.1	
15	144.9	145.9	144.7	146	145.8	145.5	0.6	
16	147	144.8	145	145.3	146.1	145.6	0.9	
17	143.4	142.9	143.3	143.6	143	143.2	0.3	
18	147	146	146.3	147.1	146.3	146.5	0.5	
19	139.1	145.7	143	145.1	146.9	144.0	3.1	
20	147.7	145.5	147.4	146.9	146.1	146.7	0.9	

Table A.8. Field Data for PQI readings for Project 3 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	129.2	129.4	128.7	128.4	128.6	128.9	0.4	136.9
Core 2	129.8	129.5	130.1	130.5	129.5	129.9	0.4	138.6
Core 3	129.5	130.5	129.9	129.8	130.3	130.0	0.4	138.5
Core 4	154.8	130.1	156.4	130.4	164.9	147.3	16.0	139.2
Core 5	129.4	167	128.9	128.6	128.7	136.5	17.0	139.7
Core 6	130	157	130.3	129.9	168.7	143.2	18.4	140.6
Core 7	128.8	168.1	168.4	169.4	169.4	160.8	17.9	138.6
1	130.3	167.2	167.9	129.4	129.2	144.8	20.8	
2	130.8	129.9	155.7	130.9	129.9	135.4	11.3	
3	137.2	131.1	129.2	129.4	130	131.4	3.3	
4	149.6	150.6	150.1	130.7	150.3	146.3	8.7	
5	130.9	150.9	138.4	131.1	130.9	136.4	8.7	
6	165.2	165.6	126.4	125.9	125.7	141.8	21.6	
7	126.6	165.7	167.4	168.1	165.2	158.6	17.9	
8	127.3	129.3	129.3	128.8	129.9	128.9	1.0	
9	146.2	148	129.2	129.1	129.9	136.5	9.7	
10	126.6	132.8	130.7	129.8	130.1	130.0	2.2	
11	128.5	129.6	129.3	128.9	129.6	129.2	0.5	
12	128.6	128.4	125	126.9	129.3	127.6	1.7	
13	146.1	146.6	138.4	147.2	146.9	145.0	3.7	
14	145.9	136.8	146.3	147	143.6	143.9	4.2	
15	128.6	129.4	130.1	126.5	126	128.1	1.8	
16	130.5	131.1	149.4	130.5	131.2	134.5	8.3	
17	130.3	146.7	146.2	170.3	130.5	144.8	16.4	
18	130.4	130.1	130.2	130.6	130.5	130.4	0.2	
19	129.4	130.7	129.9	129	143	132.4	6.0	
20	127	126.6	127.9	127.4	127.4	127.3	0.5	

Table A.9. Field Data for PQI readings for Project 3 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	148.2	148.9	148.2	148.8	149.8	148.8	0.7	141.5
Core 2	147.9	147.7	148.6	148.3	148.1	148.1	0.3	141.4
Core 3	146.8	147.4	146.8	145.7	146.7	146.7	0.6	141.4
Core 4	145.3	145.3	147.2	148.0	144.2	146.0	1.6	139.7
Core 5	127.5	140.3	141.8	139.8	147.0	139.3	7.2	140.5
Core 6	137.9	144.9	144.3	144.6	144.5	143.2	3.0	139.3
Core 7	134.7	134.6	136.7	137.7	137.9	136.3	1.6	140.5
1	166.4	158.7	153.9	139.1	140.7	151.8	11.7	
2	136.2	154.4	147.4	148.4	141.7	145.6	6.9	
3	150.6	145.6	148.0	148.9	147.8	148.2	1.8	
4	146.9	147.7	149.2	153.1	148.8	149.1	2.4	
5	140.2	148.1	148.6	148.2	147.9	146.6	3.6	
6	147.2	148.7	149.6	137.4	148.6	146.3	5.0	
7	148.1	147.2	140.2	147.9	137.9	144.3	4.8	
8	148.3	133.8	145.5	143.3	135.6	141.3	6.3	
9	147.0	139.0	143.6	147.4	143.5	144.1	3.4	
10	145.8	142.8	144.2	142.5	134.8	142.0	4.2	
11	143.3	141.5	148.1	145.0	143.5	144.3	2.5	
12	143.4	140.3	144.6	148.0	145.8	144.4	2.9	
13	147.2	140.7	144.3	144.5	144.0	144.1	2.3	
14	146.6	142.6	145.9	148.1	146.1	145.9	2.0	
15	147.4	147.7	147.9	146.9	149.6	147.9	1.0	
16	145.2	146.7	147.0	147.5	146.4	146.6	0.9	
17	137.3	139.5	132.9	142.7	142.0	138.9	4.0	
18	127.2	128.4	121.0	123.6	128.6	125.8	3.3	
19	130.0	123.5	123.3	130.5	126.6	126.8	3.4	
20	129.6	130.0	128.9	129.2	130.5	129.6	0.6	

Table A.10. Field Data for PQI readings for Project 3 Day 4

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	145.1	144.3	146.1	146.0	134.1	143.1	5.1	140.4
Core 2	147.2	148.5	146.4	145.6	147.9	147.1	1.2	139.5
Core 3	137.1	148.4	148.7	147.6	146.5	145.7	4.9	139.5
Core 4	146.4	145.4	146.4	145.5	144.3	145.6	0.9	140.0
Core 5	145.9	143.8	146.4	145.6	145.2	145.4	1.0	139.3
Core 6	145.3	143.9	141.5	143.7	143.1	143.5	1.4	137.9
Core 7	142.8	141.5	142.9	143.0	144.4	142.9	1.0	140.0
1	146.9	146.2	147.2	146.9	146.6	146.8	0.4	
2	149.6	147.9	147.4	147.9	148.2	148.2	0.8	
3	132.1	139.4	148.5	147.7	132.0	139.9	8.0	
4	145.5	146.7	146.4	145.8	146.3	146.1	0.5	
5	126.0	126.7	132.9	132.3	128.3	129.2	3.2	
6	144.7	136.2	138.0	138.8	132.8	138.1	4.4	
7	147.9	147.3	147.6	147.4	148.0	147.6	0.3	
8	139.7	147.4	146.8	147.4	147.9	145.8	3.5	
9	146.7	145.7	146.5	146.6	147.0	146.5	0.5	
10	131.2	146.9	147.6	146.1	147.9	143.9	7.2	
11	138.9	135.4	147.7	146.4	143.5	142.4	5.2	
12	146.4	145.6	143.6	145.1	146.8	145.5	1.3	
13	143.6	145.5	143.8	137.9	145.7	143.3	3.2	
14	133.8	133.6	136.1	140.0	137.8	136.3	2.7	
15	138.9	141.4	140.2	144.9	146.6	142.4	3.2	
16	136.2	145.7	144.8	146.0	143.9	143.3	4.1	
17	142.4	141.8	139.6	140.8	144.2	141.8	1.7	
18	149.5	149.0	149.2	149.3	148.0	149.0	0.6	
19	146.4	149.5	149.3	149.7	146.9	148.4	1.6	
20	146.9	146.6	143.7	137.4	135.6	142.0	5.2	

Table A.11. Field Data for PQI readings for Project 3 Day 5

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	154.1	158.1	157.8	155.7	149.6	155.1	3.5	139.2
Core 2	150.3	140.8	169.2	130.3	130.7	144.3	16.2	141.3
Core 3	135.4	136.4	137.1	135.5	172.3	143.3	16.2	142.2
Core 4	154.3	148.2	151.0	139.0	148.9	148.3	5.7	140.3
Core 5	142.7	139.9	141.7	132.5	146.2	140.6	5.1	139.7
Core 6	132.5	136.9	138.0	136.5	139.0	136.6	2.5	141.5
Core 7	132.4	133.0	133.8	134.0	135.8	133.8	1.3	140.3
1	132.5	134.7	132.9	133.5	134.2	133.6	0.9	
2	139.7	141.2	149.7	161.1	145.7	147.5	8.6	
3	144.6	157.6	152.2	147.7	143.7	149.2	5.8	
4	152.2	164.4	169.4	154.7	168.1	161.8	7.9	
5	164.2	170.4	169.6	165.3	164.7	166.8	2.9	
6	172.2	163.4	145.3	166.0	170.4	163.5	10.7	
7	171.7	143.1	170.3	169.8	172.3	165.4	12.5	
8	131.1	134.9	141.8	146.4	154.4	141.7	9.2	
9	167.2	171.6	169.3	151.7	153.6	162.7	9.3	
10	134.5	135.5	131.6	138.9	140.5	136.2	3.5	
11	131.1	132.2	133.9	140.9	141.9	136.0	5.0	
12	173.8	143.7	147.9	161.5	141.9	153.8	13.6	
13	135.0	133.4	129.7	129.9	132.5	132.1	2.3	
14	130.4	131.0	130.6	133.4	134.6	132.0	1.9	
15	131.7	136.4	129.9	134.2	143.5	135.1	5.3	
16	135.7	135.5	132.5	150.8	144.0	139.7	7.5	
17	130.8	129.8	131.8	135.6	133.5	132.3	2.3	
18	131.4	130.6	131.6	130.7	132.7	131.4	0.8	
19	171.9	156.7	150.0	165.8	173.3	163.5	10.0	
20	150.6	170.6	173.2	134.2	134.5	152.6	18.8	

Table A.12. Field Data for PQI readings for Project 4 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	137.8	137.6	143.0	141.8	142.1	140.5	2.6	139.0
Core 2	153.3	144.8	147.9	145.1	151.5	148.5	3.8	139.8
Core 3	149.2	148.1	150.4	151.8	159.3	151.8	4.4	140.1
Core 4	139.1	138.7	139.5	140.0	140.7	139.6	0.8	139.1
Core 5	176.8	176.1	172.0	178.2	172.8	175.2	2.7	139.8
Core 6	140.0	142.0	145.9	152.0	155.0	147.0	6.4	139.4
Core 7	141.0	141.7	142.5	142.2	144.3	142.3	1.2	141.2
1	143.0	144.4	144.9	169.9	164.6	153.4	12.8	
2	154.3	152.6	143.7	143.0	162.3	151.2	8.0	
3	170.5	171.7	145.5	164.7	141.4	158.8	14.3	
4	136.6	139.0	137.2	137.7	163.4	142.8	11.6	
5	139.9	140.2	139.3	139.2	138.7	139.5	0.6	
6	138.7	139.5	139.1	139.5	138.1	139.0	0.6	
7	141.9	153.2	150.0	150.9	153.6	149.9	4.7	
8	140.0	156.4	155.1	145.9	137.9	147.1	8.5	
9	139.8	145.1	145.8	149.5	138.9	143.8	4.4	
10	163.1	159.5	158.4	177.1	177.5	167.1	9.5	
11	172.2	178.6	176.7	172.5	172.9	174.6	2.9	
12	159.9	151.2	166.3	172.8	165.3	163.1	8.1	
13	138.0	142.5	144.4	156.8	143.7	145.1	7.0	
14	140.9	140.2	138.8	139.1	141.7	140.1	1.2	
15	153.8	151.3	149.4	156.3	149.2	152.0	3.0	
16	140.7	138.4	140.0	145.6	146.5	142.2	3.6	
17	140.9	144.5	145.9	144.2	140.8	143.3	2.3	
18	149.0	149.7	145.1	156.9	161.3	152.4	6.5	
19	141.1	142.2	142.0	140.7	142.8	141.8	0.9	
20	147.4	153.4	134.8	143.4	159.1	147.6	9.3	

Table A.13. Field Data for PQI readings for Project 4 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	174.6	177.8	176.9	181.8	185.6	179.3	4.4	140.2
Core 2	178.6	177.2	190.4	186	172.4	180.9	7.2	139.6
Core 3	172.6	167.5	165.7	171.4	170.3	169.5	2.8	140.8
Core 4	157.3	177.9	170.4	177.4	181.8	173.0	9.7	141.6
Core 5	169	170.9	173.4	177.4	181.1	174.4	4.9	134.9
Core 6	152.7	177.9	164.4	162	162.4	163.9	9.0	140.2
Core 7	139.1	138.6	139	139.7	137.5	138.8	0.8	141.4
1	189.7	169.5	173.7	174.2	190.1	179.4	9.7	
2	187.3	193.1	186	184.7	181.7	186.6	4.2	
3	181.2	190.3	164.8	194.8	192.2	184.7	12.2	
4	178.6	184.3	173.6	183.4	188.4	181.7	5.7	
5	171.6	174.6	177.6	173.3	173.5	174.1	2.2	
6	179.7	172.2	177.5	176.4	187.2	178.6	5.5	
7	172.2	179.2	176	176.7	178.6	176.5	2.8	
8	185.7	178.3	173.3	187.4	188.7	182.7	6.6	
9	183.1	177	180.1	182.5	181.4	180.8	2.4	
10	161.1	169.6	170.9	166.3	164.4	166.5	4.0	
11	179	182.9	187.3	172.9	170.9	178.6	6.8	
12	182.2	188.7	185.6	189.7	178.5	184.9	4.6	
13	134.7	184	170.4	178.6	186.5	170.8	21.1	
14	191	187.7	185.8	176.5	177.3	183.7	6.5	
15	166	167.3	177.1	175	184.6	174.0	7.6	
16	148.6	149.8	174.1	160.5	158	158.2	10.3	
17	152.7	155.1	184.8	176.4	152	164.2	15.3	
18	153.7	150.4	168.3	175.8	179	165.4	12.9	
19	168.3	179	170.4	180.6	170.7	173.8	5.6	
20	187	182.6	172.2	172.8	175.8	178.1	6.5	

Table A.14. Field Data for PQI readings for Project 4 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	157.2	156.5	167.3	174	174.8	166.0	8.8	141.8
Core 2	174	171.8	167	172.1	142.5	165.5	13.1	140.4
Core 3	176.9	167.8	173.9	174.7	150	168.7	11.0	141.5
Core 4	174.1	172.2	171.7	166.2	163.7	169.6	4.4	138.8
Core 5	175.3	172.6	178	177.4	168.8	174.4	3.8	139.8
Core 6	175.1	169.4	170.7	174.2	172.2	172.3	2.4	139.6
Core 7	169.5	167.2	164.8	168.1	170	167.9	2.1	138.1
1	169	163.1	175.3	176	176	171.9	5.7	
2	175.7	172.4	177.4	176.2	175.2	175.4	1.9	
3	171.7	169	174.2	174.9	171.2	172.2	2.4	
4	174.9	176.3	174	168.5	172.1	173.2	3.0	
5	173.3	168.8	157.2	171.0	174.4	168.9	6.9	
6	181.4	178.4	177.8	181.4	179.5	179.7	1.7	
7	184.6	185.5	176.1	182.4	186.8	183.1	4.2	
8	175.8	176.8	171.8	171.2	177.5	174.6	2.9	
9	151.9	155.5	174.3	157.6	170.4	161.9	9.8	
10	177.5	139.5	185.2	181.3	176.7	172.0	18.5	
11	148.6	148.3	151.3	158.3	175.6	156.4	11.5	
12	169.7	171.9	173.8	171.3	173.2	172.0	1.6	
13	166.8	170.7	166.6	174.5	172.6	170.2	3.5	
14	173	142.6	141.2	156.3	175.8	157.8	16.3	
15	171.9	171.3	172	169.3	172.2	171.3	1.2	
16	167.5	171.2	171.6	171.6	169.6	170.3	1.8	
17	169.2	170.1	169.7	167.6	170.7	169.5	1.2	
18	171.5	165.5	167	168.8	168.8	168.3	2.3	
19	135.2	134.8	135.7	136.7	134.9	135.5	0.8	
20	175.2	174.9	171.6	173.8	165.4	172.2	4.0	

Table A.15. Field Data for PQI readings for Project 4 Day 4

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	140.2	145.4	146.8	142.3	143.9	143.7	2.6	140.3
Core 2	177.5	169.2	176.6	170.8	171.1	173.0	3.7	139.4
Core 3	173.7	152.8	170.7	169.5	171.3	167.6	8.4	140.8
Core 4	172.1	170.9	174.3	172.1	172.8	172.4	1.2	139.6
Core 5	169.7	171.4	167.6	169.7	172.9	170.3	2.0	139.7
Core 6	172.6	172.2	179.0	176.1	174.0	174.8	2.8	141.6
1	141.6	163.6	164.2	142.6	164.1	155.2	12.0	
2	168.5	173.8	142.3	172.4	166.5	164.7	12.9	
3	172.0	143.4	141.2	169.4	173.8	160.0	16.2	
4	170.0	172.0	174.9	170.8	164.0	170.3	4.0	
5	174.8	166.6	169.8	143.3	145.1	159.9	14.7	
6	161.9	159.6	142.7	164.7	143.8	154.5	10.5	
7	162.1	167.0	143.8	147.2	145.2	153.1	10.7	
8	170.4	167.1	173.5	170.9	168.0	170.0	2.5	
9	175.5	174.4	175.0	173.2	173.5	174.3	1.0	
10	170.7	175.2	174.2	169.1	168.6	171.6	3.0	
11	175.5	171.0	171.3	169.4	167.4	170.9	3.0	
12	174.8	177.9	171.5	174.8	154.7	170.7	9.2	
13	175.1	153.0	172.8	171.1	174.8	169.4	9.3	
14	150.3	155.5	149.4	151.0	177.0	156.6	11.6	
15	172.7	175.1	147.6	150.4	166.9	162.5	12.8	
16	171.0	173.8	172.2	176.6	177.0	174.1	2.6	
17	157.6	179.1	173.0	177.7	178.0	173.1	9.0	
18	177.9	179.4	169.6	172.8	178.2	175.6	4.2	
19	157.9	158.6	140.8	170.1	171.3	159.7	12.3	
20	175.3	139.9	178.0	173.4	148.6	163.0	17.5	

Table A.16. Field Data for PQI readings for Project 4 Day 5

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	160.3	173.1	174.5	174.5	158.9	168.3	7.9	140.9
Core 2	166.7	172.4	173.0	170.7	168.8	170.3	2.6	138.2
Core 3	147.9	154.7	154.3	157.4	158.1	154.5	4.0	138.9
Core 4	150.1	169.9	170.0	154.4	156.8	160.2	9.2	138.4
Core 5	176.2	169.0	176.5	173.1	171.9	173.3	3.1	140.6
Core 6	171.5	171.6	179.1	177.2	171.8	174.2	3.6	140.5
Core 7	171.2	156.1	174.5	177.9	145.4	165.0	13.8	141.0
1	147.0	147.1	150.0	146.2	146.2	147.3	1.6	
2	171.0	178.0	184.1	171.9	175.6	176.1	5.3	
3	175.8	174.4	172.8	159.4	172.0	170.9	6.6	
4	171.0	176.6	172.9	171.3	173.9	173.1	2.3	
5	171.1	169.0	166.7	169.4	169.7	169.2	1.6	
6	173.2	174.8	177.6	175.7	175.5	175.4	1.6	
7	177.2	175.4	170.8	170.5	175.9	174.0	3.1	
8	176.4	171.7	175.9	170.7	176.0	174.1	2.7	
9	173.9	168.9	174.5	173.3	173.7	172.9	2.3	
10	161.4	176.8	155.0	152.6	178.7	164.9	12.2	
11	170.3	155.1	145.2	151.1	175.5	159.4	12.9	
12	161.7	175.4	176.1	175.5	174.0	172.5	6.1	
13	174.6	172.4	173.2	172.7	178.7	174.3	2.6	
14	157.2	170.5	168.2	172.8	167.5	167.2	6.0	
15	167.8	163.2	170.8	178.1	162.8	168.5	6.3	
16	178.3	180.4	178.3	165.5	177.6	176.0	6.0	
17	178.2	176.8	176.1	178.6	175.7	177.1	1.3	
18	172.8	174.8	171.0	169.7	172.8	172.2	1.9	
19	134.4	137.4	135.0	133.9	132.1	134.6	1.9	
20	170.5	165.6	168.1	173.0	164.8	168.4	3.4	

Table A.17. Field Data for PQI readings for Project 5 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	125.5	126.1	125.5	124.3	126.3	125.5	0.8	
Core 2	126.6	126.0	126.1	125.7	126.4	126.2	0.4	
Core 4	128.4	131.5	131.0	129.6	132.4	130.6	1.6	
Core 5	129.4	132.3	131.4	131.1	129.7	130.8	1.2	
Core 6	133.9	133.1	135.0	122.7	132.9	131.5	5.0	
Core 7	133.7	133.6	136.5	133.6	132.5	134.0	1.5	
1	120.1	120.2	124.8	124.3	122.6	122.4	2.2	
2	122.6	137.2	139.6	180.1	176.9	151.3	25.7	
3	121.3	120.6	122.3	121.1	122.3	121.5	0.8	
4	178.3	126.7	121.3	122.3	122.0	134.1	24.8	
5	155.1	146.4	148.1	139.2	121.2	142.0	12.9	
6	120.9	127.3	126.6	125.7	125.7	125.2	2.5	
7	122.9	129.1	131.9	132.7	136.4	130.6	5.0	
8	146.6	145.8	126.0	126.9	137.9	136.6	9.9	
9	136.7	136.6	158.3	157.6	158.5	149.5	11.8	
10	154.5	121.0	134.0	140.5	122.8	134.6	13.7	
11	123.1	132.0	166.6	122.5	123.8	133.6	18.8	
12	126.3	152.6	157.9	155.8	161.7	150.9	14.1	
13	120.8	136.1	127.7	128.0	130.3	128.6	5.5	
14	139.6	150.5	146.4	145.3	155.9	147.5	6.1	
15	122.3	134.6	144.6	142.8	146.8	138.2	10.0	
16	173.0	151.7	151.6	152.6	122.3	150.2	18.1	
17	120.8	121.3	119.6	120.7	128.7	122.2	3.7	
18	122.1	122.5	122.3	140.9	141.6	129.9	10.4	
19	161.3	132.0	123.6	122.9	129.1	133.8	15.8	
20	127.8	123.4	137.1	142.5	156.5	137.5	13.0	

Table A.18. Field Data for PQI readings for Project 5 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	128.5	127.5	125.0	121.8	123.6	125.3	2.8	140.1
Core 2	126.5	127.3	127.3	127.3	126.6	127.0	0.4	141.7
Core 3	126.8	126.6	127.0	128.3	127.9	127.3	0.7	138.3
Core 4	124.5	126.4	128.9	129.1	132.1	128.2	2.9	141.2
Core 5	128.3	126.5	126.9	125.3	126.3	126.7	1.1	139.0
Core 6	122.2	121.9	122.2	121.8	121.6	121.9	0.3	139.5
Core 7	126.9	125.8	126.4	127.4	124.5	126.2	1.1	139.4
1	133.8	131.7	132.9	132.4	133.8	132.9	0.9	
2	125.1	132.6	132.0	128.8	130.9	129.9	3.0	
3	128.2	135.4	134.8	133.0	128.6	132.0	3.4	
4	132.8	131.0	131.9	132.8	131.6	132.0	0.8	
5	133.1	132.8	131.0	134.2	133.6	132.9	1.2	
6	132.6	132.9	132.4	133.7	133.2	133.0	0.5	
7	130.5	131.8	131.0	131.1	128.3	130.5	1.3	
8	133.3	132.8	131.0	121.9	123.8	128.6	5.3	
9	129.6	133.3	132.6	133.4	134.1	132.6	1.8	
10	130.7	130.4	130.2	135.4	125.8	130.5	3.4	
11	134.0	132.6	135.7	134.7	136.0	134.6	1.4	
12	127.1	134.0	132.9	131.2	124.1	129.9	4.2	
13	130.6	133.5	131.2	133.4	134.2	132.6	1.6	
14	132.2	134.6	132.6	133.6	131.0	132.8	1.4	
15	128.2	125.8	133.9	132.5	127.5	129.6	3.5	
16	127.8	127.3	126.3	127.7	127.6	127.3	0.6	
17	120.4	120.6	122.2	120.6	120.2	120.8	0.8	
18	127.7	128.2	129.0	128.7	128.9	128.5	0.5	
19	126.4	126.8	125.8	127.0	125.8	126.4	0.6	
20	127.9	126.3	128.6	124.1	127.6	126.9	1.8	

Table A.19. Field Data for PQI readings for Project 5 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	122.3	123.4	121.5	122.1	124.3	122.7	1.1	140.6
Core 2	147.4	130.0	148.8	138.7	122.5	137.5	11.3	137.6
Core 3	150.5	152.6	152.9	150.7	154.4	152.2	1.6	138.6
Core 4	154.2	156.3	153.0	149.0	144.1	151.3	4.8	141.0
Core 5	151.0	155.3	151.4	146.3	154.7	151.7	3.6	138.4
Core 6	120.6	120.4	127.9	137.4	144.9	130.2	10.7	139.6
Core 7	164.0	161.3	165.2	167.6	162.7	164.2	2.4	141.1
1	121.6	121.4	128.9	133.1	136.2	128.2	6.7	
2	131.1	137.5	136.9	137.5	140.2	136.6	3.4	
3	154.1	155.3	129.5	157.3	157.4	150.7	11.9	
4	159.0	164.5	164.8	165.3	153.1	161.3	5.3	
5	152.8	153.6	155.7	151.4	153.2	153.3	1.6	
6	151.5	153.6	154.9	154.3	158.8	154.6	2.7	
7	158.4	160.5	163.1	158.3	165.6	161.2	3.2	
8	158.7	154.4	152.6	162.7	161.6	158.0	4.4	
9	154.6	161.0	167.7	161.7	161.6	161.3	4.6	
10	123.9	125.2	162.3	162.3	160.1	146.8	20.3	
11	162.3	165.4	161.2	153.6	158.4	160.2	4.5	
12	161.7	157.6	159.1	161.0	157.7	159.4	1.9	
13	167.3	160.0	163.0	161.8	167.8	164.0	3.4	
14	136.2	164.9	163.1	158.6	157.3	156.0	11.5	
15	156.5	156.6	162.5	129.1	151.2	151.2	13.0	
16	154.8	156.2	161.4	153.1	153.4	155.8	3.4	
17	160.4	165.4	165.0	161.0	162.7	162.9	2.3	
18	189.4	153.3	150.8	155.9	149.2	159.7	16.8	
19	157.9	120.3	120.4	120.2	120.4	127.8	16.8	
20	129.2	151.9	157.4	119.6	119.6	135.5	18.0	

Table A.20. Field Data for PQI readings for Project 6 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	123.9	134.6	151.9	156.7	152.2	143.9	14.0	141.7
Core 2	162.4	166.9	166.4	162.6	167.8	165.2	2.5	144.4
Core 3	186.3	199.4	168.1	139.5	150.6	168.8	24.7	145.6
Core 4	177.1	188.6	193.3	196.9	201.6	191.5	9.4	146.3
Core 5	158.3	155.6	158.1	191.6	163.6	165.4	14.9	143.0
Core 6	145.6	157.0	147.9	149.8	167.5	153.6	8.9	142.8
Core 7	159.7	162.7	163.3	160.4	189.6	167.1	12.6	146.1
1	159.1	162.4	157.4	159.2	157.8	159.2	2.0	
2	167.7	211.1	162.3	216.8	211.4	193.9	26.5	
3	232.1	165.5	232.8	207.1	197.9	207.1	27.8	
4	163.6	166.5	164.8	163.7	163.0	164.3	1.4	
5	184.1	187.1	185.4	188.2	186.0	186.2	1.6	
6	164.2	163.3	168.1	206.9	198.7	180.2	20.9	
7	195.2	187.8	193.7	199.1	202.3	195.6	5.5	
8	182.6	190.7	196.5	188.3	140.6	179.7	22.4	
9	148.6	149.8	148.4	146.4	147.0	148.0	1.4	
10	149.8	152.5	152.0	149.2	149.6	150.6	1.5	
11	153.1	153.1	149.9	155.5	180.8	158.5	12.6	
12	157.7	159.9	161.9	157.9	159.4	159.4	1.7	
13	153.0	153.9	180.1	163.5	166.5	163.4	11.0	
14	156.9	159.6	165.8	169.0	180.0	166.3	9.1	
15	146.5	152.3	143.6	141.5	148.7	146.5	4.2	
16	157.1	158.7	163.5	163.5	166.8	161.9	3.9	
17	224.6	217.2	220.6	215.1	219.3	219.4	3.6	
18	192.3	201.7	198.2	157.3	156.6	181.2	22.4	
19	220.9	230.9	231.0	161.0	125.0	193.8	48.2	
20	269.2	168.6	170.9	234.6	228.3	214.3	43.6	

Table A.21. Field Data for PQI readings for Project 6 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	198.6	212.0	225.5	221.9	226.8	217.0	11.8	146.1
Core 2	178.7	154.5	185.4	182.8	189.0	178.1	13.7	143.3
Core 3	169.4	185.9	153.4	192.8	179.8	176.3	15.4	143.9
Core 4	234.9	164.7	236.8	212.8	228.3	215.5	29.9	145.6
Core 5	170.2	193.0	217.7	195.9	146.1	184.6	27.3	143.3
Core 6	204.0	199.8	202.6	209.0	199.4	203.0	3.9	145.3
Core 7	203.0	180.0	162.5	153.9	180.4	176.0	18.9	144.1
1	160.6	166.5	163.4	165.8	164.3	164.1	2.3	
2	149.1	146.6	148.0	148.7	149.1	148.3	1.1	
3	148.4	155.1	151.2	152.4	152.3	151.9	2.4	
4	153.3	153.2	151.0	150.7	153.0	152.2	1.3	
5	158.4	148.0	150.6	154.5	149.4	152.2	4.2	
6	160.3	157.7	155.6	153.6	168.6	159.2	5.8	
7	170.4	174.1	158.1	167.8	169.8	168.0	6.0	
8	162.7	166.0	164.8	165.7	164.5	164.7	1.3	
9	168.7	162.3	166.1	162.2	163.7	164.6	2.8	
10	170.9	170.2	175.9	169.3	147.9	166.8	10.9	
11	162.1	208.1	145.2	159.9	162.8	167.6	23.7	
12	151.8	185.2	152.2	153.8	153.8	159.4	14.5	
13	143.3	168.8	179.9	164.0	159.4	163.1	13.4	
14	213.3	215.1	208.2	213.9	216.8	213.5	3.2	
15	130.3	169.9	188.1	139.0	177.1	160.9	25.0	
16	168.5	168.3	211.9	234.6	223.3	201.3	31.1	
17	225.6	222.5	165.1	172.9	172.9	191.8	29.6	
18	268.7	210.6	224.7	240.0	192.0	227.2	29.2	
19	235.7	245.2	224.1	211.8	242.1	231.8	13.8	
20	144.3	195.4	147.0	160.8	209.5	171.4	29.5	

Table A.22. Field Data for PQI readings for Project 6 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	143.8	142.8	156.8	152.1	144.0	147.9	6.2	140.0
Core 2	147.7	147.9	147.2	147.5	149.5	148.0	0.9	144.0
Core 3	152.6	152.1	152.1	152.9	160.1	154.0	3.4	144.8
Core 4	148.3	148.2	142.7	145.8	147.6	146.5	2.4	143.3
Core 5	152.5	149.7	150.6	151.1	150.8	150.9	1.0	143.9
Core 6	150.7	151.9	147.5	150.3	149.9	150.1	1.6	146.3
Core 7	150.3	151.3	149.9	147.5	151.8	150.2	1.7	144.6
1	156.0	130.0	150.4	151.6	153.2	148.2	10.4	
2	155.5	153.0	154.2	151.9	152.9	153.5	1.4	
3	140.7	147.9	150.5	149.0	149.0	147.4	3.9	
4	156.2	154.6	151.2	152.8	155.0	154.0	2.0	
5	150.0	151.8	154.8	153.1	151.1	152.2	1.9	
6	141.3	141.0	159.4	188.7	203.3	166.7	28.2	
7	158.4	152.7	159.9	161.7	151.8	156.9	4.4	
8	196.5	190.6	192.5	142.1	150.1	174.4	26.0	
9	147.7	150.0	150.2	178.4	150.1	155.3	13.0	
10	157.1	161.4	160.5	157.5	166.5	160.6	3.8	
11	148.2	149.1	148.1	149.6	156.5	150.3	3.5	
12	151.2	152.1	149.4	150.4	151.8	151.0	1.1	
13	151.7	149.7	148.5	150.3	150.1	150.1	1.2	
14	151.7	152.5	137.9	152.4	151.9	149.3	6.4	
15	151.7	144.2	149.7	155.7	151.9	150.6	4.2	
16	150.6	152.0	152.0	152.6	151.1	151.7	0.8	
17	150.3	149.8	189.8	149.5	149.0	157.7	18.0	
18	146.4	148.9	147.6	146.6	150.4	148.0	1.7	
19	152.3	148.6	149.4	151.9	149.5	150.3	1.7	
20	139.6	138.5	141.4	139.8	141.0	140.1	1.2	

Table A.23. Field Data for PQI readings for Project 7 Day 1

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	170.8	135.6	213.4	141.5	228.5	178.0	41.8	142.0
Core 2	161.4	159.5	160.8	166.2	164.8	162.5	2.8	138.8
Core 3	198.6	172.7	193.5	191.7	176.8	186.7	11.3	141.1
Core 4	170.1	169.0	167.1	148.0	151.0	161.0	10.6	141.5
Core 5	160.5	166.0	170.1	160.6	169.5	165.3	4.6	140.5
Core 6	166.3	168.1	167.8	171.0	162.7	167.2	3.0	141.1
Core 7	178.7	174.0	167.0	169.5	165.7	171.0	5.4	141.8
1	172.1	179.9	171.3	182.1	182.5	177.6	5.5	
2	178.4	196.8	181.3	183.6	168.0	181.6	10.4	
3	170.8	173.0	168.2	170.1	173.0	171.0	2.0	
4	166.1	169.4	165.0	172.6	145.2	163.7	10.7	
5	171.4	174.1	163.8	168.9	170.5	169.7	3.8	
6	172.4	168.9	168.8	166.6	171.5	169.6	2.3	
7	165.0	168.0	165.1	168.0	168.6	166.9	1.7	
8	168.5	163.4	171.3	171.4	166.2	168.2	3.4	
9	154.3	164.3	163.5	164.4	170.8	163.5	5.9	
10	167.5	170.5	166.6	165.0	168.9	167.7	2.1	
11	168.8	159.0	164.8	162.4	167.6	164.5	4.0	
12	165.8	169.5	152.3	169.4	172.0	165.8	7.9	
13	170.0	168.5	171.8	162.2	163.3	167.2	4.2	
14	170.5	166.7	178.1	177.3	168.0	172.1	5.3	
15	165.5	164.1	168.5	169.4	171.3	167.8	2.9	
16	165.7	140.1	163.8	169.2	169.5	161.7	12.3	
17	155.4	163.2	170.1	167.9	175.8	166.5	7.7	
18	173.2	167.4	169.1	164.1	171.2	169.0	3.5	
19	161.0	155.9	148.7	150.3	169.4	157.1	8.4	
20	135.4	164.5	167.7	170.1	173.1	162.2	15.3	

Table A.24. Field Data for PQI readings for Project 7 Day 2

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	154.6	151.3	151.4	147.8	172.4	155.5	9.7	142.0
Core 2	146.8	157.1	149.9	152.9	155	152.3	4.1	141.3
Core 3	170.4	156.9	168.9	154.2	165.2	163.1	7.2	139.0
Core 4	173.4	168.4	142.1	158.1	152.2	158.8	12.5	143.1
Core 5	164.3	148.3	142	153.9	147.2	151.1	8.5	140.6
Core 6	138.3	136.7	154.3	149.4	149.8	145.7	7.7	142.5
Core 7	148.8	173.3	144.1	141.7	154.5	152.5	12.6	142.0
1	134.6	135.5	135	141.2	137.9	136.8	2.8	
2	187.7	186.3	154.3	164.9	184.3	175.5	15.0	
3	177.9	163.7	158.2	158.3	187	169.0	12.9	
4	175.8	182.8	185.2	179	180.9	180.7	3.6	
5	162.7	162.8	171.8	168.7	164.6	166.1	4.0	
6	174.1	173.8	184.7	177.1	182.5	178.4	4.9	
7	176.7	168.2	175.8	179.4	178	175.6	4.4	
8	168.2	169.2	173.6	176.9	174.5	172.5	3.7	
9	171.5	173.6	168.3	175.3	166.4	171.0	3.7	
10	158.5	180	171.6	169.9	169.6	169.9	7.7	
11	191.4	180.5	186.5	177.2	173.2	181.8	7.3	
12	188.6	174.9	167.8	171.8	175.3	175.7	7.8	
13	158.8	160.5	161.3	156.1	168.9	161.1	4.8	
14	174.1	174.1	173.7	177.7	181.5	176.2	3.4	
15	184.6	197.0	182.9	164.4	183.6	182.5	11.7	
16	168.7	166.6	171.9	172.4	172.1	170.3	2.6	
17	173.5	165.9	173.1	170.4	174.5	171.5	3.5	
18	173.5	183.4	163.9	178.4	189.1	177.7	9.6	
19	162.3	173.7	176.1	174.2	174.1	172.1	5.5	
20	176.7	184.5	174.9	193.8	175.3	181.0	8.1	

Table A.25. Field Data for PQI readings for Project 7 Day 3

Location	1st	2nd	3rd	4th	5th	Average	Std. Dev.	Core Density
Core 1	139.2	141.3	143.7	142.2	145.2	142.3	2.3	143.6
Core 2	147.4	147.7	149.8	147.5	147.3	147.9	1.1	142.3
Core 3	146.4	139	146.2	144.6	144.3	144.1	3.0	141.2
Core 4	138.4	139.6	139.4	151	148	143.3	5.8	140.2
Core 5	152.3	148.5	145.3	141	147.6	146.9	4.2	141.3
Core 6	148.2	153.2	157.8	153.1	146.3	151.7	4.6	141.9
Core 7	141.7	139.1	139.4	144	142.3	141.3	2.1	140.2
1	138	138	138.1	138.3	137.2	137.9	0.4	
2	138.4	138.3	137.2	137.3	138.1	137.9	0.6	
3	135.7	138.2	135.4	135.1	139.5	136.8	2.0	
4	184.6	180.2	179.3	170.2	158.8	174.6	10.3	
5	152.7	205.9	207.4	166.4	168	180.1	25.0	
6	168.4	169.3	166.7	166.8	162	166.6	2.8	
7	159.2	174.5	190	178.1	187.5	177.9	12.2	
8	152.9	191.7	170.1	164.4	162.6	168.3	14.5	
9	153.5	151.8	216	153.4	147.8	164.5	28.9	
10	152.6	138.3	142.3	145.9	161.9	148.2	9.3	
11	177.4	154.2	162.4	173.2	151.5	163.7	11.4	
12	174.2	173.4	175.4	179.7	173.8	175.3	2.6	
13	195.8	230.8	213.9	137.8	159.5	187.6	38.4	
14	211.9	243.1	216.2	235.9	157.2	212.9	33.7	
15	155.1	161.1	142.7	158.3	162.5	155.9	7.9	
16	163.3	179.2	170.2	189.1	157.8	171.9	12.5	
17	192	164.8	169.5	170.3	172.5	173.8	10.5	
18	140.2	143.2	143.7	149	182.3	151.7	17.4	
19	161	187.8	182.6	179	165.5	175.2	11.4	
20	140.7	140.9	171.4	161.5	157.9	154.5	13.4	

Table A.26. Field Data for PT readings for Project 1 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	136.6	137.7	132.6	132.2	134.8	2.8		144.0
Core 2	144.9	135.3	134.1	136.5	137.7	4.9		146.3
Core 3	139.1	140.1	138.1	138.9	139.1	0.8		144.7
Core 4	143.5	142.9	141.9	143.7	143.0	0.8		148.0
Core 5	136.9	143.5	139	141.8	140.3	2.9		143.6
Core 6	145.4	138.8	138.6	142.4	141.3	3.2		147.6
Core 7	129.2	132.7	131.6	131.9	131.4	1.5		145.6
1	151.3	152.6	152.4	152.4	152.2	0.6	128	
2	151.4	151.4	153.4	152.6	152.2	1.0	123	
3	147.0	148.8	146.8	145.9	147.1	1.2	142	
4	147.0	150.0	149.6	146.6	148.3	1.7	121	
5	146.1	141.2	144.6	144.5	144.1	2.1	125	
6	153.0	153.1	151.5	152.5	152.5	0.7	117	
7	152.6	152.9	152.4	153.7	152.9	0.6	117	
8	152.2	149.4	150.6	150.5	150.7	1.2	109	
9	148.5	147.2	147.7	147.3	147.7	0.6	116	
10	144.9	144.7	143.8	144.8	144.6	0.5	135	
11	138.3	138.0	139.9	139.4	138.9	0.9	102	
12	142.9	146.3	145.0	143.6	144.5	1.5	134	
13	147.7	144.0	147.2	148.0	146.7	1.8		
14	145.8	146.7	147.1	142.9	145.6	1.9		
15	147.3	147.0	147.3	148.3	147.5	0.6		
16	140.6	141.1	136.8	139.6	139.5	1.9		
17	146.5	143.9	141.3	135.9	141.9	4.5		
18	145.1	145.1	143.3	143.8	144.3	0.9		
19	143.3	138.7	141.4	143.1	141.6	2.1		
20	145.8	145.3	144.8	145.2	145.3	0.4		
21	140.2	141.9	142.9	139.2	141.1	1.7		

Table A.27. Field Data for PT readings for Project 1 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	139.5	144.8	148.1	147.2	144.9	3.9	103	148.0
Core 2	153.8	153.6	153.1	153.5	153.5	0.3	102	144.0
Core 3	148.8	130.6	133.6	129.3	135.6	9.0	102	148.0
Core 4	138.1	144	142	144.9	142.3	3.0	100	148.3
1	151.4	152.1	149.6	153.6	151.7	1.7	158	
2	155.2	150.5	151.3	153.9	152.7	2.2	156	
3	158.2	156.5	157.7	158.2	157.7	0.8	153	
4	151.2	148.2	149.2	153.5	150.5	2.3	156	
5	151.2	149.6	151.6	152.1	151.1	1.1	153	
6	142.8	141.1	142.1	133.4	139.9	4.4	146	
7	149.2	133.8	151.8	149.3	146.0	8.2	149	
8	160.4	168.5	159.2	159.0	161.8	4.5	154	
9	158.4	156.6	159.0	158.4	158.1	1.0	154	
10	157.6	157.6	158.8	156.7	157.7	0.9	156	
11	156.3	157.3	157.3	157.5	157.1	0.5	149	
12	159.2	159.1	159.2	158.2	158.9	0.5	141	
13	146.3	149.2	153.3	144.6	148.4	3.8	152	
14	152.2	155.5	152.6	153.5	153.5	1.5	142	
15	153.2	151.5	152.9	152.3	152.5	0.7	130	
16	154.4	154.7	157.0	155.9	155.5	1.2	143	
17	154.3	156.7	159.9	158.3	157.3	2.4	149	
18	157.7	155.8	157.8	156.8	157.0	0.9	158	
19	153.1	153.7	151.0	153.5	152.8	1.2	159	
20	153.2	153.2	152.1	154.4	153.2	0.9	167	

Table A.28. Field Data for PT readings for Project 1 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 5	150.7	150.6	150.4	150.1	150.5	0.3	137.0	146.1
Core 6	136.9	143	140.1	134.2	138.6	3.8	139.0	145.8
Core 7	146.3	146.6	147.1	147.1	146.8	0.4	148.0	147.8
0	149.6	147	147.7	143.2	146.9	2.7	156	
1	144.8	146.7	145.7	144.8	145.5	0.9	146	
2	144.7	141.6	143.9	145.2	143.9	1.6	151	
3	153.4	151.8	154.6	153.5	153.3	1.2	132	
4	144.4	146.4	143.7	145.7	145.1	1.2	124	
5	141.8	140.2	141.8	139.8	140.9	1.1	139	
6	147.3	147.9	147.2	146.4	147.2	0.6	125	
7	151.2	150.2	151.5	152.1	151.3	0.8	125	
8	143.1	144.2	132.5	142.7	140.6	5.5	126	
9	141.5	141.3	142.2	140.0	141.3	0.9	142	
10	138.5	142.7	141.4	140.3	140.7	1.8	142	
11	127.5	122.6	128.7	145.5	131.1	10.0	137	
12	147.1	146.0	148.6	147.8	147.4	1.1	145	
13	151.9	150.6	150.6	150.8	151.0	0.6	138	
14	142.5	141.9	141.0	143.9	142.3	1.2	118	
15	150.9	150.8	150.8	150.4	150.7	0.2	126	
16	144.2	145.2	145.0	145.6	145.0	0.6	157	
17	146.2	146.9	146.0	145.4	146.1	0.6	152	
18	149.1	149.6	149.1	147.7	148.9	0.8	154	
19	146.3	144.6	142.3	145.3	144.6	1.7	159	
20	146.9	145.3	146.7	144.2	145.8	1.3	146	

Table A.29. Field Data for PT readings for Project 2 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	139.7	141.3	141.8	140.2	140.8	1.0	118	141.9
Core 2	138.1	140.3	137.3	139.2	138.7	1.3	119	139.0
Core 3	140.3	142.1	139.2	140.2	140.5	1.2	117	142.0
Core 4	138.6	141.1	140.5	138.5	139.7	1.3	113	141.0
Core 5	140.7	142.9	140.6	136.8	140.3	2.5	132	142.3
Core 6	140.8	139.7	140.6	148.9	142.5	4.3	148	142.1
Core 7	146.2	143.8	144.5	146.1	145.2	1.2	146	142.0
1	137.9	139.9	139.2	135.3	138.1	2.0	128	
2	135.6	136.6	134.3	131.3	134.5	2.3	134	
3	140.4	142.8	139.1	139.6	140.5	1.6	129	
4	133.0	137.8	135.9	139.0	136.4	2.6	142	
5	132.3	133.6	136.2	134.0	134.0	1.6	126	
6	134.7	138.7	139.8	137.3	137.6	2.2	134	
7	142.3	142.3	142.9	142.9	142.6	0.3	146	
8	140.7	138.3	139.1	138.1	139.1	1.2	136	
9	140.3	141.2	137.0	135.2	138.4	2.8	134	
10	145.1	145.7	146.0	144.2	145.3	0.8	123	
11	146.4	145.4	142.3	144.0	144.5	1.8	131	
12	144.4	140.9	146.1	143.1	143.6	2.2	137	
13	147.3	148.2	146.6	145.2	146.8	1.3	145	
14	139.1	138.1	138.9	138.1	138.6	0.5	149	
15	140.8	141.6	140.7	137.5	140.2	1.8	152	
16	139.1	140.2	140.2	138.6	139.5	0.8	164	
17	144.7	145.9	146.1	143.4	145.0	1.2	145	
18	136.1	138.6	135.0	135.0	136.2	1.7	152	
19	143.5	143.5	143.1	145.4	143.9	1.0	136	
20	144.2	144.7	142.9	139.6	142.9	2.3	160	

Table A.30. Field Data for PT readings for Project 2 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	141.5	139.5	141.7	141.6	141.1	1.1	99.0	142.5
Core 2	132.4	135.3	136.3	135.8	135.0	1.7	99.0	139.3
Core 3	135.5	136.8	137.4	138	136.9	1.1	103.0	139.7
Core 4	142.7	140.6	141.8	141.7	141.7	0.9	103.0	140.7
Core 5	143.9	143.9	144.2	143	143.8	0.5	102.0	140.8
Core 6	141.2	141.6	142.3	140.8	141.5	0.6	143.0	139.1
Core 7	139	138.9	138.4	136.5	138.2	1.2	136.0	138.7
1	149.2	140.4	140.3	141.0	142.7	4.3	95	
2	130.4	132.1	136.5	134.1	133.3	2.6	97	
3	140.5	139.7	141.2	142.0	140.9	1.0	99	
4	131.5	129.6	134.9	133.4	132.4	2.3	96	
5	143.1	144.2	143.7	143.8	143.7	0.5	96	
6	139.8	137.0	139.6	139.4	139.0	1.3	95	
7	142.8	142.2	133.4	140.5	139.7	4.3	101	
8	138.7	138.2	141.5	138.0	139.1	1.6	94	
9	144.9	144.7	144.4	145.6	144.9	0.5	105	
10	133.3	134.6	131.7	132.2	133.0	1.3	103	
11	145.2	142.1	142.8	142.2	143.1	1.5	96	
12	141.6	142.5	142.6	140.7	141.9	0.9	109	
13	143.6	143.0	142.4	141.2	142.6	1.0	96.0	
14	135.1	134.0	136.0	135.5	135.2	0.9	108.0	
15	142.9	137.3	133.8	133.3	136.8	4.4	120.0	
16	147.4	145.3	144.8	145.5	145.8	1.1	116.0	
17	144.5	144.2	144.0	145.1	144.5	0.5	143.0	
18	137.8	138.9	138.9	138.2	138.5	0.5	114.0	
19	140.9	140.5	141.4	141.2	141.0	0.4	113.0	
20	136.0	136.2	132.0	135.2	134.9	1.9	118.0	

Table A.31. Field Data for PT readings for Project 2 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 5	131.6	128.6	130.5	131.6	130.6	1.4	95	133.9
Core 6	140.7	141.9	141.2	135.9	139.9	2.7	96	139.7
Core 7	134.5	137.4	131	134.4	134.3	2.6	99	137.8
1	140.1	138.6	142.6	140.5	140.5	1.7	92	
2	134.8	135.8	137.4	134.7	135.7	1.3	92	
3	138.7	139.7	140.3	139.9	139.7	0.7	93	
4	135.8	138.4	136.8	135.3	136.6	1.4	93	
5	134.7	135.4	135.7	135.7	135.4	0.5	93	
6	134.4	134.8	134.2	133.5	134.2	0.5	93	
7	136.3	137.8	137.5	135.8	136.9	1.0	96	
8	129.8	128.7	117.3	128.3	126.0	5.9	95	
9	134.9	133.7	132.9	134.6	134.0	0.9	95	
10	134.4	134.8	138.1	139.3	136.7	2.4	96	
11	132.9	136.2	133.1	132.4	133.7	1.7	98	
12	128.1	127.7	139.4	138.1	133.3	6.3	99	
13	140.8	139.8	138.8	138.2	139.4	1.1	100	
14	133.0	137.0	136.2	137.3	135.9	2.0	94	
15	132.2	133.6	135.0	132.8	133.4	1.2	96	
16	137.3	138.9	136.3	137.6	137.5	1.1	98	
17	136.3	135.7	136.1	136.6	136.2	0.4	98	
18	143.2	142.2	143.0	144.4	143.2	0.9	99	
19	138.7	138.7	140.3	138.8	139.1	0.8	99	
20	128.9	133.5	127.3	122.4	128.0	4.6	102	

Table A.32. Field Data for PT readings for Project 3 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	147.4	147.9	146.7	146.5	147.1	0.6	110.0	141.3
Core 2	146.5	146.7	146.2	146.6	146.5	0.2	110.0	140.1
Core 3	150.6	150.5	150.8	149.8	150.4	0.4	124.0	141.5
Core 4	145.3	144.6	142.9	143.7	144.1	1.0	120.0	141.6
Core 5	143.6	144	140.2	141.9	142.4	1.7	128.0	141.8
Core 6	144	144.8	143.9	144.6	144.3	0.4	138.0	140.7
Core 7	144	141.8	143.3	143.3	143.1	0.9	150.0	139.8
1	142.4	140.4	143.2	142.7	142.2	1.2	138	
2	143.1	143.7	141.3	141.9	142.5	1.1	135	
3	144.9	143.3	143.3	140.2	142.9	2.0	147	
4	141.1	138.9	140.8	142.9	140.9	1.6	148	
5	143.5	143.9	144.5	144.9	144.2	0.6	143	
6	136.3	135.5	139.5	139.8	137.8	2.2	136	
7	143.6	141.4	141.9	141.3	142.1	1.1	138	
8	146.8	141.8	143.6	145.1	144.3	2.1	131	
9	144.0	141.5	143.7	142.6	143.0	1.1	126	
10	145.1	145.9	145.9	143.6	145.1	1.1	133	
11	142.9	139.9	139.9	139.8	140.6	1.5	135	
12	148.4	145.0	146.9	148.6	147.2	1.7	124	
13	142.3	143.4	144.5	141.1	142.8	1.5	124.0	
14	142.1	135.2	142.8	139.5	139.9	3.4	126.0	
15	140.5	139.3	143.9	142.5	141.6	2.0	117.0	
16	144.2	143.2	143.3	144.2	143.7	0.6	118.0	
17	144.9	145.4	146.4	144.9	145.4	0.7	120.0	
18	146.4	146.6	147.5	144.9	146.4	1.1	112.0	
19	143.8	143.0	145.8	144.2	144.2	1.2	115.0	
20	143.8	145.3	142.7	143.1	143.7	1.1	113.0	

Table A.33. Field Data for PT readings for Project 3 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	141.6	141	143.6	141.9	142.0	1.1	81	136.9
Core 2	145.2	144.5	144.1	143	144.2	0.9	91	138.6
Core 3	140.2	141	139.8	140.8	140.5	0.6	90	138.5
Core 4	144	144.5	143.7	144.7	144.2	0.5	89	139.2
Core 5	142.6	142.9	142.3	145.4	143.3	1.4	95	139.7
Core 6	144.7	144.4	143.2	143.5	144.0	0.7	94	140.6
Core 7	143.7	142.5	141.7	142.5	142.6	0.8	97	138.6
1	147.0	143.7	143.6	142.5	144.2	1.9	142	
2	147.8	146.2	147.7	147.0	147.2	0.7	127	
3	143.1	143.2	144.2	144.8	143.8	0.8	117	
4	144.9	144.0	145.9	136.1	142.7	4.5	117	
5	145.3	145.8	145.8	144.7	145.4	0.5	110	
6	138.4	135.2	135.4	136.0	136.3	1.5	99	
7	139.2	138.5	139.9	138.8	139.1	0.6	94	
8	139.9	137.8	141.2	142.0	140.2	1.8	113	
9	144.1	144.0	143.9	143.0	143.8	0.5	111	
10	142.2	141.5	140.1	142.2	141.5	1.0	108	
11	141.5	140.8	142.3	143.5	142.0	1.2	105	
12	140.5	139.5	141.6	141.5	140.8	1.0	109	
13	140.9	140.3	141.0	142.3	141.1	0.8	105	
14	141.3	141.3	142.1	140.8	141.4	0.5	99	
15	132.9	139.3	139.0	138.7	137.5	3.1	100	
16	144.4	143.4	143.2	144.4	143.9	0.6	88	
17	144.1	142.0	143.7	143.4	143.3	0.9	88	
18	141.2	143.2	142.0	142.9	142.3	0.9	87	
19	141.6	142.4	142.2	142.1	142.1	0.3	90	
20	138.7	139.1	137.7	137.9	138.4	0.7	90	

Table A.34. Field Data for PT readings for Project 3 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	146.5	145.6	145.7	146.1	146.0	0.4	89	141.5
Core 2	143.4	145.2	143.3	144.1	144.0	0.9	92	141.4
Core 3	143.8	142.5	144.2	144.4	143.7	0.9	94	141.4
Core 4	144.5	141.1	142.7	142.7	142.8	1.4	95	139.7
Core 5	142	142.6	142.4	142.7	142.4	0.3	106	140.5
Core 6	128.3	128.1	128.5	131.9	129.2	1.8	110	139.3
Core 7	144.2	143.8	144.3	143.7	144.0	0.3	119	140.5
1	143.4	144.4	143.9	144.7	144.1	0.6	100	
2	144.7	145.5	144.7	143.4	144.6	0.9	105	
3	142.5	144.3	142.7	143.1	143.2	0.8	106	
4	143.7	143.2	143.9	141.5	143.1	1.1	104	
5	143.3	141.3	145.0	143.6	143.3	1.5	105	
6	144.3	144.8	145.0	144.9	144.8	0.3	105	
7	145.1	142.8	143.9	143.7	143.9	0.9	102	
8	144.3	144.3	143.9	144.6	144.3	0.3	105	
9	144.8	145.0	143.4	146.0	144.8	1.1	102	
10	141.2	141.0	141.7	144.0	142.0	1.4	106	
11	145.2	143.7	143.0	145.5	144.4	1.2	106	
12	139.0	141.4	140.4	139.4	140.1	1.1	102	
13	137.9	141.0	143.7	140.8	140.9	2.4	103	
14	139.9	134.0	141.5	142.3	139.4	3.8	103	
15	142.5	144.2	144.1	144.1	143.7	0.8	106	
16	143.6	143.0	142.6	143.0	143.1	0.4	111	
17	141.1	137.9	142.4	139.6	140.3	1.9	120	
18	130.1	132.6	132.2	133.1	132.0	1.3	121	
19	135.8	136.6	133.0	130.2	133.9	2.9	124	
20	142.1	143.0	140.9	141.4	141.9	0.9	114	

Table A.35. Field Data for PT readings for Project 3 Day 4

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	139.3	140.5	136.1	138.6	138.6	1.9	93	140.4
Core 2	142.6	141.6	140.7	141.2	141.5	0.8	94	139.5
Core 3	143.5	143.6	143.1	143.9	143.5	0.3	94	139.5
Core 4	141.7	142.2	144.6	144.3	143.2	1.5	118	140.0
Core 5	142	141.9	141.1	142.2	141.8	0.5	115	139.3
Core 6	139.6	149.6	140.2	140.7	142.5	4.7	110	137.9
Core 7	140	135.2	142.4	142.3	140.0	3.4	124	140.0
1	140.8	141.2	140.2	140.1	140.6	0.5	95	
2	145.8	145.2	146.4	145.0	145.6	0.6	95	
3	145.7	144.3	143.7	145.3	144.8	0.9	96	
4	140.1	139.9	140.5	141.5	140.5	0.7	95	
5	139.4	137.4	141.5	141.0	139.8	1.8	112	
6	139.4	141.5	141.2	140.3	140.6	0.9	111	
7	144.0	144.7	143.8	144.4	144.2	0.4	108	
8	143.2	143.7	142.8	143.0	143.2	0.4	112	
9	141.5	143.7	142.8	144.2	143.1	1.2	116	
10	143.6	143.9	144.7	145.3	144.4	0.8	113	
11	142.5	143.5	146.0	145.4	144.4	1.6	117	
12	143.5	143.3	142.2	143.1	143.0	0.6	119	
13	138.9	139.1	139.2	141.5	139.7	1.2	118	
14	143.1	142.8	142.3	144.2	143.1	0.8	112	
15	144.3	143.2	143.4	141.0	143.0	1.4	113	
16	144.7	144.1	145.2	143.5	144.4	0.7	114	
17	140.8	140.0	140.5	136.6	139.5	1.9	119	
18	146.4	145.5	145.8	147.6	146.3	0.9	111	
19	144.8	146.3	143.8	146.8	145.4	1.4	112	
20	144.1	143.6	144.6	144.2	144.1	0.4	131	

Table A.36. Field Data for PT readings for Project 3 Day 5

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	126.6	130.5	126.3	124.2	126.9	2.6	84	139.2
Core 2	142.3	144.8	145.3	146.4	144.7	1.7	89	141.3
Core 3	145.4	145.9	143.9	146.1	145.3	1.0	96	142.2
Core 4	138.7	142.3	143	142.7	141.7	2.0	91	140.3
Core 5	143.3	142.3	141.2	141.1	142.0	1.0	89	139.7
Core 6	135.3	138.5	137.5	140.3	137.9	2.1	98	141.5
Core 7	142.6	142.6	140.2	136.9	140.6	2.7	111	140.3
1	135.0	131.9	133.3	130.7	132.7	1.9	88	
2	129.6	135.7	135.5	137.3	134.5	3.4	90	
3	141.0	144.0	141.3	140.5	141.7	1.6	90	
4	142.8	142.3	142.4	141.6	142.3	0.5	87	
5	145.3	144.4	145.8	144.4	145.0	0.7	88	
6	143.6	144.9	144.4	142.7	143.9	1.0	90	
7	143.6	143.0	142.3	142.9	143.0	0.5	92	
8	145.9	144.6	142.7	142.7	144.0	1.6	91	
9	145.2	145.1	145.9	143.4	144.9	1.1	90	
10	137.0	131.3	131.7	134.9	133.7	2.7	90	
11	147.0	146.8	145.7	147.4	146.7	0.7	88	
12	146.8	146.8	145.3	145.8	146.2	0.8		
13	141.6	140.2	139.5	140.3	140.4	0.9	90	
14	142.1	140.7	140.4	142.7	141.5	1.1	80	
15	147.9	147.3	146.3	146.3	147.0	0.8	79	
16	148.0	147.8	148.5	147.6	148.0	0.4	113	
17	142.5	143.8	144.5	144.8	143.9	1.0	101	
18	139.5	141.2	139.7	137.3	139.4	1.6	103	
19	145.4	144.3	144.1	146.5	145.1	1.1	103	
20	143.3	143.8	144.4	144.6	144.0	0.6	77	

Table A.37. Field Data for PT readings for Project 4 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	140.3	140.9	143	141.2	141.4	1.2	95	139.0
Core 2	143.5	141.5	142.8	142.7	142.6	0.8	98	139.8
Core 3	143.3	144.2	140.7	143.6	143.0	1.5	94	140.1
Core 4	142.6	142.6	143	142	142.6	0.4	95	139.1
Core 5	142.2	142.7	143.1	144	143.0	0.8	95	139.8
Core 6	141.8	140.8	142.7	142.5	142.0	0.9	126	139.4
Core 7	145.3	144.7	145	145.3	145.1	0.3	129	141.2
1	139.7	139.9	141.7	141.0	140.6	0.9	139	
2	143.3	143.9	143.0	143.5	143.4	0.4	134	
3	144.6	140.8	141.6	142.5	142.4	1.6	124	
4	140.7	140.1	139.9	138.4	139.8	1.0	143	
5	145.2	143.0	143.3	144.8	144.1	1.1	131	
6	143.7	144.4	144.0	143.5	143.9	0.4	127	
7	142.9	143.5	142.3	141.6	142.6	0.8	133	
8	141.1	141.5	142.4	142.1	141.8	0.6	134	
9	141.8	141.9	142.3	142.6	142.2	0.4	142	
10	146.2	145.1	146.0	145.5	145.7	0.5	105	
11	146.5	145.9	145.9	146.0	146.1	0.3	105	
12	143.5	142.9	143.1	144.6	143.5	0.8	105	
13	138.7	139.6	139.3	141.8	139.9	1.4	95	
14	142.6	142.5	142.0	142.4	142.4	0.3	98	
15	144.1	142.9	143.4	142.4	143.2	0.7	97	
16	143.5	143.3	143.1	143.4	143.3	0.2	102	
17	144.3	142.2	144.4	144.1	143.8	1.0	105	
18	143.8	143.9	144.0	143.7	143.9	0.1	103	
19	146.1	145.6	146.6	144.9	145.8	0.7	102	
20	143.2	141.7	138.9	140.5	141.1	1.8	97	

Table A38. Field Data for PT readings for Project 4 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	141.8	140.8	140.4	139.8	140.7	0.8	98	140.2
Core 2	141.8	142.3	142.6	143.4	142.5	0.7	93	139.6
Core 3	141.3	142.1	142	143.7	142.3	1.0	85	140.8
Core 4	146.2	146.7	147.3	146.5	146.7	0.5	91	141.6
Core 5	139.4	139.2	138.4	139.4	139.1	0.5	105	134.9
Core 6	142.3	143.4	144.2	141.2	142.8	1.3	112	140.2
Core 7	145.2	145.5	145.5	146.4	145.7	0.5	114	141.4
1	146.1	146.0	145.5	146.3	146.0	0.3	113	
2	144.0	143.5	143.8	145.4	144.2	0.8	109	
3	141.9	142.6	142.3	141.2	142.0	0.6	109	
4	147.3	147.2	148.2	147.7	147.6	0.5	113	
5	143.3	142.9	143.6	143.8	143.4	0.4	111	
6	145.8	145.8	144.9	145.5	145.5	0.4	116	
7	145.4	145.4	144.6	144.6	145.0	0.5	120	
8	144.5	144.7	145.7	144.6	144.9	0.6	112	
9	143.6	144.0	144.8	143.3	143.9	0.6	115	
10	134.7	133.3	133.8	133.2	133.8	0.7	100	
11	144.6	145.0	144.8	143.9	144.6	0.5	90	
12	141.7	142.9	141.4	141.4	141.9	0.7	99	
13	140.8	143.3	140.6	141.7	141.6	1.2	99	
14	145.9	144.3	143.3	144.4	144.5	1.1	91	
15	142.0	141.8	142.2	142.4	142.1	0.3	91	
16	143.6	142.4	143.3	142.5	143.0	0.6	85	
17	138.5	141.6	140.8	138.4	139.8	1.6	96	
18	147.5	147.3	146.8	147.0	147.2	0.3	94	
19	140.8	141.0	140.1	138.5	140.1	1.1	92	
20	147.5	147.8	144.5	147.1	146.7	1.5	94	

Table A.39. Field Data for PT readings for Project 4 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	145.6	144.3	145.5	143.9	144.8	0.9	99	141.8
Core 2	140	143.5	144.2	143.7	142.9	1.9	98	140.4
Core 3	145.5	145.3	146.6	147.5	146.2	1.0	99	141.5
Core 4	143.2	142.6	143.1	143	143.0	0.3	117	138.8
Core 5	146	142	144.1	144.6	144.2	1.7	105	139.8
Core 6	142.4	144.1	141.4	142.8	142.7	1.1	108	139.6
Core 7	141.1	142.9	142.5	143.1	142.4	0.9	113	138.1
1	140.1	145.8	145.8	141.9	143.4	2.9	106	
2	144.4	144.3	144.6	145.6	144.7	0.6	109	
3	139.5	141.5	141.1	140.2	140.6	0.9	105	
4	145.9	145.3	144.6	145.9	145.4	0.6	108	
5	140.2	141.4	143.1	140.1	141.2	1.4	112	
6	144.1	144.3	143.5	143.3	143.8	0.5	109	
7	146.2	145.5	145.6	146.4	145.9	0.4	110	
8	145.9	146.6	145.7	145.6	146.0	0.5	107	
9	145.9	145.9	145.8	146.3	146.0	0.2	110	
10	143.9	143.7	143.2	143.0	143.5	0.4	131	
11	144.7	143.4	143.4	143.6	143.8	0.6	123	
12	143.6	145.3	142.9	145.0	144.2	1.1	122	
13	146.1	144.5	144.5	144.0	144.8	0.9	121	
14	145.1	144.9	146.0	144.7	145.2	0.6	122	
15	141.3	141.8	143.6	141.5	142.1	1.1	120	
16	144.7	143.6	144.7	145.5	144.6	0.8	114	
17	142.8	145.1	142.2	145.5	143.9	1.6	112	
18	142.7	141.1	142.8	141.4	142.0	0.9	119	
19	139.6	141.8	141.2	140.6	140.8	0.9	115	
20	142.1	141.9	142.3	142.4	142.2	0.2	118	

Table A.40. Field Data for PT readings for Project 4 Day 4

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	144.1	142.6	144.7	143.6	143.8	0.9	109	140.3
Core 2	144.4	144.5	143	142.9	143.7	0.9	107	139.4
Core 3	144.4	143.8	144.7	145.1	144.5	0.5	107	140.8
Core 4	141.9	143.9	141.9	143.4	142.8	1.0	104	139.6
Core 5	145.8	141.6	141.3	144	143.2	2.1	105	139.7
Core 6	142.9	144.8	147.8	144.7	145.1	2.0	101	141.6
1	148.3	145.2	144.9	148.4	146.7	1.9	108	
2	145.2	147.6	147.7	147.0	146.9	1.2	110	
3	146.2	146.5	143.6	145.2	145.4	1.3	110	
4	144.3	145.3	144.6	144.6	144.7	0.4	108	
5	147.2	146.1	146.2	146.9	146.6	0.5	108	
6	145.2	147.1	147.7	145.7	146.4	1.2	109	
7	142.5	145.2	146.7	144.7	144.8	1.7	109	
8	145.8	146.1	146.4	144.8	145.8	0.7	107	
9	145.4	145.3	146.0	146.2	145.7	0.4	110	
10	142.5	141.8	143.0	145.0	143.1	1.4	107	
11	140.7	139.1	138.7	141.0	139.9	1.1	98	
12	142.5	142.3	144.2	142.7	142.9	0.9	104	
13	145.8	144.5	144.5	146.3	145.3	0.9	104	
14	144.7	143.4	145.5	143.3	144.2	1.1	108	
15	143.6	140.3	142.5	144.9	142.8	1.9	110	
16	143.9	145.9	142.4	144.3	144.1	1.4	107	
17	144.6	144.7	145.7	145.9	145.2	0.7	112	
18	147.3	147.2	147.1	146.6	147.1	0.3	109	
19	147.3	145.4	144.1	145.0	145.5	1.3	105	
20	143.1	146.4	144.8	144.7	144.8	1.3	107	

Table A.41. Field Data for PT readings for Project 4 Day 5

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	149.4	145.4	144.4	145.7	146.2	2.2	101	140.9
Core 2	145.6	146.0	146.0	143.8	145.4	1.1	99	138.2
Core 3	142.5	144.7	144.3	144.6	144.0	1.0	98	138.9
Core 4	145.0	143.9	143.3	142.6	143.7	1.0	100	138.4
Core 5	143.4	144.0	145.0	144.5	144.2	0.7	102	140.6
Core 6	146.5	144.3	145.1	147.3	145.8	1.4	105	140.5
Core 7	145.0	146.4	145.3	145.5	145.6	0.6	111	141.0
1	142.5	145.2	143.3	143.8	143.7	1.1	100	
2	142.4	144.9	143.6	145.1	144.0	1.3	101	
3	142.2	143.7	138.9	136.3	140.3	3.3	102	
4	141.1	142.3	141.1	139.2	140.9	1.3	99	
5	140.2	139.9	138.4	138.1	139.2	1.1	100	
6	146.0	145.3	145.8	147.7	146.2	1.0	99	
7	143.9	145.7	146.5	146.5	145.7	1.2	100	
8	149.5	147.6	147.7	144.9	147.4	1.9	99	
9	142.1	142.8	142.9	144.5	143.1	1.0	100	
10	143.8	145.5	145.9	145.7	145.2	1.0	101	
11	144.5	144.1	145.0	145.9	144.9	0.8	101	
12	145.6	145.8	143.7	143.7	144.7	1.2	107	
13	140.1	143.5	143.8	143.6	142.8	1.8	106	
14	141.3	140.7	141.3	140.8	141.0	0.3	106	
15	146.3	144.7	145.3	145.8	145.5	0.7	118	
16	149.4	149.2	148.8	149.4	149.2	0.3	112	
17	146.8	146.2	147.0	147.8	147.0	0.7	113	
18	142.9	141.3	144.2	141.9	142.6	1.3	110	
19	132.0	141.1	133.1	141.9	137.0	5.2	104	
20	145.0	144.6	144.4	144.2	144.6	0.3	120	

Table A.42. Field Data for PT readings for Project 5 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	111.2	112.2	114.3	113.2	112.7	1.3		
Core 2	115.8	115.9	115	115.5	115.6	0.4	80	
Core 4	116.1	116.1	114.7	114.1	115.3	1.0	81	
Core 5	115.1	110	112	114.1	112.8	2.3	82	
Core 6	116.7	115.3	116.1	116.5	116.2	0.6	84	
Core 7	113.2	113.3	116.5	115.6	114.7	1.7	84	
1	119.2	118.1	119.2	118.9	118.9	0.5	81	
2	117.5	118.9	118.5	119.5	118.6	0.8	83	
3	116.7	118.4	118.1	?	117.7	0.9	83	
4	118.7	119.2	117.4	118.2	118.4	0.8	83	
5	119.7	120.9	112.1	119.5	118.1	4.0	82	
6	113.8	111.0	114.1	110.7	112.4	1.8	83	
7	111.9	111.7	104.7	113.4	110.4	3.9	83	
8	118.4	117.3	116.9	117.4	117.5	0.6	83	
9	116.6	118.6	109.1	118.8	115.8	4.6	81	
10	117.6	117.9	117.4	118.5	117.9	0.5	81	
11	113.7	112.6	116.8	115.9	114.8	1.9	82	
12	116.1	109.2	116.4	117.6	114.8	3.8	81	
13	115.5	111.8	117.3	113.8	114.6	2.4	72	
14	116.4	112.5	113.3	113.9	114.0	1.7	77	
15	118.7	118.5	114.2	117.2	117.2	2.1	77	
16	117.4	117.3	119.3	116.5	117.6	1.2	80	
17	118.4	119.5	116.8	116.7	117.9	1.3	78	
18	115.8	115.0	116.6	118.5	116.5	1.5	80	
19	118.9	120.2	114.9	118.1	118.0	2.3	80	
20	117.8	117.8	118.2	118.4	118.1	0.3	78	

Table A.43. Field Data for PT readings for Project 5 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	112.8	113.2	113.0	114.4	113.4	0.7	86	140.1
Core 2	117.1	117.2	117.7	117.2	117.3	0.3	87	141.7
Core 3	113.6	114.2	115.1	115.7	114.7	0.9	85	138.3
Core 4	116.1	117.2	117.5	116.9	116.9	0.6	?	141.2
Core 5	116.4	116.8	116.3	116.5	116.5	0.2	91	139.0
Core 6	113.6	114.8	114.8	115.2	114.6	0.7	127	139.5
Core 7	116.3	115.5	115.4	116.4	115.9	0.5	108	139.4
1	112.8	110.7	112.3	113.2	112.3	1.1	88	
2	115.2	113.5	116.1	116.3	115.3	1.3	88	
3	116.7	117.2	117.0	117.1	117.0	0.2	98	
4	111.2	108.6	111.8	114.3	111.5	2.3	91	
5	116.8	113.5	117.9	117.5	116.4	2.0	90	
6	117.1	118.0	118.3	118.0	117.9	0.5	89	
7	111.0	111.6	111.6	110.9	111.3	0.4	87	
8	112.4	112.2	112.2	112.4	112.3	0.1	88	
9	113.8	115.9	114.5	115.1	114.8	0.9	88	
10	116.3	115.1	115.0	114.3	115.2	0.8	89	
11	116.3	115.8	115.5	115.5	115.8	0.4	94	
12	115.7	115.6	115.4	113.3	115.0	1.1	89	
13	113.5	113.7	114.3	115.9	114.4	1.1	97	
14	113.3	114.6	115.4	114.4	114.4	0.9	110	
15	118.5	117.0	117.5	116.7	117.4	0.8	110	
16	116.5	116.4	116.9	116.4	116.6	0.2	107	
17	114.6	115.3	115.1	114.0	114.8	0.6	130	
18	114.3	115.7	115.7	115.5	115.3	0.7	126	
19	116.2	115.3	116.1	116.7	116.1	0.6	110	
20	115.0	116.5	115.4	113.9	115.2	1.1	112	

Table A.44. Field Data for PT readings for Project 5 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	117.2	117.2	117.3	117.4	117.3	0.1	123	140.6
Core 2	115.6	115.5	115.9	116.2	115.8	0.3	108	137.6
Core 3	117.0	116.3	116.4	117.3	116.8	0.5	110	138.6
Core 4	116.6	116.5	115.5	115.4	116.0	0.6	108	141.0
Core 5	116.9	116.9	116.2	116.9	116.7	0.4	89	138.4
Core 6	115.9	116.2	115.9	116.6	116.2	0.3	94	139.6
Core 7	118.2	117.4	119.2	118.1	118.2	0.7	93	141.1
1	119.1	118.9	119.2	119.1	119.1	0.1	104	
2	116.8	116.3	117.0	116.7	116.7	0.3	105	
3	117.2	117.1	116.0	117.1	116.9	0.6	103	
4	117.1	117.9	117.4	116.3	117.2	0.7	101	
5	116.7	116.6	118.0	117.4	117.2	0.7	104	
6	117.4	117.5	118.3	117.8	117.8	0.4	103	
7	116.3	116.5	116.2	116.0	116.3	0.2	101	
8	112.4	113.8	114.4	114.3	113.7	0.9	101	
9	118.4	118.1	118.0	117.5	118.0	0.4	98	
10	116.3	117.5	116.1	115.4	116.3	0.9	102	
11	117.2	116.7	117.2	117.0	117.0	0.2	103	
12	115.7	116.8	116.1	114.6	115.8	0.9	105	
13	116.5	113.2	116.8	116.3	115.7	1.7	105	
14	117.1	116.3	117.0	116.3	116.7	0.4	104	
15	116.5	117.2	117.2	117.1	117.0	0.3	102	
16	118.6	116.7	116.4	117.4	117.3	1.0	110	
17	117.9	117.8	118.2	118.8	118.2	0.4	106	
18	117.4	117.0	116.5	116.4	116.8	0.5	107	
19	118.2	118.4	117.8	118.5	118.2	0.3	112	
20	116.5	115.0	115.9	116.1	115.9	0.6	113	

Table A.45. Field Data for PT readings for Project 6 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	124.4	124.0	123.9	119.0	122.8	2.6	90	141.7
Core 2	126.4	126.7	127.3	126.9	126.8	0.4	87	144.4
Core 3	126.9	128.3	128.2	128.2	127.9	0.7	90	145.6
Core 4	127.8	127.0	126.0	128.0	127.2	0.9	88	146.3
Core 5	128.3	129.4	131.4	129.4	129.6	1.3	88	143.0
Core 6	125.7	125.4	126.2	126.9	126.1	0.7	87	142.8
Core 7	128.8	130.0	128.6	128.9	129.1	0.6	86	146.1
1	129.8	128.3	127.5	128.3	128.5	1.0	92	
2	127.2	127.1	126.0	125.8	126.5	0.7	92	
3	127.2	126.5	127.1	126.9	126.9	0.3	91	
4	123.5	126.3	125.9	124.9	125.2	1.2	91	
5	127.8	125.4	125.8	126.6	126.4	1.1	91	
6	128.7	129.4	128.5	127.3	128.5	0.9	95	
7	128.4	130.0	129.0	127.5	128.7	1.1	88	
8	130.2	129.1	129.6	128.1	129.3	0.9	91	
9	127.0	124.6	125.6	125.2	125.6	1.0	91	
10	128.3	129.0	125.6	125.2	127.0	1.9	91	
11	122.3	119.6	122.3	123.6	122.0	1.7	91	
12	126.2	128.5	129.4	129.4	128.4	1.5	94	
13	126.8	126.4	126.7	127.7	126.9	0.6	?	
14	125.8	127.7	127.6	127.8	127.2	1.0	88	
15	128.9	129.0	128.7	128.3	128.7	0.3	88	
16	126.5	127.7	126.5	127.8	127.1	0.7	87	
17	127.3	126.9	126.1	126.7	126.8	0.5	88	
18	128.2	126.1	126.9	125.6	126.7	1.1	90	
19	125.7	127.4	127.2	128.0	127.1	1.0	96	
20	125.6	127.3	125.5	124.9	125.8	1.0	113	

Table A.46. Field Data for PT readings for Project 6 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	127.3	129.4	127.2	126.0	127.5	1.4	124	146.1
Core 2	124.2	126.9	124.4	126.1	125.4	1.3	104	143.3
Core 3	125.7	125.3	125.1	127.6	125.9	1.1	92	143.9
Core 4	125.3	129.2	126.7	128.2	127.4	1.7	92	145.6
Core 5	125.0	126.8	126.4	126.7	126.2	0.8	88	143.3
Core 6	124.1	125.8	126.0	125.0	125.2	0.9	95	145.3
Core 7	128.7	127.0	127.8	128.0	127.9	0.7	85	144.1
1	125.9	125.2	125.0	125.7	125.5	0.4	90	
2	123.2	124.0	123.7	125.6	124.1	1.0	90	
3	125.7	125.9	127.2	128.0	126.7	1.1	92	
4	125.7	124.2	127.8	126.7	126.1	1.5	90	
5	128.2	125.5	126.1	126.1	126.5	1.2	89	
6	123.3	122.5	122.1	121.2	122.3	0.9	91	
7	127.2	123.5	128.5	127.5	126.7	2.2	91	
8	125.6	127.1	127.7	127.5	127.0	1.0	94	
9	127.6	127.0	126.3	126.4	126.8	0.6	95	
10	127.0	126.0	127.5	127.2	126.9	0.7	94	
11	130.5	128.3	127.2	127.5	128.4	1.5	94	
12	125.8	124.0	127.2	126.4	125.9	1.4	94	
13	126.0	129.3	128.5	127.8	127.9	1.4	95	
14	125.3	123.8	127.1	128.1	126.1	1.9	98	
15	126.4	126.7	128.0	128.3	127.4	0.9	99	
16	126.1	126.5	125.7	126.1	126.1	0.3	132	
17	128.5	126.7	126.6	126.6	127.1	0.9	130	
18	126.4	125.8	126.2	127.1	126.4	0.5	126	
19	126.2	126.6	126.3	125.8	126.2	0.3	142	
20	125.4	125.9	124.6	124.2	125.0	0.8	116	

Table A.47. Field Data for PT readings for Project 6 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	121.2	121.9	123.2	124.1	122.6	1.3	107	140.0
Core 2	128.0	129.6	125.0	124.9	126.9	2.3	109	144.0
Core 3	123.6	125.1	125.0	124.0	124.4	0.7	99	144.8
Core 4	126.1	125.4	127.0	128.5	126.8	1.3	96	143.3
Core 5	126.1	125.6	125.6	124.9	125.6	0.5	106	143.9
Core 6	127.2	126.6	127.6	129.2	127.7	1.1	99	146.3
Core 7	124.6	125.7	126.4	126.6	125.8	0.9	98	144.6
1	126.0	127.3	127.0	126.5	126.7	0.6	103	
2	127.8	127.1	127.0	127.1	127.3	0.4	106	
3	125.6	127.3	126.9	128.5	127.1	1.2	107	
4	125.6	125.5	125.7	125.0	125.5	0.3	106	
5	126.0	124.5	126.1	124.6	125.3	0.9	103	
6	127.7	129.1	127.5	128.2	128.1	0.7	100	
7	121.9	124.0	124.2	126.0	124.0	1.7	104	
8	127.2	126.2	127.9	126.7	127.0	0.7	107	
9	130.1	129.5	130.3	131.0	130.2	0.6	106	
10	125.4	125.5	125.5	125.9	125.6	0.2	106	
11	125.9	128.2	127.8	127.4	127.3	1.0	105	
12	125.8	125.8	127.1	127.0	126.4	0.7	112	
13	123.6	124.4	124.4	125.9	124.6	1.0	114	
14	126.2	125.8	126.3	127.3	126.4	0.6	119	
15	126.6	127.8	128.5	126.7	127.4	0.9	110	
16	126.5	127.1	127.4	127.2	127.1	0.4	114	
17	126.5	127.7	125.9	126.0	126.5	0.8	114	
18	125.8	126.7	125.6	127.4	126.4	0.8	113	
19	128.8	127.1	128.7	128.7	128.3	0.8	123	
20	126.8	127.2	125.0	126.4	126.4	1.0	108	

Table A.48. Field Data for PT readings for Project 7 Day 1

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	148.0	149.5	150.6	146.8	148.7	1.7	75	142.0
Core 2	144.8	142.5	143.5	143.5	143.6	0.9	76	138.8
Core 3	144.5	142.3	142.7	143.1	143.2	1.0	75	141.1
Core 4	146.9	144.2	146.3	147.2	146.2	1.4	74	141.5
Core 5	146.1	143.9	146.6	147.2	146.0	1.4	74	140.5
Core 6	143.4	145.5	144.4	146.1	144.9	1.2	73	141.1
Core 7	144.2	144.7	142.9	144.0	144.0	0.8	75	141.8
1	148.6	148.5	149.3	148.2	148.7	0.5	88	
2	145.1	145.6	147.3	147.0	146.3	1.1	90	
3	145.3	145.0	145.6	145.0	145.2	0.3	91	
4	143.5	146.0	142.6	143.9	144.0	1.4	91	
5	144.3	143.6	143.5	145.0	144.1	0.7	90	
6	146.6	149.0	147.6	148.3	147.9	1.0	91	
7	147.3	148.3	147.4	148.2	147.8	0.5	92	
8	143.5	144.5	142.1	144.4	143.6	1.1	95	
9	148.8	146.0	144.3	149.3	147.1	2.4	96	
10	146.0	148.1	149.1	148.1	147.8	1.3	96	
11	144.8	143.6	145.5	142.6	144.1	1.3	94	
12	147.7	145.4	145.2	145.3	145.9	1.2	86	
13	151.2	148.2	147.0	146.7	148.3	2.1	90	
14	145.0	146.5	144.8	145.1	145.4	0.8	90	
15	143.2	144.5	143.8	141.1	143.2	1.5	88	
16	143.1	140.8	144.4	143.1	142.9	1.5	87	
17	140.8	140.2	141.3	141.0	140.8	0.5	87	
18	137.7	136.8	138.5	138.2	137.8	0.7	91	
19	145.7	147.1	145.8	145.1	145.9	0.8	92	
20	145.0	145.7	145.8	146.5	145.8	0.6	105	

Table A.49. Field Data for PT readings for Project 7 Day 2

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	147.6	147.8	148.5	146.9	147.7	0.7	65	142.0
Core 2	147.9	145.4	143.4	145.9	145.7	1.8	63	141.3
Core 3	144.6	141.2	144.7	142.7	143.3	1.7	63	139.0
Core 4	147.9	148.1	146.3	148.4	147.7	0.9	66	143.1
Core 5	140.2	141.1	141	140.8	140.8	0.4	67	140.6
Core 6	146.1	146.1	147.9	146.9	146.8	0.9	76	142.5
Core 7	149.6	149.6	148.7	148.4	149.1	0.6	68	142.0
1	139.4	138.9	140.4	141.9	140.2	1.3	81	
2	134.2	133.8	132.0	130.9	132.7	1.5	80	
3	150.8	149.8	148.5	146.2	148.8	2.0	82	
4	145.2	146.2	145.2	145.1	145.4	0.5	83	
5	144.0	143.3	142.8	144.9	143.8	0.9	83	
6	145.8	144.9	143.3	143.1	144.3	1.3	85	
7	144.0	145.6	144.2	145.3	144.8	0.8	83	
8	150.2	150.0	150.3	150.3	150.2	0.1	84	
9	145.3	143.5	144.4	143.0	144.1	1.0	84	
10	140.7	143.8	142.9	145.1	143.1	1.9	90	
11	146.7	145.3	145.1	147.1	146.1	1.0	103	
12	148.5	134.8	139.1	144.7	141.8	6.0	97	
13	149.4	149.6	150.6	149.4	149.8	0.6	99	
14	148.6	148.2	148.2	148.4	148.4	0.2	99	
15	145.0	143.4	144.4	141.1	143.5	1.7	103	
16	146.3	148.7	147.5	147.5	147.5	1.0	92	
17	147.1	146.4	146.4	147.4	146.8	0.5	92	
18	147.4	150.2	151.6	150.1	149.8	1.8	101	
19	150.3	152.9	151.5	150.9	151.4	1.1	98	
20	140.8	147.1	146.5	147.9	145.6	3.2	96	

Table A.50. Field Data for PT readings for Project 7 Day 3

Location	1st	2nd	3rd	4th	Average	Std. Dev.	Temperature	Core Density
Core 1	147.7	145.4	148.3	147.7	147.3	1.3	47.0	143.6
Core 2	148.2	147.6	148.2	146.1	147.5	1.0	48.0	142.3
Core 3	144.8	145.8	142	141.1	143.4	2.2	49.0	141.2
Core 4	146.3	146.8	147.2	146.7	146.8	0.4	49.0	140.2
Core 5	146.7	146.5	148.7	145.6	146.9	1.3	51.0	141.3
Core 6	149.3	149	150.1	149.9	149.6	0.5	51.0	141.9
Core 7	140.4	146.6	143.7	143	143.4	2.5	53.0	140.2
1	144.7	144.4	142.5	143.4	143.8	1.0	87	
2	149.1	148.4	149.0	149.3	149.0	0.4	84	
3	139.2	140.8	140.3	142.0	140.6	1.2	82	
4	147.7	147.5	148.5	148.3	148.0	0.5	81	
5	142.4	143.3	142.8	143.3	143.0	0.4	77	
6	147.2	147.6	146.1	145.1	146.5	1.1	79	
7	148.1	149.4	146.9	148.9	148.3	1.1	78	
8	149.1	146.7	148.1	146.4	147.6	1.3	81	
9	141.6	143.8	144.5	146.1	144.0	1.9	77	
10	149.0	145.1	146.4	145.5	146.5	1.8	76	
11	145.1	144.2	146.3	144.8	145.1	0.9	77	
12	147.2	147.4	145.2	145.5	146.3	1.1	78	
13	142.2	143.6	141.1	141.7	142.2	1.1	76.0	
14	145.1	143.5	146.3	146.7	145.4	1.4	76.0	
15	140.3	142.5	140.1	140.3	140.8	1.1	76.0	
16	146.2	146.1	145.2	145.4	145.7	0.5	76.0	
17	150.4	148.5	147.6	148.3	148.7	1.2	77.0	
18	147.5	147.8	147.1	147.0	147.4	0.4	80.0	
19	147.5	149.1	150.0	150.9	149.4	1.4	69.0	
20	142.7	144.3	140.1	139.2	141.6	2.3	71.0	

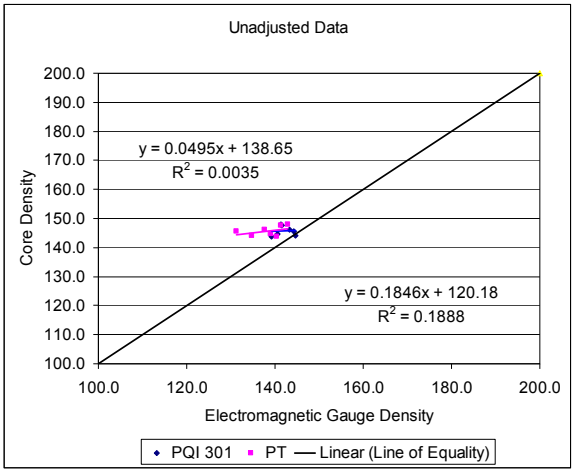


Figure A.1. Project 1 Day 1 Unadjusted Data

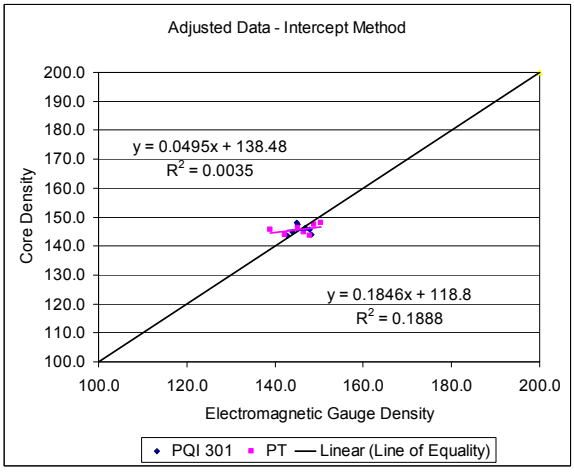


Figure A.2. Project 1 Day 1 Adjusted Data – Intercept Method

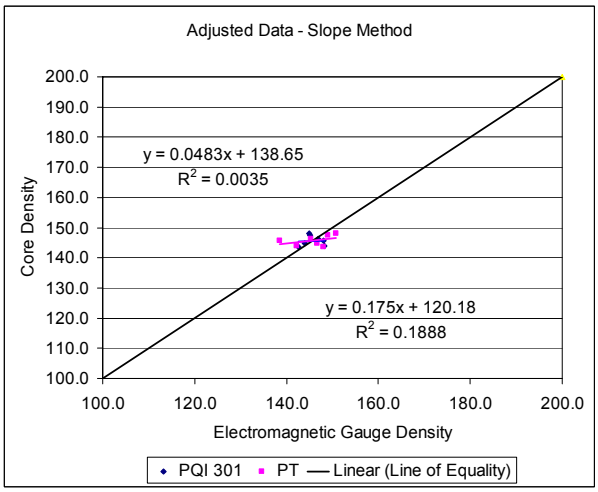


Figure A.3. Project 1 Day 1 Adjusted Data – Slope Method

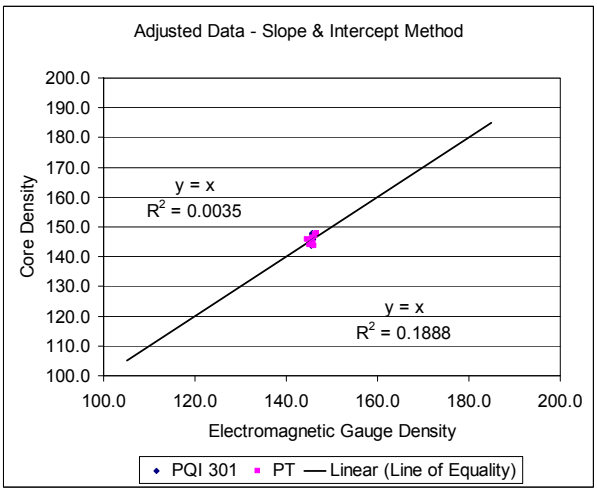


Figure A.4. Project 1 Day 1 Adjusted Data – Slope & Intercept Method

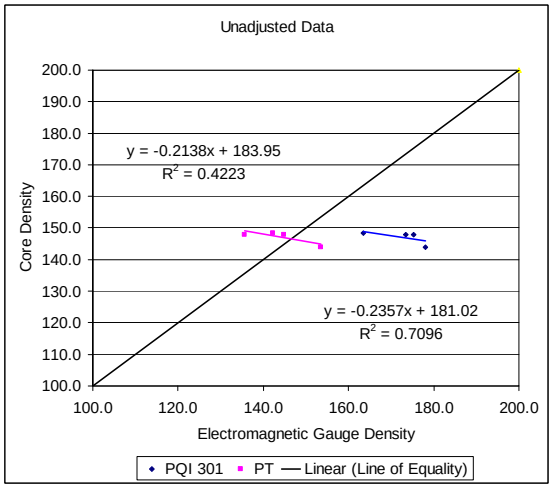


Figure A.5. Project 1 Day 2 Unadjusted Data Data

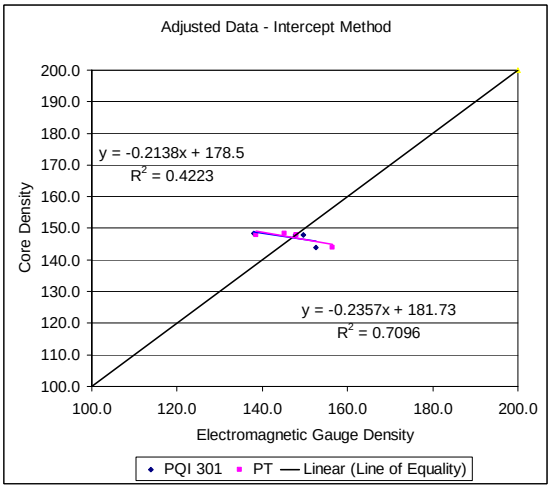


Figure A.6. Project 1 Day 2 Adjusted Intercept Method

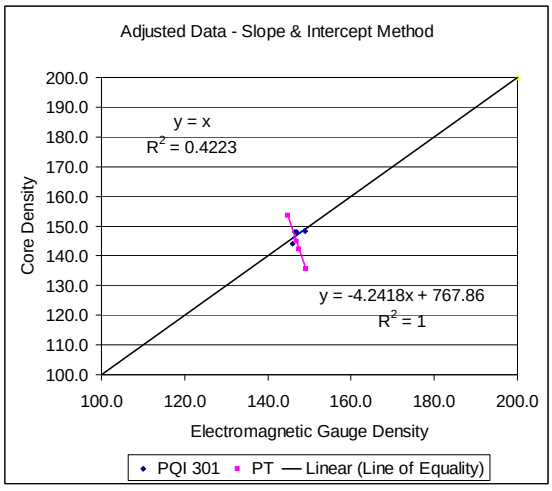


Figure A.7. Project 1 Day 2 Adjusted Data Slope Method

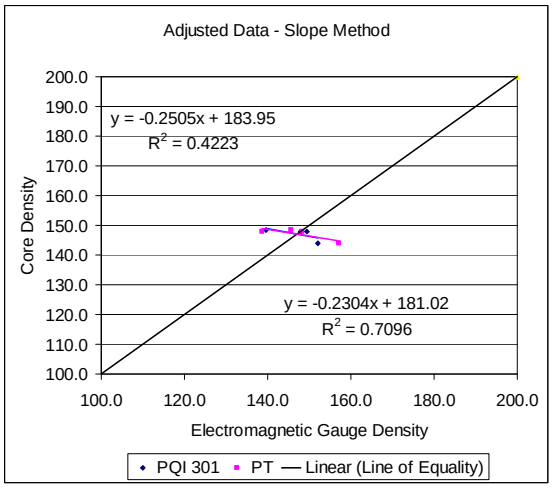


Figure A.8. Project 1 Day 2 Adjusted Data Slope & Intercept Method

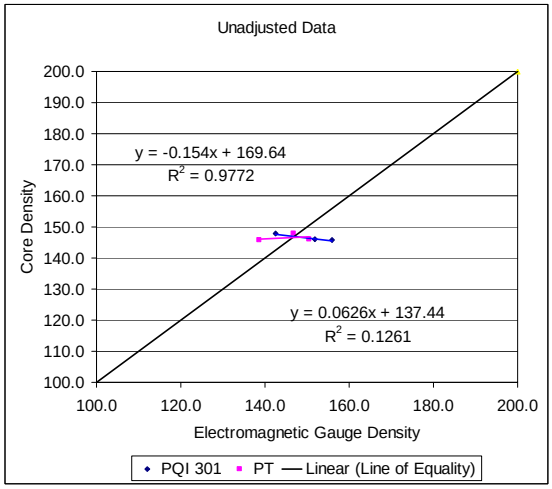


Figure A.9. Project 1 Day 3 Unadjusted Data

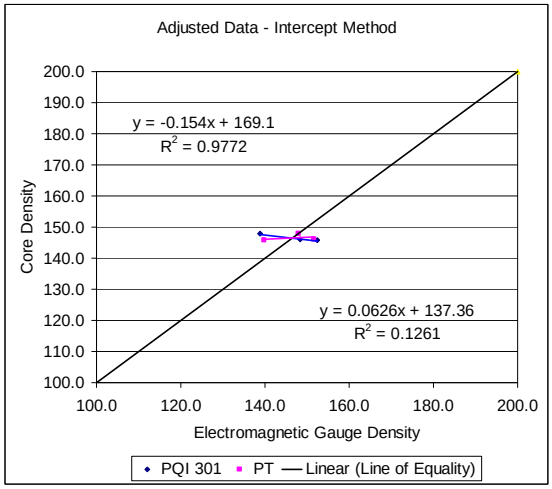


Figure A.10. Project 1 Day 3 Adjusted Data Intercept Method

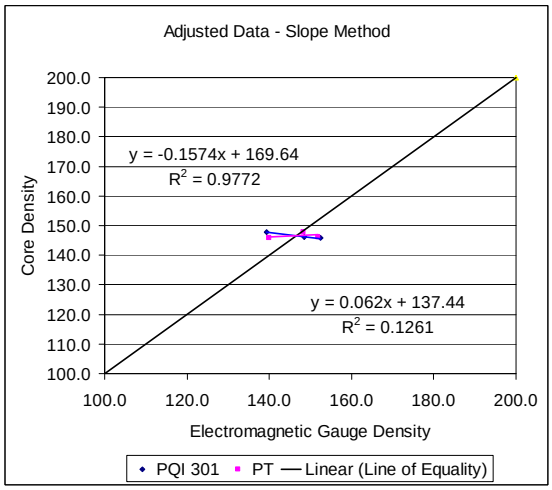


Figure A.11. Project 1 Day 3 Adjusted Data – – Slope Method

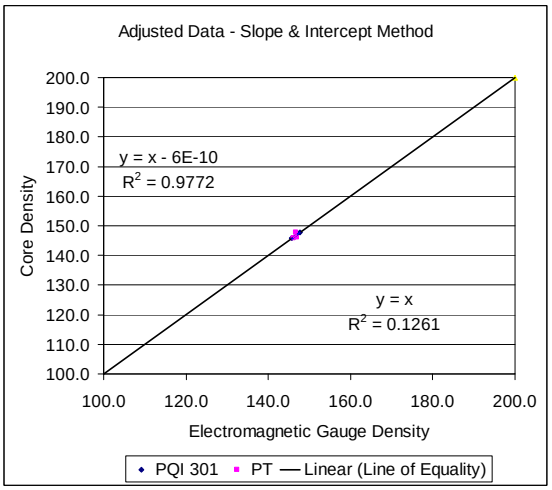


Figure A.12. Project 1 Day 3 Adjusted Data Slope & Intercept Method

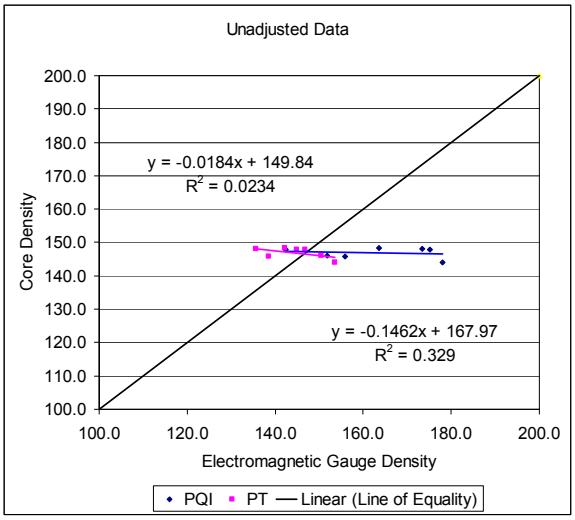


Figure A.13. Project 1 Lot 2 Unadjusted Data –

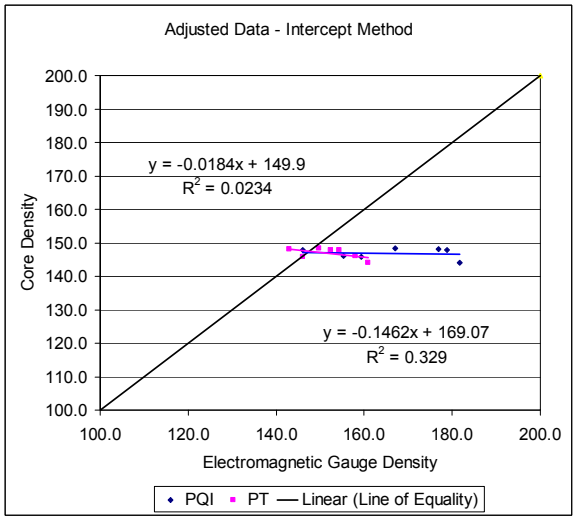


Figure A.14. Project 1 Lot 2 Adjusted Data Intercept Method

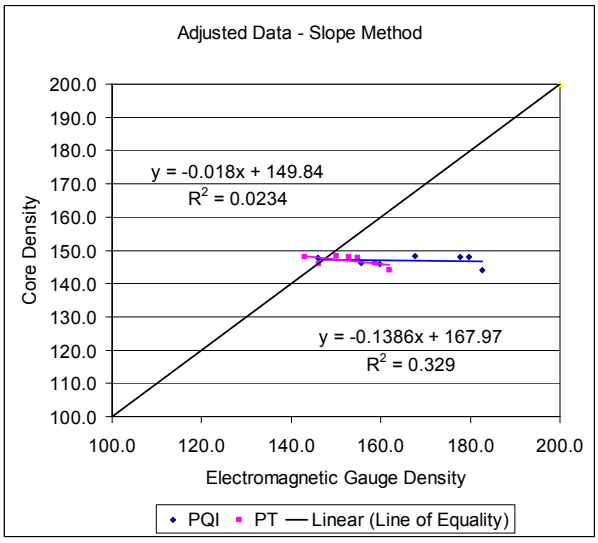


Figure A.15. Project 1 Lot 2 Adjusted Data – Slope & Intercept Method

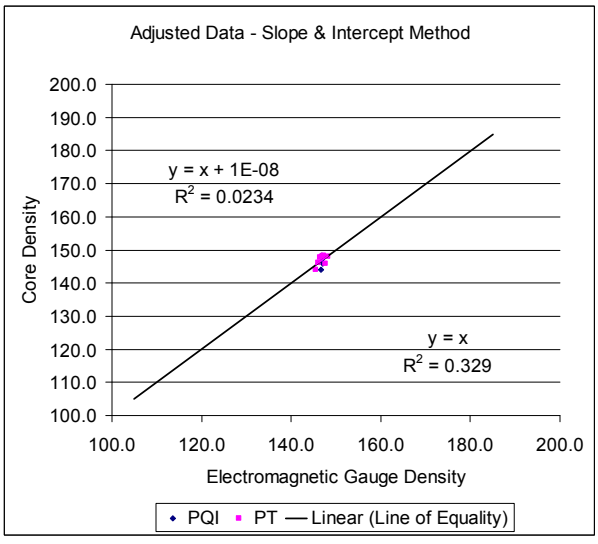


Figure A.16. Project 1 Lot 2 Adjusted Data – Slope Method

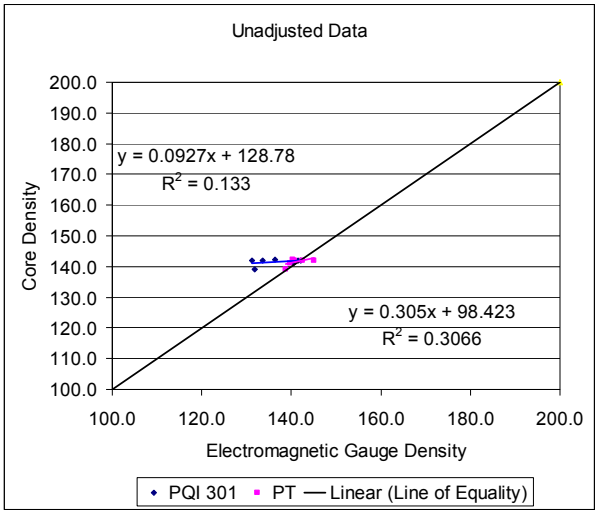


Figure A.17. Project 2 Day 1 Unadjusted Data

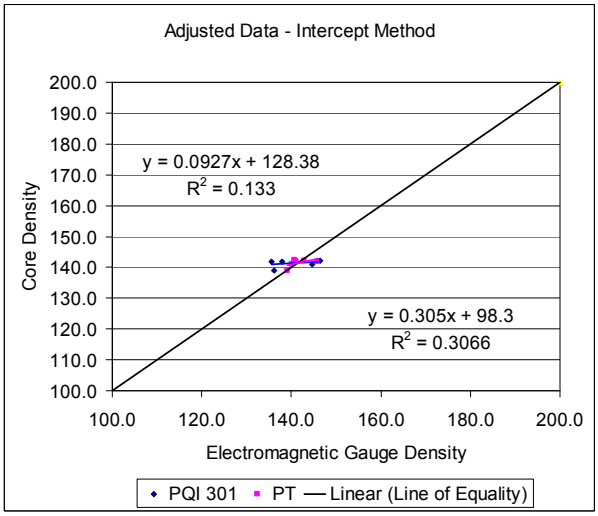


Figure A.18. Project 2 Day 1 Adjusted Data Intercept Method

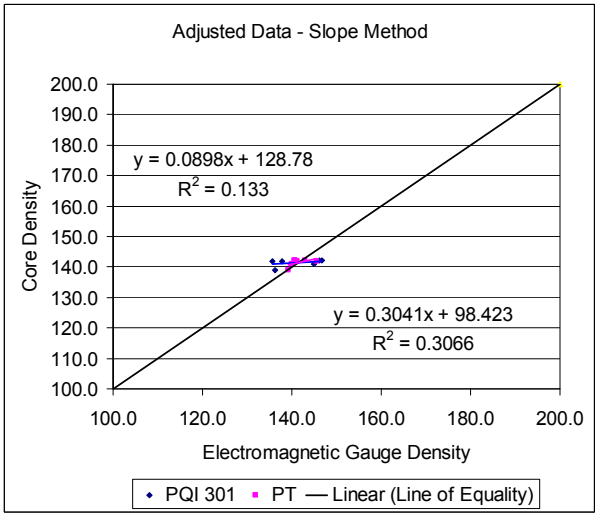


Figure A.19. Project 2 Day 1 Adjusted Data – Slope Method

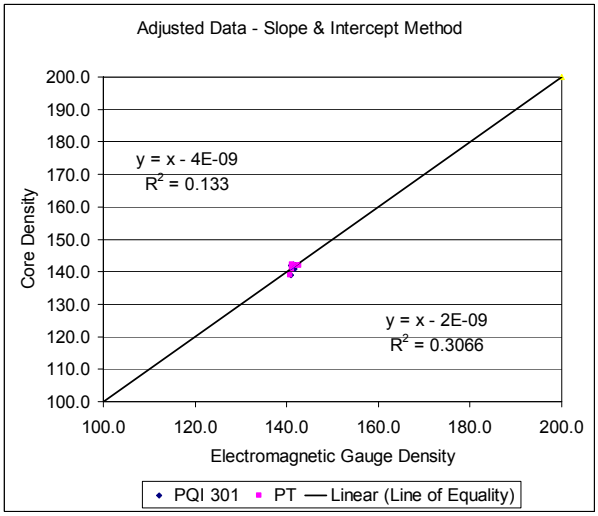


Figure A.20. Project 2 Day 1 Adjusted Data – Slope & Intercept Method

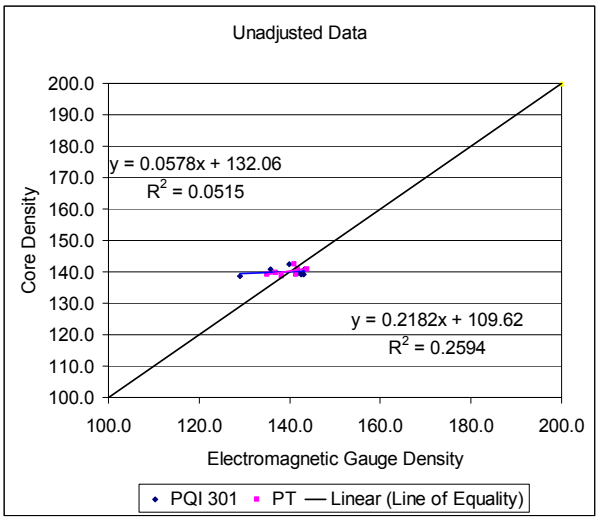


Figure A.21. Project 2 Day 2 Unadjusted Data –

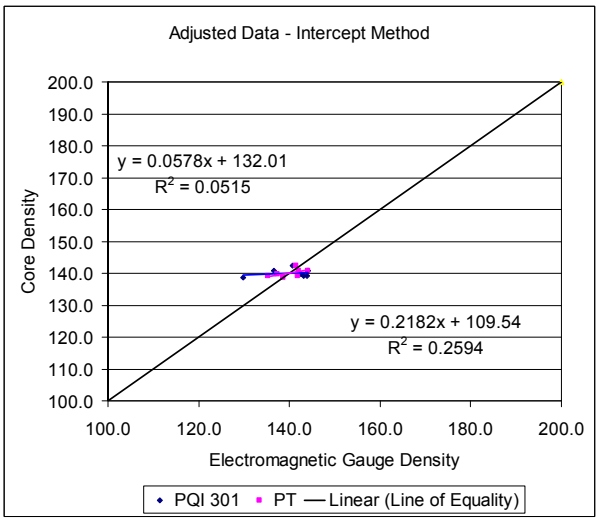


Figure A.22. Project 2 Day 2 Adjusted Data Intercept Method

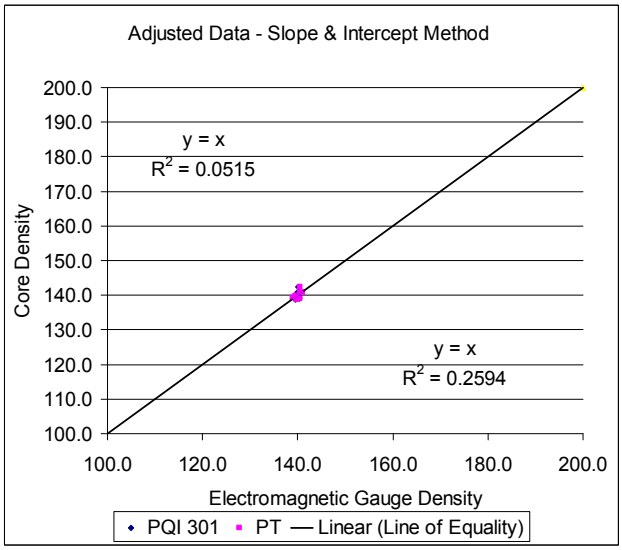


Figure A.23. Project 2 Day 2 Adjusted Data – Slope Method

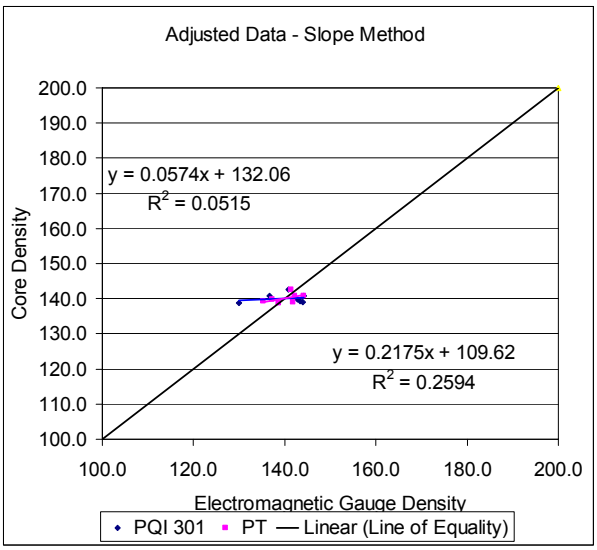


Figure A.24. Project 2 Day 2 Adjusted Data Slope & Intercept Method

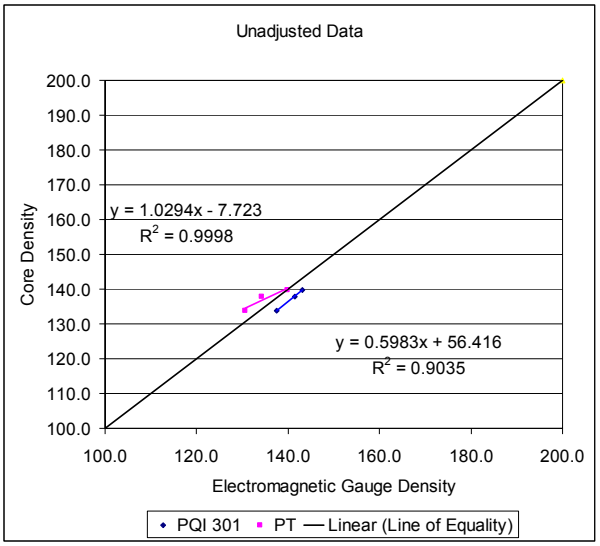


Figure A.25. Project 2 Day 3 Unadjusted Data

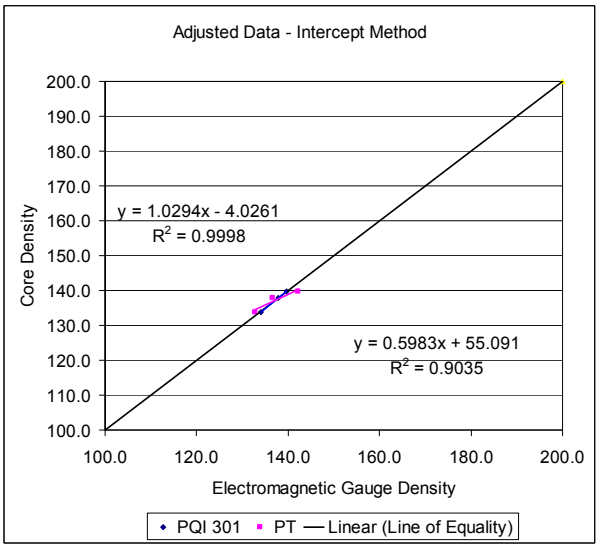


Figure A.26. Project 2 Day 3 Adjusted Data Intercept Method

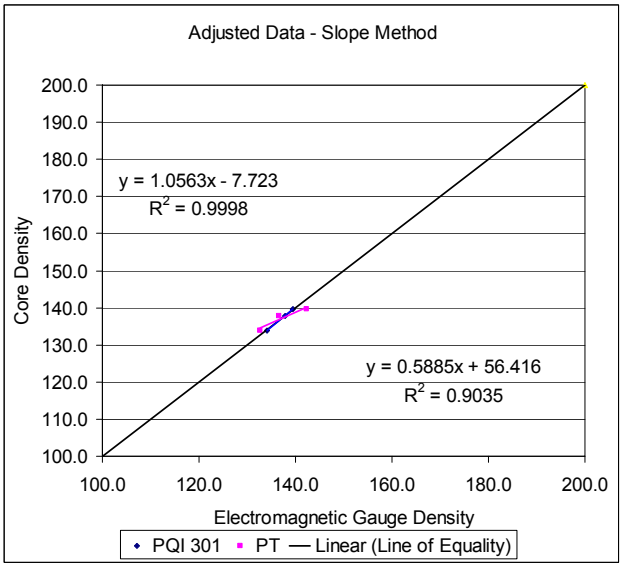


Figure A.27. Project 2 Day 3 Adjusted Data – Adjusted Data Slope Method

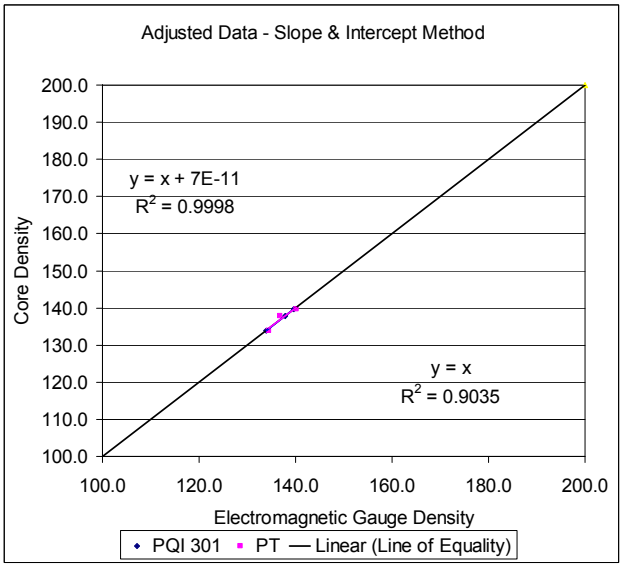


Figure A.28. Project 2 Day 3 Slope & Intercept Method

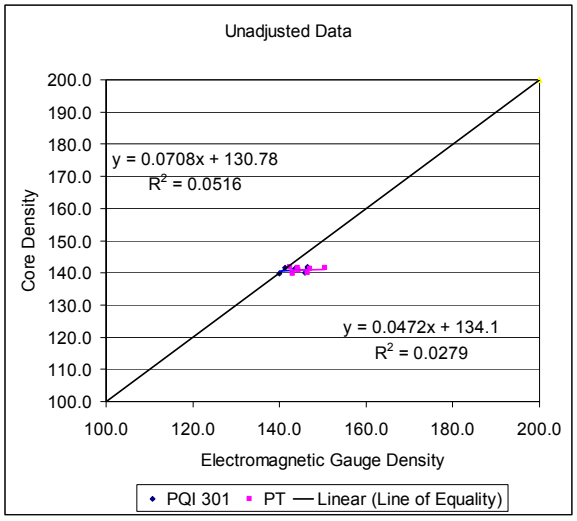


Figure A.29. Project 3 Day 1 Unadjusted Data

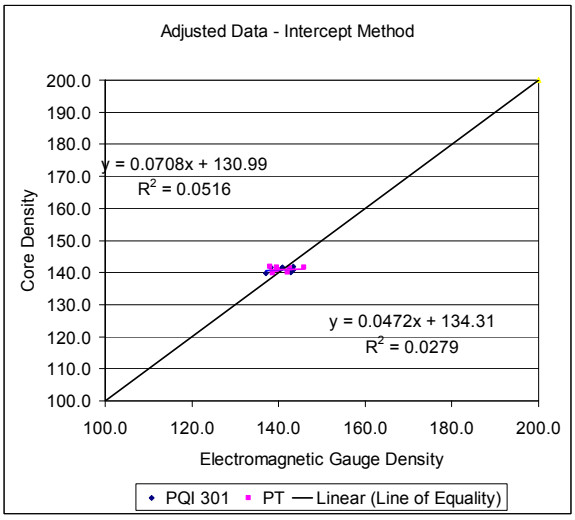


Figure A.30. Project 3 Day 1 Adjusted Data Intercept Method

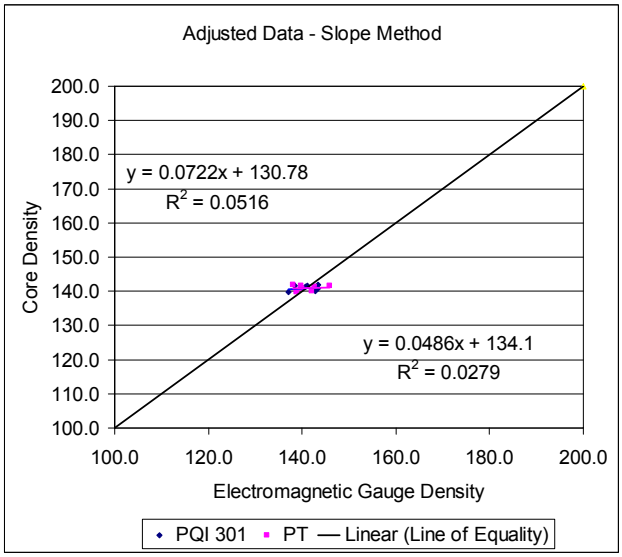


Figure A.31. Project 3 Day 1 Adjusted Data Slope Method

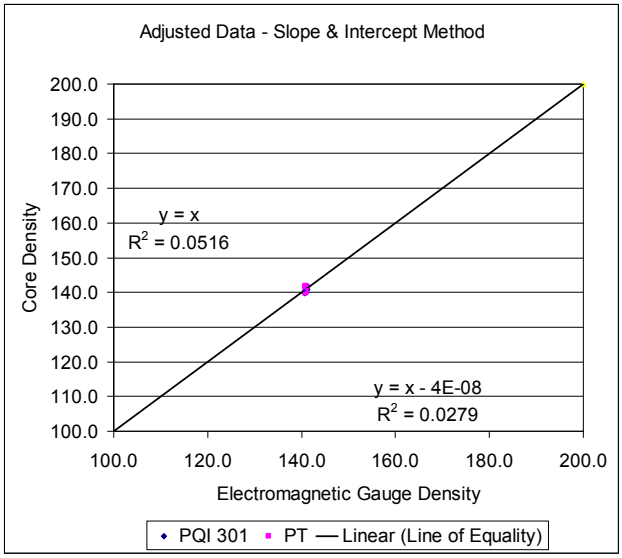


Figure A.32. Project 3 Day 1 Adjusted Data – Slope & Intercept Method

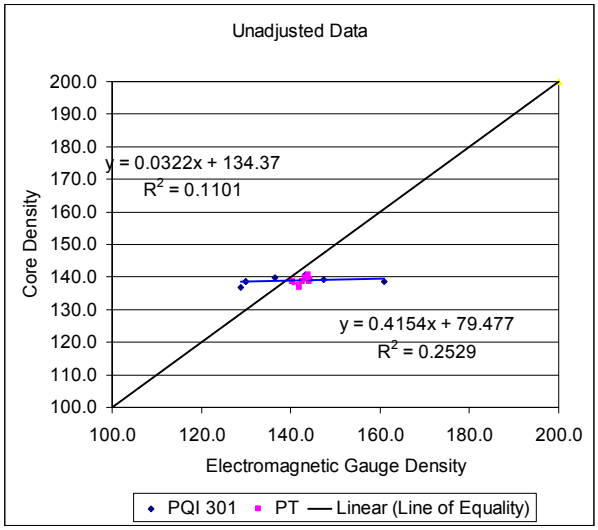


Figure A.33. Project 3 Day 2 Unadjusted Data

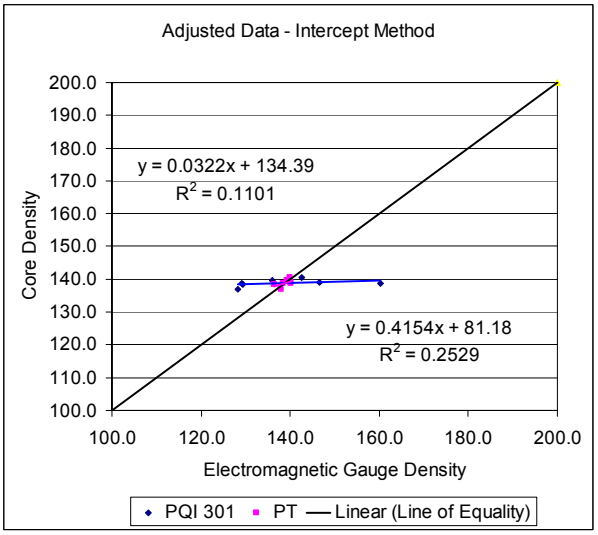


Figure A.34. Project 3 Day 2 Adjusted Data Intercept Method

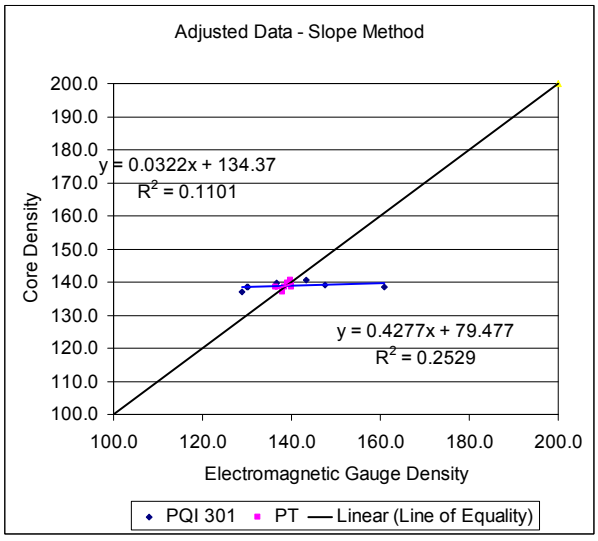


Figure A.35. Project 3 Day 2 Adjusted Data Slope Method

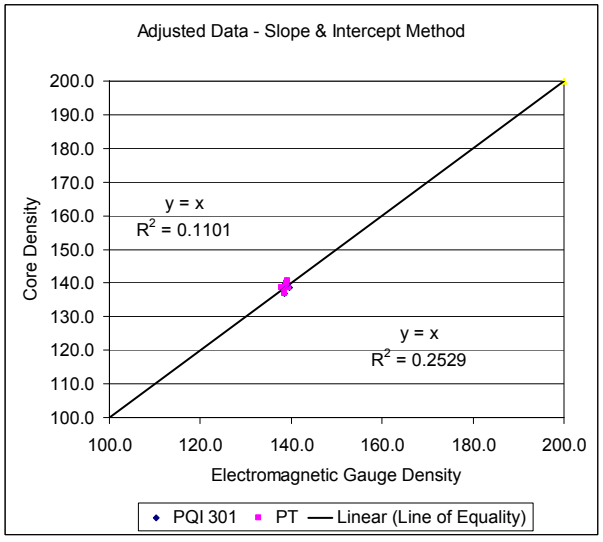


Figure A.36. Project 3 Day 2 Adjusted Data – Slope & Intercept Method

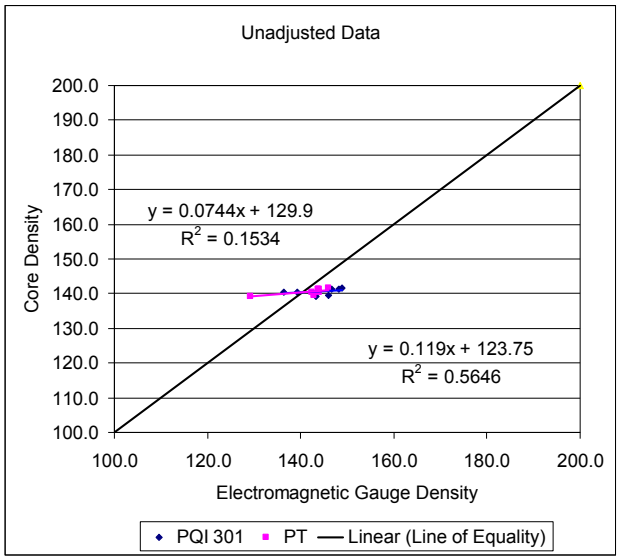


Figure A.37. Project 3 Day 3 Unadjusted Data

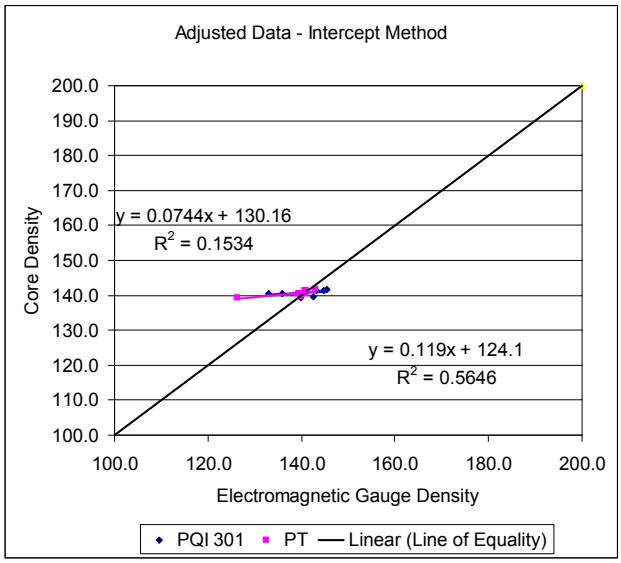


Figure A.38. Project 3 Day 3 Adjusted Data Intercept Method

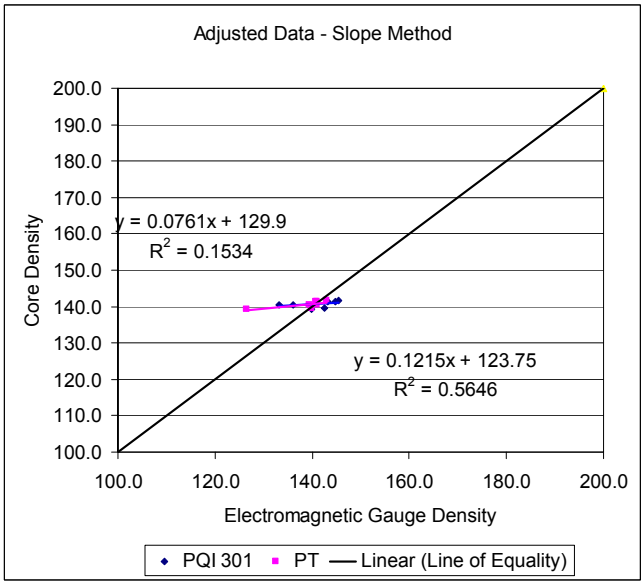


Figure A.39. Project 3 Day 3 Adjusted Data – Slope Method

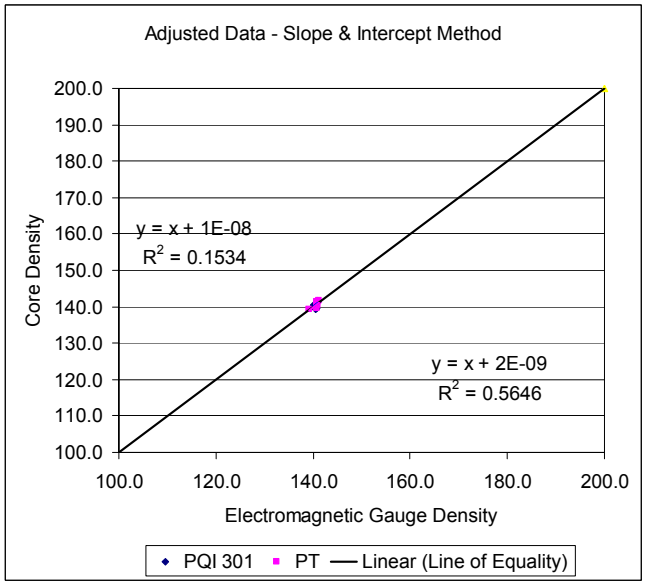


Figure A.40. Project 3 Day 3 Adjusted Data Slope & Intercept Method

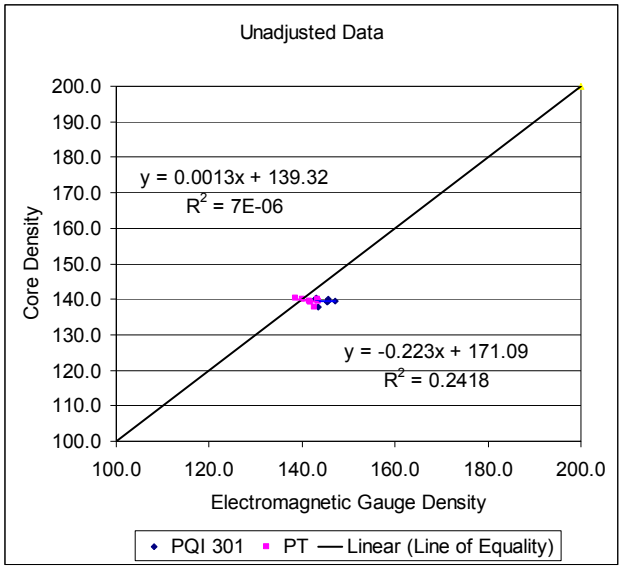


Figure A.41. Project 3 Day 4 Unadjusted Data

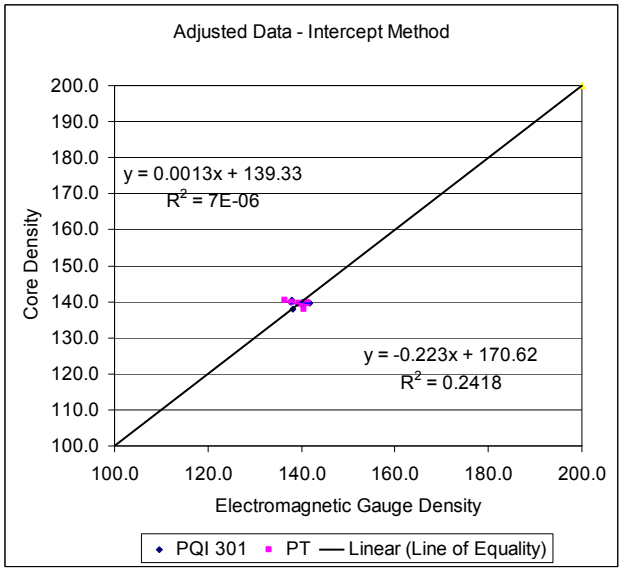


Figure A.42. Project 3 Day 4 Adjusted Data Intercept Method

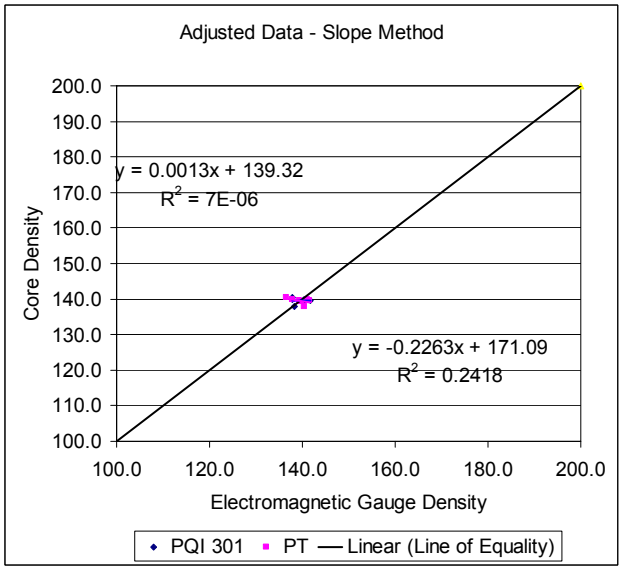


Figure A.43. Project 3 Day 4 Adjusted Data – Slope Method

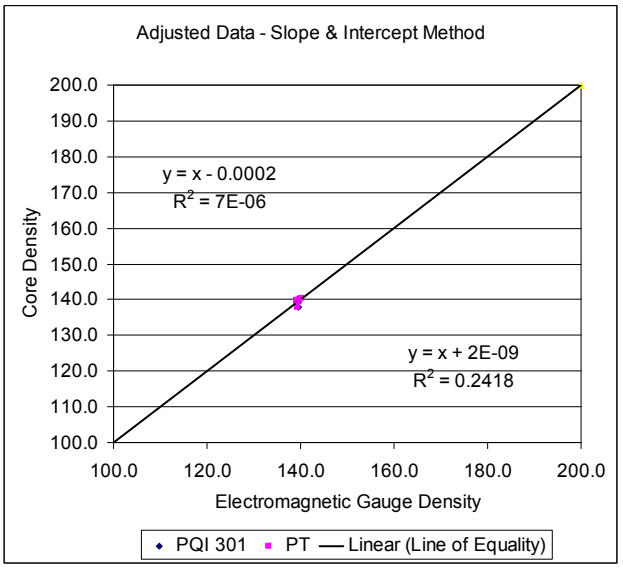


Figure A.44. Project 3 Day 4 Adjusted Data Slope & Intercept Method

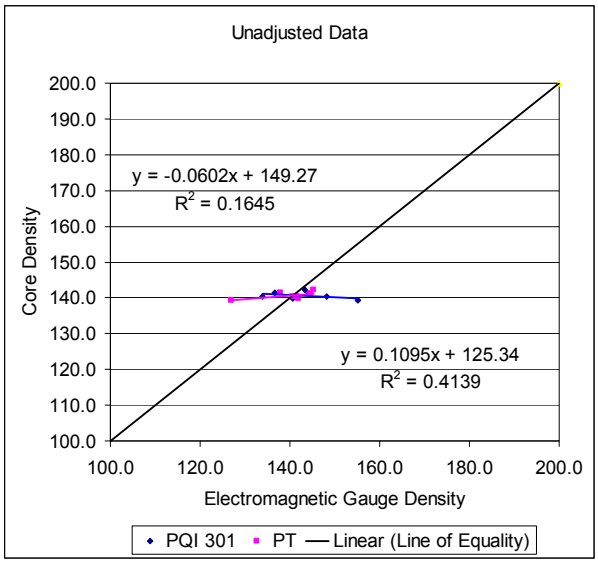


Figure A.45. Project 3 Day 5 Unadjusted Data

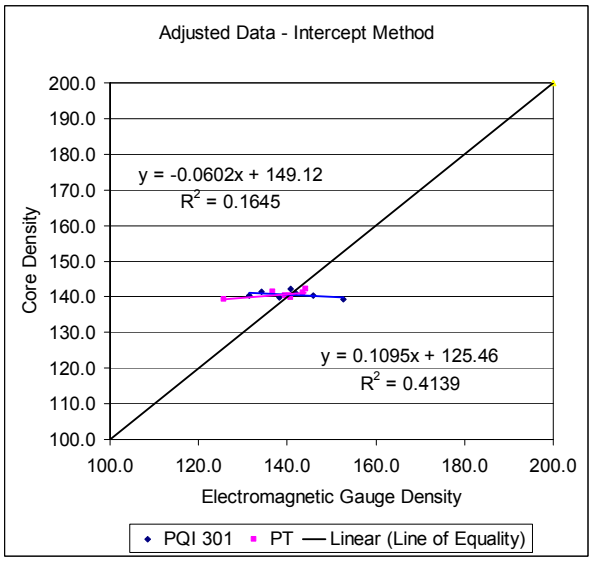


Figure A.46. Project 3 Day 5 Adjusted Data Intercept Method

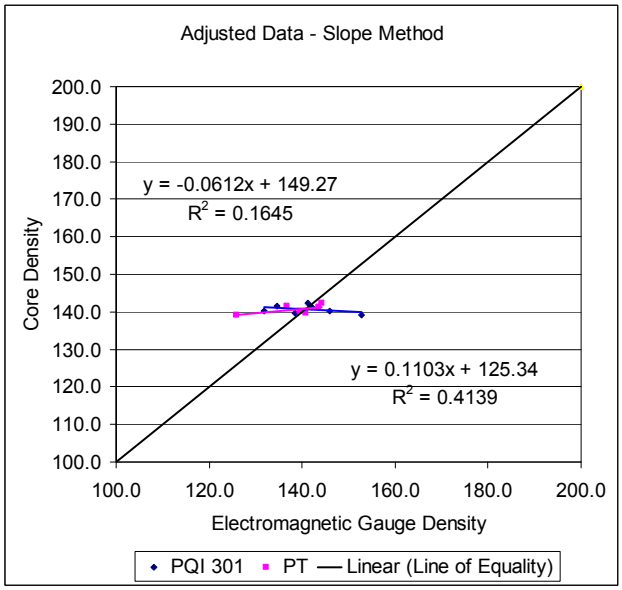


Figure A.47. Project 3 Day 5 Adjusted Data – Slope Method

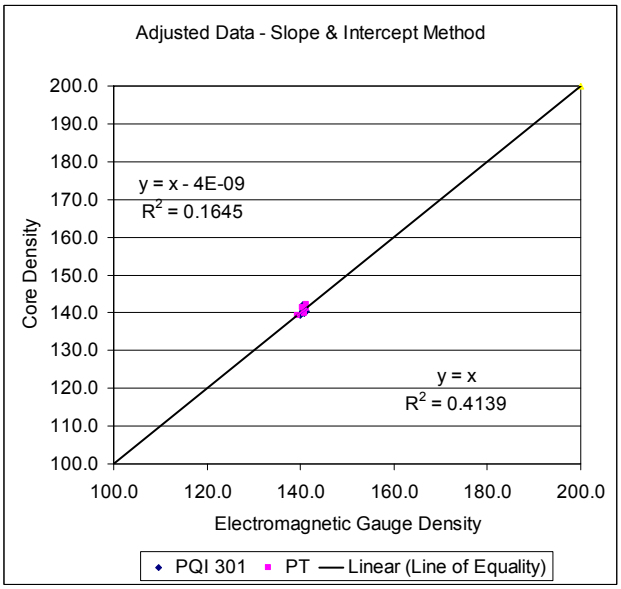


Figure A.48. Project 3 Day 5 Adjusted Data Slope & Intercept Method

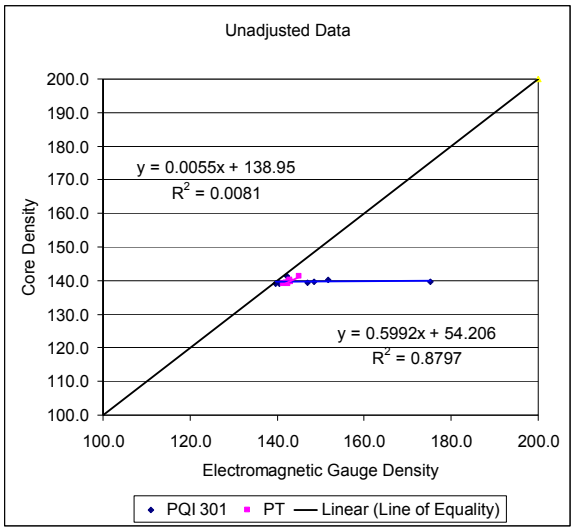


Figure A.49. Project 4 Day 1 Unadjusted Data

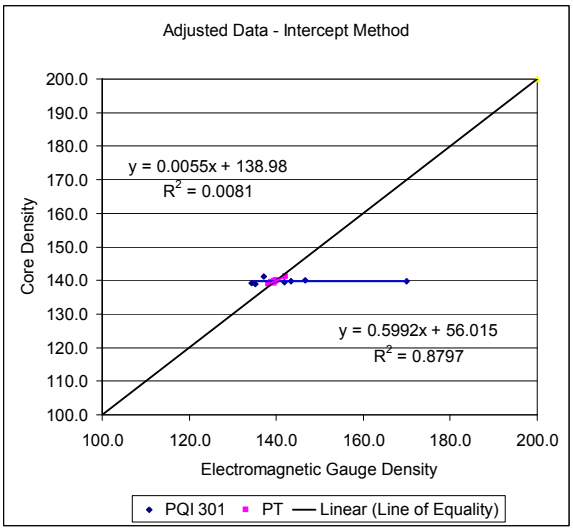


Figure A.50. Project 4 Day 1 Adjusted Data Intercept Method

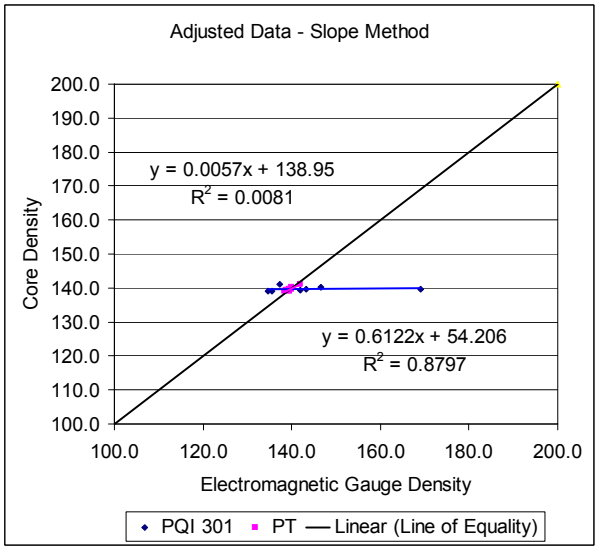


Figure A.51. Project 4 Day 1 Adjusted Data – Slope Method

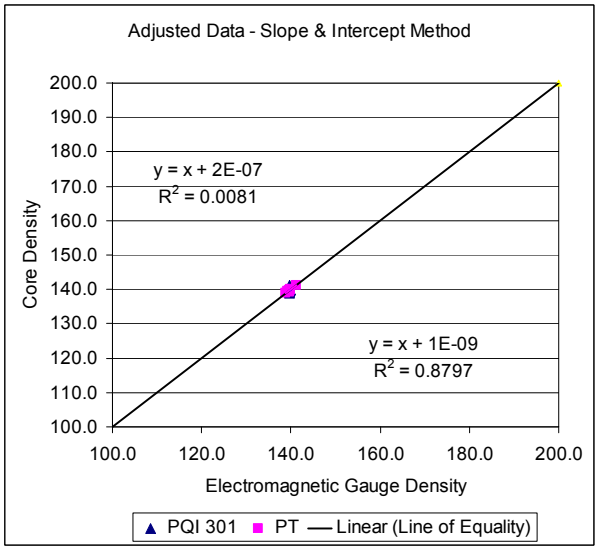


Figure A.52. Project 4 Day 1 Adjusted Data – Slope & Intercept Method

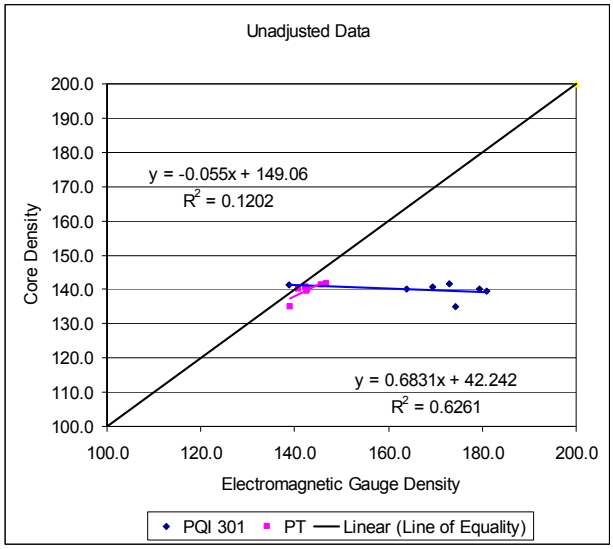


Figure A.53. Project 4 Day 2 Unadjusted Data

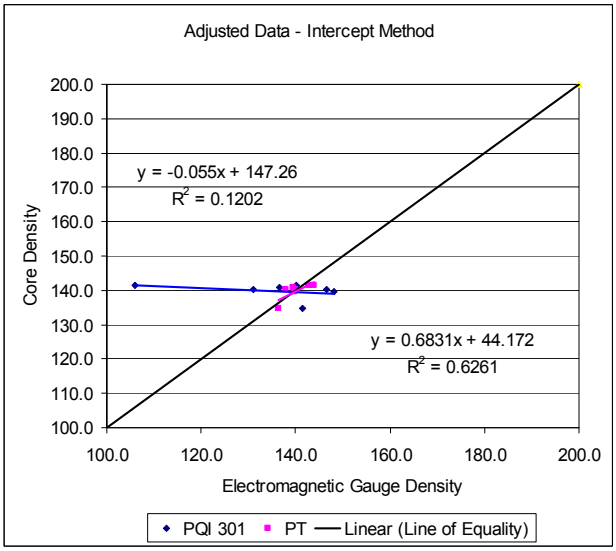


Figure A.54. Project 4 Day 2 Adjusted Data Intercept Method

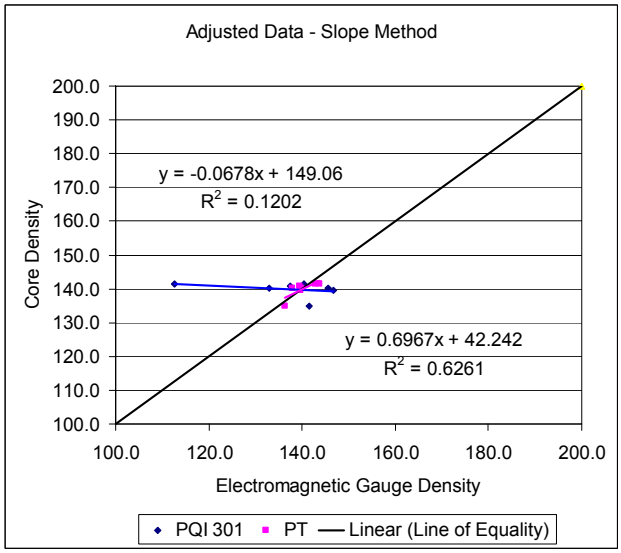


Figure A.55. Project 4 Day 2 Adjusted Data – Slope Method

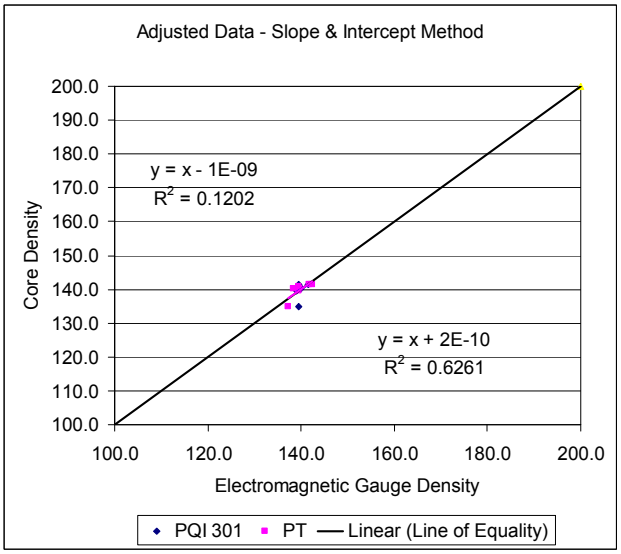
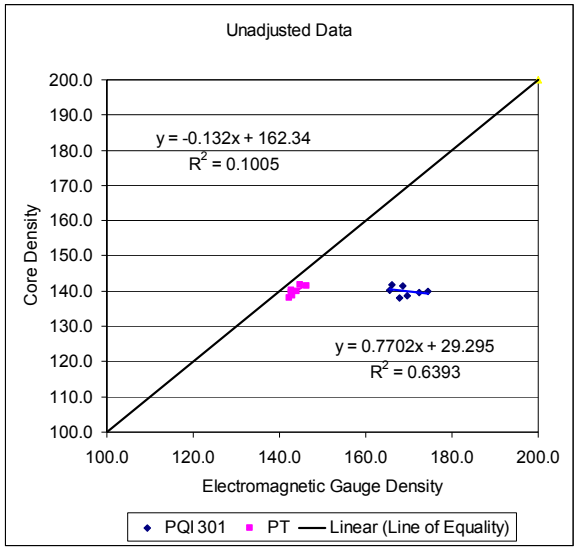


Figure A.56. Project 4 Day 2 Adjusted Data – Slope & Intercept Method



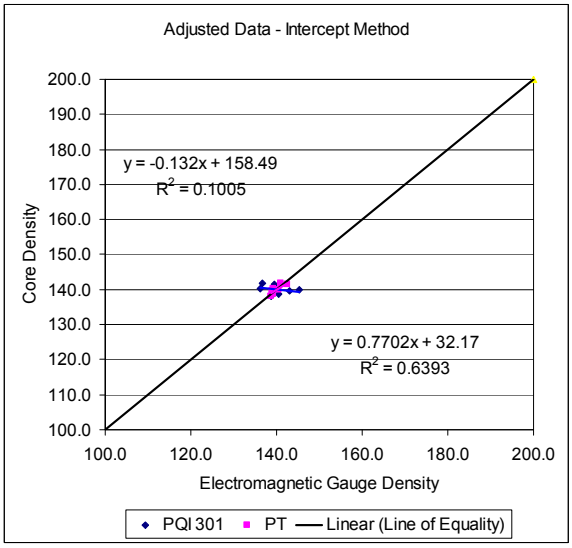
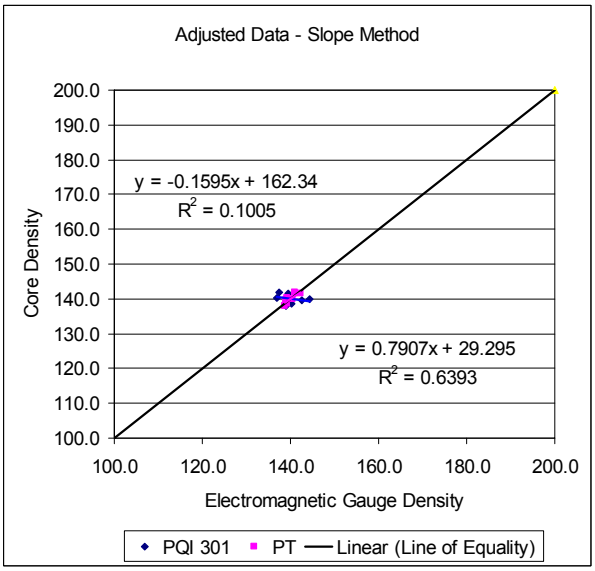


Figure A.57. Project 4 Day 3 Unadjusted Data

Figure A.58. Project 4 Day 3 Adjusted Data Intercept Method



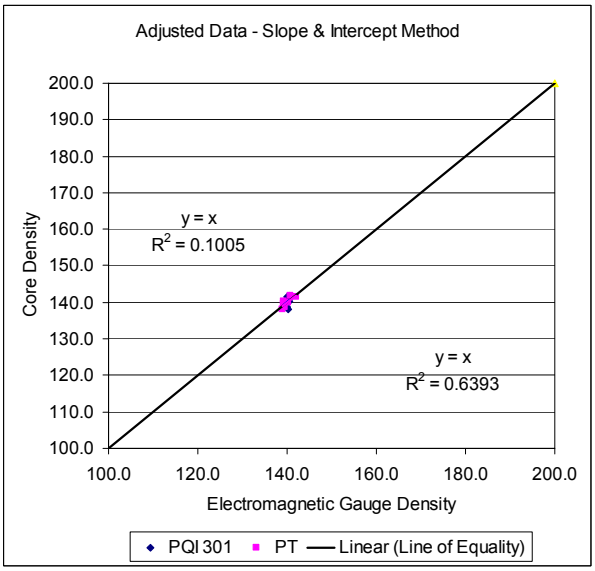


Figure A.59. Project 4 Day 3 Adjusted Data – Slope Method

Figure A.60. Project 4 Day 3 Adjusted Data – Slope & Intercept Method

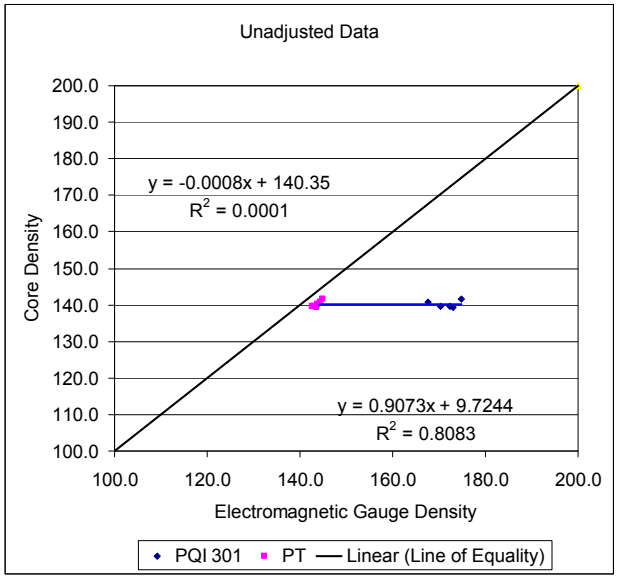


Figure A.61. Project 4 Day 4 Unadjusted Data –

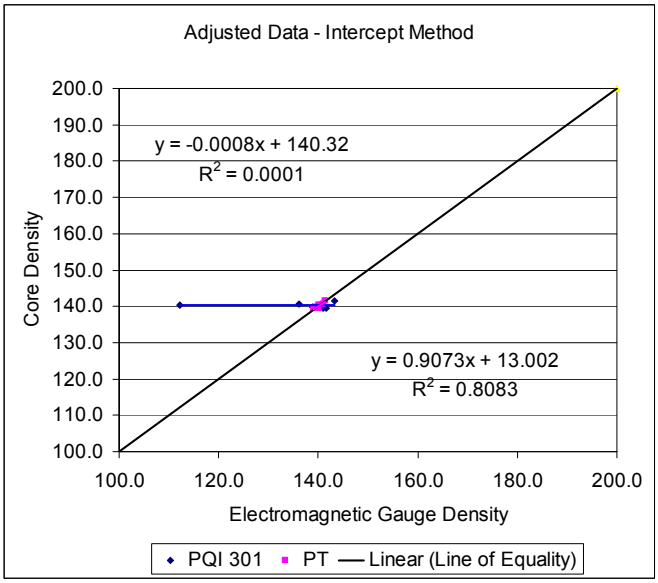


Figure A.62. Project 4 Day 4 Adjusted Data Intercept Method

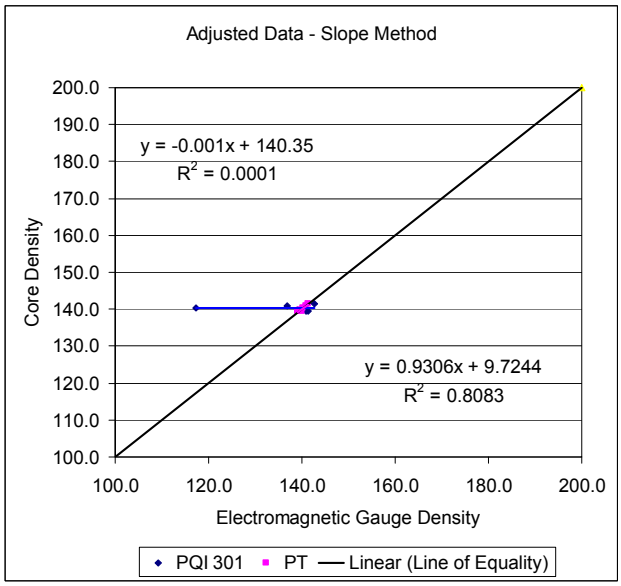


Figure A.63. Project 4 Day 4 Adjusted Data – Slope Method

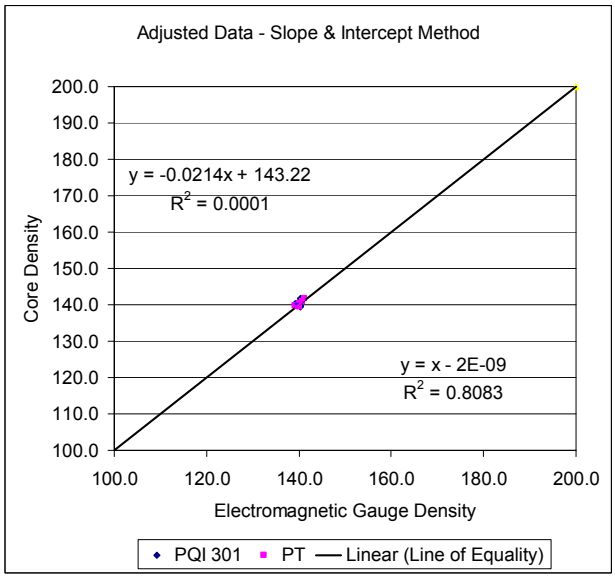


Figure A.64. Project 4 Day 4 Adjusted Data – Slope & Intercept Method

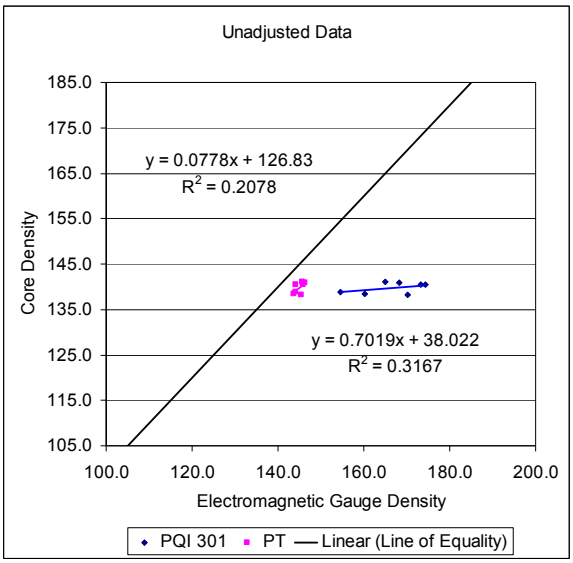


Figure A.65. Project 4 Day 5 Unadjusted Data

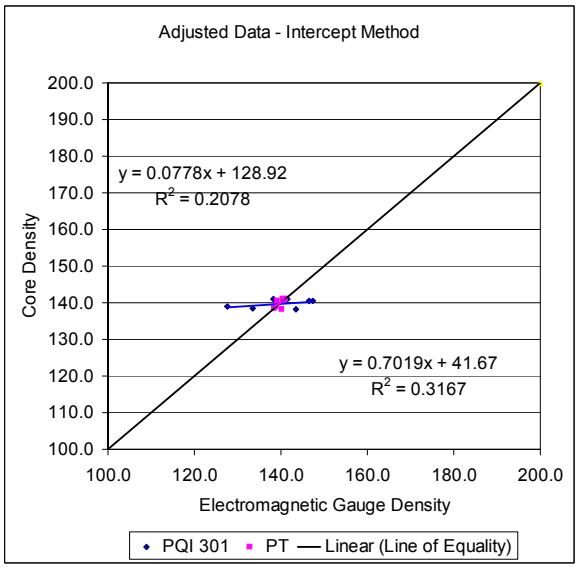


Figure A.66. Project 4 Day 5 Adjusted Data Intercept Method

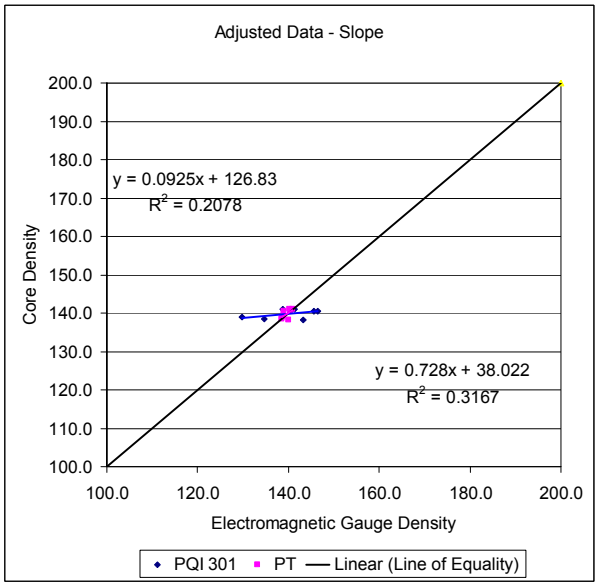


Figure A.67. Project 4 Day 5 Adjusted Data – Slope Method

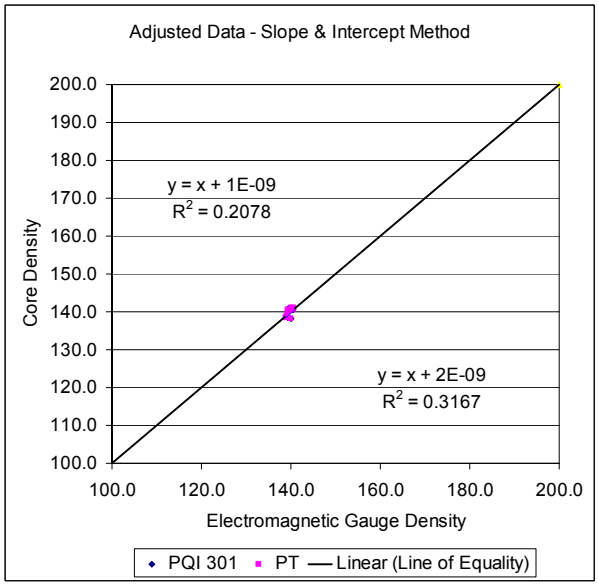
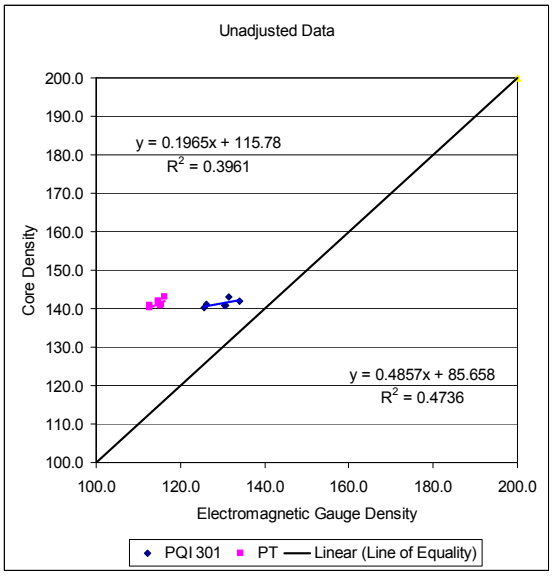


Figure A.68. Project 4 Day 5 Adjusted Data Slope & Intercept Method



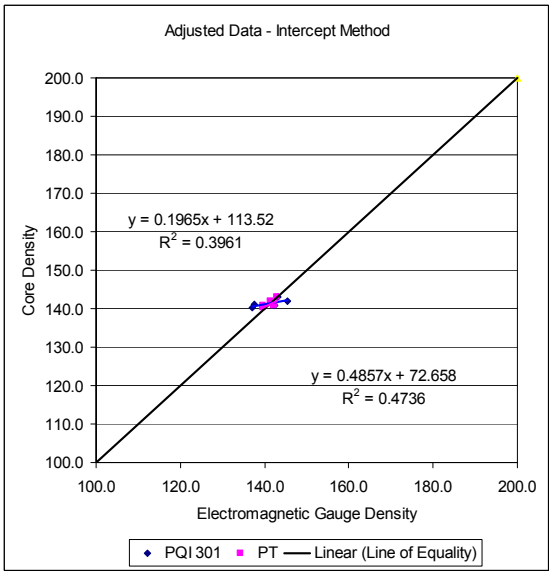
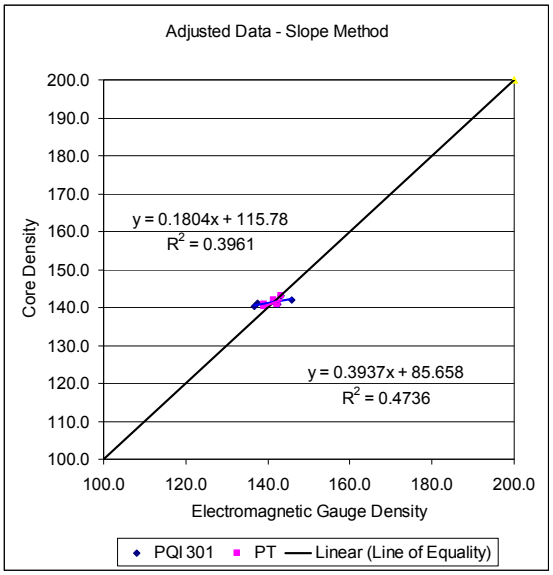


Figure A.69. Project 5 Day 1 Unadjusted Data **Figure A.70. Project 5 Day 1 Adjusted Data**



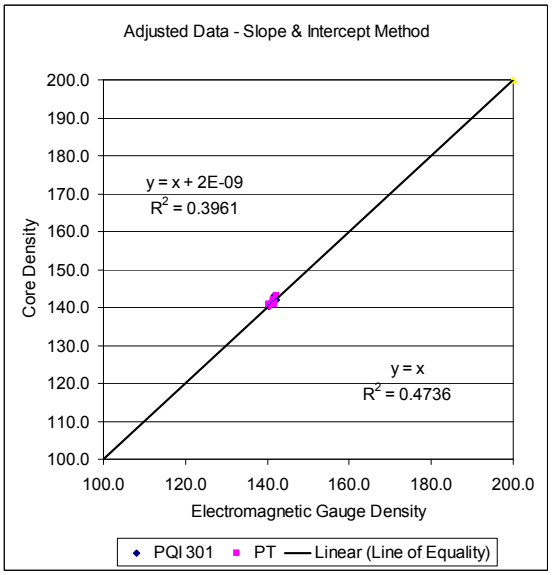
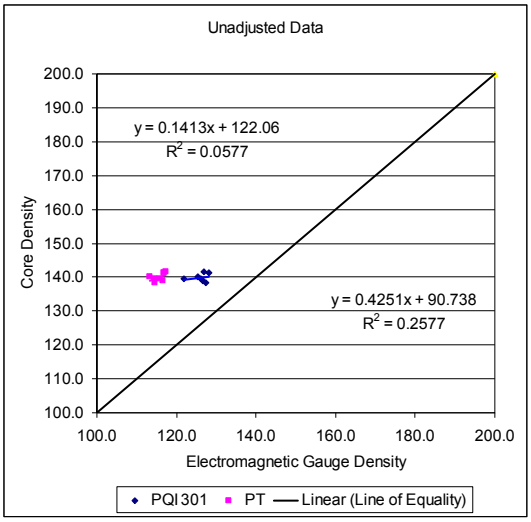


Figure A.71. Project 5 Day 1 Adjusted Data – Slope Method **Figure A.72. Project 5 Day 1 Adjusted Data – Slope & Intercept Method**



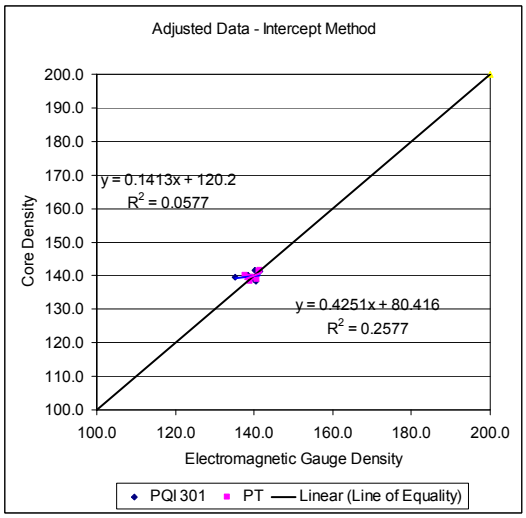
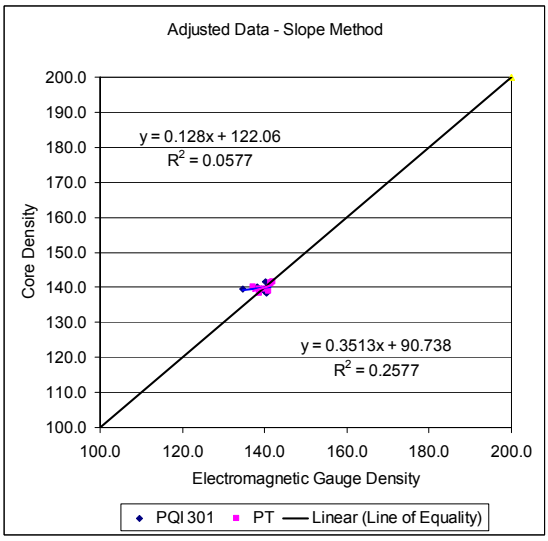


Figure A.73. Project 5 Day 2 Unadjusted Data

Figure A.74. Project 5 Day 2 Adjusted Data Intercept Method



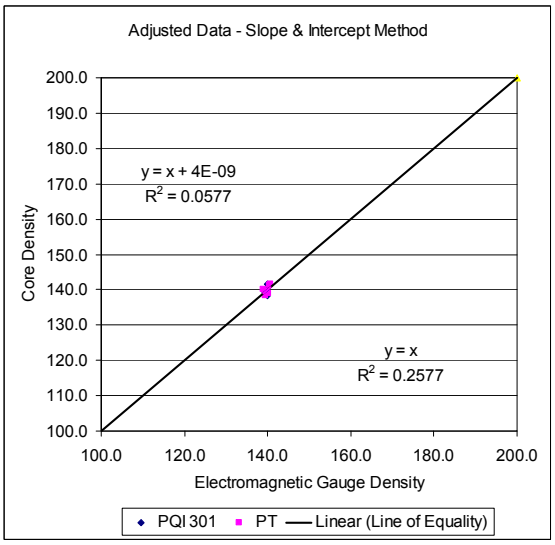


Figure A.75. Project 5 Day 2 Adjusted Data Slope Method

Figure A.76. Project 5 Day 2 Adjusted Data – Slope & Intercept Method

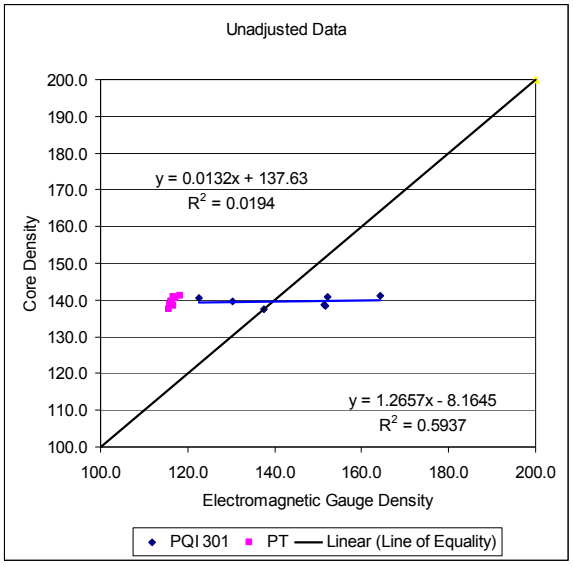


Figure A.77. Project 5 Day 3 Unadjusted Data

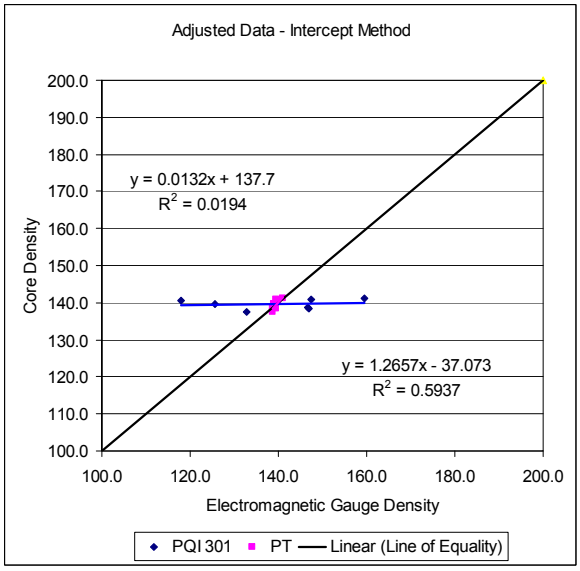


Figure A.78. Project 5 Day 3 Adjusted Data Intercept Method

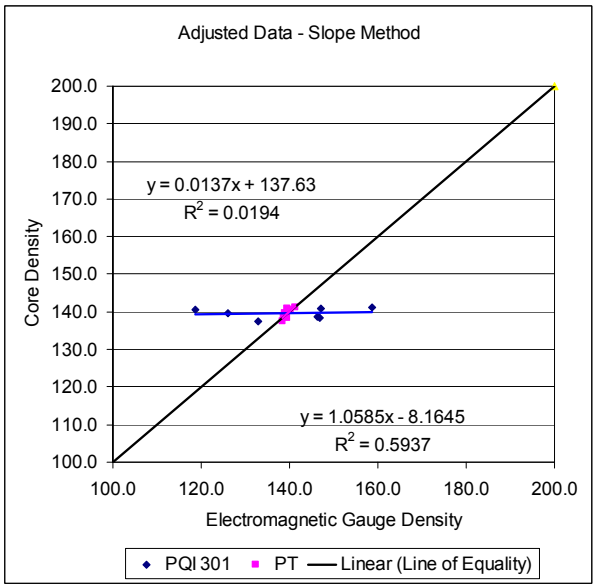


Figure A.79. Project 5 Day 3 Adjusted Data – Slope Method

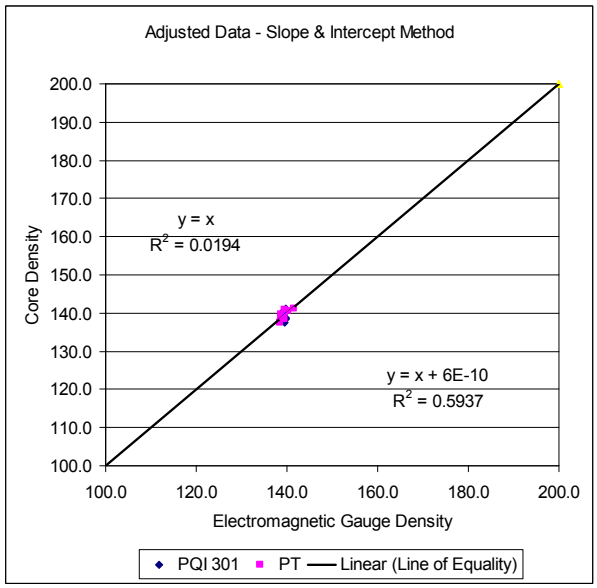
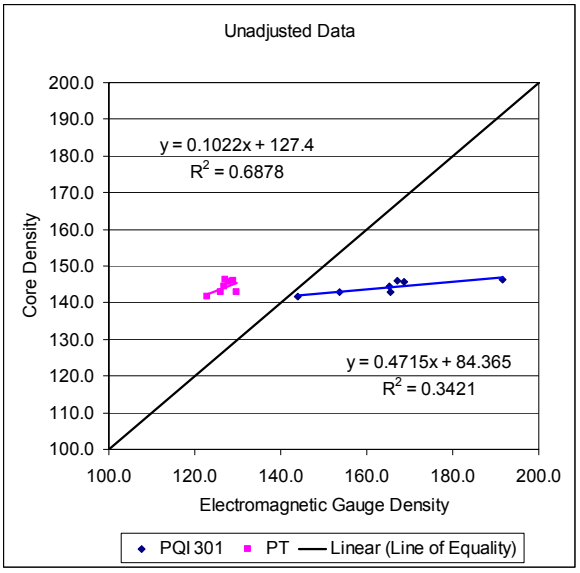


Figure A.80. Project 5 Day 3 Adjusted Data Slope & Intercept Method



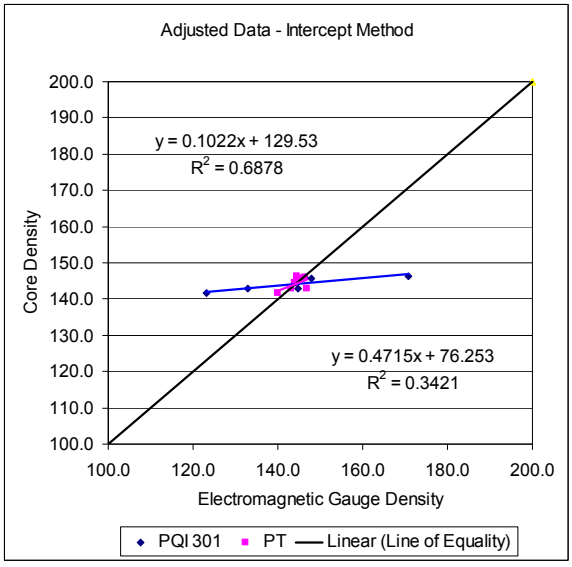
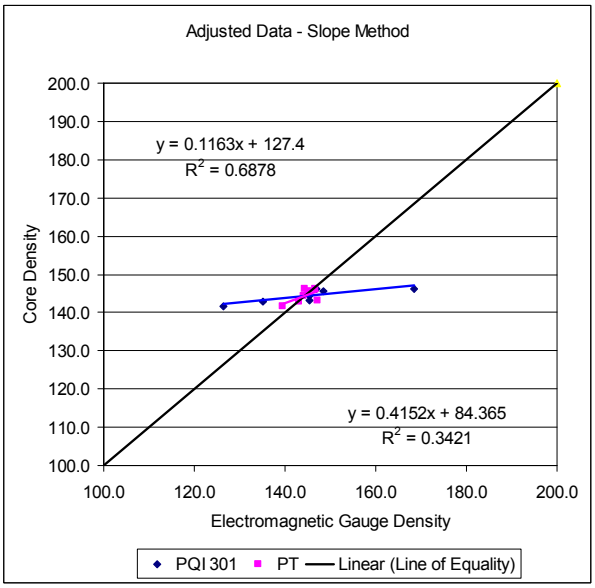


Figure A.81. Project 6 Day 1 Unadjusted Data

Figure A.82. Project 6 Day 1 AdjustedData Intercept Method



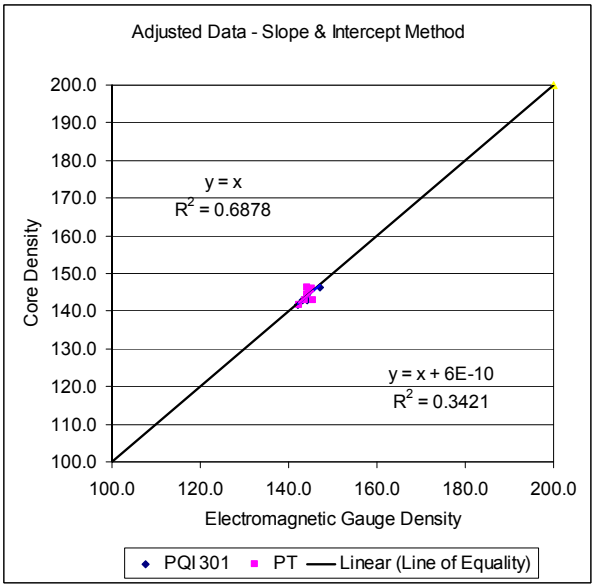


Figure A.83. Project 6 Day 1 Adjusted Data – Slope Method

Figure A.84. Project 6 Day 1 Adjusted Data Slope & Intercept Method

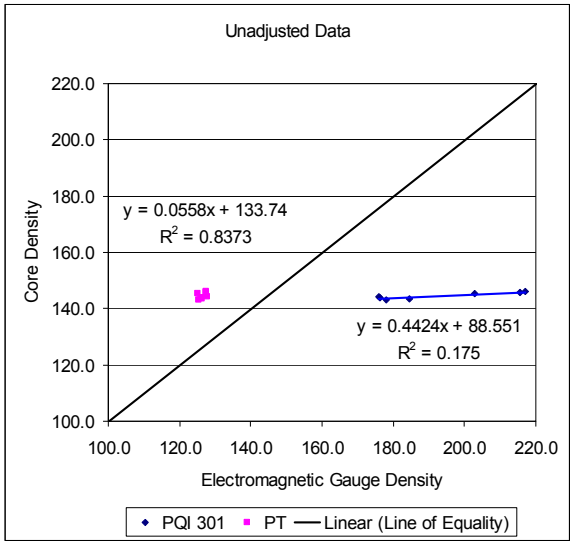


Figure A.85. Project 6 Day 2 Unadjusted Data

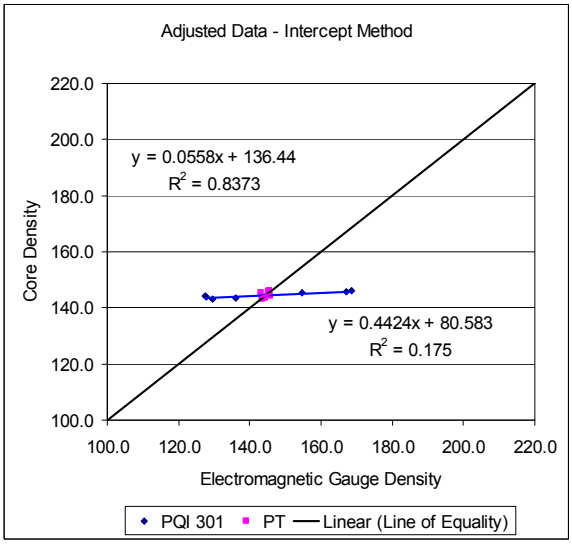


Figure A.86. Project 6 Day 2 Adjusted Data Intercept Method

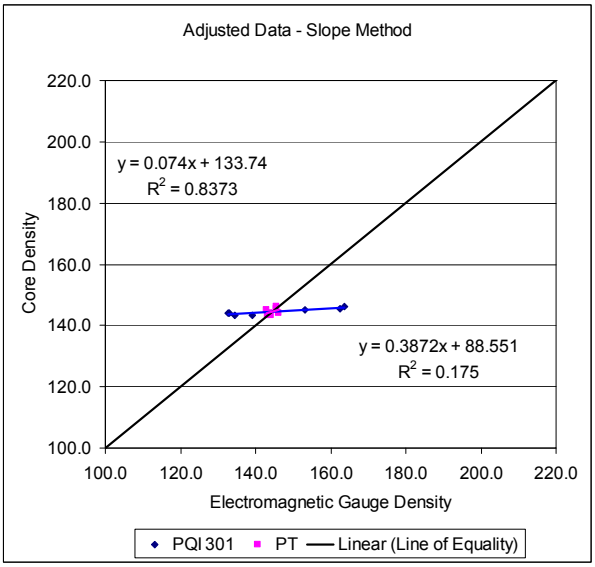


Figure A.87. Project 6 Day 2 Adjusted Data – Slope Method

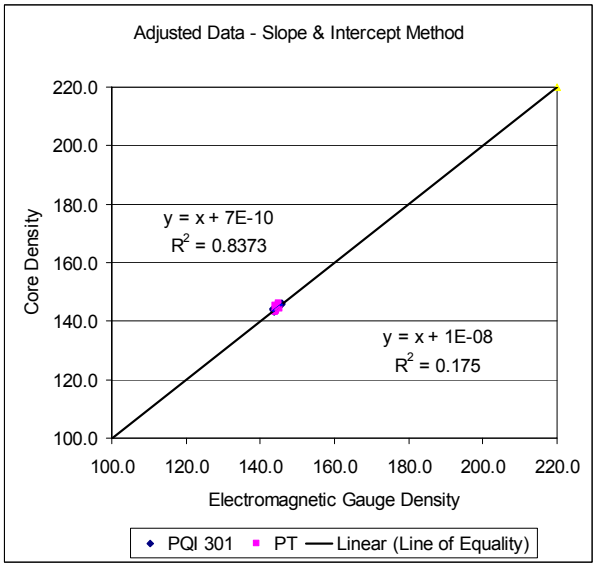


Figure A.88. Project 6 Day 2 Adjusted Data Slope & Intercept Method

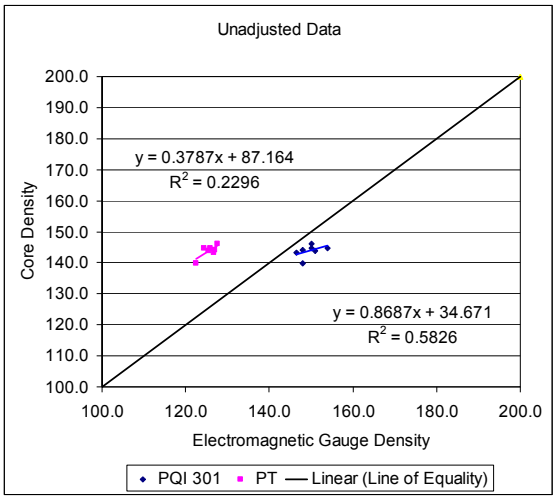


Figure A.89. Project 6 Day 3 Unadjusted Data

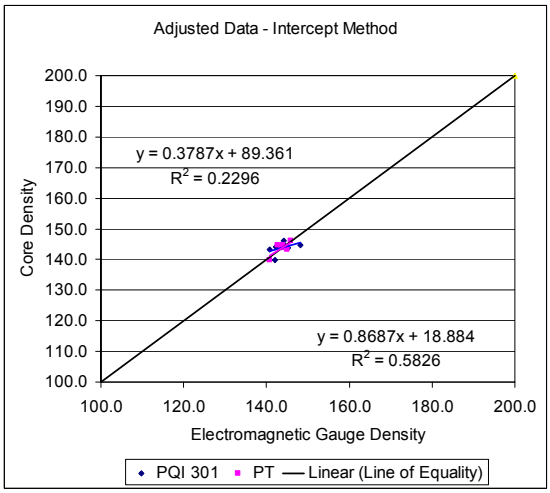


Figure A.90. Project 6 Day 3 Adjusted Data Intercept Method

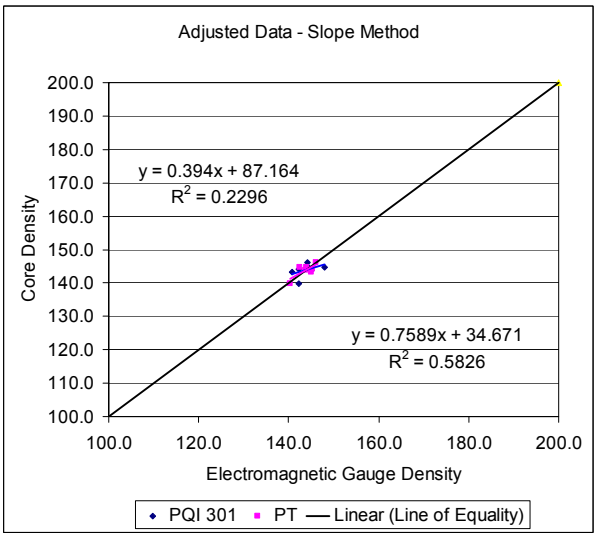


Figure A.91. Project 6 Day 3 Adjusted Data – Slope Method

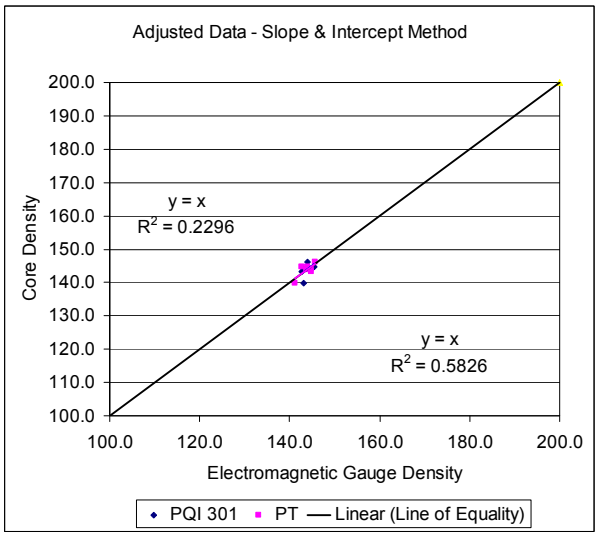


Figure A.92. Project 6 Day 3 Adjusted Data Slope & Intercept Method

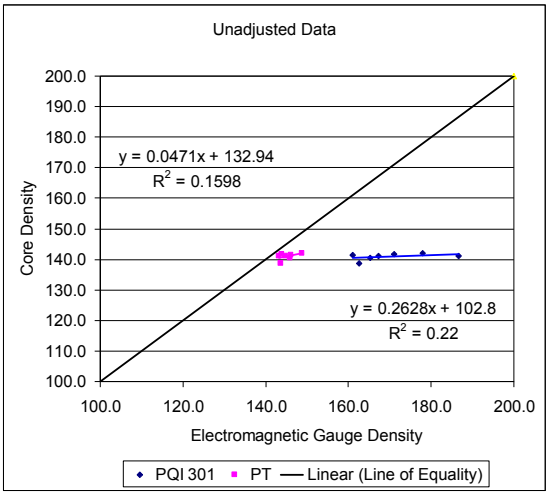


Figure A.93. Project 7 Day 1 Unadjusted Data

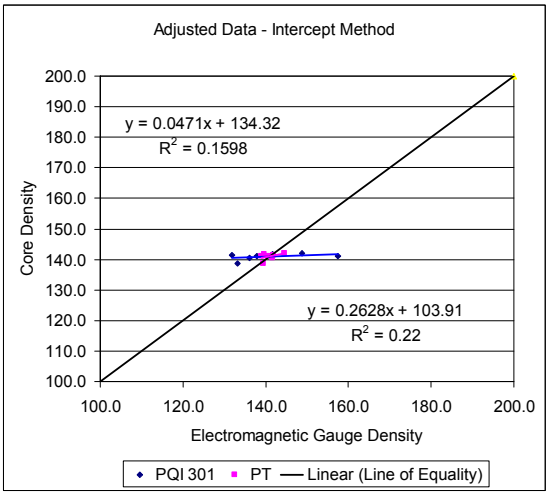


Figure A.94. Project 7 Day 1 Adjusted Data Intercept Method

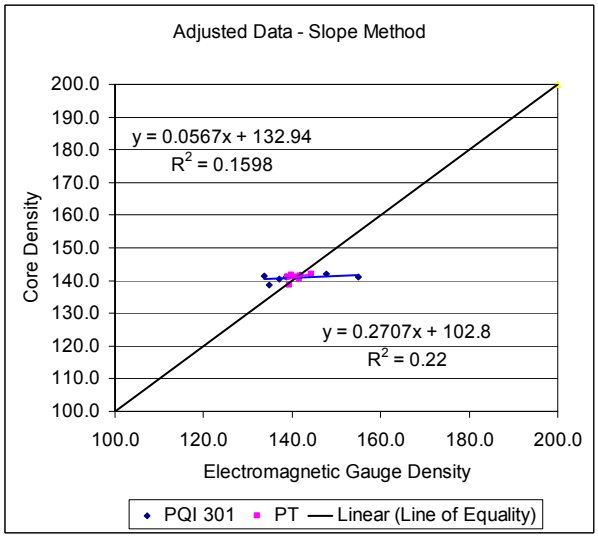


Figure A.95. Project 7 Day 1 Adjusted Data – Slope Method

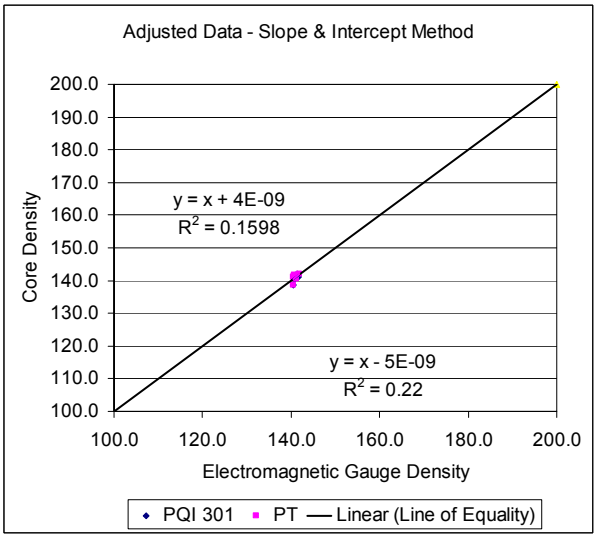


Figure A.96. Project 7 Day 1 Adjusted Data – Slope & Intercept Method

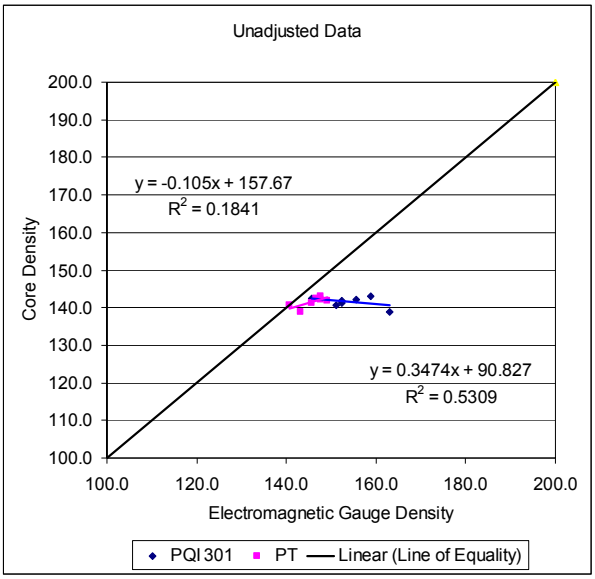


Figure A.97. Project 7 Day 2 Unadjusted Data

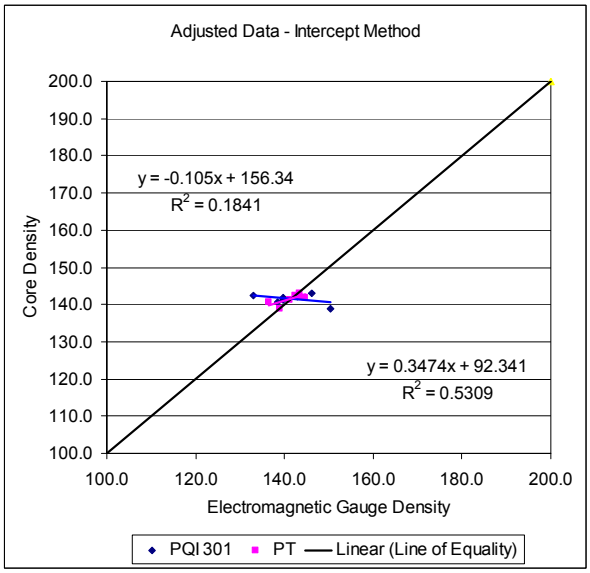


Figure A.98. Project 7 Day 2 Adjusted Data Intercept Method

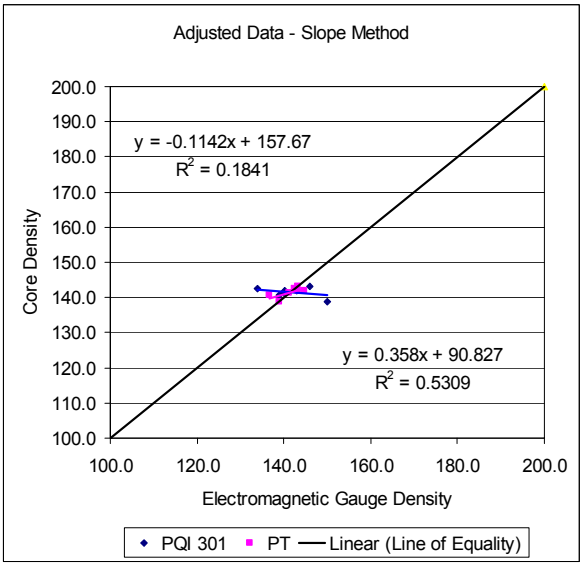


Figure A.99. Project 7 Day 2 Adjusted Data Slope Method

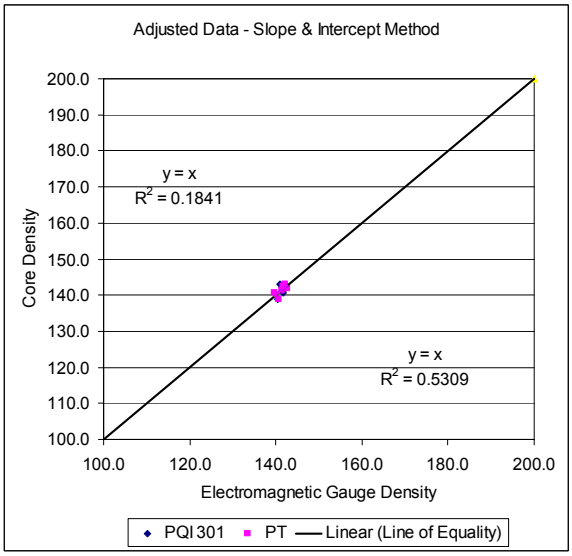


Figure A.100. Project 7 Day 2 Adjusted Data Slope & Intercept Method

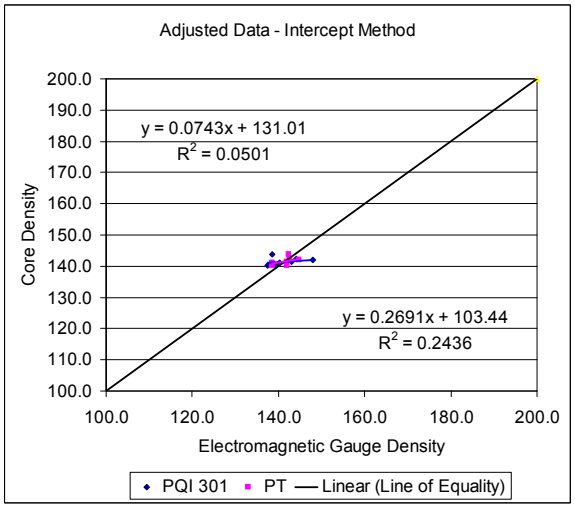


Figure A.101. Project 7 Day 3 Unadjusted

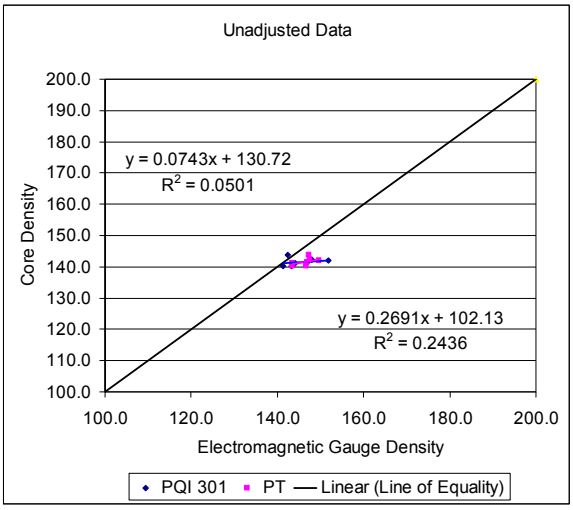


Figure A.102. Project 7 Day 3 Adjusted Intercept Method

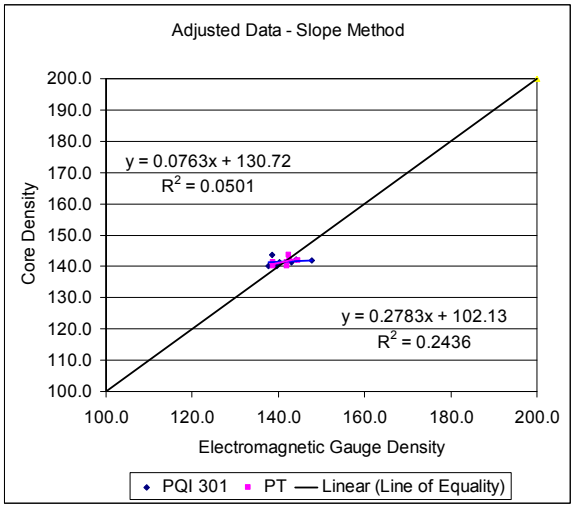


Figure A.103. Project 7 Day 3 Adjusted Data Slope Method

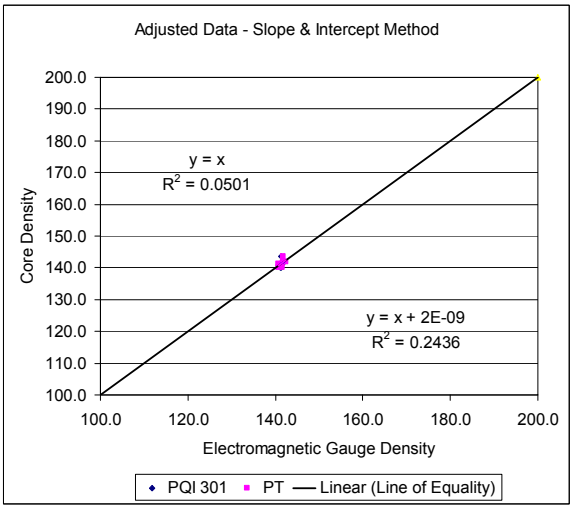


Figure A104. Project 7 Day 3 Adjusted Data Slope & Intercept Method

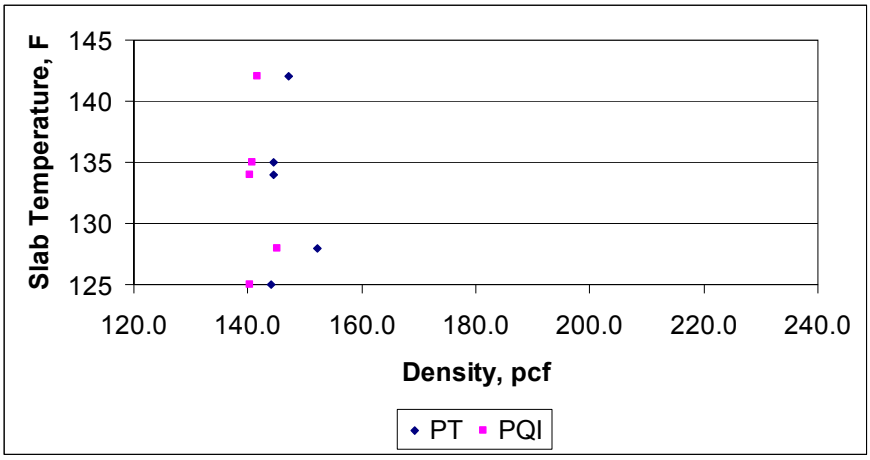


Figure A.105. Project 1 Day 1 Unadjusted Data vs. Slab Temperature

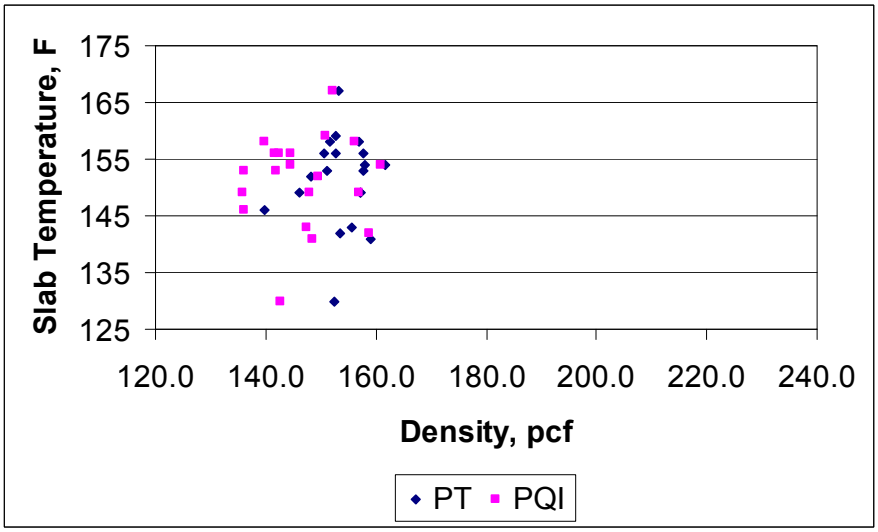


Figure A.106. Project 1 Day 2 Unadjusted Data vs. Slab Temperature

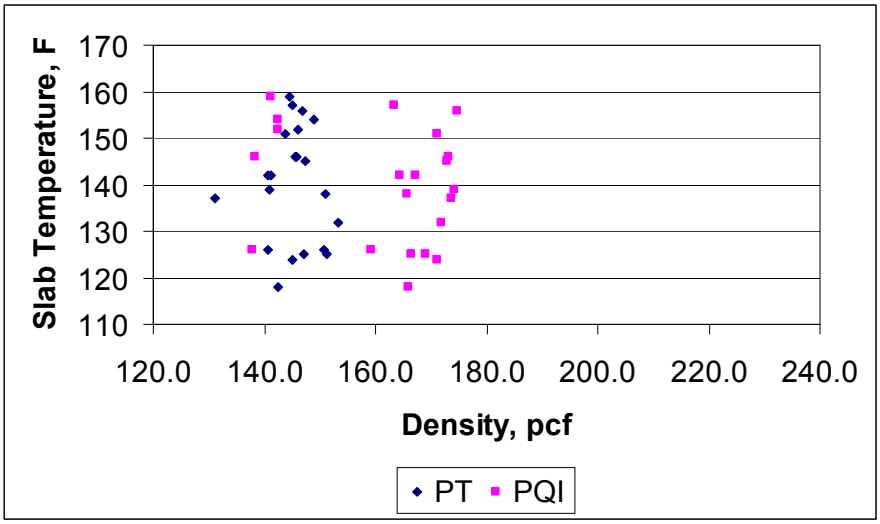


Figure A.107. Project 1 Day 3 Unadjusted Data vs. Slab Temperature

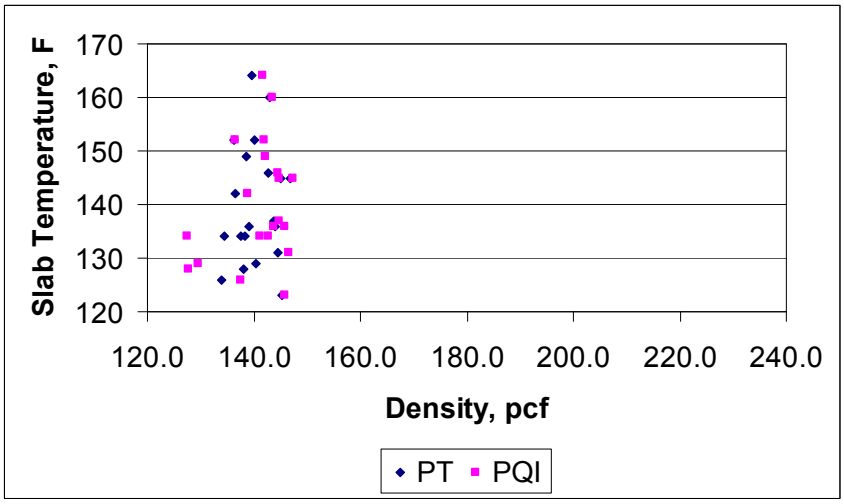


Figure A.108. Project 2 Day 1 Unadjusted Data vs. Slab Temperature

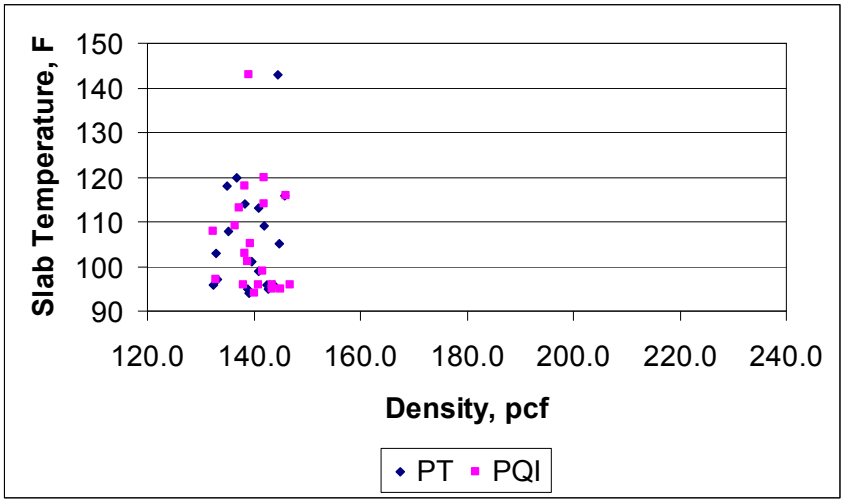


Figure A.109. Project 2 Day 2 Unadjusted Data vs. Slab Temperature

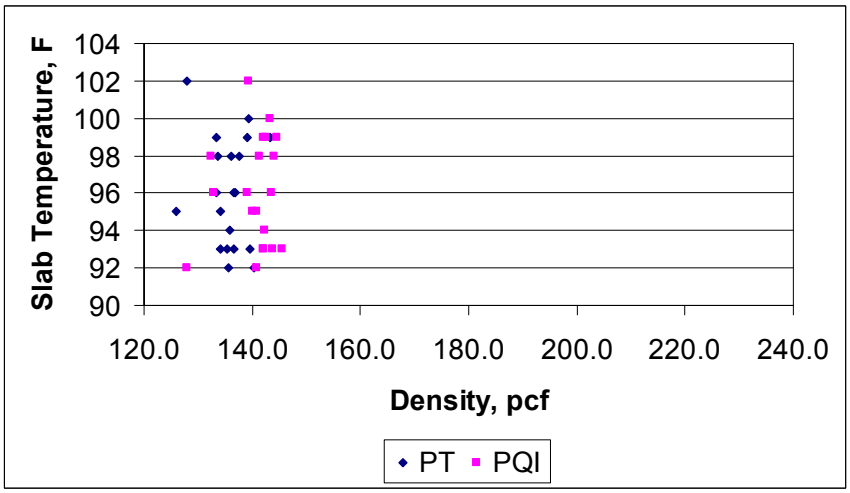


Figure A.110. Project 2 Day 3 Unadjusted Data vs. Slab Temperature

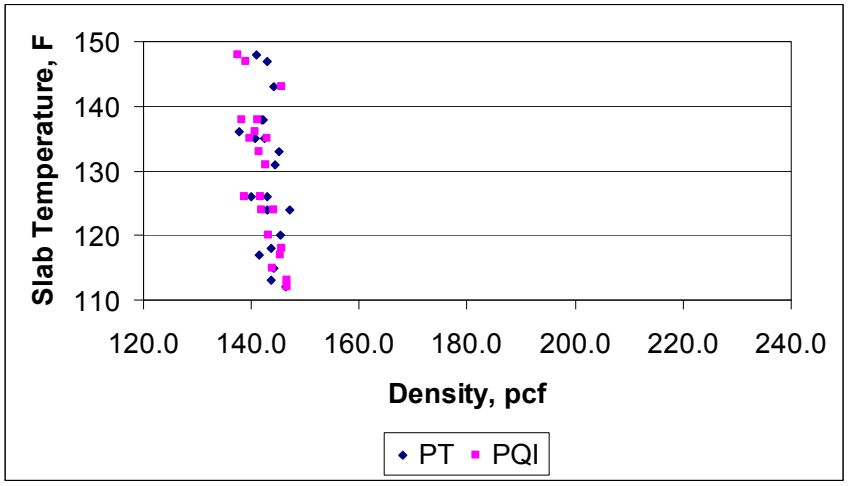


Figure A.111. Project 3 Day 1 Unadjusted Data vs. Slab Temperature

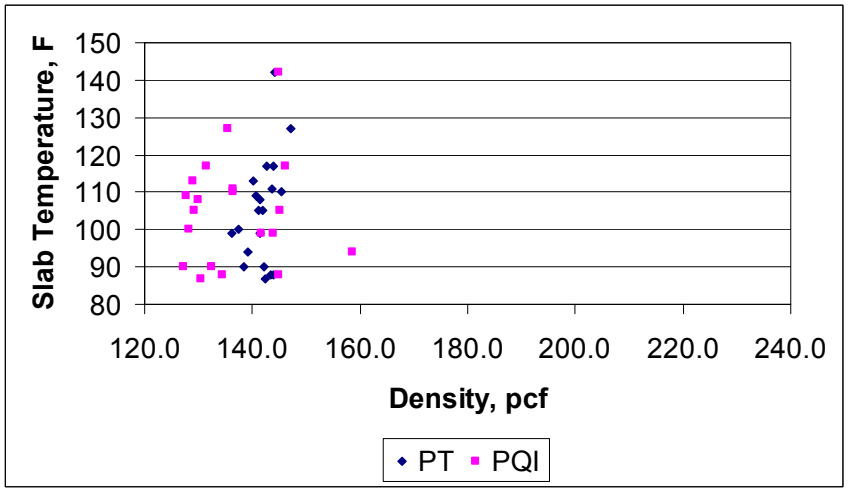


Figure A.112. Project 3 Day 2 Unadjusted Data vs. Slab Temperature

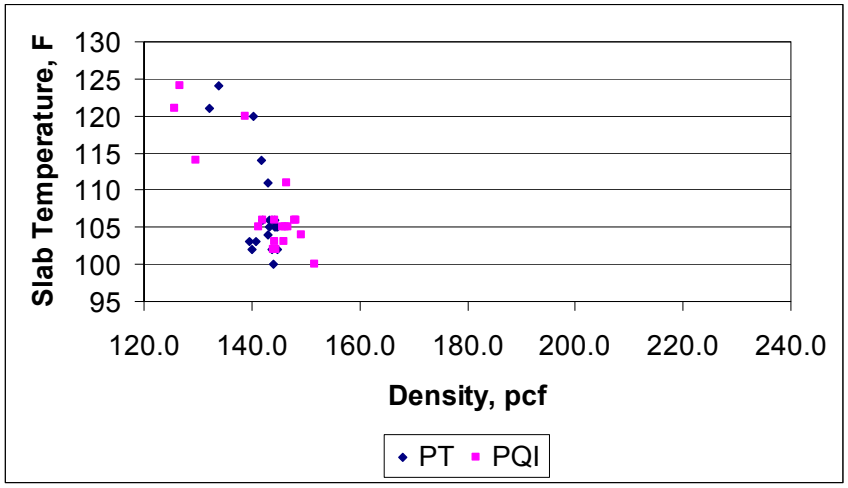


Figure A.113. Project 3 Day 3 Unadjusted Data vs. Slab Temperature

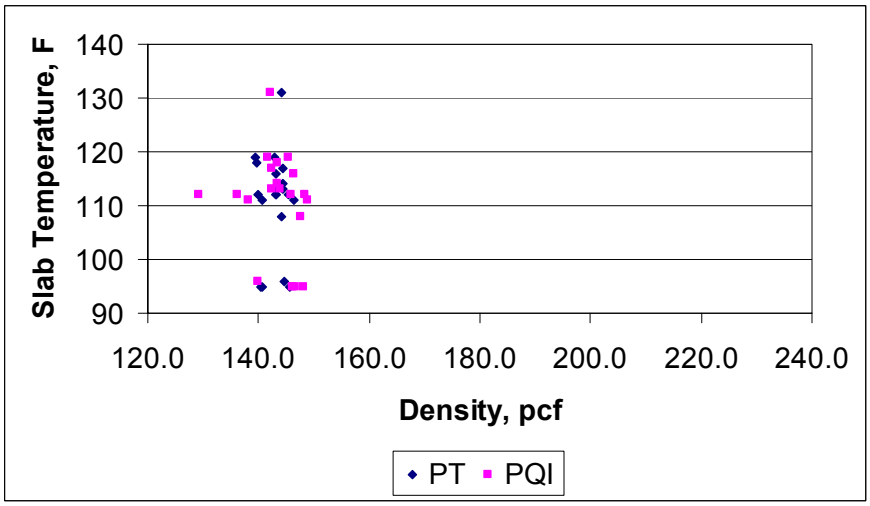


Figure A.114. Project 3 Day 4 Unadjusted Data vs. Slab Temperature

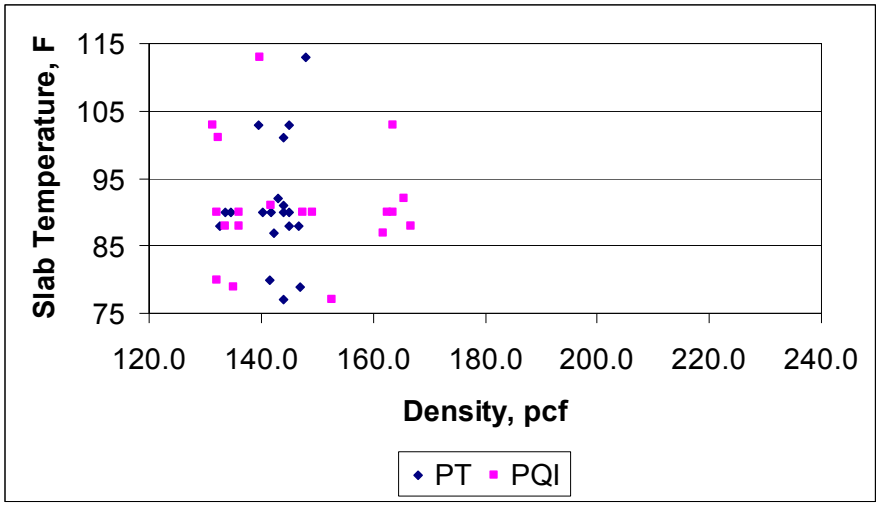


Figure A.115. Project 3 Day 5 Unadjusted Data vs. Slab Temperature

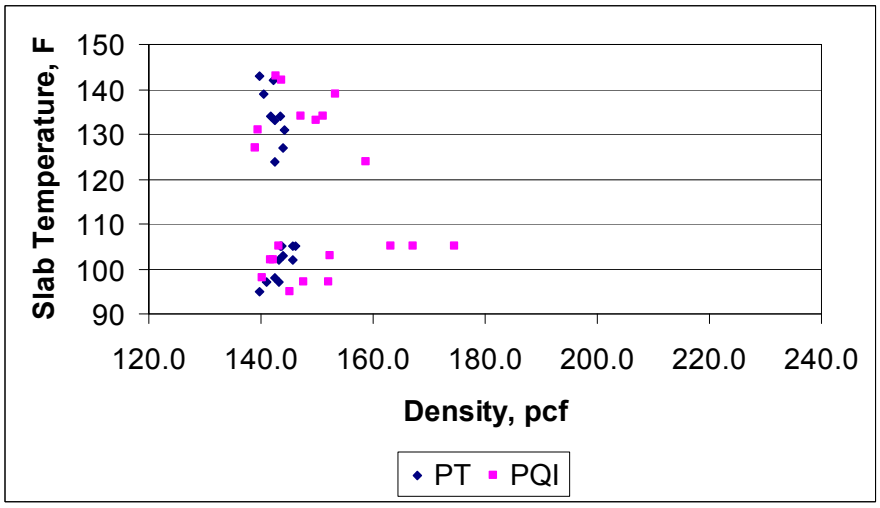


Figure A.116. Project 4 Day 1 Unadjusted Data vs. Slab Temperature

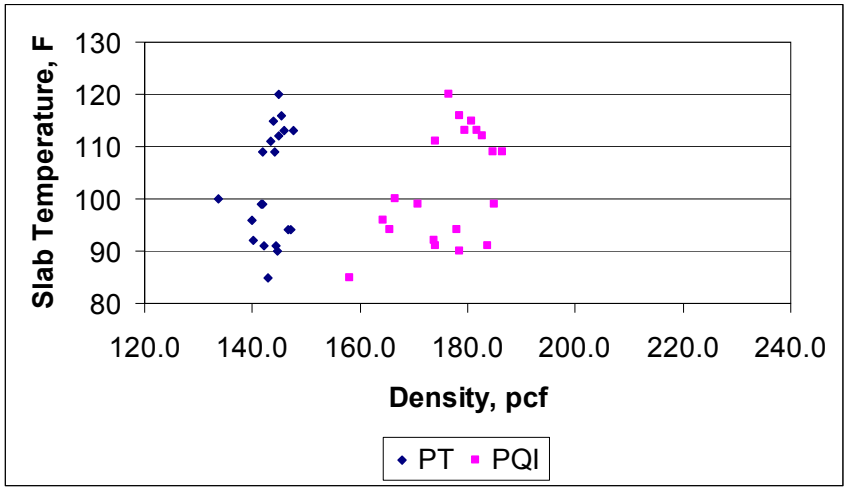


Figure A.117. Project 4 Day 2 Unadjusted Data vs. Slab Temperature

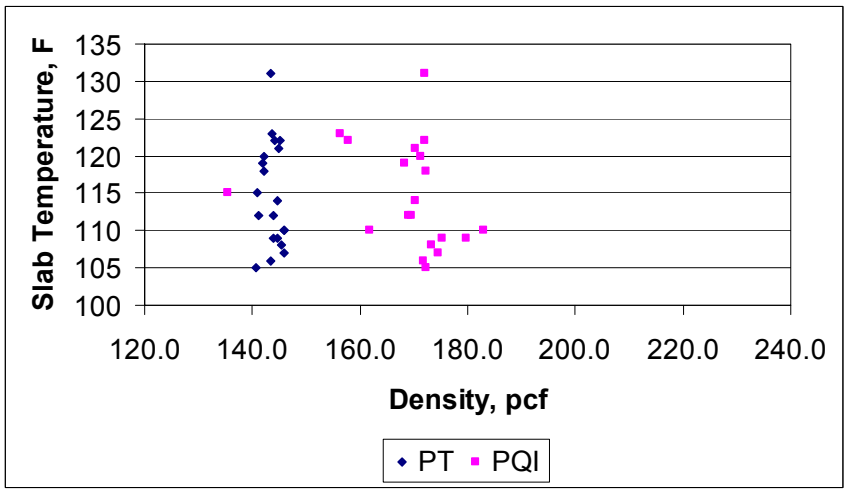


Figure A.118. Project 4 Day 3 Unadjusted Data vs. Slab Temperature

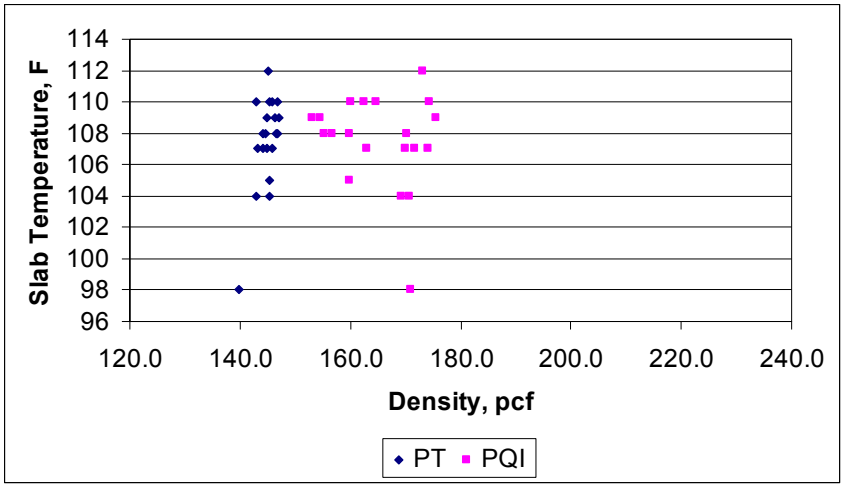


Figure A.119. Project 4 Day 4 Unadjusted Data vs. Slab Temperature

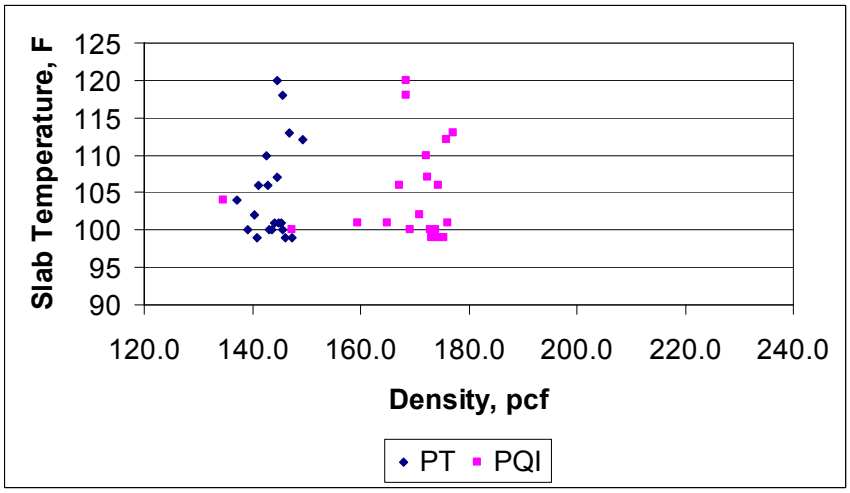


Figure A.120. Project 4 Day 5 Unadjusted Data vs. Slab Temperature

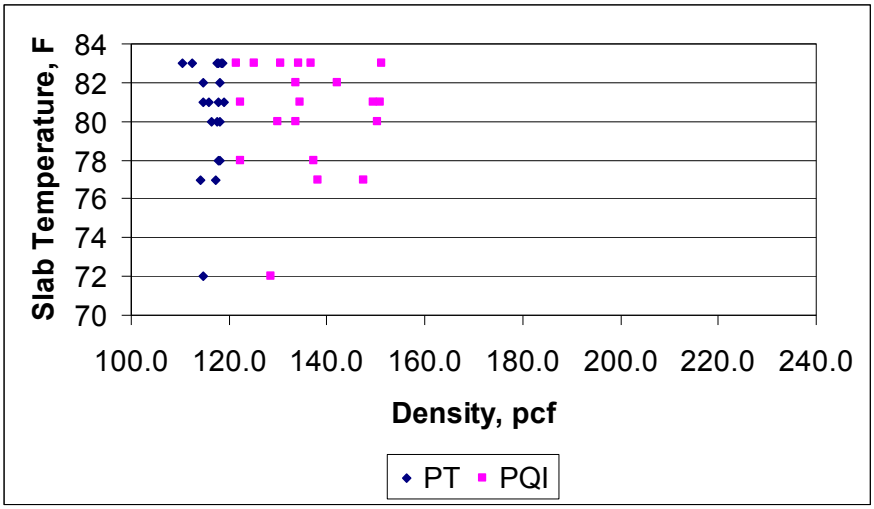


Figure A.121. Project 5 Day 1 Unadjusted Data vs. Slab Temperature

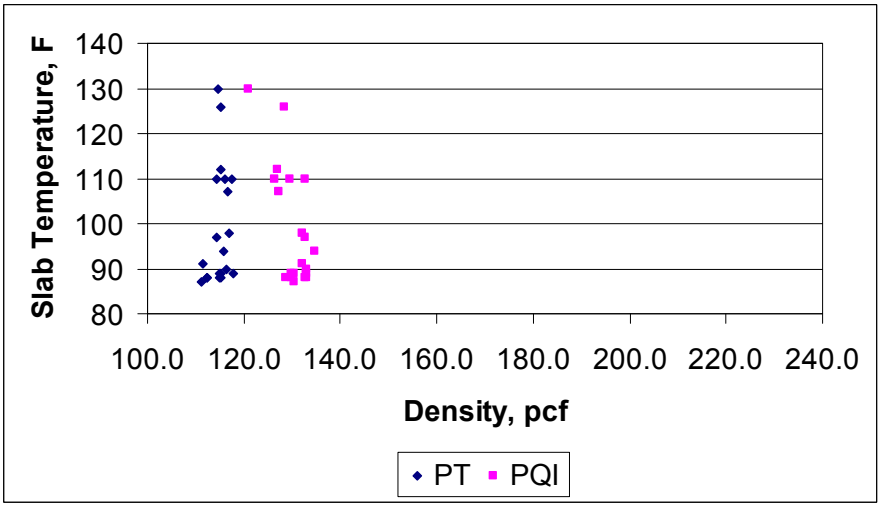


Figure A.122. Project 5 Day 2 Unadjusted Data vs. Slab Temperature

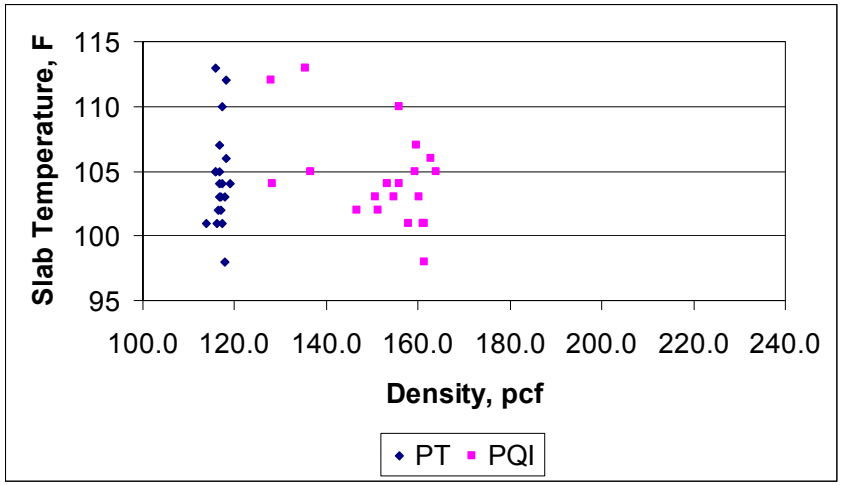


Figure A.123. Project 5 Day 3 Unadjusted Data vs. Slab Temperature

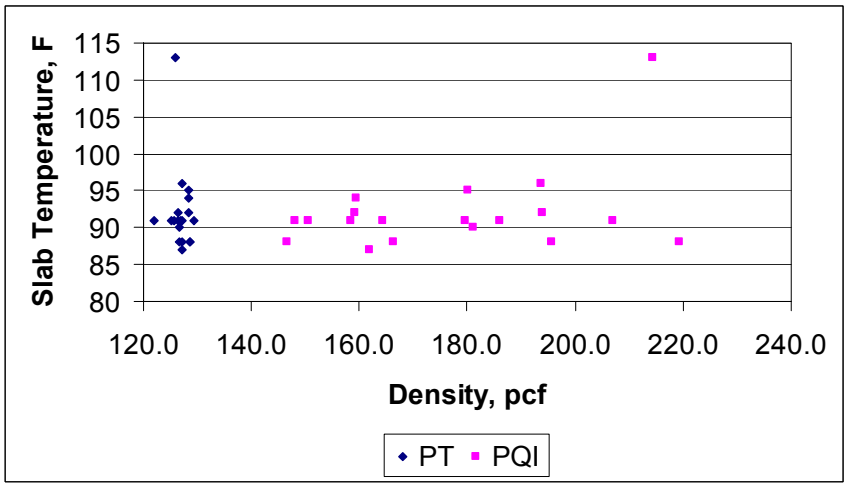


Figure A.124. Project 6 Day 1 Unadjusted Data vs. Slab Temperature

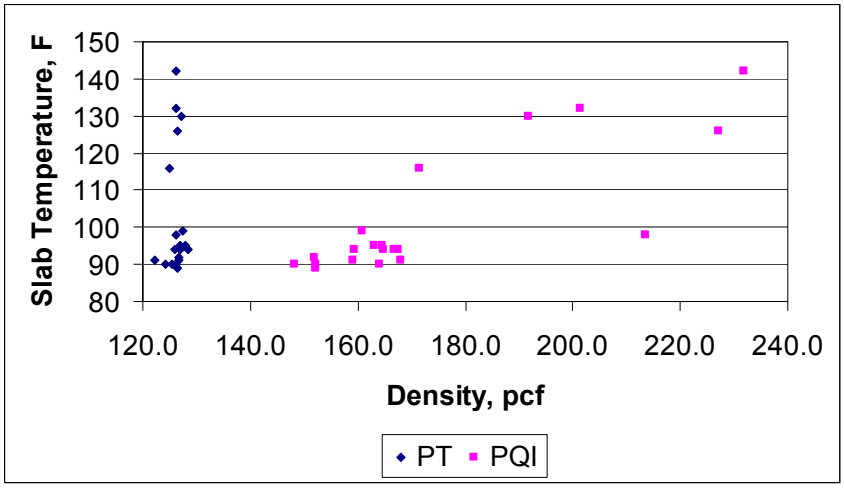


Figure A.125. Project 6 Day 2 Unadjusted Data vs. Slab Temperature

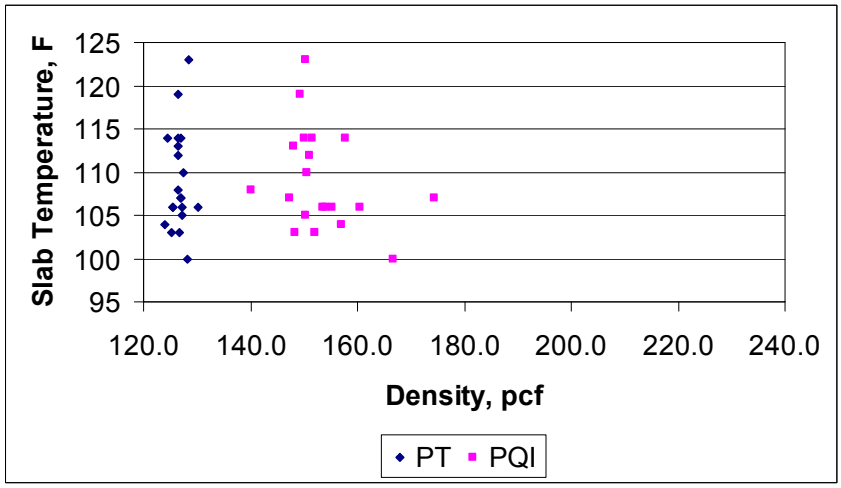


Figure A.126. Project 6 Day 3 Unadjusted Data vs. Slab Temperature

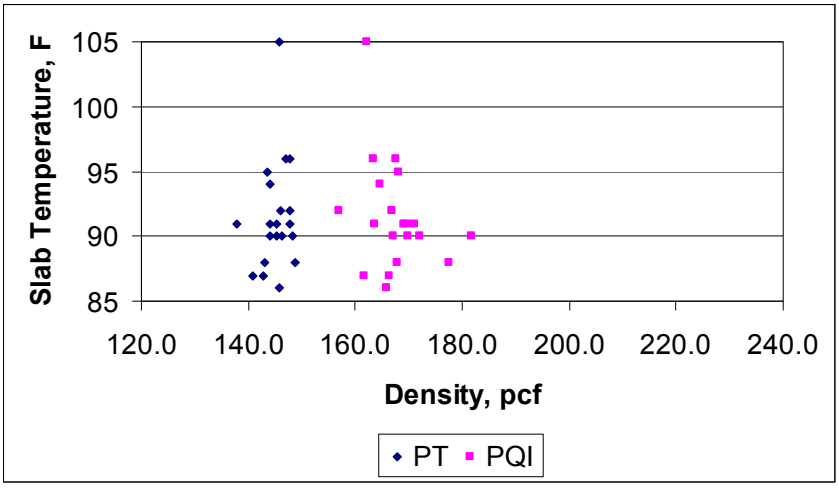


Figure A.127. Project 7 Day 1 Unadjusted Data vs. Slab Temperature

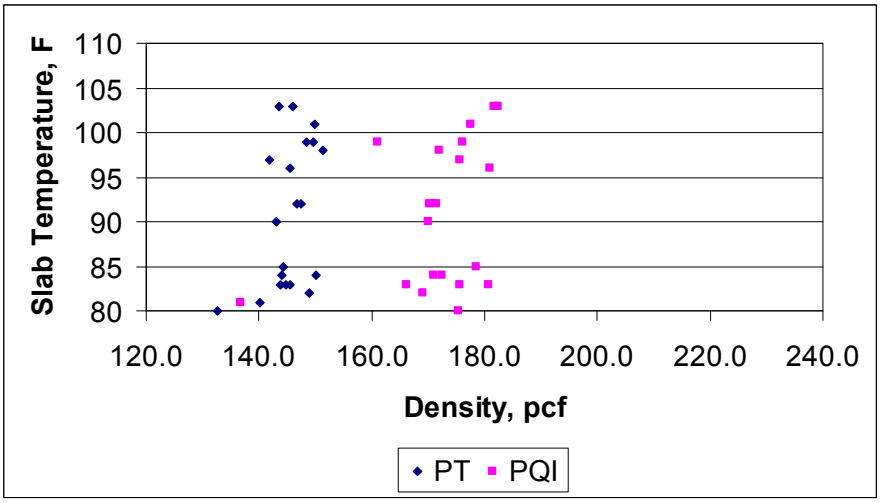


Figure A.128. Project 7 Day 2 Unadjusted Data vs. Slab Temperature

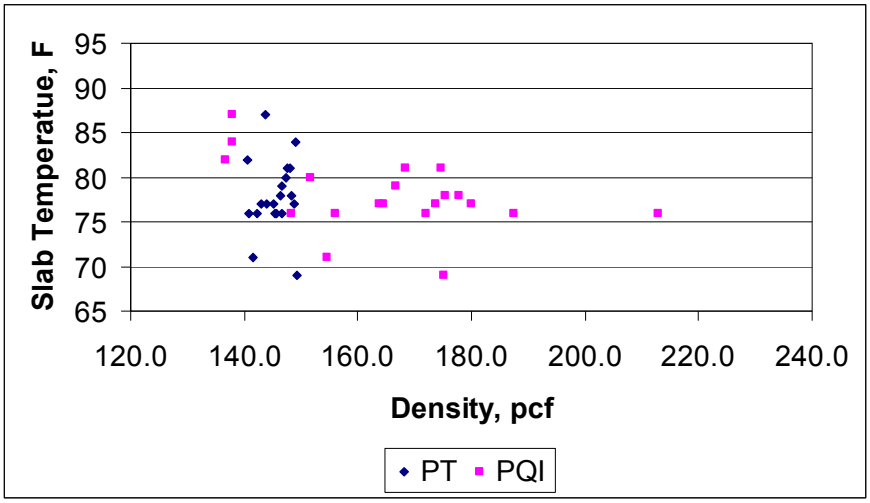


Figure A.129. Project 7 Day 3 Unadjusted Data vs. Slab Temperature

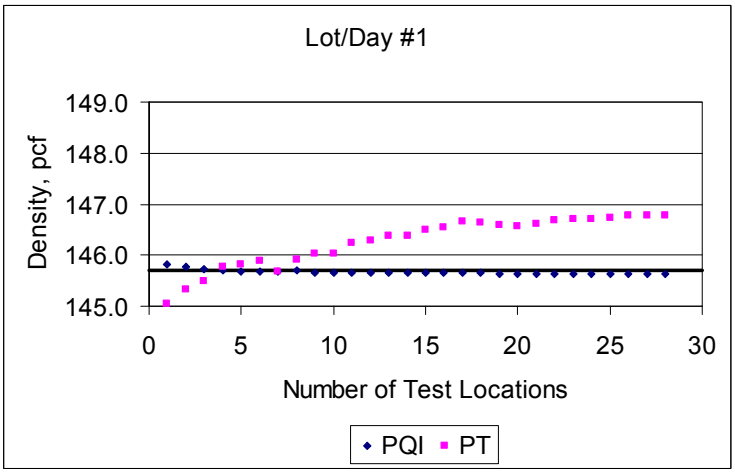


Figure A.130. Project 1 Day 1 Electromagnetic gauge density

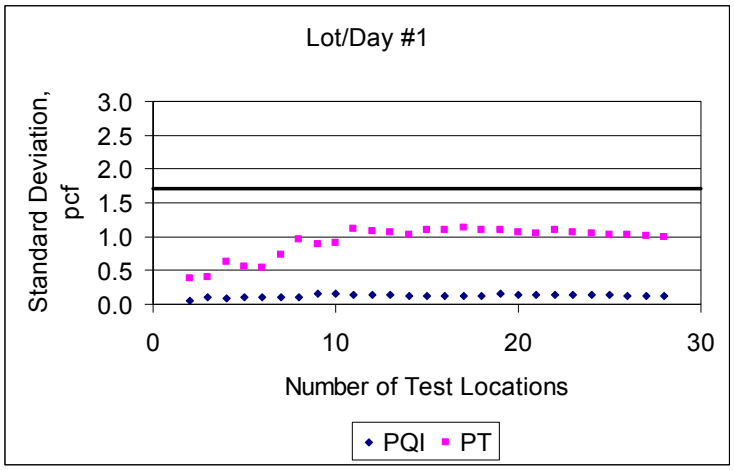


Figure A.131. Project 1 Day 1 Electromagnetic gauge Standard Deviation

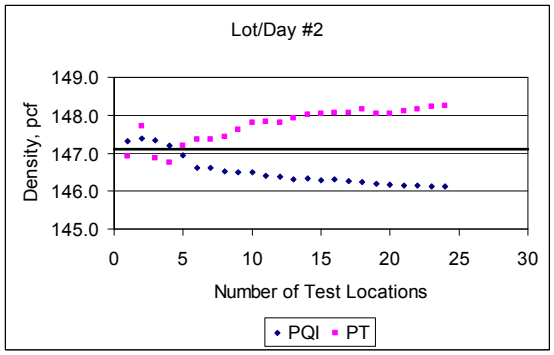


Figure A.132. Project 1 Day 2 Electromagnetic gauge density

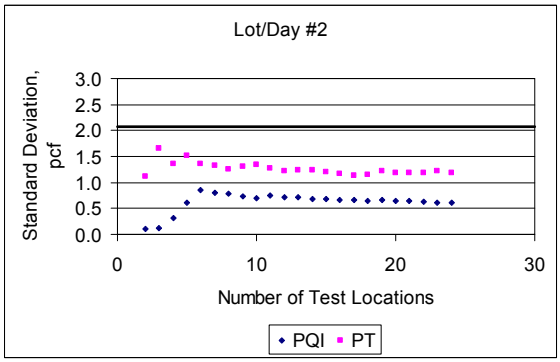


Figure A.133. Project 1 Day 2 Electromagnetic gauge Standard Deviation

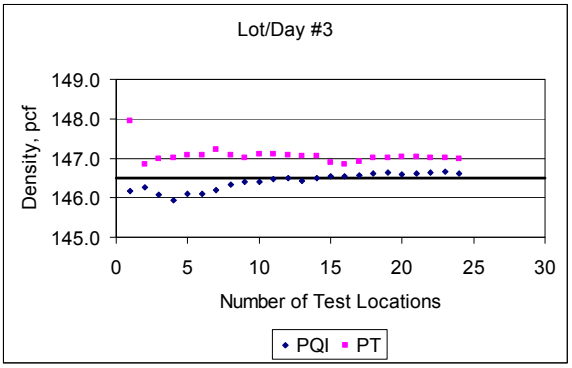


Figure A.134. Project 1 Day 3 Electromagnetic gauge density

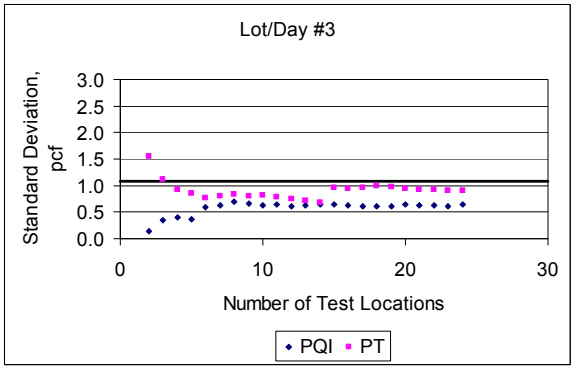


Figure A.135. Project 1 Day 3 Electromagnetic gauge Standard Deviation

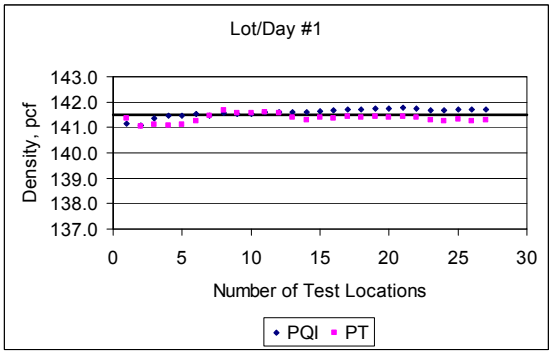


Figure A.136. Project 1 Lot 2 Electromagnetic gauge density

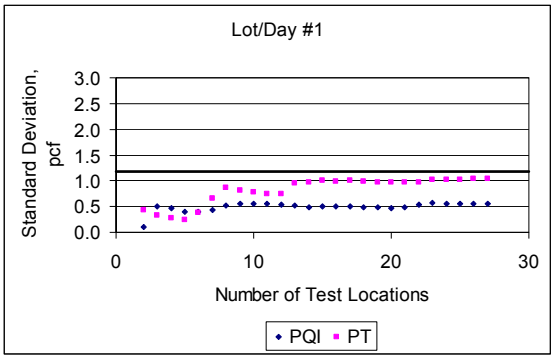


Figure A.137. Project 1 Lot 2 Electromagnetic gauge Standard Deviation

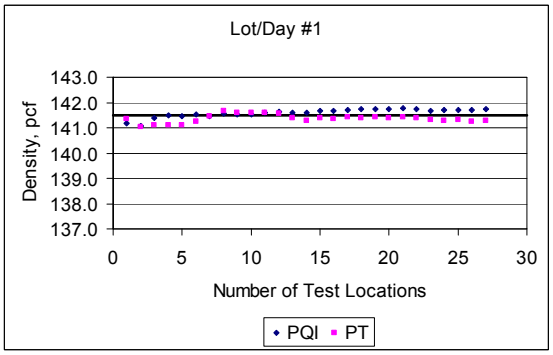


Figure A.138. Project 2 Day 1 Electromagnetic gauge density

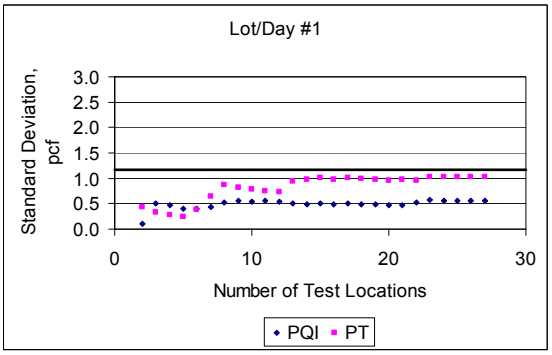


Figure A.139. Project 2 Day 1 Electromagnetic gauge Standard Deviation

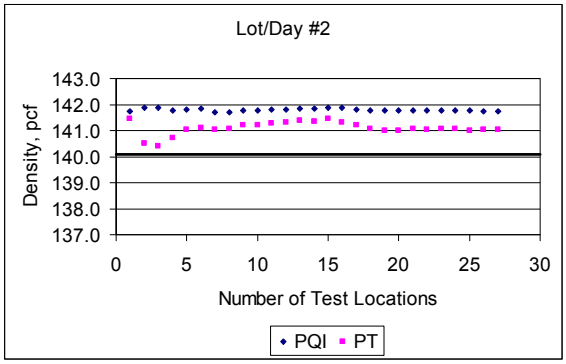


Figure A.140. Project 2 Day 2 Electromagnetic gauge density

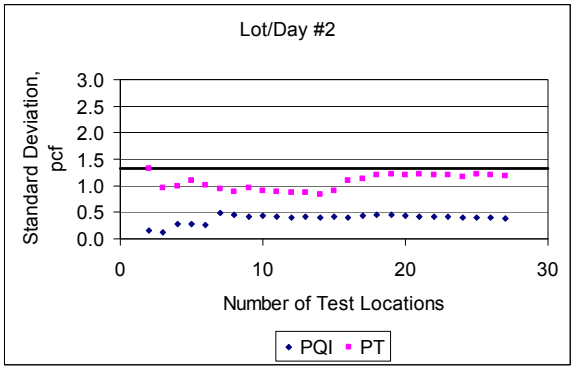


Figure A.141. Project 2 Day 2 Electromagnetic gauge Standard Deviation

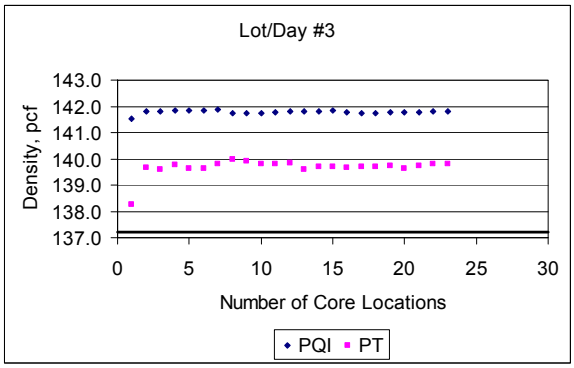


Figure A.142. Project 2 Day 3 Electromagnetic gauge density

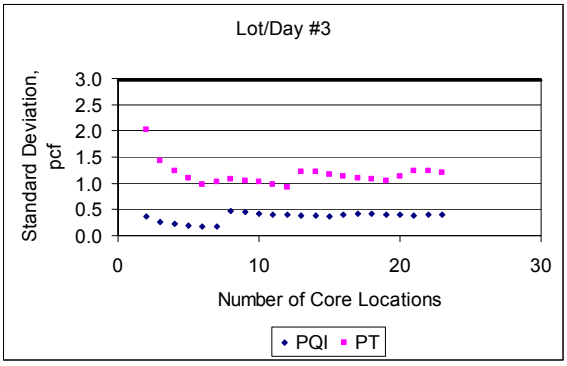


Figure A.143. Project 2 Day 3 Electromagnetic gauge Standard Deviation

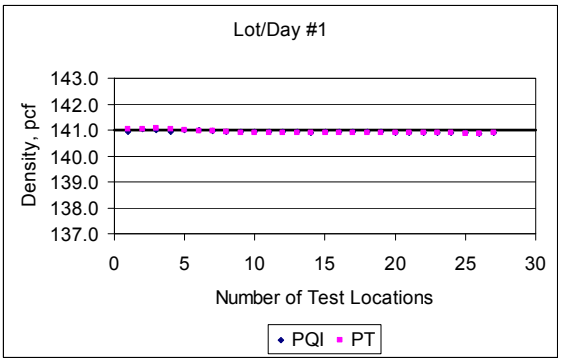


Figure A.144. Project 3 Day 1 Electromagnetic gauge density

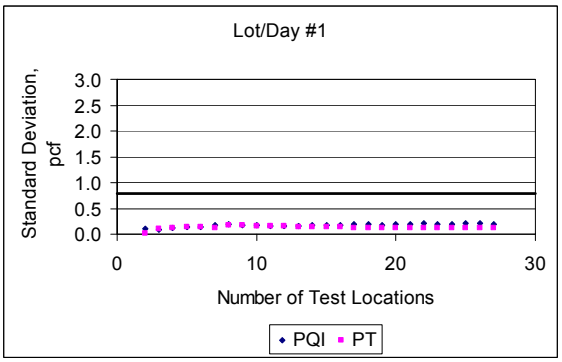


Figure A.145. Project 3 Day 1 Electromagnetic gauge Standard Deviation

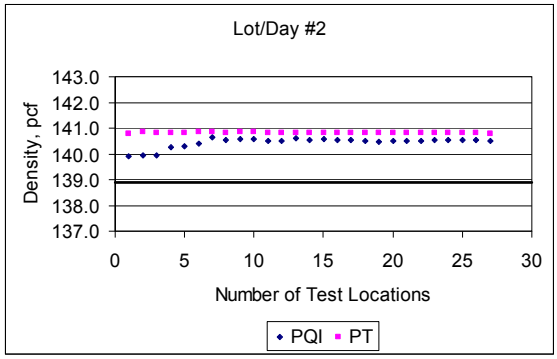


Figure A.146. Project 3 Day 2 Electromagnetic gauge density

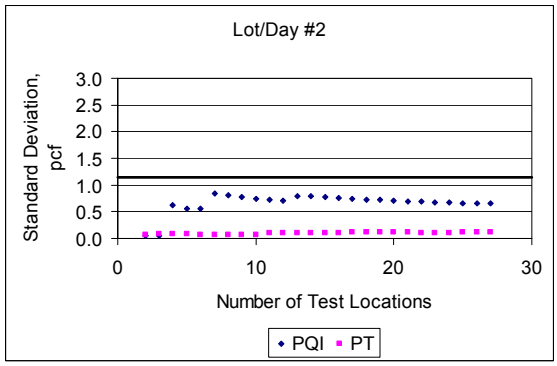


Figure A.147. Project 3 Day 2 Electromagnetic gauge Standard Deviation

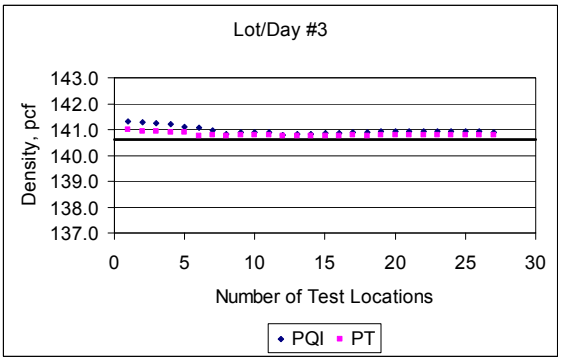


Figure A.148. Project 3 Day 3 Electromagnetic gauge density

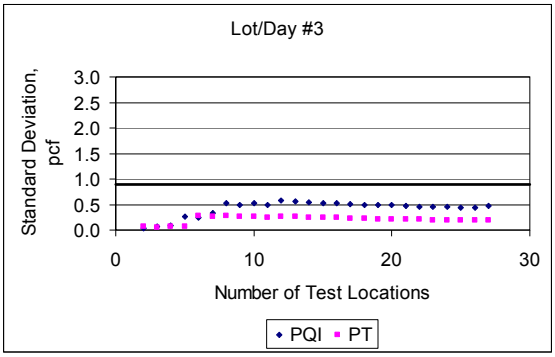


Figure A.149. Project 3 Day 3 Electromagnetic gauge Standard Deviation

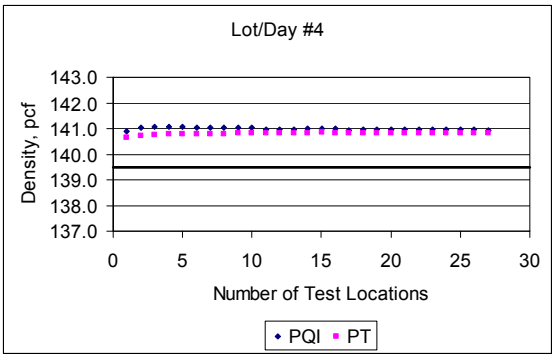


Figure A.150. Project 3 Day 4 Electromagnetic gauge density

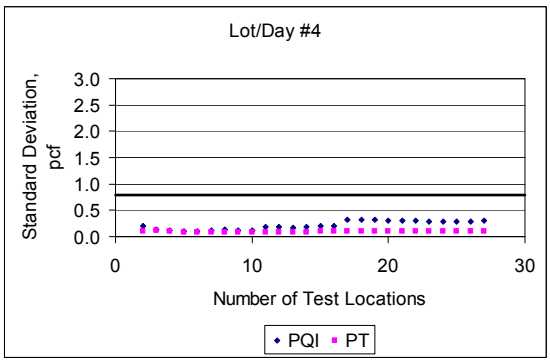


Figure A.151. Project 3 Day 4 Electromagnetic gauge Standard Deviation

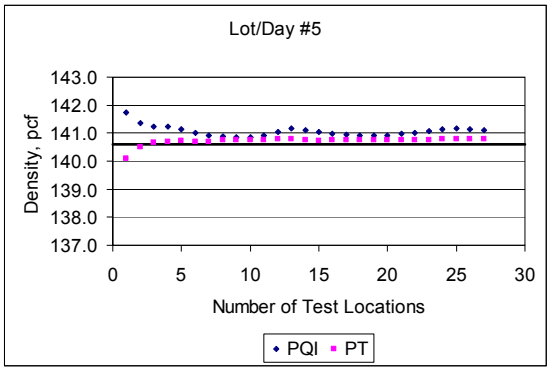


Figure A.152. Project 3 Day 5 Electromagnetic gauge density

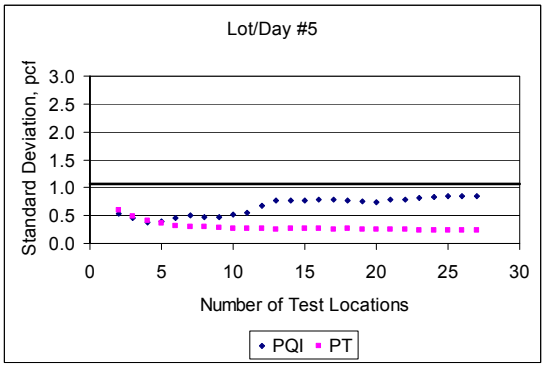


Figure A.153. Project 3 Day 5 Electromagnetic gauge Standard Deviation

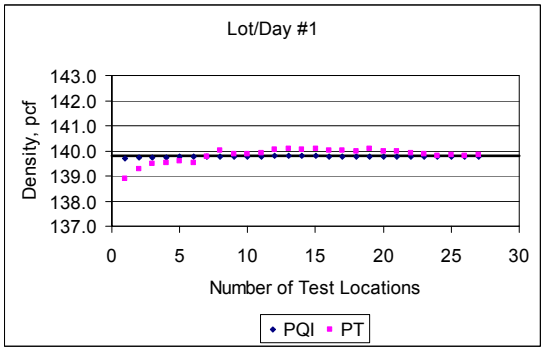


Figure A.154. Project 4 Day 1 Electromagnetic gauge density

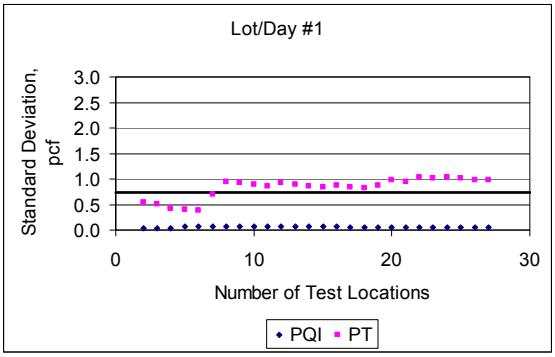


Figure A.155. Project 4 Day 1 Electromagnetic gauge Standard Deviation

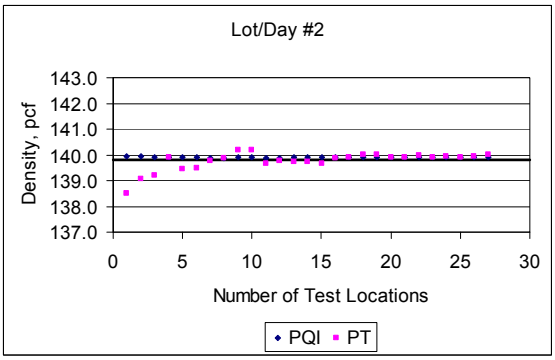


Figure A.156. Project 4 Day 2 Electromagnetic gauge density

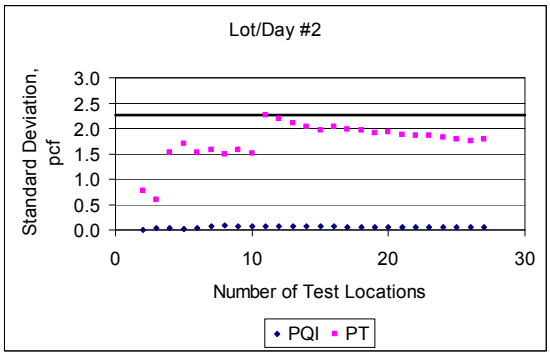


Figure A.157. Project 4 Day 2 Electromagnetic gauge Standard Deviation

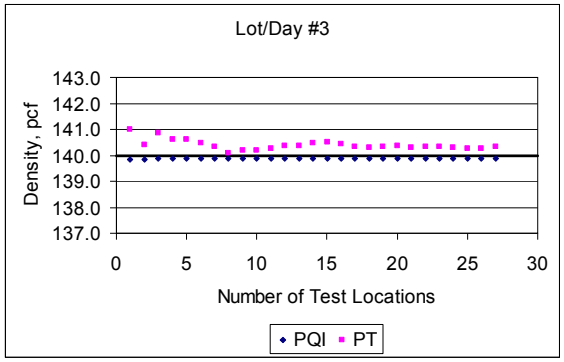


Figure A.158. Project 4 Day 3 Electromagnetic gauge density

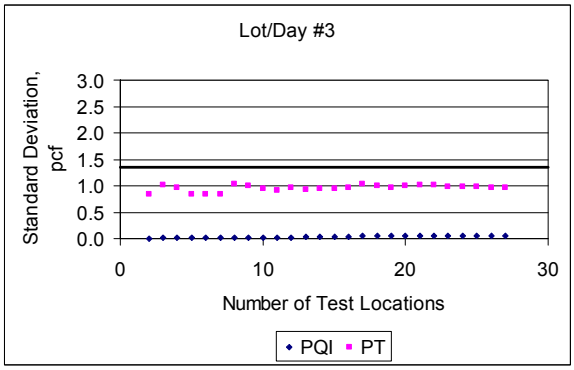


Figure A.159. Project 4 Day 3 Electromagnetic gauge Standard Deviation

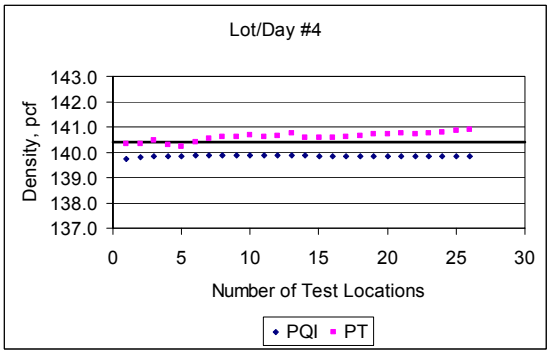


Figure A.160. Project 4 Day 4 Electromagnetic gauge density

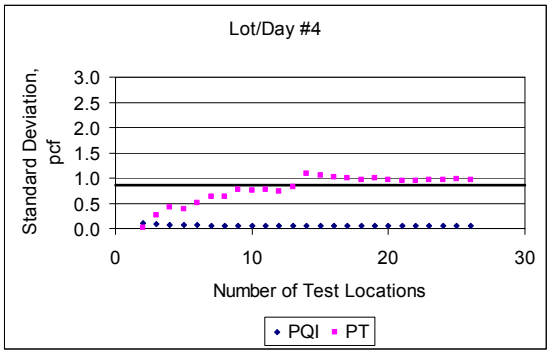


Figure A.161. Project 4 Day 4 Electromagnetic gauge Standard Deviation

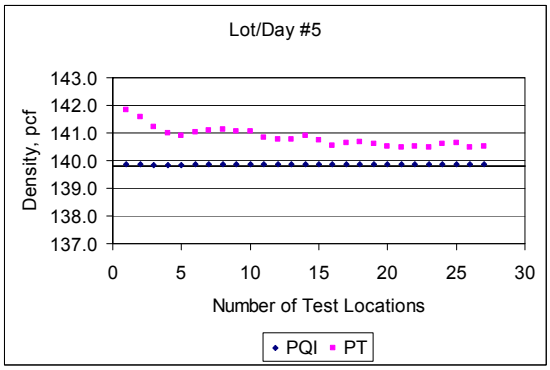


Figure A.162. Project 4 Day 5 Electromagnetic gauge density

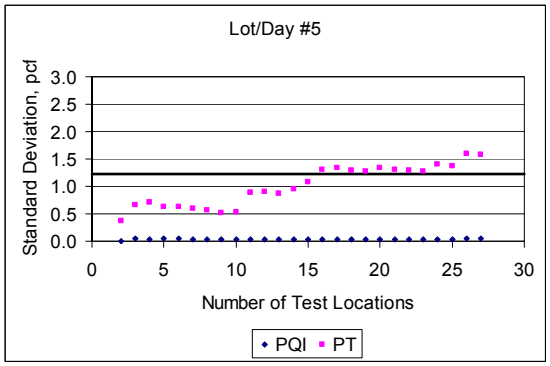


Figure A.163. Project 4 Day 5 Electromagnetic gauge Standard Deviation

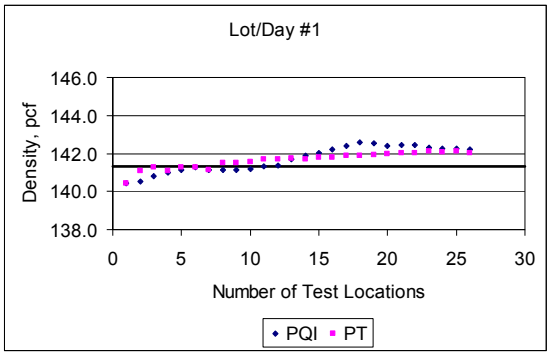


Figure A.164. Project 5 Day 1 Electromagnetic gauge density

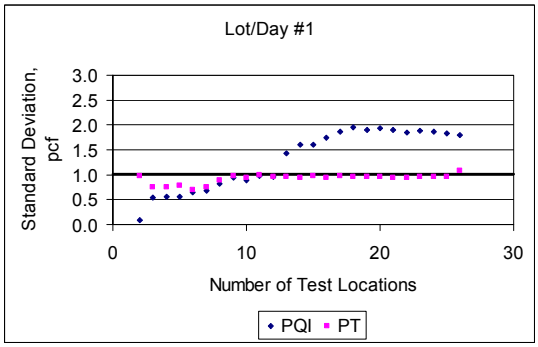


Figure A.165. Project 5 Day 1 Electromagnetic gauge Standard Deviation

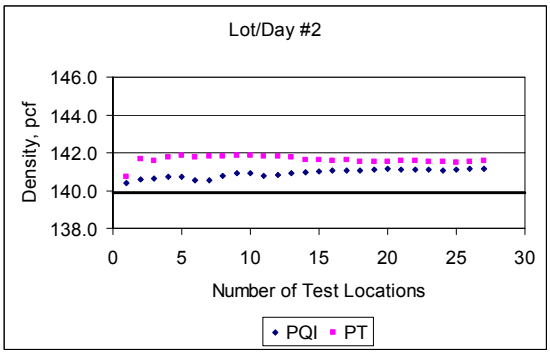


Figure A.166. Project 5 Day 2 Electromagnetic gauge density

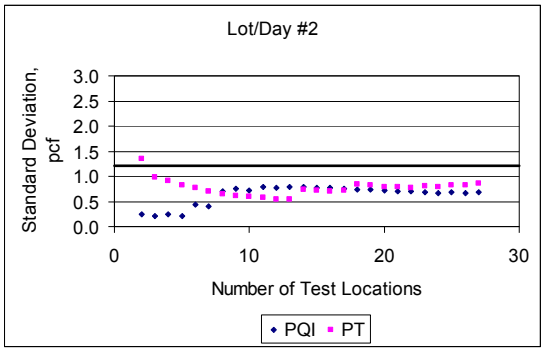


Figure A.167. Project 5 Day 2 Electromagnetic gauge Standard Deviation

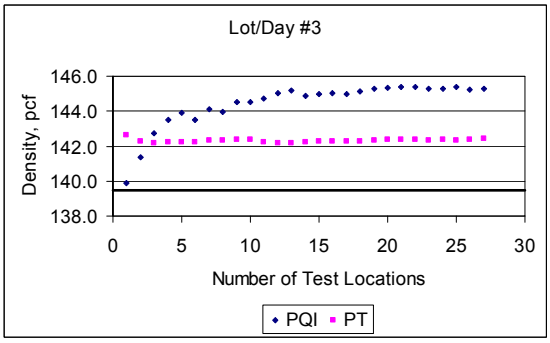


Figure A.168. Project 5 Day 3 Electromagnetic gauge density

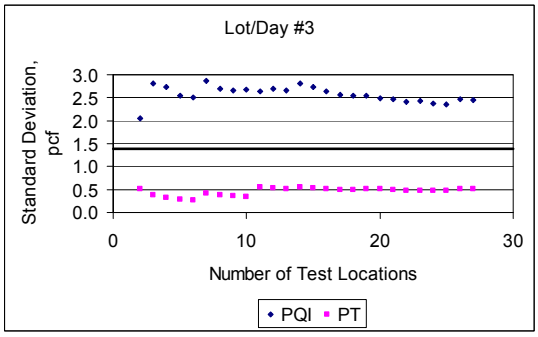


Figure A.169. Project 5 Day 3 Electromagnetic gauge Standard Deviation

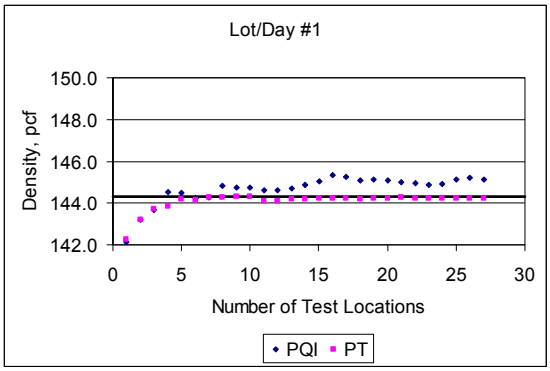


Figure A.170. Project 6 Day 1 Electromagnetic gauge density

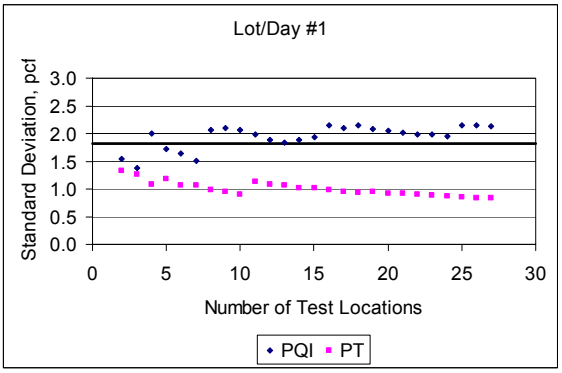


Figure A.171. Project 6 Day 1 Electromagnetic gauge Standard Deviation

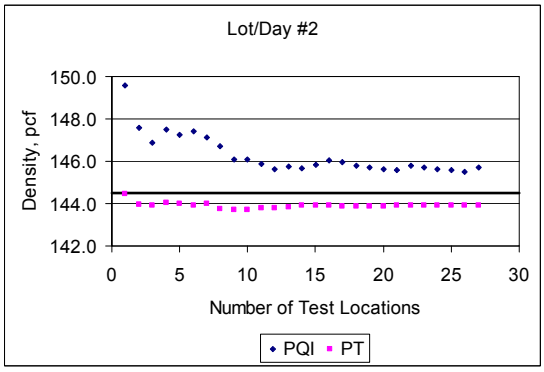


Figure A.172. Project 6 Day 2 Electromagnetic gauge density

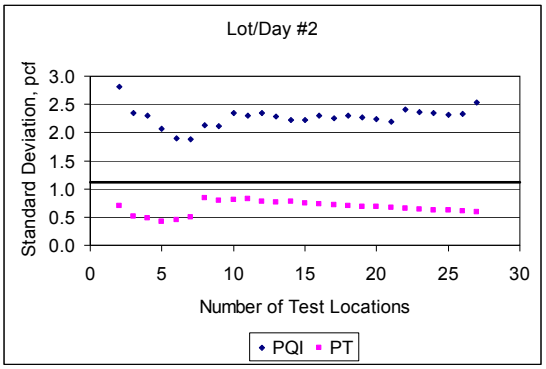


Figure A.173. Project 6 Day 2 Electromagnetic gauge Standard Deviation

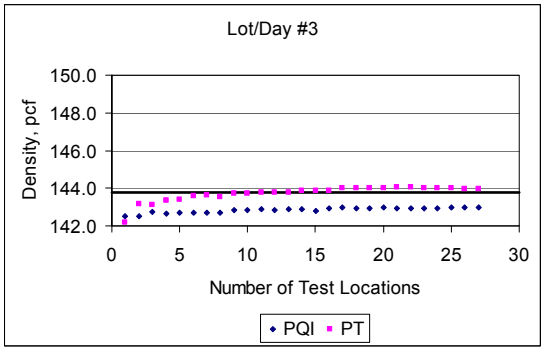


Figure A.174. Project 6 Day 3 Electromagnetic gauge density

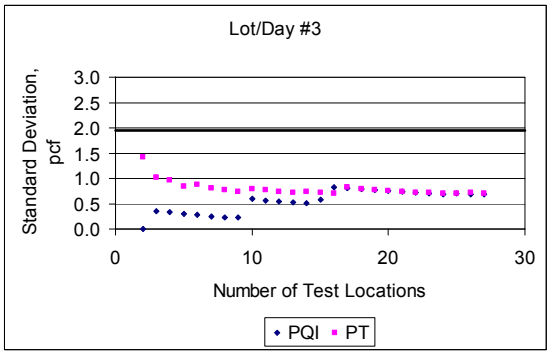


Figure A.175. Project 6 Day 3 Electromagnetic gauge Standard Deviation

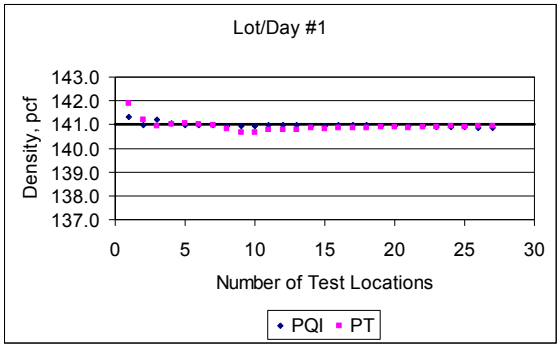


Figure A.176. Project 7 Day 1 Electromagnetic gauge density

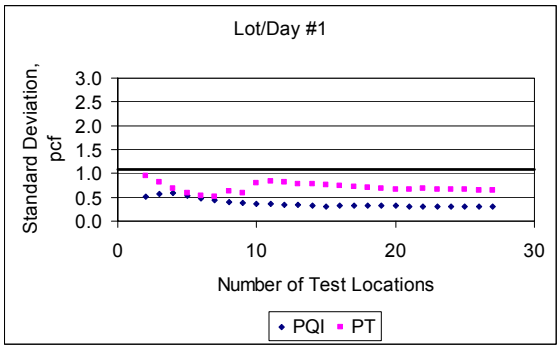


Figure A.177. Project 7 Day 1 Electromagnetic gauge Standard Deviation

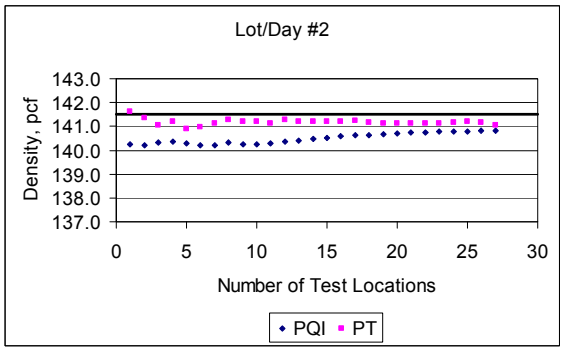


Figure A.178. Project 7 Day 2 Electromagnetic gauge density

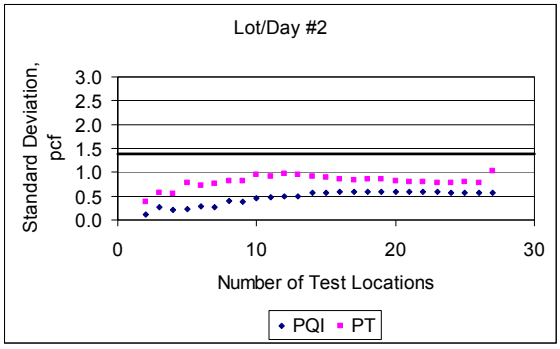


Figure A.179. Project 7 Day 2 Electromagnetic gauge Standard Deviation

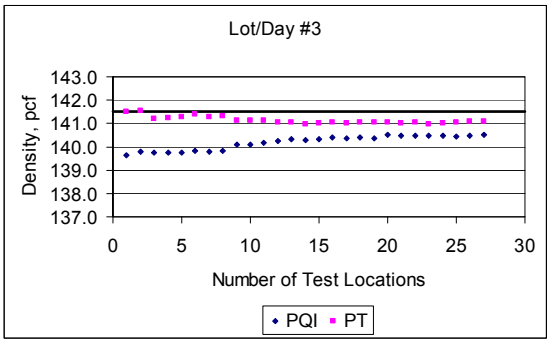


Figure A.180. Project 7 Day 3 Electromagnetic gauge density

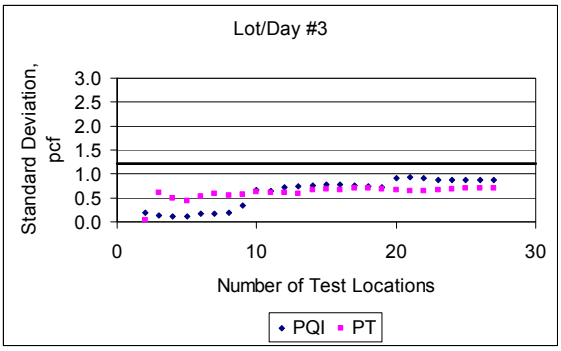


Figure A.181. Project 7 Day 3 Electromagnetic gauge Standard Deviation

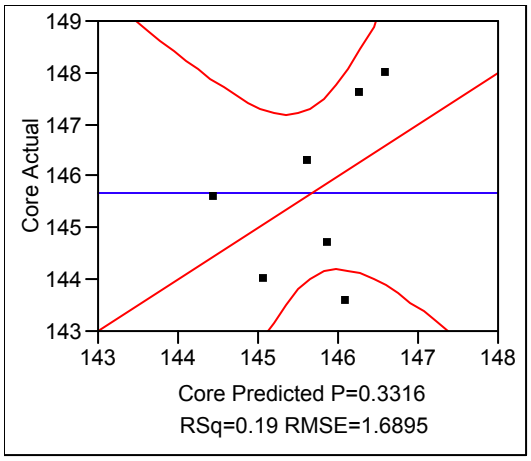


Figure A.182. Project 1 Day 1 Pavetracker regression equation

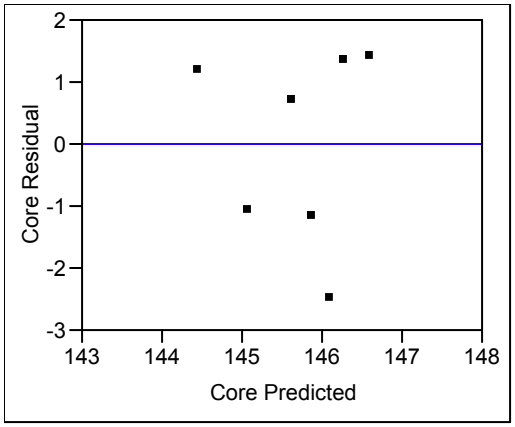


Figure A.183. Project 1 Day 1 Pavetracker residuals

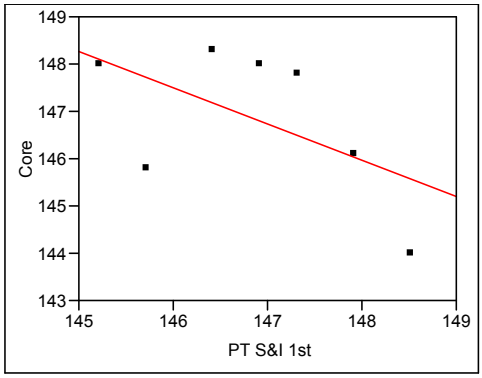


Figure A.184. Project 1 Day 2 & 3 Pavetracker regression equation

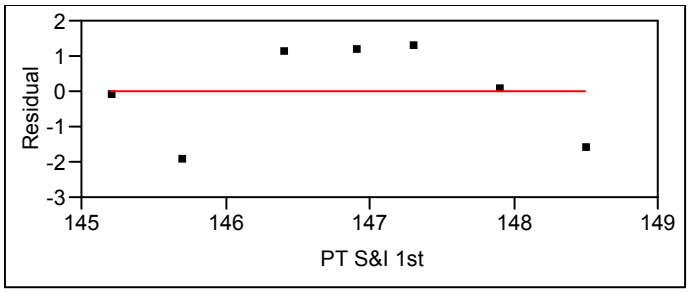


Figure A.185. Project 1 Day 2 & 3 Pavetracker residuals

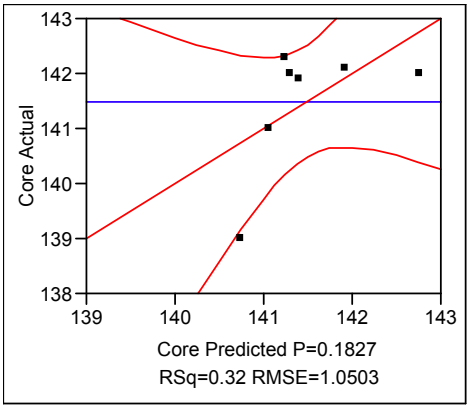


Figure A.186. Project 2 Day 1 Pavetracker regression equation

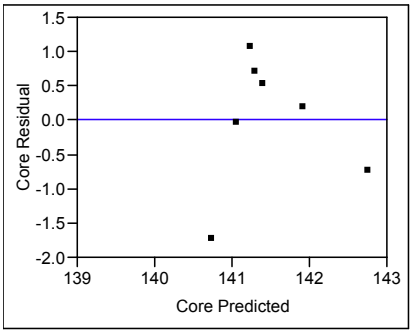


Figure A.187. Project 2 Day 1 Pavetracker residuals

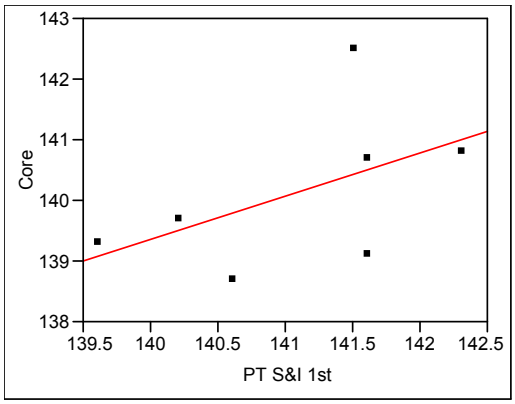


Figure A.188. Project 2 Day 2 Pavetracker regression equation

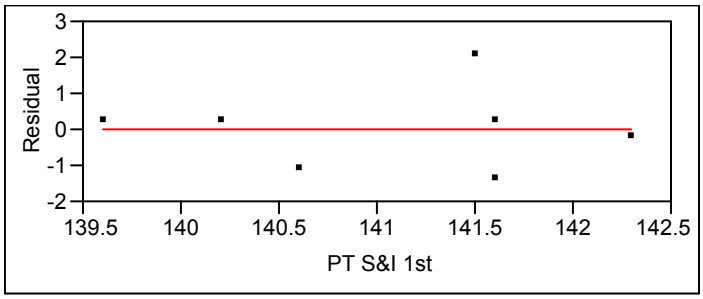


Figure A.189. Project 2 Day 2 Pavetracker residuals

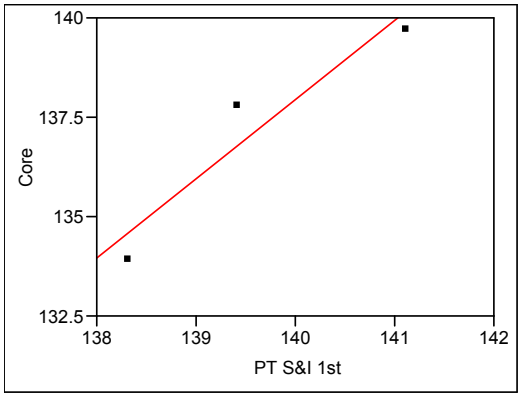


Figure A.190. Project 2 Day 3 Pavetracker regression equation

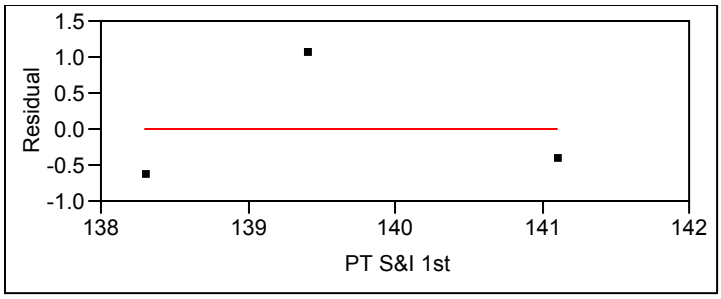


Figure A.191. Project 2 Day 3 Pavetracker residuals

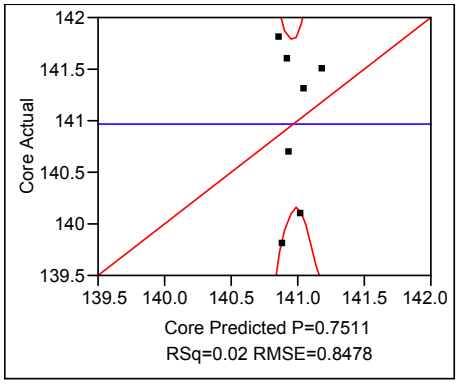


Figure A.192. Project 3 Day 1 Pavetracker regression equation

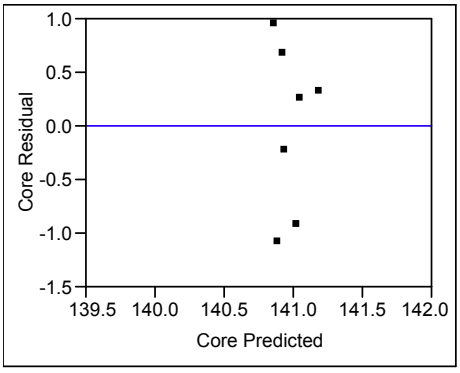


Figure A.193. Project 3 Day 1 Pavetracker residuals

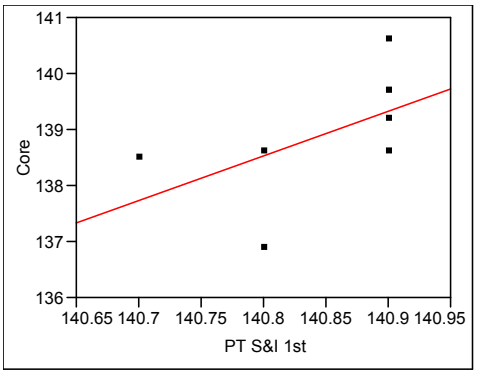


Figure A.194. Project 3 Day 2 Pavetracker regression equation

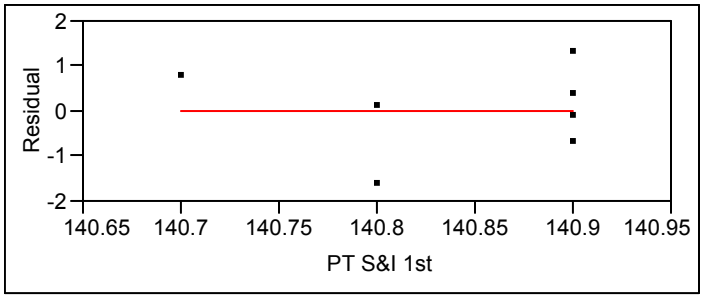


Figure A.195. Project 3 Day 2 Pavetracker residuals

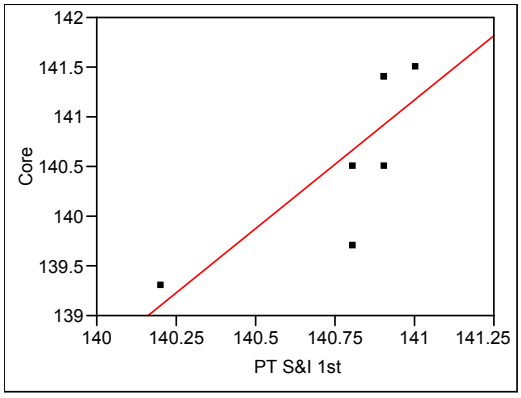


Figure A.196. Project 3 Day 3 Pavetracker regression equation

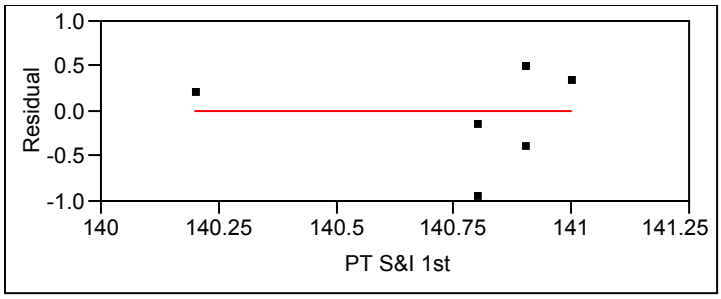


Figure A.197. Project 3 Day 3 Pavetracker residuals

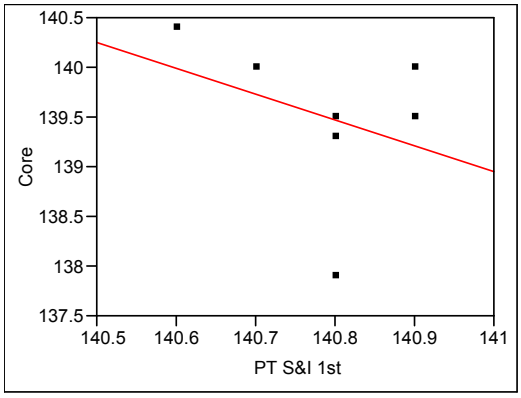


Figure A.198. Project 3 Day 4 Pavetracker regression equation

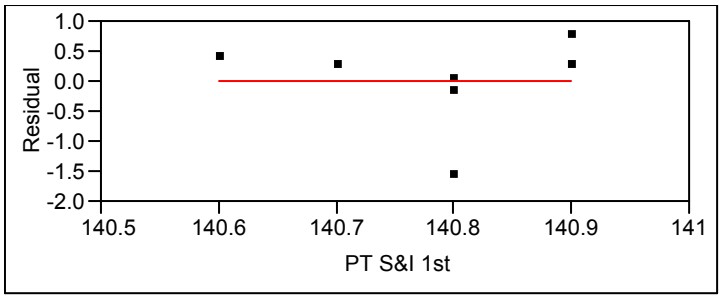


Figure A.199. Project 3 Day 4 Pavetracker residuals

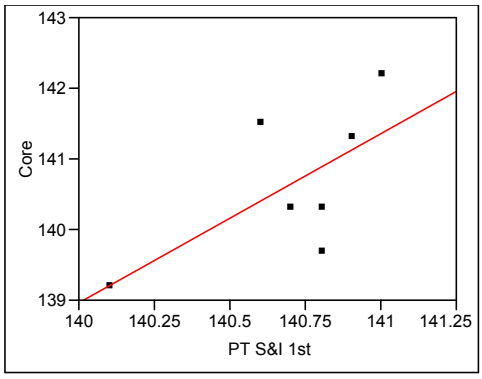


Figure A.200. Project 3 Day 5 Pavetracker regression equation

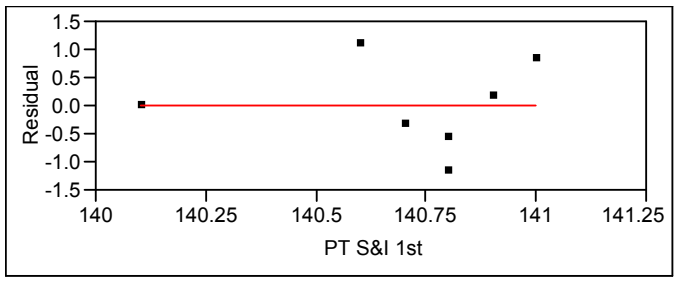


Figure A.201. Project 3 Day 5 Pavetracker residuals

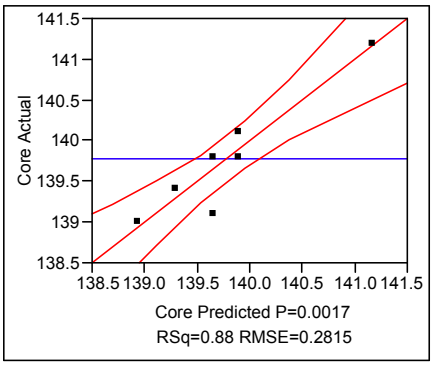


Figure A.202. Project 4 Day 1 Pavetracker regression equation

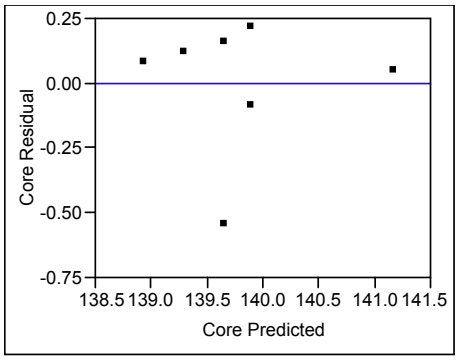


Figure A.203. Project 4 Day 1 Pavetracker residuals

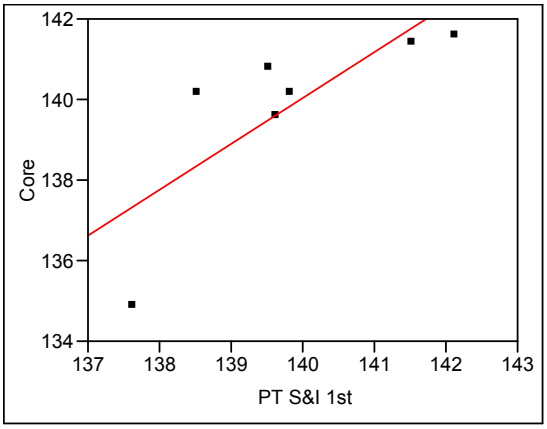


Figure A.204. Project 4 Day 2 Pavetracker regression equation

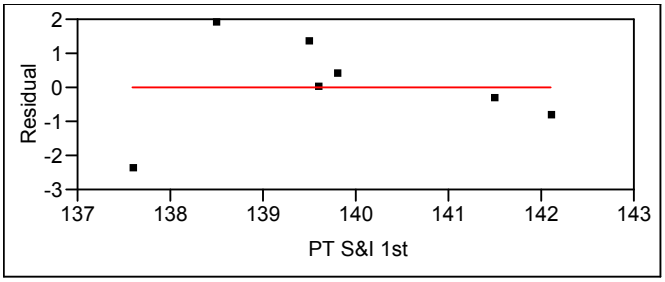


Figure A.205. Project 4 Day 2 Pavetracker residuals

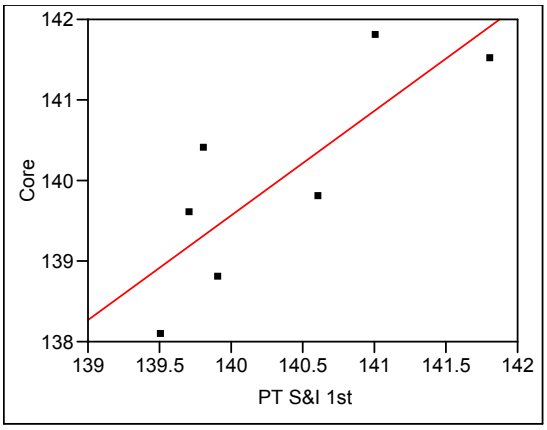


Figure A.206. Project 4 Day 3 Pavetracker regression equation

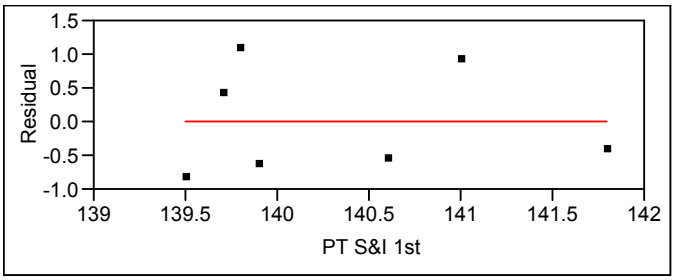


Figure A.207. Project 4 Day 3 Pavetracker residuals

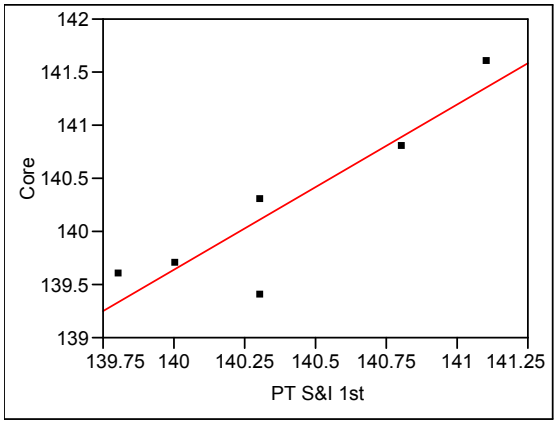


Figure A.208. Project 4 Day 4 Pavetracker regression equation

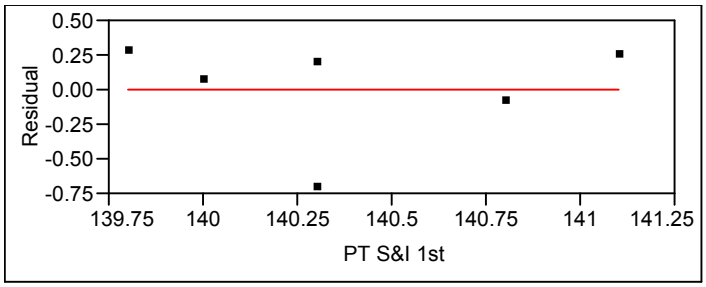


Figure A.209. Project 4 Day 4 Pavetracker residuals

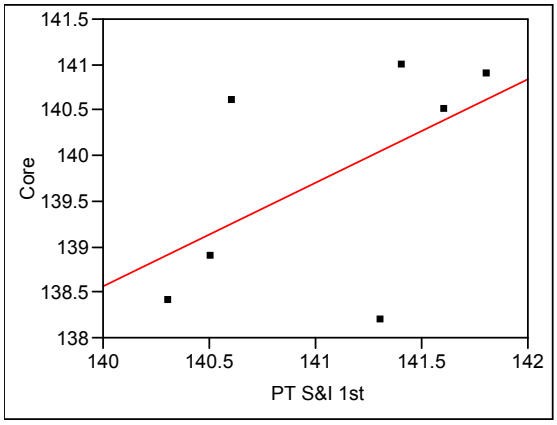


Figure A.210. Project 4 Day 5 Pavetracker regression equation

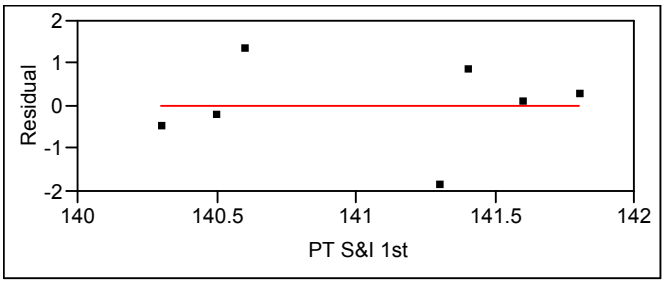


Figure A.211. Project 4 Day 5 Pavetracker residuals

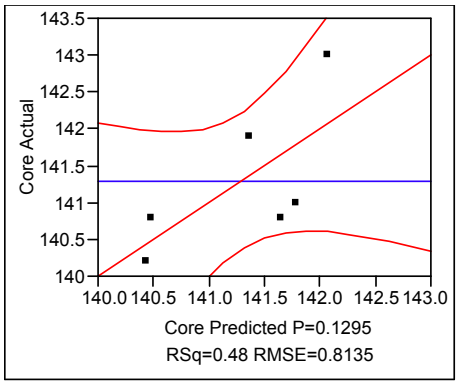


Figure A.212. Project 5 Day 1 Pavetracker regression equation

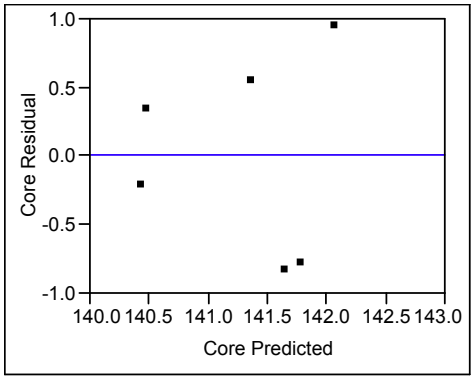


Figure A.213. Project 5 Day 1 Pavetracker residuals

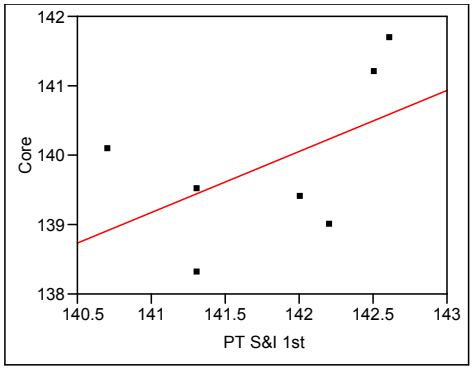


Figure A.214. Project 5 Day 2 Pavetracker regression equation

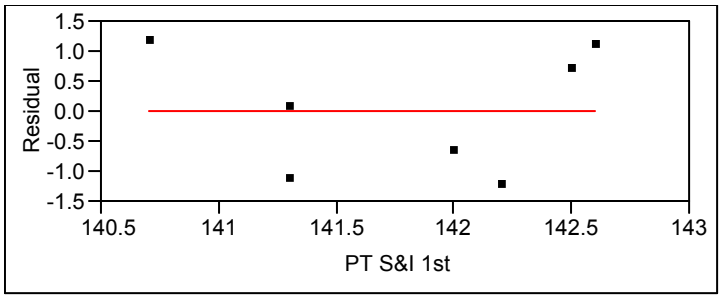


Figure A.215. Project 5 Day 2 Pavetracker residuals

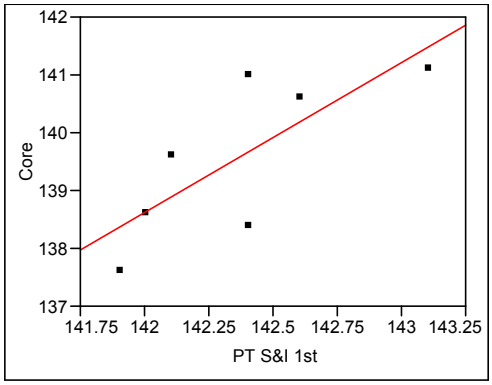


Figure A.216. Project 5 Day 3 Pavetracker regression equation

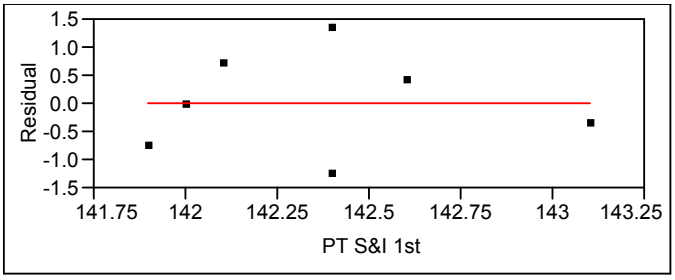


Figure A.217. Project 5 Day 3 Pavetracker residuals

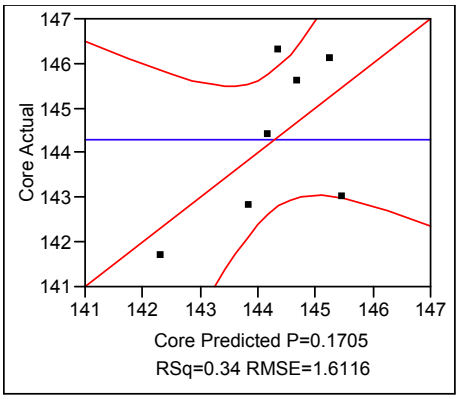


Figure A.218. Project 6 Day 1 Pavetracker regression equation

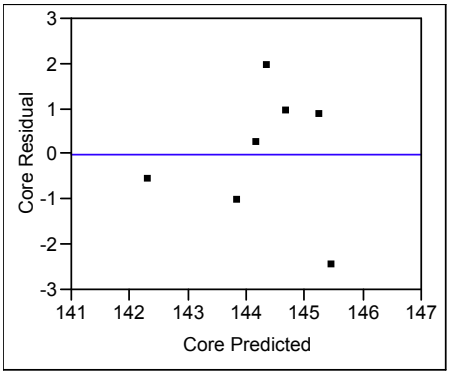


Figure A.219. Project 6 Day 1 Pavetracker residuals

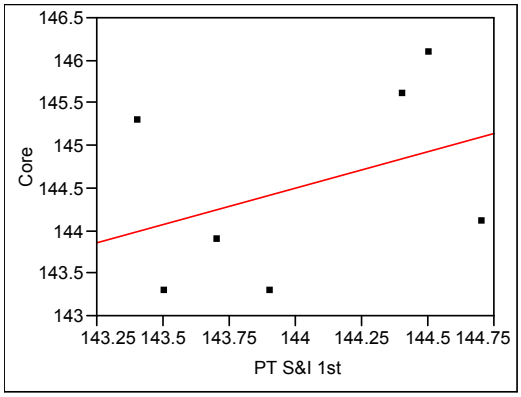


Figure A.220. Project 6 Day 2 Pavetracker regression equation

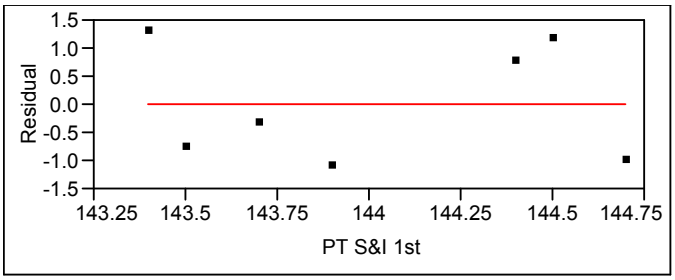


Figure A.221. Project 6 Day 2 Pavetracker residuals

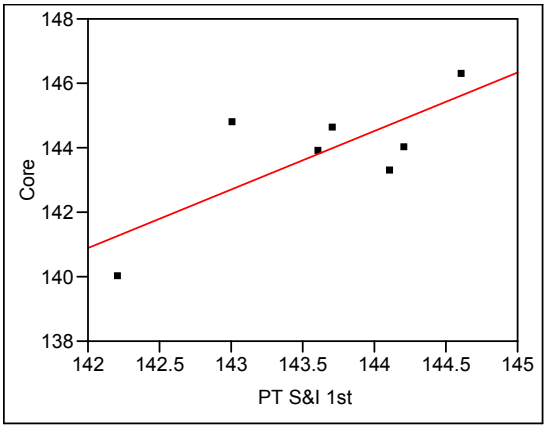


Figure A.222. Project 6 Day 3 Pavetracker regression equation

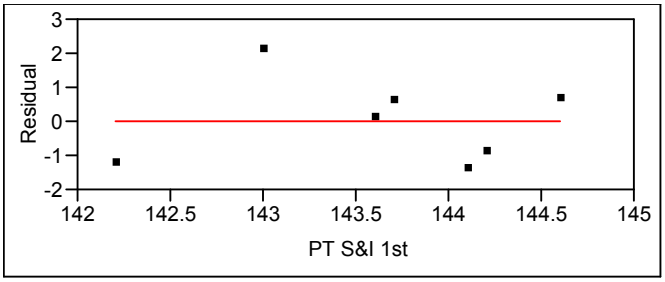


Figure A.223. Project 6 Day 3 Pavetracker residuals

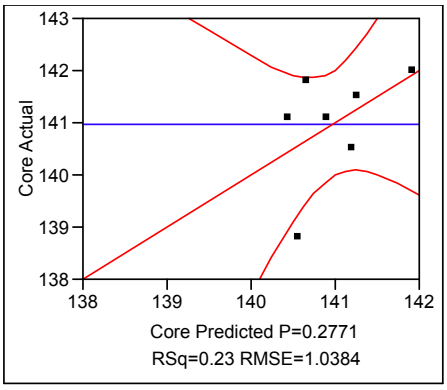


Figure A.224. Project 7 Day 1 Pavetracker regression equation

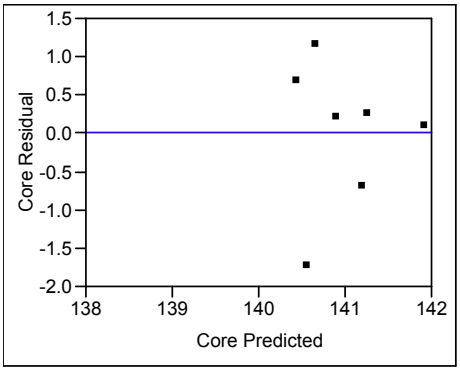


Figure A.225. Project 7 Day 1 Pavetracker residuals

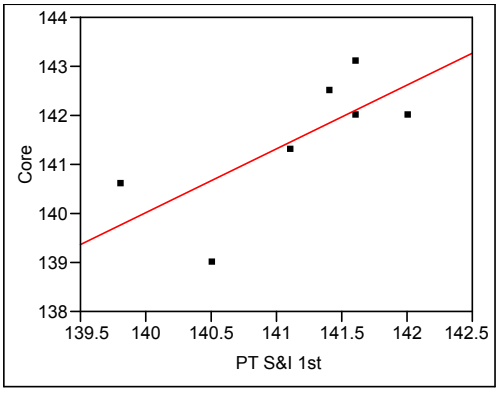


Figure A.226. Project 7 Day 2 Pavetracker regression equation

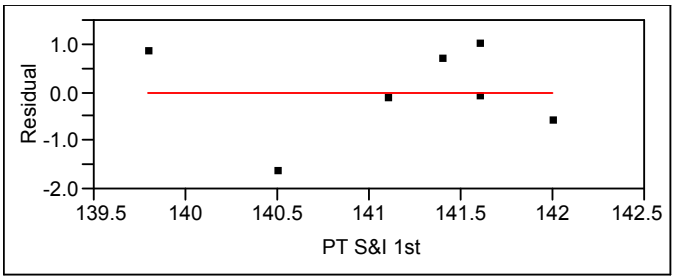


Figure A.227. Project 7 Day 2 Pavetracker residuals

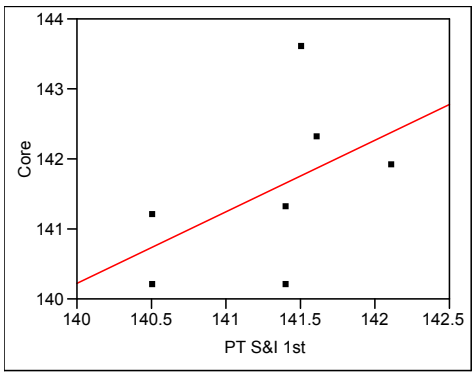


Figure A.228. Project 7 Day 3 Pavetracker regression equation

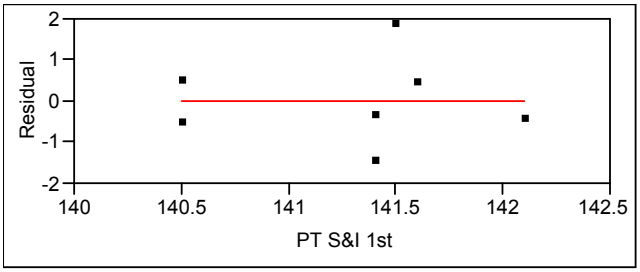


Figure A.229. Project 7 Day 3 Pavetracker residuals

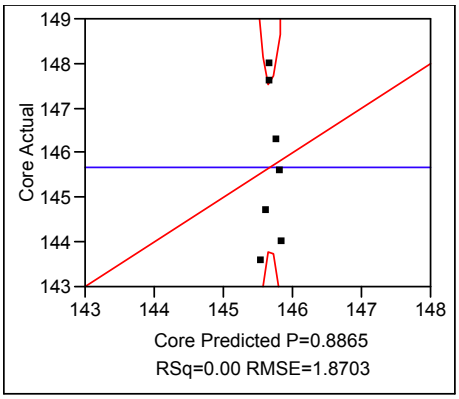


Figure A.230. Project 1 Day 1 PQI regression equation

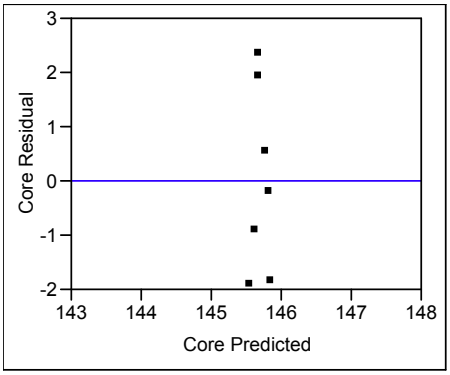


Figure A.231. Project 1 Day 1 PQI residuals

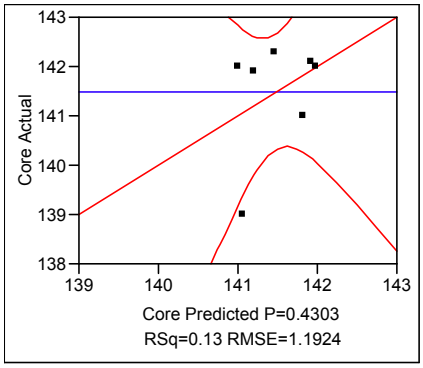


Figure A.232. Project 2 Day 1 PQI regression equation

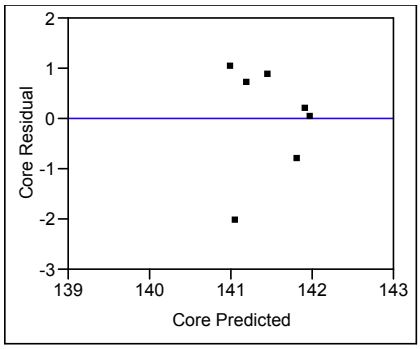


Figure A.232. Project 2 Day 1 PQI residuals

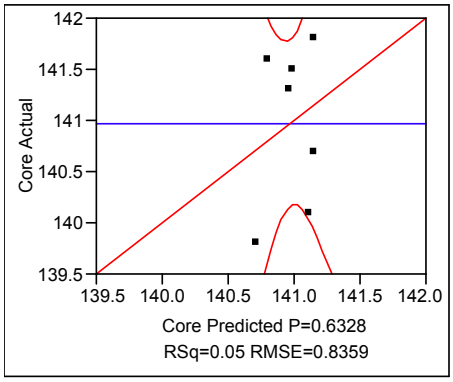


Figure A.233. Project 3 Day 1 PQI regression equation

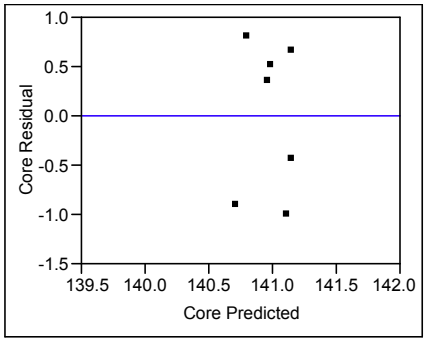


Figure A.234. Project 3 Day 1 PQI residuals

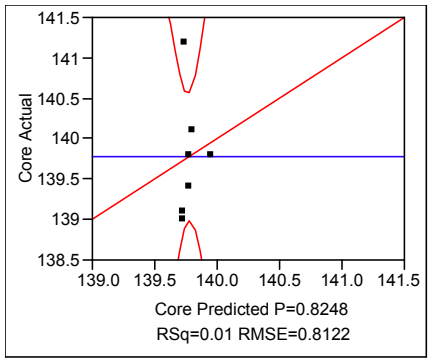


Figure A.235. Project 4 Day 1 PQI regression equation

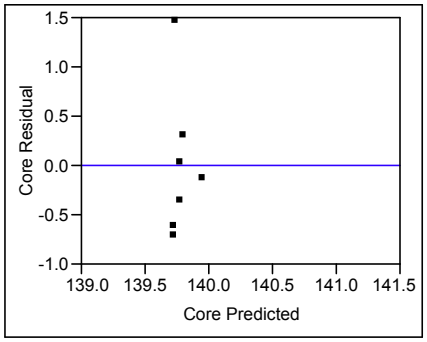


Figure A.235. Project 4 Day 1 PQI residuals

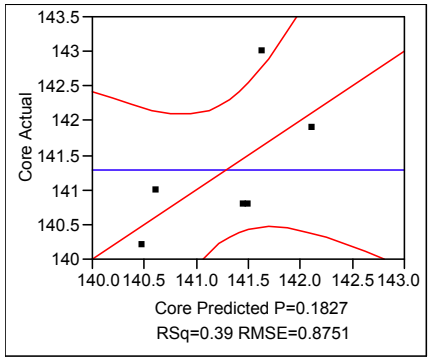


Figure A.236. Project 5 Day 1 PQI regression equation

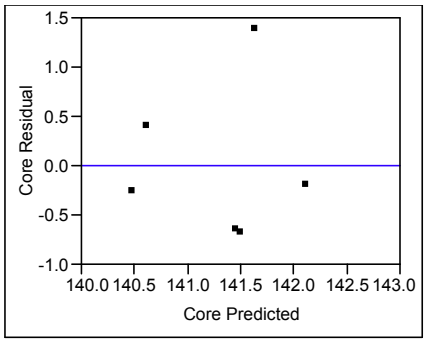


Figure A.237. Project 5 Day 1 PQI residuals

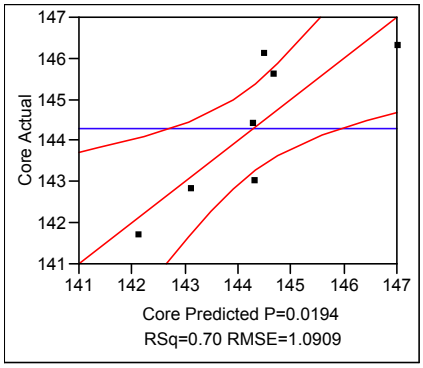


Figure A.238. Project 6 Day 1 PQI regression equation

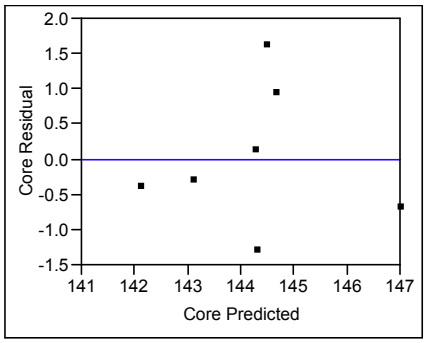


Figure A.239. Project 6 Day 1 PQI residuals

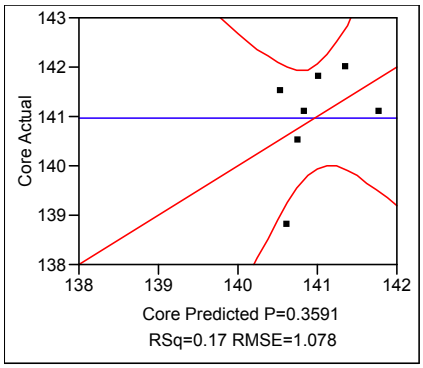


Figure A.240. Project 7 Day 1 PQI regression equation

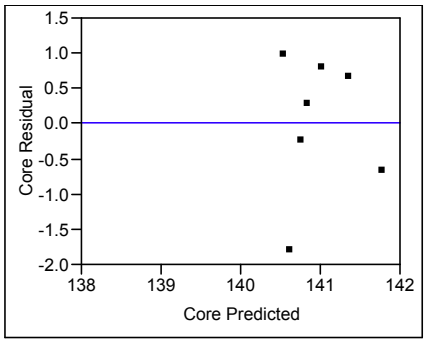


Figure A.241. Project 7 Day 1 PQI residuals