

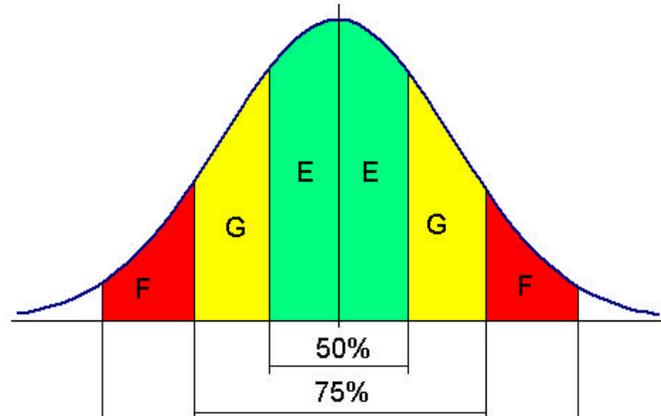
UTAH DEPARTMENT OF TRANSPORTATION

TECHNICAL BULLETIN MT-07.02

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ent, errors in calibration, errors in testing procedure, etc. On the other extreme data point in a normal distribution. The intent of this bulletin and the procedures for determining outliers as expressed in ASTM E 178-02 action.

for outliers depending upon the type of suspect data. The spreadsheet and provides results based on two data sets: single sample data; and impose of each test and how the spreadsheet displays results is described f significance is used for all tests according to general recommendations s.

UDOT webpage at

[hp/tid=1387/outliers.XLS](http://tid=1387/outliers.XLS). The spreadsheet consists of two receives all test data and the *outlier results worksheet* analyzes the ctions. Five tests are described in E 178 and each test result is *results worksheet*. The tests are 1) the T test for single maximum or outliers on both the left and right tails, 3) the Tietjen and Moore ie left and right tails, 4) the Grubbs statistic for determining multiple determining outliers in multiple samples between laboratories. The ple tests to the same set of data. The spreadsheet user must decide d on the data provided. The laboratory tests require a separate data *sheet*.

Single samples: Enter all the test data for single samples in the yellow cells of **Table 1**. The gold cell must contain

the total number of tests entered (the n value). As many as 50 test results may be examined. Once the data is entered, tab to the *Outlier Results Worksheet* to view the analysis of the data. To simplify interpretation of results, most of the calculations and statistics are hidden. The cells with blue text will recommend keeping the suspect tests, discarding the suspected outliers, or discarding the outliers and re-examining the results. Again, it is appropriate to examine the data to determine which test results to apply.

Multi-laboratory tests: Enter the test data for multiple tests between laboratories in the yellow cells of **Table 2**. Data for as many as 5 replicate tests in 30 different labs may be entered. The gold cells must contain the number of laboratories analyzed and the number of replicates. Tab to the *Outlier Results Worksheet* to view the recommendations in the cells with blue text.

CONCLUSION

The spreadsheets and the tests included are designed to simplify the task of detecting outliers in a set of data. For more detail on how the results were derived, ASTM E 178 should be examined.

Once an outlier is determined, a complete investigation should be conducted to determine the cause. A close examination of the material, testing equipment, calibration records, testing procedures, calculations and recording procedures, technician skills, etc., should be conducted. The detection of outliers is simply the first step in gaining confidence in the testing results. Follow up is always necessary.

FURTHER INFORMATION AND RELATED DOCUMENTS

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Websites, publications, other sources:

Technical Bulletins: <http://www.udot.utah.gov/index.php/m=c/tid=1387>

UDOT Manual of Instruction, Section 1011, Independent Assurance
http://www.udot.utah.gov/download.php/tid=644/Independant_Assurance_8-1012.pdf

ASTM E 178-02