

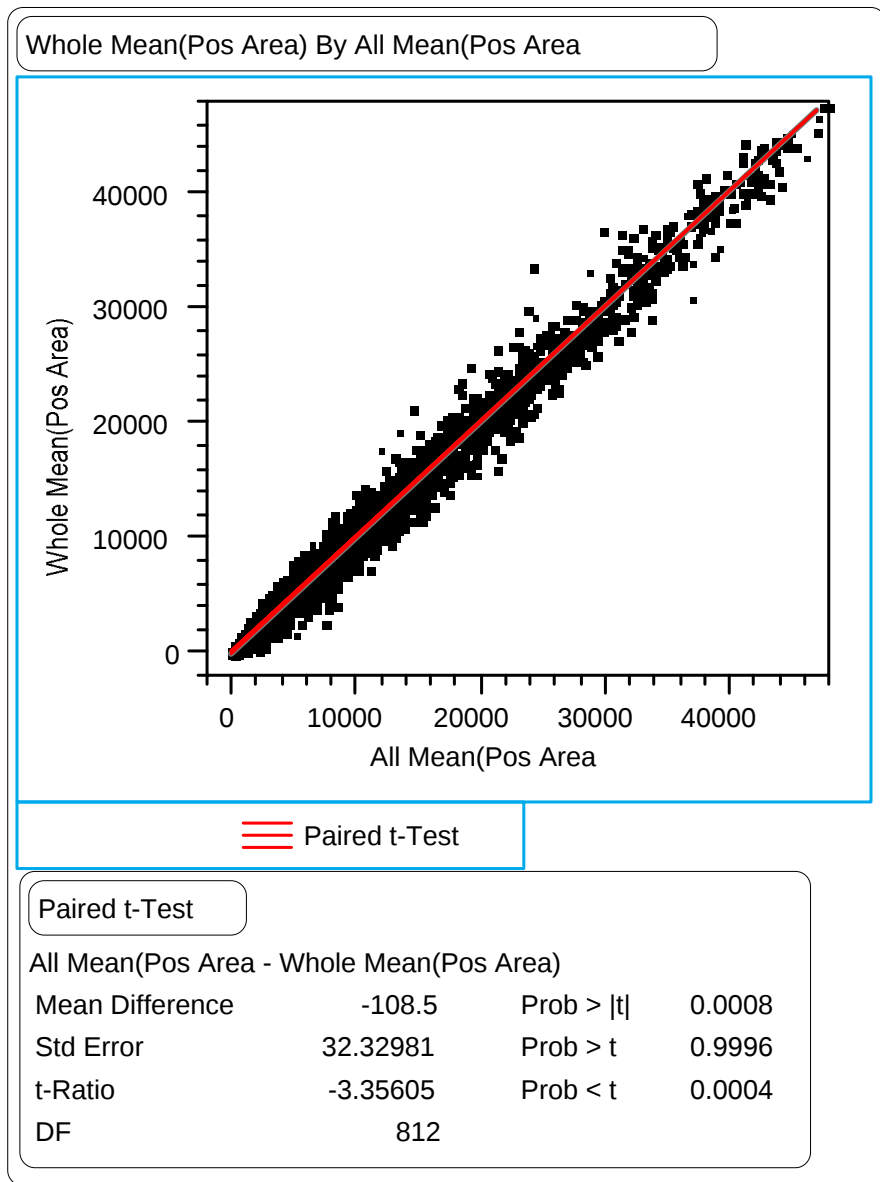


Figure 137. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the positive area index.

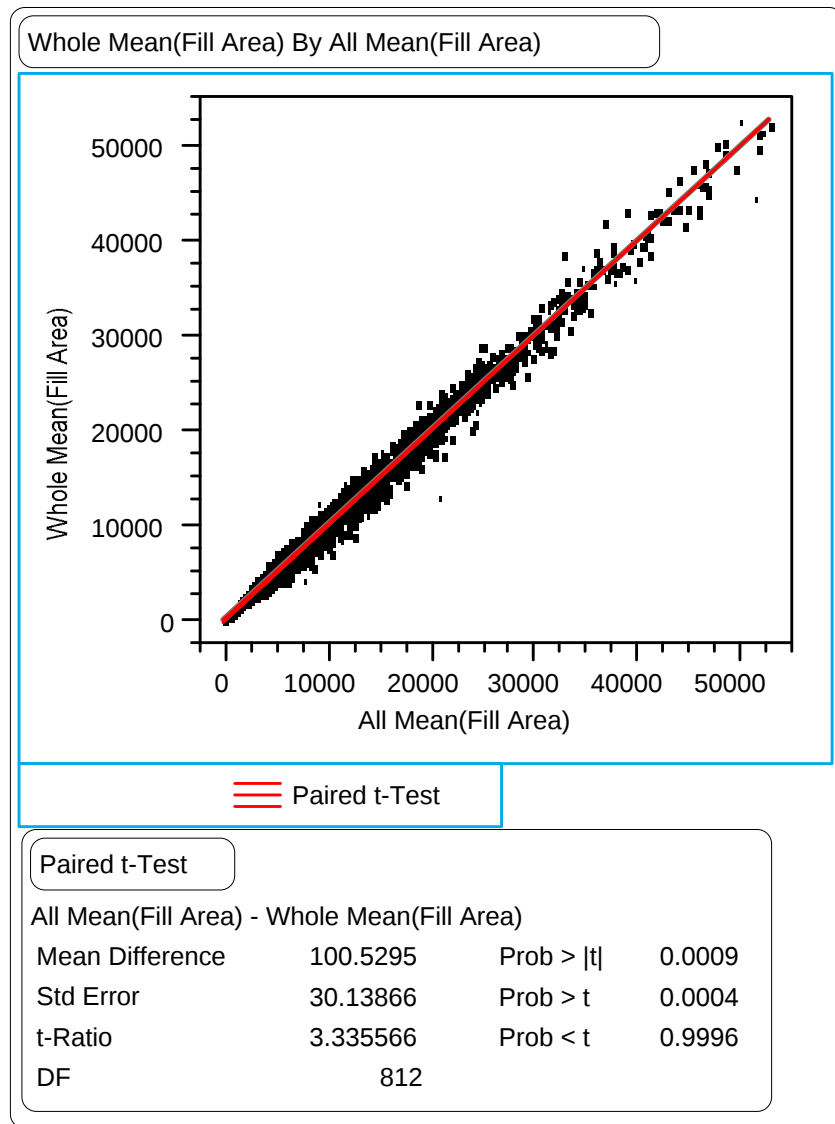


Figure 138. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the fill area index.

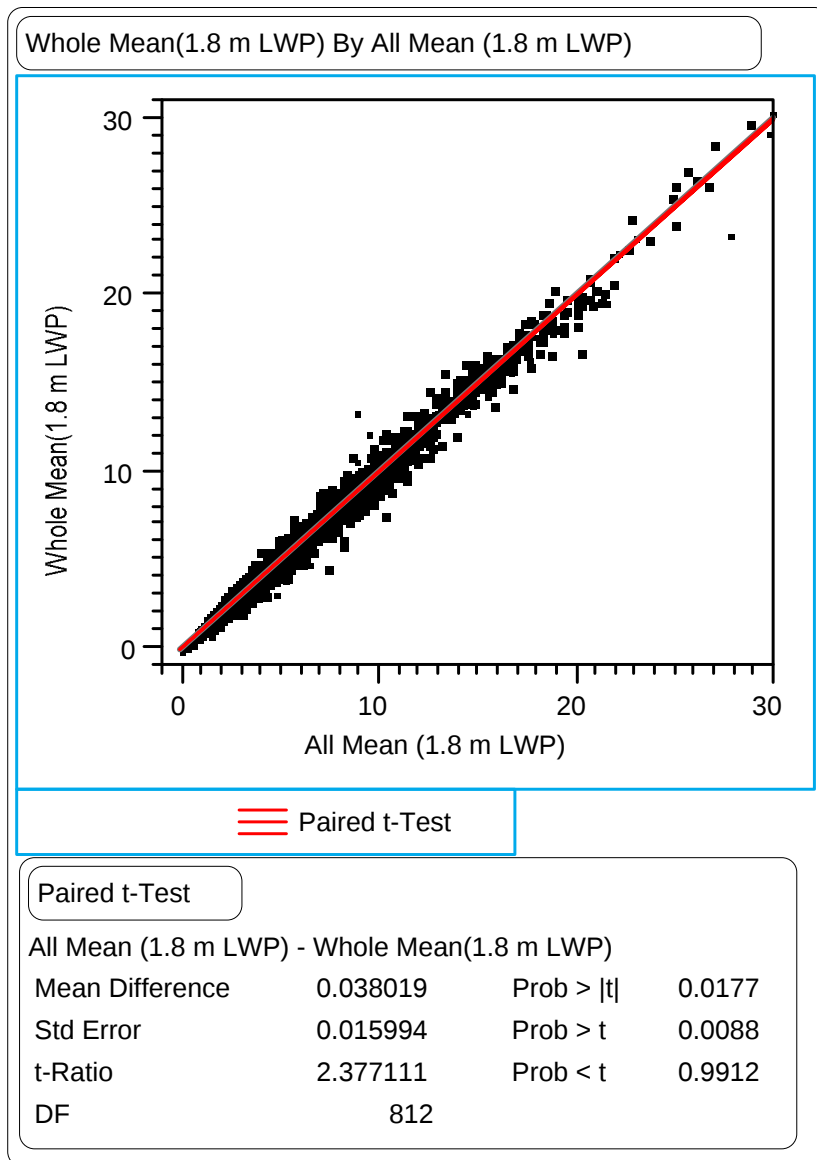


Figure 139. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the LWP 1.8-m rut depths.

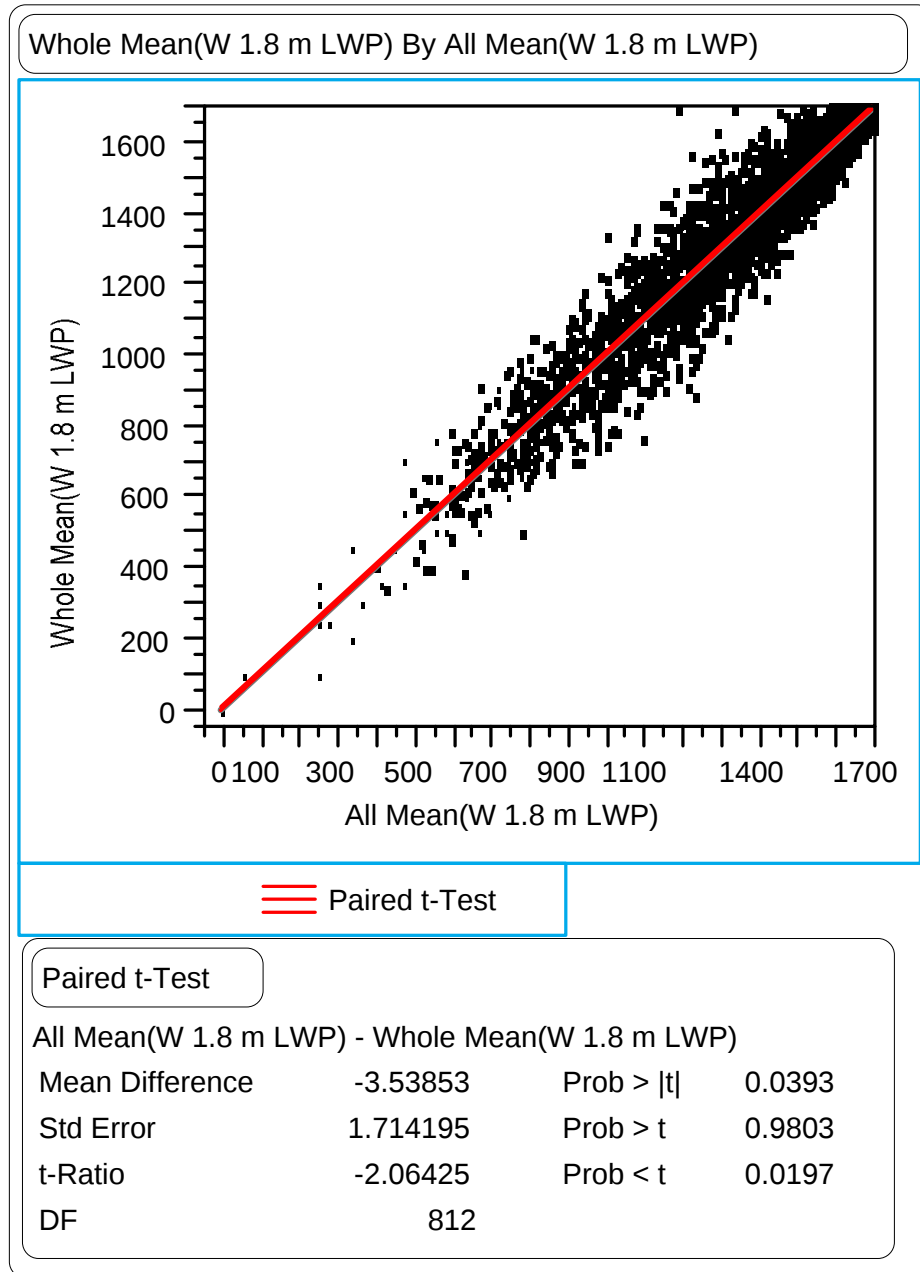


Figure 140. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the LWP 1.8-m rut widths.

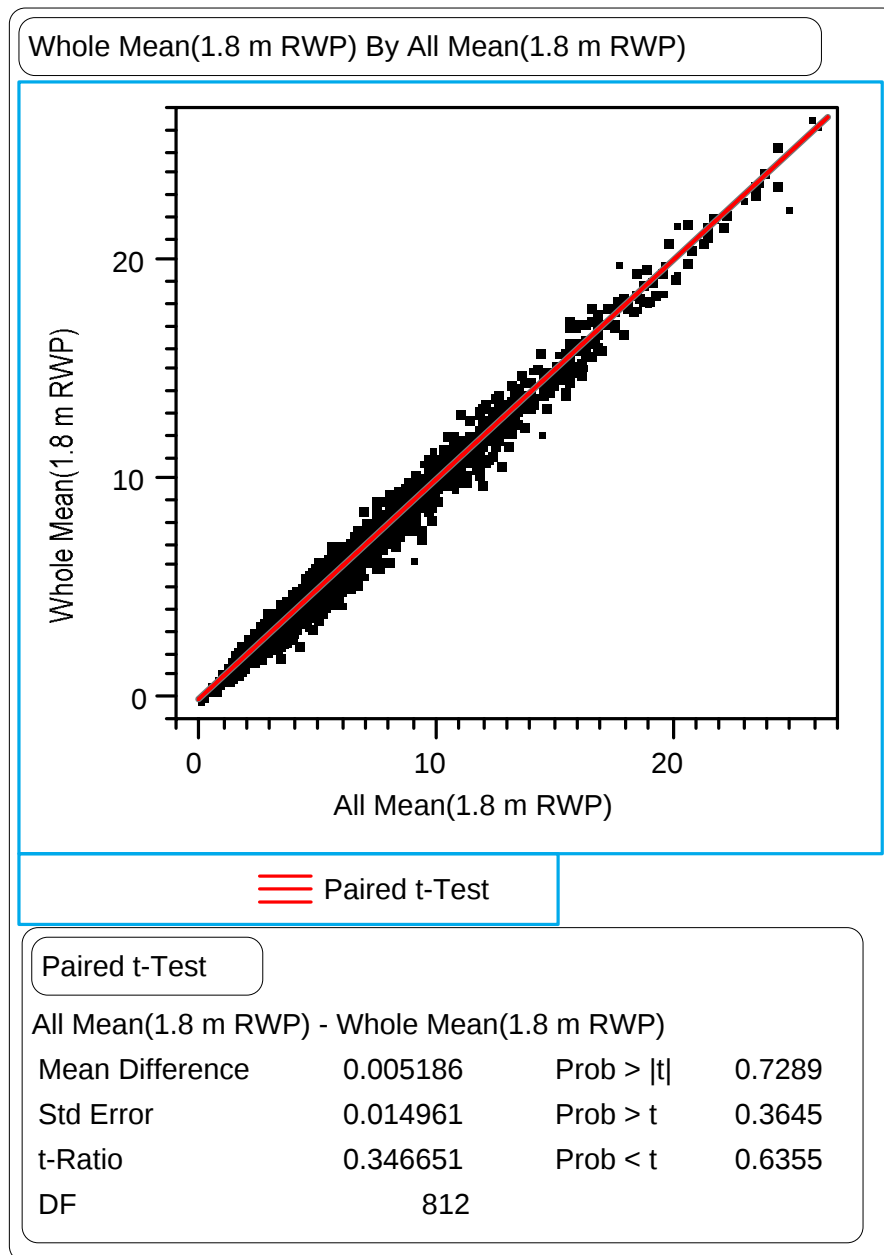


Figure 141. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the RWP 1.8-m rut depths.

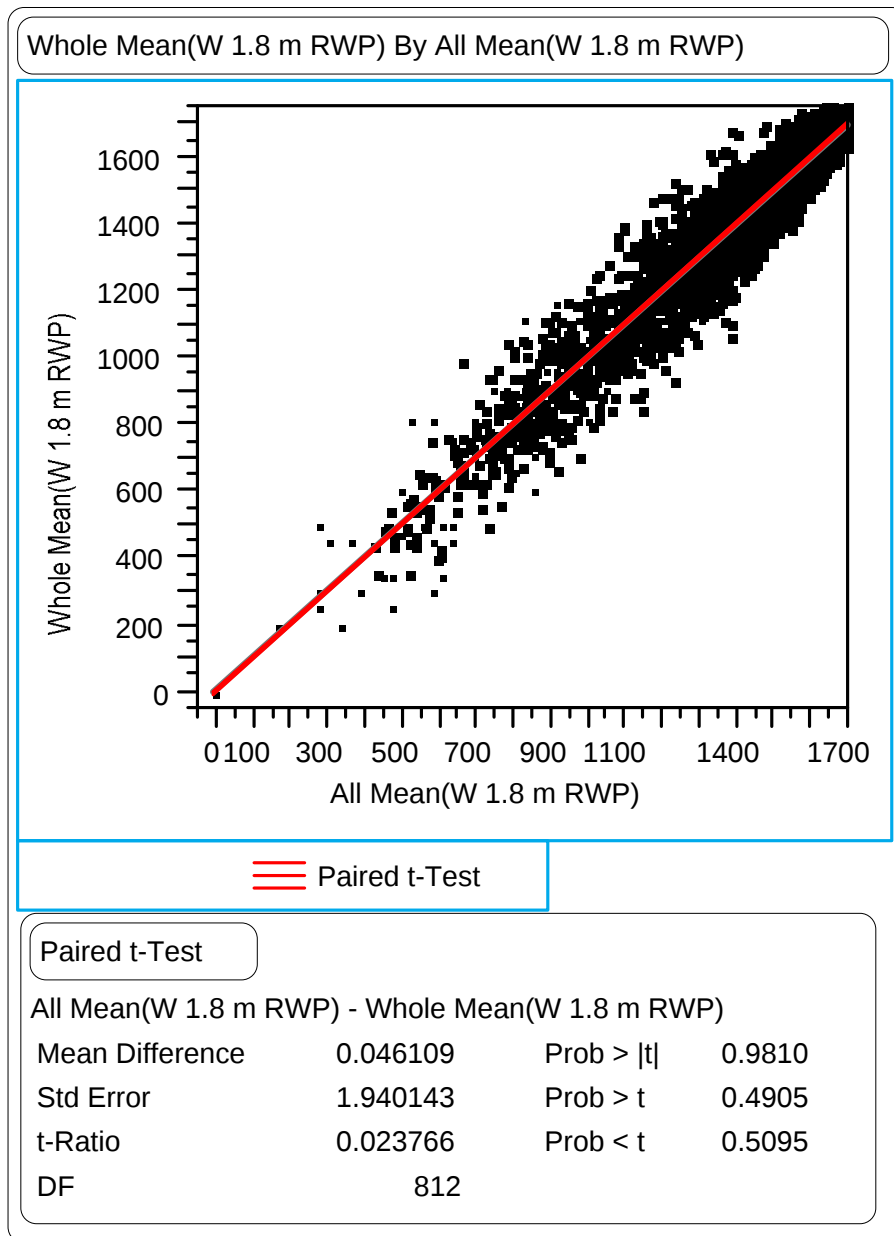


Figure 142. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the RWP 1.8-m rut widths.

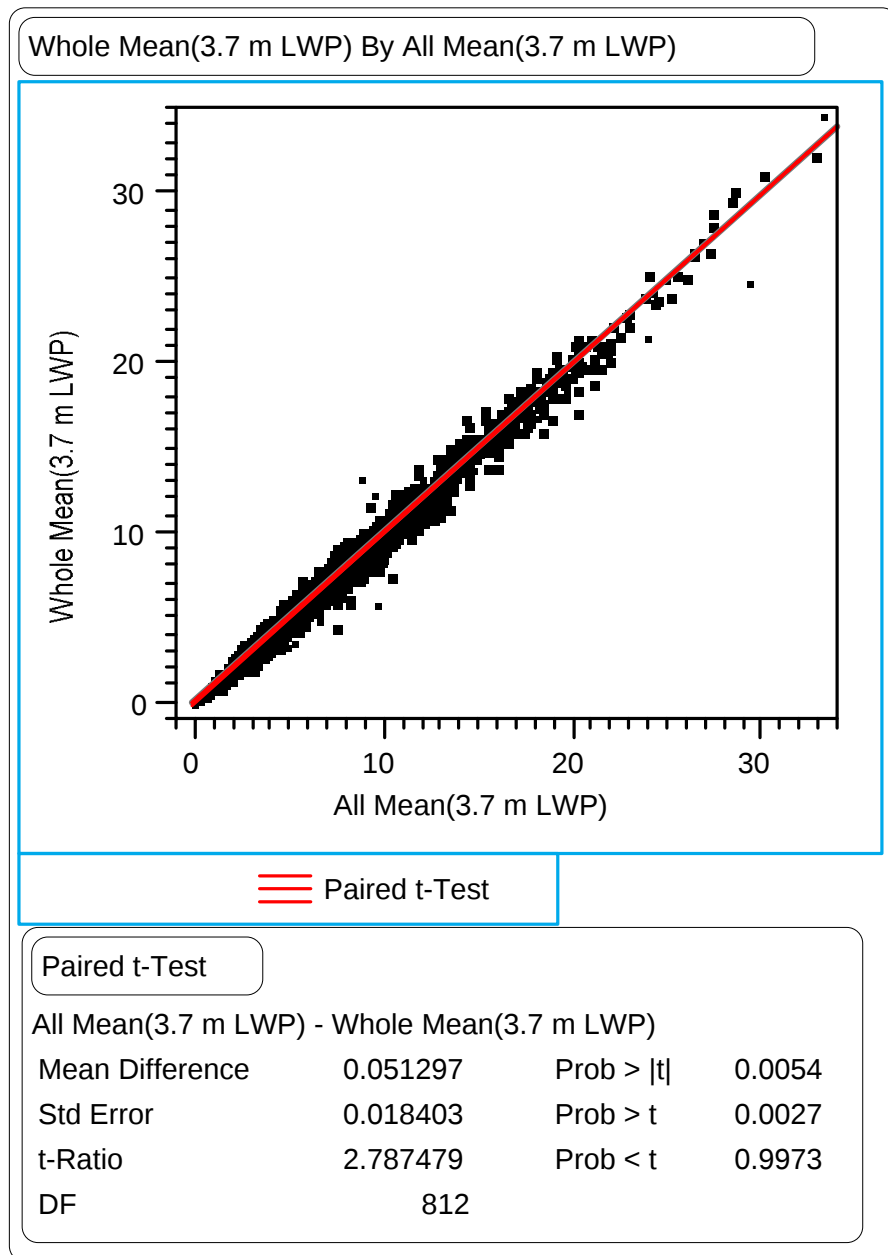
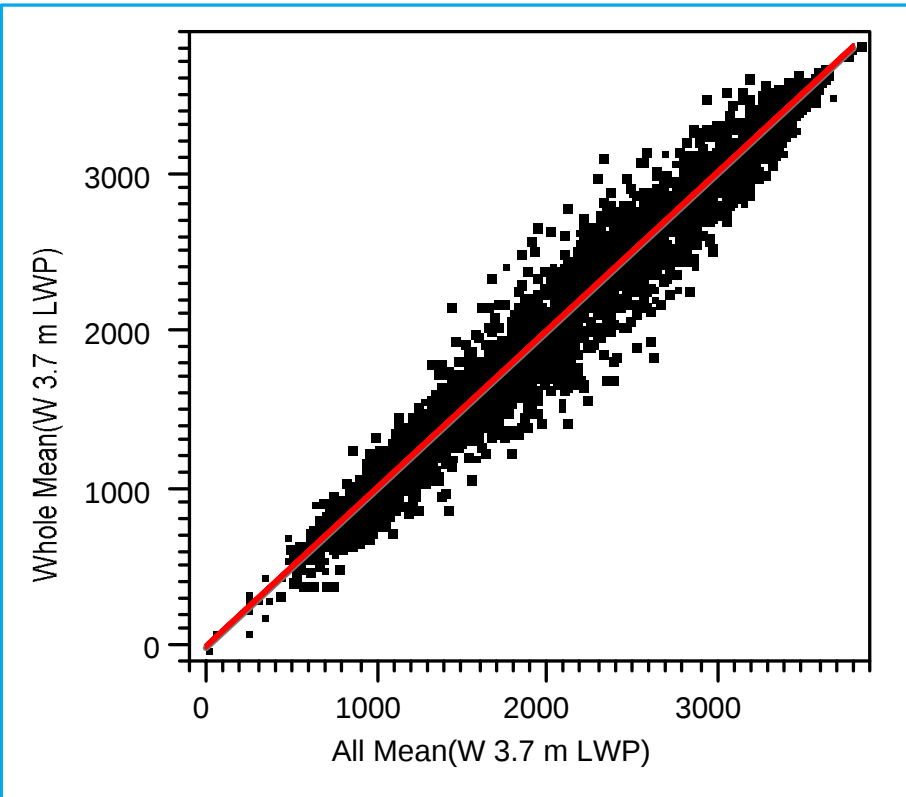


Figure 143. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the LWP wire line rut depths.

Whole Mean(W 3.7 m LWP) By All Mean(W 3.7 m LWP)



≡ Paired t-Test

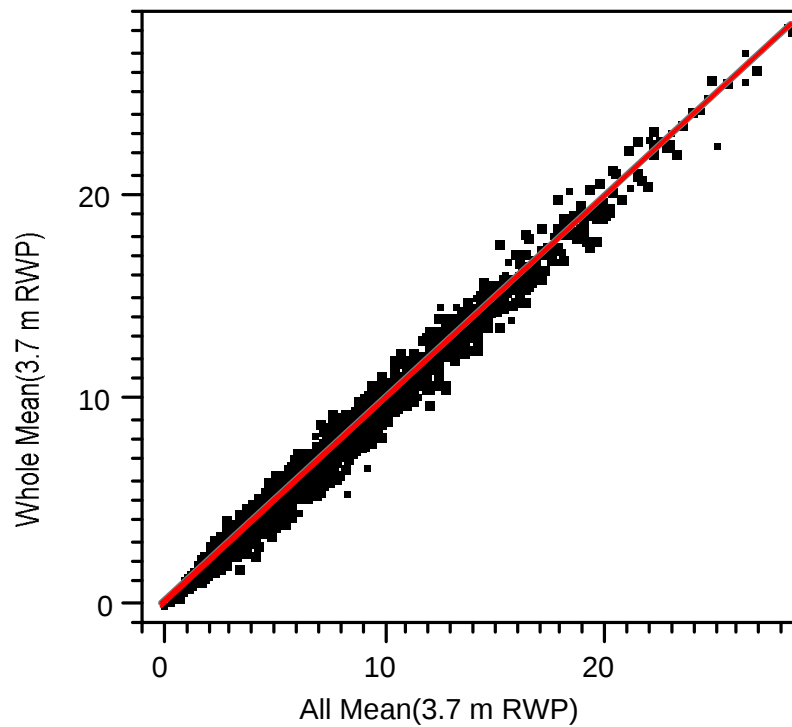
Paired t-Test

All Mean(W 3.7 m LWP) - Whole Mean(W 3.7 m LWP)

Mean Difference	-6.03334	Prob > t	0.2188
Std Error	4.902696	Prob > t	0.8906
t-Ratio	-1.23062	Prob < t	0.1094
DF	812		

Figure 144. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the LWP wire line rut widths.

Whole Mean(3.7 m RWP) By All Mean(3.7 m RWP)



Paired t-Test

Paired t-Test

All Mean(3.7 m RWP) - Whole Mean(3.7 m RWP)

Mean Difference	0.024371	Prob > t	0.1377
Std Error	0.016403	Prob > t	0.0689
t-Ratio	1.485794	Prob < t	0.9311
DF	812		

Figure 145. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick® for the RWP wire line rut depths.

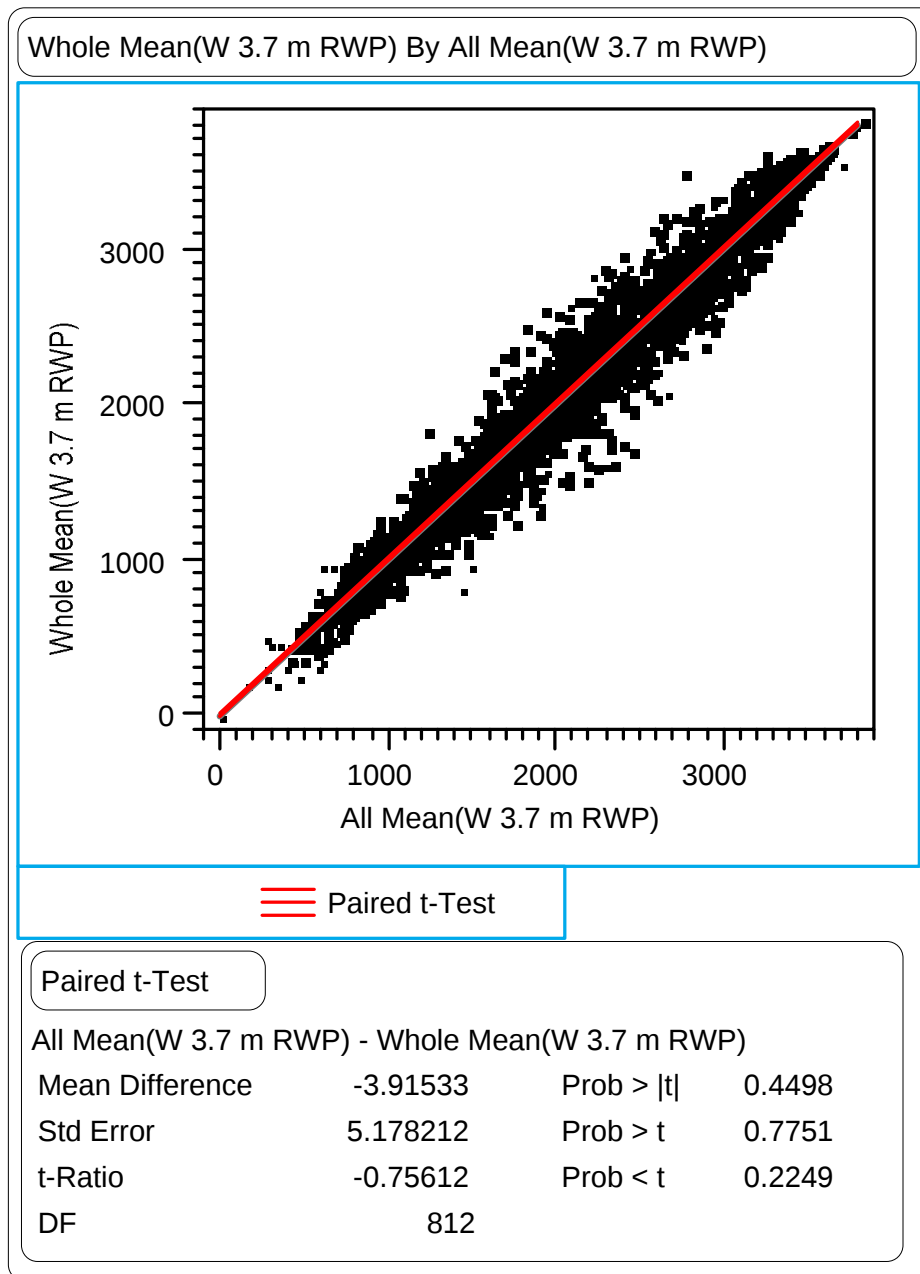


Figure 146. Paired t-test comparing section means from all of the profiles versus those from profiles taken every 30 m for data collected by Dipstick[®] for the RWP wire line rut widths.

APPENDIX D.

t-TESTS COMPARING VARIOUS PAVEMENT PARAMETERS

These are the comparisons that were performed in chapter 4. Figures 147 through 157 provide the results of the comparisons of each index for the GPS-1 (HMAC over granular base) section means and the GPS-7 (HMAC overlay of PCC) section means. The top box of each figure provides a graphical review of the results. The middle box provides the results from a t-test for comparing means with equal variances at an α -level of 5 percent. The bottom box provides the results of a comparison of the variances between the groups and an ANOVA test in case the variances are not equal. Figures 158 through 168 provide the results of the comparisons of the GPS-1 (HMAC over granular base) and GPS-2 (HMAC over stabilized base) sections by surface thickness. Figures 169 through 179 provide the results of the comparisons of granular versus stabilized base types for GPS-1 and GPS-2 sections with less than 127 mm of HMAC surface. Figures 180 through 190 provide the results of the comparisons of asphalt stabilized bases to cement stabilized bases for GPS-1 and GPS-2 sections with less than 127 mm of HMAC surface. Figures 191 through 201 provide the results of the comparisons between the freeze (F) zone and the no freeze (NF) zone for the GPS-7 test sections. The bottom half of the upper box of numbers provides the results of the t-tests comparing each set of values. If the value in the table is positive, the difference is statistically significant, which means that the data sets are from two different populations with a 95 percent level of confidence. The bottom box provides a comparison of the standard deviations. The column of numbers provided under the heading "Prob>F" are the probabilities of getting an F-ratio that large given that the standard deviations are the same. A value of 0.05 or less is statistically significant.

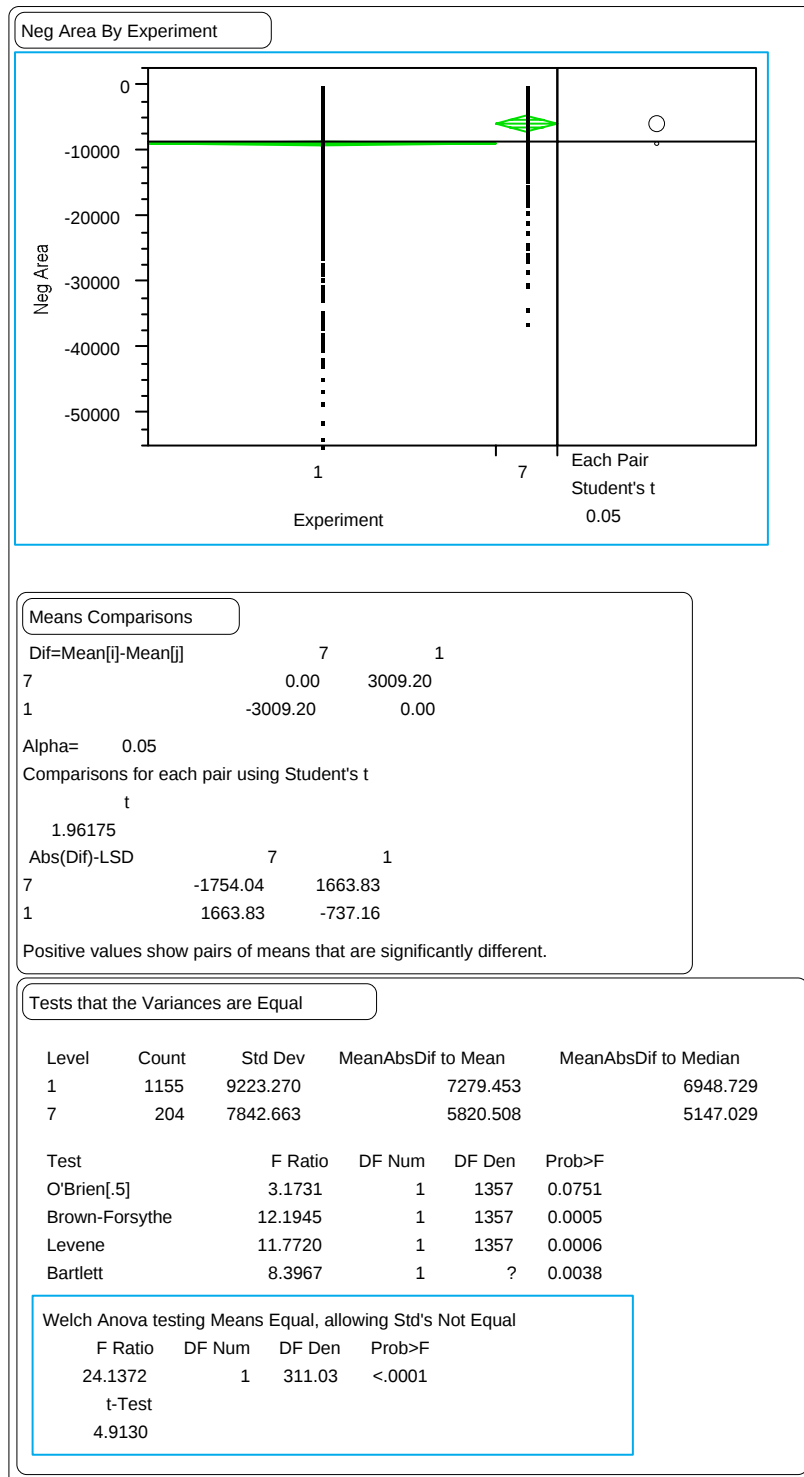


Figure 147. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the negative area index.

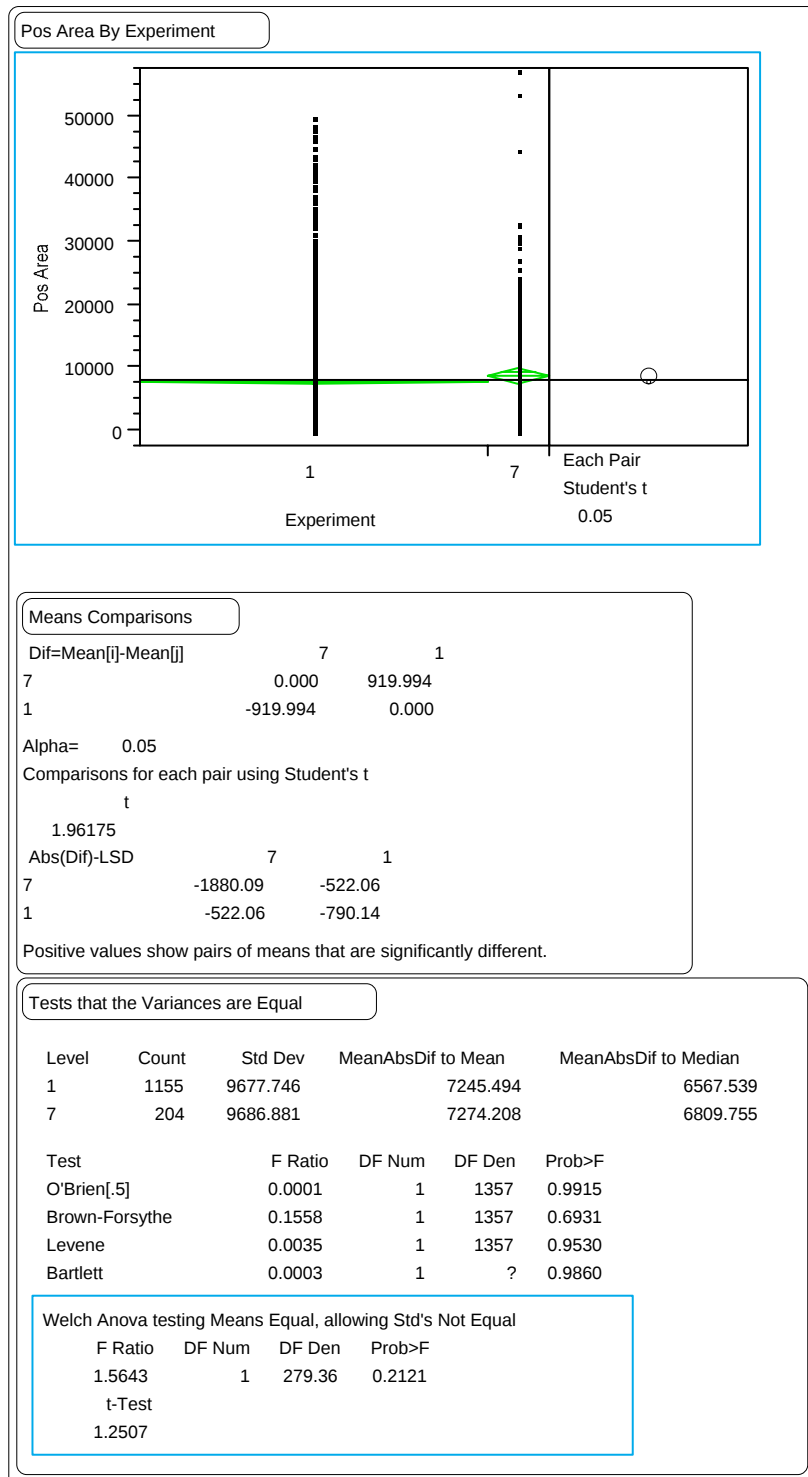


Figure 148. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the positive area index.

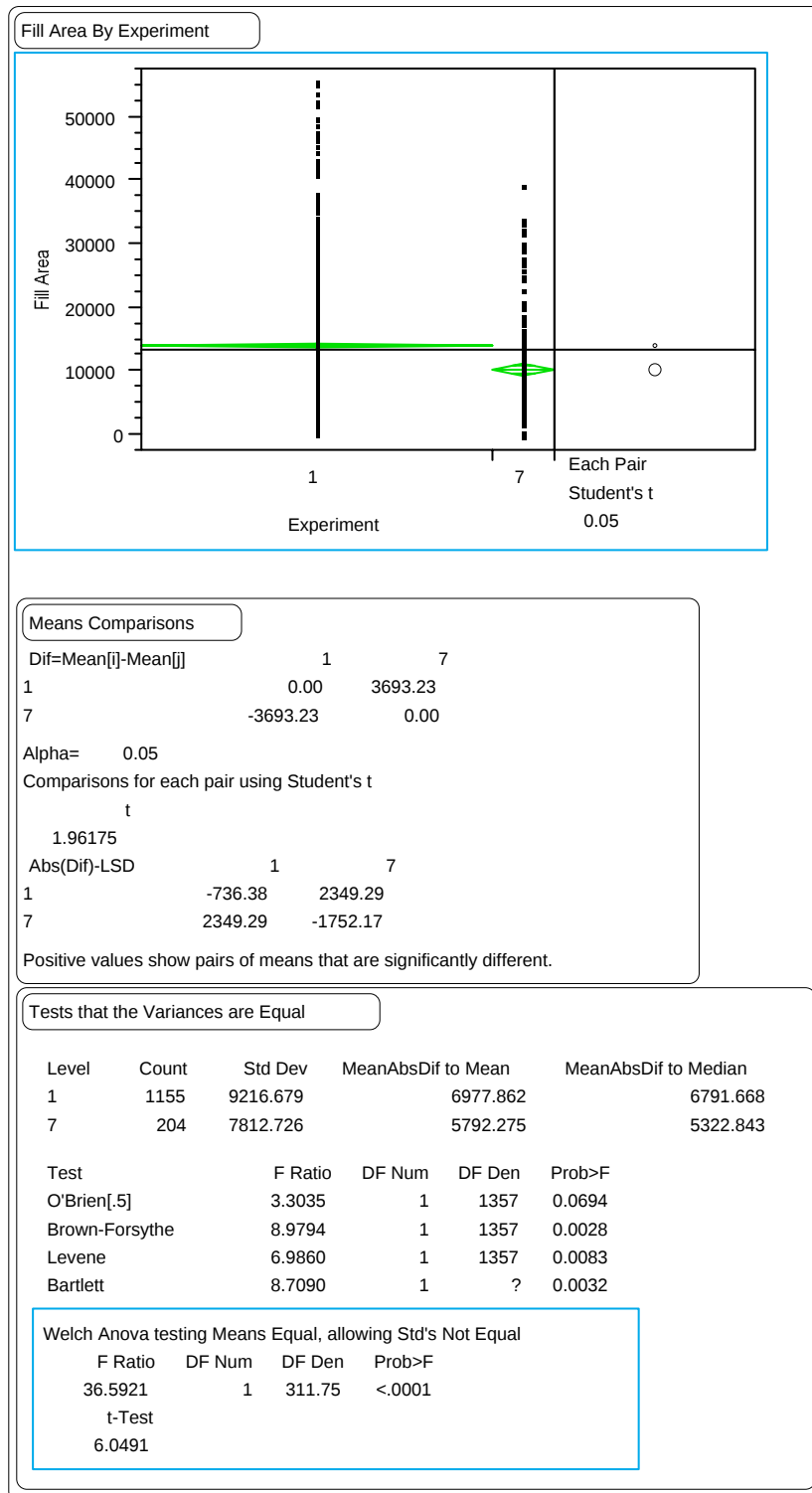


Figure 149. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the fill area index.

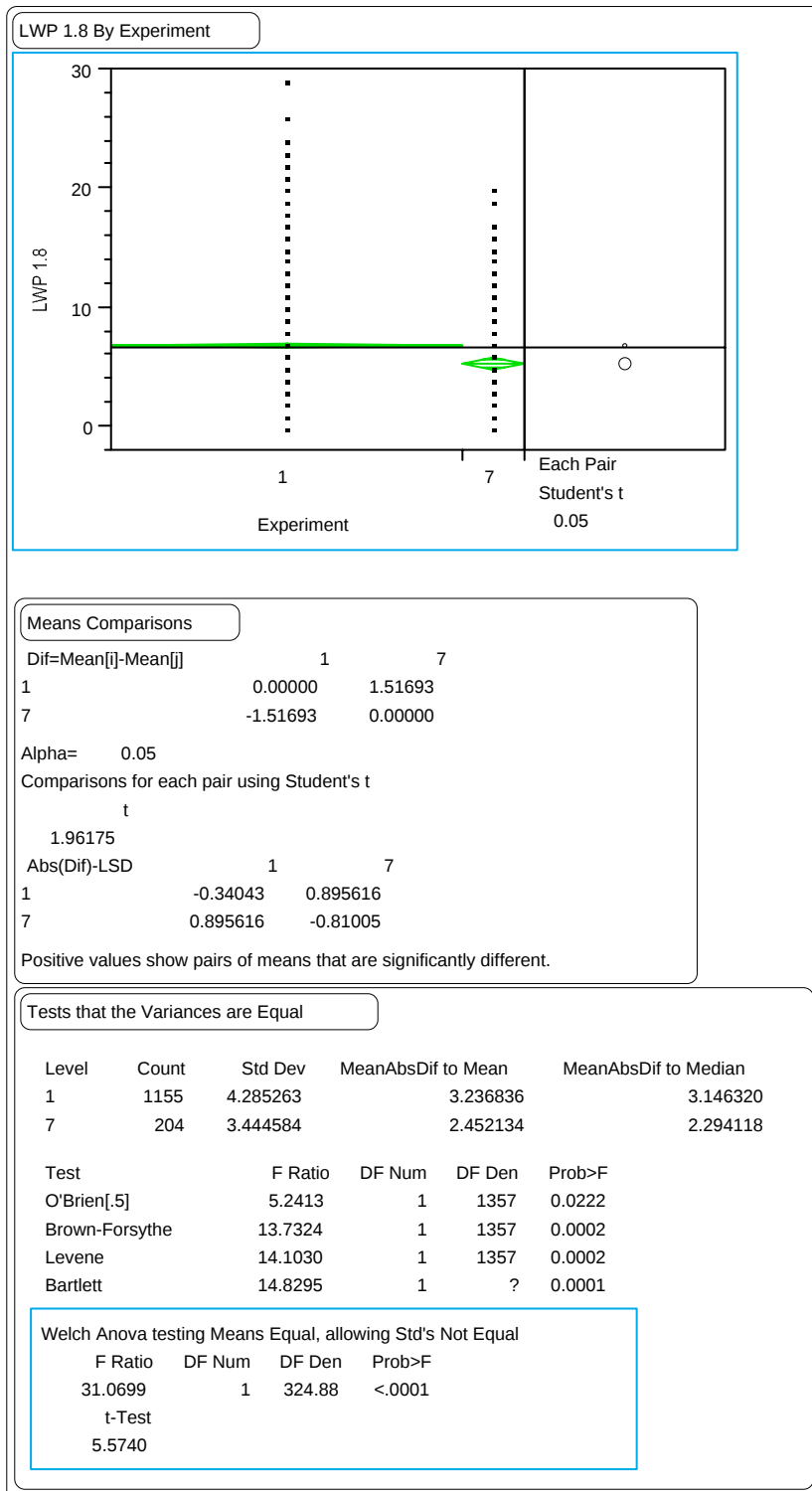


Figure 150. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the LWP 1.8-m rut depths.

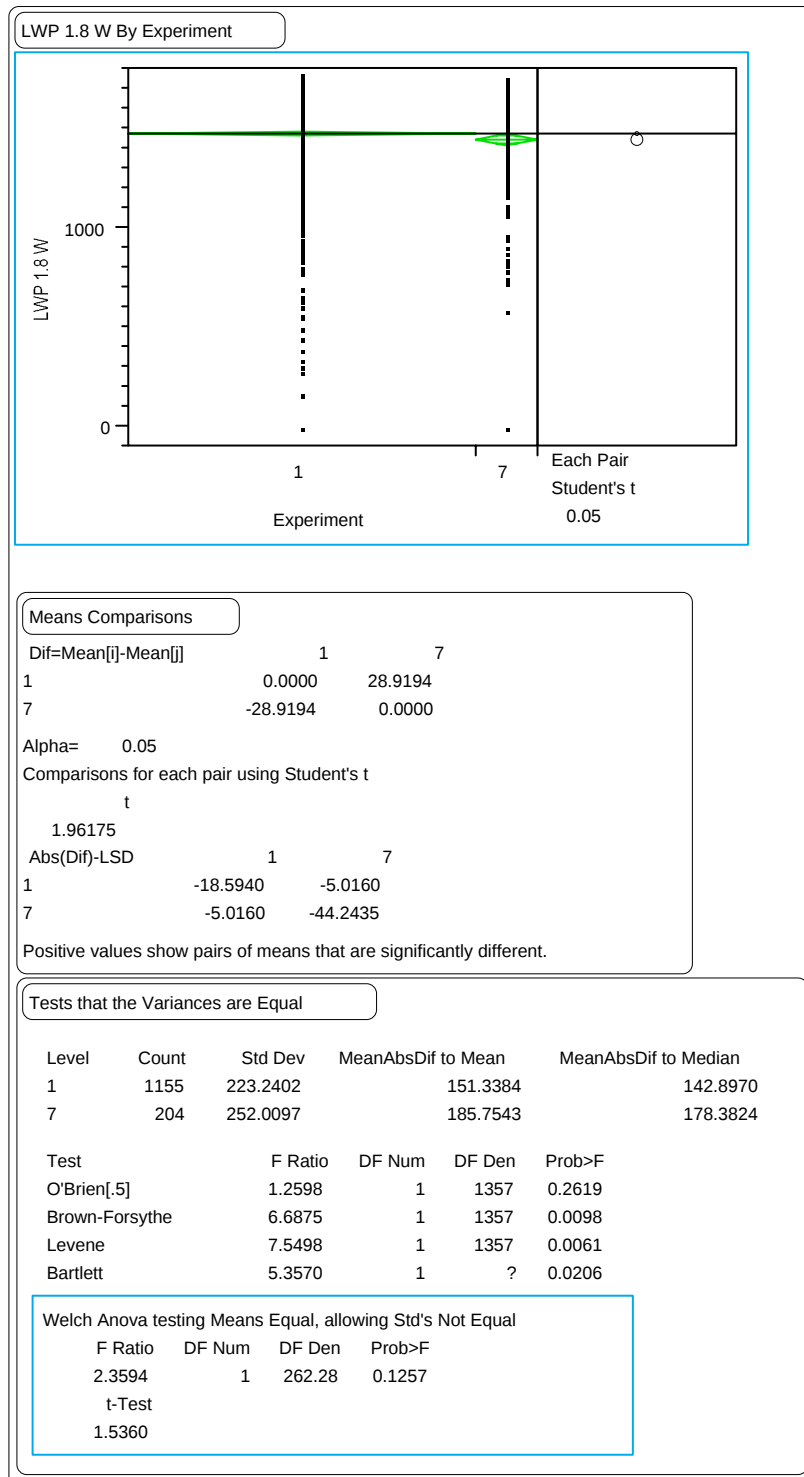


Figure 151. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the LWP 1.8-m rut widths.

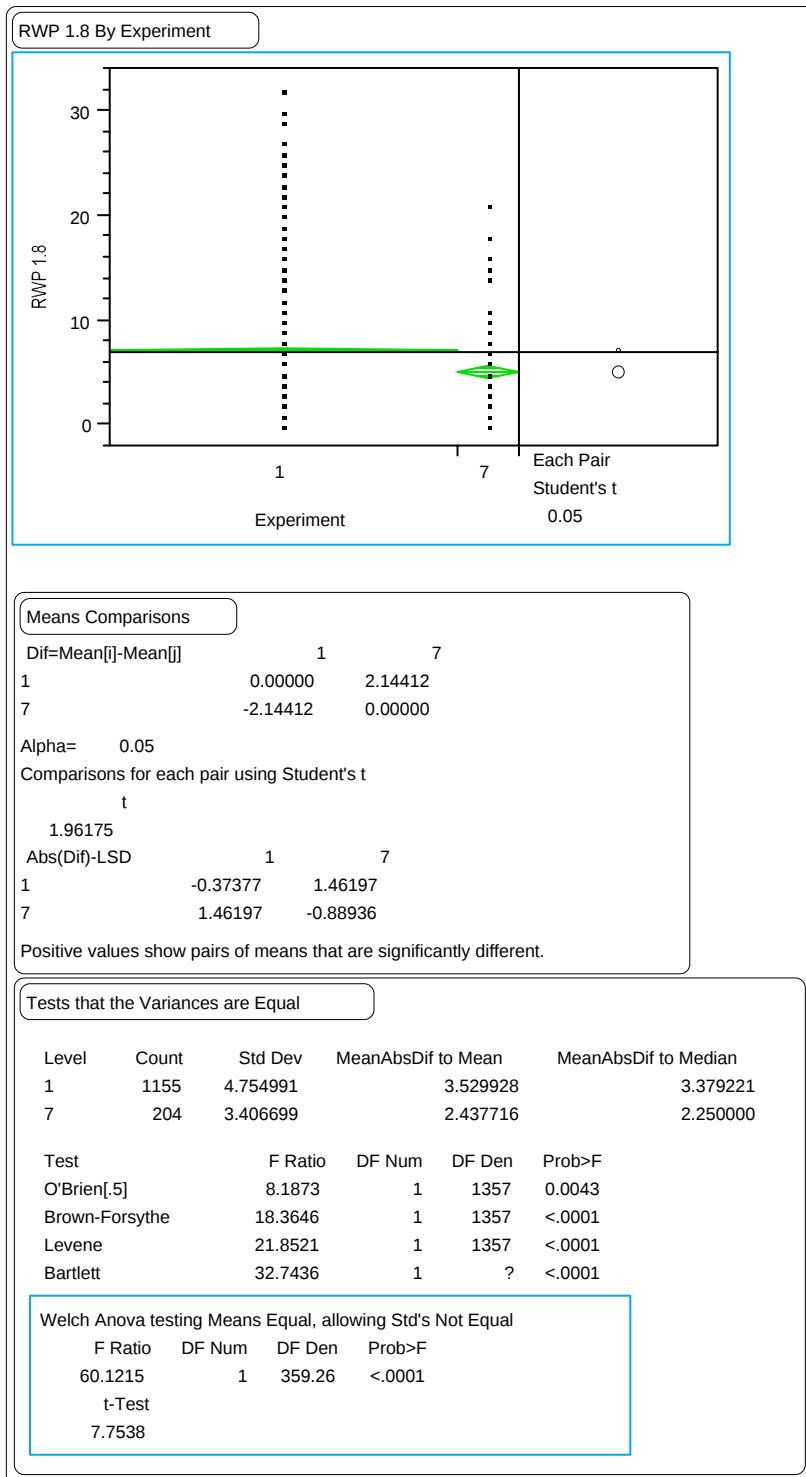


Figure 152. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the RWP 1.8-m rut depths.

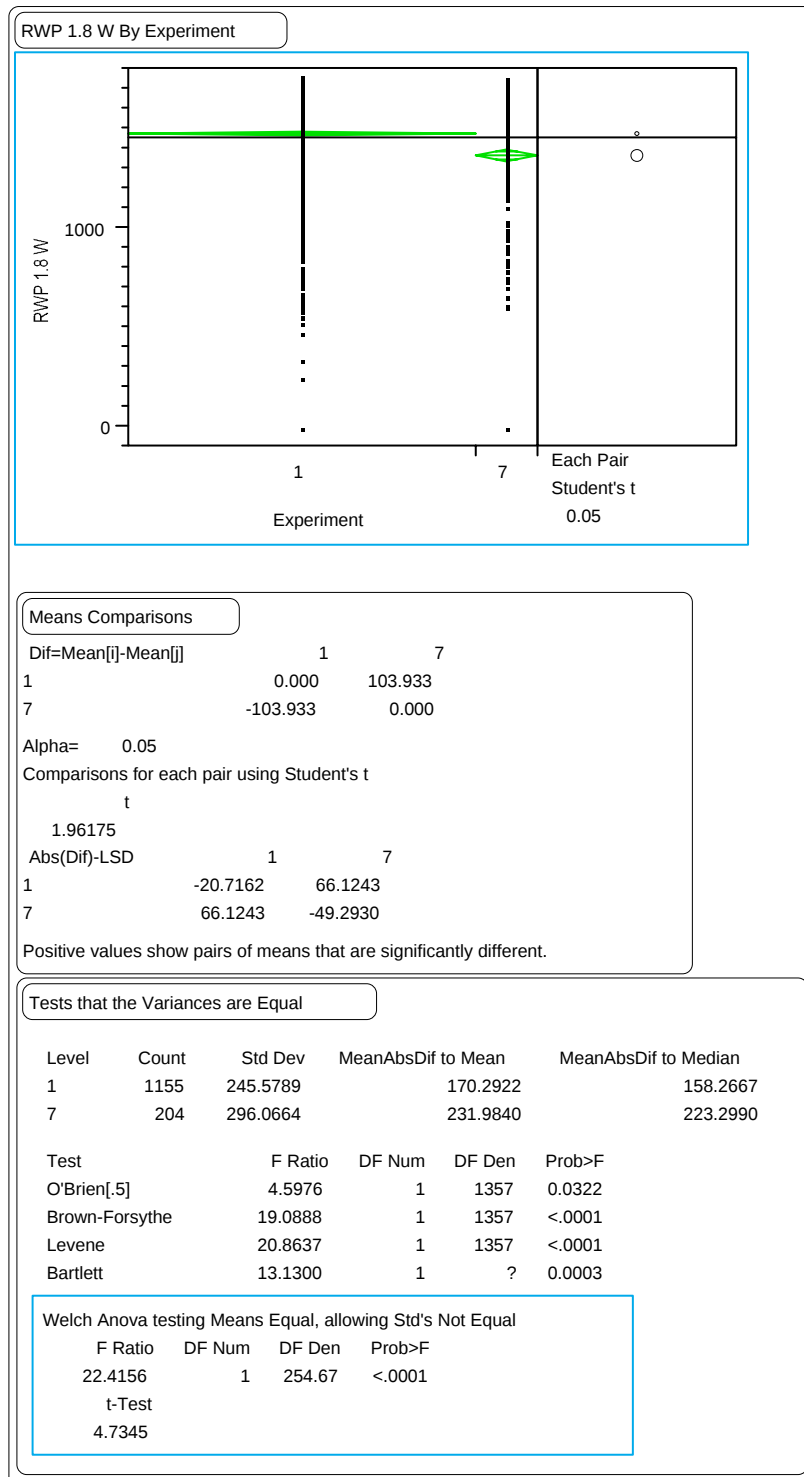


Figure 153. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the RWP 1.8-m rut widths.

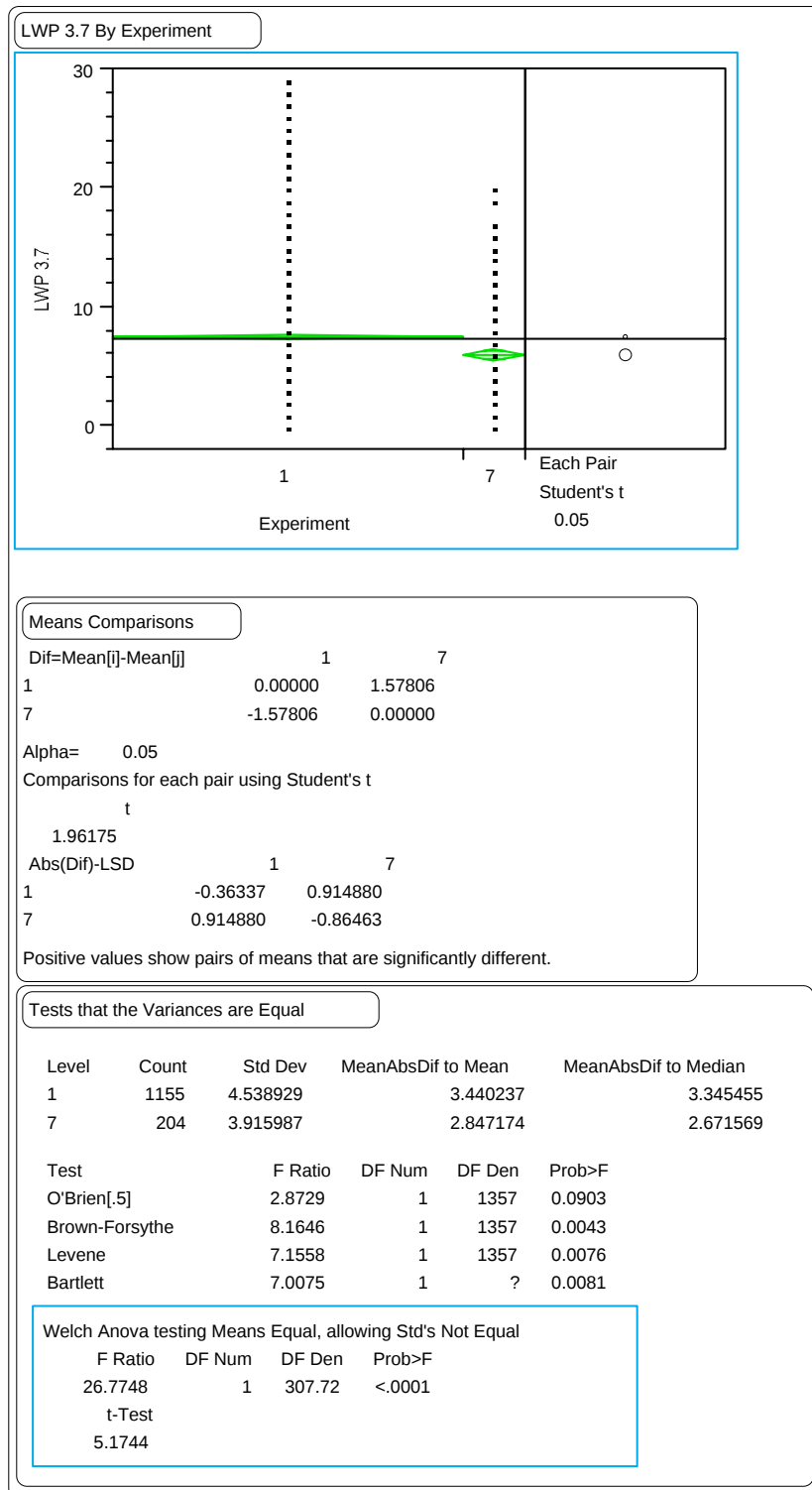


Figure 154. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the LWP wire line rut depths.

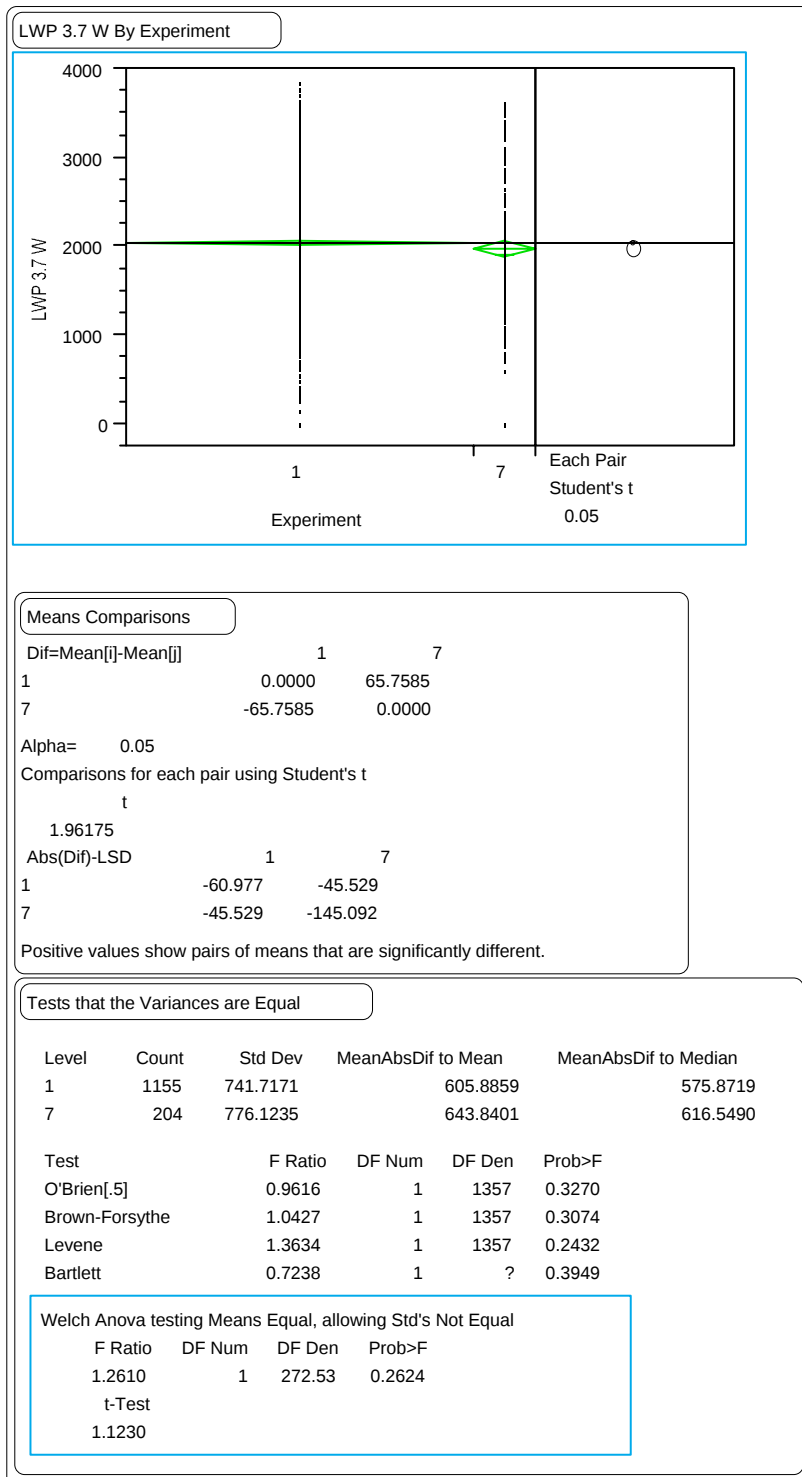


Figure 155. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the LWP wire line rut widths.

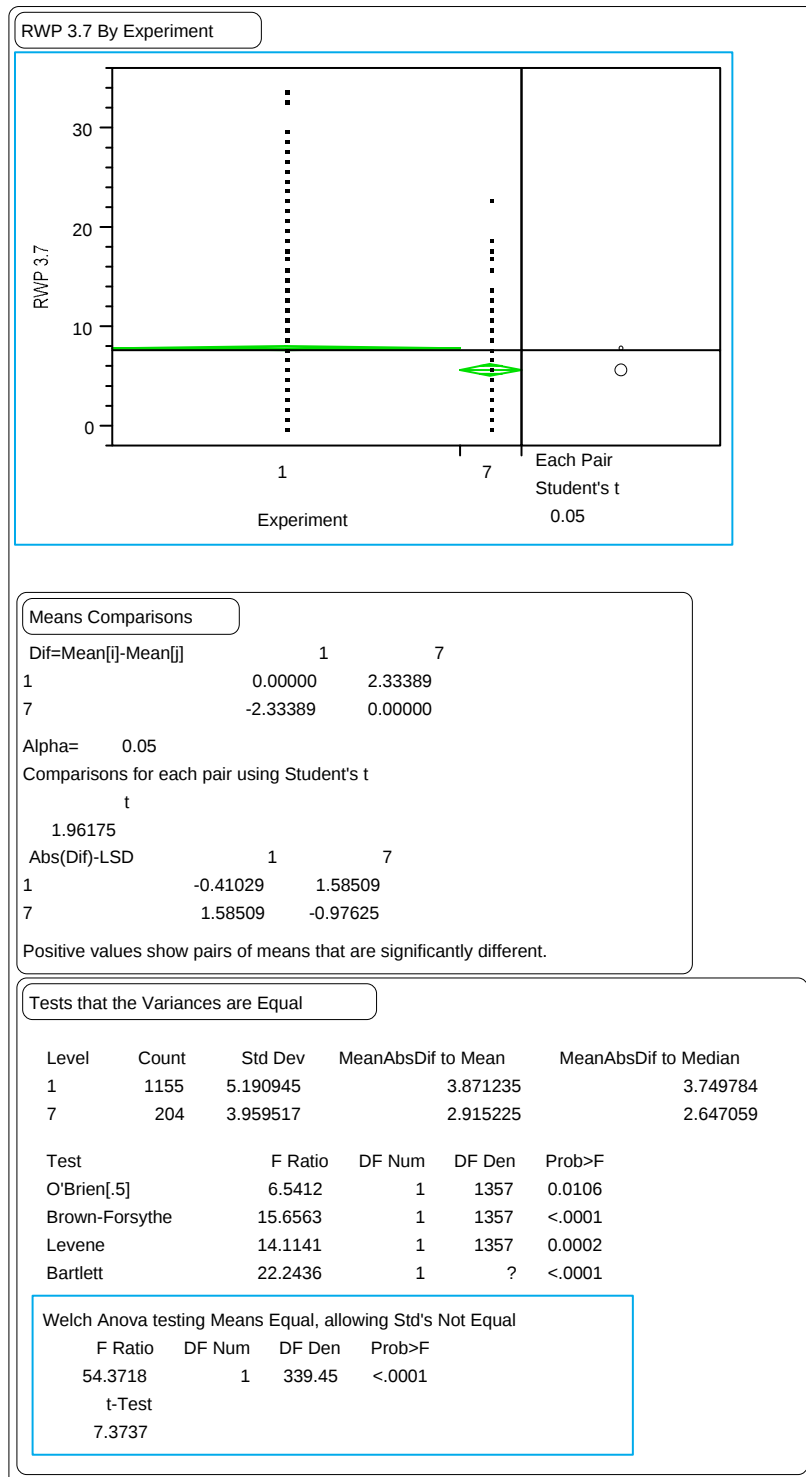


Figure 156. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the RWP wire line rut depths.

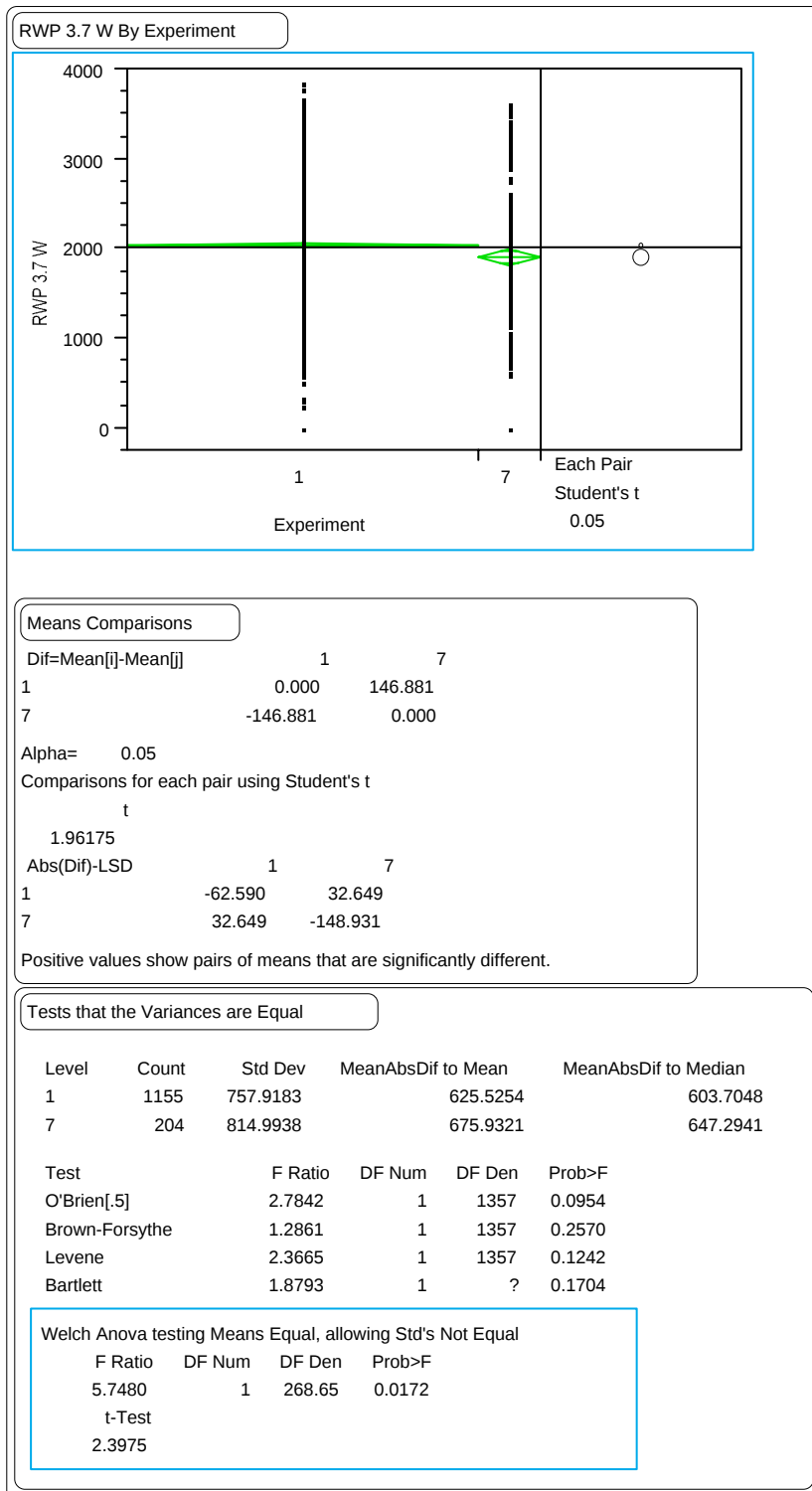


Figure 157. Paired t-test comparing GPS-1 section means versus GPS-7 section means for the RWP wire line rut widths.

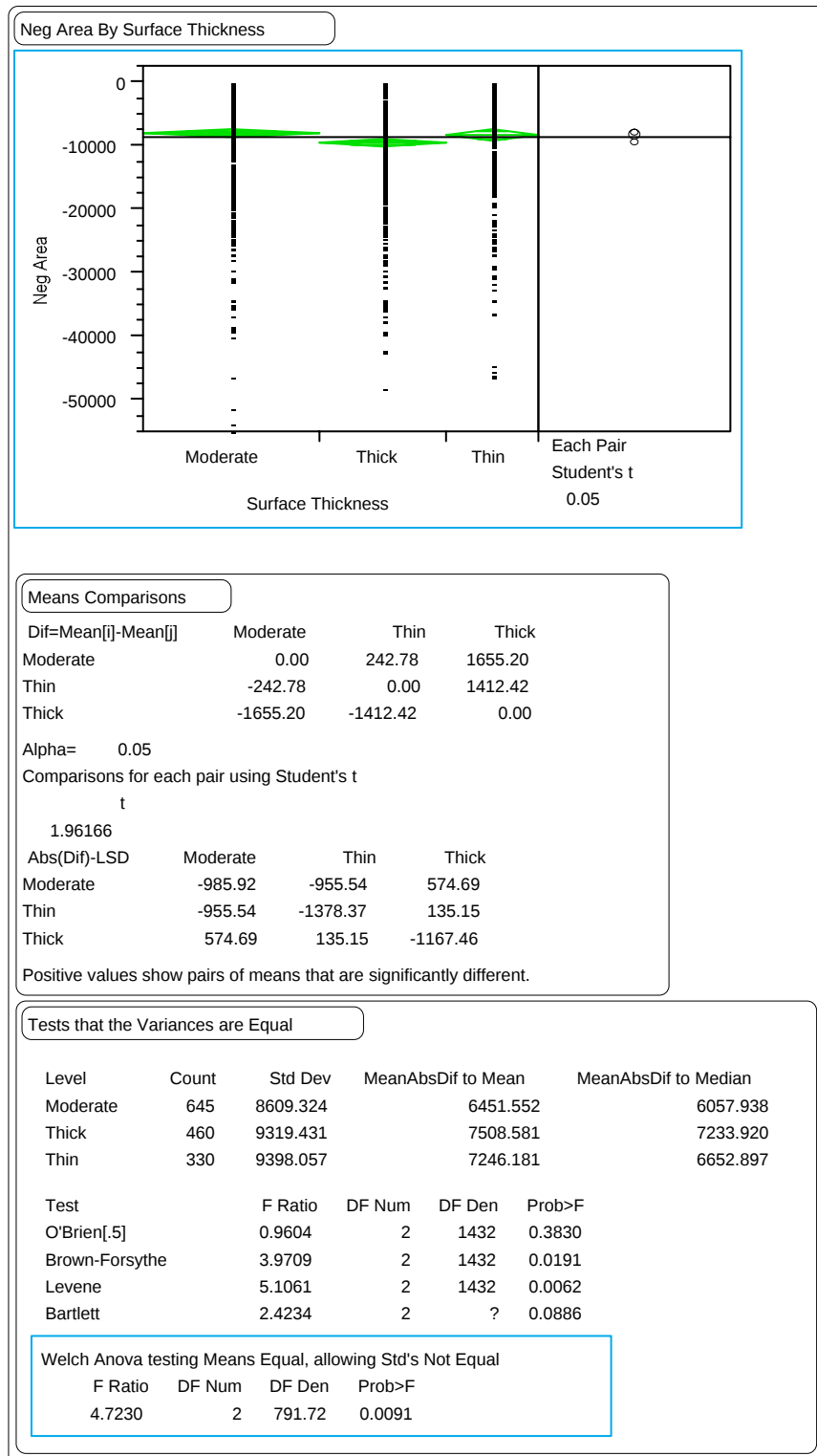


Figure 158. Paired t-test comparing GPS-1 and GPS-2 section means for the negative area index versus surface thickness.

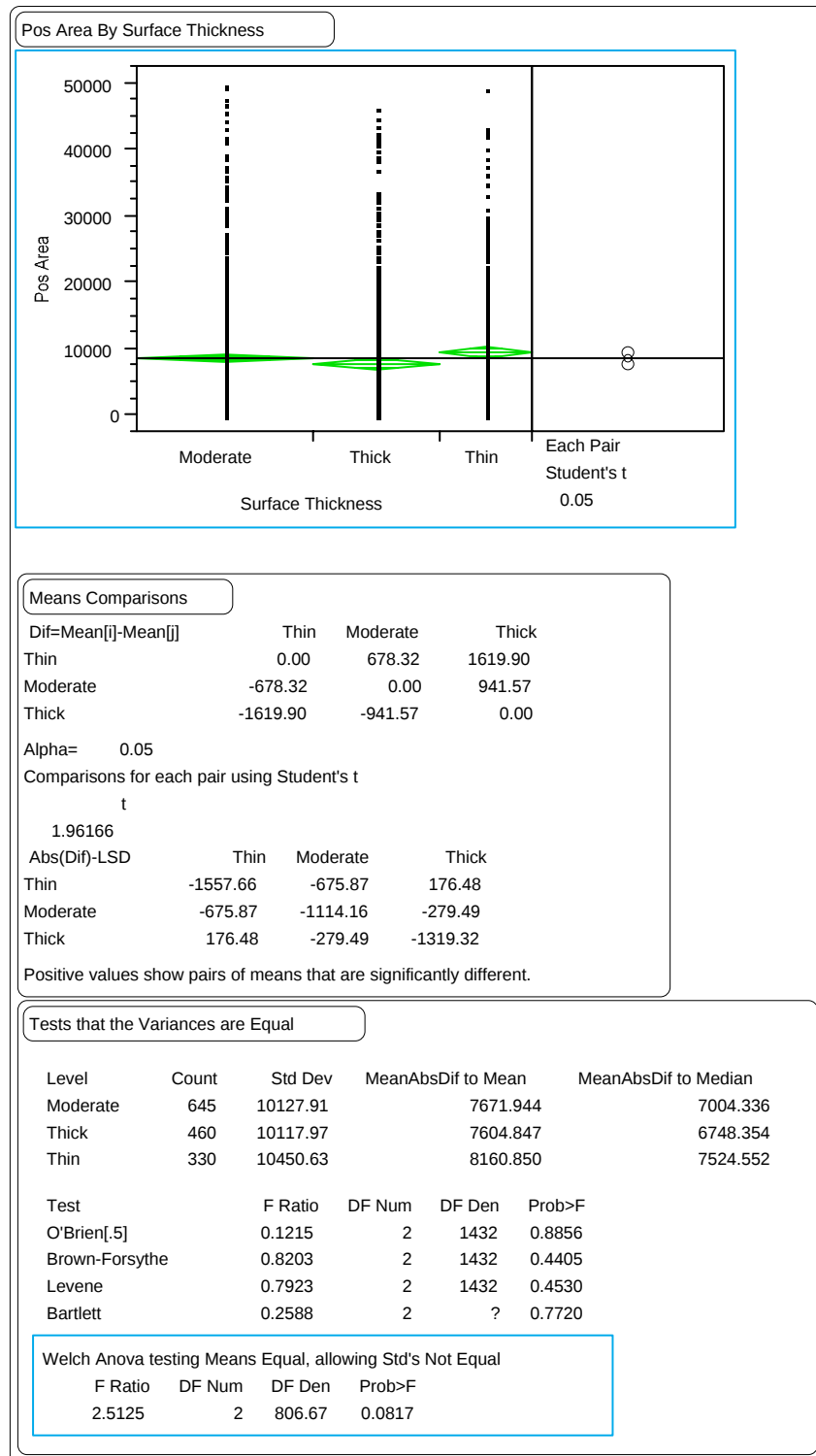


Figure 159. Paired t-test comparing GPS-1 and GPS-2 section means for the positive area index versus surface thickness.

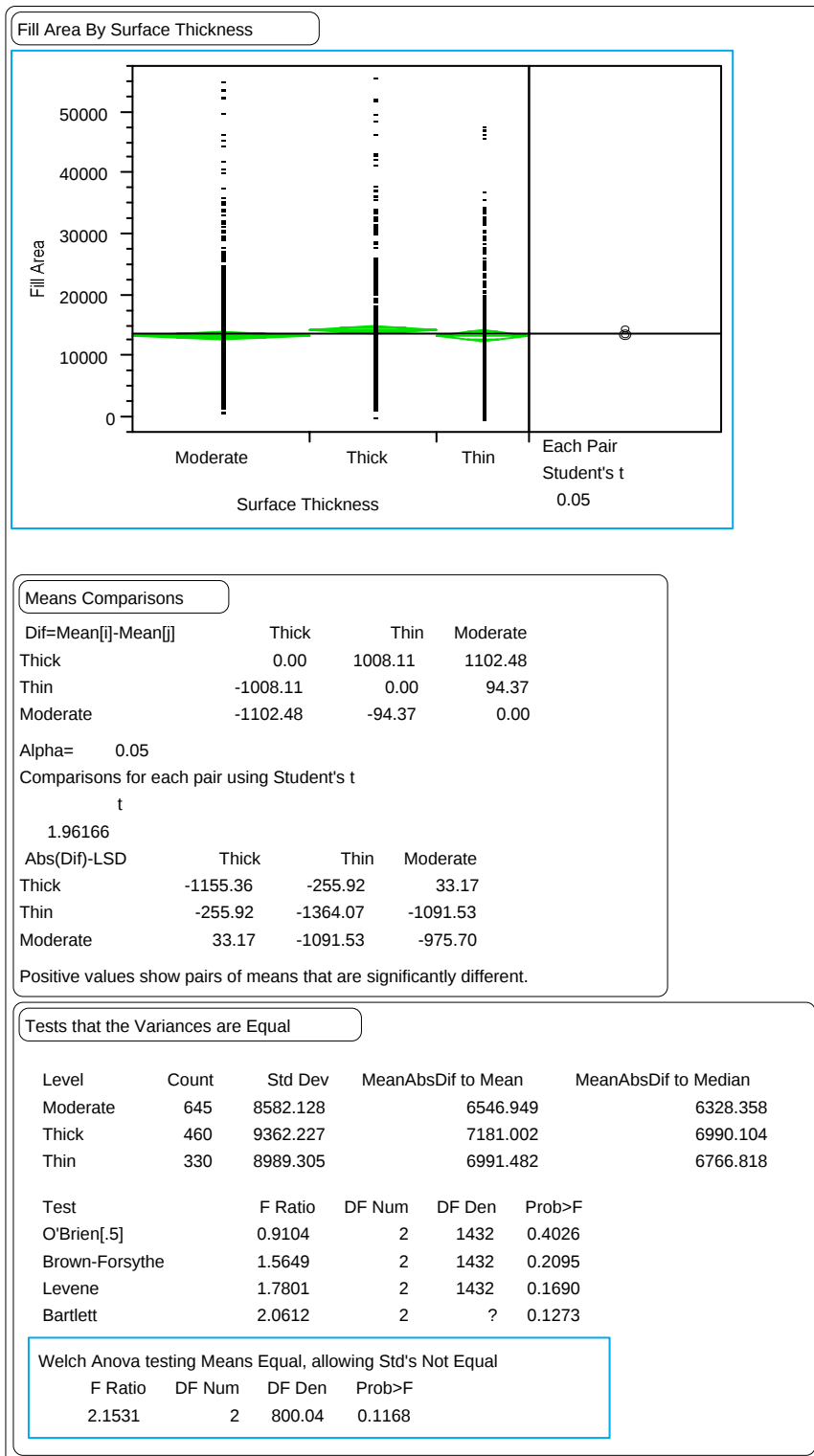


Figure 160. Paired t-test comparing GPS-1 and GPS-2 section means for the fill area index versus surface thickness.

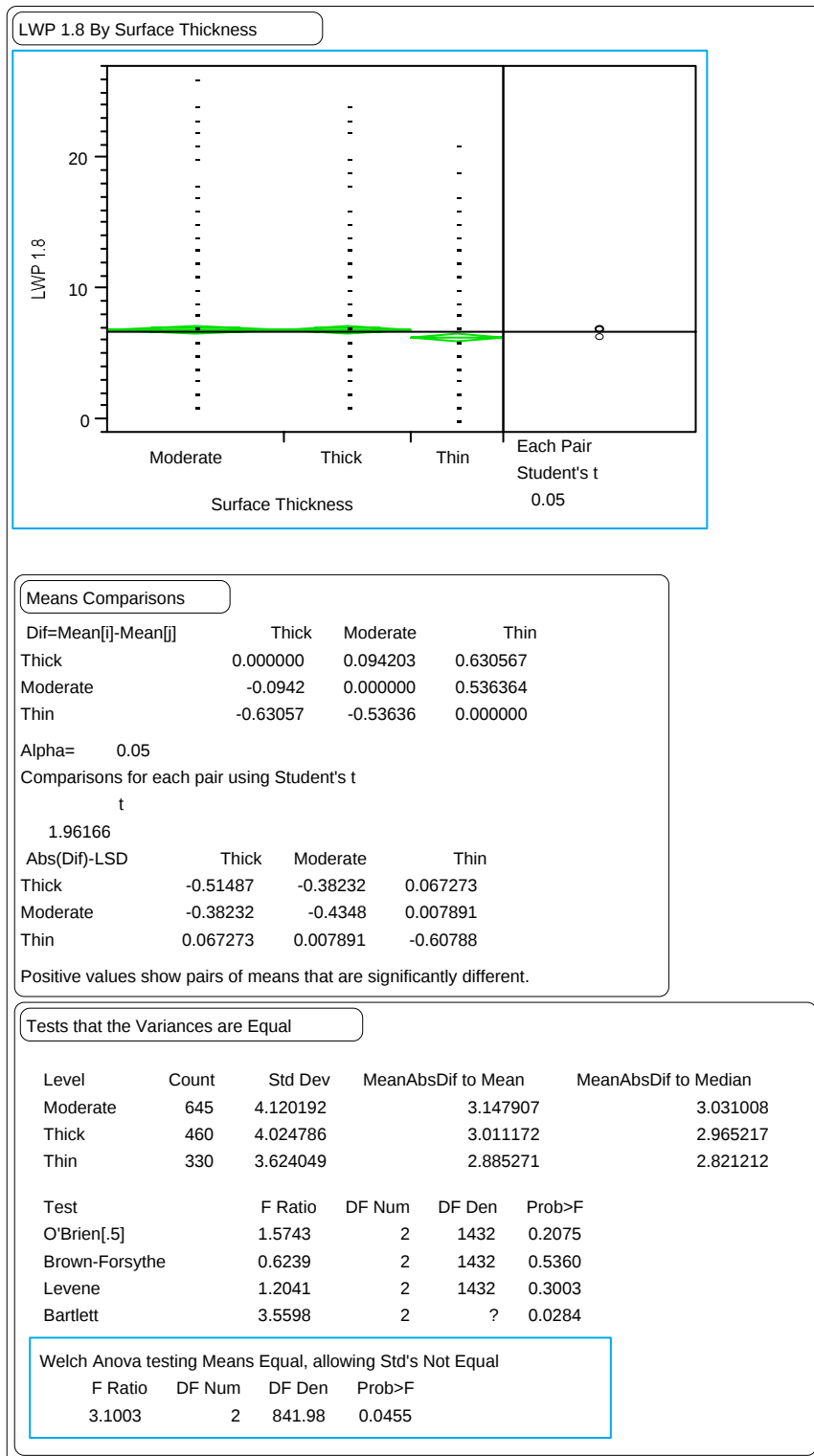


Figure 161. Paired t-test comparing GPS-1 and GPS-2 section means for the LWP 1.8-m rut depths versus surface thickness.

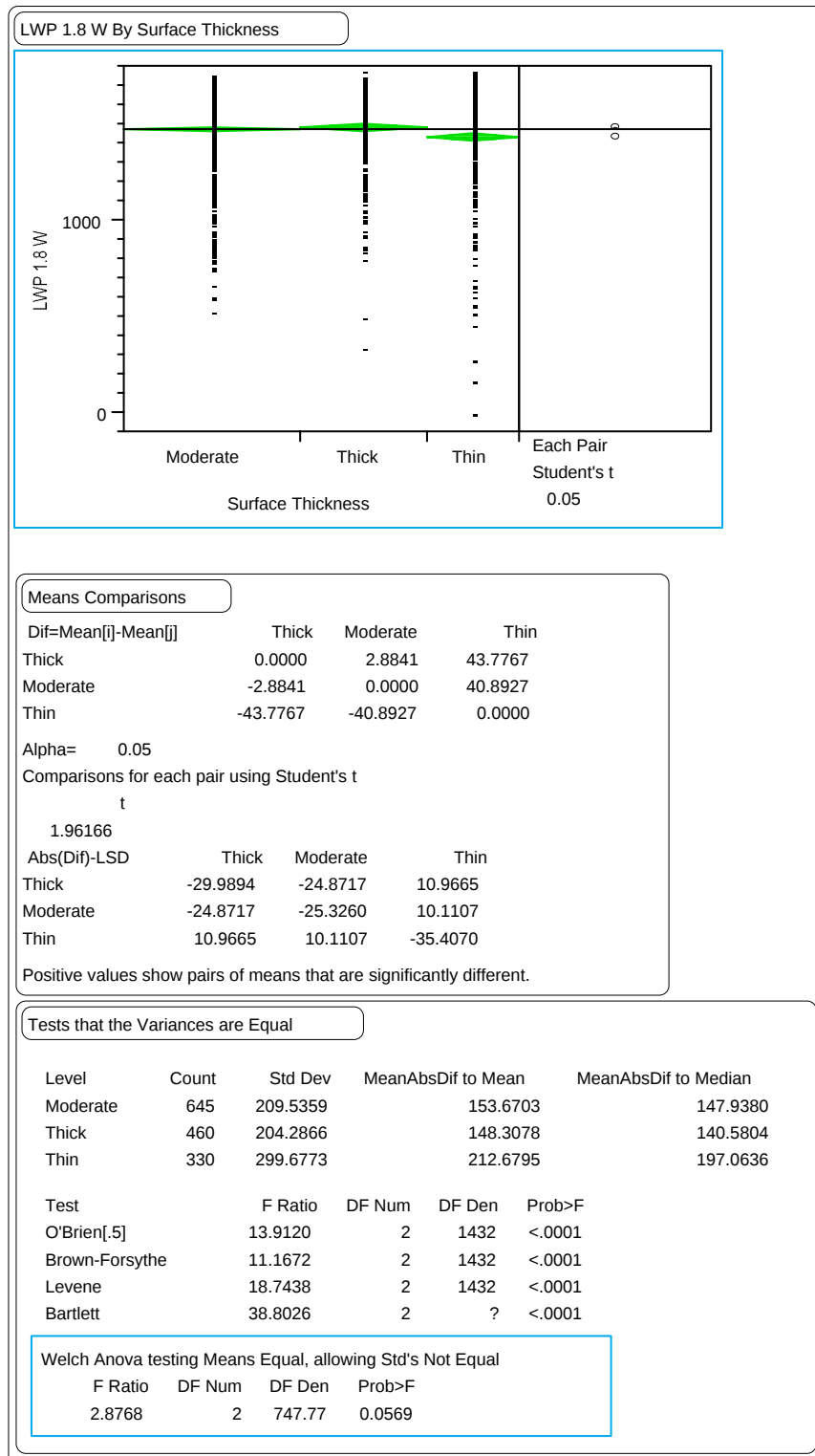


Figure 162. Paired t-test comparing GPS-1 and GPS-2 section means for the LWP 1.8-m rut widths versus surface thickness.

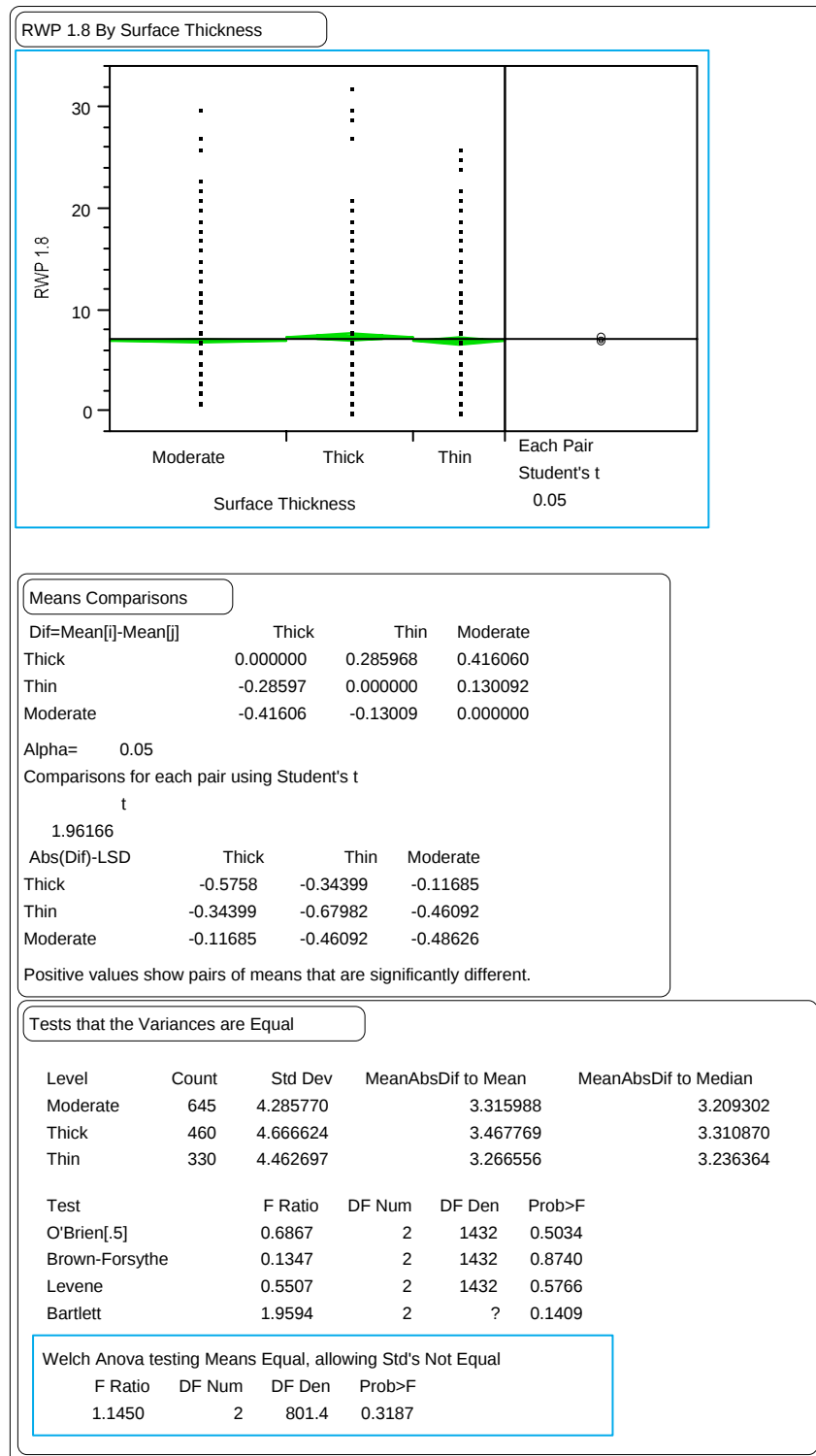


Figure 163. Paired t-test comparing GPS-1 and GPS-2 section means for the RWP 1.8-m rut depths versus surface thickness.

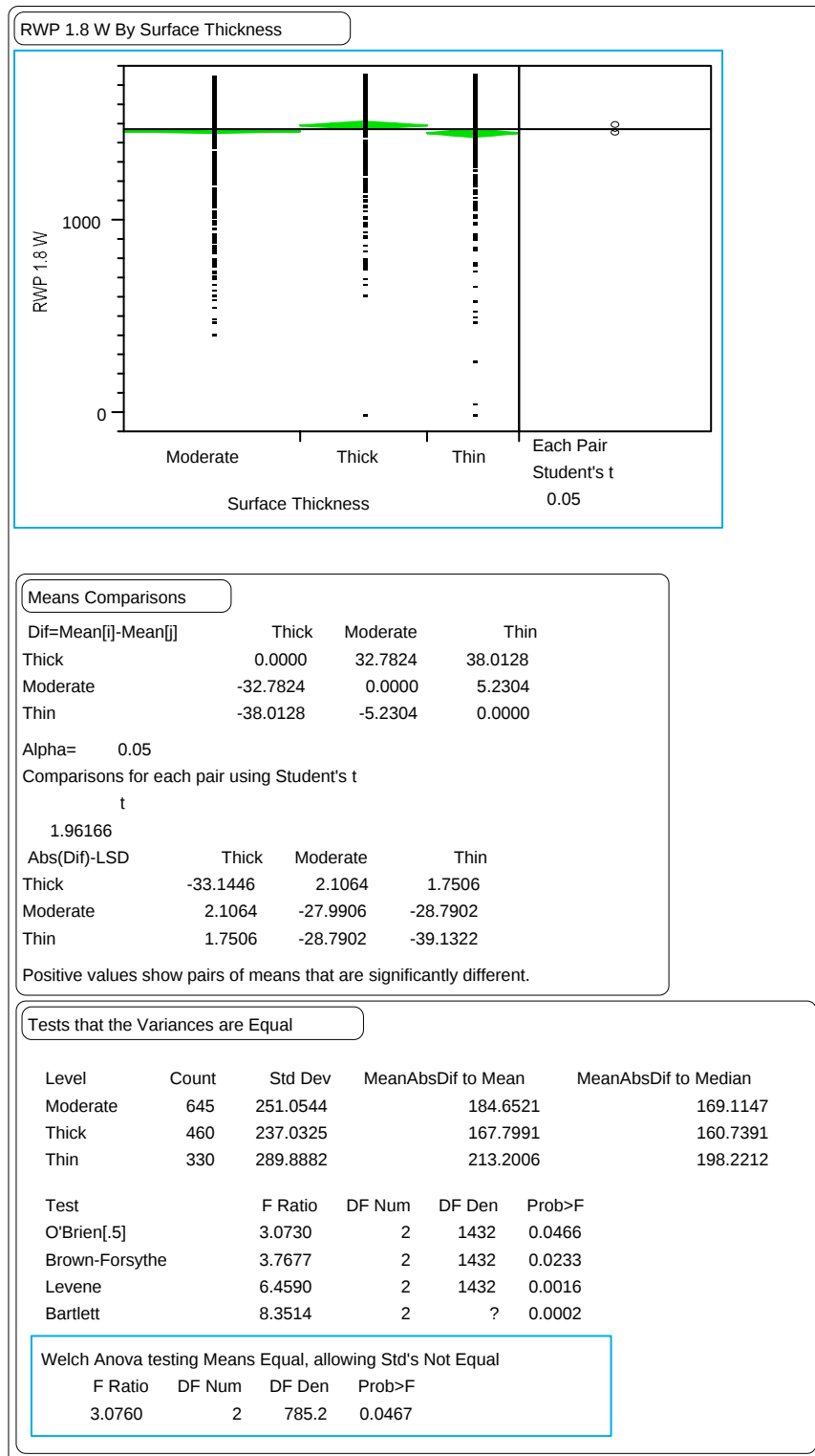


Figure 164. Paired t-test comparing GPS-1 and GPS-2 section means for the RWP 1.8-m rut widths versus surface thickness.

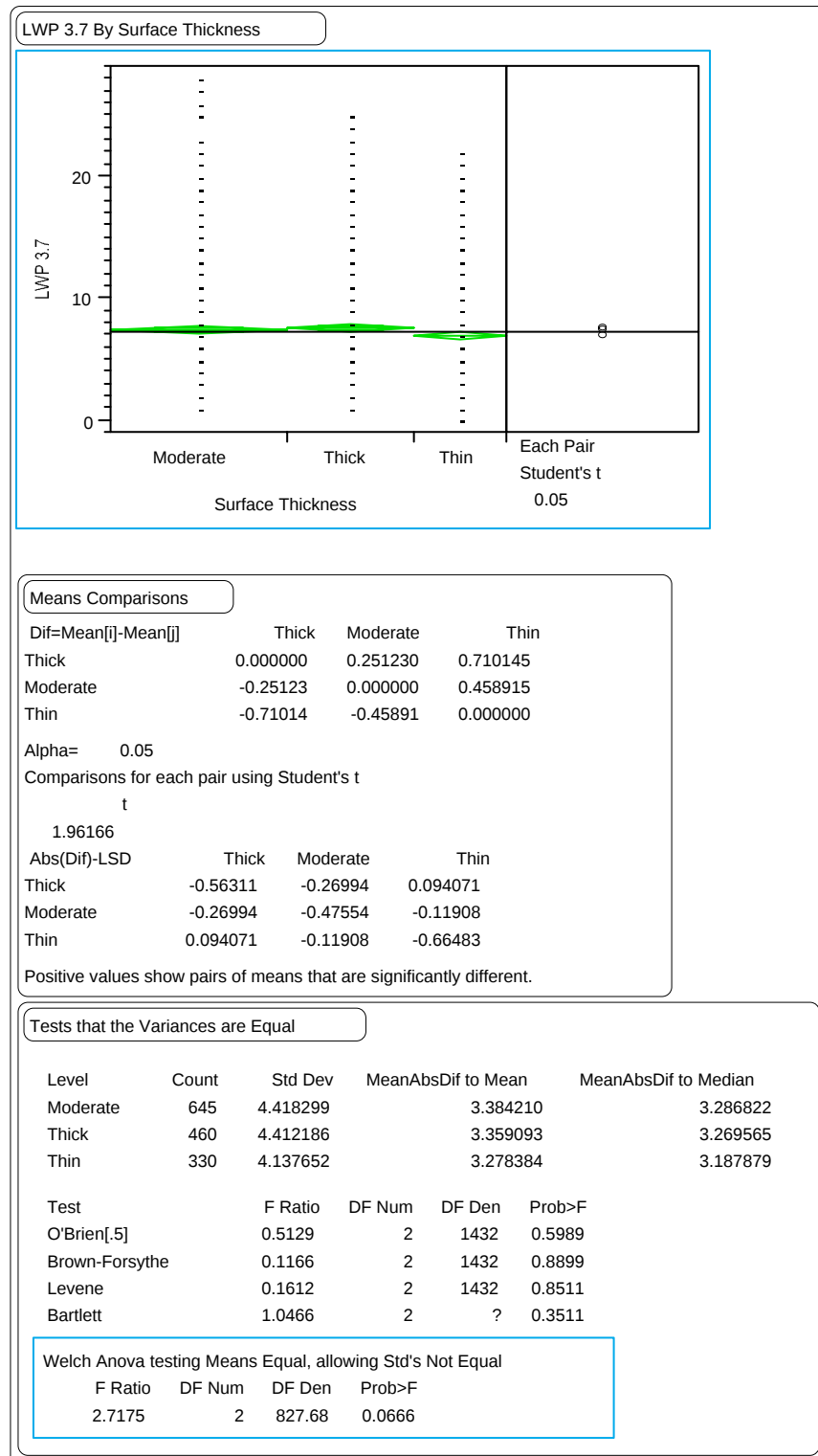


Figure 165. Paired t-test comparing GPS-1 and GPS-2 section means for the LWP wire line rut depths versus surface thickness.

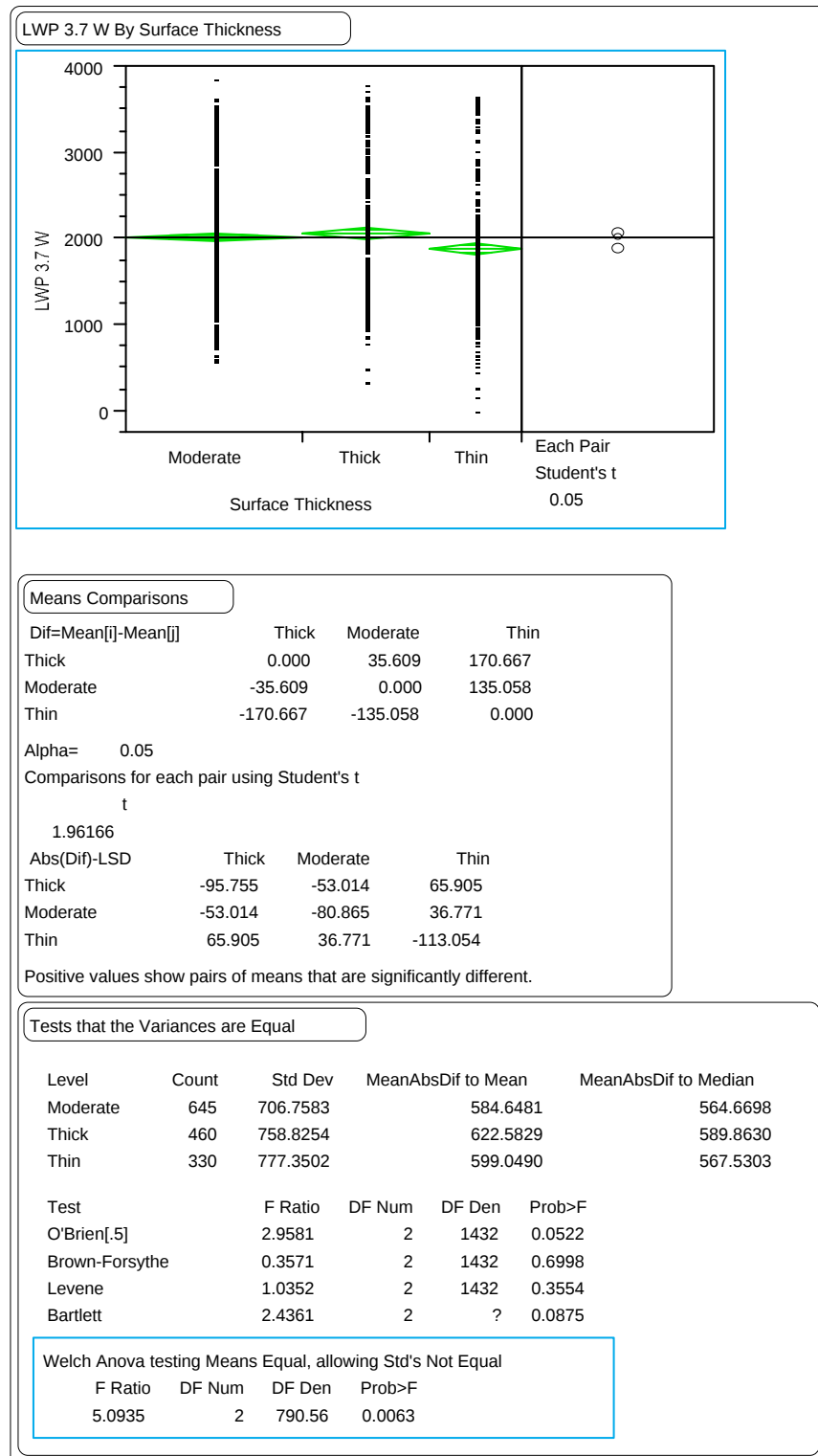


Figure 166. Paired t-test comparing GPS-1 and GPS-2 section means for the LWP wire line rut widths versus surface thickness.

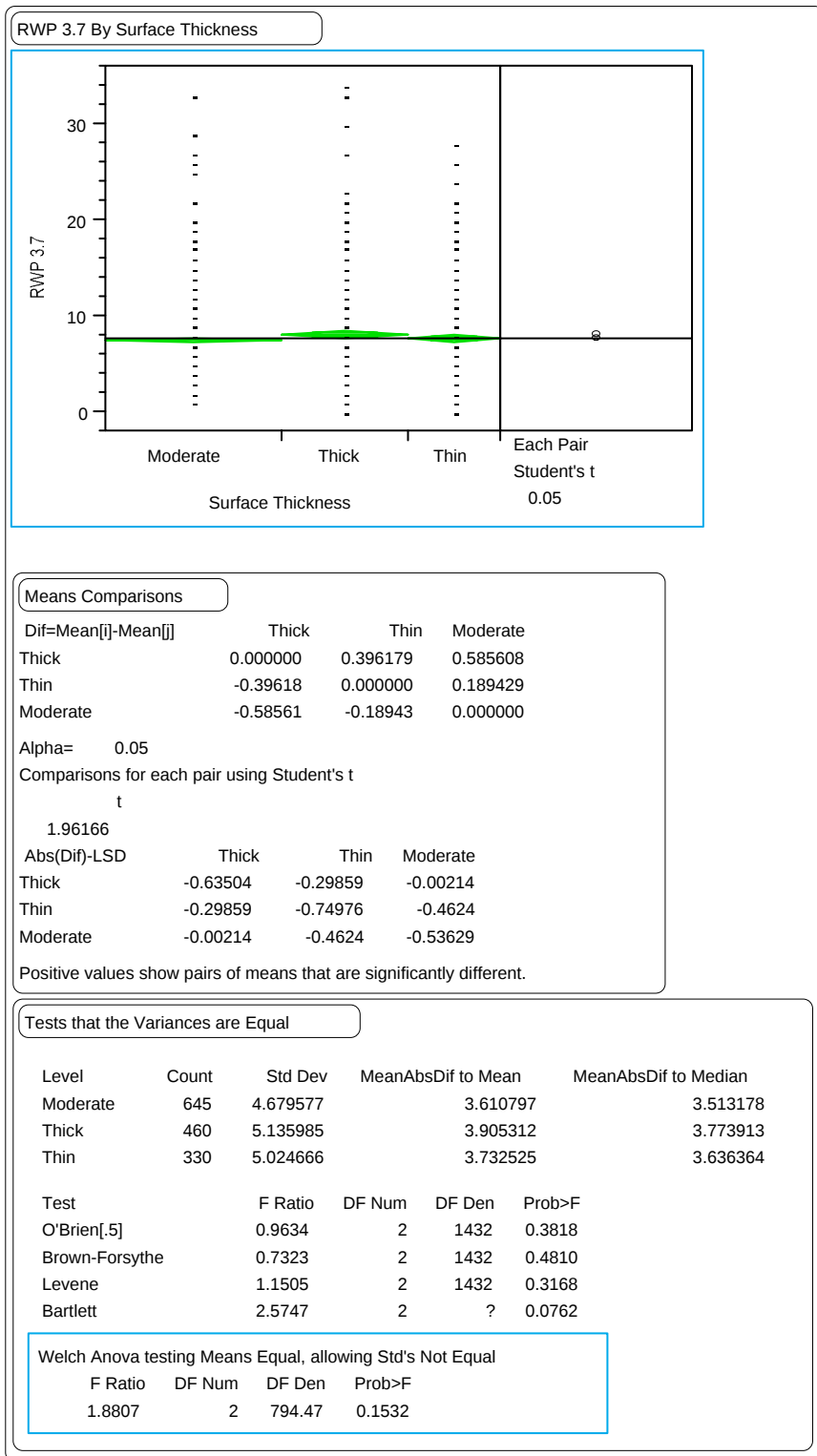


Figure 167. Paired t-test comparing GPS-1 and GPS-2 section means for the RWP wire line rut depths versus surface thickness.

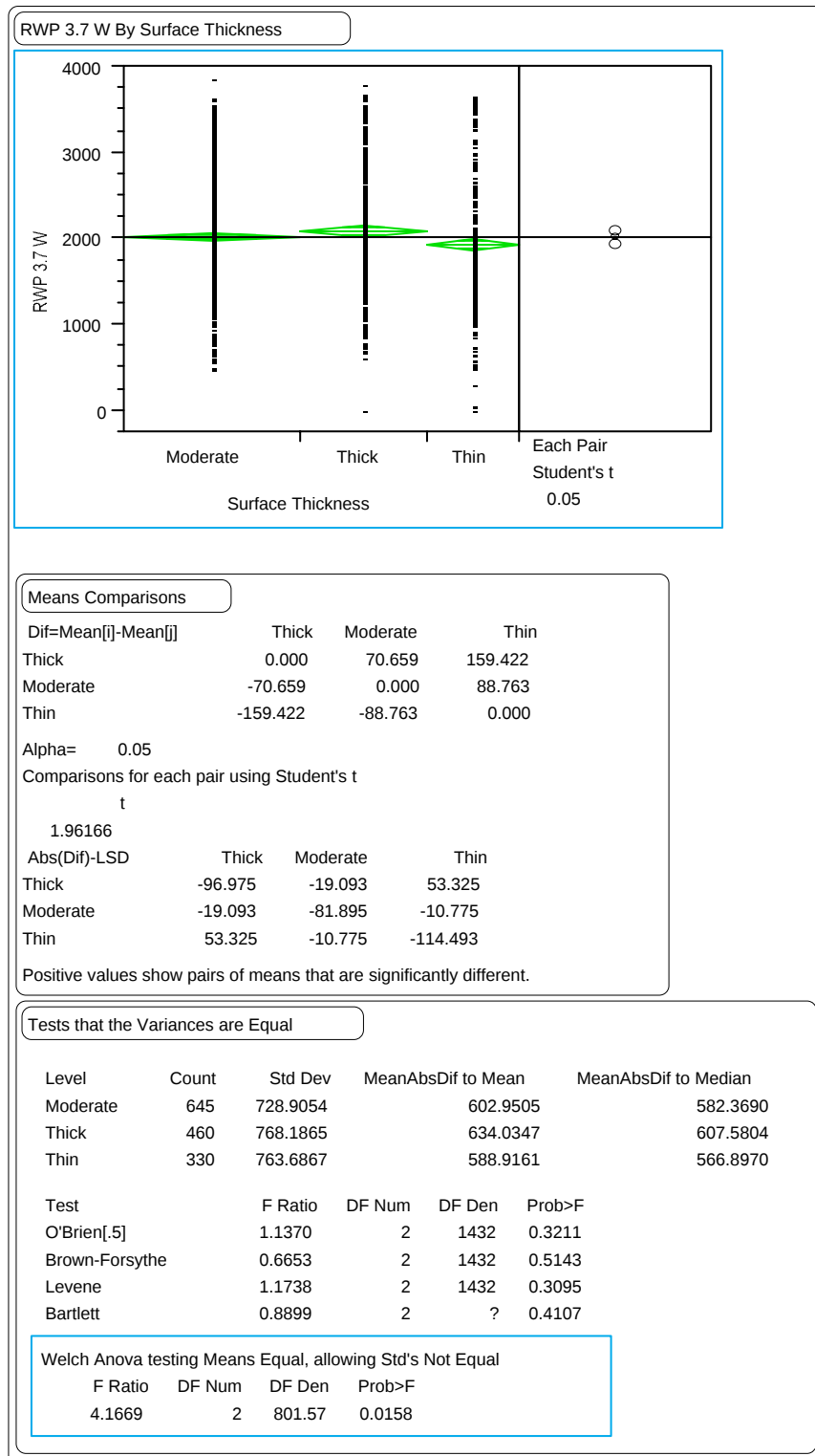


Figure 168. Paired t-test comparing GPS-1 and GPS-2 section means for the RWP wire line rut widths versus surface thickness.

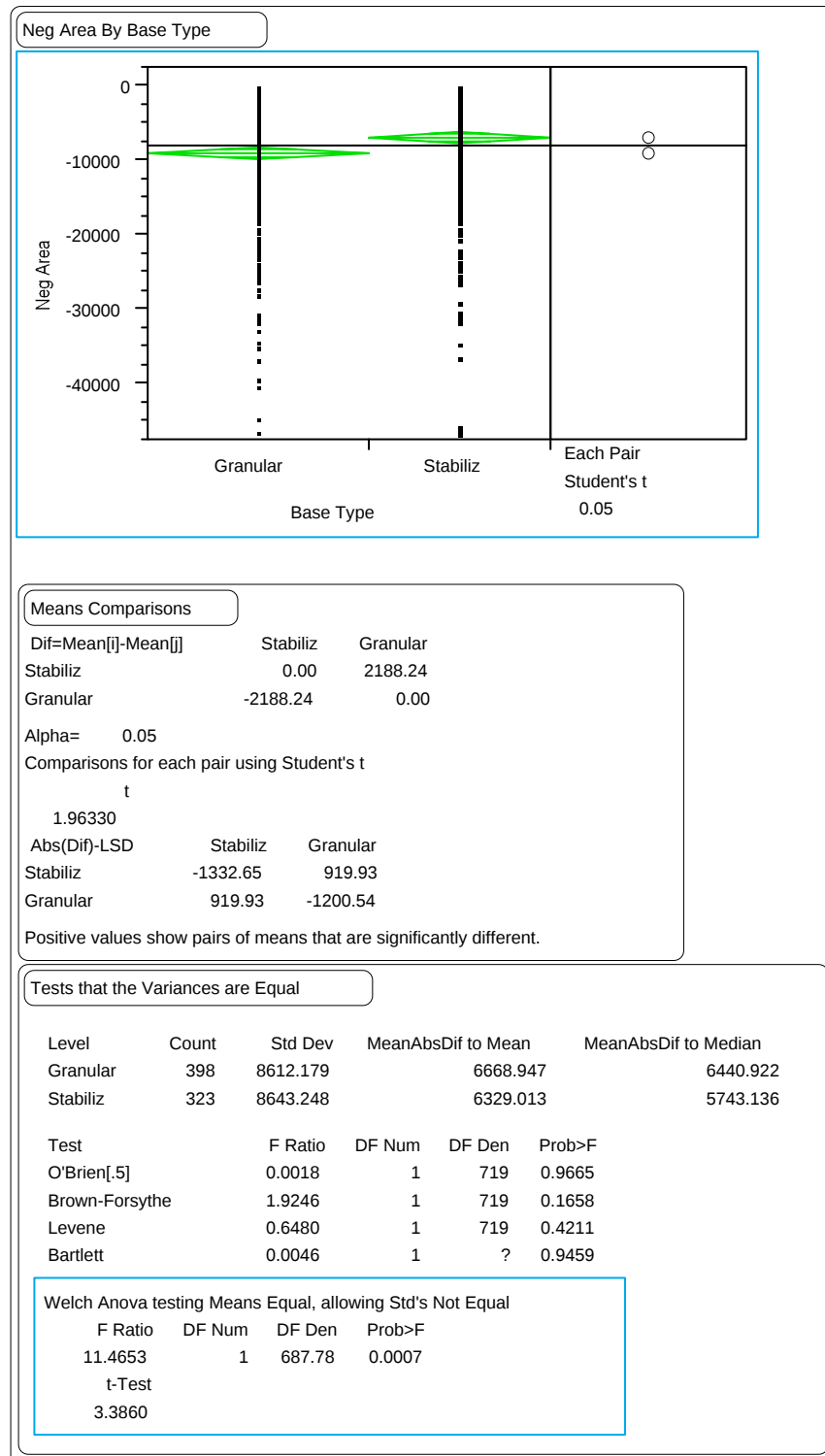


Figure 169. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the negative area index versus base type.

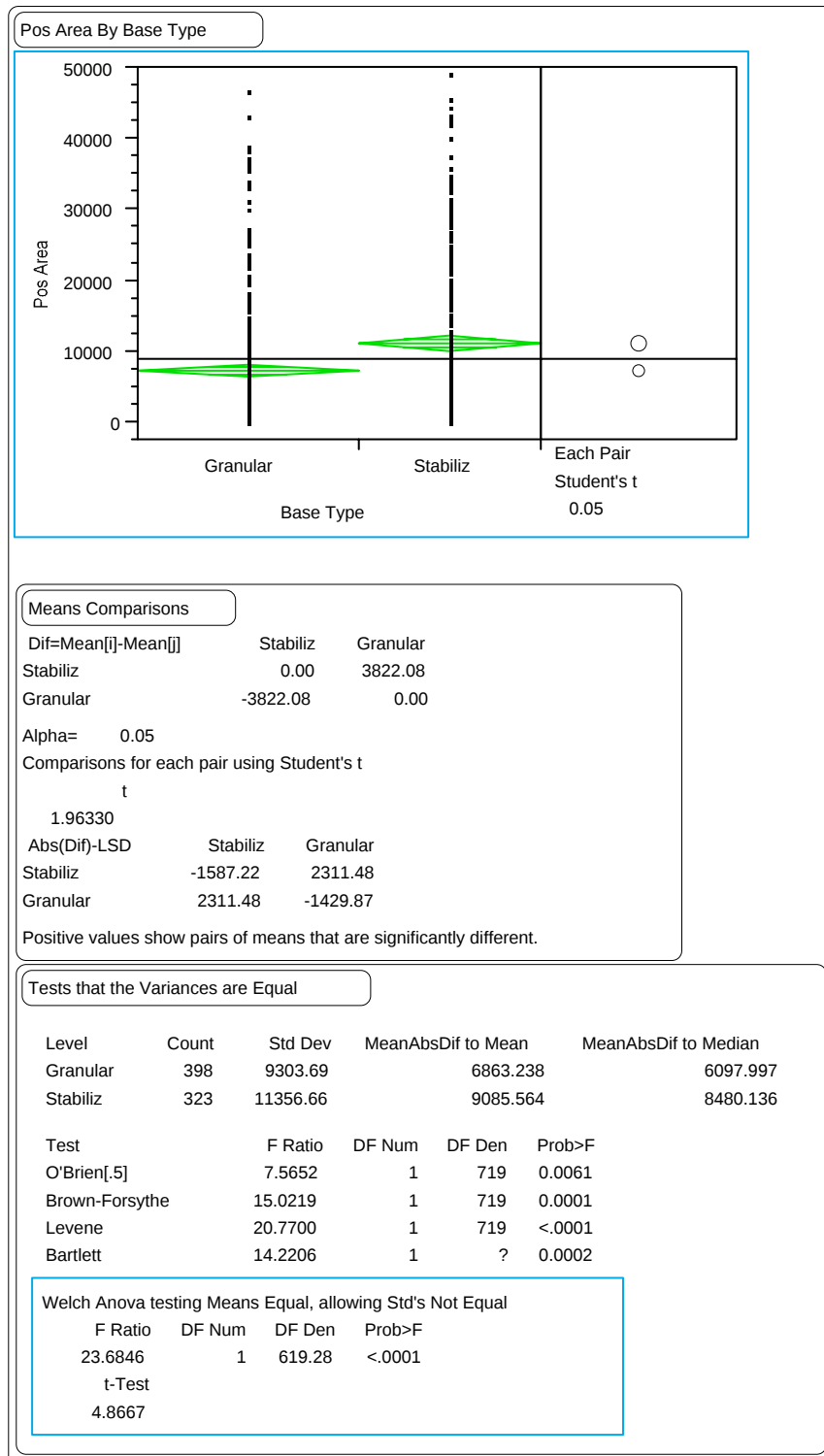


Figure 170. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the positive area index versus base type.

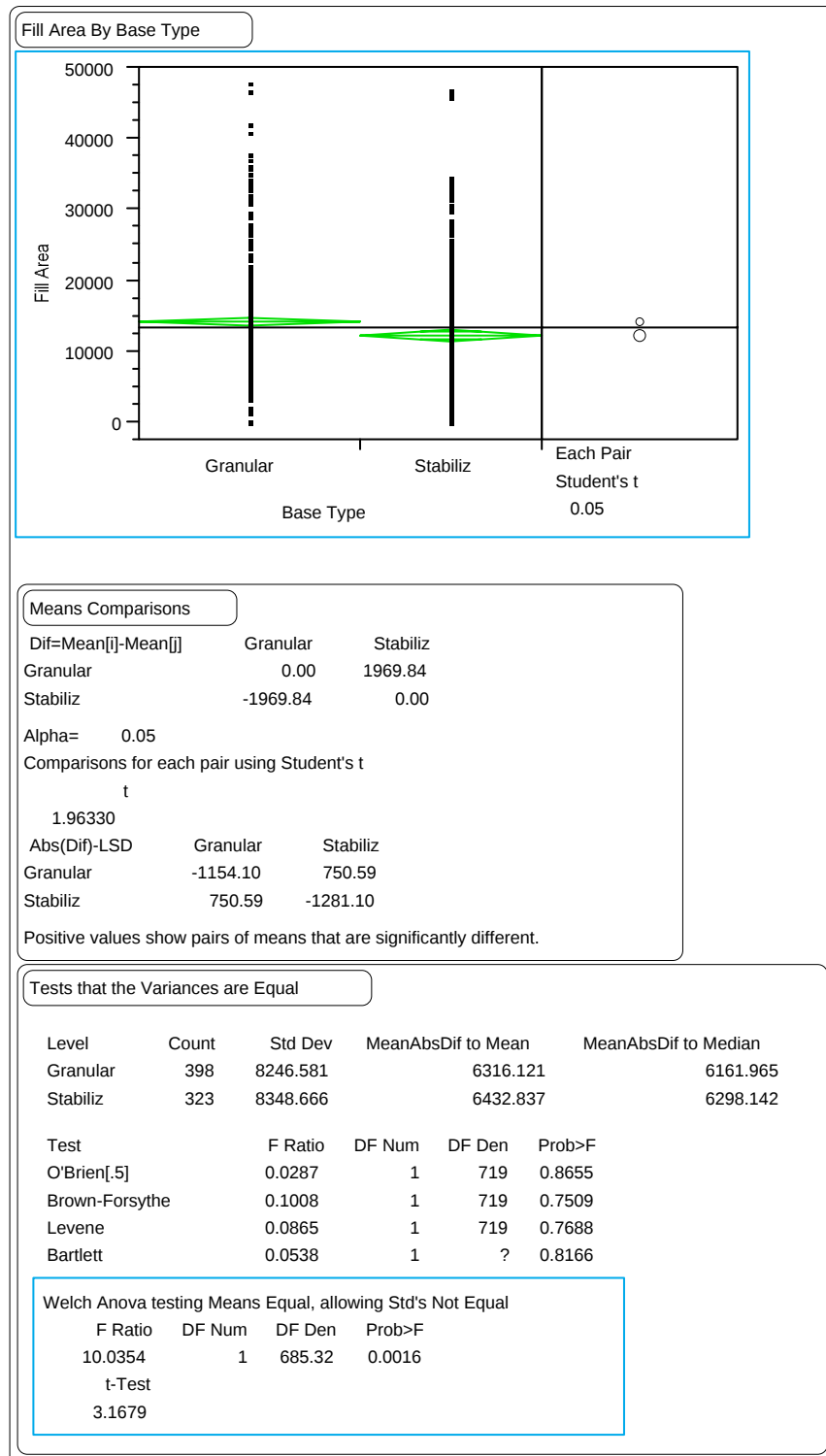


Figure 171. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the fill area index versus base type.

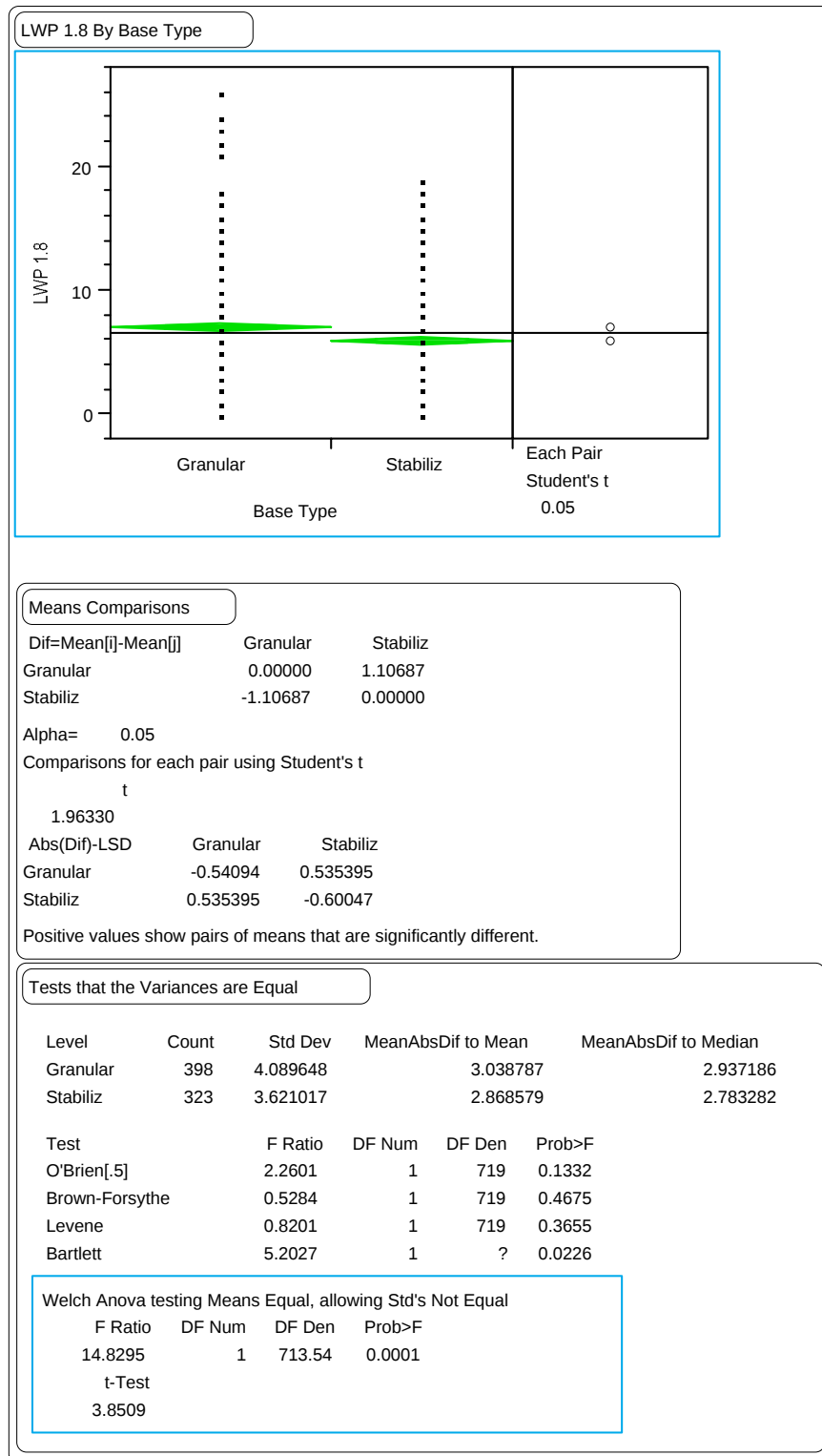


Figure 172. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the LWP 1.8-m rut depths versus base type.

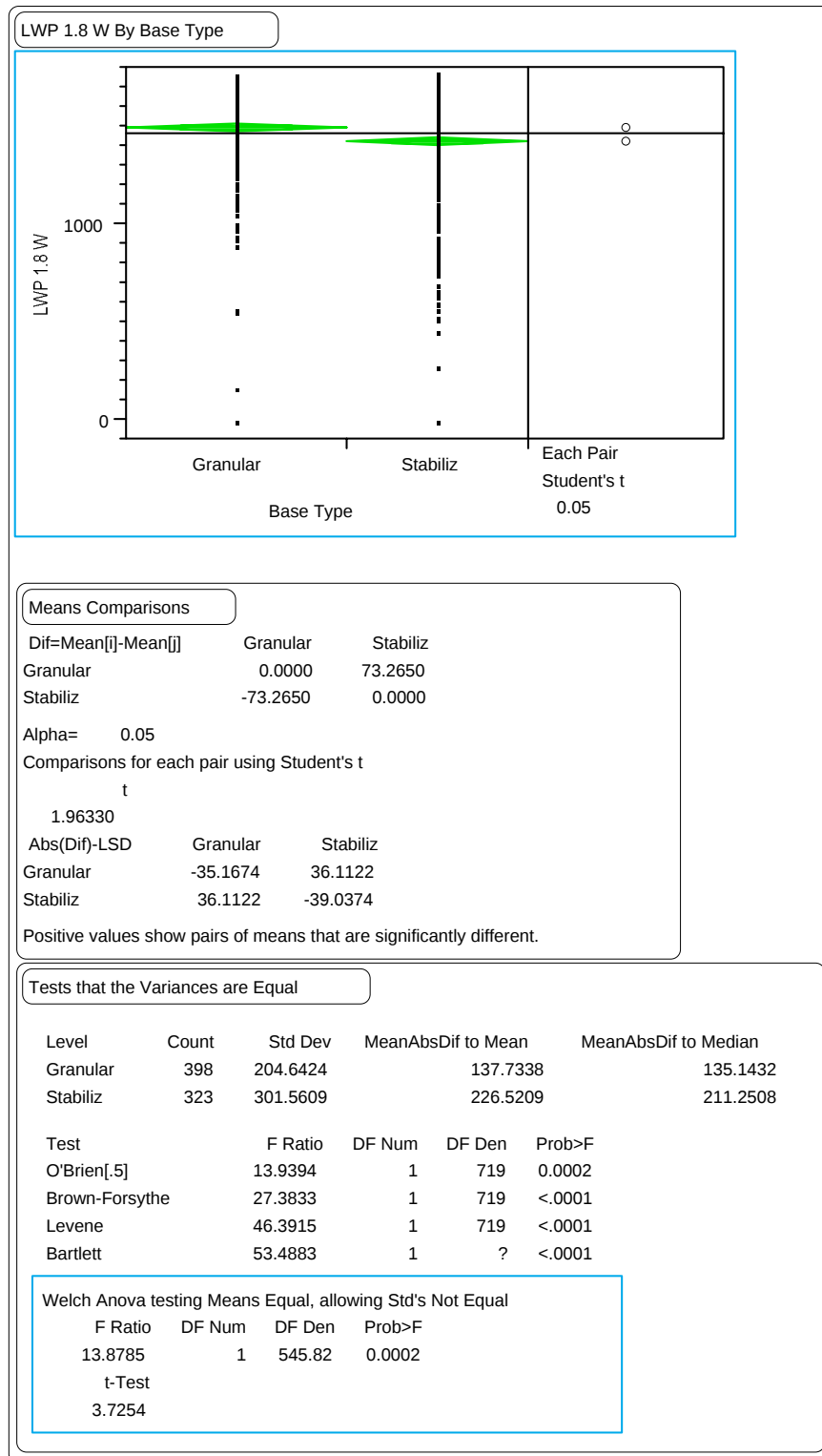


Figure 173. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the LWP 1.8-m rut widths versus base type.

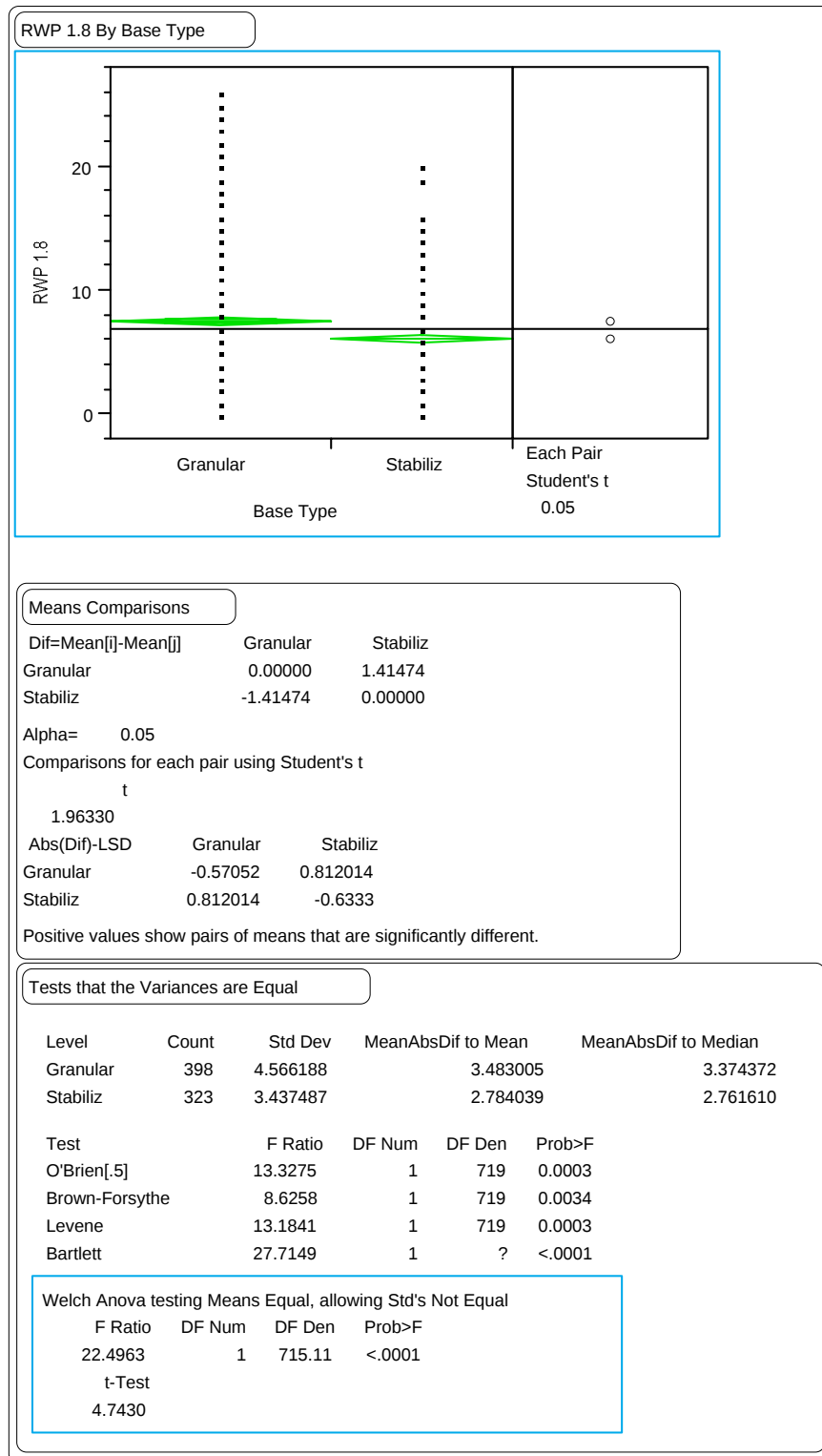


Figure 174. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the RWP 1.8-m rut depths versus base type.

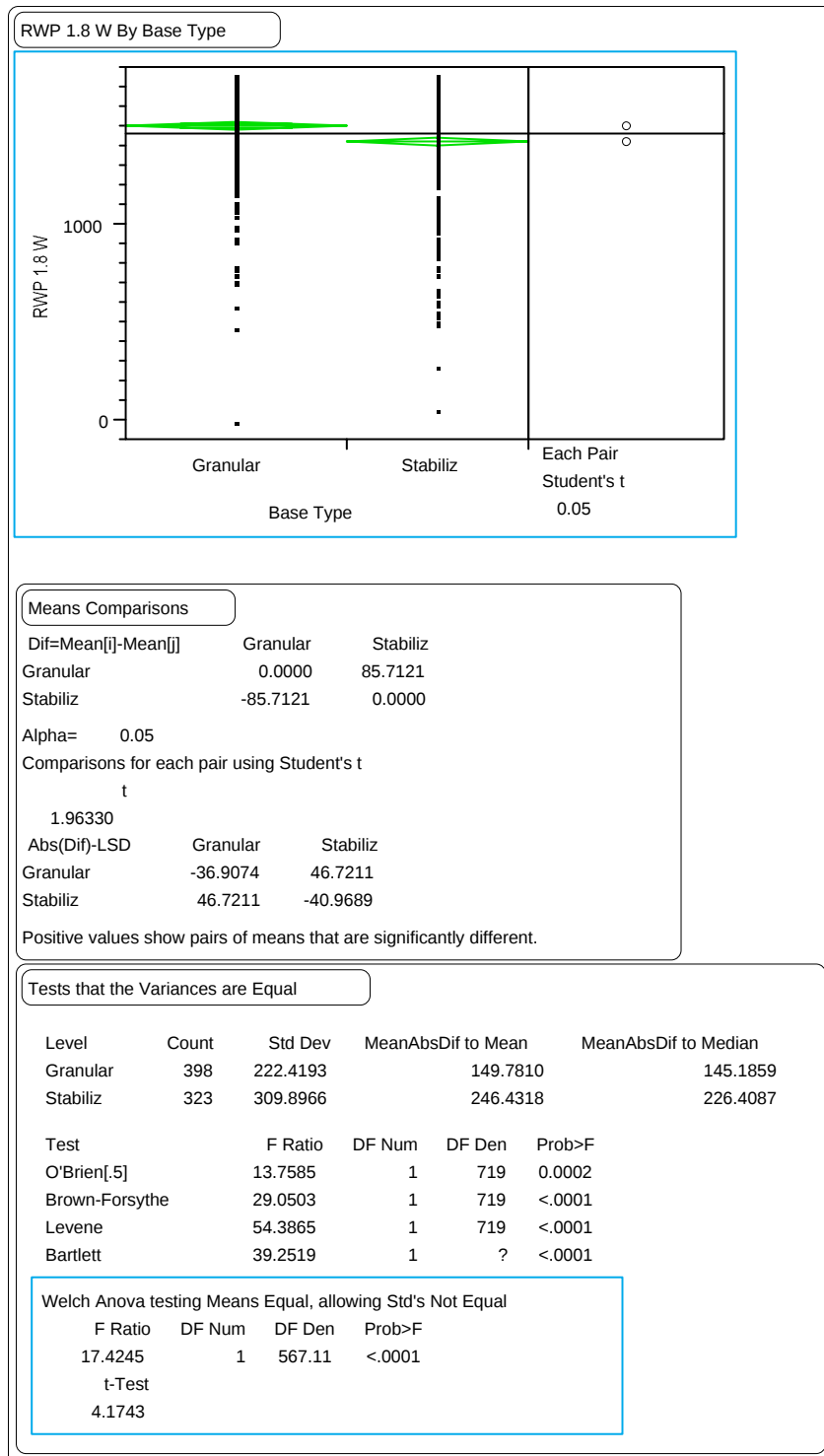


Figure 175. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the RWP 1.8-m rut widths versus base type.

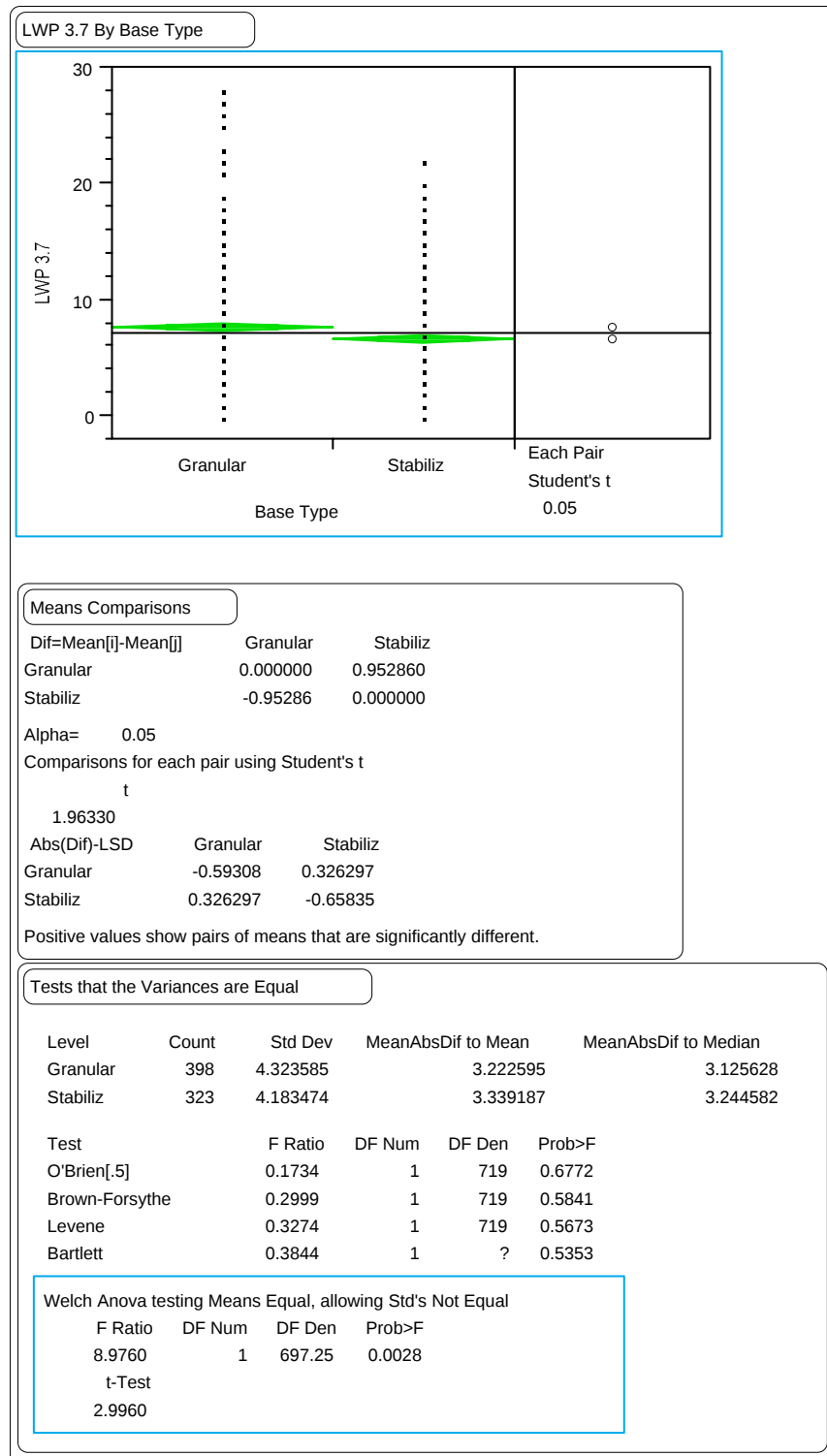


Figure 176. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the LWP wire line rut depths versus base type.

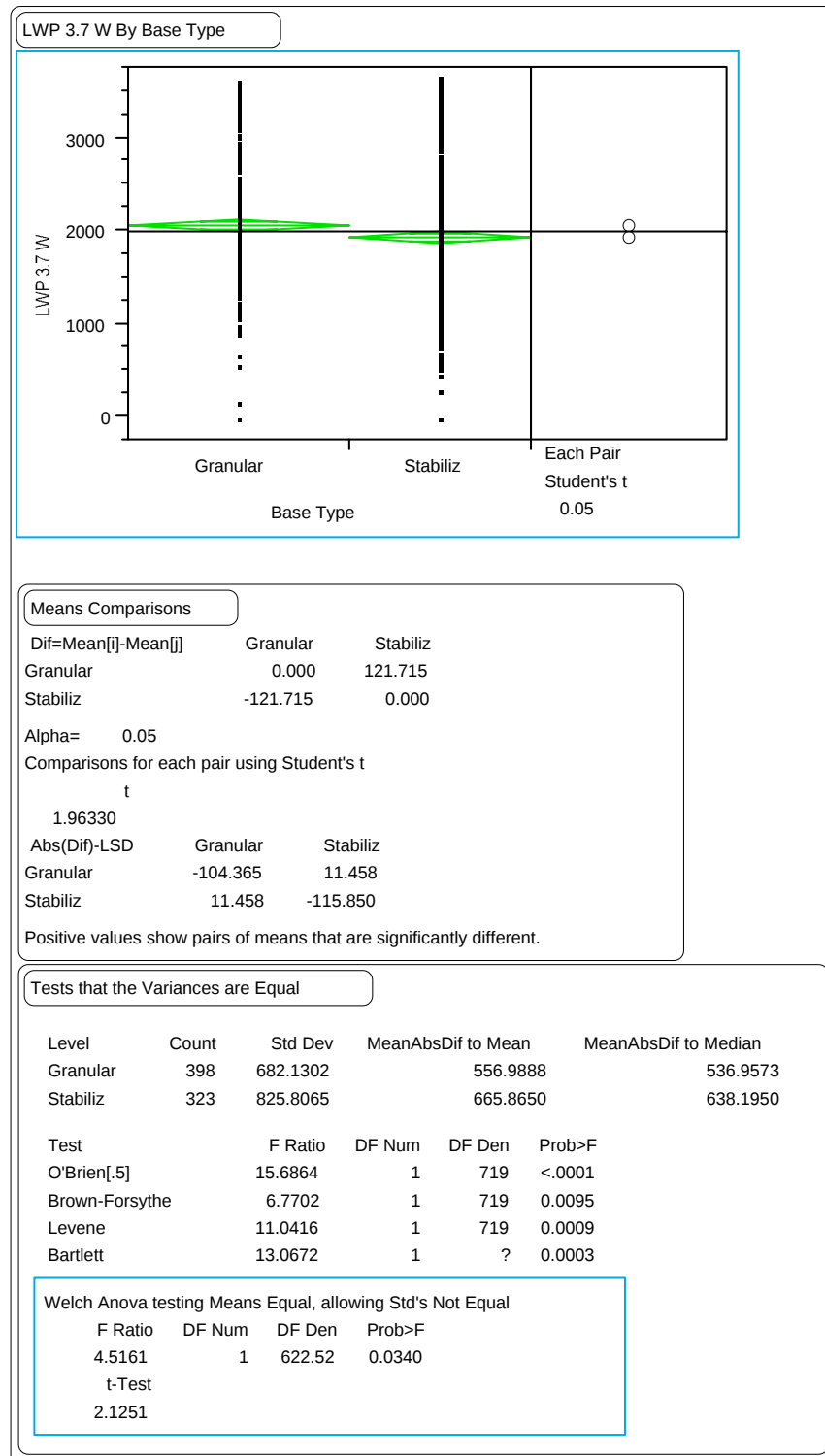


Figure 177. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the LWP wire line rut widths versus base type.

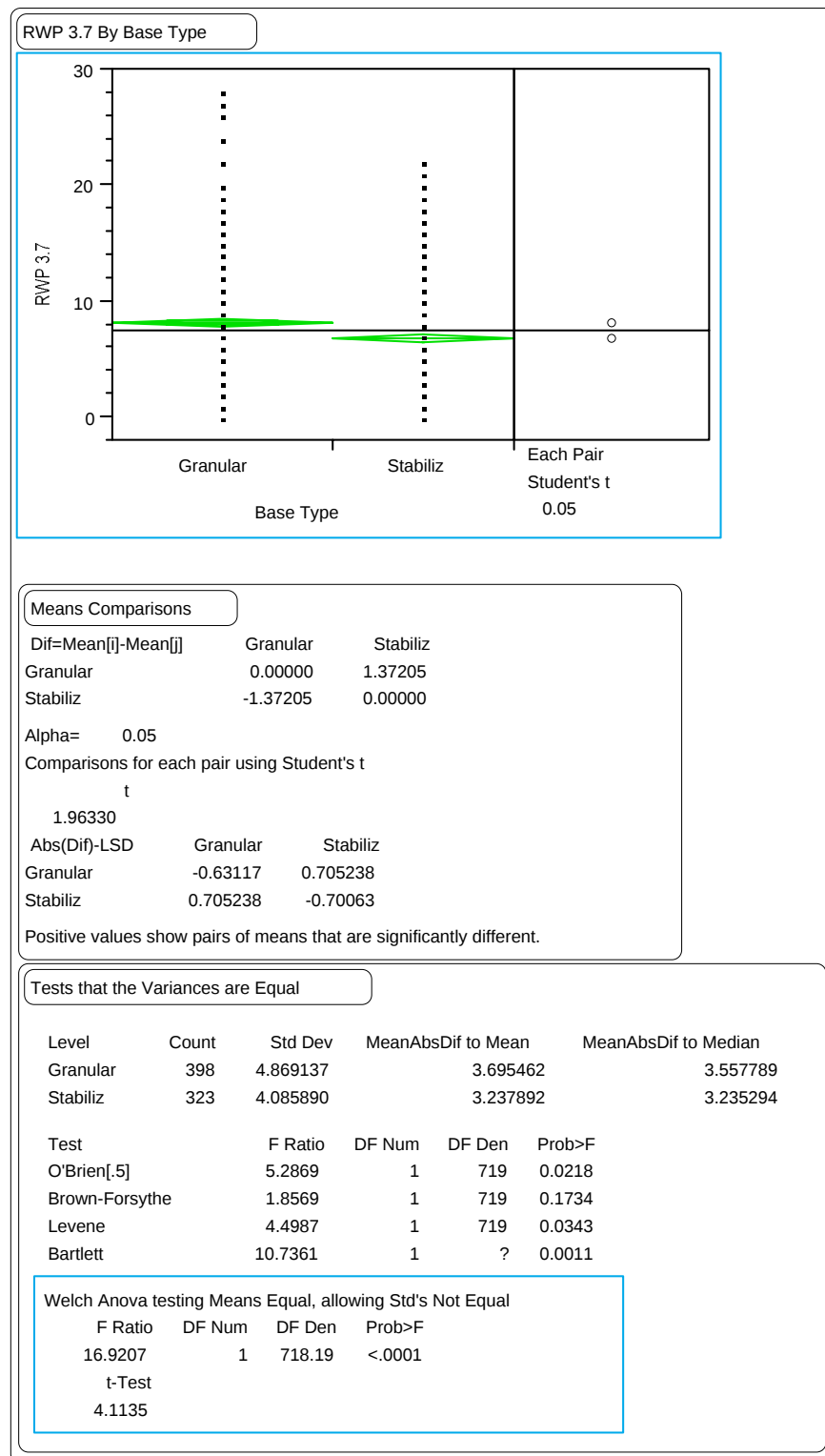


Figure 178. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the RWP wire line rut depths versus base type.

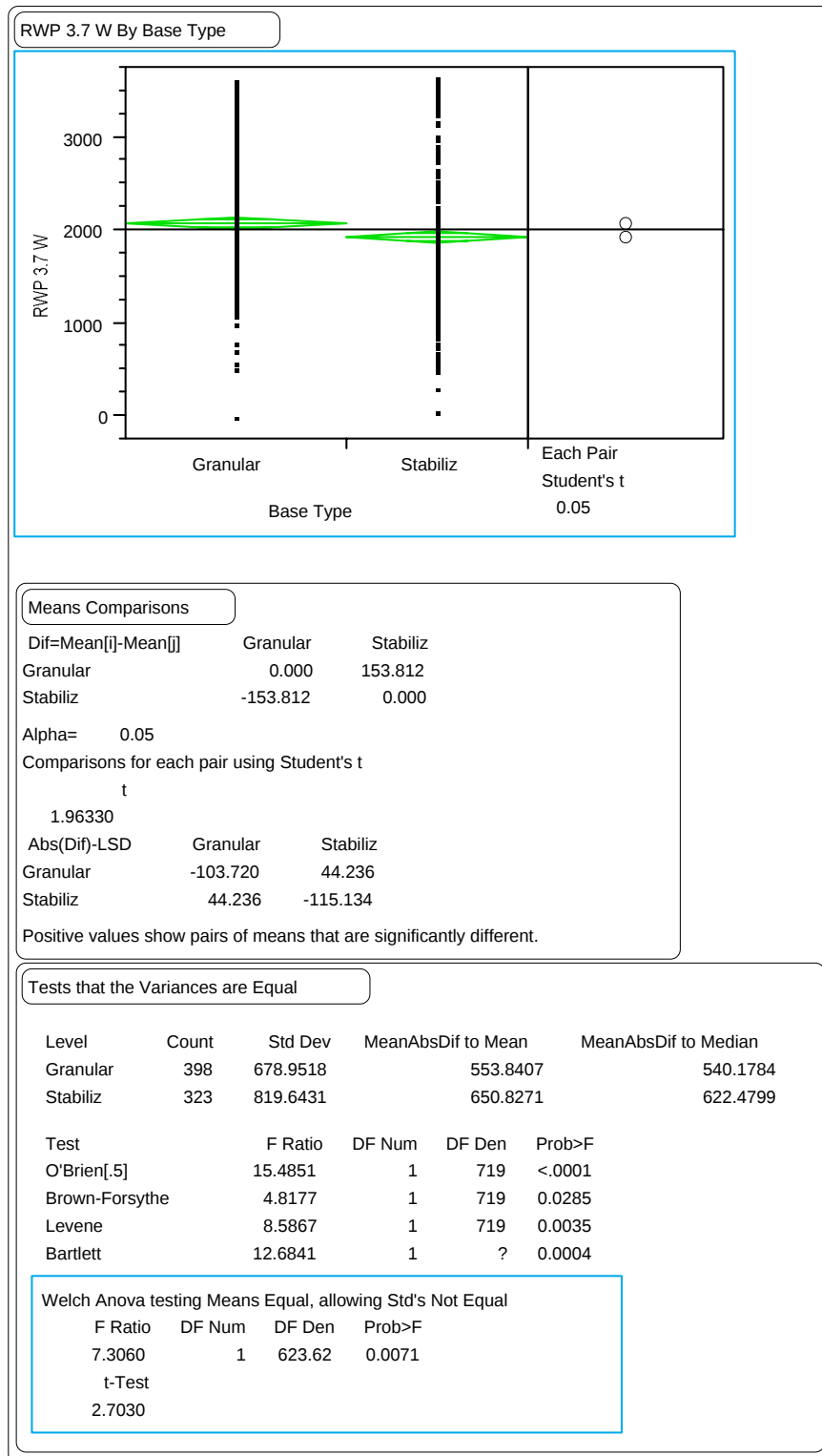


Figure 179. Paired t-test comparing thin-surfaced GPS-1 and GPS-2 section means for the RWP wire line rut widths versus base type.

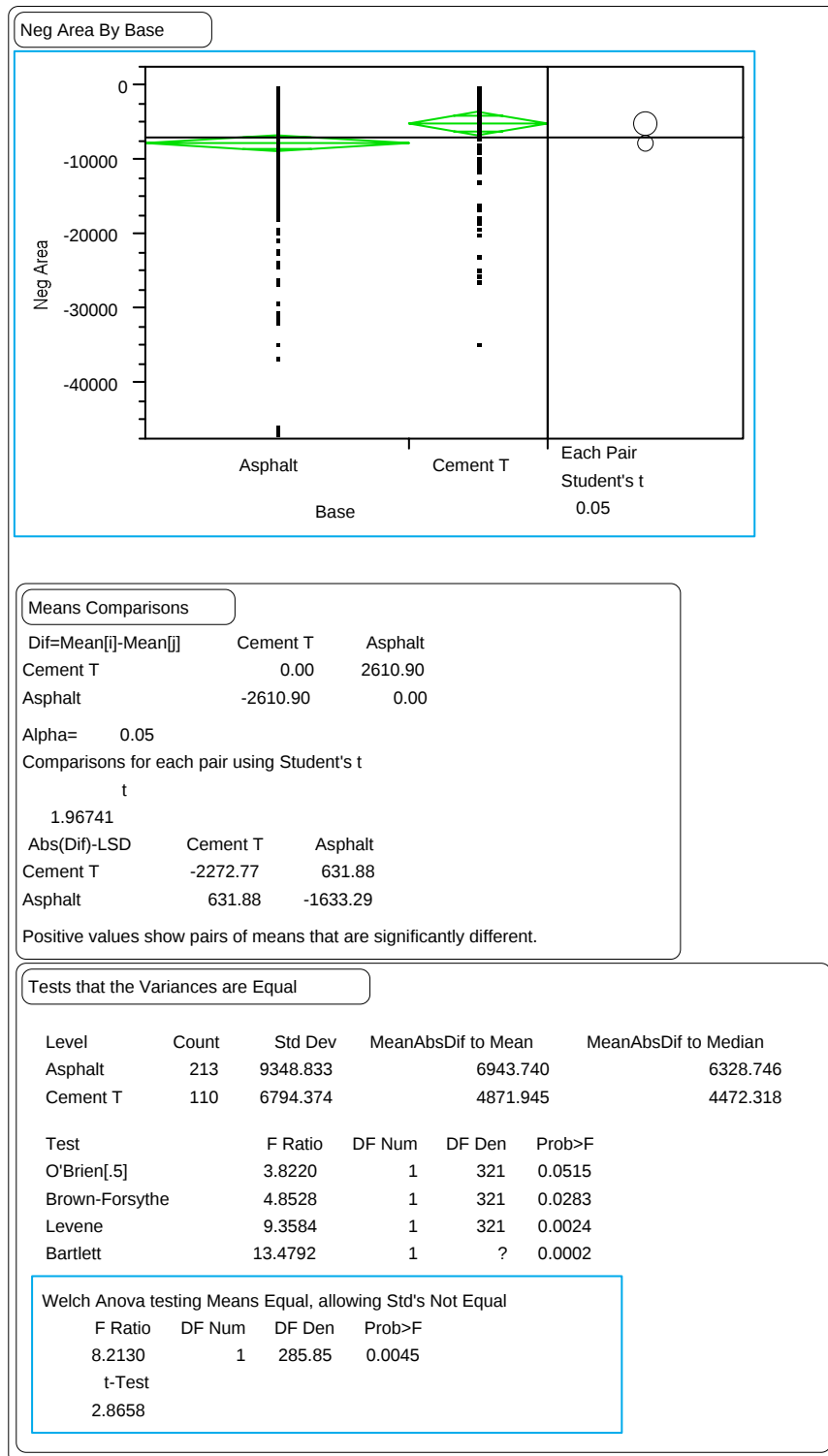


Figure 180. Paired t-test comparing thin-surfaced GPS-2 section means for the negative area index versus base type.

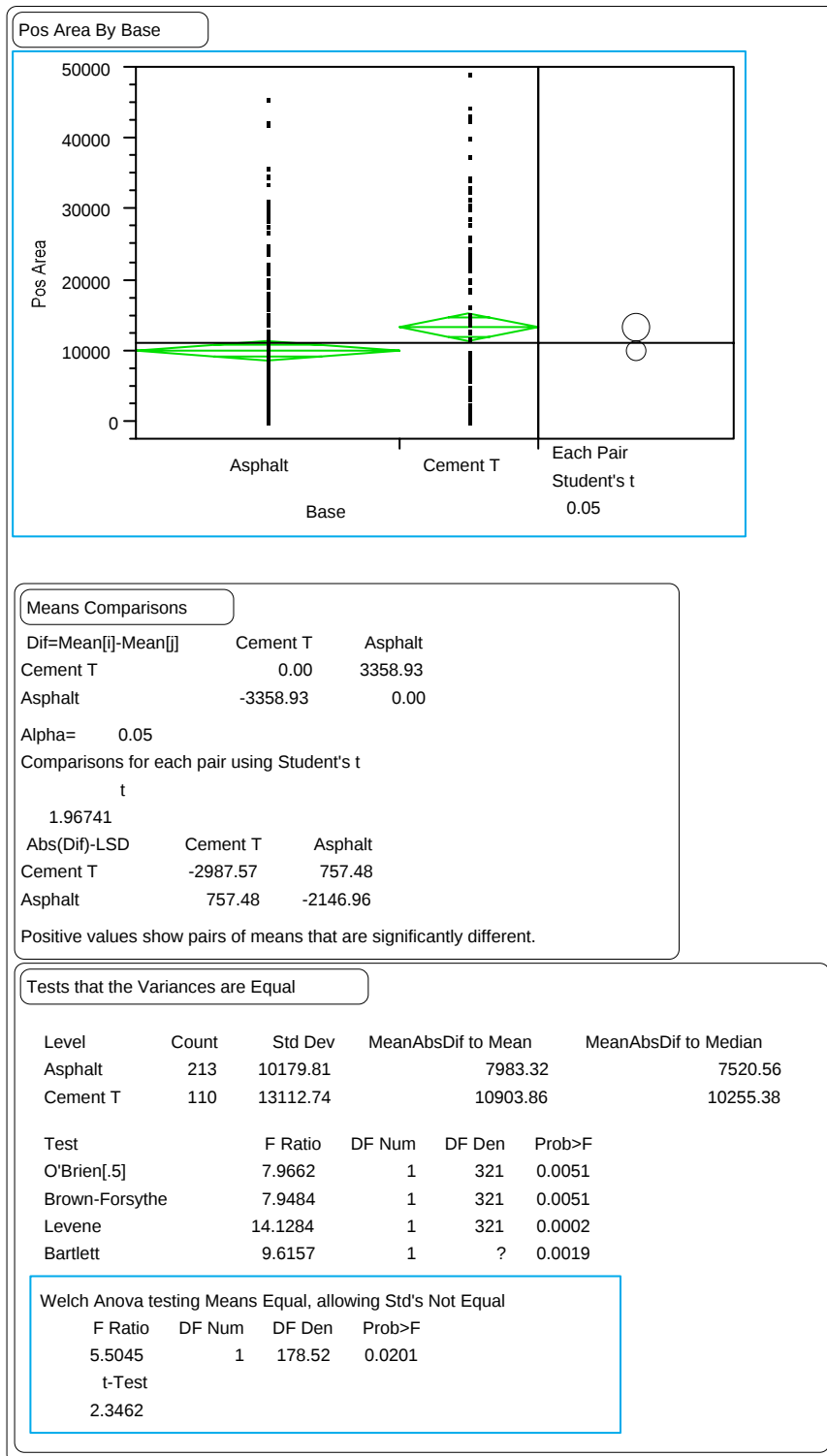


Figure 181. Paired t-test comparing thin-surfaced GPS-2 section means for the positive area index versus base type.

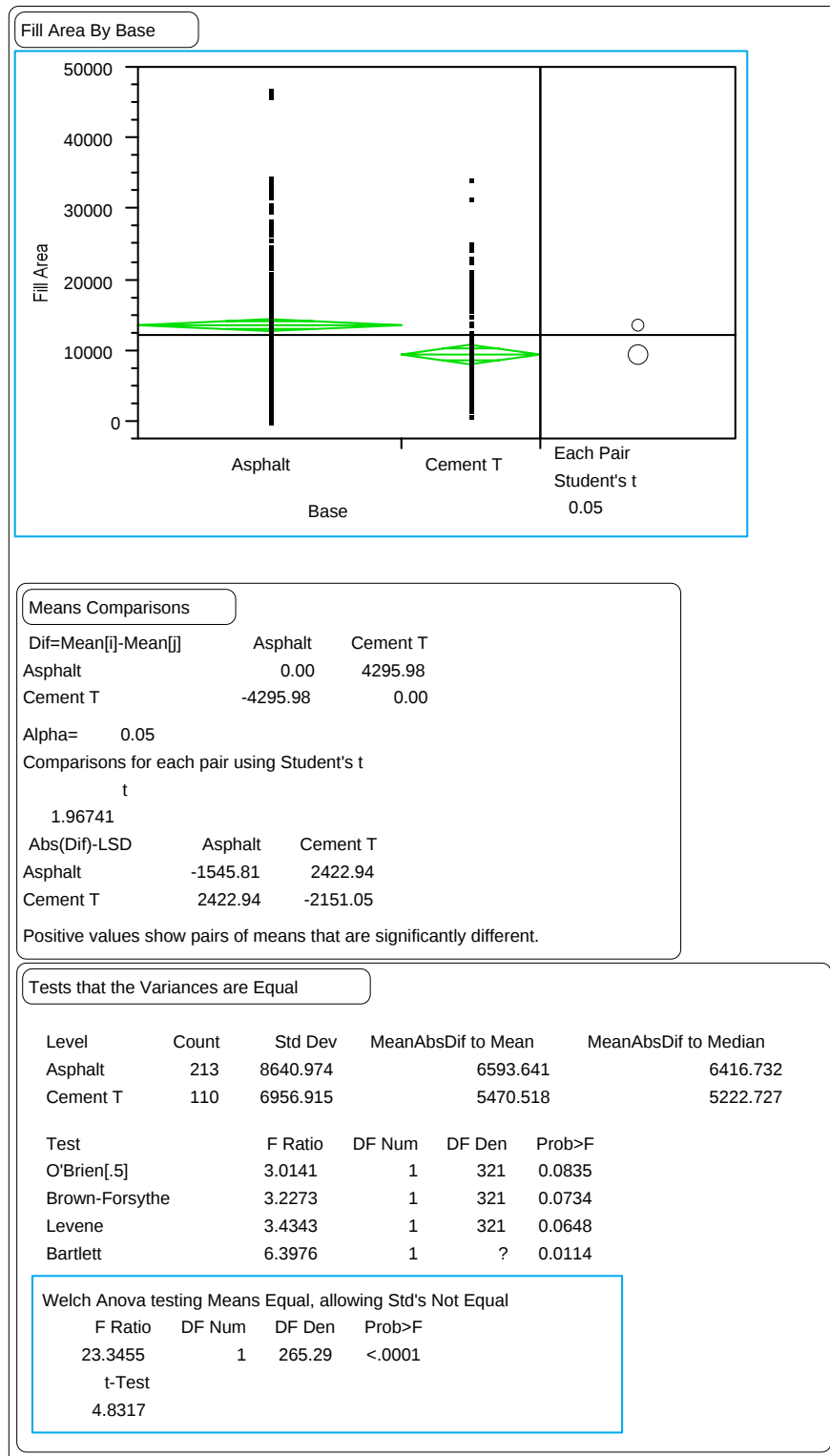


Figure 182. Paired t-test comparing thin-surfaced GPS-2 section means for the fill area index versus base type.

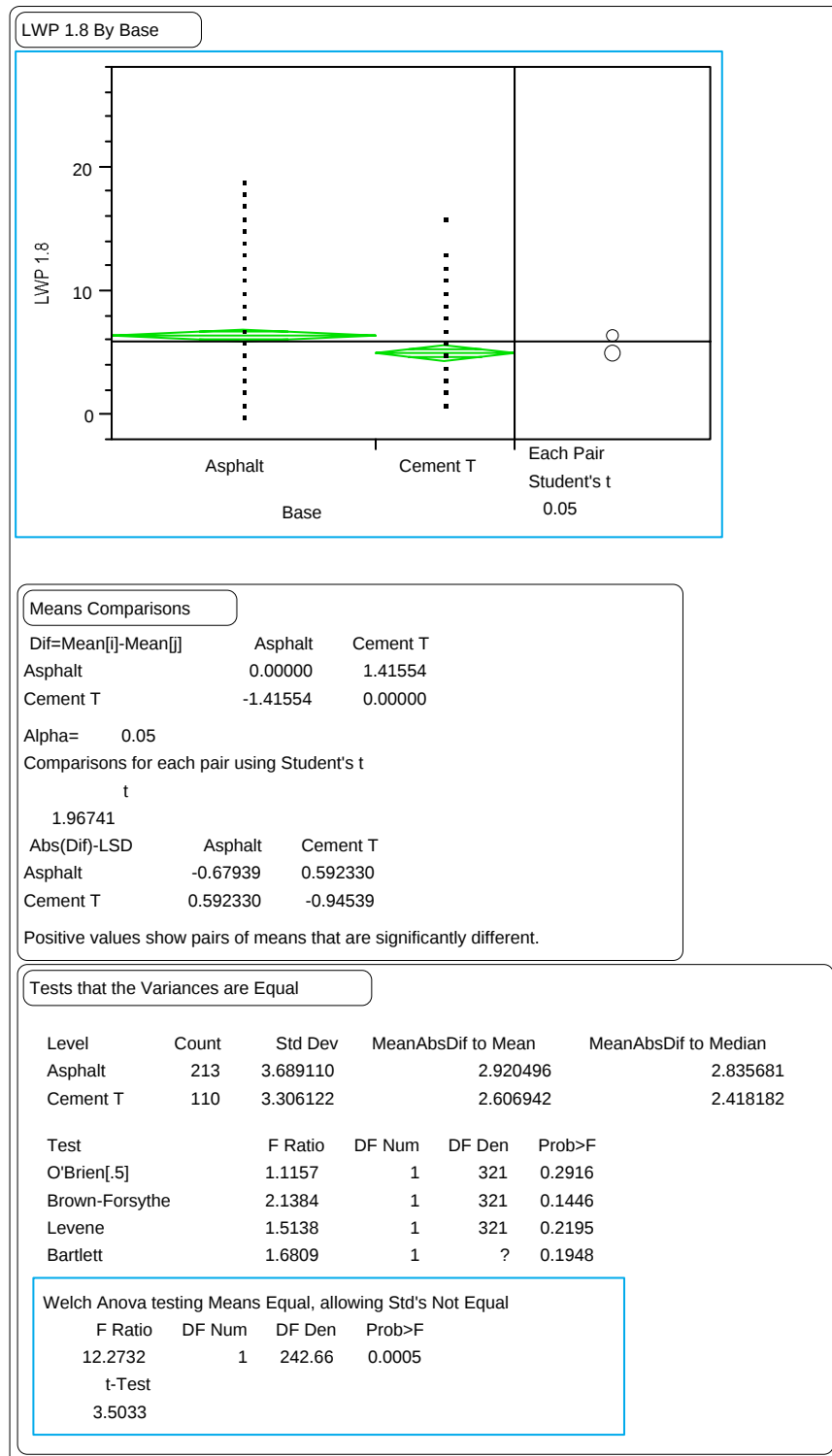


Figure 183. Paired t-test comparing thin-surfaced GPS-2 section means for the LWP 1.8-m rut depths versus base type.

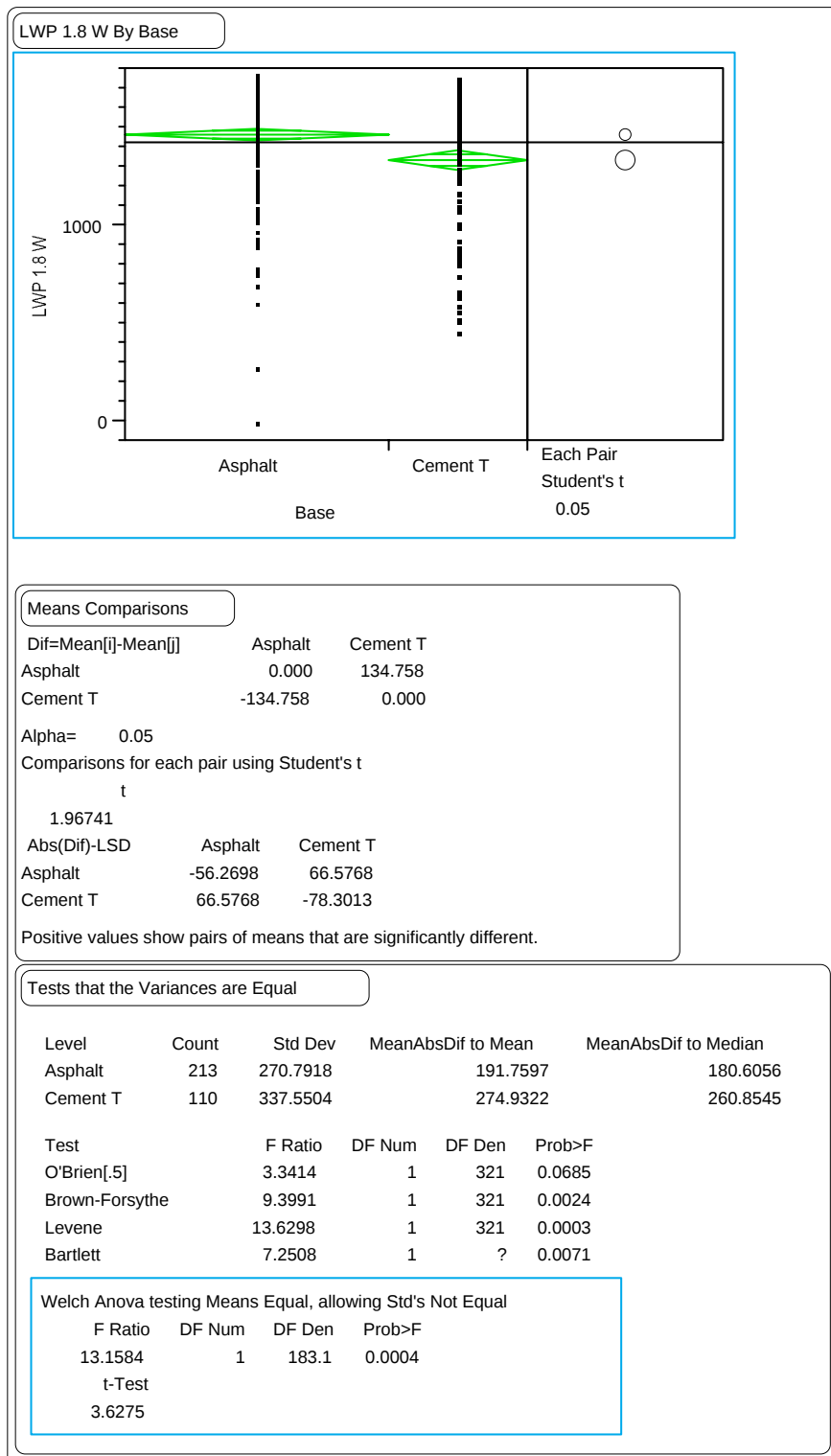


Figure 184. Paired t-test comparing thin-surfaced GPS-2 section means for the LWP 1.8-m rut widths versus base type.

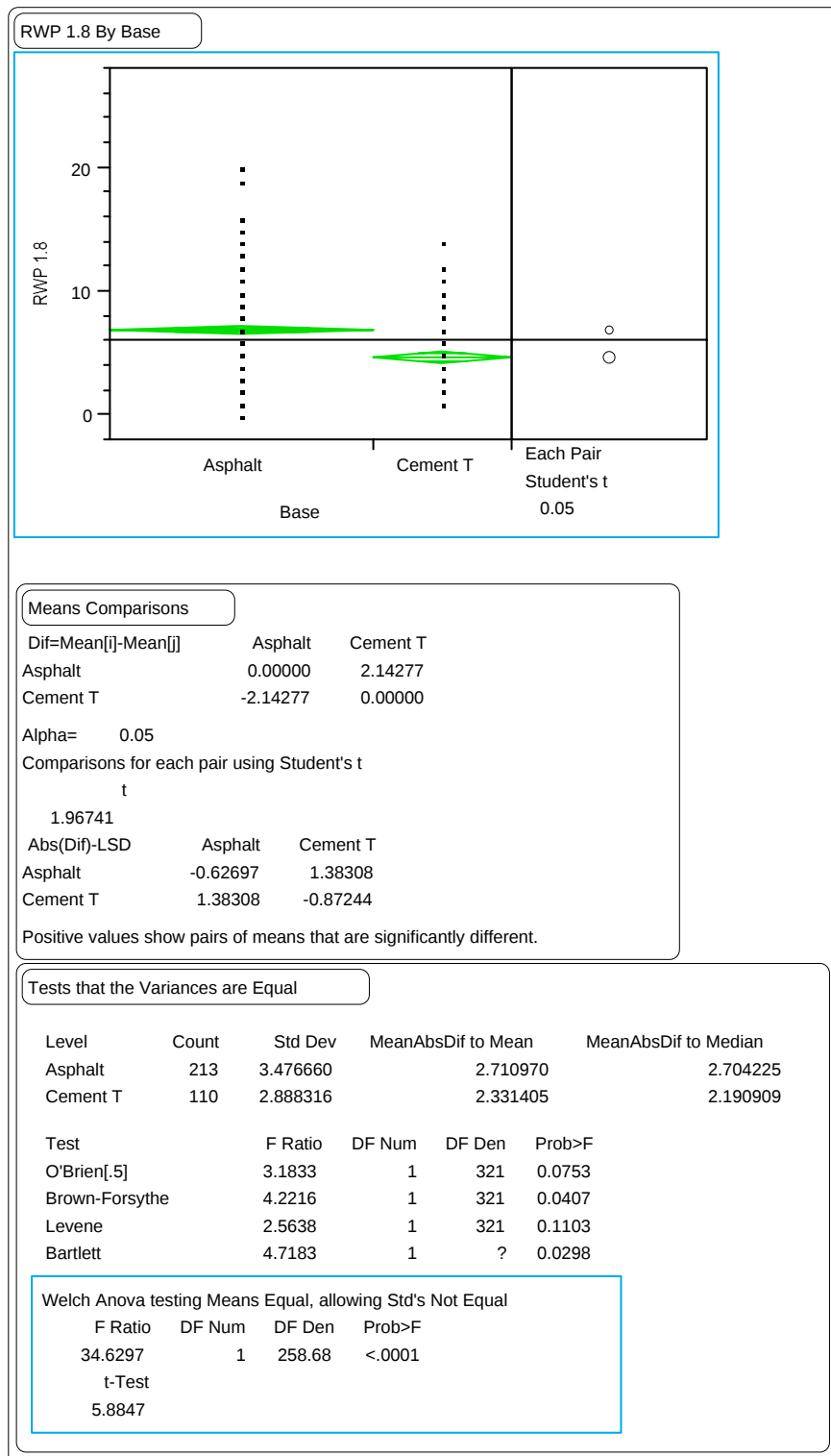


Figure 185. Paired t-test comparing thin-surfaced GPS-2 section means for the RWP 1.8-m rut depths versus base type.

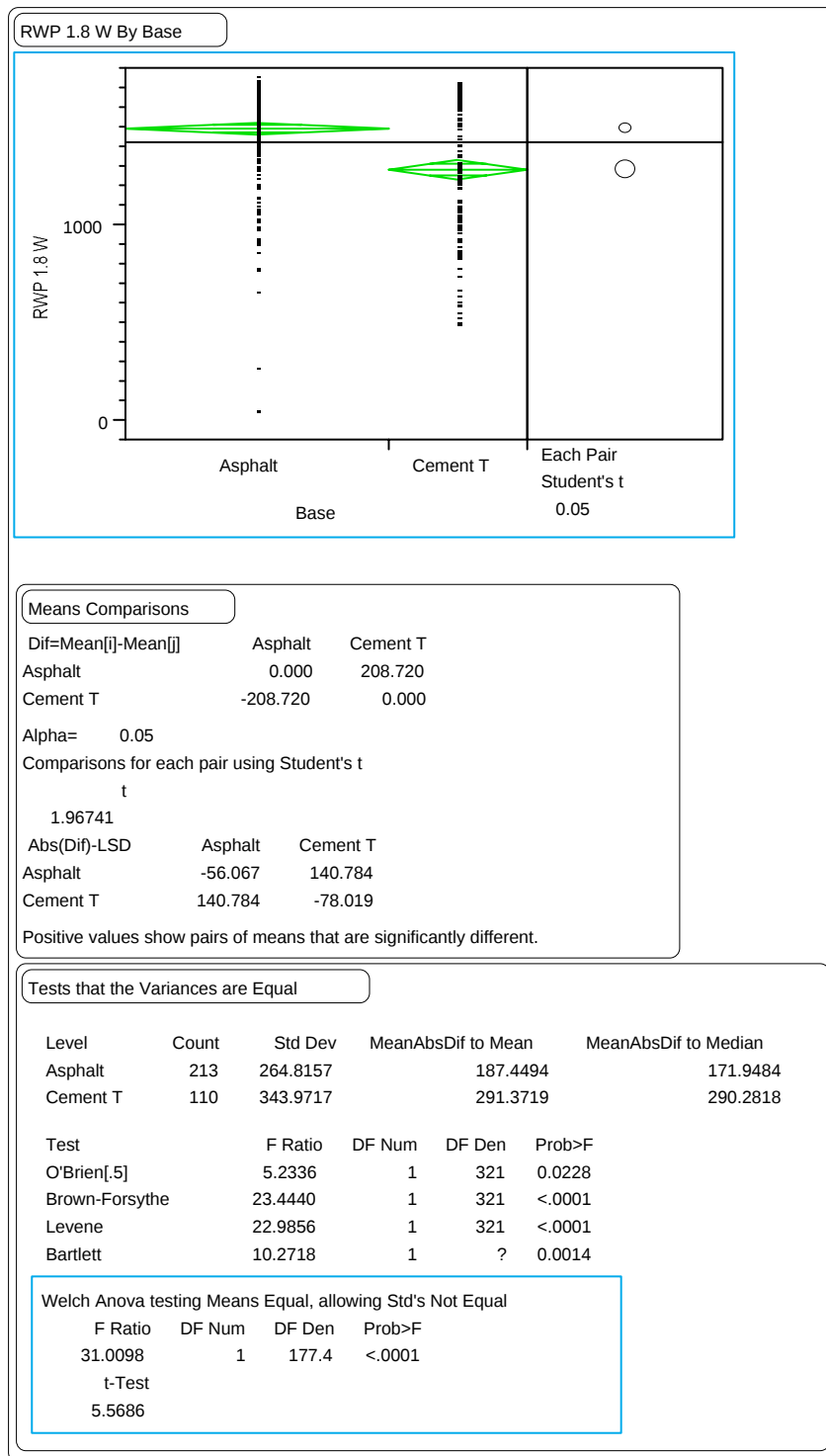


Figure 186. Paired t-test comparing thin-surfaced GPS-2 section means for the RWP 1.8-m rut widths versus base type.

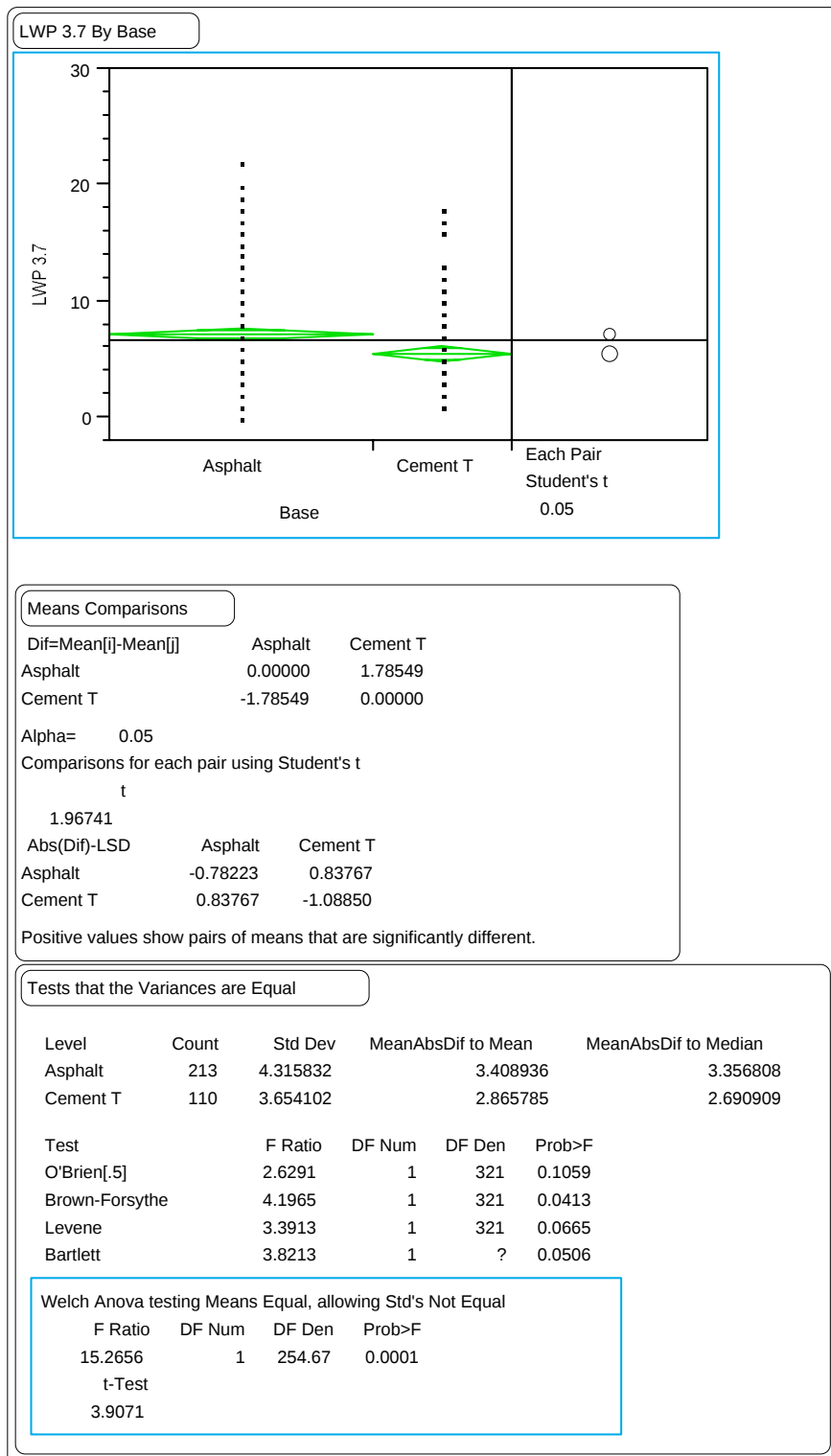


Figure 187. Paired t-test comparing thin-surfaced GPS-2 section means for the LWP wire line rut depths versus base type.

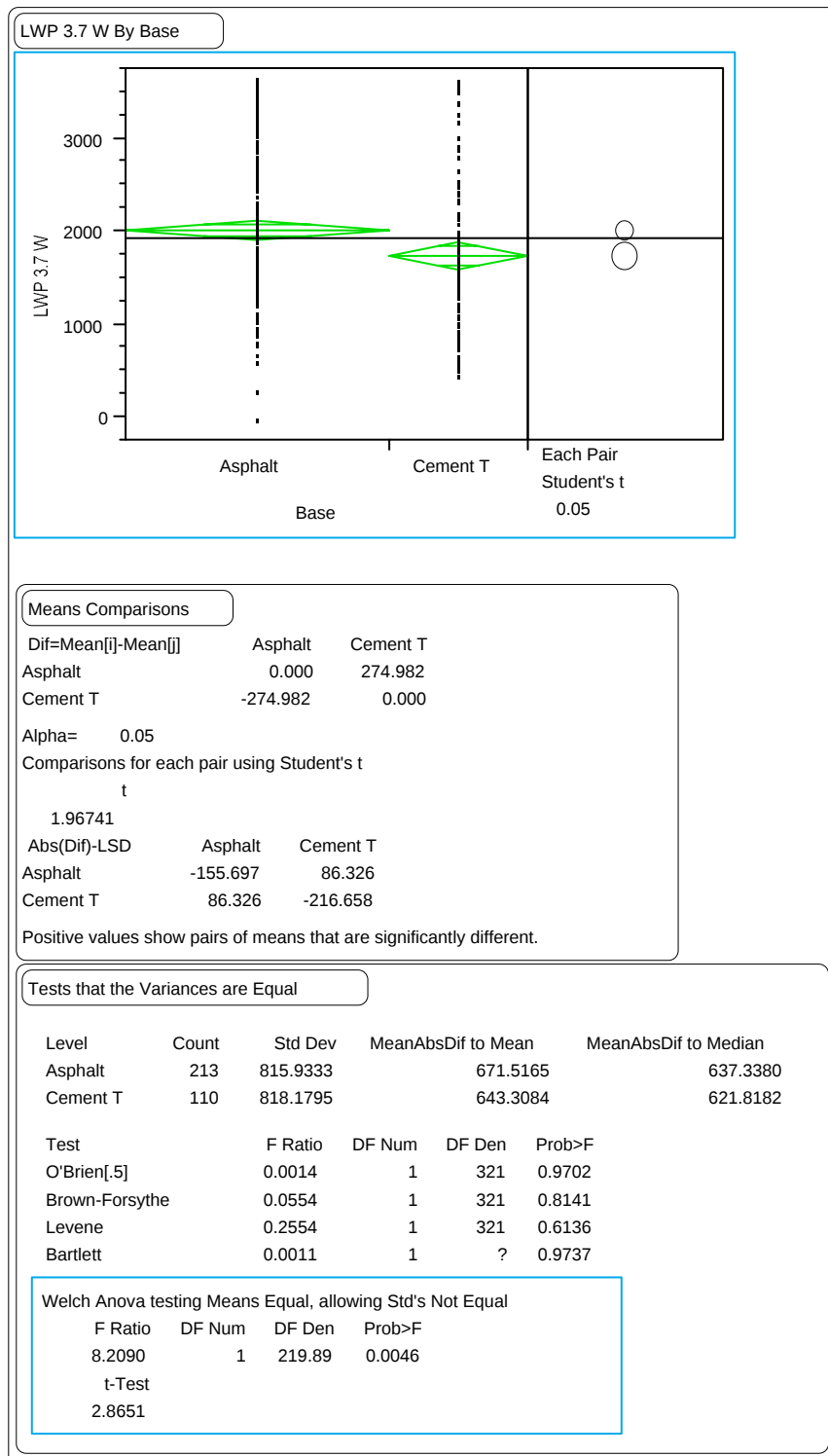


Figure 188. Paired t-test comparing thin-surfaced GPS-2 section means for the LWP wire line rut widths versus base type.

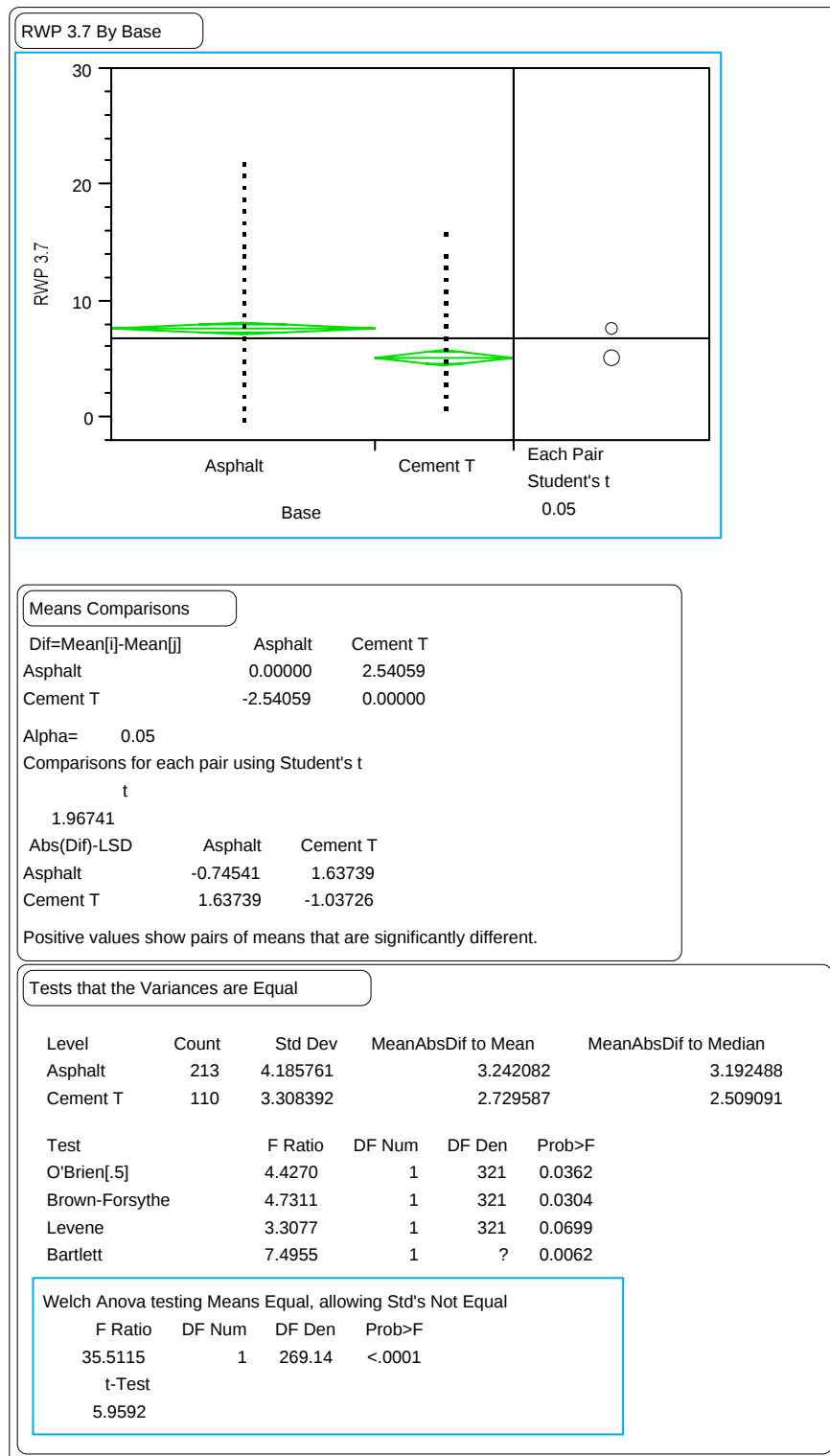


Figure 189. Paired t-test comparing thin-surfaced GPS-2 section means for the RWP wire line rut depths versus base type.

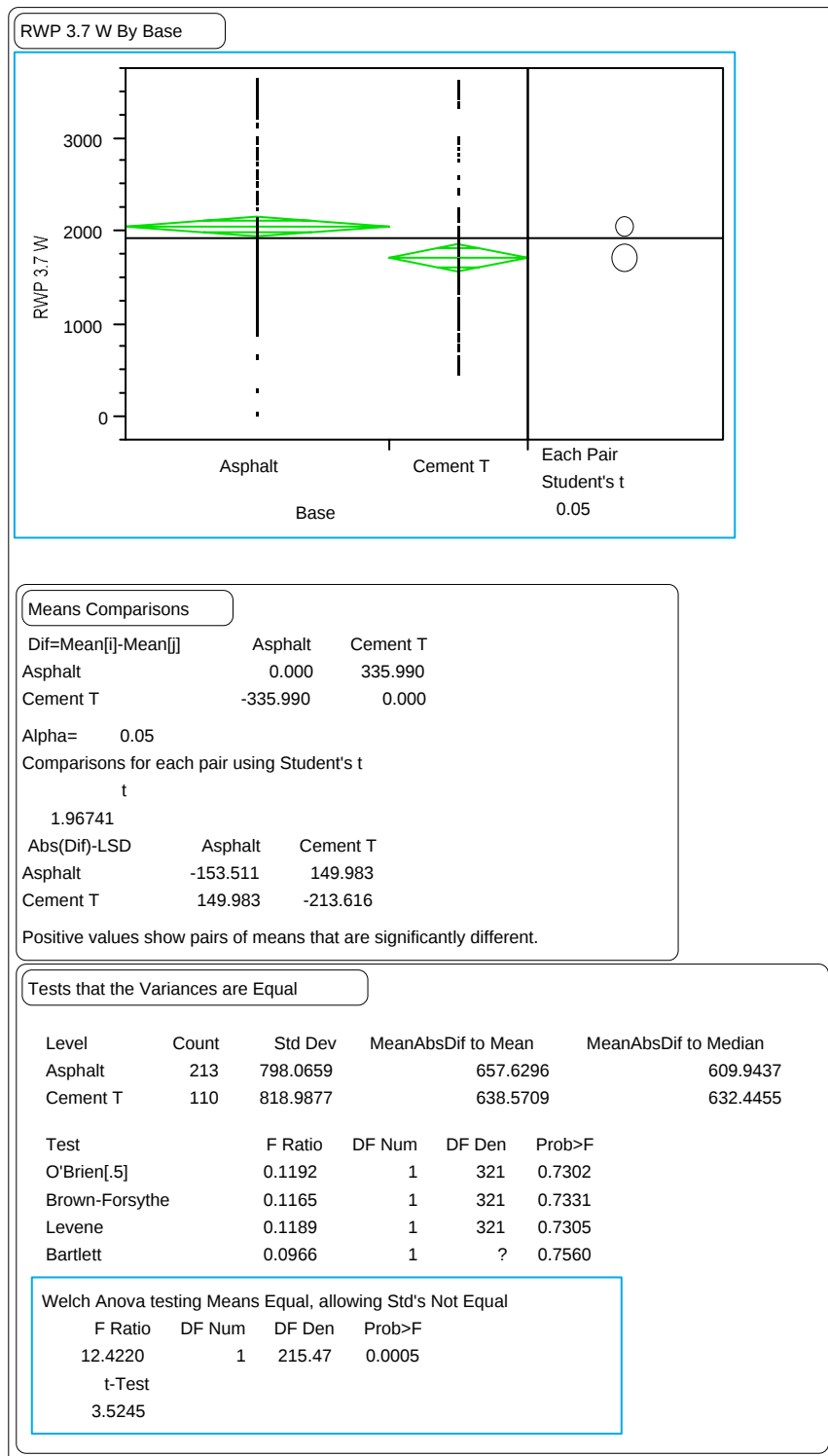


Figure 190. Paired t-test comparing thin-surfaced GPS-2 section means for the RWP wire line rut widths versus base type.

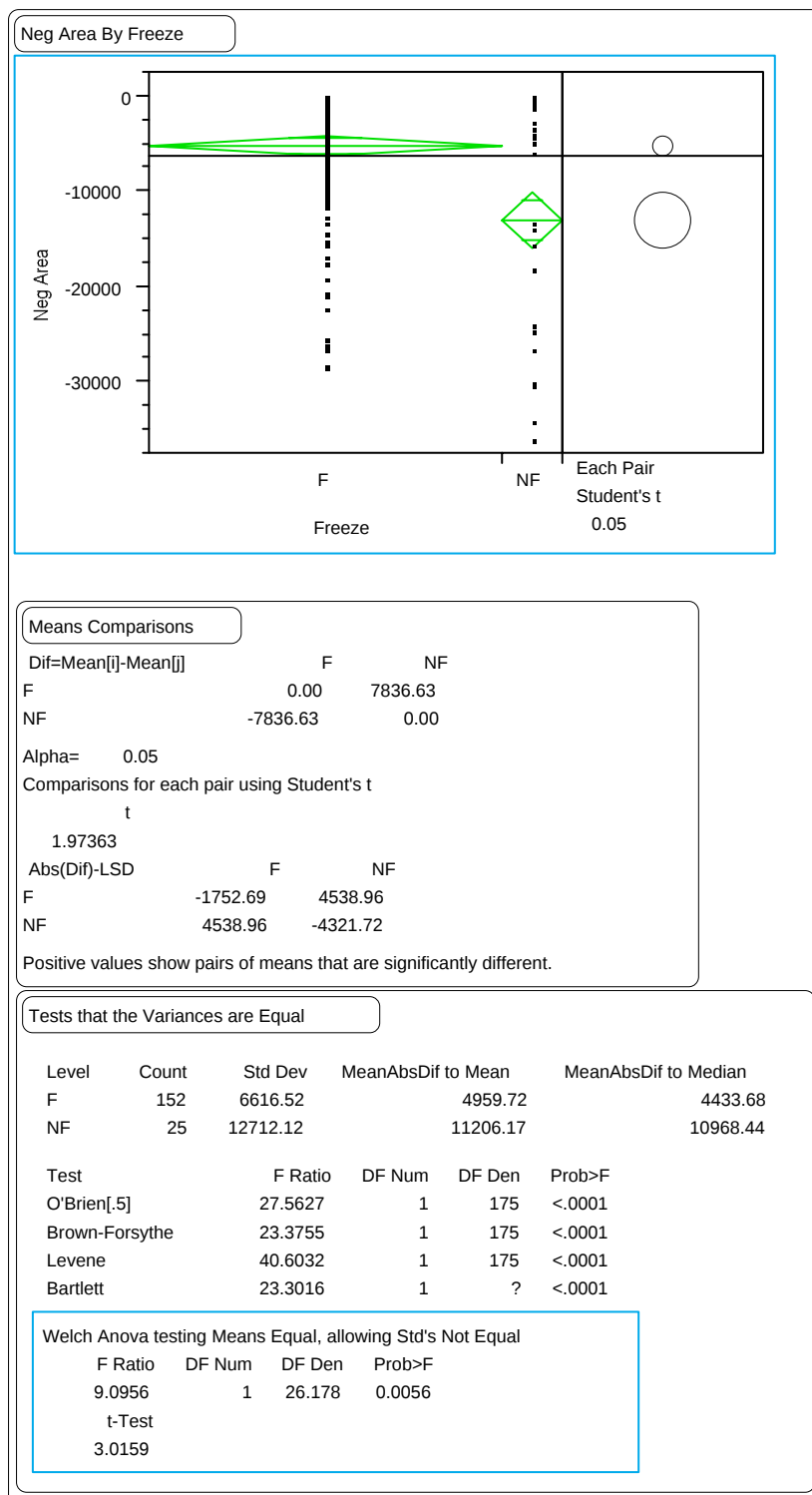


Figure 191. Paired t-test comparing climate for the GPS-7 section means of the negative area index.

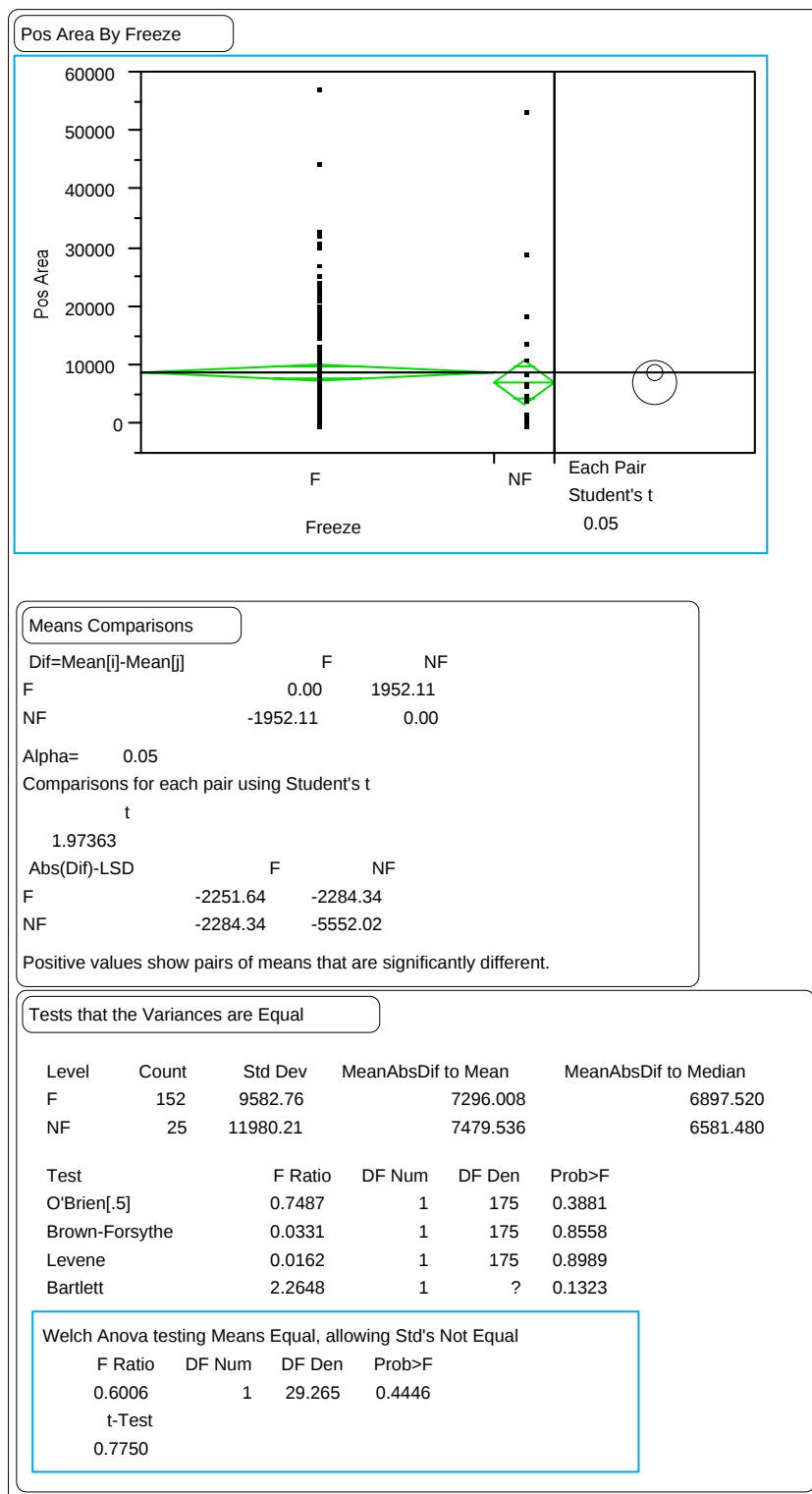


Figure 192. Paired t-test comparing climate for the GPS-7 section means of the positive area index.

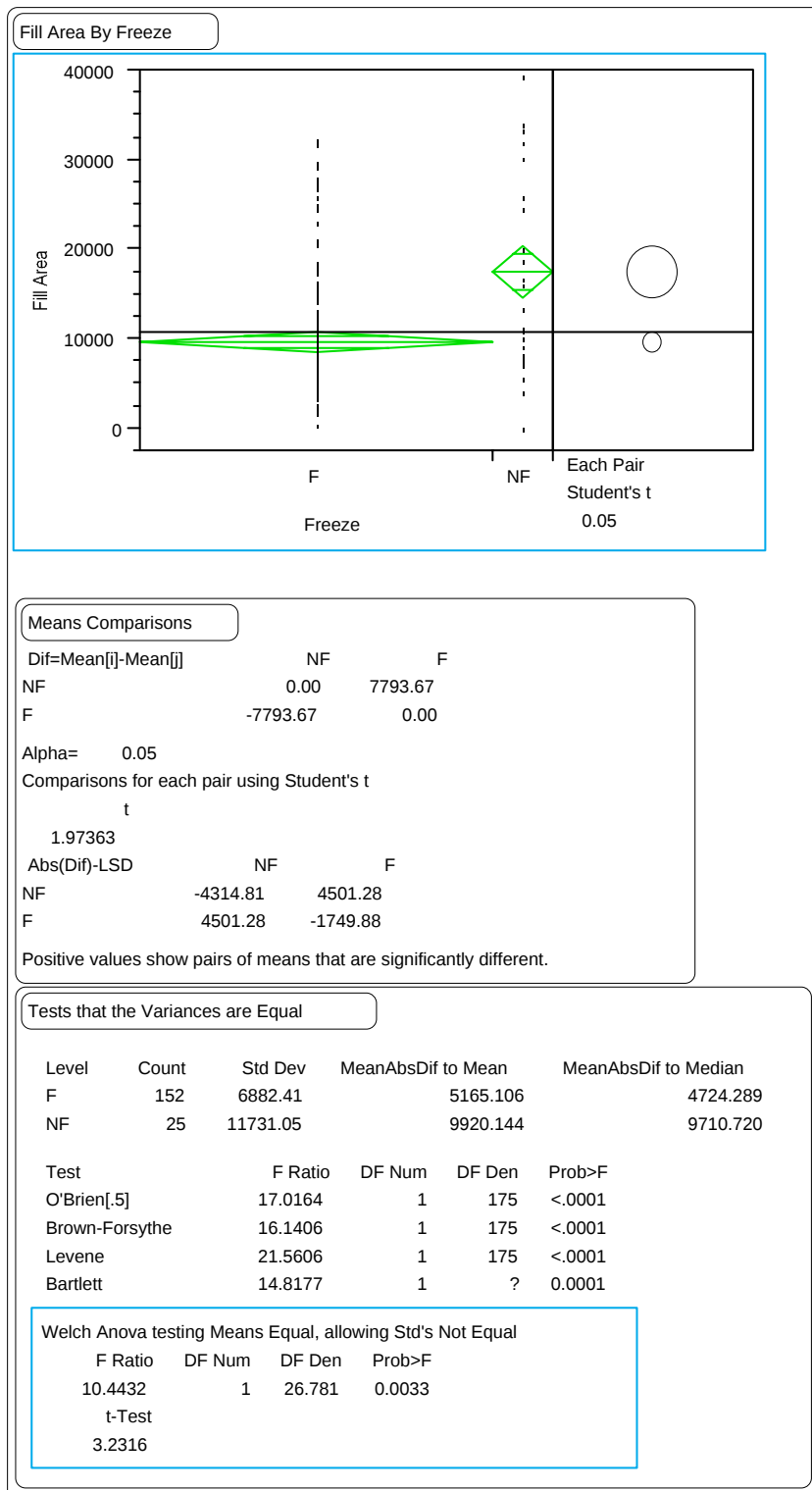


Figure 193. Paired t-test comparing climate for the GPS-7 section means of the fill area index.

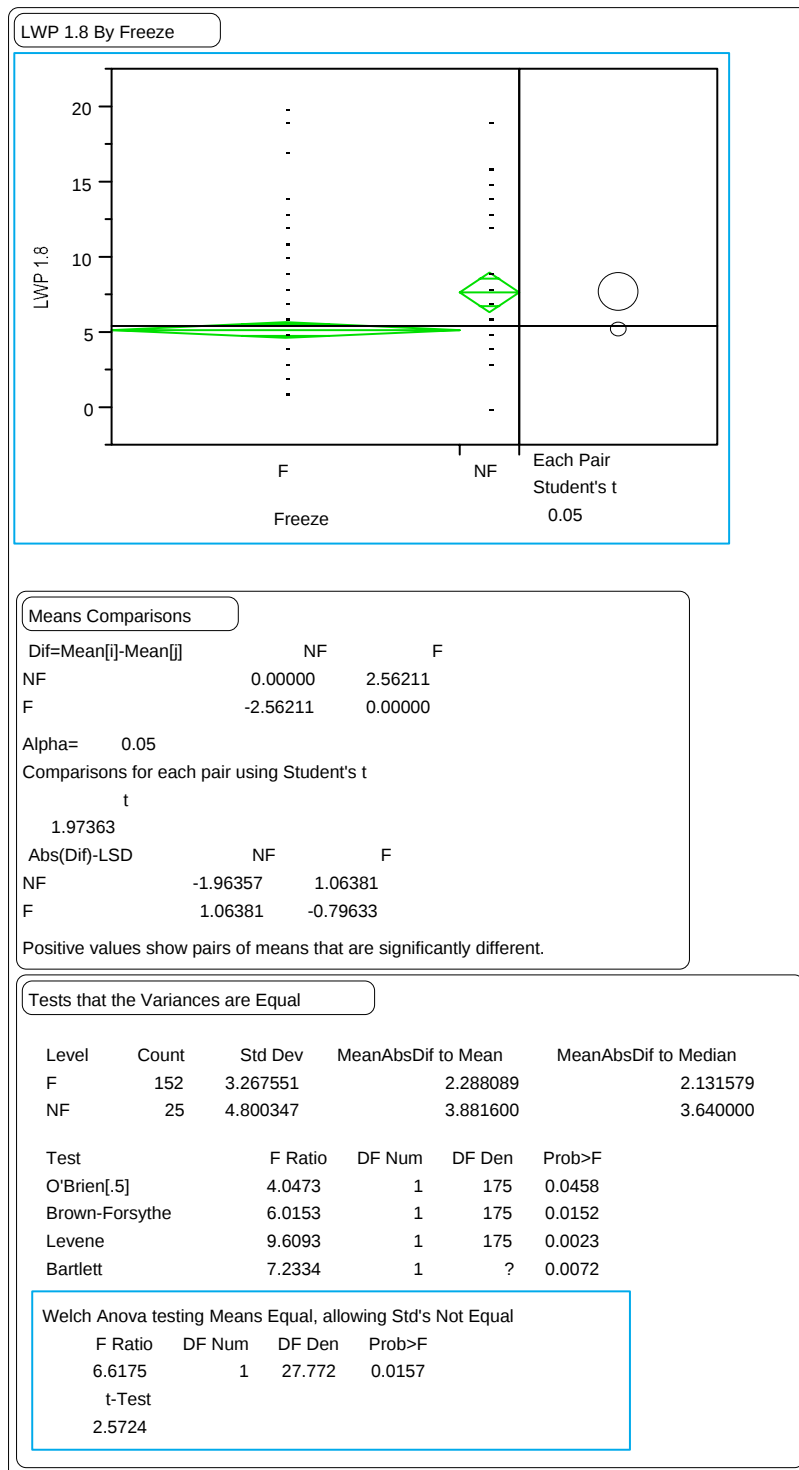


Figure 194. Paired t-test comparing climate for the GPS-7 section means of the LWP 1.8-m rut depths.

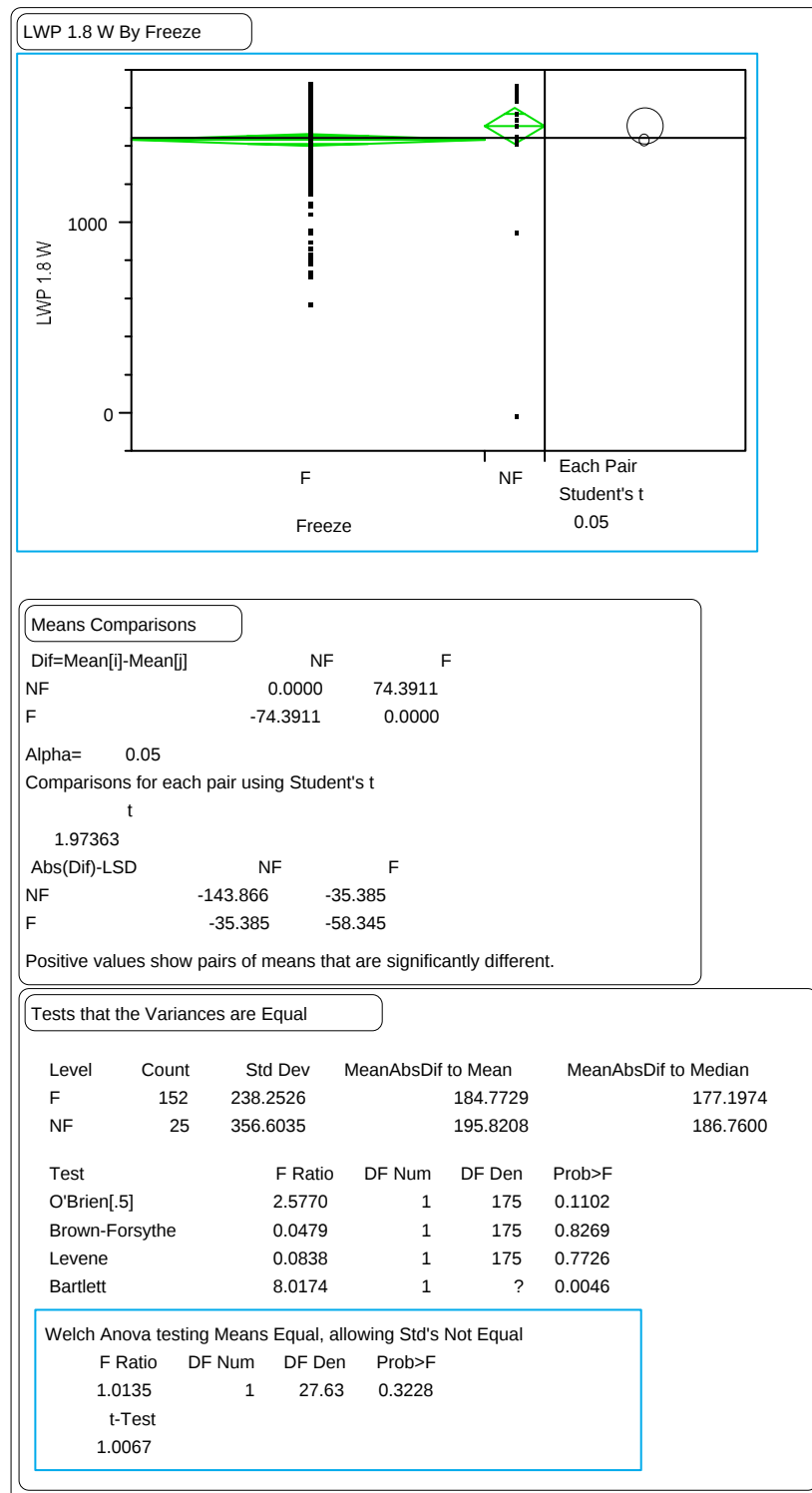


Figure 195. Paired t-test comparing climate for the GPS-7 section means of the LWP 1.8-m rut widths.

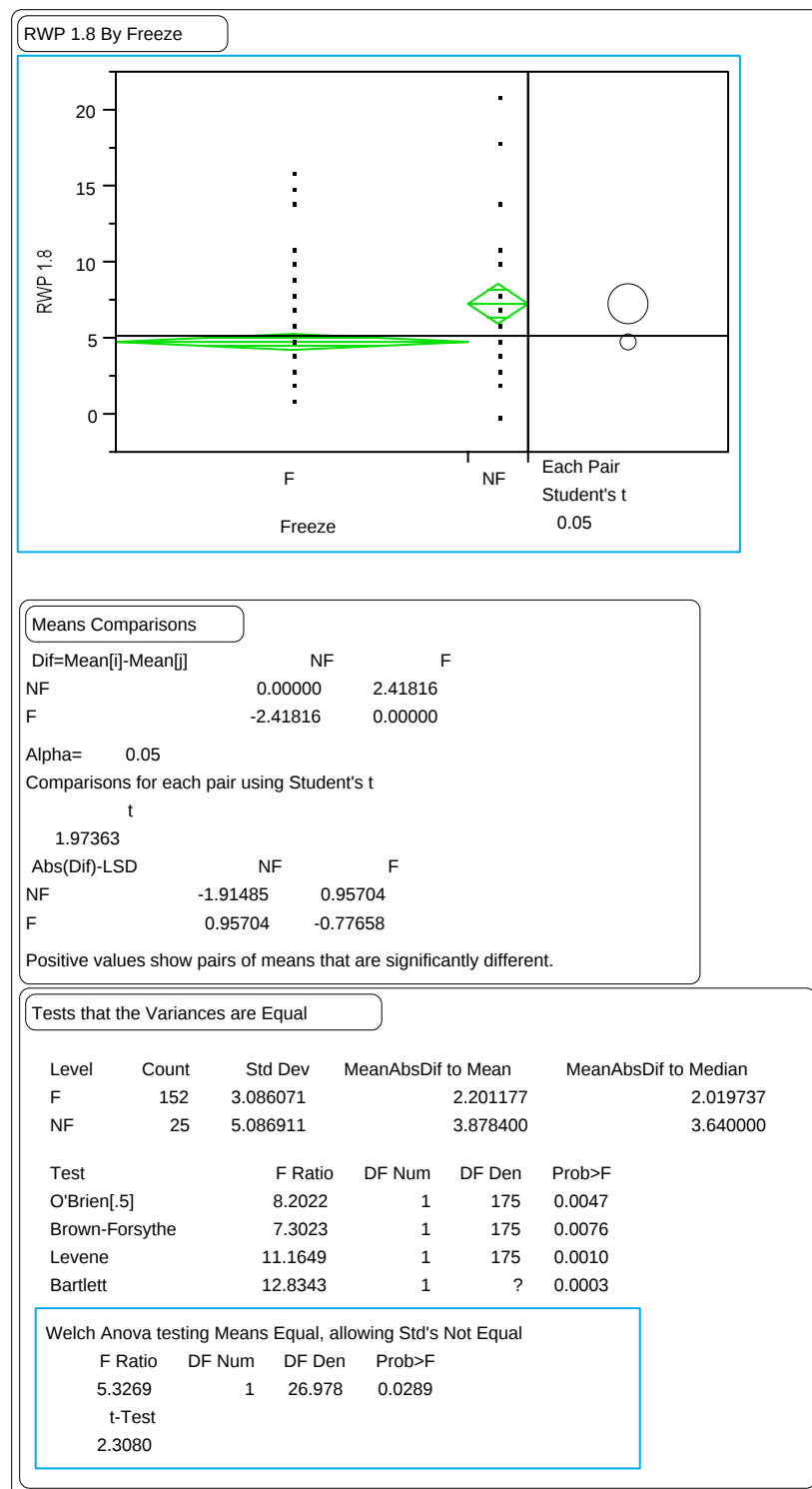


Figure 196. Paired t-test comparing climate for the GPS-7 section means of the RWP 1.8-m rut depths.

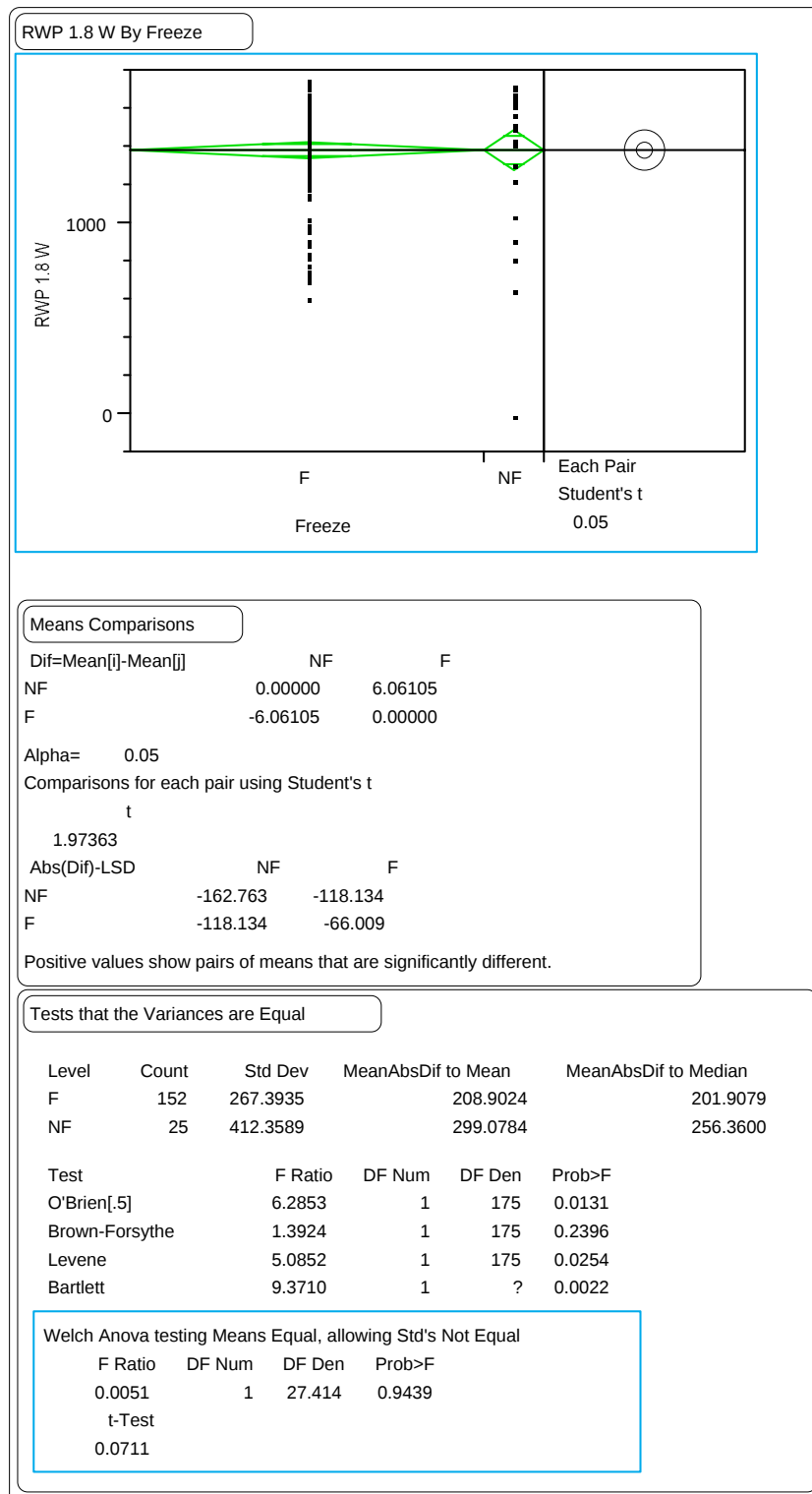


Figure 197. Paired t-test comparing climate for the GPS-7 section means of the RWP 1.8-m rut widths.

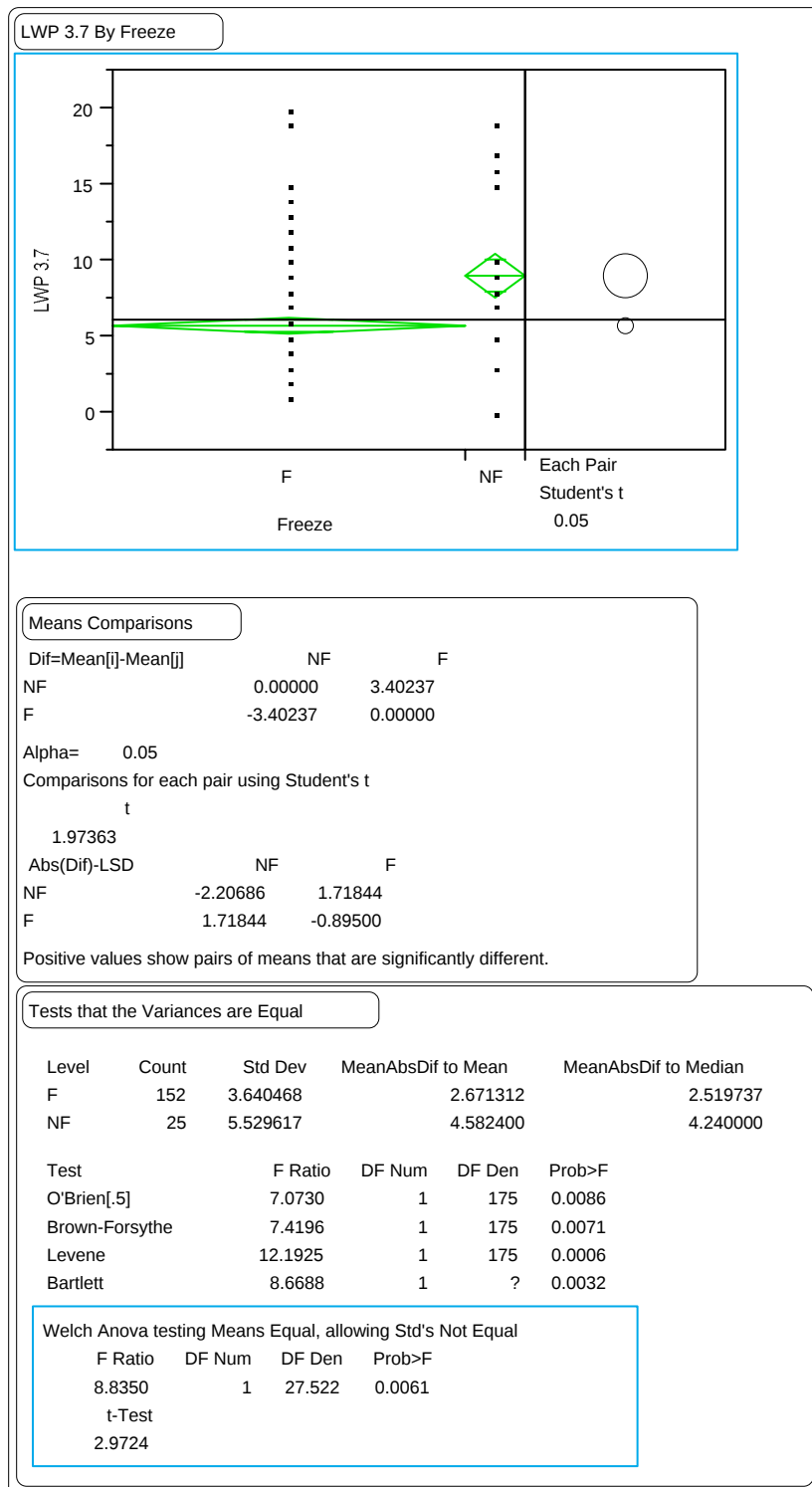


Figure 198. Paired t-test comparing climate for the GPS-7 section means of the LWP wire line rut depths.

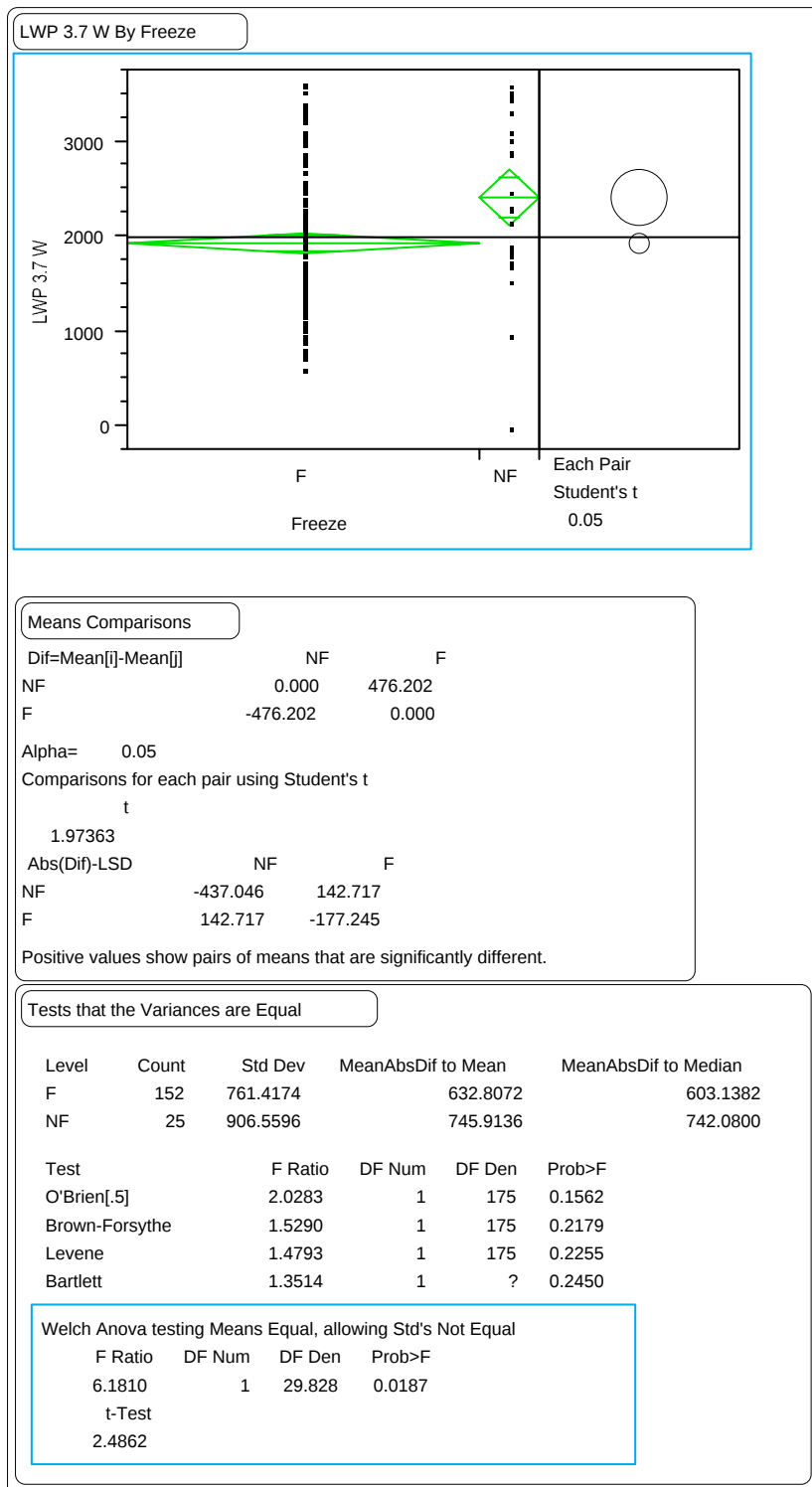


Figure 199. Paired t-test comparing climate for the GPS-7 section means of the LWP wire line rut widths.

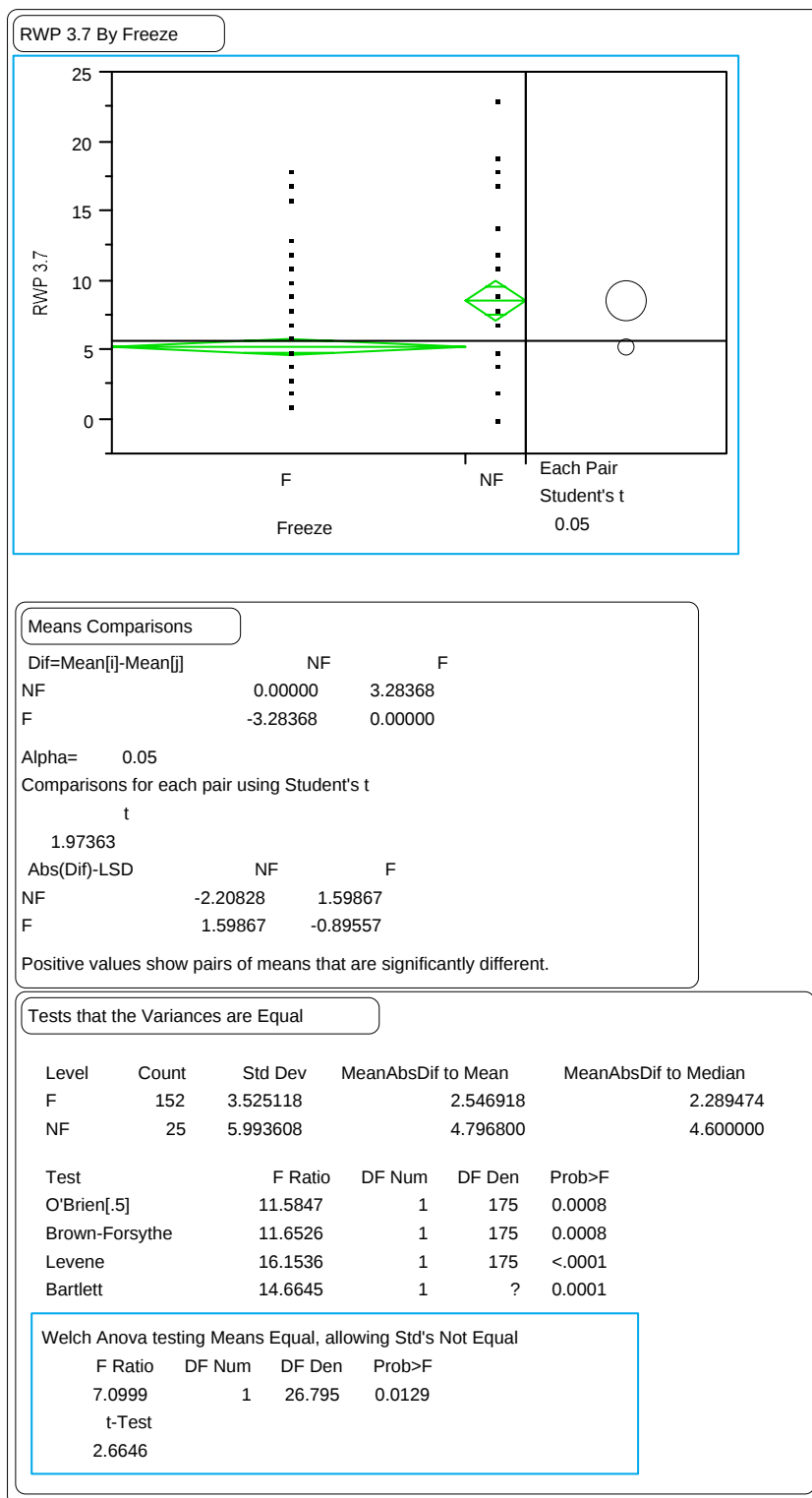


Figure 200. Paired t-test comparing climate for the GPS-7 section means of the RWP wire line rut depths.

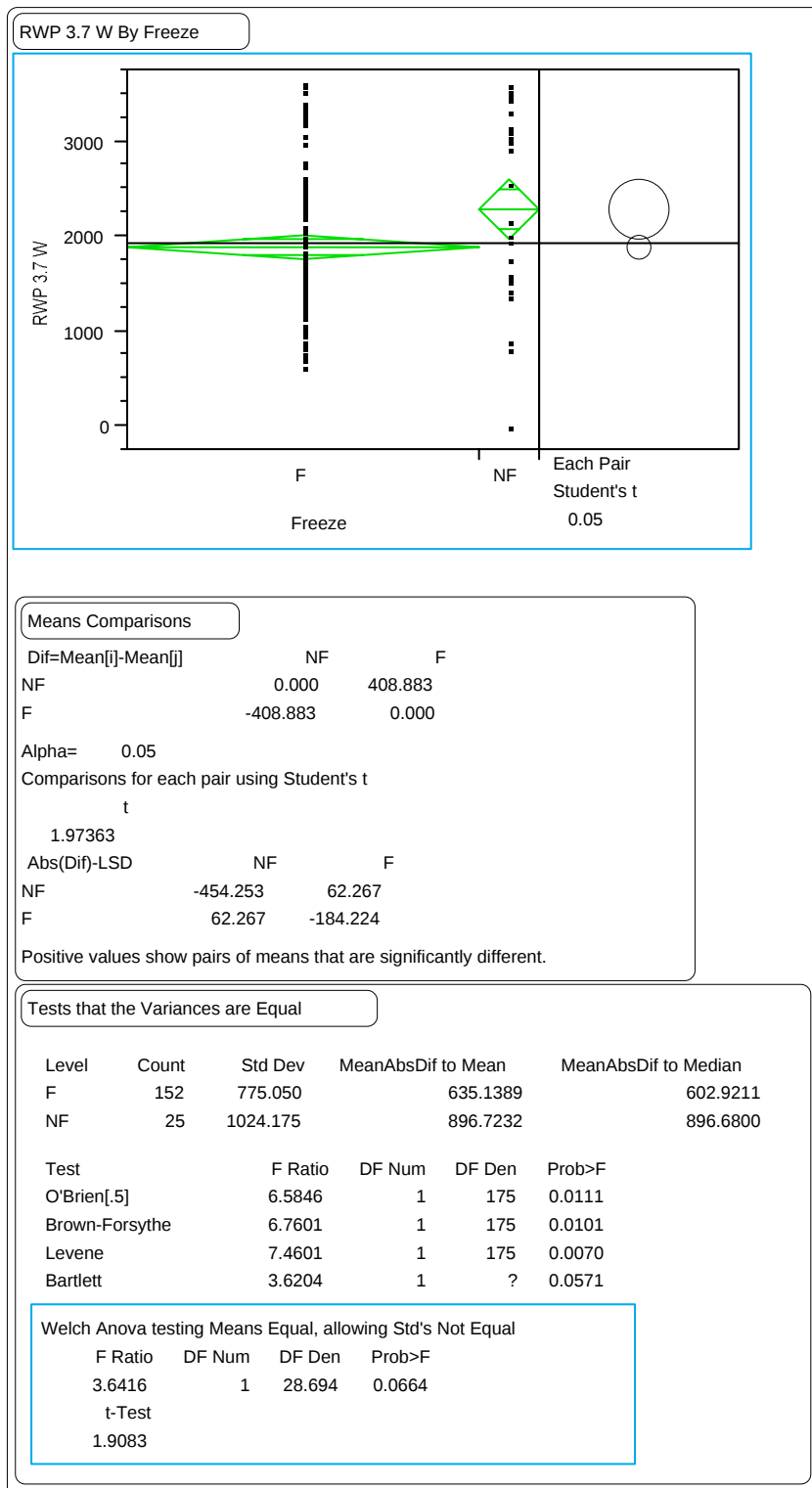


Figure 201. Paired t-test comparing climate for the GPS-7 section means of the RWP wire line rut widths.

APPENDIX E.

COMPARISONS OF TIME-SERIES SLOPES

The slopes for the time-series data for each test section were determined for each of the indices. The distributions of the slopes are provided in figures 202 through 212. The signs of the slopes for each of the indices were compared to the signs for the LWP 1.8-m rut depth. These results are provided in figures 213 through 222. The top block in each figure is a graphical presentation of the results. The second block is a contingency table that provides a count for each cell in the table. A “-1” indicates a negative slope, a “0” indicates a zero slope, and a “1” indicates a positive slope. The bottom block provides the statistical results for each analysis.

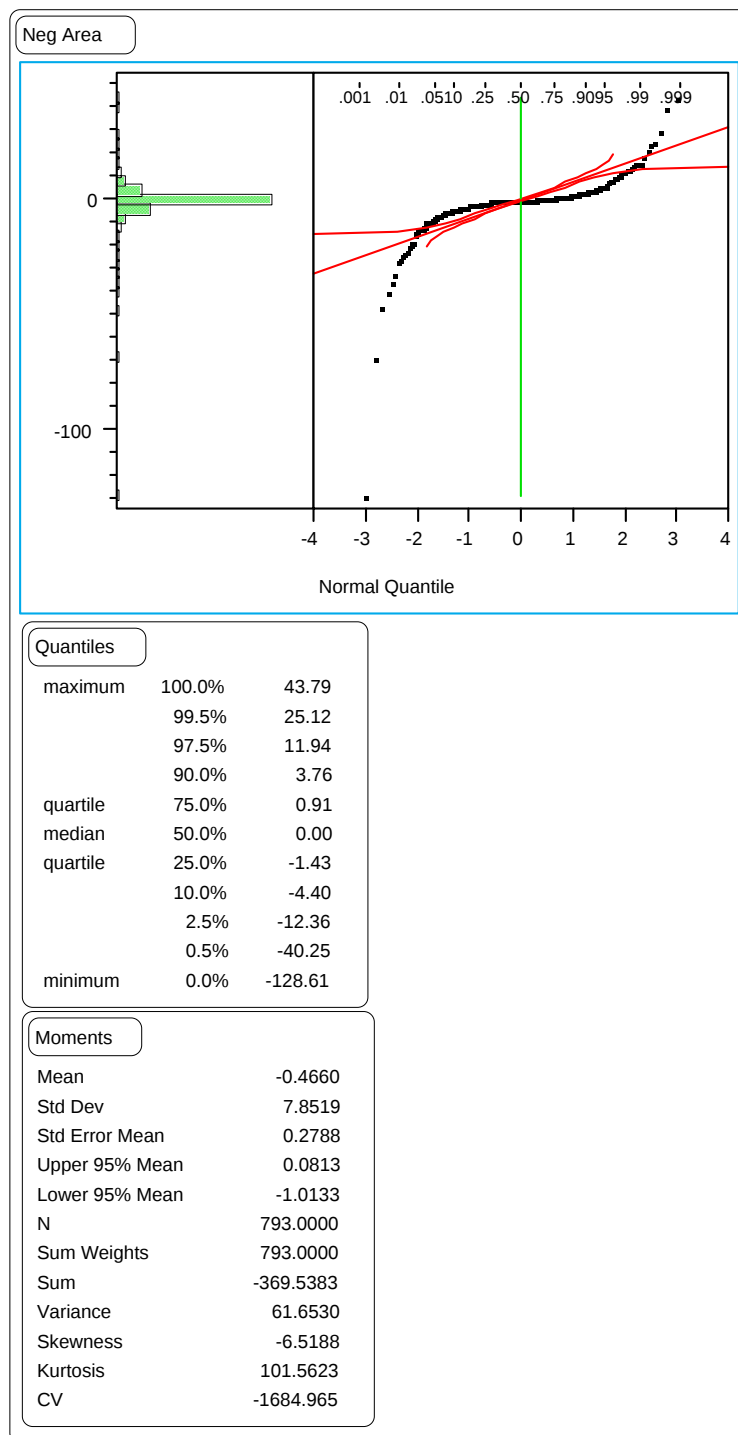


Figure 202. Distribution of the time-series slopes for the negative area index.

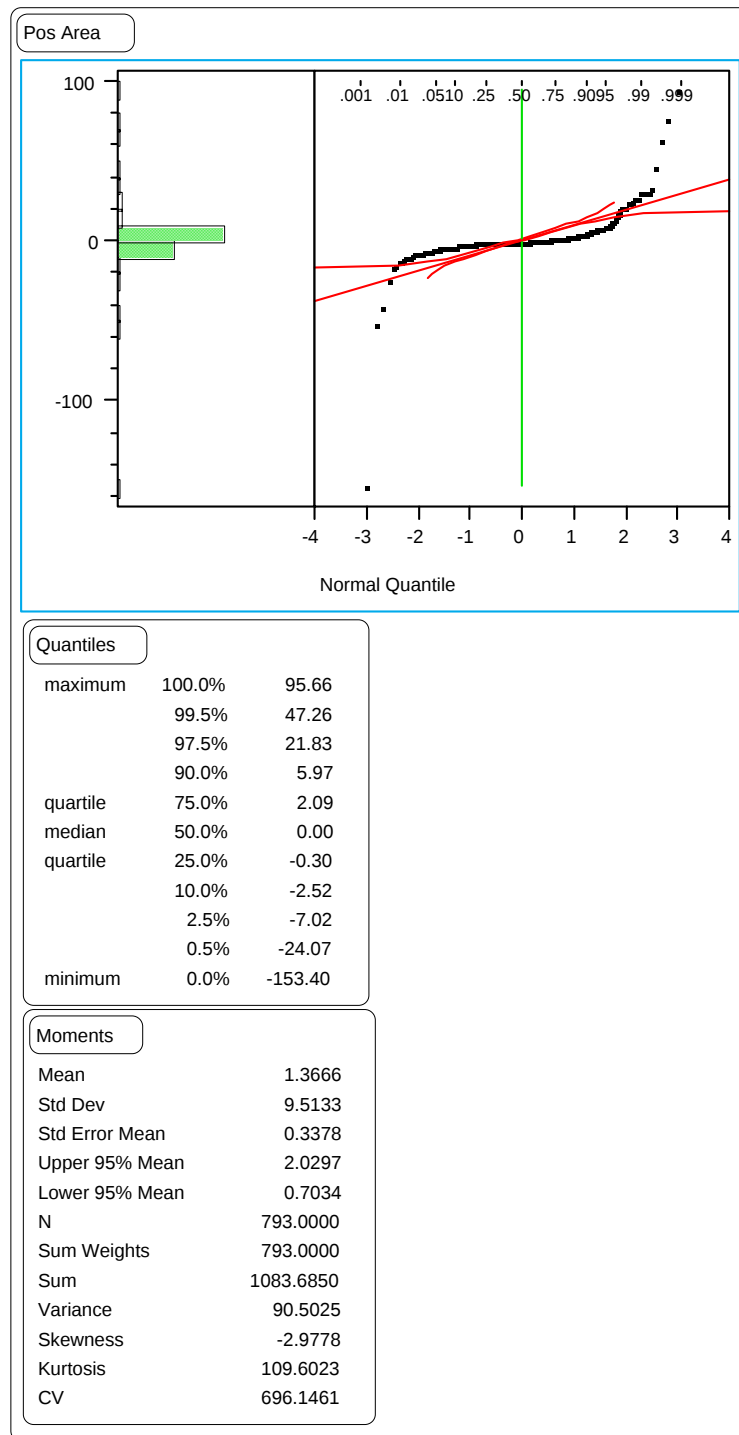


Figure 203. Distribution of the time-series slopes for the positive area index.

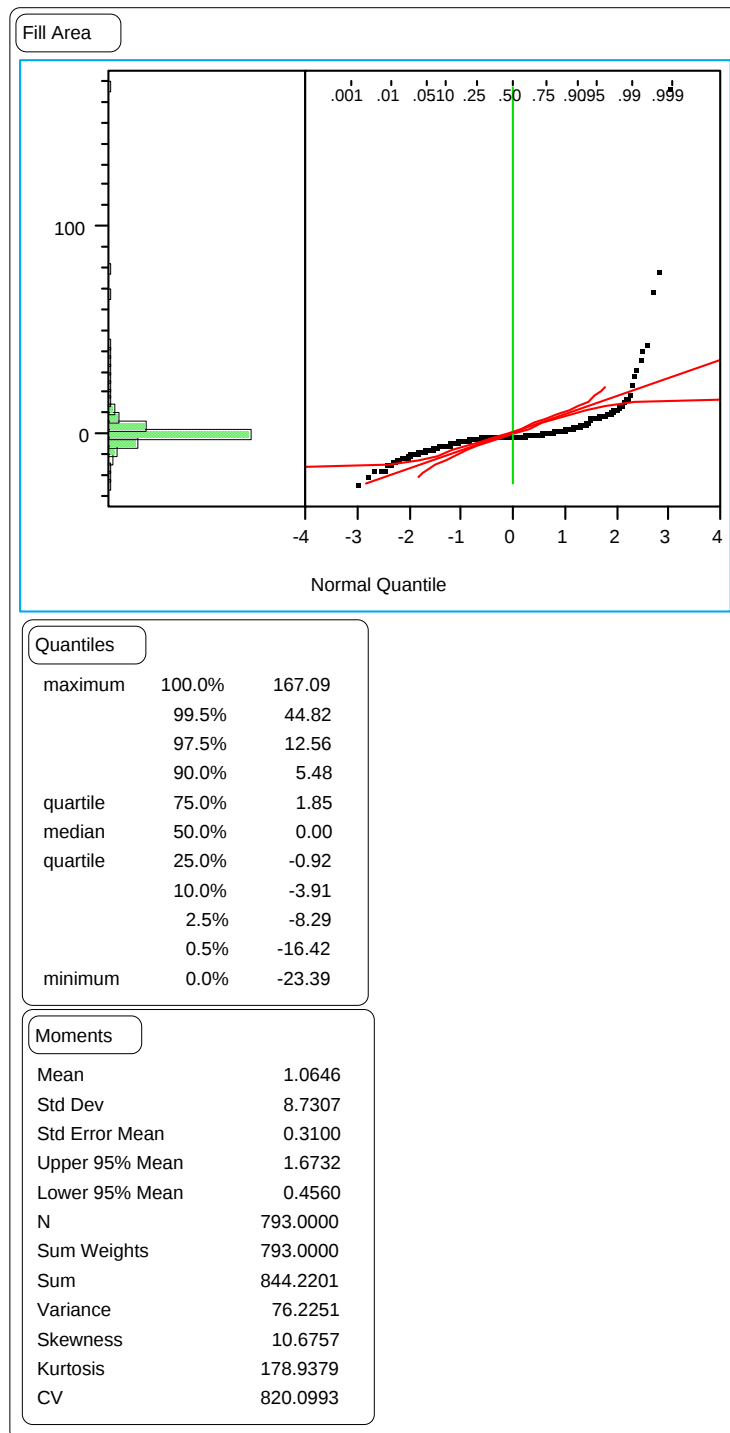


Figure 204. Distribution of the time-series slopes for the fill area index.

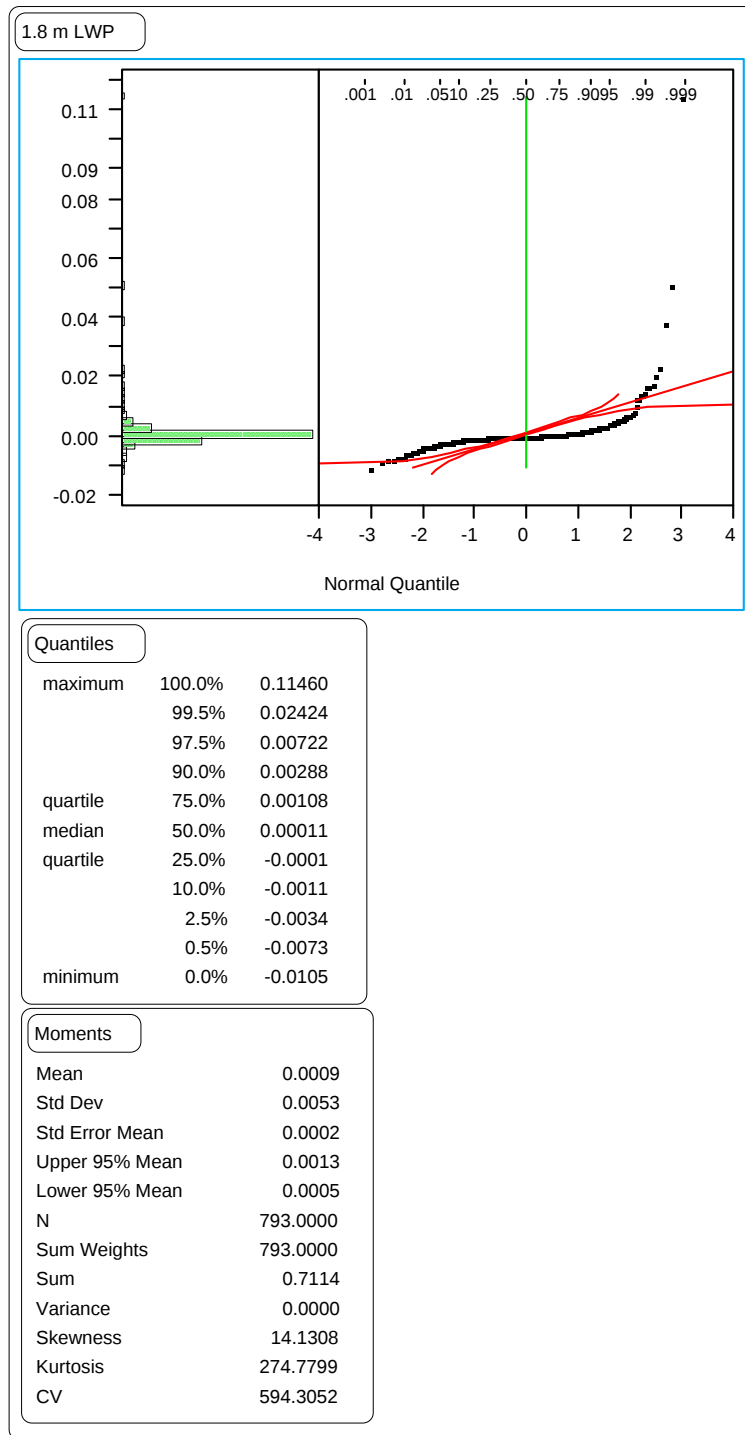


Figure 205. Distribution of the time-series slopes for the LWP 1.8-m rut depths.

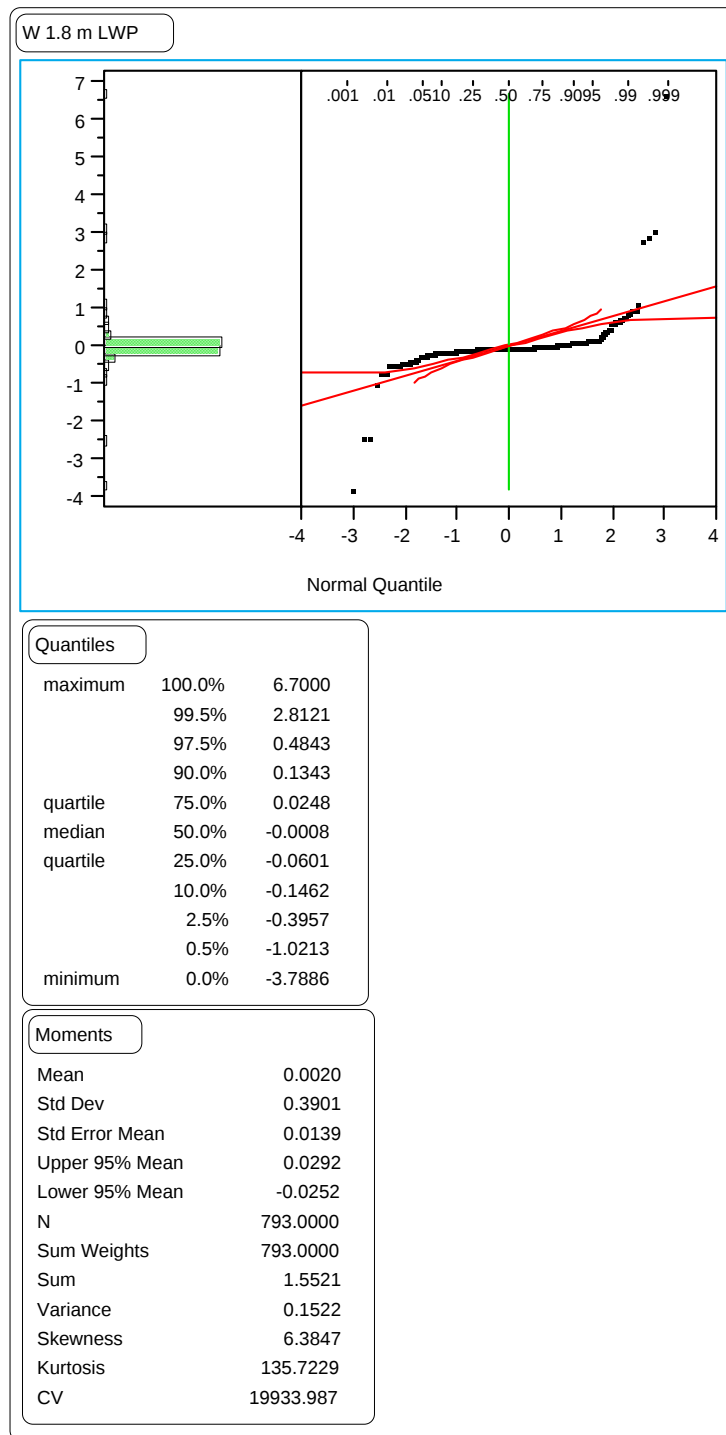


Figure 206. Distribution of the time-series slopes for the LWP 1.8-m rut widths.

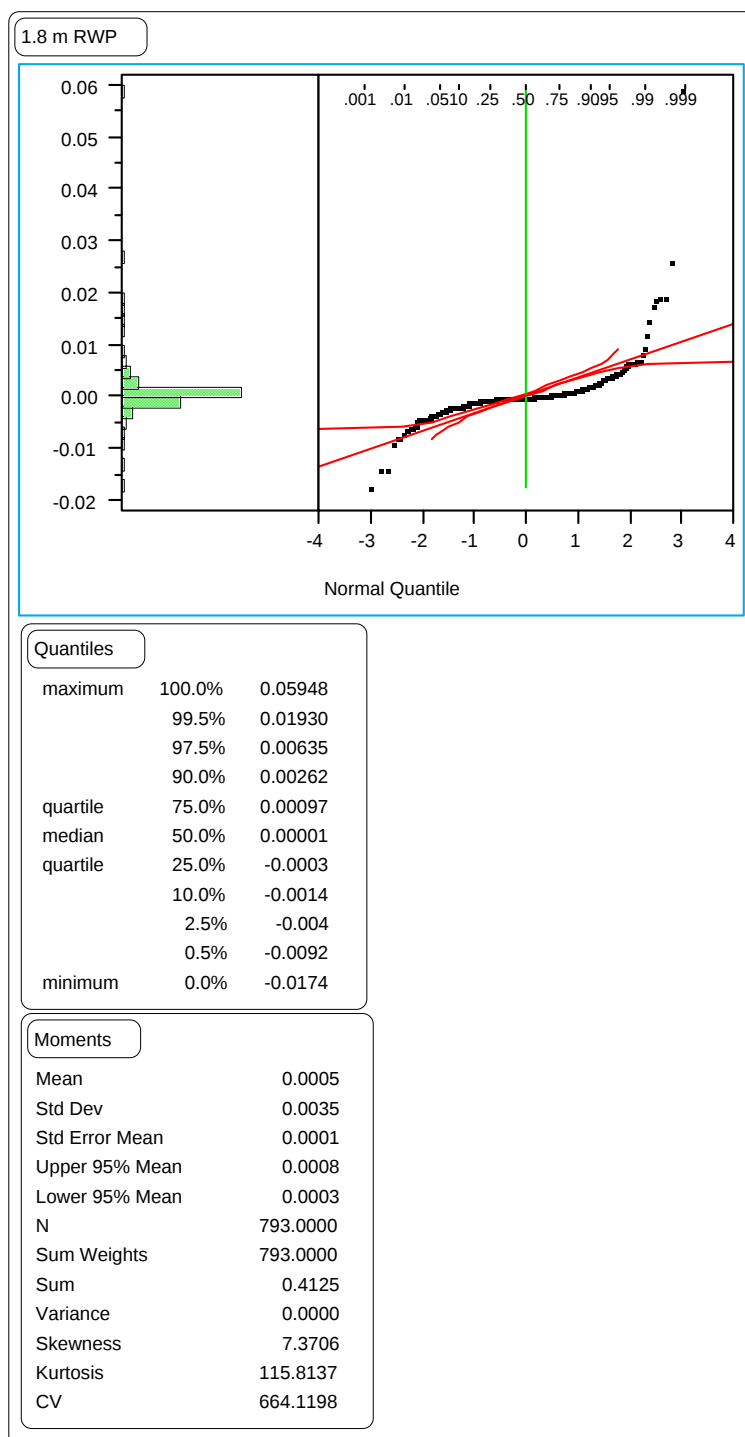


Figure 207. Distribution of the time-series slopes for the RWP 1.8-m rut depths.

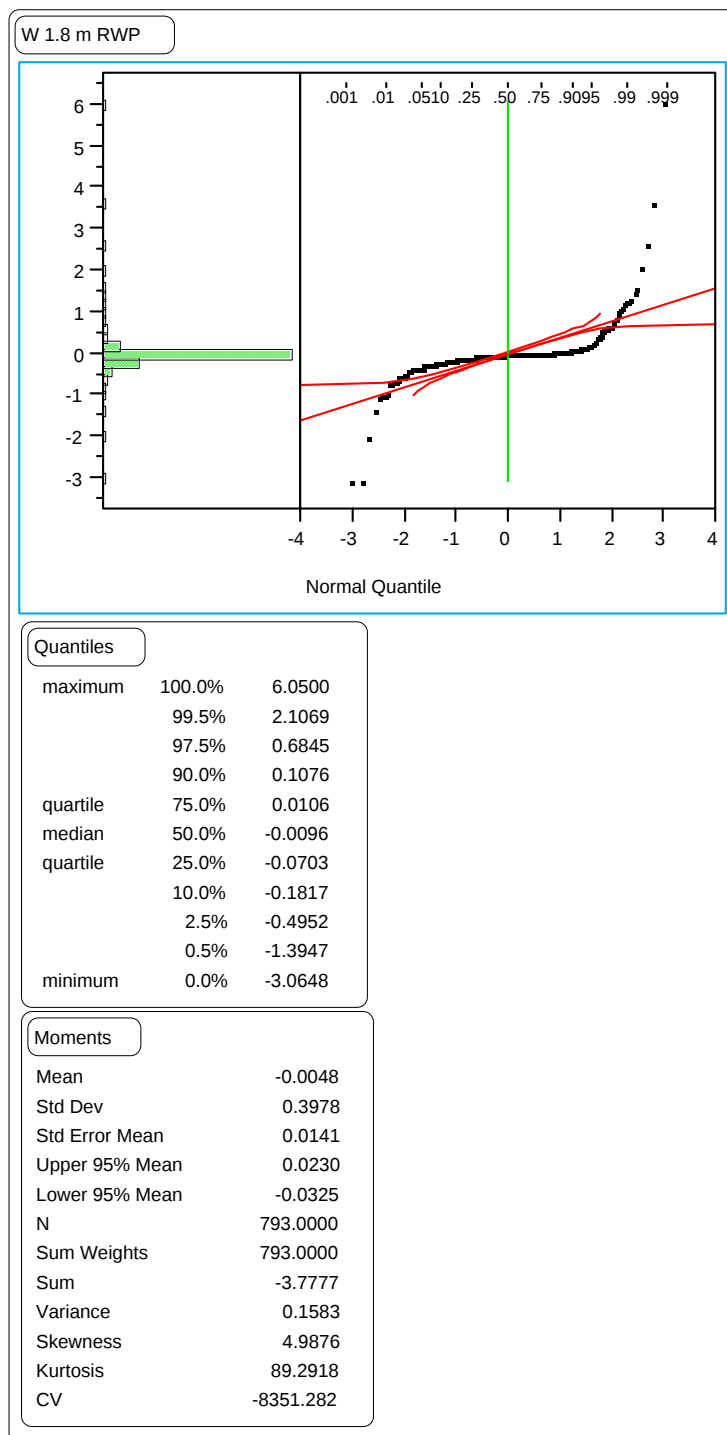


Figure 208. Distribution of the time-series slopes for the RWP 1.8-m rut widths.

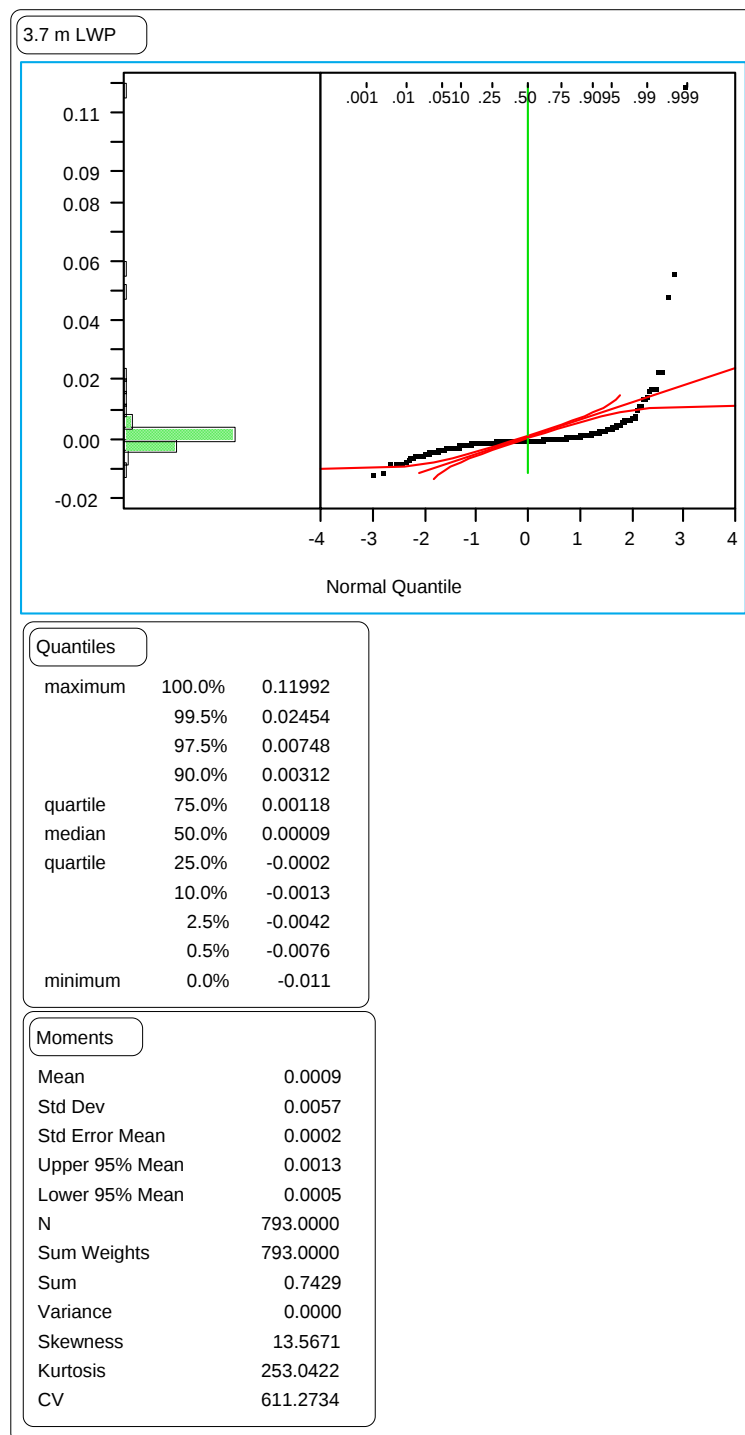


Figure 209. Distribution of the time-series slopes for the LWP wire line rut depths.

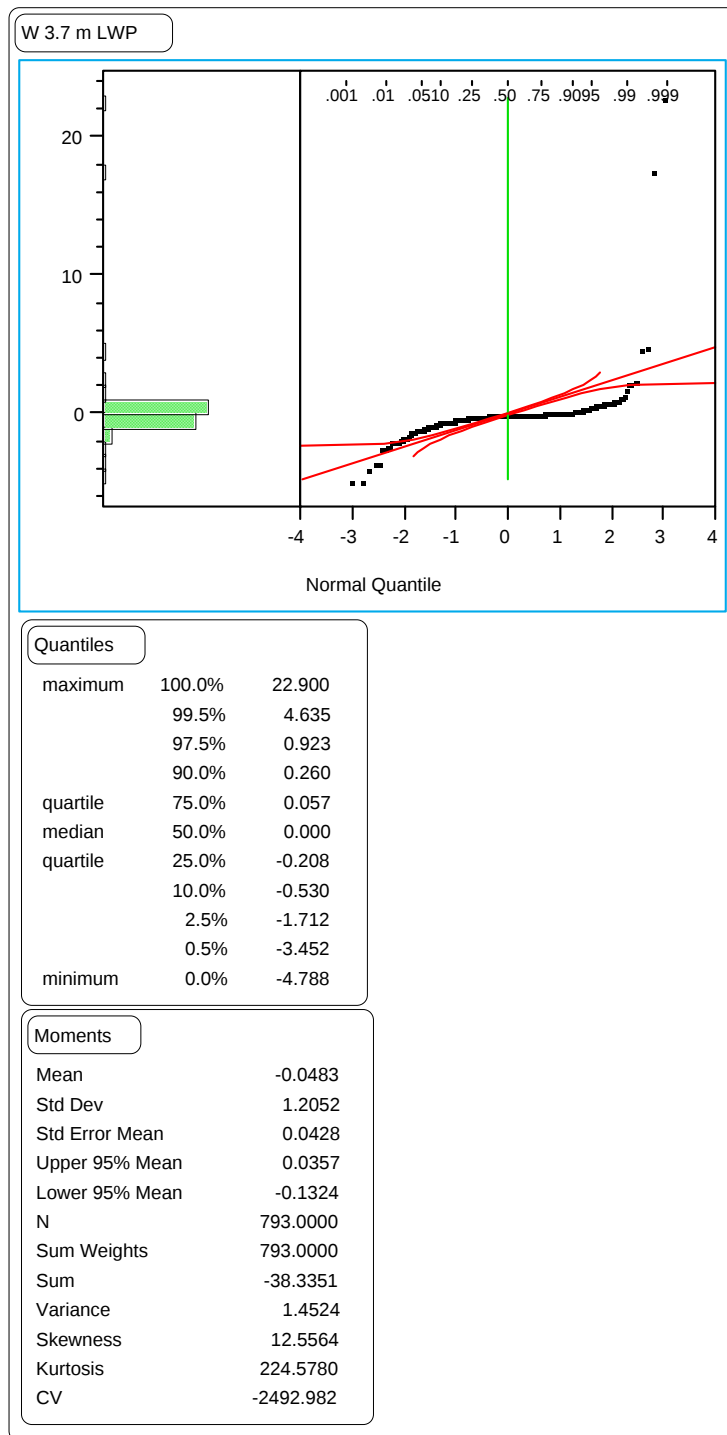


Figure 210. Distribution of the time-series slopes for the LWP wire line rut widths.

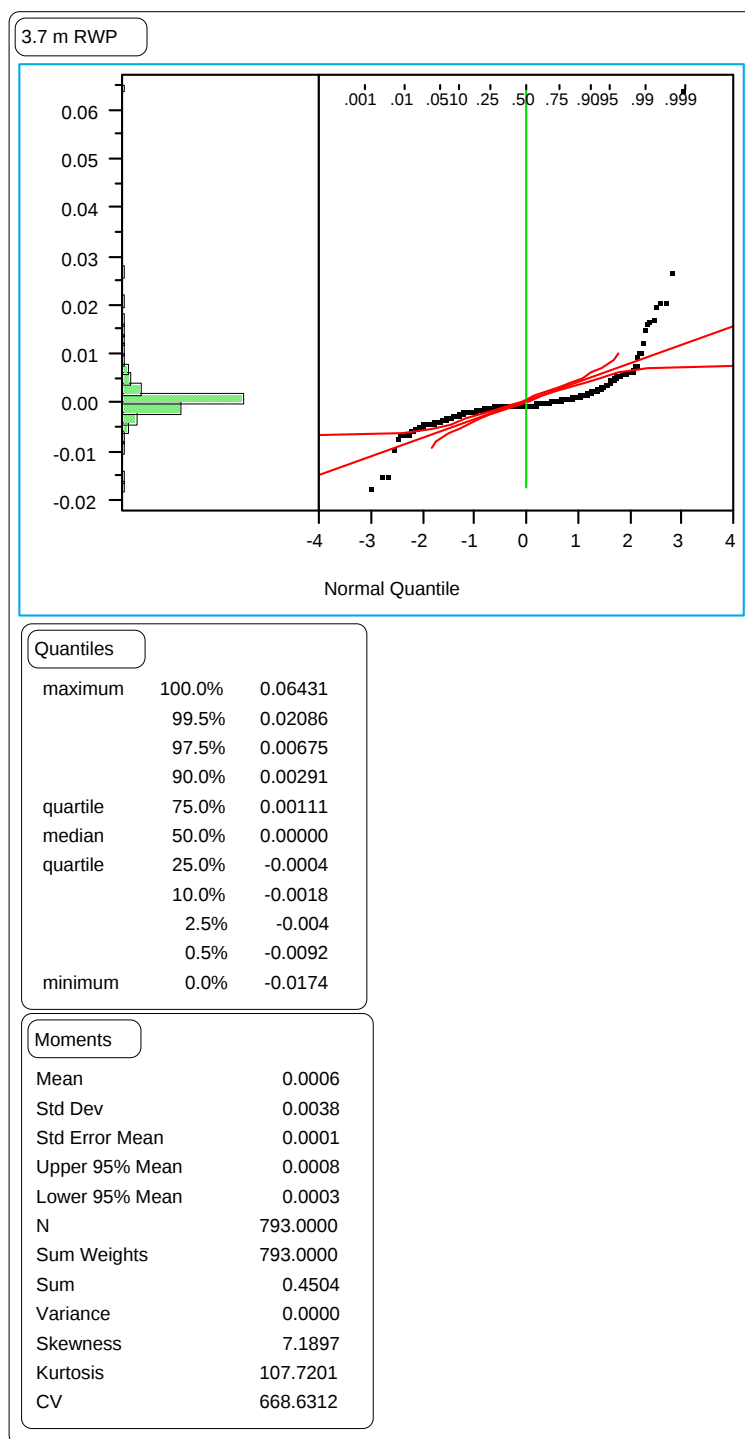


Figure 211. Distribution of the time-series slopes for the RWP wire line rut depths.

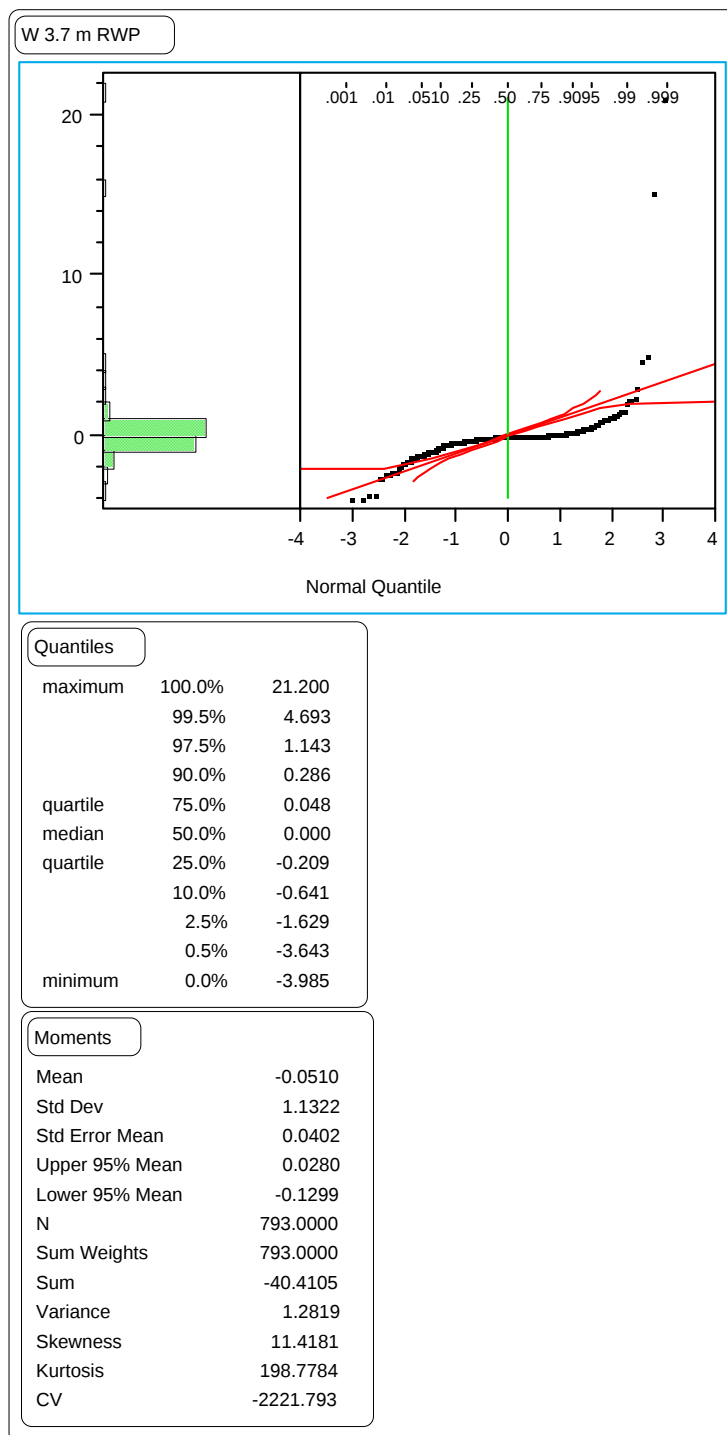


Figure 212. Distribution of the time-series slopes for the RWP wire line rut widths.

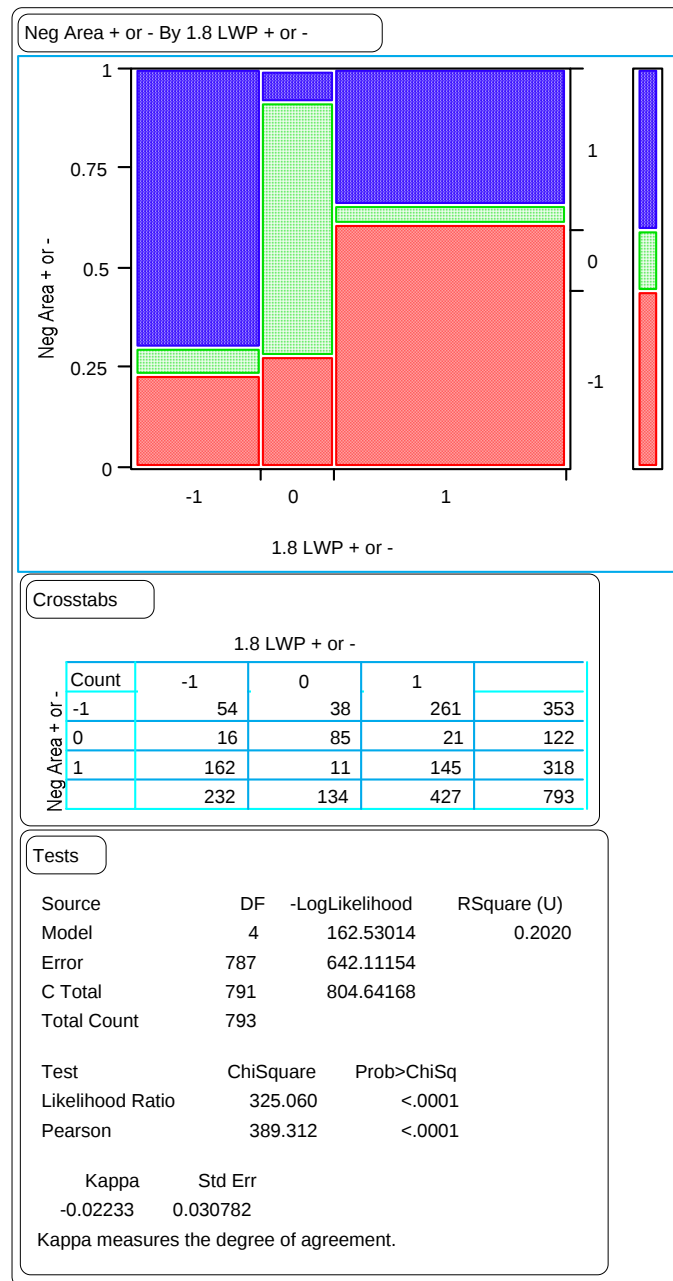


Figure 213. Comparison of the signs of the slopes for the negative area index versus those for the LWP 1.8-m rut depths.

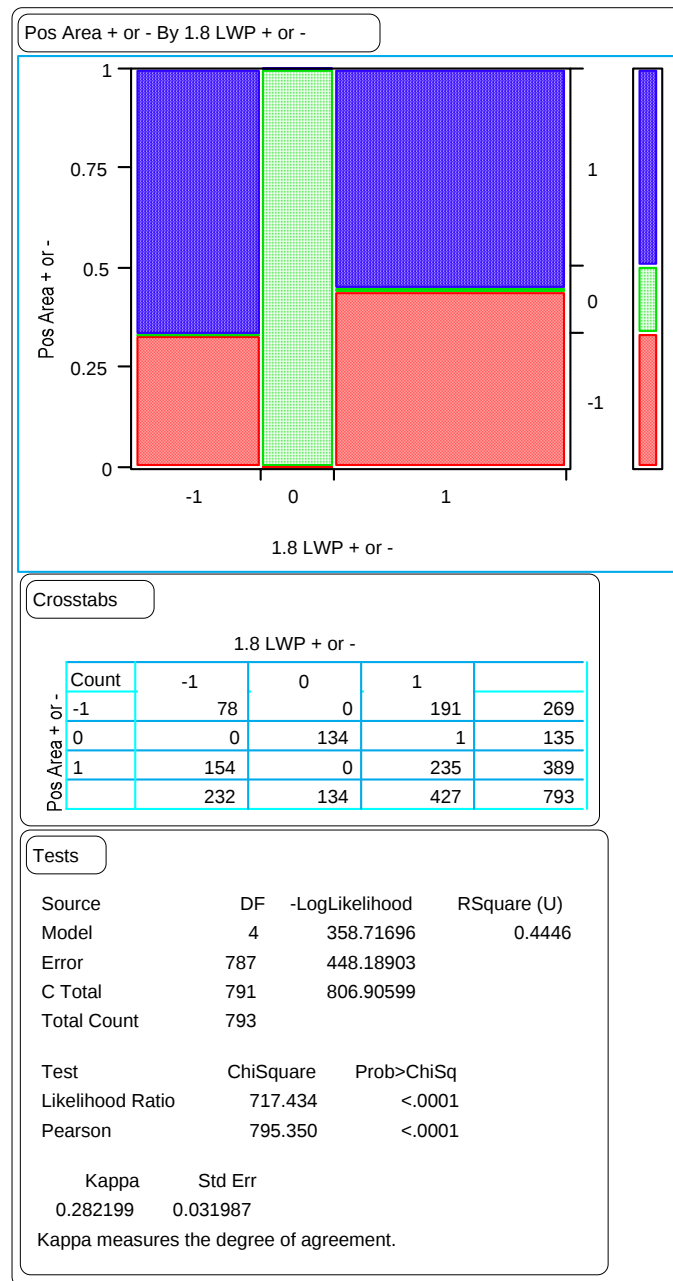


Figure 214. Comparison of the signs of the slopes for the positive area index versus those for the LWP 1.8-m rut depths.

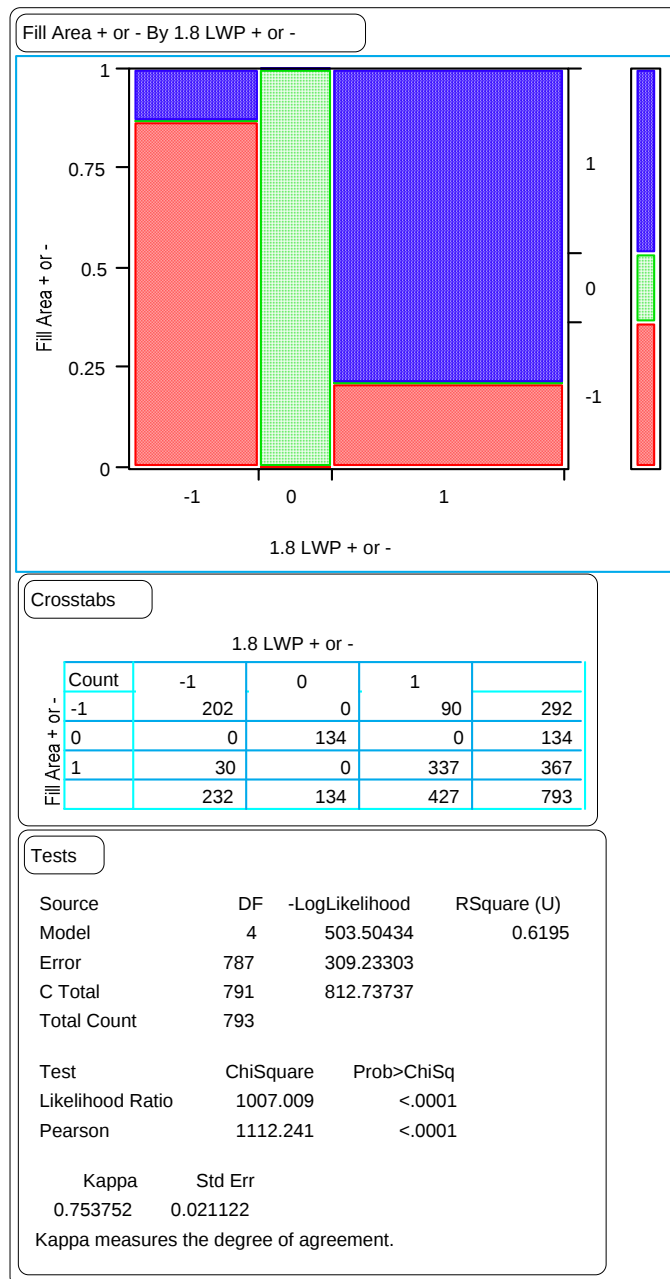


Figure 215. Comparison of the signs of the slopes for the fill area index versus those for the LWP 1.8-m rut depths.

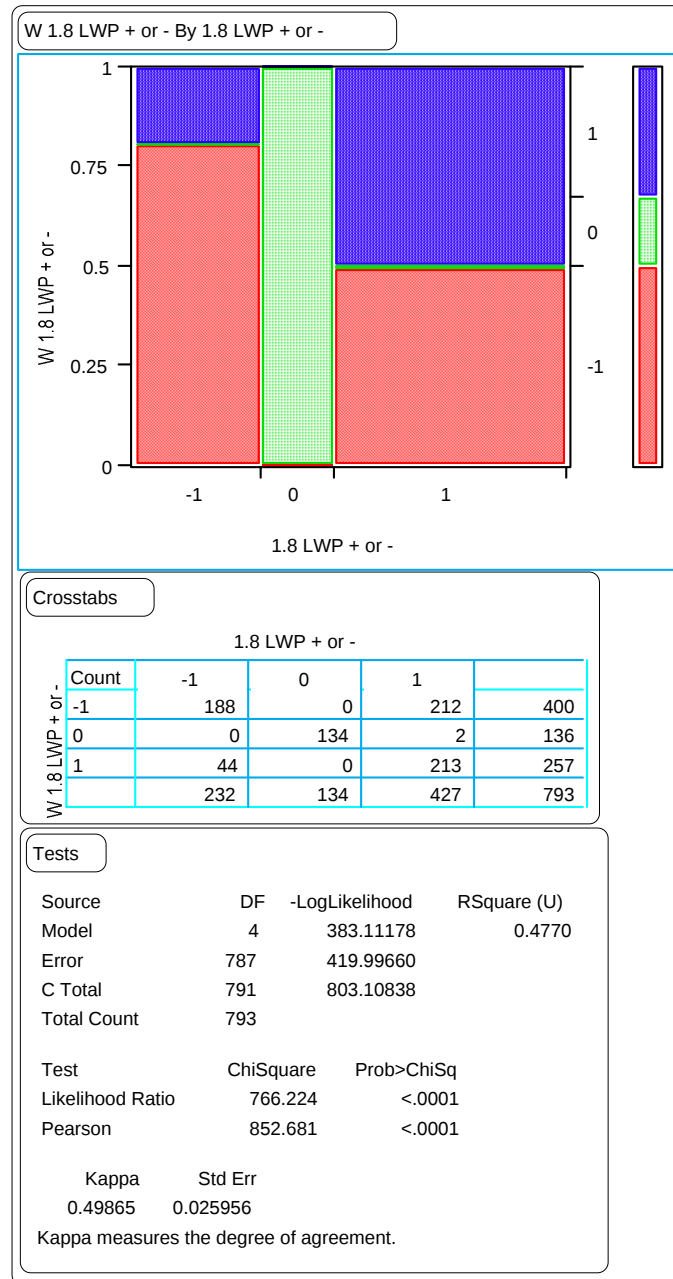


Figure 216. Comparison of the signs of the slopes for the LWP 1.8-m rut widths versus those for the LWP 1.8-m rut depths.

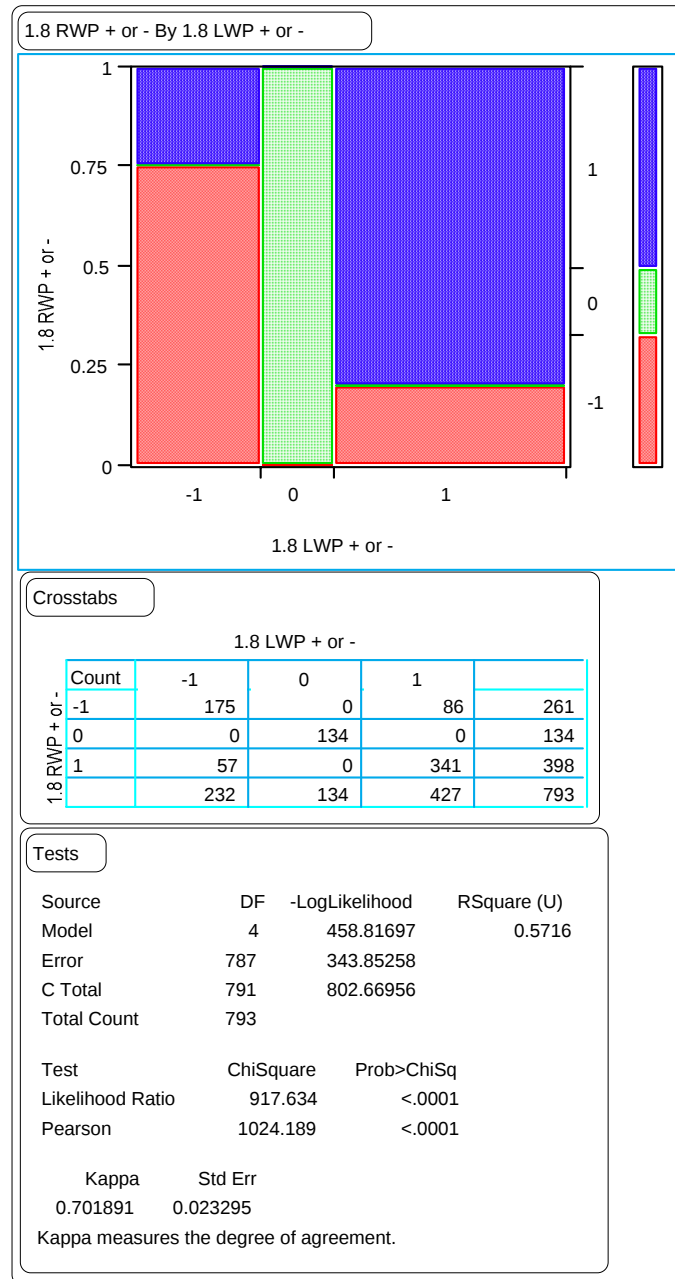


Figure 217. Comparison of the signs of the slopes for the RWP 1.8-m rut depths versus those for the LWP 1.8-m rut depths.

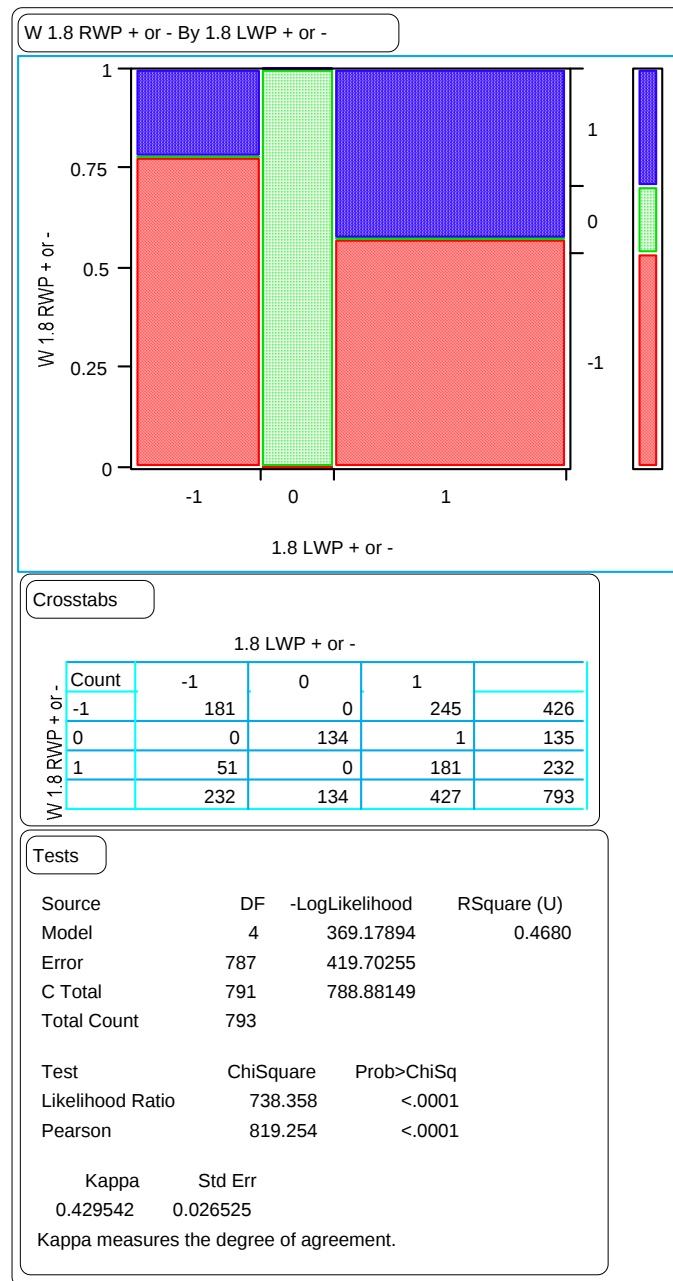


Figure 218. Comparison of the signs of the slopes for the RWP 1.8-m rut widths versus those for the LWP 1.8-m rut depths.

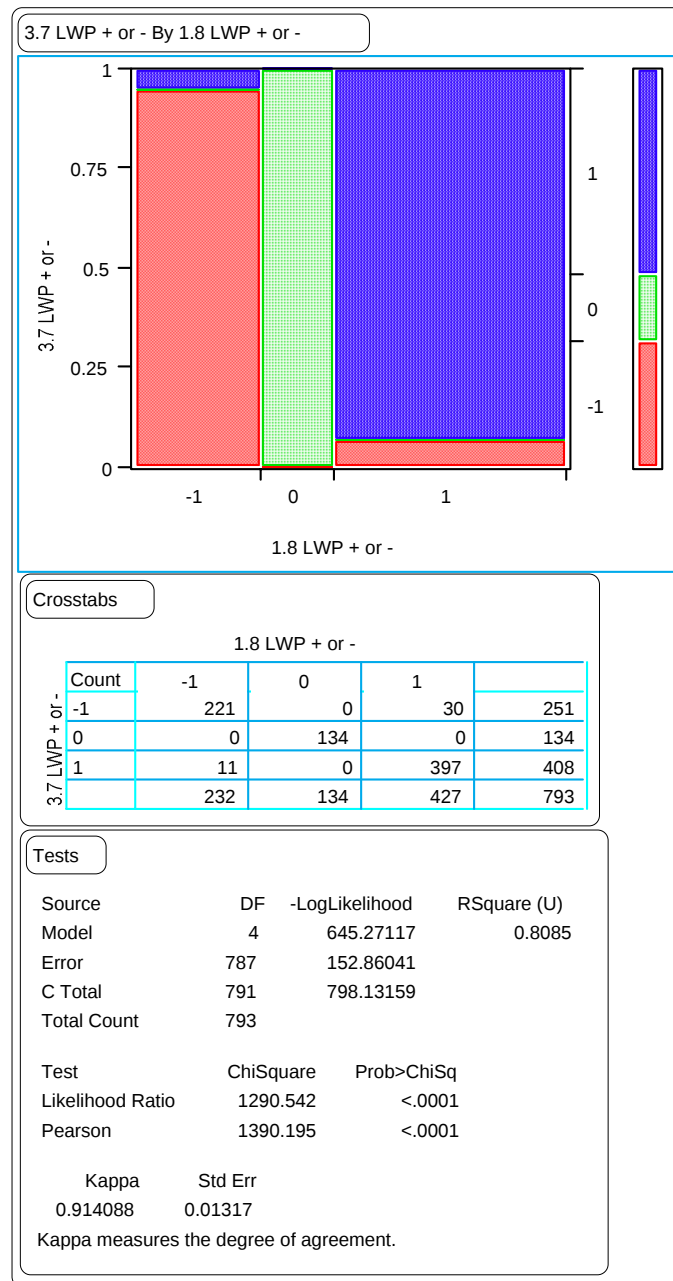


Figure 219. Comparison of the sign of the slopes for the LWP wire line rut depths versus those for the LWP 1.8-m rut depths.

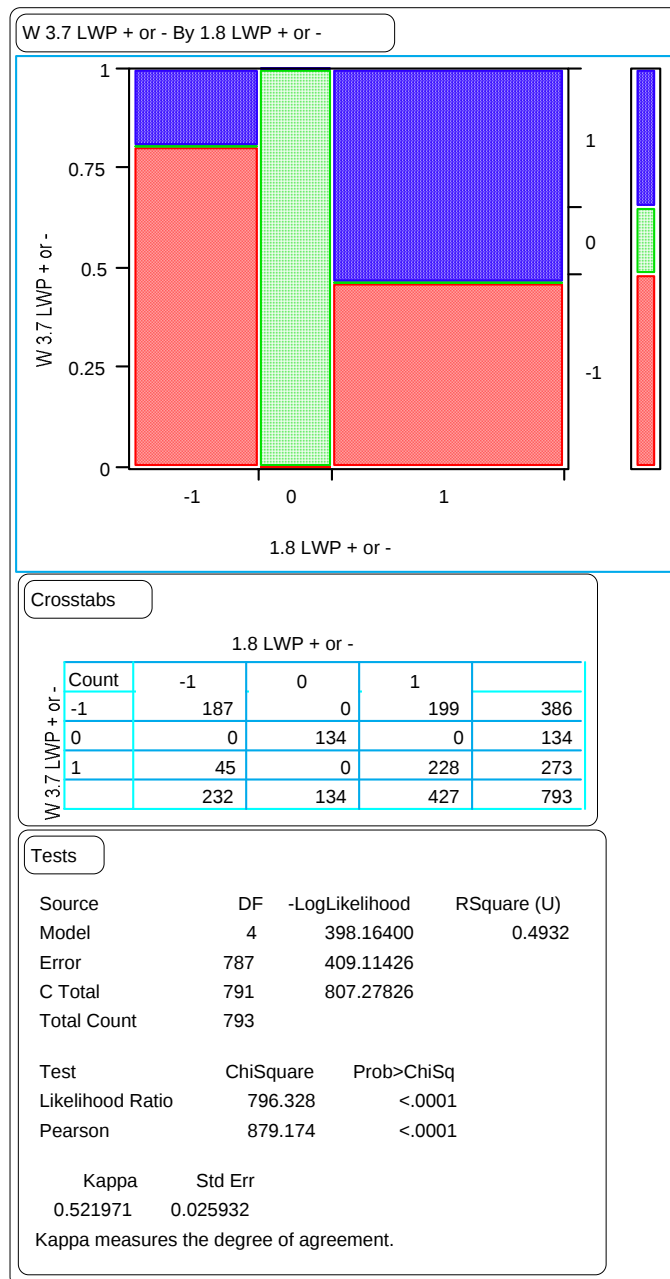


Figure 220. Comparison of the signs of the slopes for the LWP wire line rut widths versus those for the LWP 1.8-m rut depths.

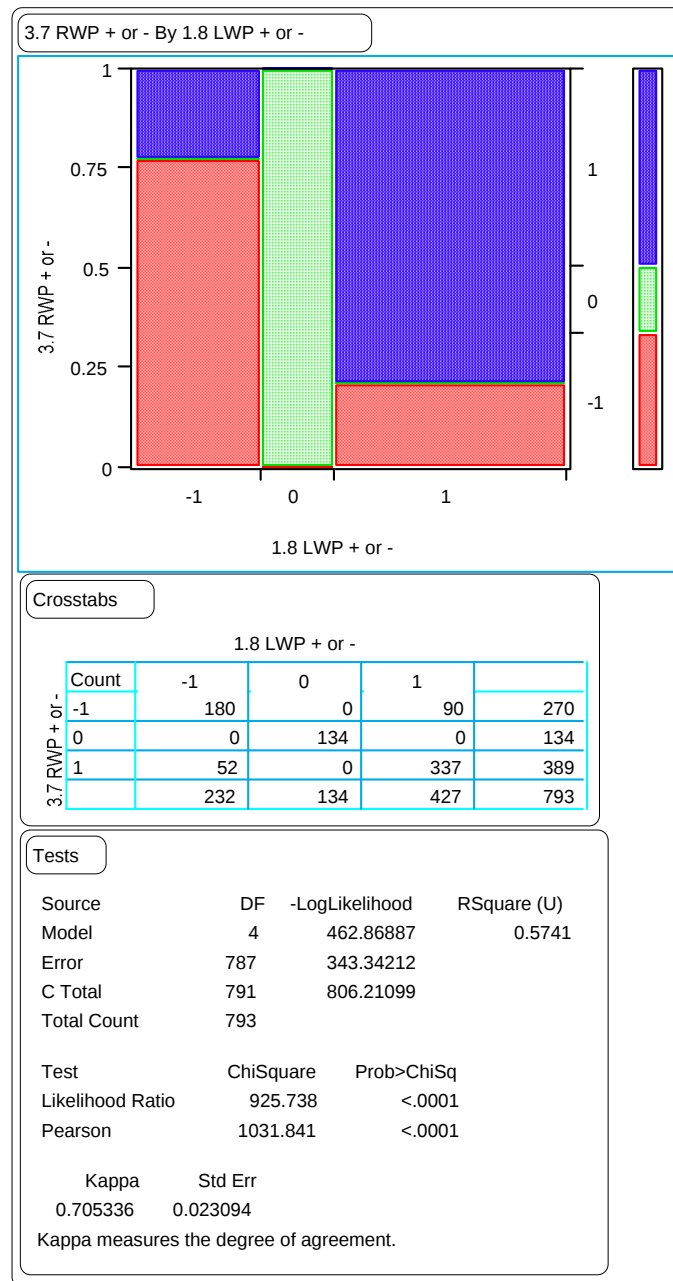


Figure 221. Comparison of the signs of the slopes for the RWP wire line rut depths versus those for the LWP 1.8-m rut depths.

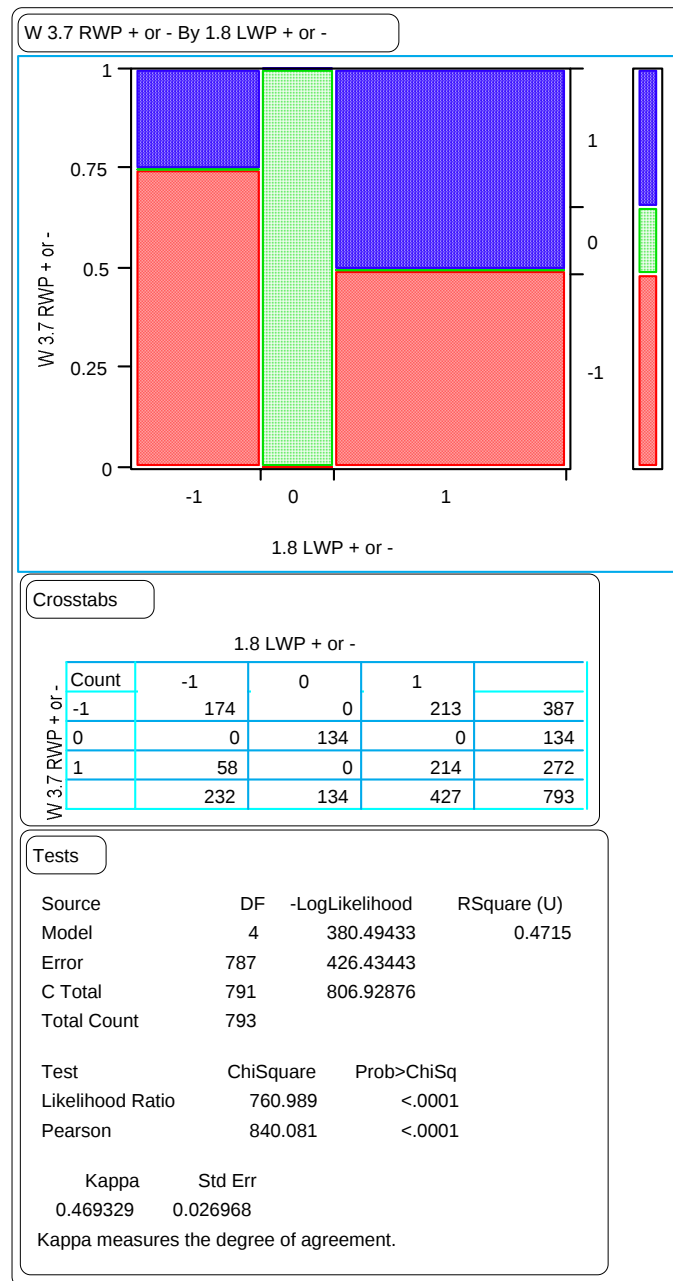


Figure 222. Comparison of the signs of the slopes for the RWP wire line rut widths versus those for the LWP 1.8-m rut depths.

REFERENCES

1. Gramling, W.L. and Hunt, J.E. *Photographic Pavement Distress Record Collection and Transverse Profile Analysis*, Report No. SHRP-P-600, National Research Council, Washington, D.C., 1993, unpublished.
2. *Distress Identification Manual for the Long-Term Pavement Performance Project*, Report No. SHRP-P-338, National Research Council, Washington, D.C., 1993.
3. Henderson, B. and Abukhater, B. *Long Term Pavement Performance PROQUAL V2.08 Users Documentation*, June 1998, Publication No. FHWA-TS-98-00-01, Federal Highway Administration, McLean, Virginia, June 1998.
4. *The AASHO Road Test, Report 5 Pavement Research*, Special Report 61E, Highway Research Board, Washington, D.C., 1962.
5. Simpson, A.L.; Rauhut, J.B.; Jordahl, P.J.; Owusu-Antwi, E.; Darter, M.I.; Ahmad, R.; Pendleton, O.J.; and Lee, Y.H. *Sensitivity Analyses for Selected Pavement Distresses*, Report No. SHRP-P-393, National Research Council, Washington, D.C., 1994.
6. Von Quintus, H. and Killingsworth, B. *Analyses Relating to Pavement Material Characterizations and Their Effects on Pavement Performance*, Report No. FHWA-RD-97-085, Federal Highway Administration, McLean, Virginia, 1998.
7. Thomas, G.B., Jr. and Finney, R.L. *Calculus and Analytic Geometry*, Sixth Edition, Addison-Wesley Publishing Company, Reading, Massachusetts, 1984.
8. Rosner, B. *Fundamentals of Biostatistics*, Third Edition, PSW-Kent Publishing Company, Boston, Massachusetts, 1990.
9. ASTM C670-96, "Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials," *ASTM Standards on Precision and Bias for Various Applications*, Fifth Edition, American Society for Testing and Materials, West Conshohocken, Pennsylvania, 1997.