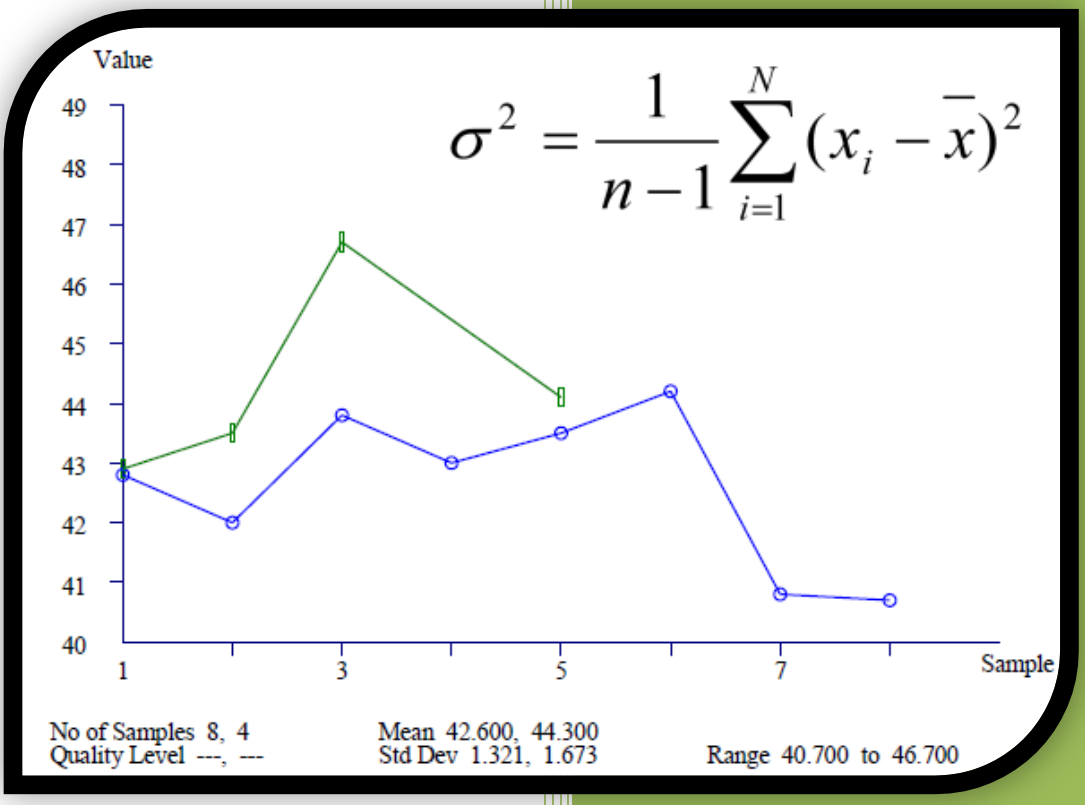
2016

QL-PAY 6.0 User's Manual

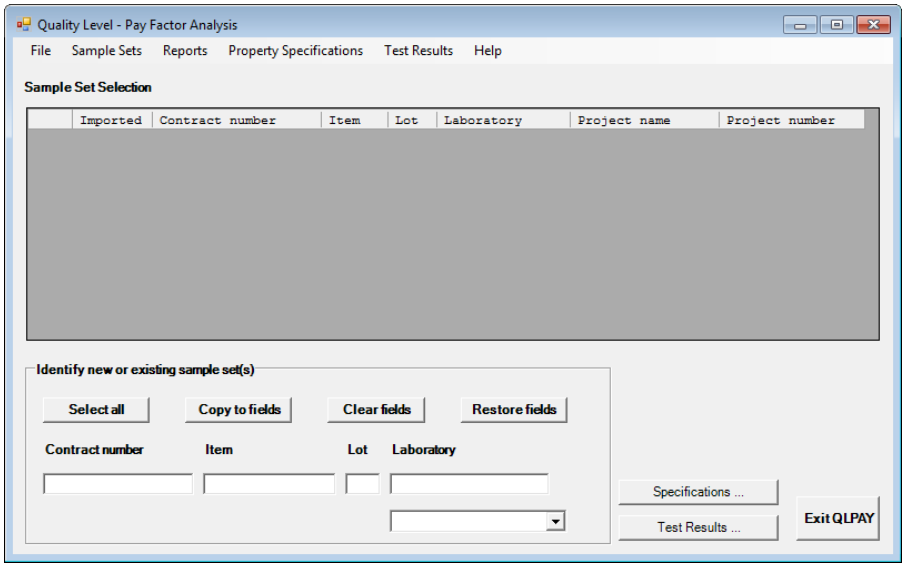


Computer Program for Statistical Evaluation

Table of Contents

1. Introduction

QL-PAY is a program created to assist in the evaluation of material quality and consistency through statistical analysis. It will determine the quality level, percent within limits, and the pay factor of an item. The program also provides a data verification analysis used to compare data obtained by the contractor to data from the samples sent to the government central laboratory. The program uses the F and t statistics with a significance level of 0.01 for comparison of data samples.

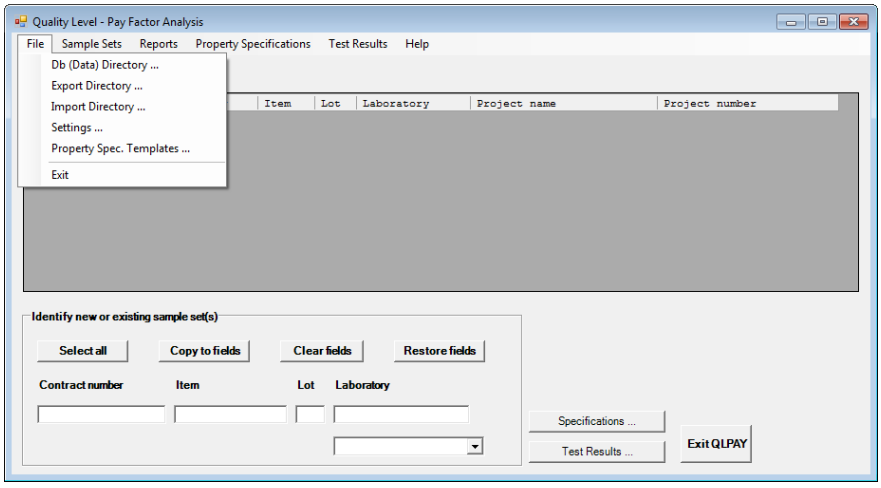


QL-PAY home screen.

2. Getting Started

2.1. Menu Functions

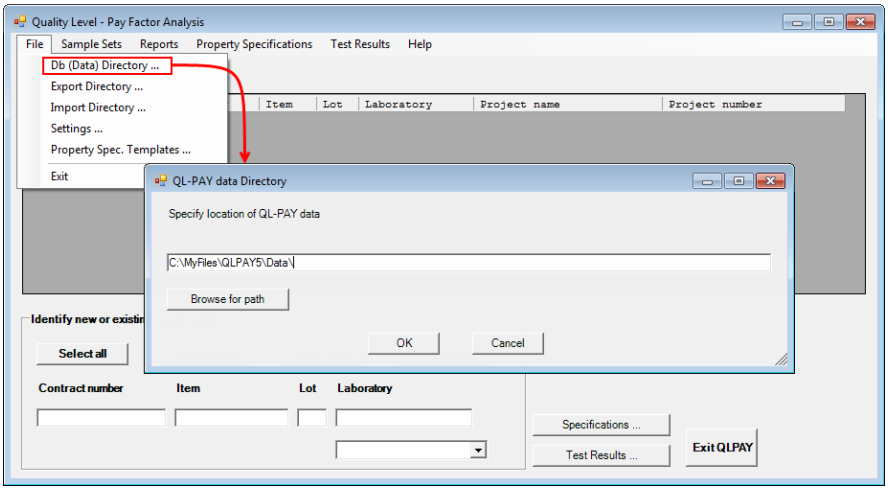
2.1.1. File



File menu from the home screen of QL-PAY.

A. Db (Data) Directory
   This specifies where the sample set data is located on the hard drive.
B. Export Directory
   When exporting data from the program, a transfer file will be established in the specified directory. The data from the QL-PAY program is exported as a .XML that can be read by another user.
C. Import Directory
   This specifies the default location for the transfer files to import.

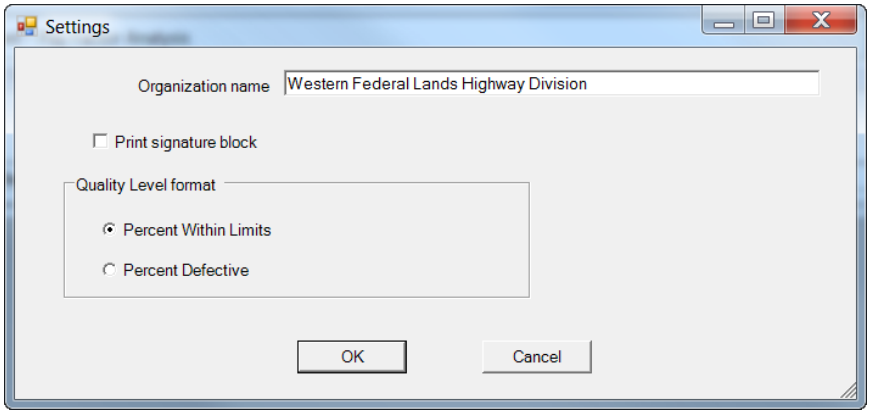
Note: *The directories should automatically be set up within the QL-PAY file in a default location already on the computer hard drive upon initial installation of the program. This can be located by selecting the directory the user wants to view from the "file" menu.*



Locating the directories in QL-PAY.

D. Settings

The settings tab allows for the Organization Name, Print Signature Box, and Quality Level Format to be adjusted.

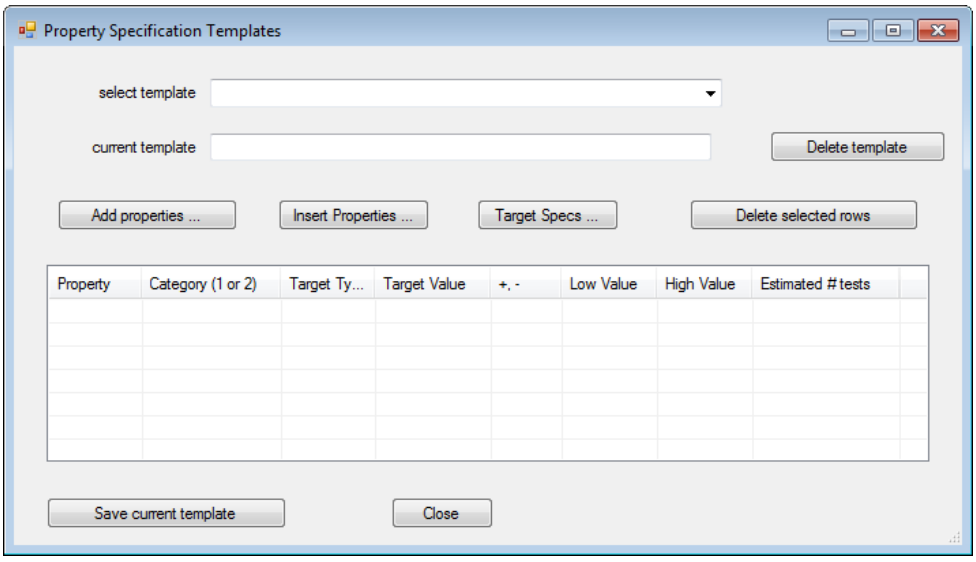


QL-PAY main settings window.

a. Organization Name: The organization name will appear on all generated reports.
b. Print Signature Box: When checked, a signature block will be printed on the Pay Factor Report.
c. Quality Level Format: Depending on the box selected, Quality Level will be reported as "Percent within Limits" or as "Percent Defective."

E. Property Specifications Templates

Prior to inputting data, property specifications will need to be provided. Users can create a custom template to aid in classifying property sets.

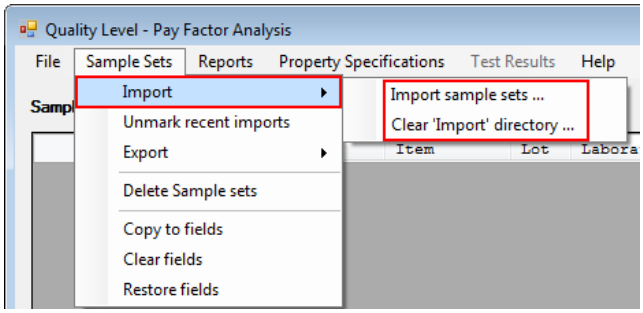


Property specification template window.

This tab within the file menu allows new templates to be established that can be reused from the user's computer. These templates can be found when setting up projects under "Property Specifications." See ***Section 3.5 Creating a New Target Specification Template*** for more detailed instruction.

2.1.2. Sample Sets

A. Import



View of the sample set import menu functions.

a. Import Sample Sets

The user can import transfer files into QL-PAY using this option. The user will have an .XML file that will be placed in the "import directory" mentioned above in the "File" menu functions. When importing data sets, inconsistencies in the property specifications will be flagged by QL-PAY. The user will be notified of these inconsistencies and is able to choose to proceed or not. See ***Section 5.1 Import*** for more detailed instructions.

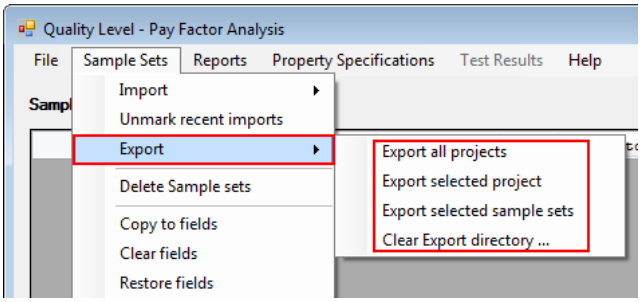
b. Clear "Import" Directory

This function provides the user with the ability to delete the .XML transfer files from the import directory.

B. Unmark Recent Imports

Upon transfer into QL-PAY, the imported sample sets are denoted with a check mark under the "Imported" column heading. The check marks will remain in the column until QL-PAY is closed, unless they are removed by the user during the session.

C. Export



View of the sample set export menu functions.

Note: *In QL-PAY, a project is specified as a group of sample sets that are encompassed by an identical project name and project number entered by the user. When selecting a "project," all sample sets that have the corresponding project name and number will be included in the export file.*

a. Export all Projects
   All sample set data for every project in QL-PAY is exported to a transfer file in the export directory.
b. Export Selected Project
   This allows the user to export the sample set files associated with the selected project, thus creating a transfer file in the export directory.
c. Export Selected Sample Set
   The function exports only sample sets selected by the user to the export directory.
d. Clear Export Directory
   This function provides the user with the ability to delete the .XML transfer files from the export directory.

D. Delete Sample Sets
   The user can delete the sample sets by highlighting the appropriate sample sets. See ***Section 3.4 Deleting an Existing Sample Set*** for further instruction.

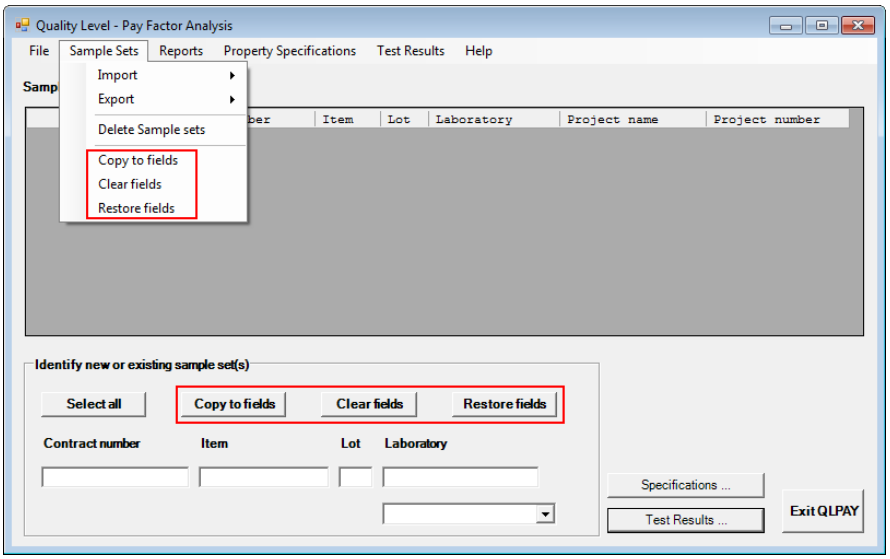
E. Copy to Fields
   When a sample set is selected, the user can copy the Contract Number, Item, Lot, and Laboratory into the "Identify new or existing sample set" fields to minimize entering project information multiple times for the same project.

F. Clear Fields
   When information has been entered in the "Identify new or existing sample set" fields, it can be cleared by selecting this option.

G. Restore Fields

The restore function will re-establish the data that was entered previously into the editable fields.

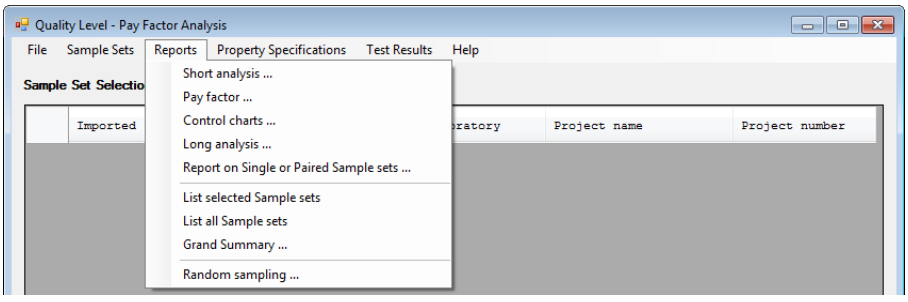
Note: *Copy/Clear/Restore fields can be found in the "sample sets" menu function or they can also be located as buttons in the "Identify new or existing sample set" box in the lower portion of the home screen.*



Copy/Clear/Restore fields locations on the home screen.

2.1.3. Reports

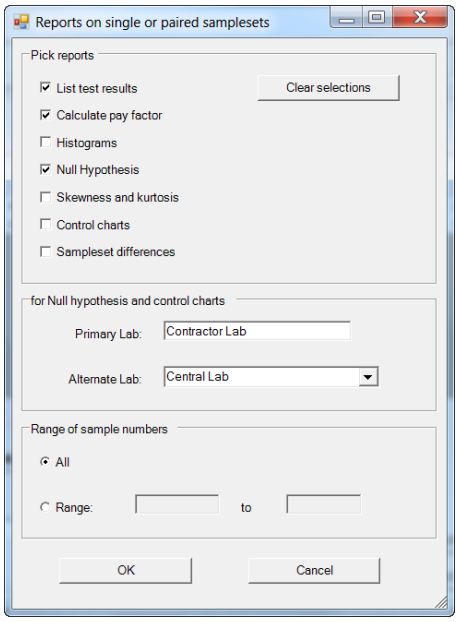
The pull down menu from the "Reports" tab provides options to select various pre-selected report types. See ***Section 4 Reports*** for a detailed explanation of the report components.



Reports menu function on the home screen.

A. Short Analysis

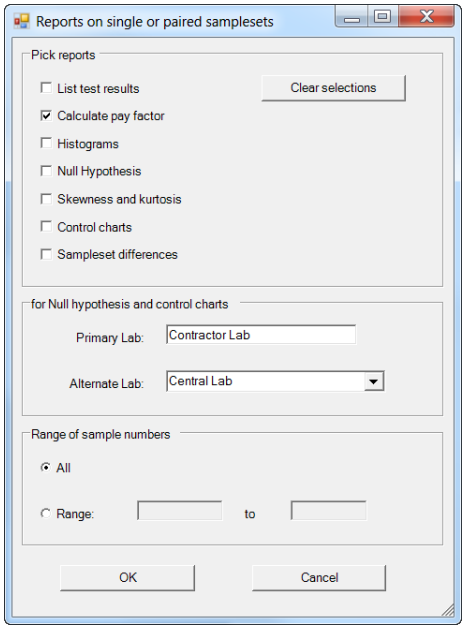
The short analysis compiles the test result values with the pay factor and null hypothesis analysis. The generated report will include a listing of the test results, pay factor analysis, and null hypothesis for the selected sample set.



Short analysis short cut report selection.

B. Pay Factor

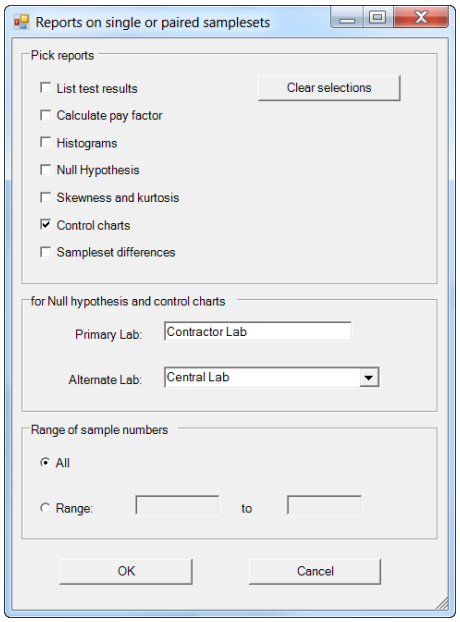
The pay factor report will generate a report with the pay factor for the sample set.



Pay factor short cut report selection.

C. Control Charts

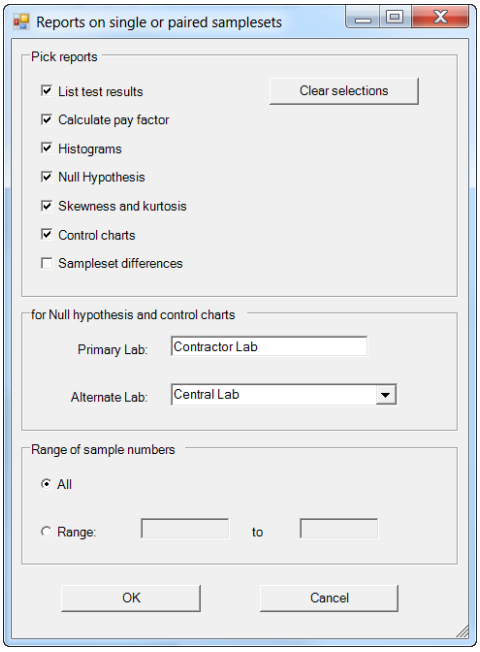
Control Charts show a comparison of the test results with the specification limits.



Control chart short cut report selection.

D. Long Analysis

The long analysis includes a listing of the test result values, pay factor analysis, histograms, null hypothesis, skewness and kurtosis, and control charts for the selected sample set.



Long analysis short cut report selection.

Note: *The previous four report selections (A-D) are a pre-selected specialized report short cut. By choosing these particular reports, a report will be generated with the data pertaining to the specific report.*

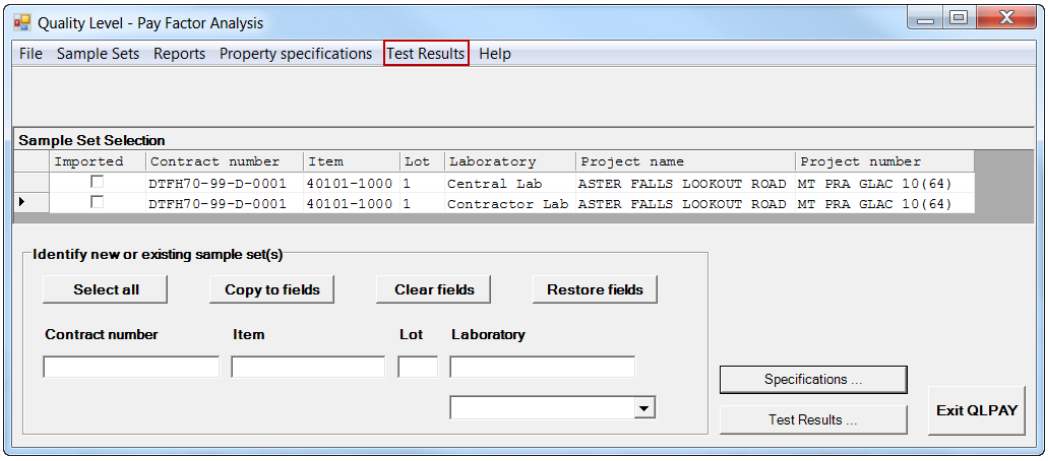
E. Report on Single or Paired Sample Sets
   This report option brings up the selection box to allow the user to manually select the combination of reports to run on the sample sets.
F. List Selected Sample Sets
   This creates a list of the identifying information for the sample set that is selected.
G. List All Sample Sets
   This function creates a list of the identifying information for all of the sample sets that are inputted in the QL-PAY database.
H. Grand Summary
   A report is produced that includes the summary of all of the properties in the selected sample sets, along with the option to include an analysis of the sample sets and/or histograms of the data.
I. Random Sampling
   A report is generated at the user's discretion to produce random numbers using the project information of the selected sample set. The random numbers can be established by an item quantity or by roadway stationing of the project using the parameters in the report options. See ***Section 6.1 Generating Random Number Reports*** for specific instructions regarding random sampling.

2.1.4. Property Specifications

A "property set" is an asset of properties pertaining to a lot specified by Contract Number, Item Number, and Lot Number. This set contains one or more "Properties and Specifications" for the various items on a project that need to be tracked through QL-PAY. These property sets are applied to the different labs that are performing tests for the specific properties.

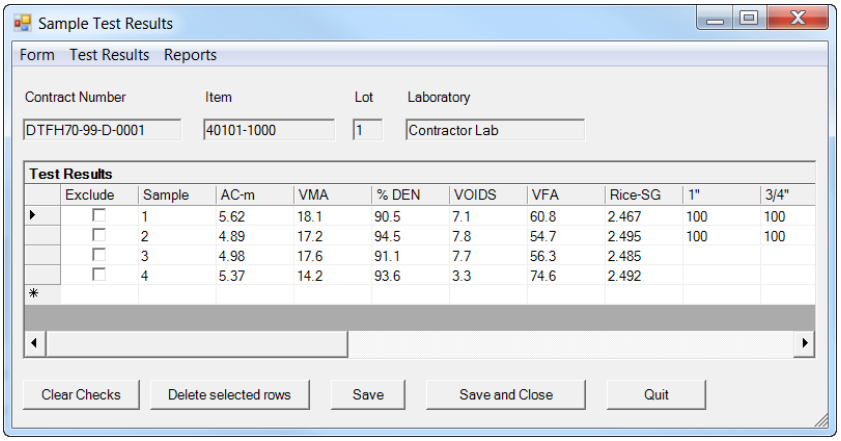
Due to the program design, the user must provide a specific project name and project number to be able to select properties. However, when any changes are made to the property set information, the changes are applied to all the labs that are connected to the particular property set.

2.1.5. Test Results



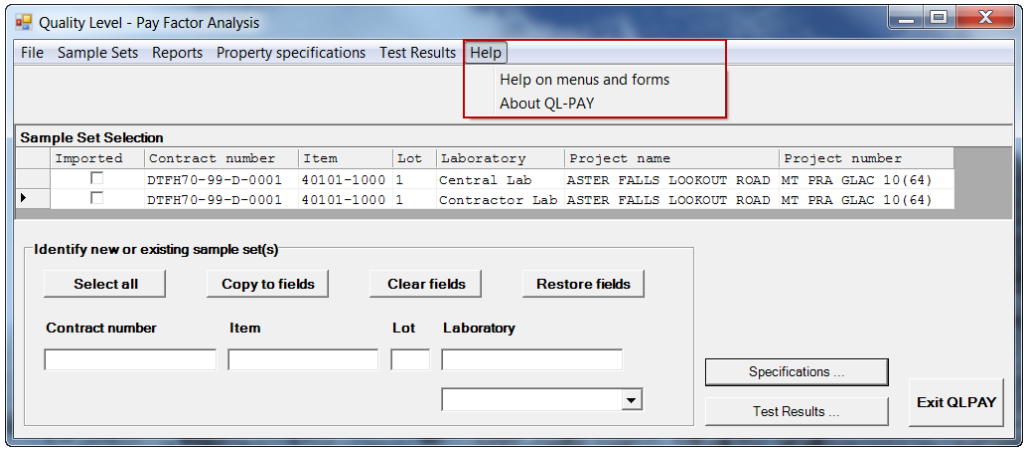
Test Results menu on the home screen.

The "Test Results" tab directs the user to a window for entering test results specific to the selected sample set. The user can choose to exclude certain samples, delete samples, and generate reports from this window. Verify the appropriate laboratory has been selected prior to entering results.



Window for entering test results.

2.1.6. Help



Help drop down menu on the home screen.

A. Help on Menus and Forms
   This help function will give you the basic information related to menus and forms within the QL-PAY database.

B. About QL-PAY
   The version and build number of the QL-PAY program being used are displayed under this option.

3. Setting Up a Project

3.1. Using the Contract

To determine how an item will be accepted, each Section of the contract has an Acceptance Subsection and Sampling, Testing, and Acceptance Requirements Tables that will denote how the material will be evaluated. If it is stated that a particular material will be evaluated under Subsection 106.05, QL-PAY will be used for statistical analysis to determine the pay factor for the material. Generally speaking, the items governed by statistical evaluation procedures are Aggregate Courses, Treated Aggregate Courses, Asphalt Concrete, and Structural Concrete.

Example Section 301. — UNTREATED AGGREGATE COURSES

301.08 Acceptance. See Example Table 301-1 for sampling, testing, and acceptance requirements; including the category for quality characteristics.

Aggregate gradation and surface course plasticity index will be evaluated under Subsection 106.05. Other aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

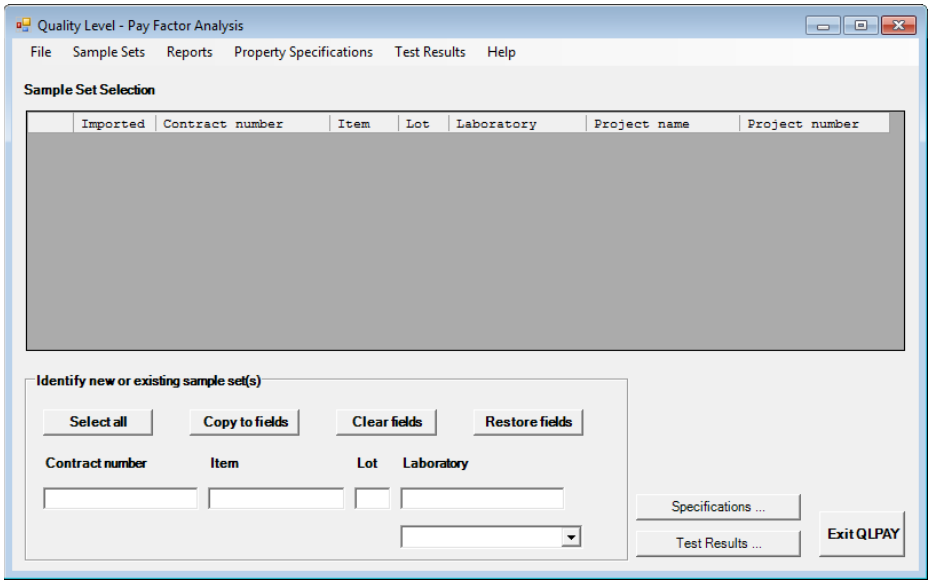
Example Section 301. Untreated Aggregate Courses Acceptance subsection.

Example Table 301-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Base course grading C, D, & E	Statistical (106.05)	Gradation 3/8 Inch (9.5 mm) No. 4 (4.75 mm) No. 200 (75 µm) Other specified sieves	 I I I II	AASHTO T 27 & T 11	1 per 1000 tons (900 metric tons)	From windrow or roadbed after processing	Yes	4 hours	-
Subbase & base course Grading A, B, C, D, & E	Measured and tested for conformance (106.04)	Liquid limit Moisture-density (max density) Density Moisture content (in-place)	- - - -	AASHTO R 58 & T 89, Method A AASHTO T 180, method D[(1)] AASHTO T 310 or other approved procedures “	1 per 1000 tons (900 metric tons) 1 per type & source of material 1 per 500 tons (450 metric tons) “	From windrow or roadbed after processing Stockpile or production output In-place after compaction “	Yes ” No “	4 hours “ End of shift “	- - - -

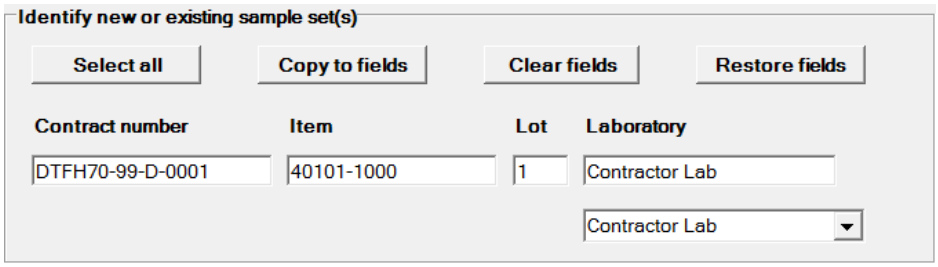
Example Table 301-1 Sampling, Testing, and Acceptance requirements for Untreated Aggregate Courses.

3.2. Creating a Sample Set



Initial view when opening QL-PAY.

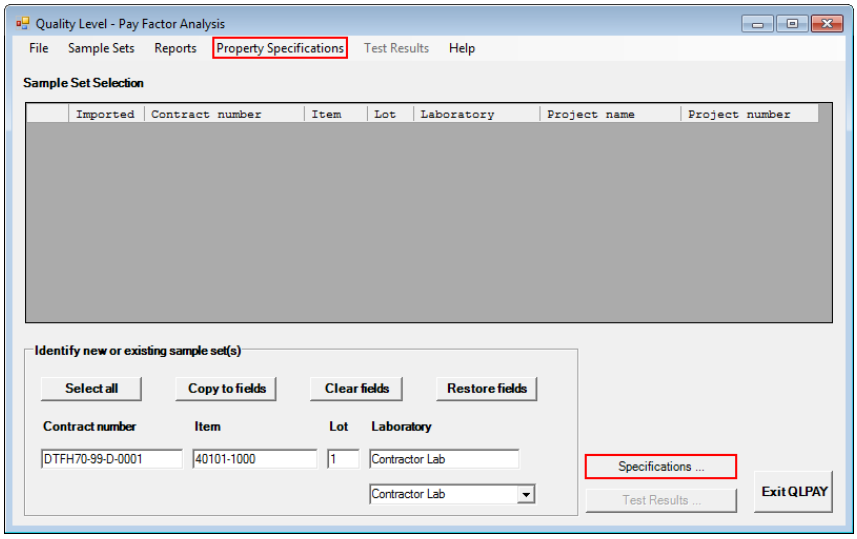
A. Enter data in the "Identify New or Existing Sample Set" fields: Contract Number, Item, Lot, and Laboratory.



Completed project data entered in the sample set box.

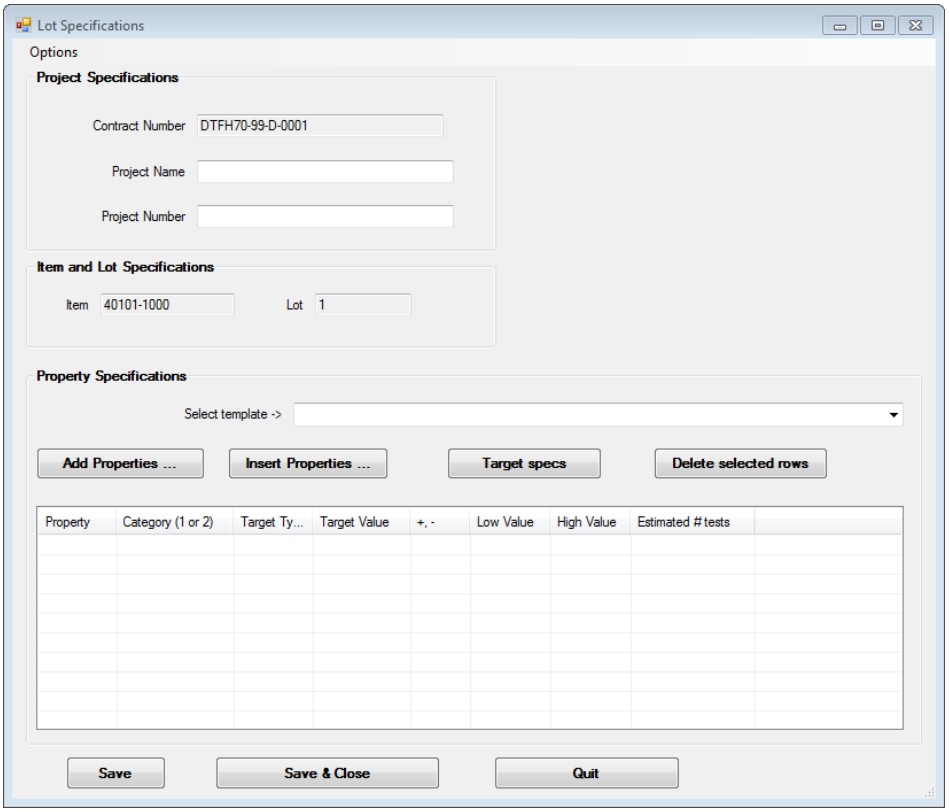
Note: *Typically, there will be a "Central Lab" and "Contractor Lab" sample set for each item. Make sure the drop down menu is not highlighted when moving on to the next step or it will not copy over to become a sample set.*

a. Click on “Specifications” to proceed once all fields are completed. This window can be accessed from either the “Specifications” button on the lower right of the home screen or the menu icon stating “Property Specifications.”



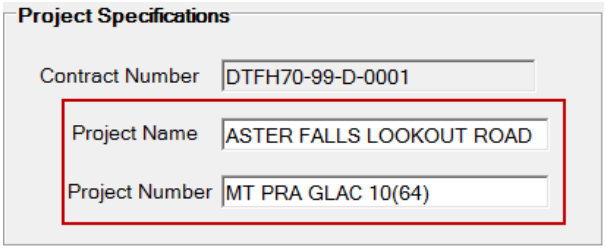
Selecting specifications once sample set data is entered.

B. Specifications



Initial view after opening the specifications window.

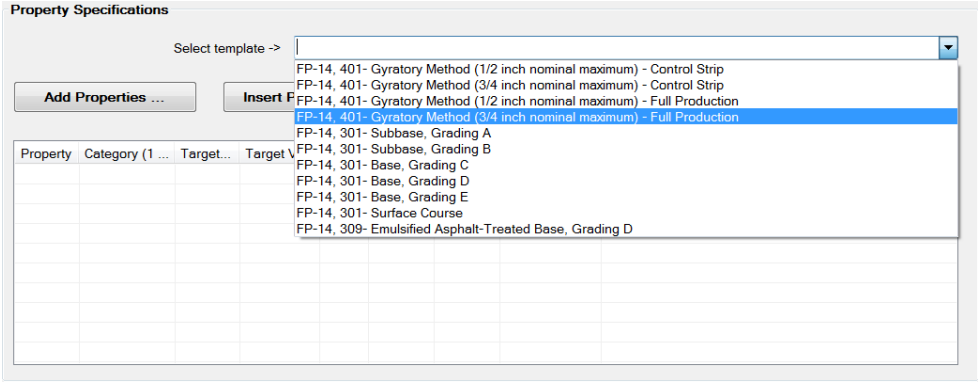
a. Enter the Project Name and Number.



Entered project name and number.

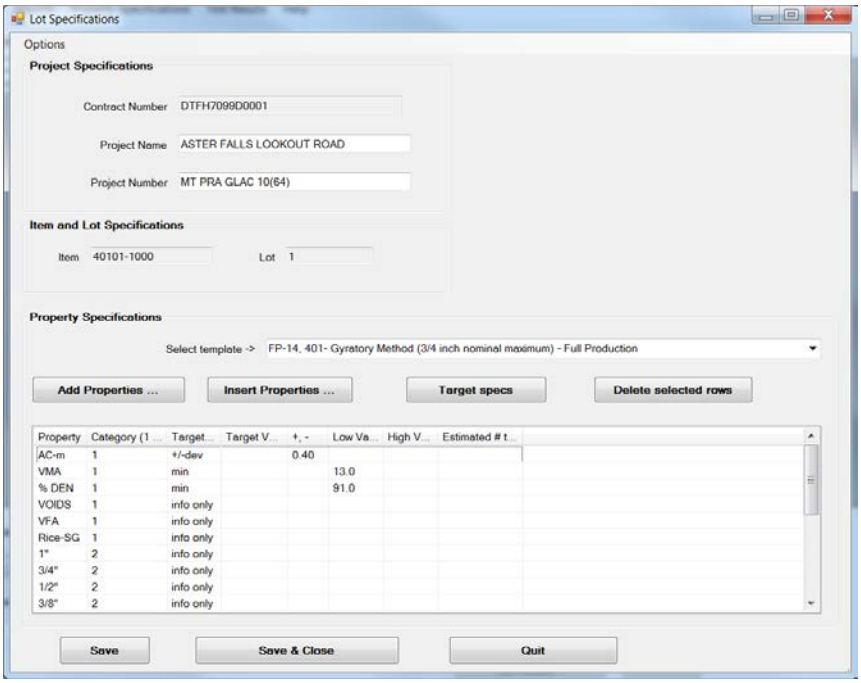
Note: *The project name and number must be identical for all files associated with the particular project, i.e. Item 401 and Item 301 sample sets.*

b. Select the appropriate template from the drop down menu under "Property Specifications."



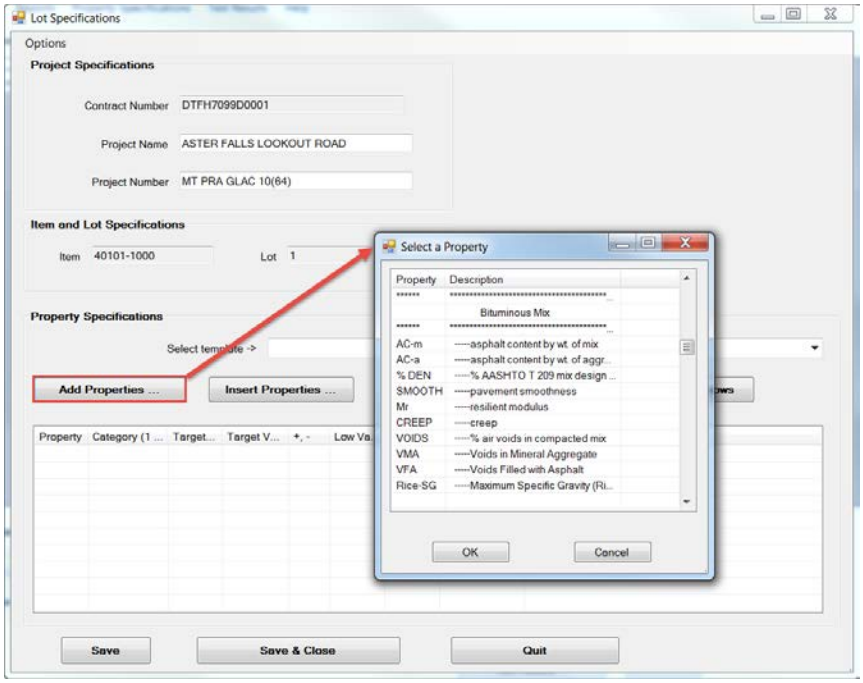
Drop down menu for the property specifications template.

By selecting a template, the majority of the specification has already been entered into the program and only minor changes will need to be completed. See the next page for a view of the property specifications template.



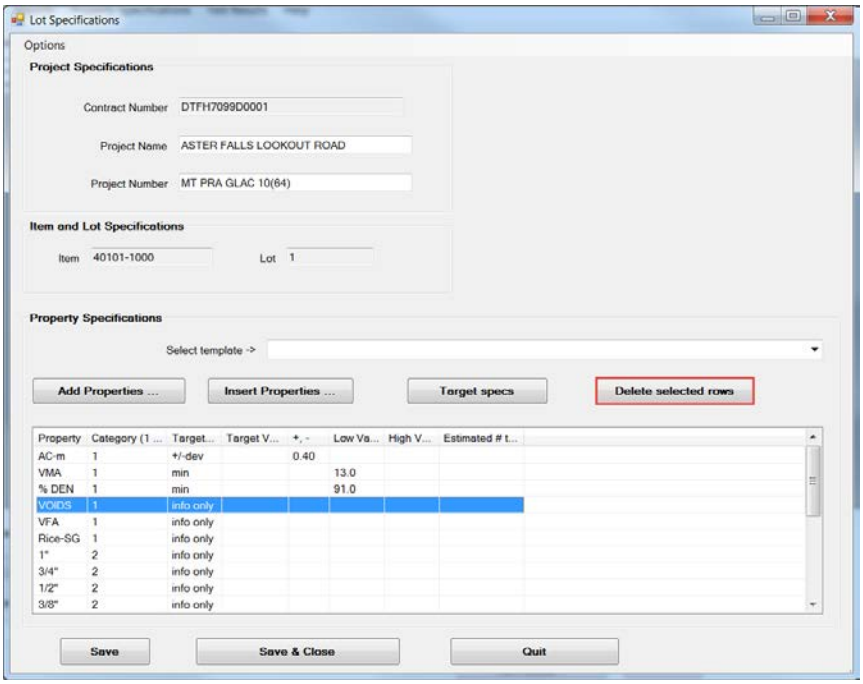
Choosing a property specifications template.

c. If there is not a template specified for the item to be evaluated, property specifications can be added manually by using the “Add Properties” tool and individually selecting the properties required for analysis from the “Select a Property” window.



Process for selecting individual properties.

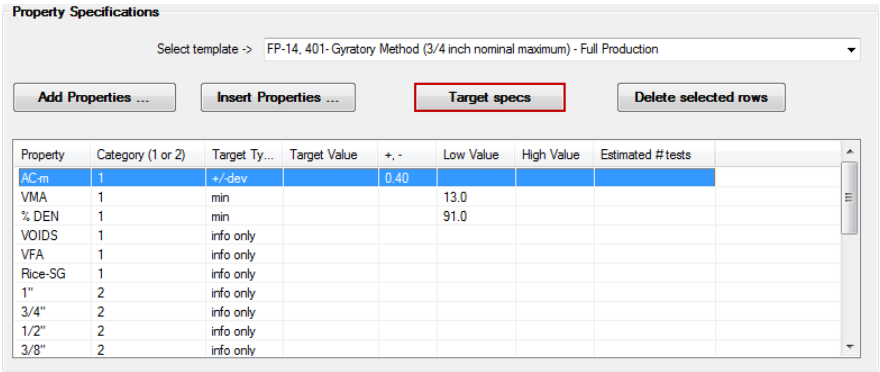
d. When using templates, there may be additional properties in the property specifications templates than are shown in the sampling and testing requirements of the contract. The additional properties can be removed in two ways, either by highlighting the row to delete and select the button that states “Delete selected rows” or the user can press the delete button on the keyboard.



Deleting highlighted property specifications.

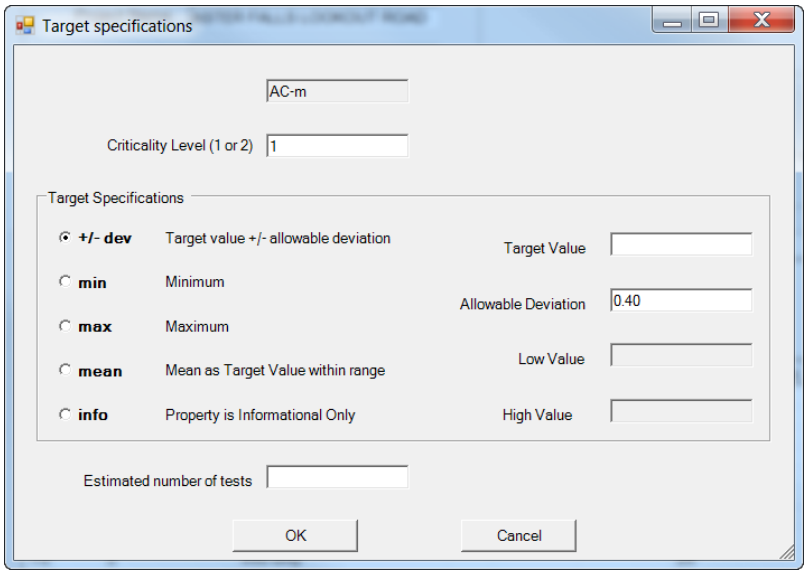
C. Providing Target Specifications to Match the Contract

a. To input specification targets, highlight the property in the lower table and click on the “Target Specs” button.



Highlighted property prior to selecting target specs.

This will bring up a new window to enter the specifications for the particular property.



Target specification window.

b. Select the criticality level for the target specification. The criticality level (category) defines the lowest acceptable quality level a material can reach and still receive the contract price. The category is broken into two levels which are stated in the Sampling, Testing and Acceptance Requirements Table within each section of the contract. Category I and II are based on acceptable quality levels of 95 percent and 90 percent, respectively. For additional information, see Subsection 106.05 in the specifications.

c. Determine the testing parameters for each property and select the appropriate specification type, i.e. min, max, etc. When the appropriate button is selected, the corresponding fields on the right will be highlighted to enter data. Each field will need to be filled with data from either the sampling and testing specification, material specification or a mix design.

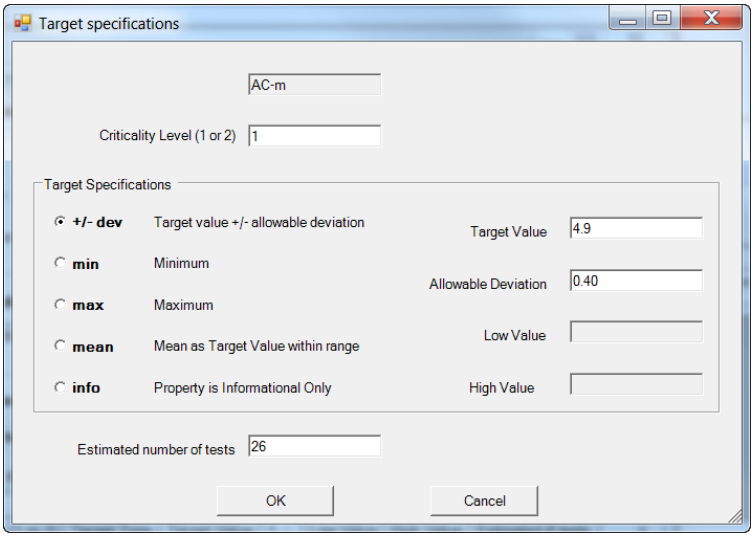
   i. ***+/- dev:*** By selecting this option, the contract requires a target value and an allowable deviation be set for each individual property.

   ii. ***Min:*** A minimum parameter is used when the contract states that a lower specification limit is required for the property.

   iii. ***Max:*** The maximum value will be used when the specification specifies an upper limit for the property.

   iv. ***Mean:*** When using the "mean" target specification, the program establishes the mean of the inputted data as the target value. If the mean exceeds the maximum specification limit or is lower than the minimum specification limit, the program will automatically set the target value at the maximum or minimum specification limit as appropriate.

v. ***Info:*** By selecting the info button, the particular property will only be displayed in the reports for informational purposes. These properties will not be used when calculating a pay factor.

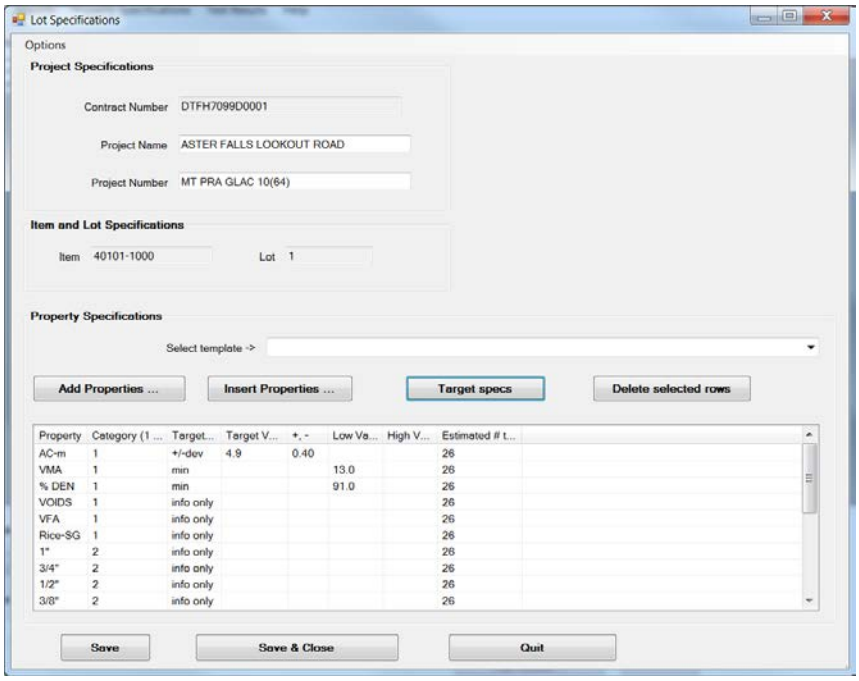


AC-m target specifications window completed.

Note: *Estimate the number of tests that will be taken throughout the project and enter in the appropriate field. This number can be changed at a later date if the number of tests increases or decreases. The final number of tests taken should be reflected under each property at the completion of the item.*

Note: *The reports will not include a pay factor or percent within limits (PWL) if the estimated number of tests for a particular item is not entered.*

d. After the target specifications are entered, click "OK" and proceed to adjusting the remainder of the properties. The completed specifications window is shown on the following page.



Target Specifications adjusted per contract requirements.

e. When finished entering all of the properties, click "Save and Close."

Note: *The specifications window has three options for leaving the window: "Save," "Save and Close," and "Quit." Each function has a separate outcome.*

Save: If the user selects "Save," the data that has been entered will be saved, but the specifications window will not close.

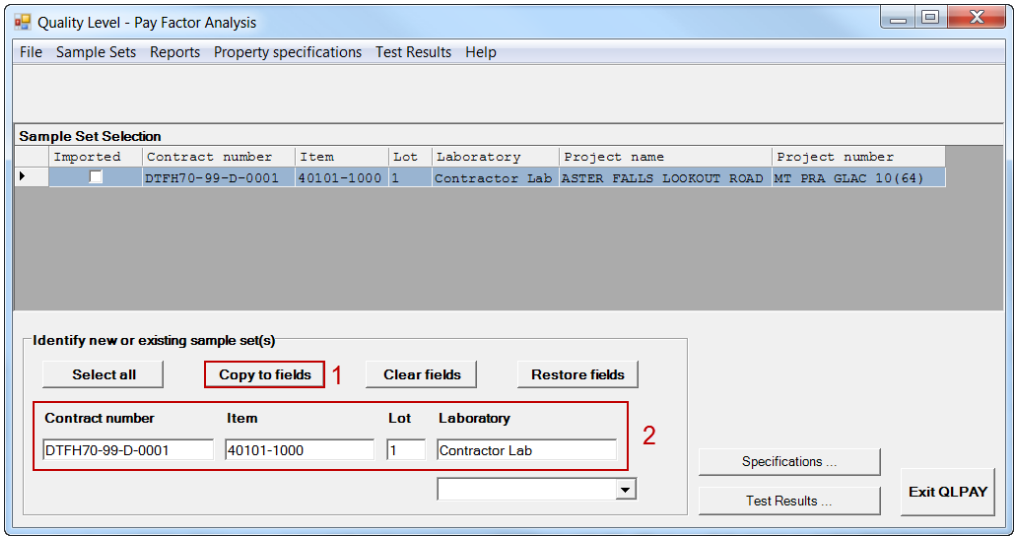
Save and Close: By selecting "Save and Close," the data that has been entered will be saved and the specifications window will close.

Quit: If the user presses "Quit," none of the changes made to the specifications will be saved and it will resort back to the data that was entered prior to opening the specification set and close the window.

3.3. Creating a Secondary Lab Sample Set in the same Lot

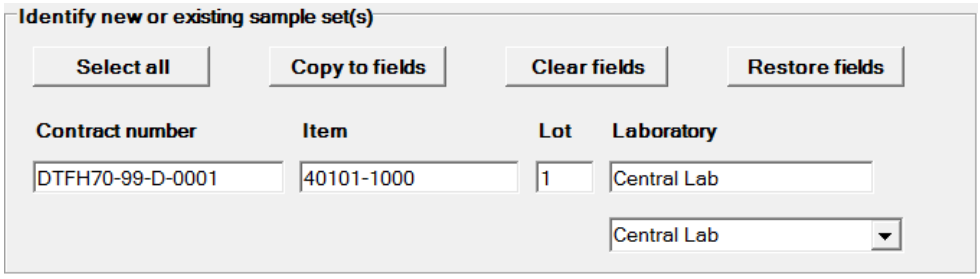
A. From the home screen of the QL-PAY program, press the “Clear Fields” button located in the “Identify New or Existing Sample Set(s)” box.

B. Highlight the sample set to create a secondary lab and select the “Copy to Fields” button. This will copy the project information to be used for the new sample set.



After selecting Copy to Fields, the sample set information is transferred.

C. In the “Laboratory” drop down menu, choose “Central Lab.”

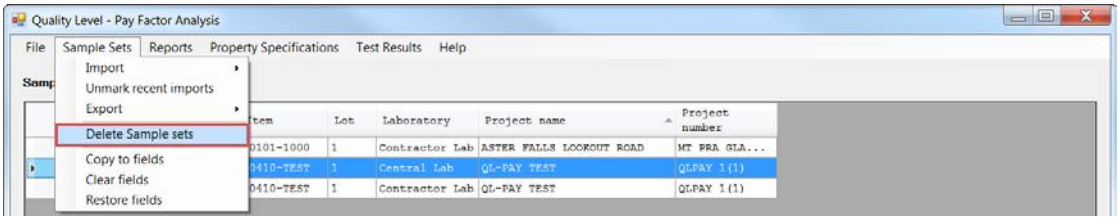


View after selecting copy to fields and the Central Lab.

D. Click on “Specifications.” The specifications should be identical to the original sample set. Select “Save and Close” once the property specifications have been reviewed for accuracy.

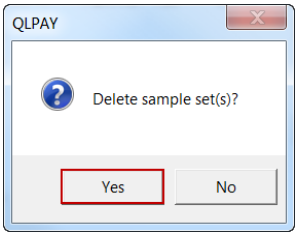
3.4. Deleting an Existing Sample Set

To delete a sample set, highlight the sample set to delete and click on the “Sample Sets” drop down menu.



Deleting an existing sample set.

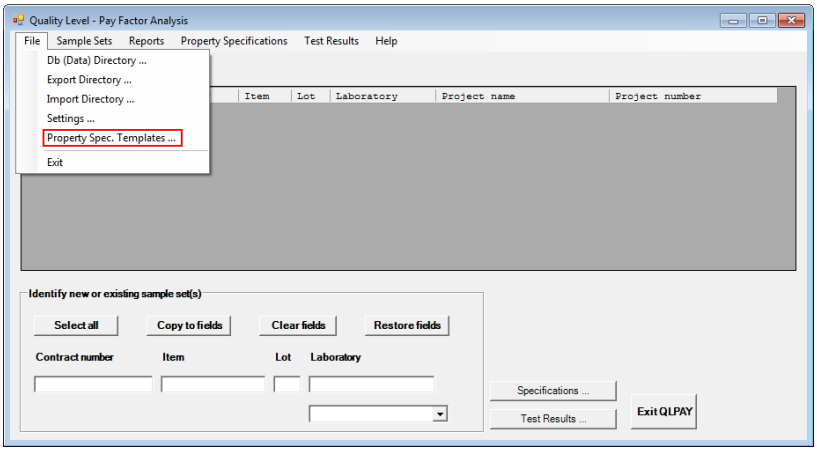
From there, select “Delete Sample sets” → “Yes.”



Deletion confirmation.

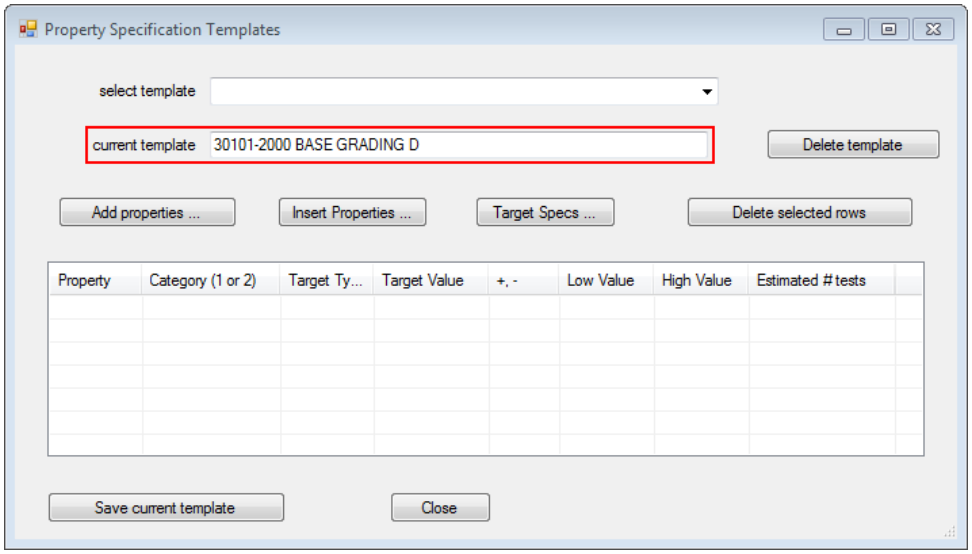
3.5. Creating a New Target Specification Template

A. Go to “File” → “Property Spec. Templates.”



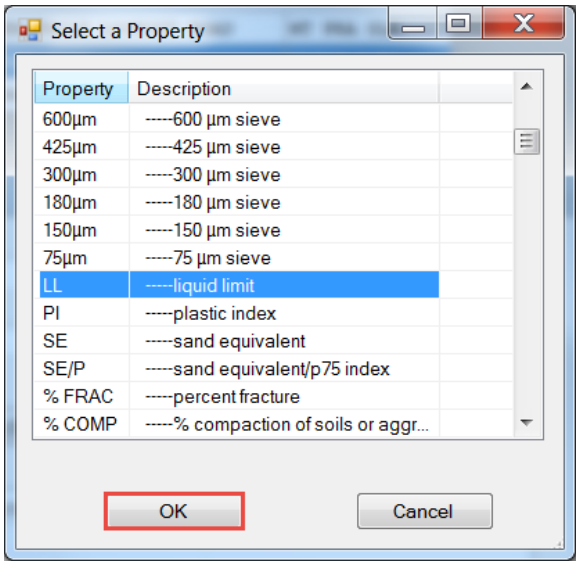
Selecting the property specification template function.

B. Under the “Current Template” field, type the title the new template will be named.



Creating a new template.

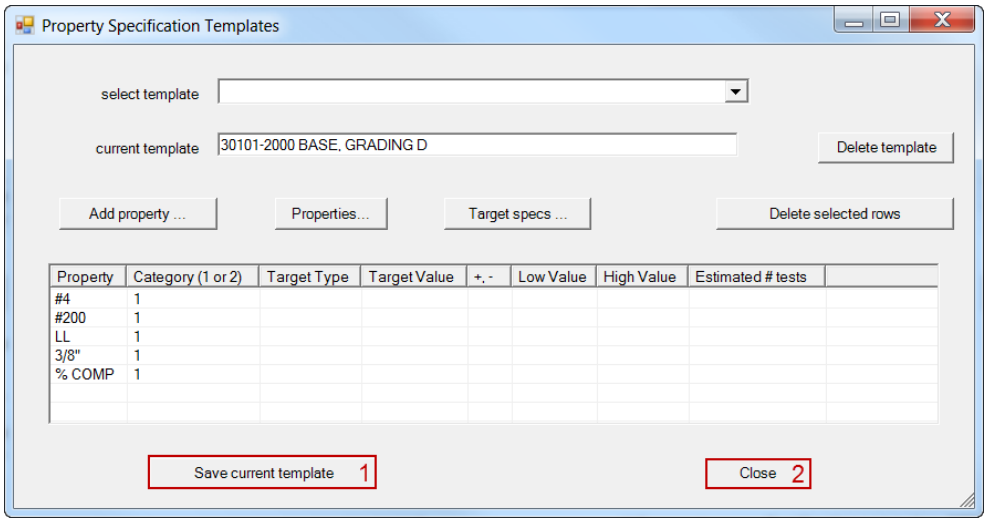
C. Select “Add Properties.” Highlight the properties to be included in the template and click “OK.”



Selecting a property.

D. To rearrange the order of the properties within the new template, drag and drop the property in the desired location.

E. When all properties and locations have been set in the template, select “Save Current Template” and then “Close.”



Steps to save and close the property specification template.

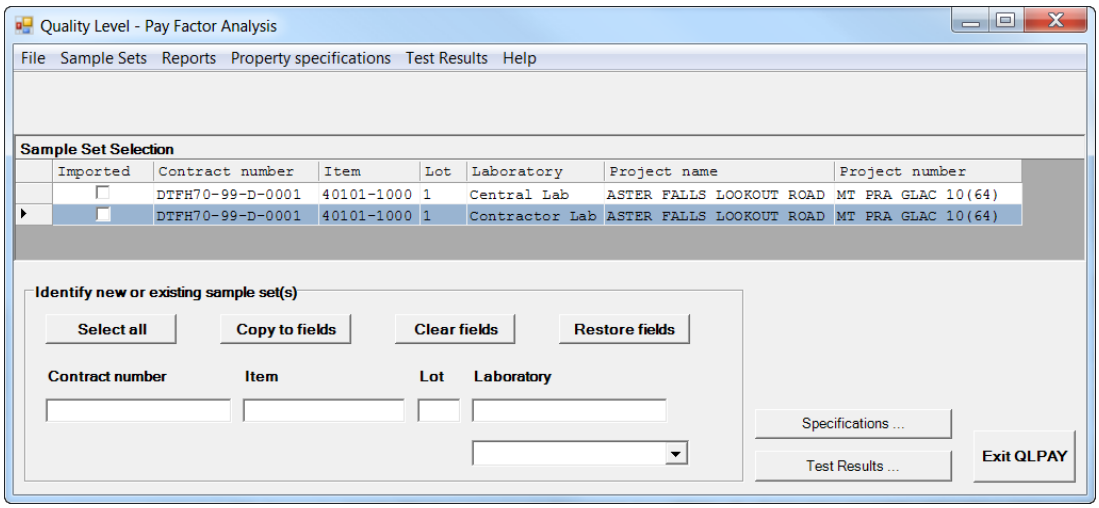
F. The template will now be available to select under the specifications window, when creating a new sample set.

G. This process can also be used to edit existing templates by selecting a template on the “Property Spec. Templates” page instead of creating a new one.

Note: *Templates that are created by the user are only stored on the user’s computer and will not transfer to another user.*

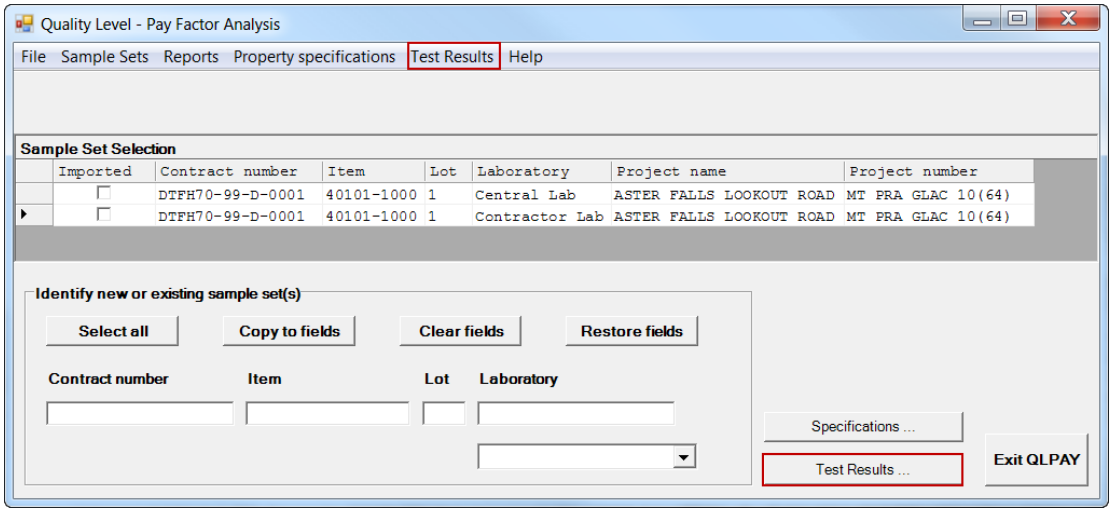
3.6. Inputting Test Results

A. Highlight the sample set that the user has test results for.



Highlighted sample set.

B. The test results can be accessed from two locations on the home screen. The user can either select the “Test Results” button at the lower right of the window or use the “Test Results” menu drop down.

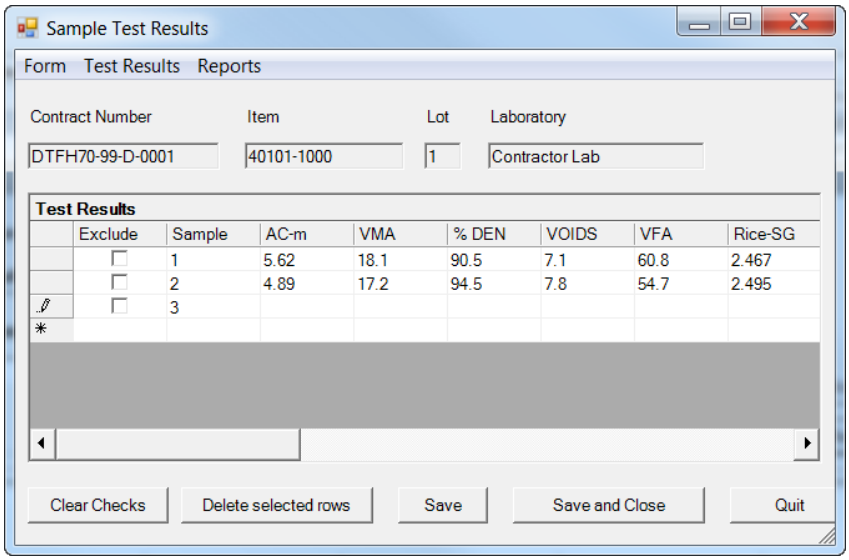


Options to access the test results screen.

C. Begin entering the test result data, starting with Sample #1. Make sure to include consecutive sample numbers when entering in the test result data, i.e. 1,2,3,4, etc. and do not skip lines.

Note: *Three test results are needed before a statistical analysis can be computed.*

a. When entering test results, review the testing requirements for the appropriate number of decimal places to record.



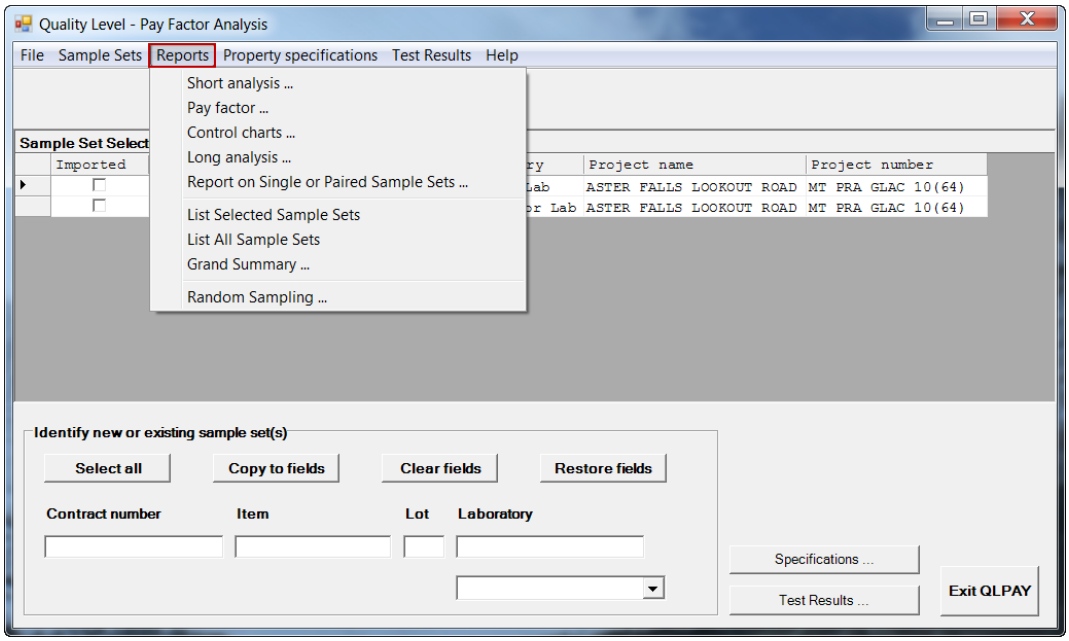
View of consecutive test results being entered.

b. Select the “Exclude” box, if there are test results for a sample number that the user does not want to include in the analysis.

Note: *When entering a verifying lab’s test results, make certain to enter the appropriate sample number which correlates to the contractor’s sample, i.e. 3 and 3. This will allow QL-PAY to compare corresponding sample splits throughout the analysis process.*

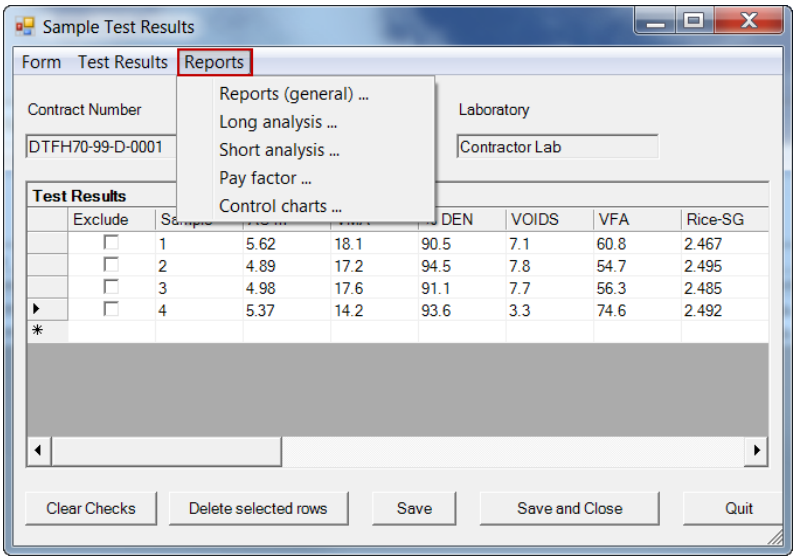
4. Reports

QL-PAY has the option to generate a combination of reports comparing the test results that have been entered for the project sample sets. The report selection can be accessed from two places within the program. From the home screen of QL-PAY, the reports can be obtained through the drop down menu under “Reports.”



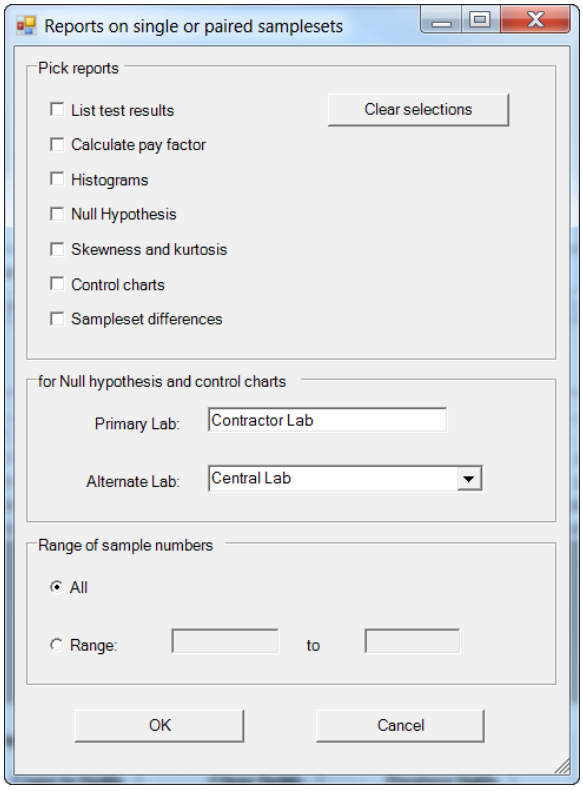
Selecting the reports menu from the home screen.

If the user is in the test results screen, the reports can be obtained by selecting the “Reports” drop down menu.



Selecting the reports menu from the test results screen.

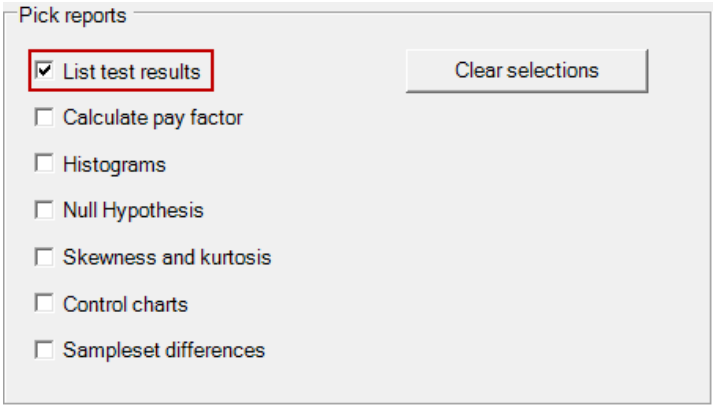
Once the reports function has been chosen, the following is the main screen that will be used to generate an array of reports covering the sample set data that has been selected.



Report selections.

4.1. List Test Results

By selecting “list test results” in a report, QL-PAY will format all of the test results entered within the sample set into a legible list.



Selection of list test results report.

This report allows the user to review the entered data for accuracy and any discrepancies. See below for a sample printout of the listed test results report.

SAMPLE SET LISTING

Project Name: ASTER FALLS LOOKOUT ROAD Item Number: 40101-1000
Project Number: MT PRA GLAC 10(64) Lot Number: 1
Project ID: DTFH7099D0001 Lab: Contractor Lab

** ACCEPTANCE PARAMETERS **

Quality Characteristic:	AC-m	VMA	% DEN	VOIDS	VFA	Rice-SG	1"	3/4"	1/2"
Target Type:	+/-dev	min	min	info	info	info	info	info	info
Target Value:	4.9	13.0	91.0						
Allowable Deviation:	0.40								
Est. No. Tests:	9	9	9	9	9	9	9	9	9
Category:	1	1	1	1	1	1	2	2	2
Actual No. Samples:	9	9	9	9	9	9	9	9	9

** TEST RESULTS **

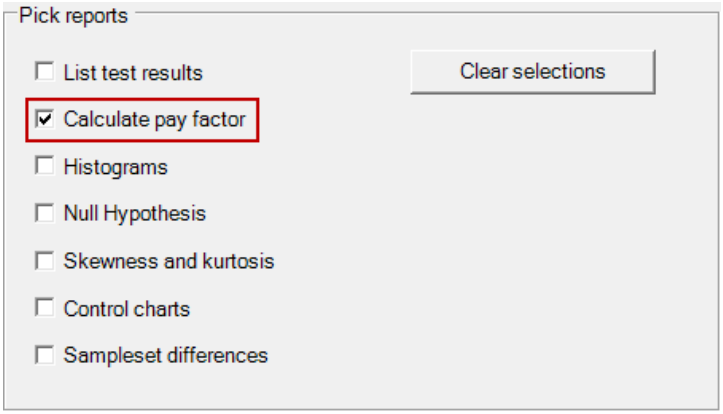
Sample Number	AC-m	VMA	% DEN	VOIDS	VFA	Rice-SG	1"	3/4"	1/2"
1	5.42	18.1	90.5	7.1	60.8	2.467	100	100	85.2
2	4.89	17.2	94.0	7.8	54.7	2.495	100	100	82.1
3	4.73	15.6	92.3	3.9	66.4	2.483	100	100	85.6
4	5.21	15.5	94.1	4.6	70.0	2.492	100	100	80.1
5	4.92	14.7	91.2	5.8	59.4	2.473	100	100	83.2
6	5.11	15.9	92.3	7.0	62.3	2.478	100	100	84.1
7	4.98	17.3	91.7	6.4	68.7	2.488	100	100	82.6
8	5.10	14.5	92.6	3.8	56.4	2.477	100	100	81.7
9	4.93	15.0	93.4	4.9	69.3	2.481	100	100	84.3

Listed test results from QL-PAY report.

Note: *An asterisk (*) will be displayed adjacent to the sample number for any test result that has been excluded from the analysis. The user must save the file prior to running the report for the exclusion not to be considered in the analysis.*

4.2. Calculate Pay Factor

The pay factor report will list the Percent Within Limits (PWL) and pay factor for each property that is being evaluated in the sample set.



Selection of calculate pay factor report.

Throughout the testing, the report will produce a projected final pay factor based on the current quality level and the estimated number of tests. A final pay factor will be reported when the number of inputted test results equals the estimated number of tests.

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: MT PRA GLAC 10(64)
Project ID: DTPH7099D0001

Item Number: 40101-1000
Lot Number: 1
Lab: Contractor Lab

Quality Levels and Pay Factors

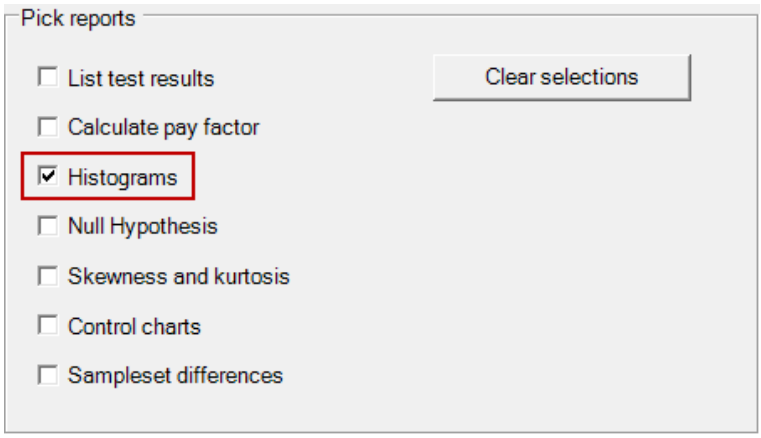
Quality Charac-teristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
AC-m	4.90	+,- 0.40	5.03	0.203	91	1.02
VMA	13.00	min	15.98	1.270	100	1.05
% DEN	91.00	min	92.46	1.226	88	1.00
VOIDS	info		5.70	1.469	---	---
VFA	info		63.11	5.738	---	---
Rice-SG	info		2.482	0.009	---	---
1"	info		100.00	0.000	---	---
3/4"	info		100.00	0.000	---	---
1/2"	info		83.21	1.775	---	---
3/8"	info		---	---	---	---
#4	info		---	---	---	---
#8	info		---	---	---	---
#16	info		---	---	---	---
#30	info		---	---	---	---
#50	info		---	---	---	---
#200	info		---	---	---	---

TESTING COMPLETED
FINAL PAY FACTOR: 1.00

Quality levels and pay factors QL-PAY report.

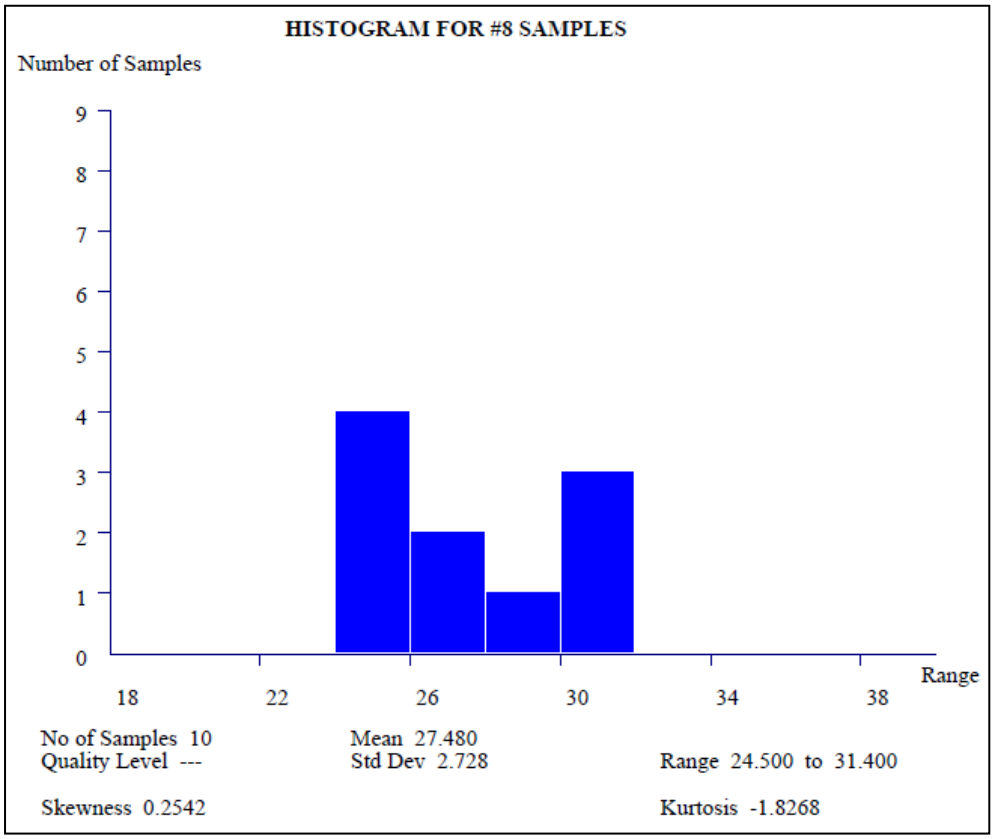
4.3. Histograms

A histogram shows where the data resides and how many results lie between specific values.



Selection of histogram report.

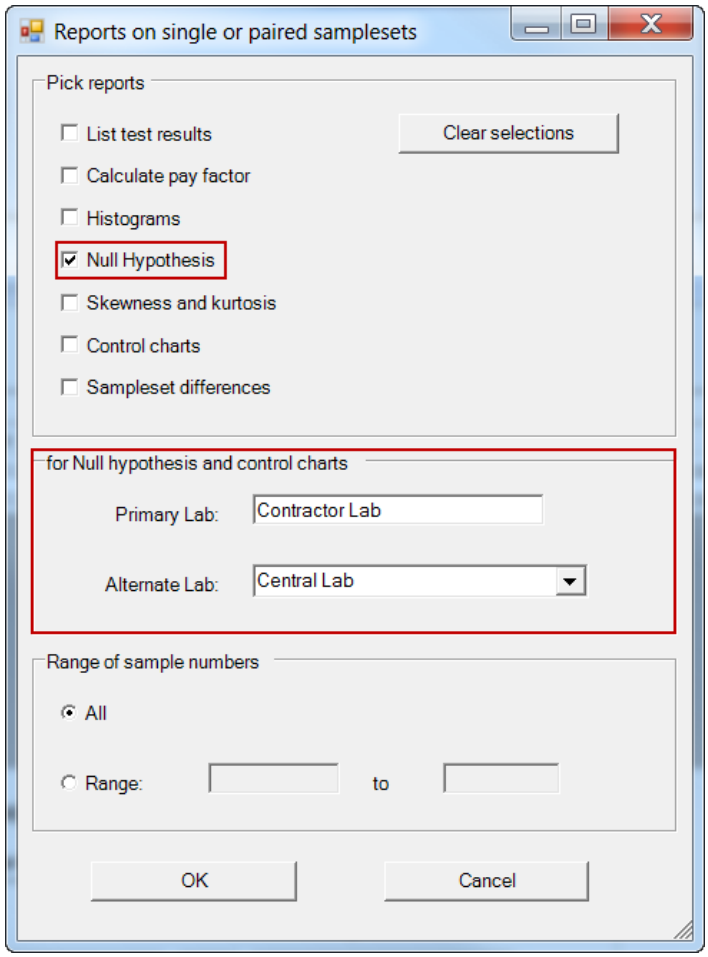
These charts allow for easier viewing of data in a graphical manner.



Plotted histogram for #8 sieve in the sample set.

4.4. Null Hypothesis

The null hypothesis can only be used when two labs are being compared.



Selection for generating the Null Hypothesis report.

When comparing the contractor lab to the central lab, the results should be similar but not identical. The null hypothesis is computed at a 0.01 significance level.

The null hypothesis generates two analyses: independent and paired. An independent analysis compares the contractor's test results that do not have corresponding government results with the results that have been recorded to date from the central lab. A paired analysis compares the corresponding contractor and government test results. The t statistic is used as a comparison of the mean values of the individual properties within the sample sets. The F statistic is used to analyze the variance of the data. Computed F and t values based on the inputted data are compared to critical F and t values that have been established using standard statistical methods.

Two key questions to ask when reviewing the null hypothesis report are:

1) Are the Means similar?
    a. This is answered using the t statistic.
2) Are the variances similar?
    a. This is answered using the F statistic.

NULL HYPOTHESIS TEST (0.01 SIGNIFICANCE LEVEL)

Contractor Lab vs. Central Lab

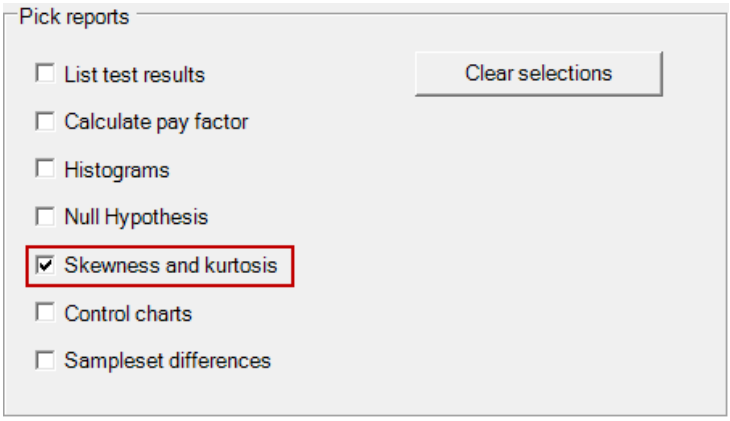
PAIRED T-STATISTIC

	Critical t-value	Computed t-value	
AC-m	3.355	1.120	Results within acceptable limits
VMA	3.355	0.800	Results within acceptable limits
% DEN	3.355	0.359	Results within acceptable limits
VOIDS	3.355	0.000	Results within acceptable limits
VFA	3.355	0.686	Results within acceptable limits
Rice-SG	3.355	0.229	Results within acceptable limits
1"	---	---	(Unable to calculate)
3/4"	---	---	(Unable to calculate)
1/2"	3.355	0.000	Results within acceptable limits
3/8"	3.355	0.359	Results within acceptable limits
#4	3.355	0.610	Results within acceptable limits
#8	3.355	0.512	Results within acceptable limits
#16	3.355	1.000	Results within acceptable limits
#30	3.355	2.000	Results within acceptable limits
#50	3.355	0.147	Results within acceptable limits
#200	3.355	1.955	Results within acceptable limits

Null hypothesis report from QL-PAY.

4.5. Skewness and Kurtosis

Skewness and Kurtosis are parameters used to determine if the data is normally distributed.



Selection of Skewness and Kurtosis report.

The following is an example of how a skewness and kurtosis report would appear in QL-PAY.

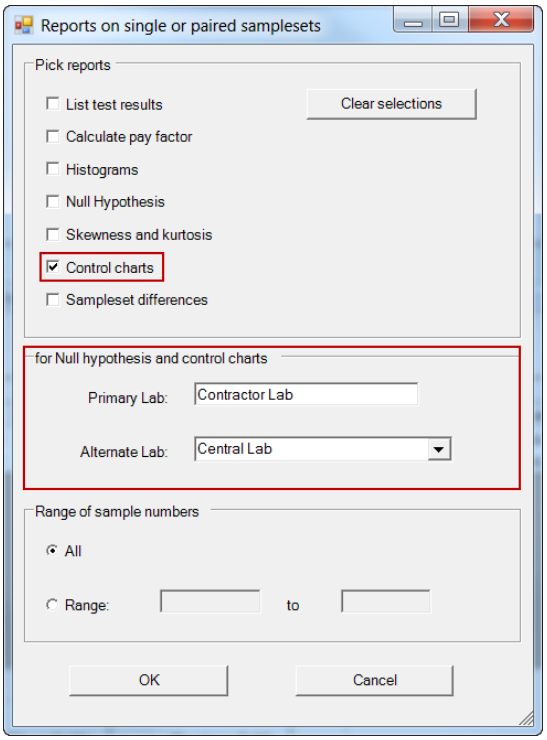
Skewness and Kurtosis Statistics

Quality Charac-teristic	Skewness	Kurtosis
AC-m	0.6064	0.5768
VMA	0.5720	-1.0671
% DEN	0.1454	-1.2004
VOIDS	0.0006	-1.5912
VFA	-0.1593	-1.5898
Rice-SG	-0.0021	-0.6570
1"		
3/4"		
1/2"	-0.3353	-0.5033
3/8"	-0.3703	-1.2872
#4	-0.3393	-1.3181
#8	-1.1107	2.2004
#16	-0.8745	1.7391
#30	0.5002	1.0148
#50	0.1231	-1.2780
#200	0.9807	0.3766

Skewness and kurtosis report from QL-PAY.

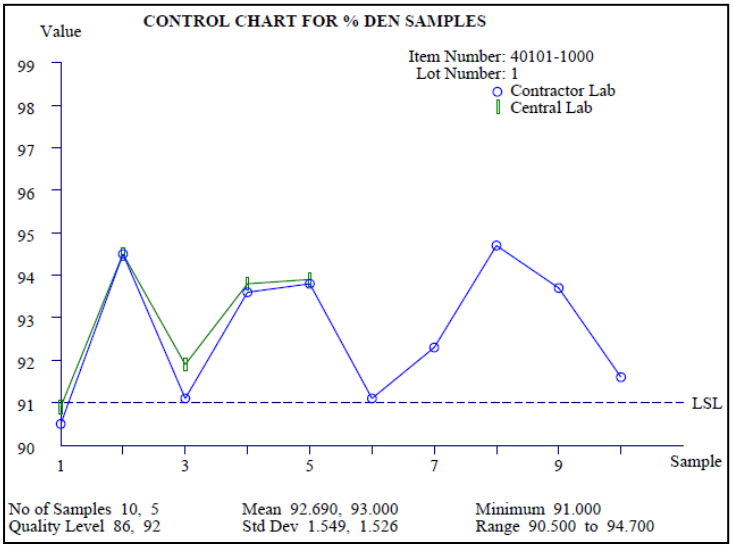
4.6. Control Charts

The set of control charts produced by QL-PAY depicts the data in relation to the specification limits. If an alternate lab has been selected, both sets of data will be plotted.



Selection for generating a control chart report.

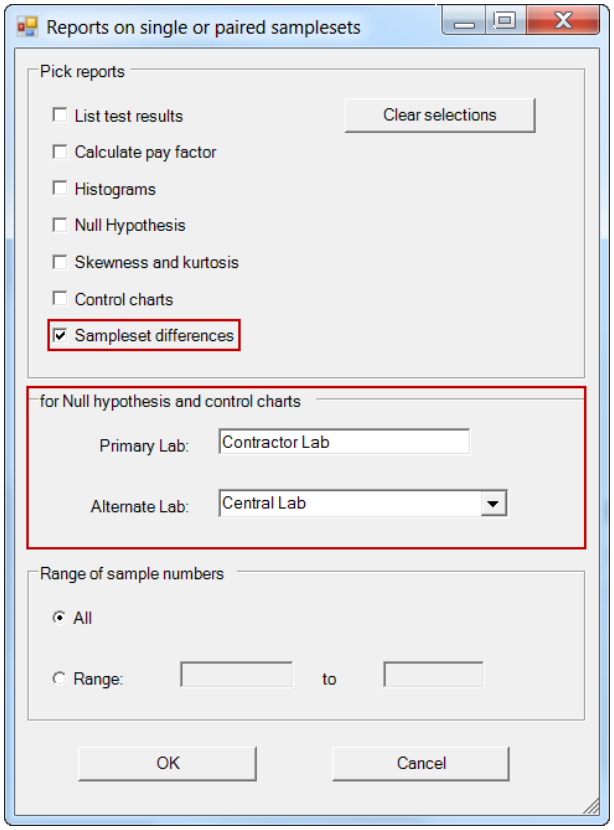
These charts are beneficial in evaluating the consistency between the two labs and can assist in evaluating the data if a bias exists. These charts are also valuable to use as production charts to help in visually assessing the consistency of the specific product or process.



Control chart from a QL-PAY report.

4.7. Sample Set Differences

The sample set differences report shows the actual difference between the contractor and the central lab value on a sample by sample basis. The report will show differences for only those samples where a contractor and a central lab value exist. This report can only be used if a primary and an alternate lab are selected.



Selection showing the sample set differences report.

The +/- shows the numerical representation of the data viewed in the control charts if the two labs are selected. A sample of the printout for the sample set differences report is shown on the next page.

SAMPLE SET DIFFERENCES

** ACCEPTANCE PARAMETERS **

Quality Characteristic:	AC-m	VMA	% DEN
Target Type:	+/-dev	min	min
Target Value:	5.2	13.0	91.0
Allowable Deviation:	0.40		
Est. No. Tests:	10	10	10
Category:	1	1	1
Actual No. Samples:	10, 3	10, 3	10, 5

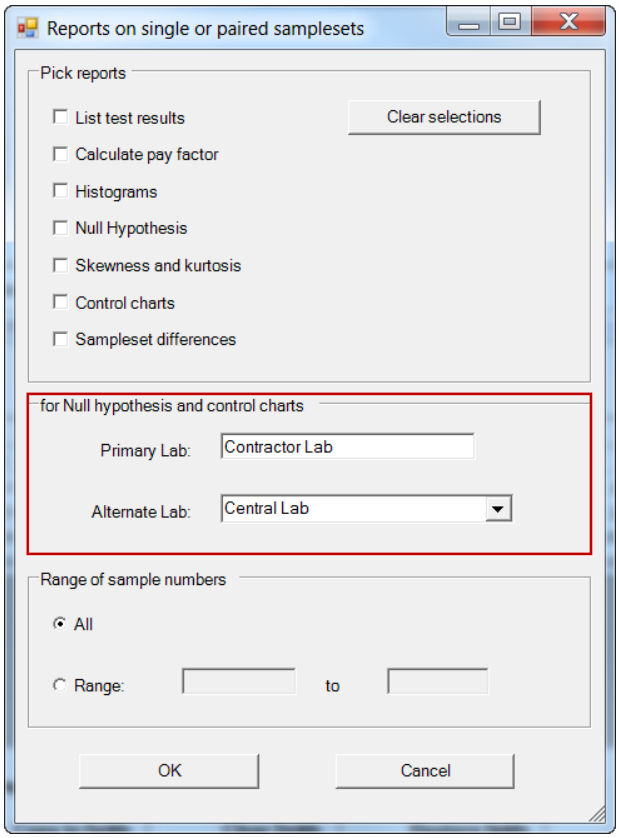
** TEST RESULTS **

Sample Number	AC-m			DIFF	VMA			DIFF	% DEN		DIFF
1	5.62	-	5.25	+ 0.370	18.1	-	15.4	+ 2.700	90.5	- 90.9	- 0.400
2	4.89	-	4.58	+ 0.310	17.2	-	15.3	+ 1.900	94.5	- 94.5	0.000
3	4.98	-	5.02	- 0.040	17.6	-	15.9	+ 1.700	91.1	- 91.9	- 0.800
4	5.37	-			14.2	-			93.6	- 93.8	- 0.200
5	5.15	-			14.3	-			93.8	- 93.9	- 0.100
6	5.18	-			13.5	-			91.1	-	
7	4.65	-			13.0	-			92.3	-	
8	4.55	-			13.1	-			94.7	-	
9	4.63	-			12.9	-			93.7	-	
10	4.66	-			15.4	-			91.6	-	

Report showing the sample set differences.

4.8. Primary and Alternate Lab Selection

QL-PAY allows for the test results from the contractor's lab to be compared with the results from an alternate lab. An alternate lab selection is mandatory if the "null hypothesis" or "sampleset differences" report options are selected.

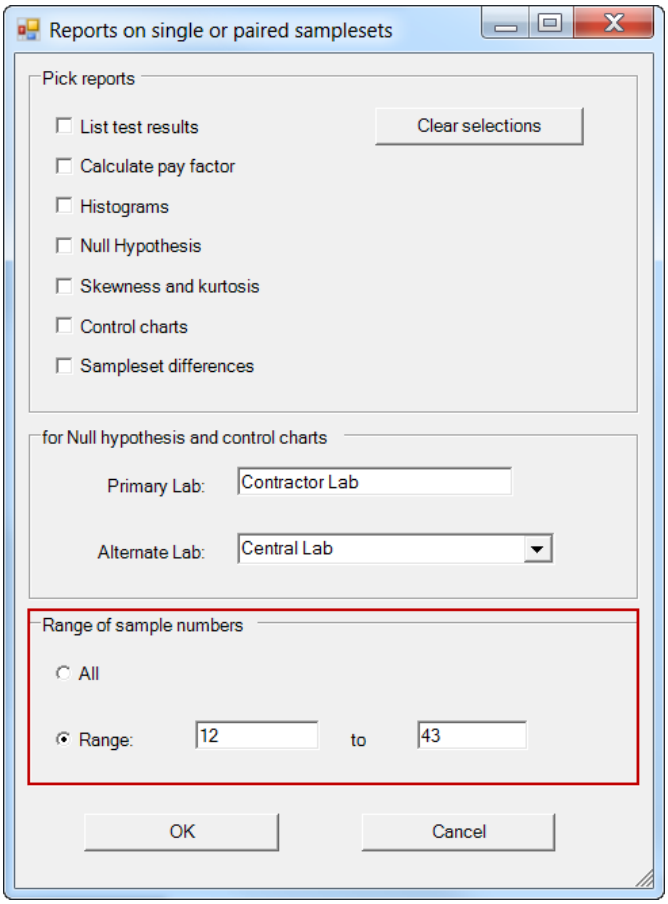


Report specifications for lab comparison.

The primary lab will be affiliated with the sample set selected prior to selecting the reports function. Most times, the primary lab will be established as the contractor lab and the alternate lab will be the central lab for comparison purposes.

4.9. Range of Sample Numbers

When using any of the report functions, the user can choose to use the entire set of test results in the sample set or select a range of data values to include in the analysis. The report selection page is automatically set to include all of the test results. If the user wants to generate a report including a range of test results, the "Range" button must be selected and the appropriate range entered in the fields.



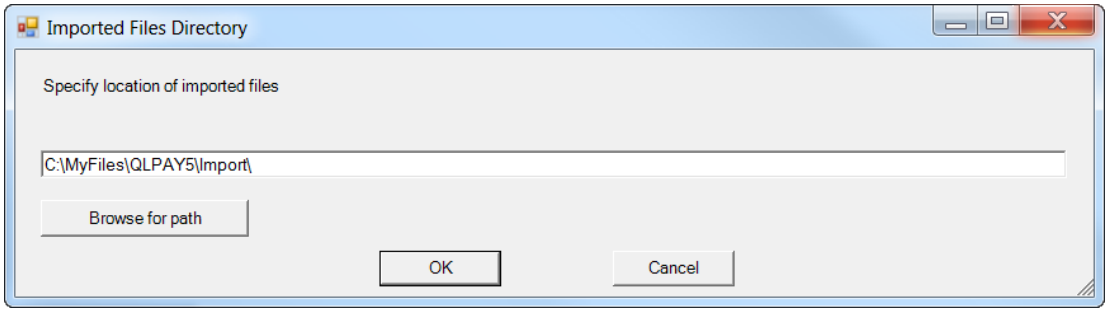
Specifying a range of sample numbers.

5. Importing/Exporting

When importing or exporting data files from QL-PAY, each file has a specific number sequence associated with the day it was created. The file name format is qlpf+YY+mm+dd+nnn.xml. For example, the file below would look like qlpf+12+01+26+001.xml; therefore, it was the first file created on January 26, 2012.

5.1. Import

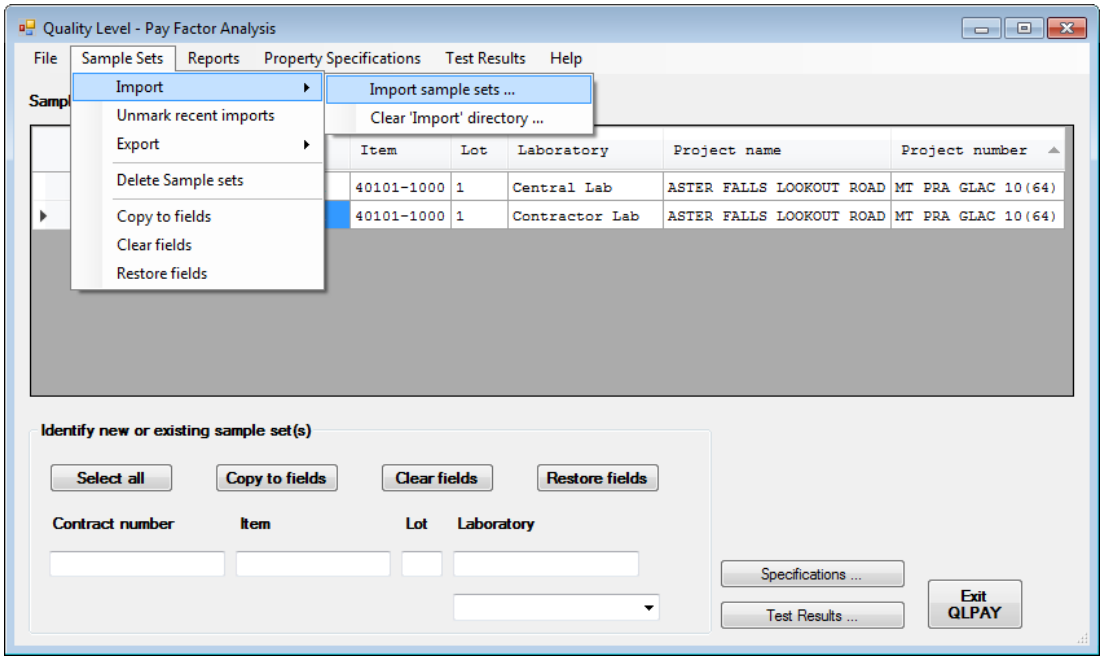
A. Find the location the imported files are being pulled from by looking in the "Imported Files Directory."



Imported files directory.

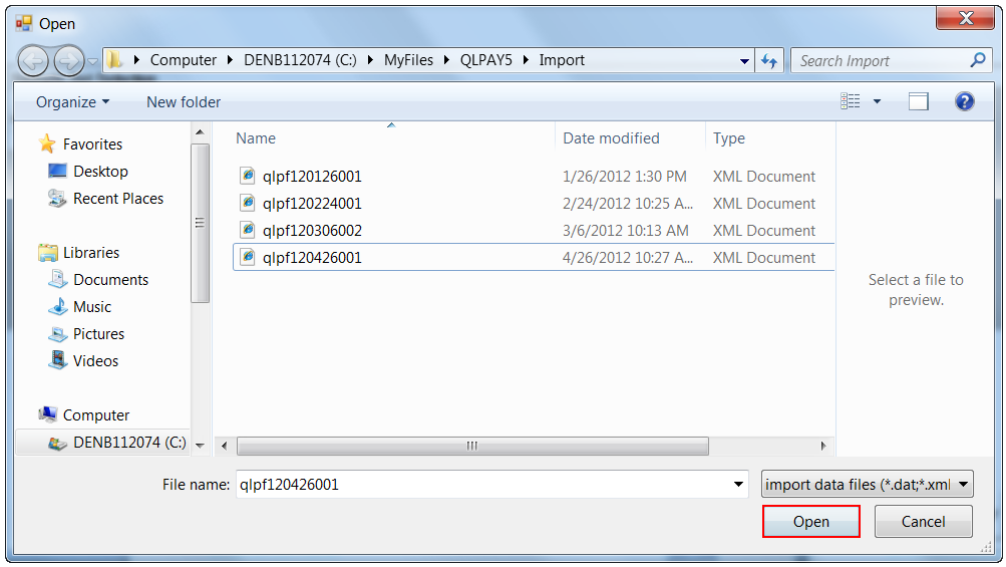
B. Save the file to be imported in the above file directory.

C. Go to "Sample Sets" → "Import" → "Import Sample Sets." A window will open showing the files available to be imported.



Importing a sample set.

D. Select the file(s) to be imported and select "Open." A screen shot is shown on the following page.

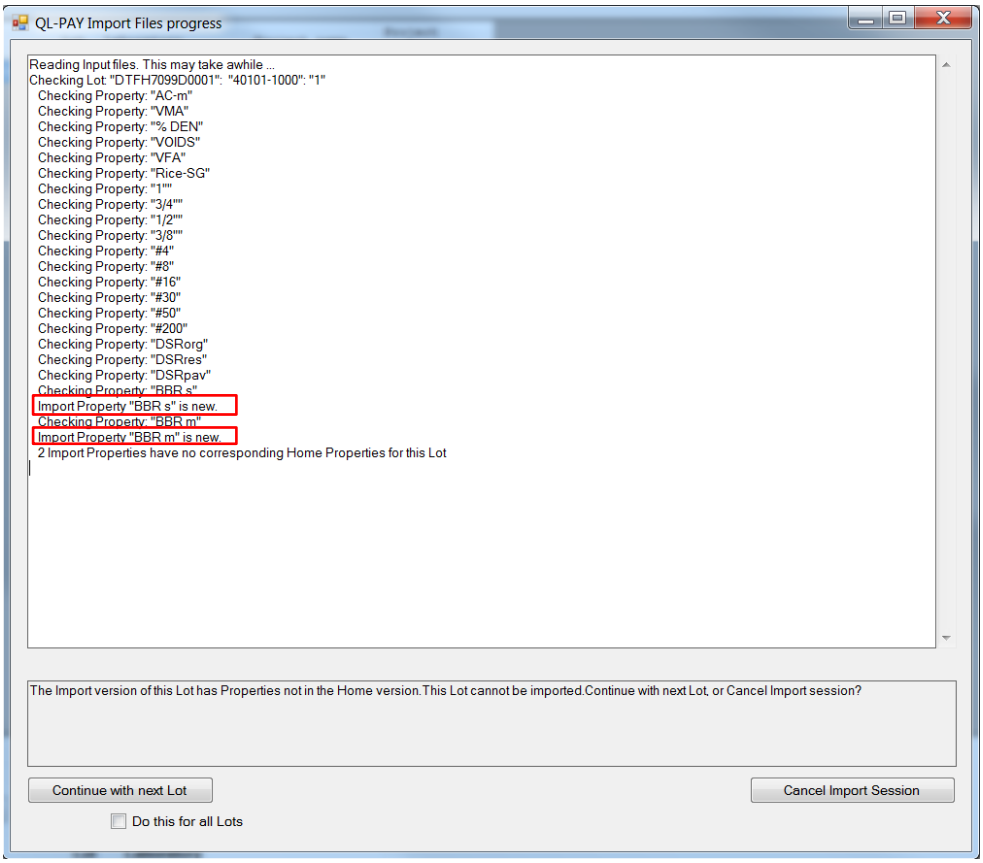


Selecting files to import from the file directory.

E. QL-PAY will analyze the existing and new lot(s) to be imported. This import process can be time consuming.

   a. Existing Lots: A lot that has different test results than the existing lot in the user's database. When importing an existing lot, the test results in the file being imported will overwrite the results already in the QL-PAY database. QL-Pay will not warn the user prior to overwriting the results.

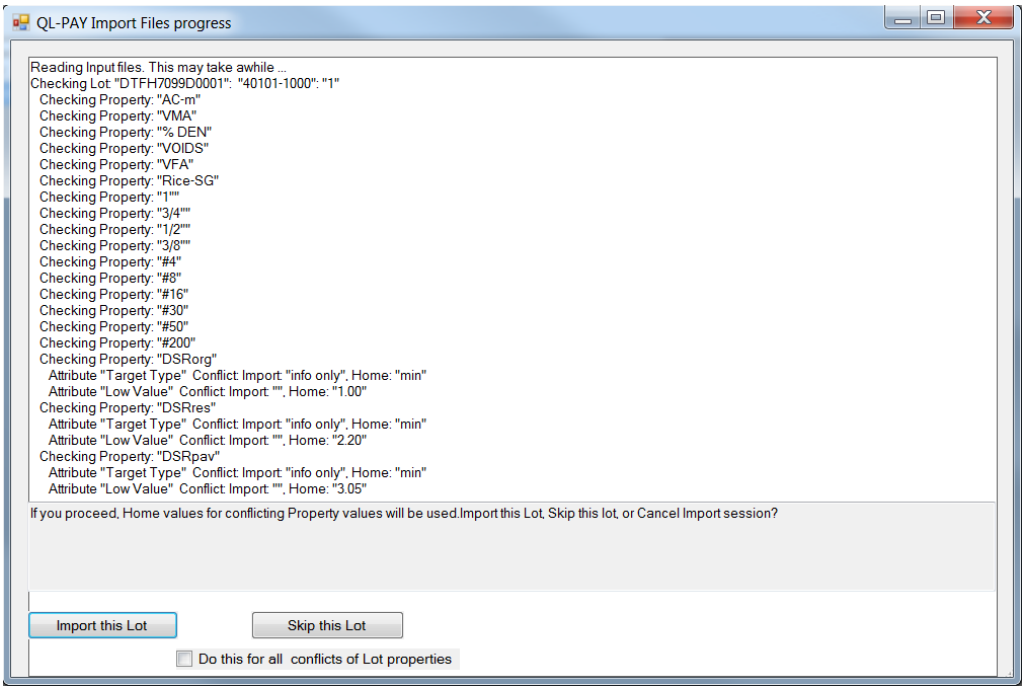
      If the properties of existing lots do not match the lots to be imported, QL-PAY will notify the user during the import process. A new version of a lot with more properties than the home lot cannot be imported. The home lot is the lot that exists in the user's QL-PAY database at the time of importing. A screen shot of the user notification in the import window is shown on the following page.



User notification of import lot with properties not in home lot.

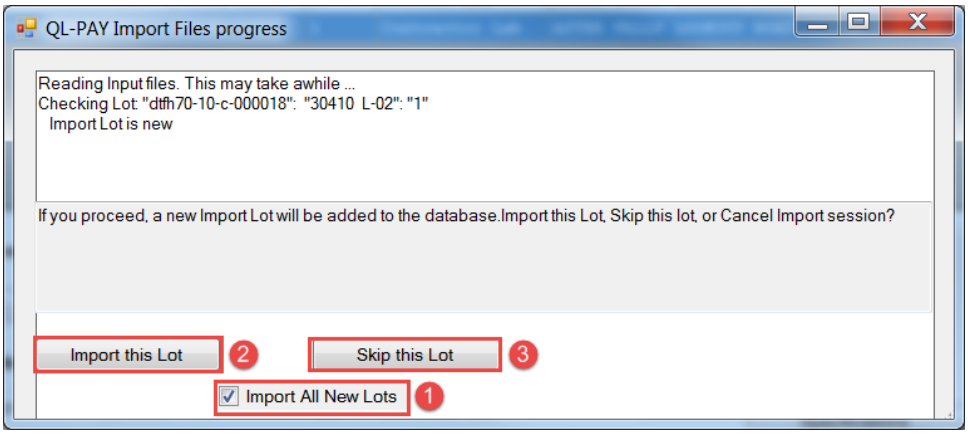
In this case, the user will need to cancel the import session and either add the properties boxed in red to the home lot, or delete the entire home lot and then import the new version of the lot again.

The user will also be notified when property specifications do not match between the home lot and the new version of the lot to be imported. QL PAY will use home values for the conflicting property specifications if the lot is imported. See the screen shot on the following page.



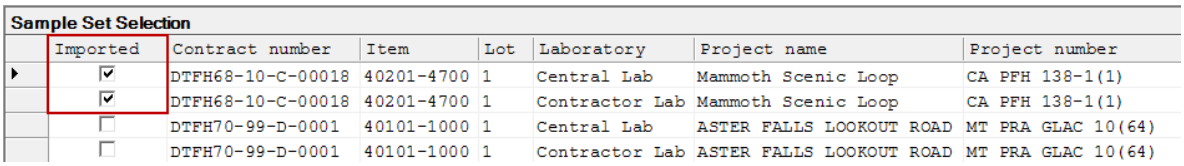
User notification of import version with property specification conflicts.

b. New Lots: A lot that does not already exist in the user's database. QL-PAY will prompt the user to Import or Skip each new lot in the file. If all new lots need to be imported, check the "Import All New Lots" (box 1 below). If the user does not want to import a specific lot, select "Skip this Lot" (box 3 below).



Importing lot selection window.

F. The sample sets will have been brought into the QL-PAY viewing window and will be seen with a check-mark in the imported column.

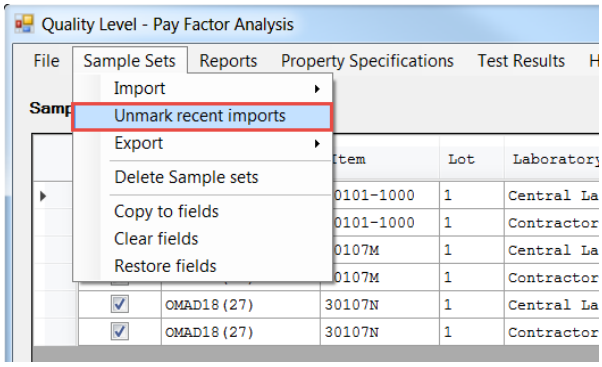


Sample Set Selection

Imported	Contract number	Item	Lot	Laboratory	Project name	Project number
☑	DTFH68-10-C-00018	40201-4700	1	Central Lab	Mammoth Scenic Loop	CA PFH 138-1(1)
☑	DTFH68-10-C-00018	40201-4700	1	Contractor Lab	Mammoth Scenic Loop	CA PFH 138-1(1)
☐	DTFH70-99-D-0001	40101-1000	1	Central Lab	ASTER FALLS LOOKOUT ROAD	MT PRA GLAC 10(64)
☐	DTFH70-99-D-0001	40101-1000	1	Contractor Lab	ASTER FALLS LOOKOUT ROAD	MT PRA GLAC 10(64)

Recently imported sample sets showing the imported check-marks.

When the user ends the current session in the program, the imported files will no longer be check-marked. To remove the check-marks prior to ending the session, go to "Sample Sets" → "Unmark recent imports."



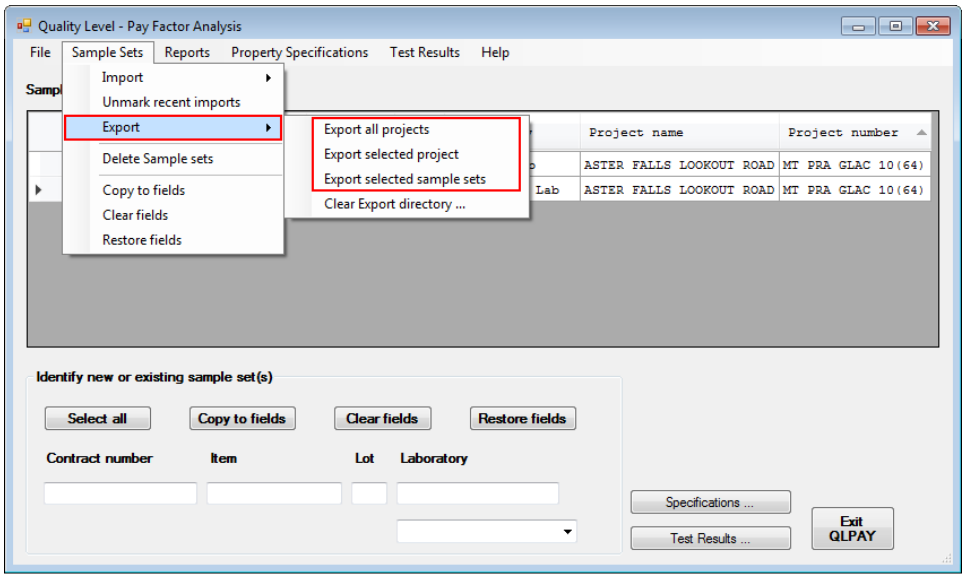
Selection for unmarking recent imports.

5.2. Export

Sample sets can be exported from QL-PAY in three separate ways: by the selected project, all projects, or selected sample sets.

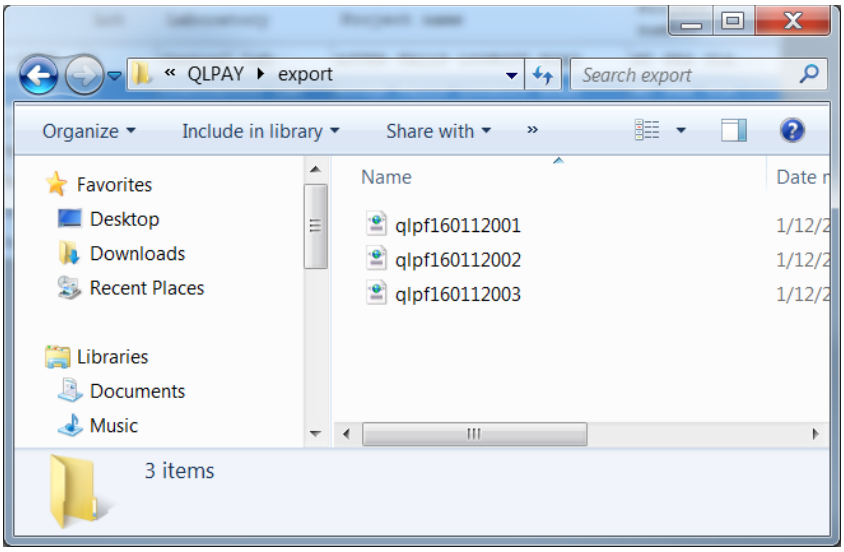
a. Selected Project: This will export all sample sets associated with the project that is currently highlighted.
b. All Projects: This option will export all projects in the QL-PAY database.
c. Selected Sample Sets: This will only export the individual sample set(s) the user has selected.

A. Select the appropriate exporting function needed by going to "Sample Sets" → "Export" → "Export _____." A screen shot of the export menu is shown on the following page.



Exporting sample set functions.

B. The data set(s) will be saved in a single file and sent to the export directory. This file can now be stored on the computer or sent electronically to be used by others.



Exported file directory.

Note: *Even if multiple sample sets are exported at one time, there will only be one file created. Files will accumulate in the export directory until removed by the user.*

6. Random Sampling

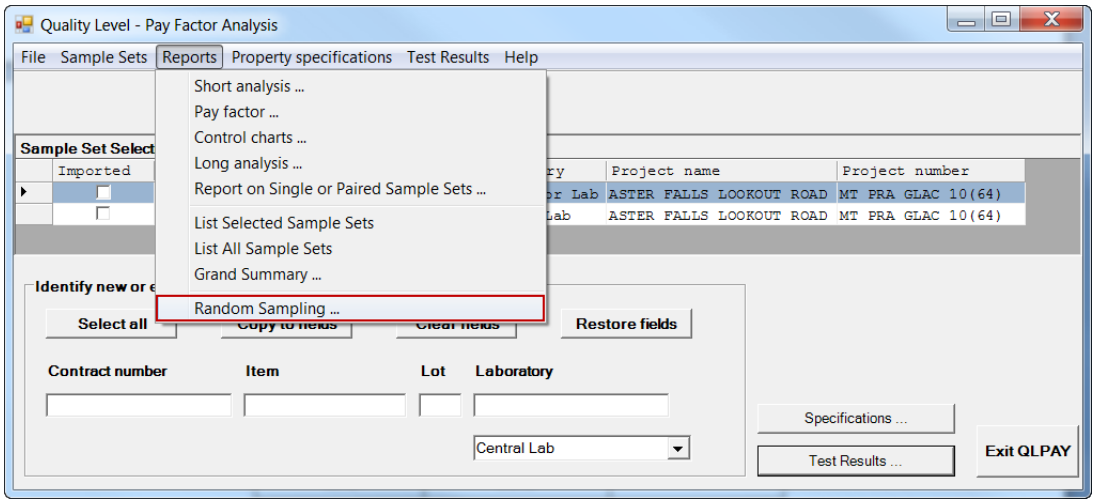
The random sampling function of QL-PAY is used to generate random numbers by quantity and stationing for use on the project. The contract requires certain items to be sampled at a specific frequency, thus calling for random sample numbers to be generated. QL-PAY is set up with stratified random sampling. This results in the random numbers being distributed throughout the entire sample section rather than constrained to a small portion of the sample area.

6.1. Generating Random Number Reports

6.1.1. By Quantity

A. Select the "Sample Set" the user wants to generate a "Random Number Report" for.

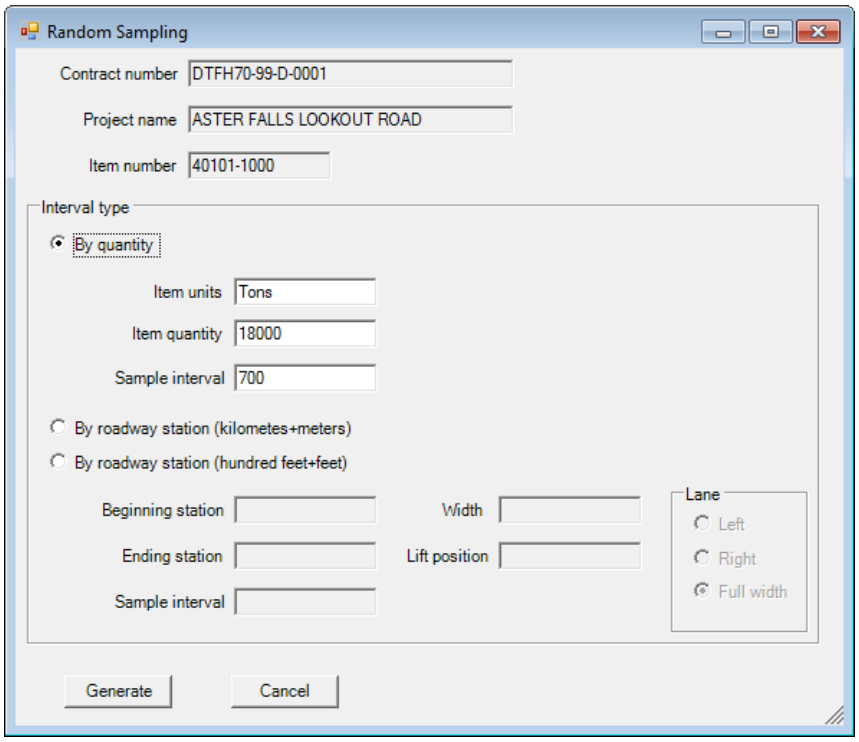
B. Open the Random Sampling function by selecting "Reports" and then "Random Sampling."



Process to open the random sampling function.

C. Select the Interval Type as "By Quantity."

D. Enter the appropriate data from the contract documents into the open fields. For this example, the contract calls for 18,000 tons of 401 Asphalt Concrete Pavement, Gyratory mix with a sampling frequency of 1 per 700 tons, thus 26 random numbers would be needed. The random sampling window is shown on the following page.



View of random sampling data entry.

E. Select "Generate." A PDF report will appear with the generated random numbers. An example report is shown below.

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: DTFH7099D0001
Sample Interval: 700

Item Number: 40101-1000
Item Units: Tons
Item Quantity: 18000

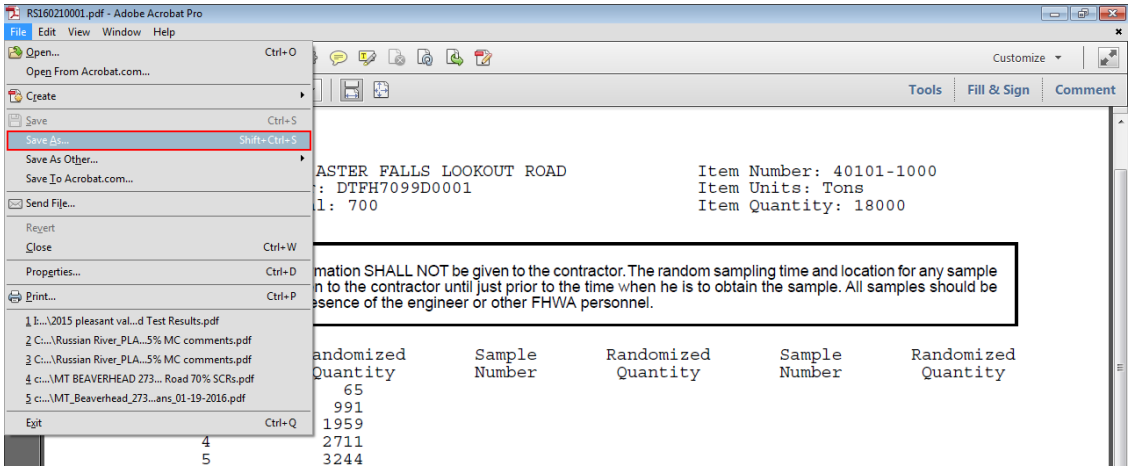
Copies of this information SHALL NOT be given to the contractor. The random sampling time and location for any sample should not be given to the contractor until just prior to the time when he is to obtain the sample. All samples should be obtained in the presence of the engineer or other FHWA personnel.

Sample Number	Randomized Quantity	Sample Number	Randomized Quantity	Sample Number	Randomized Quantity
1	65				
2	991				
3	1959				
4	2711				
5	3244				
6	4162				
7	4271				
8	5084				
9	6081				
10	6848				
11	7415				
12	8239				

Generated random number report.

Note: *QL-Pay may generate reports not totaling the number of tests needed per the specifications. If this happens, adjustments may need to be made to the sample interval to generate the appropriate number of samples.*

F. The report can be saved by using the “save as” function in the generated PDF file.

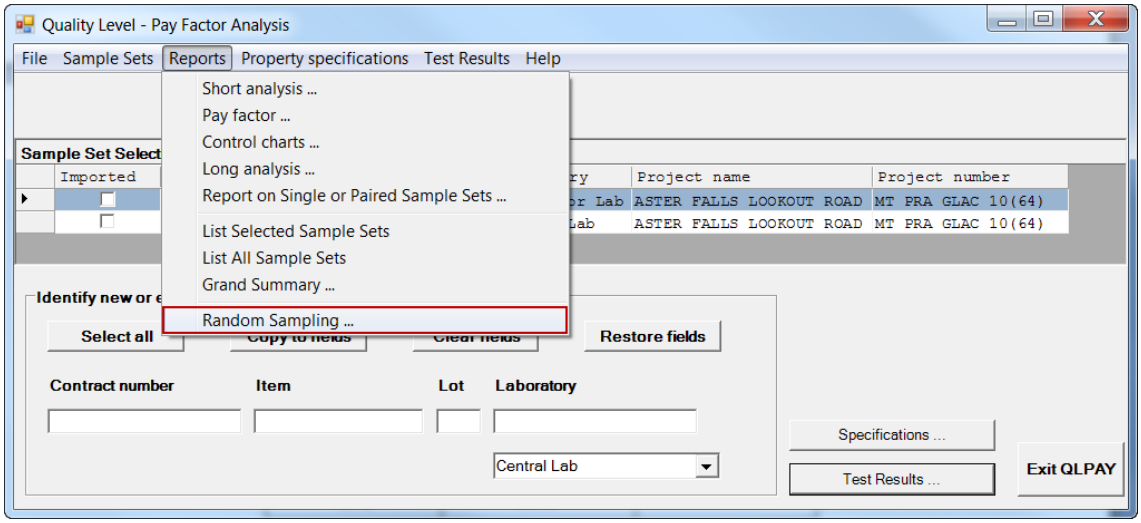


Menu functions in Adobe Acrobat to save the random number report.

6.1.2. By Roadway Station

A. Select the “Sample Set” the user wants to generate a “Random Number Report” for.

B. Open the Random Sampling function by selecting “Reports” and then “Random Sampling.”



Process to open the random sampling function.

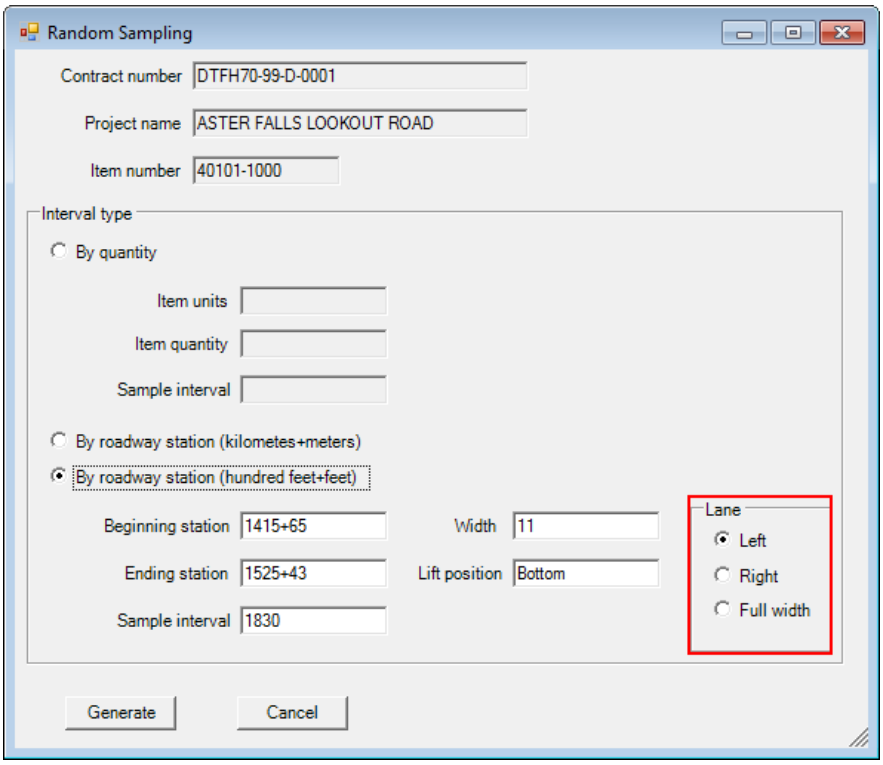
C. Select the Interval Type as “By Roadway Station” using the appropriate project units.

D. Enter the appropriate data from the contract documents. For this example, the contract calls for 18,000 tons of 401 Asphalt Concrete Pavement, Gyratory mix with a sampling frequency of 1 per 700 tons, thus 26 random numbers will be needed.

   a. Generally, projects will be paved in two lanes and two lifts. To ensure that samples are taken from each lane and lift, there will be four reports

generated with an equally distributed combination of bottom/top and left/right.

The random sample data entry window for roadway stationing is shown on the next page.



Random sampling data entry for roadway station.

Note: *When entering the data in the fields, make sure to specify which lane the random numbers are generated for.*

E. Select "Generate." A PDF report will appear with the generated random numbers.

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: DTFH7099D0001
Sample Interval: 1830
Beginning Station: 1415+65
Ending Station: 1525+43

Item Number: 40101-1000
Item Units: feet
Lane: Left
Width: 11
Lift Position: Bottom

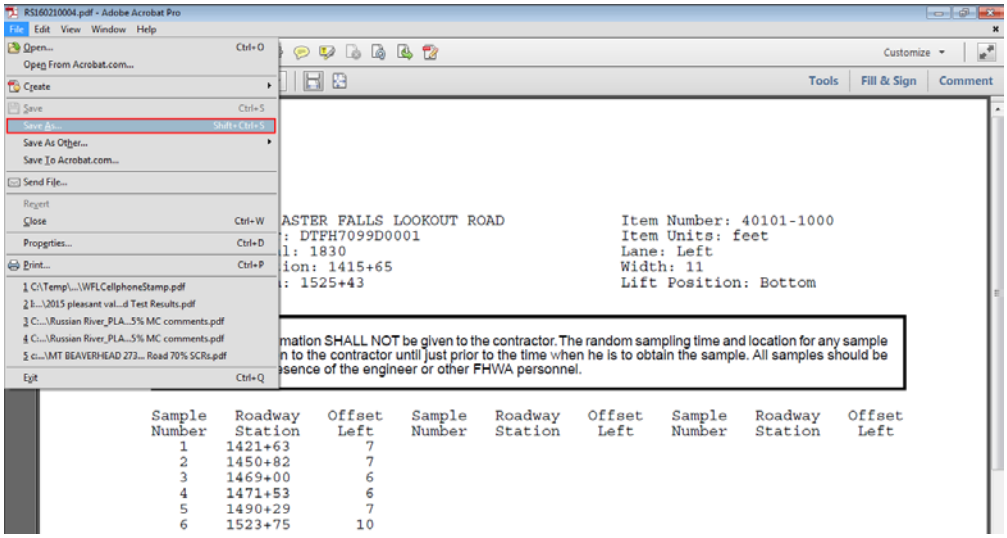
Copies of this information SHALL NOT be given to the contractor. The random sampling time and location for any sample should not be given to the contractor until just prior to the time when he is to obtain the sample. All samples should be obtained in the presence of the engineer or other FHWA personnel.

Sample Number	Roadway Station	Offset Left	Sample Number	Roadway Station	Offset Left	Sample Number	Roadway Station	Offset Left
1	1421+63	7						
2	1450+82	7						
3	1469+00	6						
4	1471+53	6						
5	1490+29	7						

Generated random number report.

Note: *QL-Pay may generate reports not totaling the number of tests needed per the specifications. If this happens, adjustments may need to be made to the sample interval to generate the appropriate number of samples.*

F. The report can be saved by using the "save as" function in the generated PDF file.



Menu functions in Adobe Acrobat to save the random number report.

7. Examples

This section will take the user through five different examples:

The contract pages used for the QL-PAY setup examples are not specific to any project and should only be used for the following examples.

7.1. Section 301 Aggregate Courses Example

7.1. Section 301 Aggregate Courses Example

This example will go through the process of setting up the sample set for 301 Aggregate Base Grading D.

TASK ORDER AWARD	Contract No. DTFH70-99-D-0001
_____ Solicitation No. DTFH70-08-R-00021	River Contractors, Inc. P.O. Box 223 West Glacier, MT 59936
MT PRA GLAC 10(64) ASTER FALLS LOOKOUT ROAD	AWARD DATE: March 10, 2015

Pay Item No.	Item	Quantity	Unit	Unit Price	Amount
30101-2000	Aggregate Base Grading D	10,000	TON	$30.00	$300,000.00

Example Section 301. — UNTREATED AGGREGATE COURSES

Material

301.02 Conform to the following Subsections:

Subbase, base, and surface course aggregate	703.05
Water	725.01(c)

301.08 Acceptance. See Example Table 301-1 for sampling, testing, and acceptance requirements; including the category for quality characteristics.

Aggregate gradation and surface course plasticity index will be evaluated under Subsection 106.05. Other aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

(a) Aggregate gradation. The upper and lower specification limits are equal to the calculated mean of all test results plus or minus the allowable deviations shown in Example Table 703-2 and Example Table 703-3, except as follows:

(1) If the calculated mean value for a tested sieve exceeds the maximum gradation value shown in Example Table 703-2 or 703-3, the upper specification is equal to the maximum gradation value plus the allowable deviation, and the lower specification is equal to the maximum gradation value minus the allowable deviation.

(2) If the calculated mean value for a tested sieve is less than the minimum gradation value shown in Example Table 703-2 or 703-3, the upper specification is equal to the minimum gradation value plus the allowable deviation and the lower specification is equal to the minimum gradation value minus the allowable deviation.

Example Table 301-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Base course grading C, D, & E	Statistical (106.05)	Gradation 3/8 Inch (9.5 mm) No. 4 (4.75 mm) No. 200 (75 µm) Other specified sieves	I I I II	AASHTO T 27 & T 11	1 per 1000 tons (900 metric tons)	From windrow or roadbed after processing	Yes	4 hours	-
Subbase & base course Grading A, B, C, D, & E	Measured and tested for conformance (106.04)	Liquid limit Moisture-density (max density) Density Moisture content (in-place)	- - - -	AASHTO R 58 & T 89, Method A AASHTO T 180, method D(1) AASHTO T 310 or other approved procedures “	1 per 1000 tons (900 metric tons) 1 per type & source of material 1 per 500 tons (450 metric tons) “	From windrow or roadbed after processing Stockpile or production output In-place after compaction “	Yes ” No “	4 hours “ End of shift “	- - - -

Example Section 703. — AGGREGATE

703.05 Subbase, Base, and Surface Course Aggregate.

(a) General. Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming the following:

(1) Los Angeles abrasion, AASHTO T 96	50 percent max.
(2) Soundness of aggregate using sodium sulfate, AASHTO T 104 (5 cycles)	12 percent loss max.
(3) Durability index (coarse), AASHTO T 210	35 min.
(4) Durability index (fine), AASHTO T 210	35 min.
(5) Fractured faces, ASTM D5821	50 percent min.
(6) Without organic matter and lumps or balls of clay	

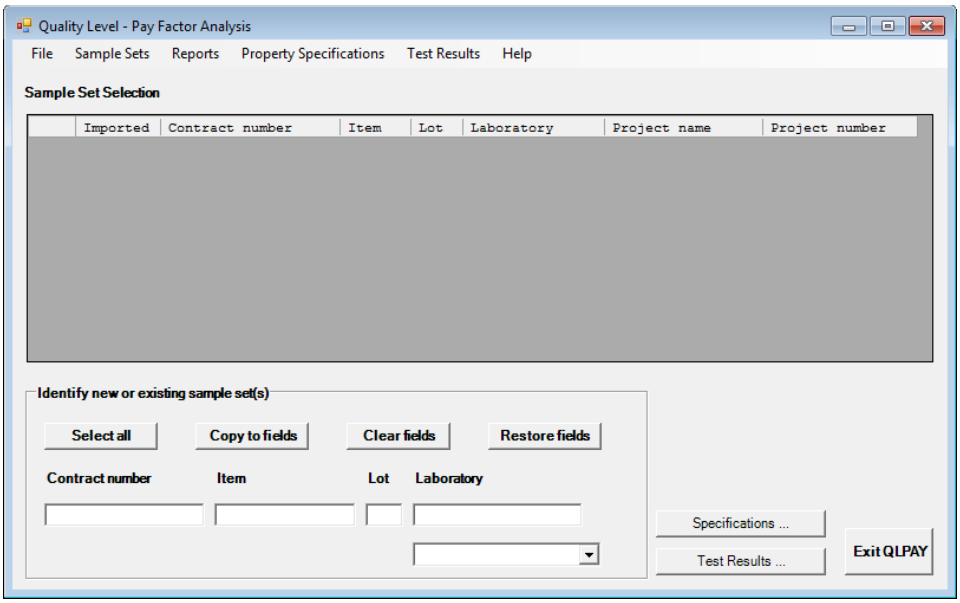
(b) Subbase or base aggregate. In addition to Subsection 703.05(a), conform to the following:

(1) Gradation	Example Table 703-2
(2) Liquid limit, AASHTO T 89	25 max.

Example Table 703-2
Target Value Ranges for Subbase and Base Gradation

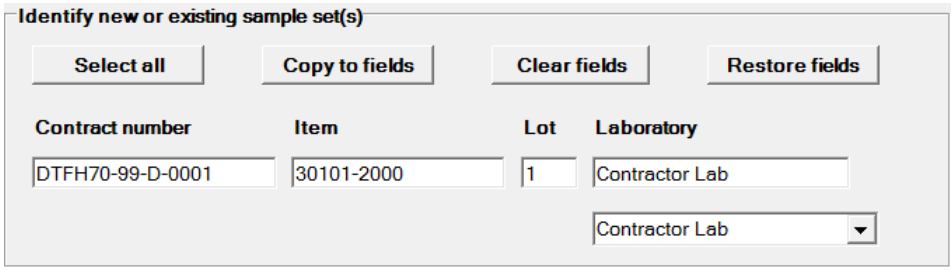
Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)				
	Grading Designation				
	A (Subbase)	B (Subbase)	C (Base)	D (Base)	E (Base)
2 ½ inch (63 mm)	100				
2 inch (50 mm)	97 – 100	100	100		
1 ½ inch (37.5 mm)		97 – 100			
1 inch (25 mm)	65 - 79 (6)		80 – 100 (6)	100	
¾ inch (19 mm)			64 – 94 (6)	86 – 100 (6)	100
½ inch (12.5 mm)	45 - 59 (7)				
3/8 inch (9.5mm)			40 – 69 (6)	51 – 82 (6)	62 – 90 (6)
No. 4 (4.75 mm)	28 – 42 (6)	40 – 60 (8)	31 – 54 (6)	36 – 64 (6)	36 – 74 (6)
No. 40 (425 µm)	9 – 17 (4)			12 – 26 (4)	12 – 26 (4)
No. 200 (75 µm)	4.0 – 8.0 (3)	4.0 – 12.0 (4)	4.0 – 7.0 (3)	4.0 – 7.0 (3)	4.0 – 7.0 (3)

( ) The value in the parentheses is the allowable deviation (±) from the target values.



Initial view when opening QL-PAY.

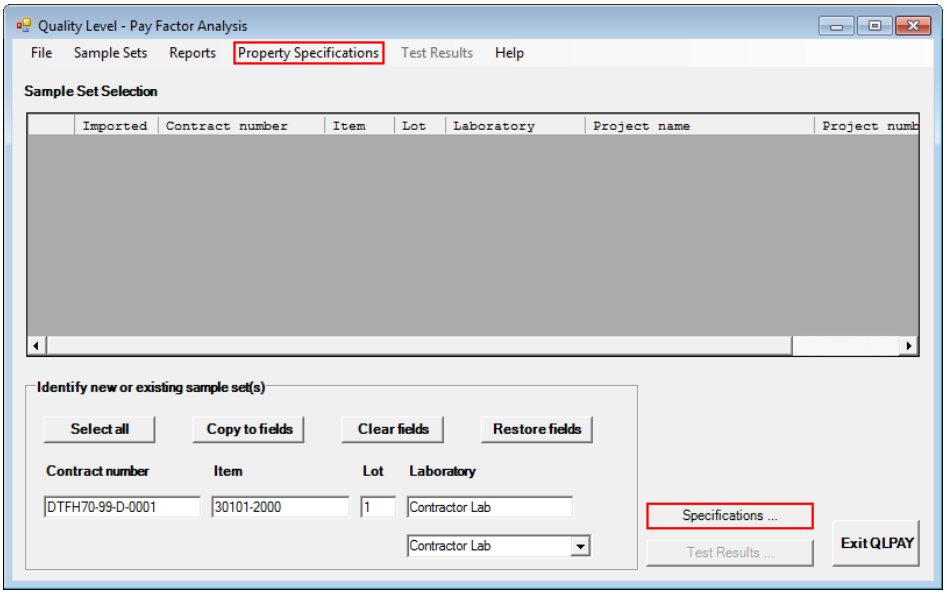
A. Enter data in the "Identify New or Existing Sample Set" fields
   a. Contract Number: This can be found on the front cover of the contract. For this example it is DTFH70-99-D-0001.
   b. Item: Place the Item Number in this field. This example will begin with 301 Aggregate Base Grading D (30101-2000).
   c. Lot: Generally speaking, there is only one lot for each item; therefore, the sample sets will always begin with Lot "1."
   d. Lab: Determine the lab the user will be using for the test results. Typically, there will be a "Central Lab" and "Contractor Lab" sample set for each item.



View after entering data into the sample set box.

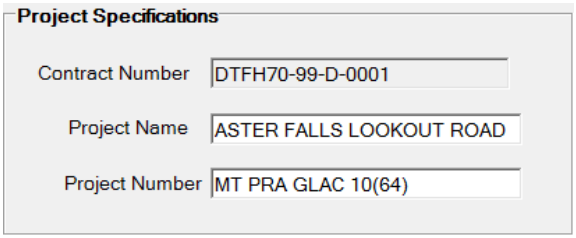
B. Specifications

a. Click on “Specifications.”



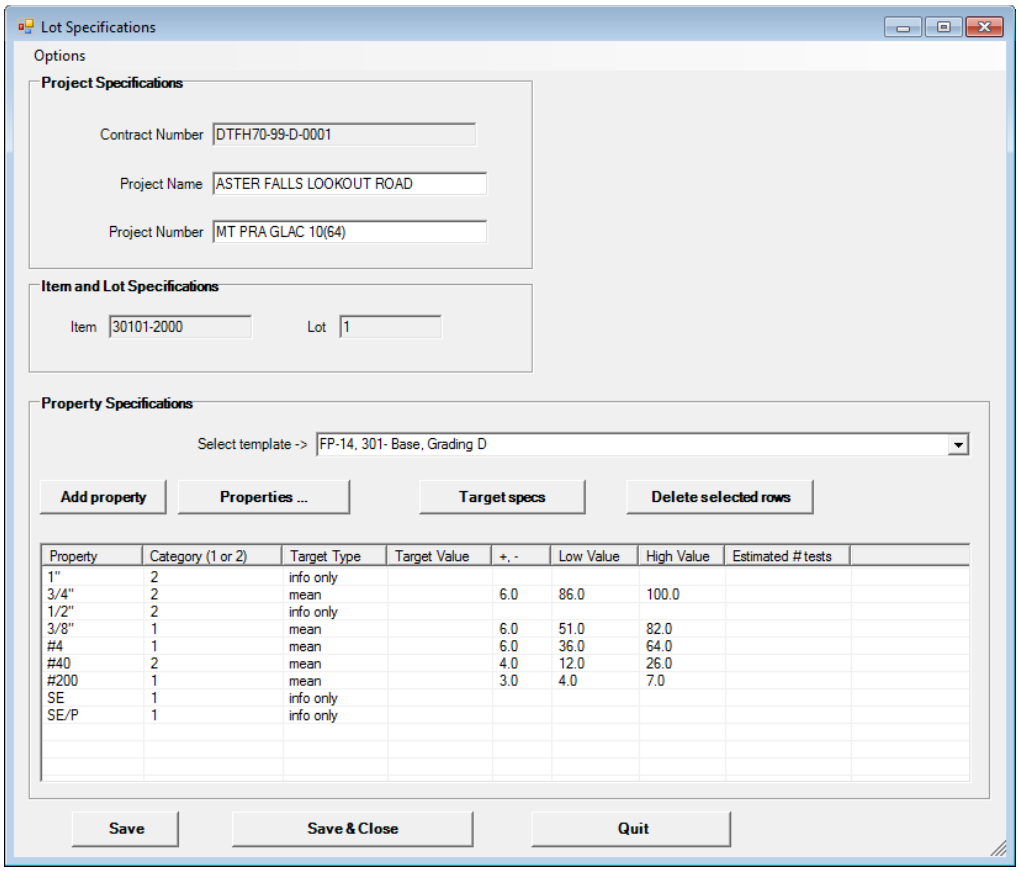
Selecting property specifications.

b. Enter the Project Name and Number from the contract cover page into the corresponding fields.



Project Name and Number under the specifications window.

c. Select the appropriate template from the drop down menu under “Property Specifications.” For this example, choose FP-14, 301- Base, Grading D. By selecting this template, the majority of the specification has already been entered into the program and only minor changes will need to be completed.

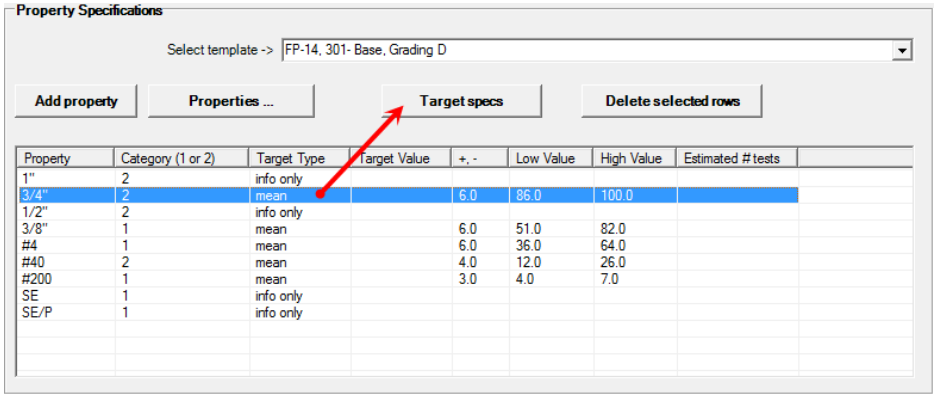


View after entering project name and number and selecting the template.

C. Adjusting Property Specifications to Match Contract

a. After opening the specifications dialog box and selecting a template, the Sampling, Testing, and Acceptance Requirements will be needed to finish inputting the correct data.

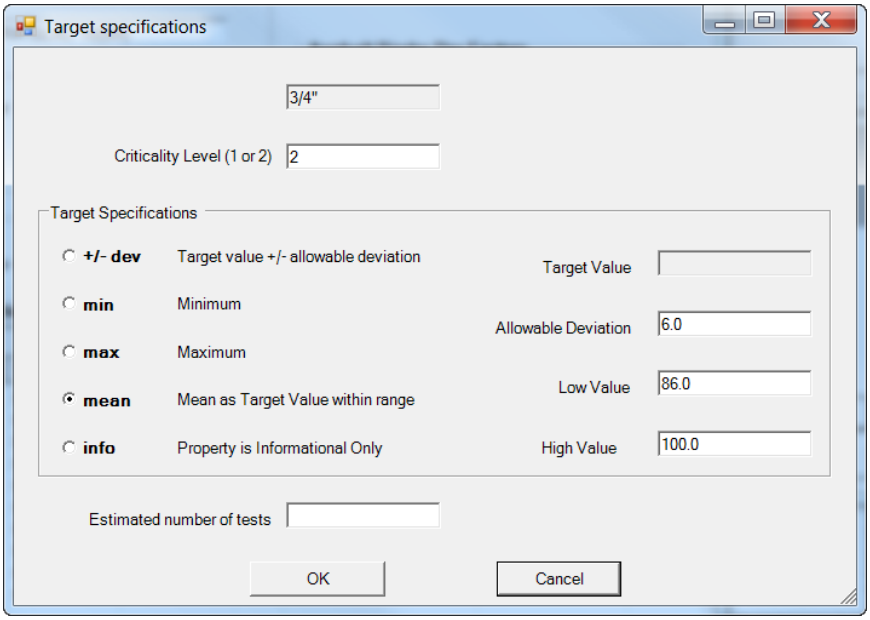
b. To adjust the properties, highlight the property in the lower table to adjust and click on the “Target Specs” button.



Highlight the property and select Target Specs.

This will bring up a new window to enter the testing parameters for the particular property. Determine the testing parameters for each property and select the appropriate target specifications, i.e. min, max, etc.

In this example, highlight the "3/4 inch" property in the lower table and select "Target Specs." Each field that is not grayed out will need to be filled in with data from either the sampling and testing specification, material specification or the mix design.

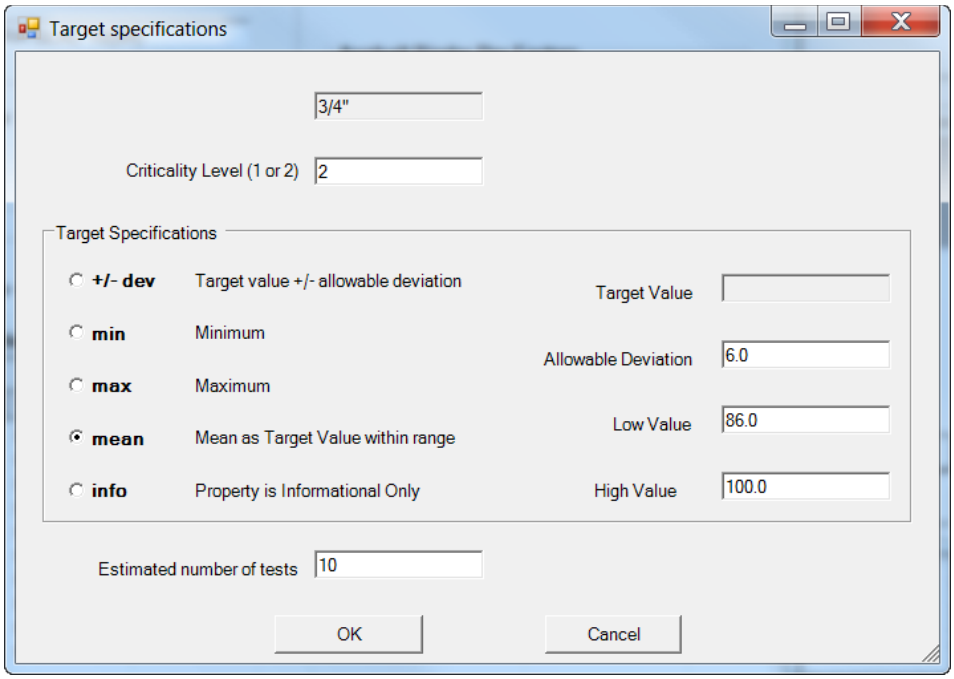


View of the Target Specifications window.

i. The criticality level is found in Example Table 301-1 under category. The ¾" sieve is a category 2.

ii. The target specification for the ¾" sieve is the mean. This is found in the Acceptance Subsection of 301 Untreated Aggregate Courses. The allowable deviation and the low/high value can be found under Example Table 703-2 Target Value Ranges for Subbase and Base Gradation. The values have already been entered in to the fields as part of the template but the user should verify that the values correlate with the specifications in the contract.

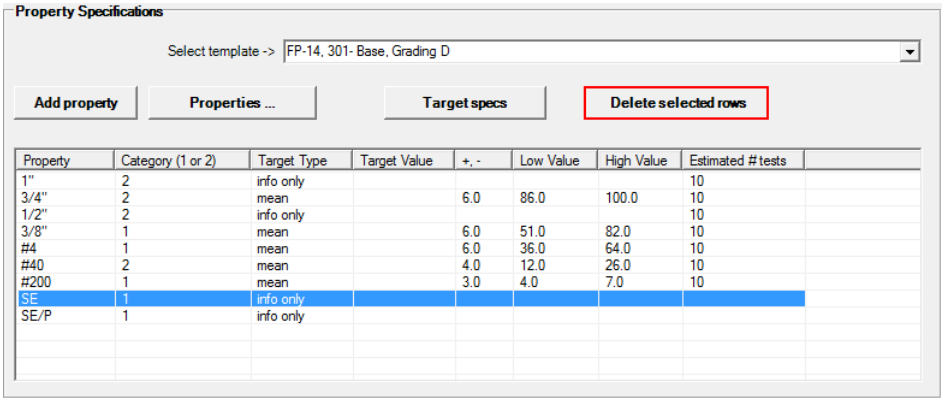
c. The estimated number of tests needs to be the actual number of tests that will be taken throughout the project. This number can be changed at a later date if the number of tests increases or decreases, but the final number of tests taken should be reflected under each property at the completion of the item. To determine the number of tests, divide the contract quantity for the item by the sampling frequency and use that value for all of the estimated number of tests. For this example, the contract requires 10,000 tons and the sampling frequency is 1 per 1000 tons (from Example Table 301-1); therefore, the estimated number will be 10 tests for this project.



¾" sieve entered target specs.

d. After the target specifications are entered, click "OK" and proceed to adjusting the remainder of the properties.

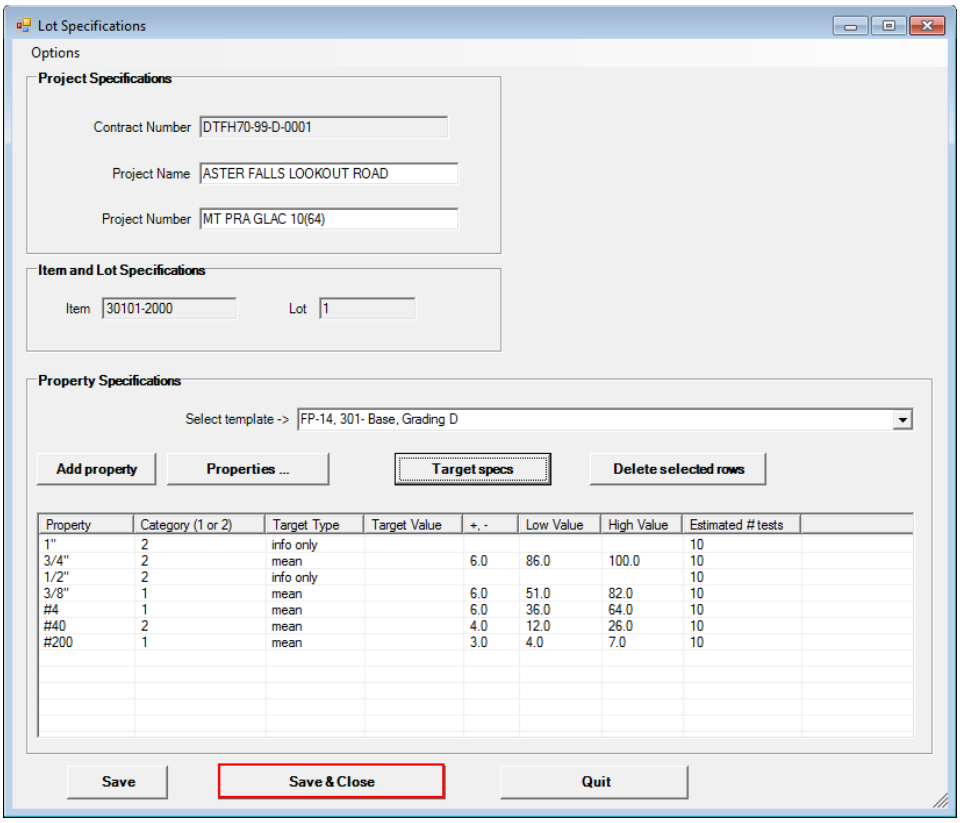
e. Due to using the template, there are additional properties in the property specifications than are called for in the sampling and testing requirements. The additional properties can be removed in two ways, either by selecting the row to delete and select the button that states "Delete selected rows" or the user can press the "delete" key on the keyboard.



Deleting the selected property specification.

For this example remove the SE and SE/P property specifications.

f. When finished entering all of the properties, click "Save and Close." This is shown on the following page.

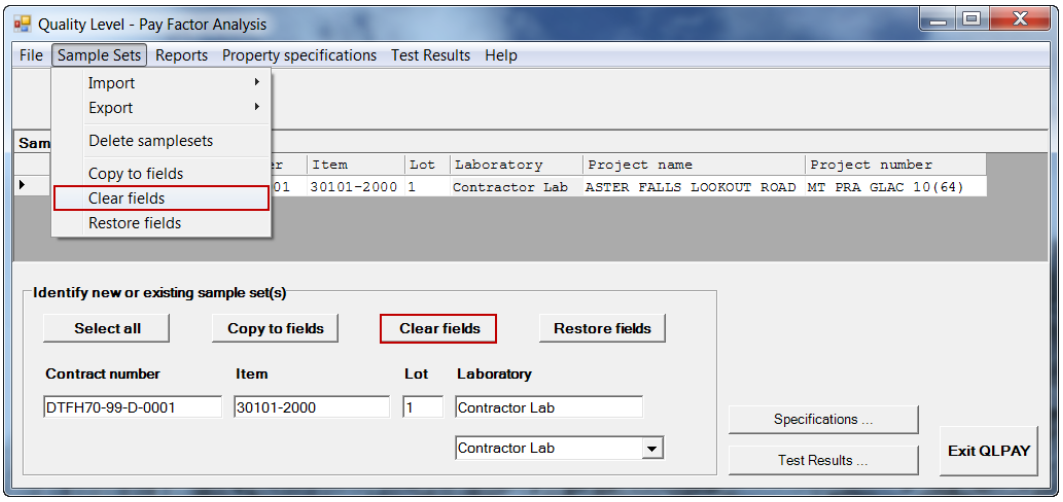


View of completed target specifications prior to selecting Save & Close.

Note: *If the user presses "Quit," none of the changes made to the specifications will be saved and it will resort back to the data that was entered prior to opening the specification set.*

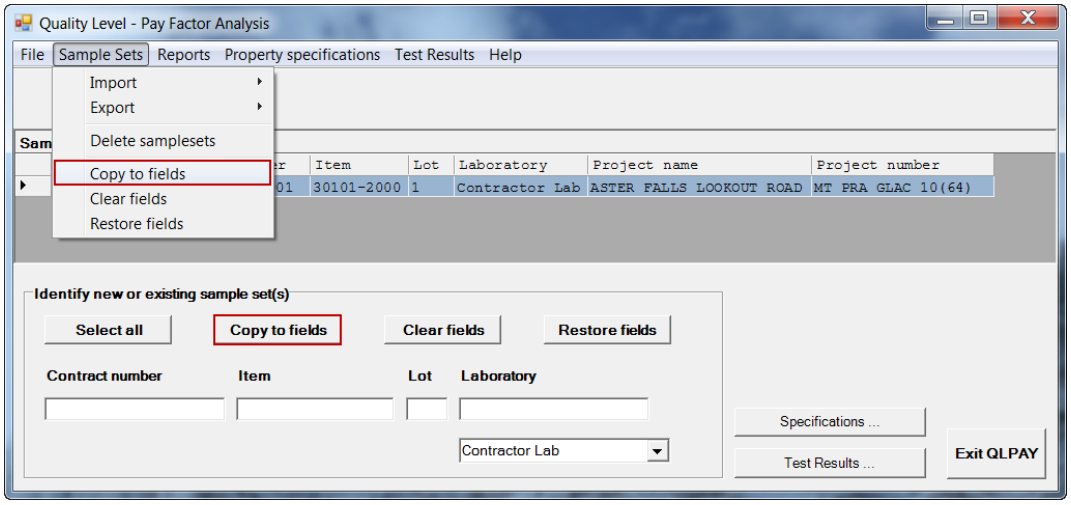
D. Creating a Secondary Lab Sample Set in the same Lot

a. From the home screen of the QL-PAY program, press the "Clear Fields" button located in the "Identify New or Existing Sample Set(s)" box or in the Sample Sets drop down menu. This is shown on the following page.



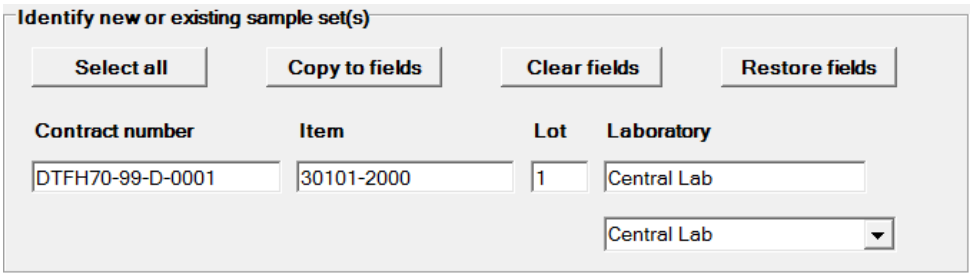
Operating the clear fields function.

b. Highlight the sample set to create a secondary lab and select the "Copy to Fields" button. This will copy the project information to be used for the new sample set.



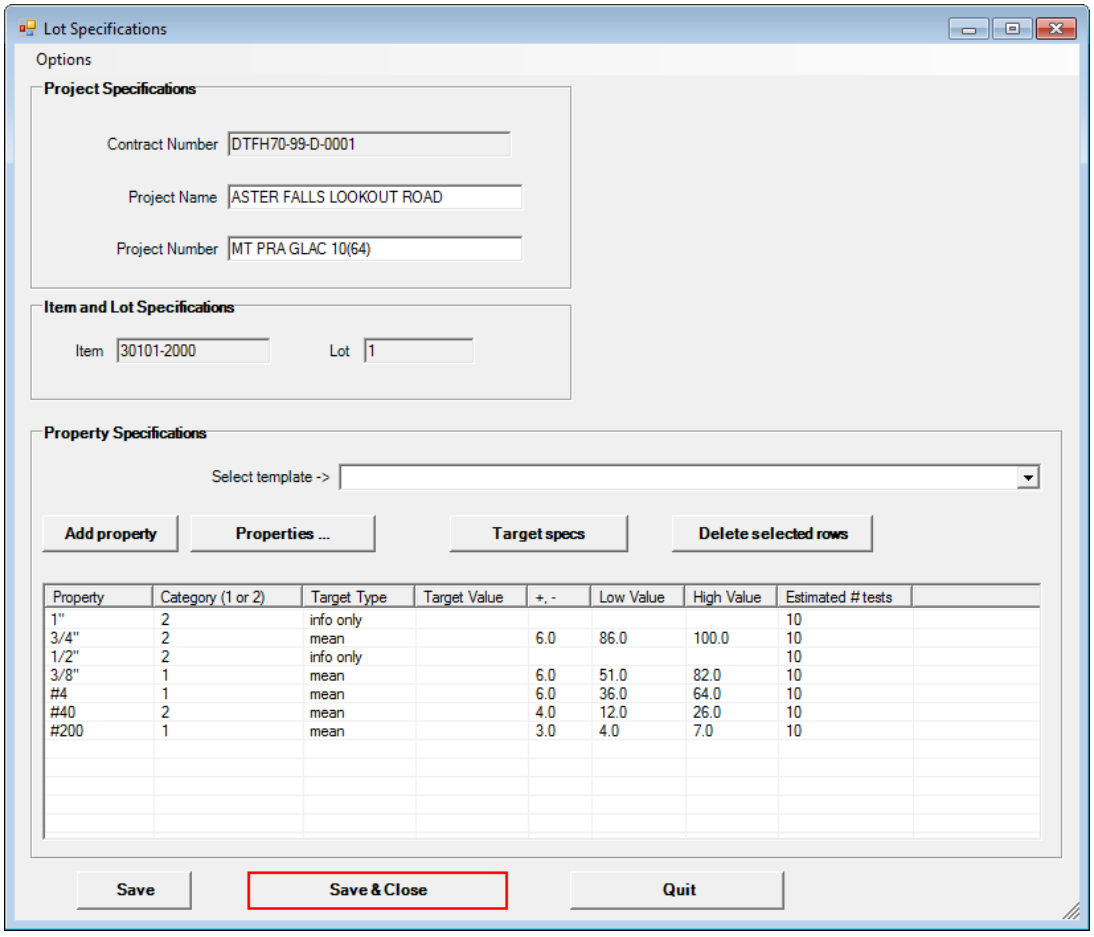
Selecting copy to fields after highlighting sample set.

c. In the “Laboratory” drop down menu, choose “Central Lab.”



View after selecting copying fields and Central Lab.

d. Click on “Specifications.” The specifications should be identical to the original sample set. Once the property specifications have been reviewed for accuracy, select “Save and Close.”



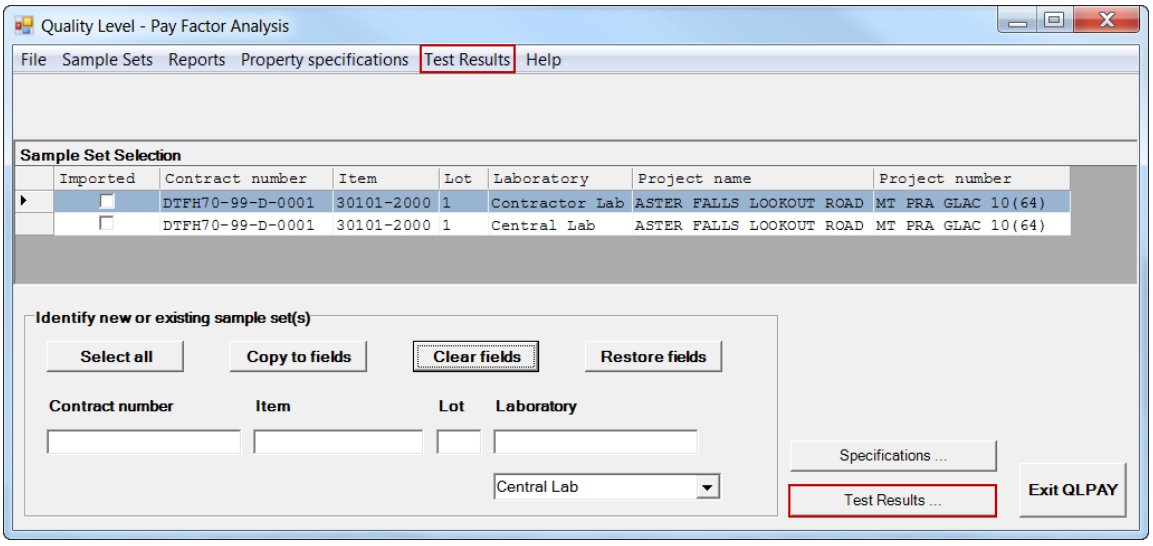
View of copied target specifications for the Central Lab.

e. QL-PAY is now set up to handle all of the 30101 sampling and testing for the project.

E. Entering Test Results

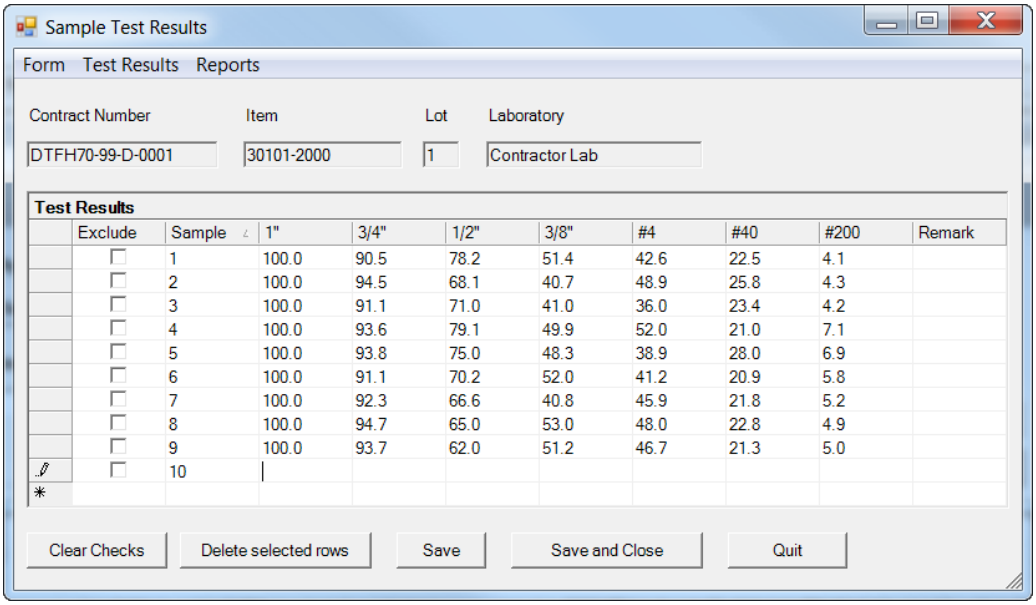
a. Highlight the sample set that the user has test results for.

b. Select the “Test Results” button at the lower right of the window or the “Test Results” drop down menu.



Locations that can be selected to enter test results.

c. Begin entering the test result data, starting with Sample #1. Make sure to include consecutive sample numbers when entering in the test result data, i.e. 1,2,3,4, etc.



View of consecutive test results being entered.

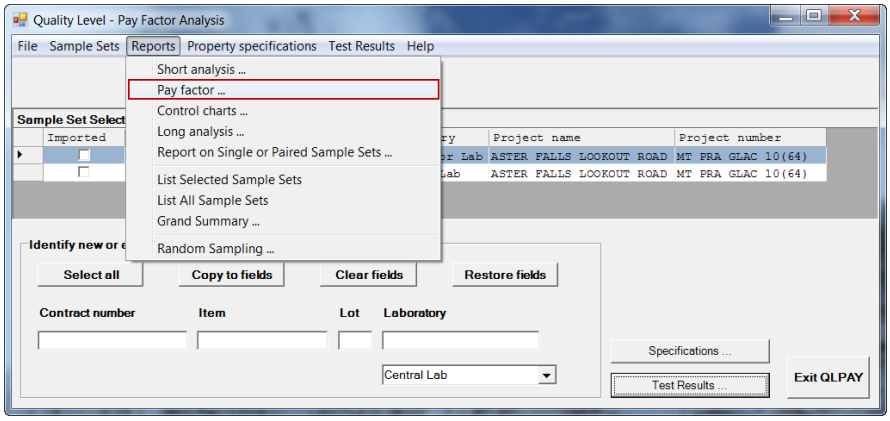
d. Three test results are needed before a statistical analysis can be computed.

e. When entering test results for the central lab on split samples, make sure the test numbers match the corresponding contractor test result sample number or the analysis will not be valid.

f. Select “Save and Close” when all of the test results have been entered into the program.

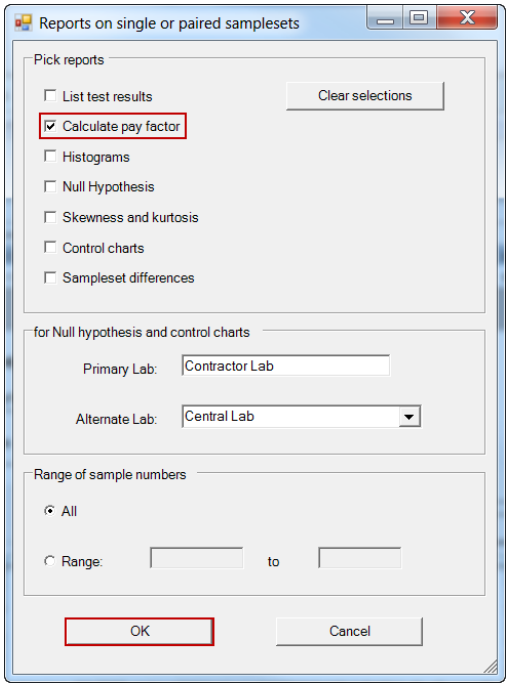
F. Calculating Pay Factor

a. Highlight the sample set for the contractor’s lab and select the “Pay factor” under the reports drop down menu.



Selecting the pay factor report for the contractor’s lab.

b. The reports menu will appear. By selecting the “Pay factor” report, the “Calculate pay factor” button should already be checked. If not, select only the pay factor button and then select “OK.”



Pay factor report selection.

c. QL-PAY will produce a PDF report calculating the pay factor for the test results that have been entered under the sample set. When the estimated number of tests have been completed, QL-PAY will note that the testing has been completed and the final pay factor value.

The view below shows the final pay factor for Aster Falls Lookout Road. When using the "mean" property specification, QL-PAY will adjust the target value to the mean of the samples unless the target value falls outside of the range in the contract specifications. This is shown when comparing the "Actual target value" column to the "Mean" column.

Western Federal Lands Highway Division

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: MT PRA GLAC 10(64)
Project ID: DTFH70-99-D-0001

Item Number: 30101-2000
Lot Number: 1
Lab: Contractor Lab

Quality Levels and Pay Factors

Quality Charac-teristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
1"	info		100.00	0.000	---	---
3/4"	91.50	+,- 6.0	91.50	0.721	100	1.00
1/2"	info		70.80	5.595	---	---
3/8"	51.00	+,- 6.0	47.39	4.974	66	0.88
#4	43.82	+,- 6.0	43.82	2.249	100	1.05
#40	22.93	+,- 4.0	22.93	2.295	94	1.00
#200	5.45	+,- 3.0	5.45	0.832	100	1.05

TESTING COMPLETED
FINAL PAY FACTOR: 0.88

Lot Terminated: Corrective Action Required

Pay factor report printout with 3/8" sieve out of specification limit.

When reviewing the 3/8" sieve, the contract specifications state the range for the target value is between 51.0 and 82.0. After all of the sampling was completed, the mean for the 3/8" sieve was 47.39. This value is outside of the property specification; therefore, QL-PAY automatically sets the target value to the lowest value (51.00) within the specification range. This change can be seen highlighted in red in the above QL-PAY report.

Note: *The "Calculate Pay Factor" report was selected for example purposes only. For more information on other available reports see* ***Section 4 Reports.***

7.2. Section 401
Asphalt Concrete Pavement by Gyratory Mix Design Method – Control Strip
Example

7.2. Section 401 Asphalt Concrete Pavement by Gyratory Mix Design Method –Control Strip Example

This example will go through the process of setting up the sample sets for the control strip of 401 Asphalt Concrete Pavement, Gyratory Mix.

TASK ORDER AWARD	Contract No. DTFH70-99-D-0001
_____ Solicitation No. DTFH70-08-R-00021	River Contractors, Inc. P.O. Box 223 West Glacier, MT 59936
MT PRA GLAC 10(64) ASTER FALLS LOOKOUT ROAD	AWARD DATE: March 10, 2015

Pay Item No.	Item	Quantity	Unit	Unit Price	Amount
40101-1000	**Asphalt Concrete Pavement, Gyratory Mix, ¾" Nominal Max. Size Aggregate, 0.3 to < 3 Million ESAL**	**18,000**	**TON**	**$138.00**	**$2,484,000.00**

Example Section 401. — ASPHALT CONCRETE PAVEMENT BY GYRATORY MIX DESIGN METHOD

Material

401.02 Conform to the following Subsections:

Antistrip additive	702.05
Asphalt binder	702.01
Asphalt concrete aggregate	703.07
Mineral filler	725.05

401.12 Production Start-Up Procedures.

(b) Control strip. Provide 7 days notice before beginning production of an asphalt concrete mix.

On the first day of production, produce sufficient asphalt concrete mix to construct a 1000-foot (300-meter) long control strip, one-lane wide, and at the designated lift thickness. Construct the control strip on the project at an approved location.

Construct the control strip using asphalt concrete mix production, lay-down, and compaction procedures intended for the entire mix. Cease production after construction of the control strip until the asphalt concrete mix and the control strip are evaluated for acceptance.

(1) Mixture. Take and test at least three control strip asphalt concrete mix samples and evaluate according to Subsection 401.17. The asphalt concrete mix is acceptable if all test results are within specification limits for asphalt content and VMA; and the calculated pay factor for asphalt content, VMA, and gradation is 0.90 or greater.

(2) Compaction. Compact according to Subsection 401.14. Take nuclear gauge density readings behind each roller pass to determine the roller pattern necessary to achieve required density.

Take nuclear gauge density readings and cut and test core samples according to Table 401-8. Density is acceptable if the core density pay factor is 0.90 or greater. Furnish the CO with documented nuclear gauge readings correlated to core specific gravities.

Repeat the control strip process until an acceptable control strip is produced. See Subsection 106.01 for the disposition of material in unacceptable control strips. Accepted control strips may remain in place and will be accepted and measured as a part of the completed pavement. Tests used for the control strip will not be included in the evaluation for payment according to Subsection 106.05. When a control strip is verified and accepted, full production may begin.

Use these start-up procedures when producing material from a different plant or when resuming production after a termination of production due to unsatisfactory quality according to Subsection 106.05.

Example Section 401. — ASPHALT CONCRETE PAVEMENT BY GYRATORY MIX DESIGN METHOD

401.17 Acceptance. See Table 401-8 for sampling, testing, and acceptance requirements.

Aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

Mineral filler, antistrip additives, and WMA additives will be evaluated under Subsections 106.02 and 106.03.

Asphalt content, VMA, and core density will be evaluated under Subsection 106.05. Pavement roughness will be evaluated under Subsection 106.04. Asphalt binder will be evaluated under Subsections 106.03 and 106.04. Evaluations will consider the following:

(a) Asphalt content. The upper and lower specification limits are the approved JMF target value plus or minus 0.4 percent;

(b) VMA. The lower specification limit is the value shown in Example Table 401-1. After the JMF has been verified according to Subsections 401.03 and 401.12, use the Contractor's combined coarse and fine bulk specific gravity of aggregate G_{sb} values to calculate VMA on field produced asphalt concrete mix samples;

(c) Density (core). The lower specification limit is 91.0 percent of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209.

The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day;

(d) Pavement roughness. The evaluation for pavement will be made after all defective areas are addressed. See Subsection 401.16(g); and

(e) Asphalt binder. The pay factor is determined from Table 401-7.

Construction of the HMA or WMA pavement course will be evaluated under Subsections 106.02 and 106.04.

Example Table 401-1
Gyratory Asphalt Concrete Mix Design Requirements, AASHTO R 35

Design ESAL (Million)	Gyratory Compaction Level (% Theoretical Maximum Specific Gravity, G_{mm}) AASHTO T 312			Minimum Voids-in-the Mineral Aggregate (VMA), % [1] Nominal Maximum Size Aggregate [2]					Voids Filled with Asphalt (VFA), %	Dust-to-Binder Ratio [3]	Minimum Tensile Strength Ratio, AASHTO T 283
	$N_{initial}$	N_{design}	N_{max}	1 inch (25mm)	¾ inch (19mm)	½ inch (12.5mm)	⅜ inch (9.5mm)	#4 sieve (4.75 mm)			
< 0.3	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	12.0–15.0	13.0-16.0	14.0-17.0	15.0-18.0	-	70.0 - 80.0	0.8 -1.6	0.80
0.3 to < 3	7 (≤90.5%)	75 (96.0%)	115 (≤98.0%)						65.0 - 78.0		
3 to 30	8 (≤89.0%)	100 (96.0%)	160 (≤98.0%)						65.0 - 78.0		
-	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	-	-	-	-	16.0 -19.0	76.0 – 80.0	0.6 – 2.0	

Example Table 401–8
Sampling, Testing and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Method Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
				Production Start-up (control strip)					
Asphalt concrete pavement	Statistical (106.05)	Gradation		AASHTO T 30	3 minimum	Behind the paver before compaction	Yes	6 hours	-
		No. 4 (4.75 mm)	I						
		No. 30 (600 µm)	I						
		No. 200 (75 µm)	I						
		Other specified sieves	II						
		Asphalt content	I	AASHTO T 308	"	"	"	"	-
		VMA	I	AASHTO R 35	"	"	"	"	-
		Density	I	AASHTO T 166	5 minimum	In-place after compacting	"	24 hours	Deliver cores to CO after determining specific gravity and compaction
	Measured and tested for conformance (106.04)	Mix temperature	–	-	3 minimum	Hauling vehicle before dumping or windrow before pickup	No	Immediately upon completion of test	-
		Maximum specific gravity	–	AASHTO T 209	First load and as determined by CO thereafter	Behind the paver before compaction	Yes	24 hours	-

U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway

WORKSHEET FOR SUPERPAVE ASPHALT CONCRETE MIX DESIGN
AASHTO R 35

Project: MT PRA GLAC 10(64) Date: 3/15/2015

Contractor: River Contractors, Inc. Nominal Maximum Aggregate Size, in: 3/4"

Asphalt supplier: Hot Rock Asphalt Grade of asphalt: 58-34

Sources for: Aggregates: Snow Pack Quarry Mineral filler: Graymont Lime

Testing laboratory name: Slate Testing Phone:

Testing performed by: Mya Mixer

Testing reported by: Mya Mixer

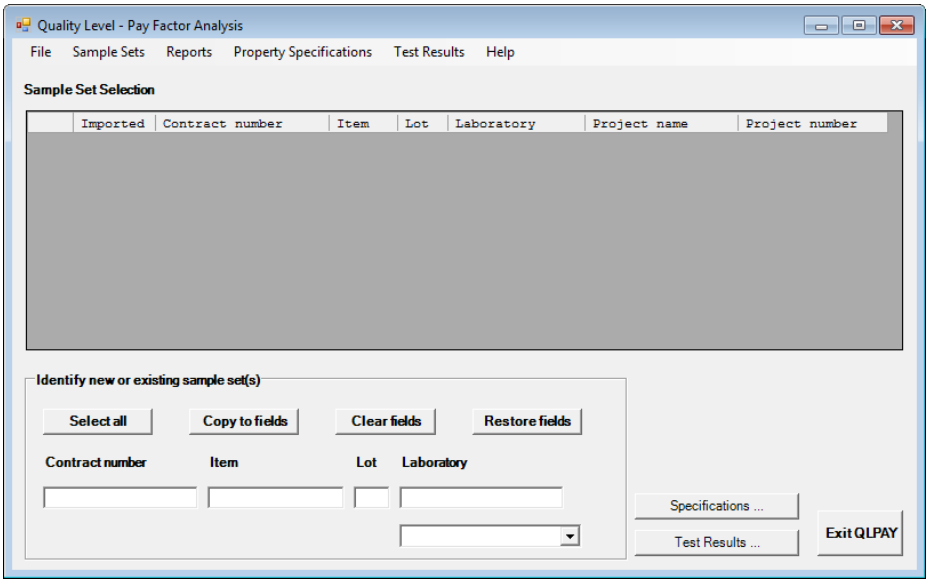
☑ English ☐ Metric **SUMMARY OF THE PROPOSED JOB-MIX-FORMULA**

1. Number of gyrations (N_{ini}/ N_{des}/ N_{max})	7/75/115	10. Specific gravity of binder (G_b)	1.024
2. Percent binder by mass of total mix (P_b)[1]	4.90	11. Recommended plant mixing temperature,°F (Attach Temperature Viscosity Curve)	309-324
3. Percent binder by mass of aggregate	5.14	12. Percent compaction at N_{max}	97.9
4. Air voids (V_a) at N_{des}	4.0	13. Hveem stabilometer value (If specified)	
5. Voids in mineral aggregate (VMA) at N_{des}	13.4	14. Moisture Susceptibility:	AASHTO T 283
6. Voids filled with asphalt (VFA) at N_{des}	70.4	a. Dry strength, psi	485.4
7. Maximum unit mass (G_{mm})	2.508	b. Wet strength, psi	438.0
8. Effective specific gravity of aggregate (G_{se})	2.710	c. Index of Retained Strength, %	90.20
9. Dust-to-Binder Ratio (DP)	1.6		

Is RAP included in Mix Design? ☐ Yes ☑ No

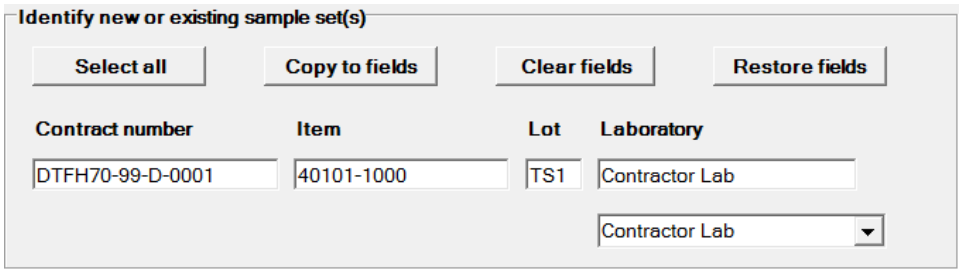
GRADATION TARGET VALUES AND ALLOWABLE DEVIATIONS			SPECIFIC GRAVITY AND ABSORPTION			
Sieve Sizes	Job Mix Formula Target Value[2]	Allowable Deviation[3] %		Fine Aggregate (AASHTO T 84)	Coarse Aggregate (AASHTO T 85)	Combined Aggregate
3/4 inch	99.5					
1/2 inch	83.0	4	Bulk SG (G_{sb})	2.608	2.669	2.643
3/8 inch	68.8	5				
No. 4	42.1	6	Bulk SSD SG	2.629	2.692	2.665
No. 8	25.2	4				
No. 16	20.0	3	Apparent SG (G_{sb})	2.662	2.732	2.703
No. 30	13.3	3				
No. 50	10.1	3	Absorption	0.80 %	0.90 %	0.86 %
No. 200	6.3	2				

Example 401 Superpave Hot Asphalt Concrete Mix Design.



Initial view when opening QL-PAY.

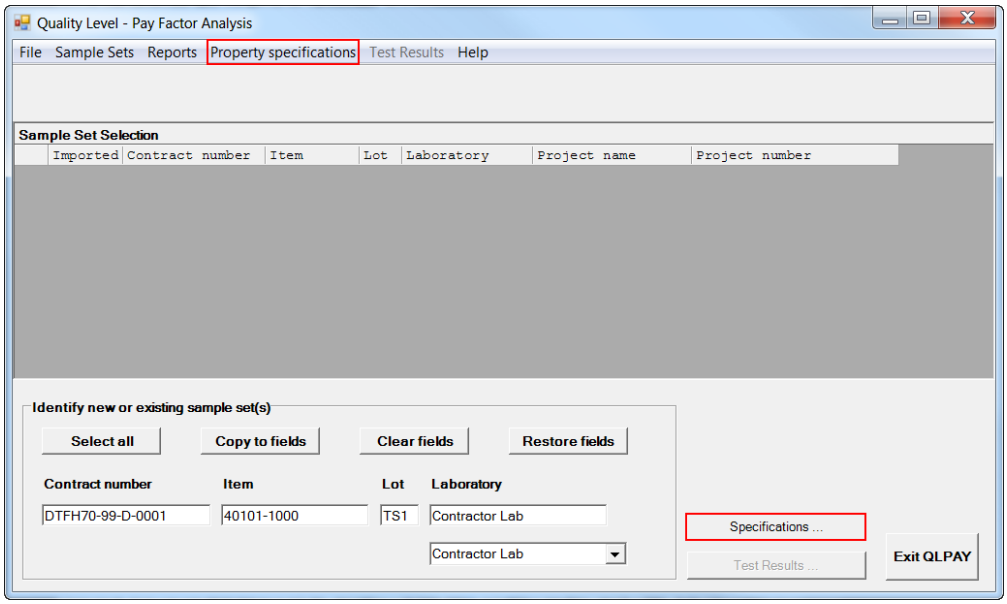
A. Enter data in the "Identify New or Existing Sample Set" fields
   a. Contract Number: This can be found on the front cover of the contract. For this example it is DTFH70-99-D-0001.
   b. Item: Place the Item Number in this field. This example will begin with 401 Asphalt Concrete Pavement, Gyratory Mix (40101-1000).
   c. Lot: To distinguish between production testing and the control strip, set the Lot as "TS1," for test strip 1. By labeling the Lot as "TS1," the user has the opportunity to create a sequence of additional sample sets if multiple test strips are required.
   d. Laboratory: Select "Contractor Lab" in the drop down menu. The "Contractor Lab" is typically used for a control strip, due to the testing being completed on-site.



View after entering data into the sample set box.

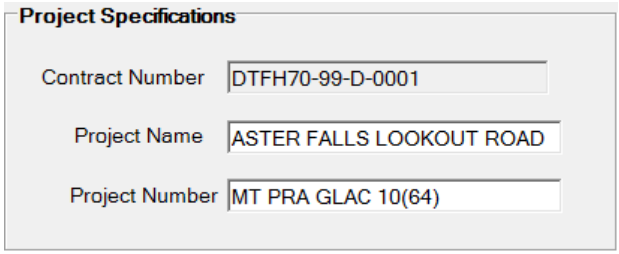
B. Specifications

a. Click on “Specifications.”



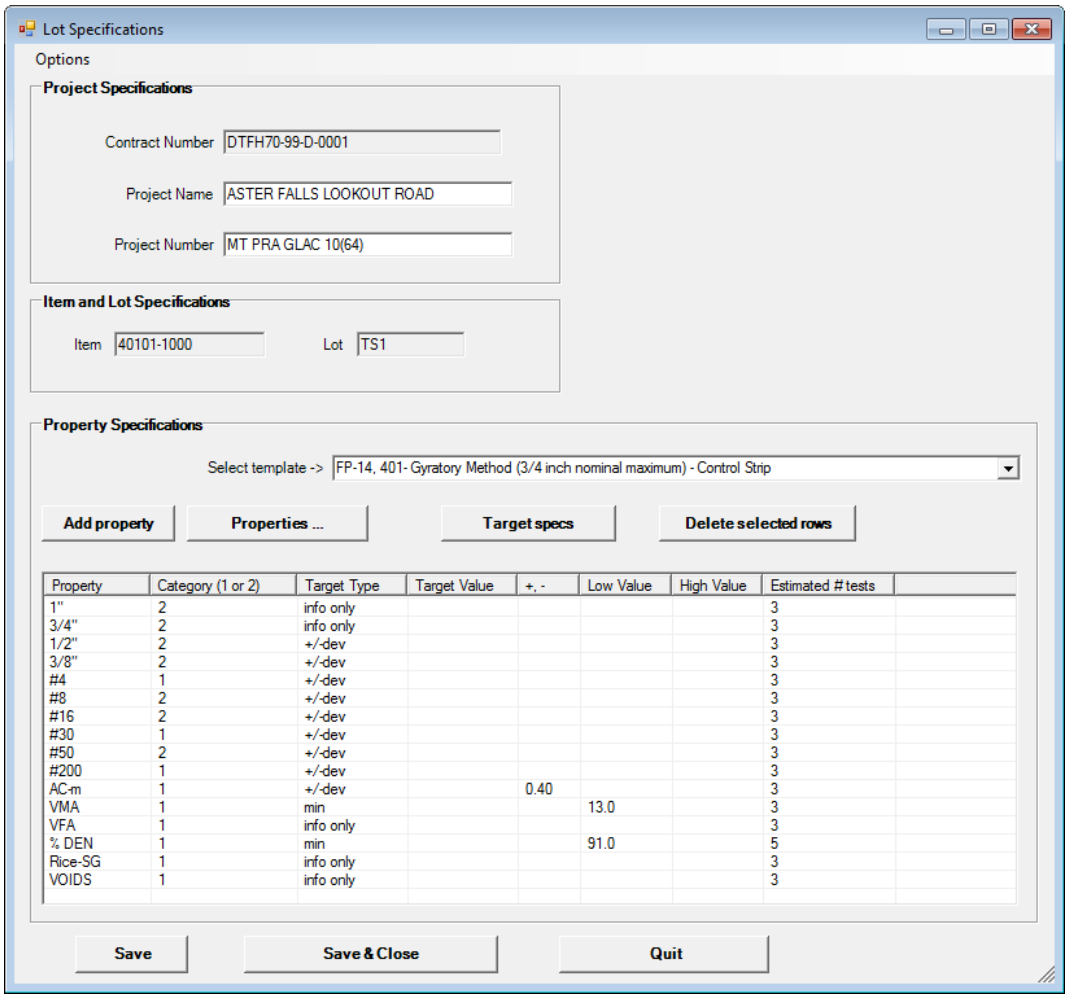
Selecting property specifications.

b. Enter the Project Name and Number from the contract cover page into the corresponding fields.



Project Name and Number under the specifications window.

c. Select the appropriate template from the drop down menu under “Property Specifications.” For this example, choose FP-14, 401 – Gyratory Method (3/4 inch nominal maximum) – Control Strip. By selecting this template, the majority of the specification has already been entered into the program and only minor changes will need to be completed. The screen view of the template selection is shown on the following page.

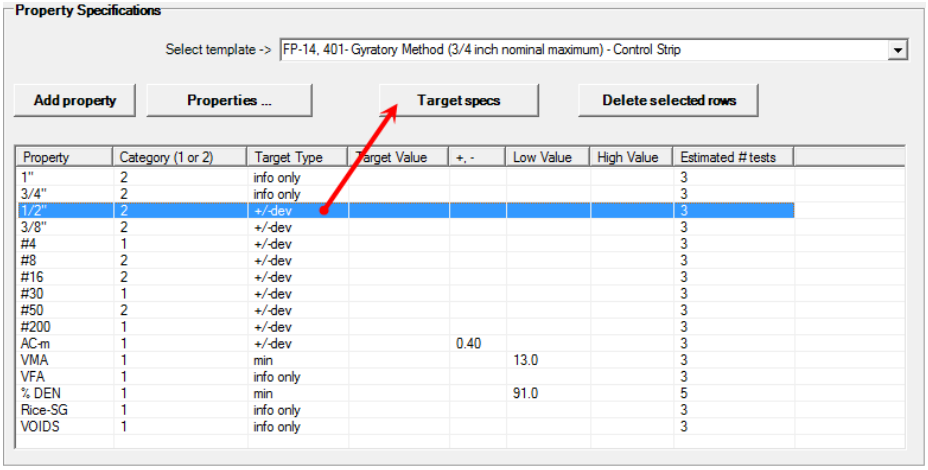


View after entering project name and number and selecting the template.

C. Adjusting Property Specifications to Match Contract

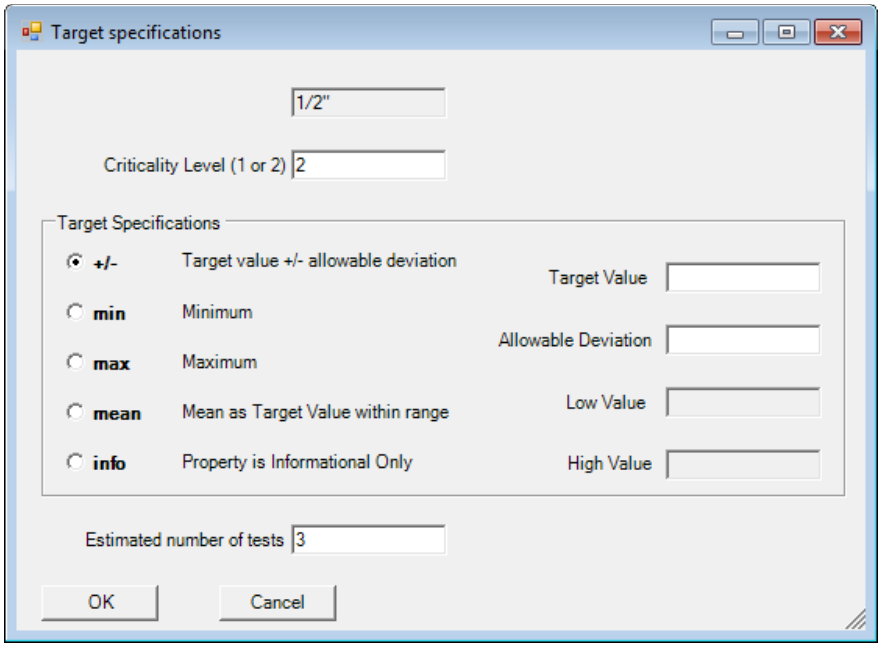
a. After opening the specifications dialog box and selecting a template, the Sampling, Testing, and Acceptance Requirements along with information from the asphalt mix design will be needed to finish inputting the correct data.

b. To adjust the properties, highlight the property in the lower table to adjust and click on the “Target Specs” button. This will bring up a new window to enter the testing parameters for the particular property. Determine the testing parameters for each property and select the appropriate target specifications, i.e. min, max, etc. This is shown on the following page.



Highlight the property and selecting Target Specs.

In this example, highlight the "1/2" property in the lower table and select "Target Specs." Each field that is not grayed out will need to be filled in with data from either the sampling and testing specification, material specification or the mix design.

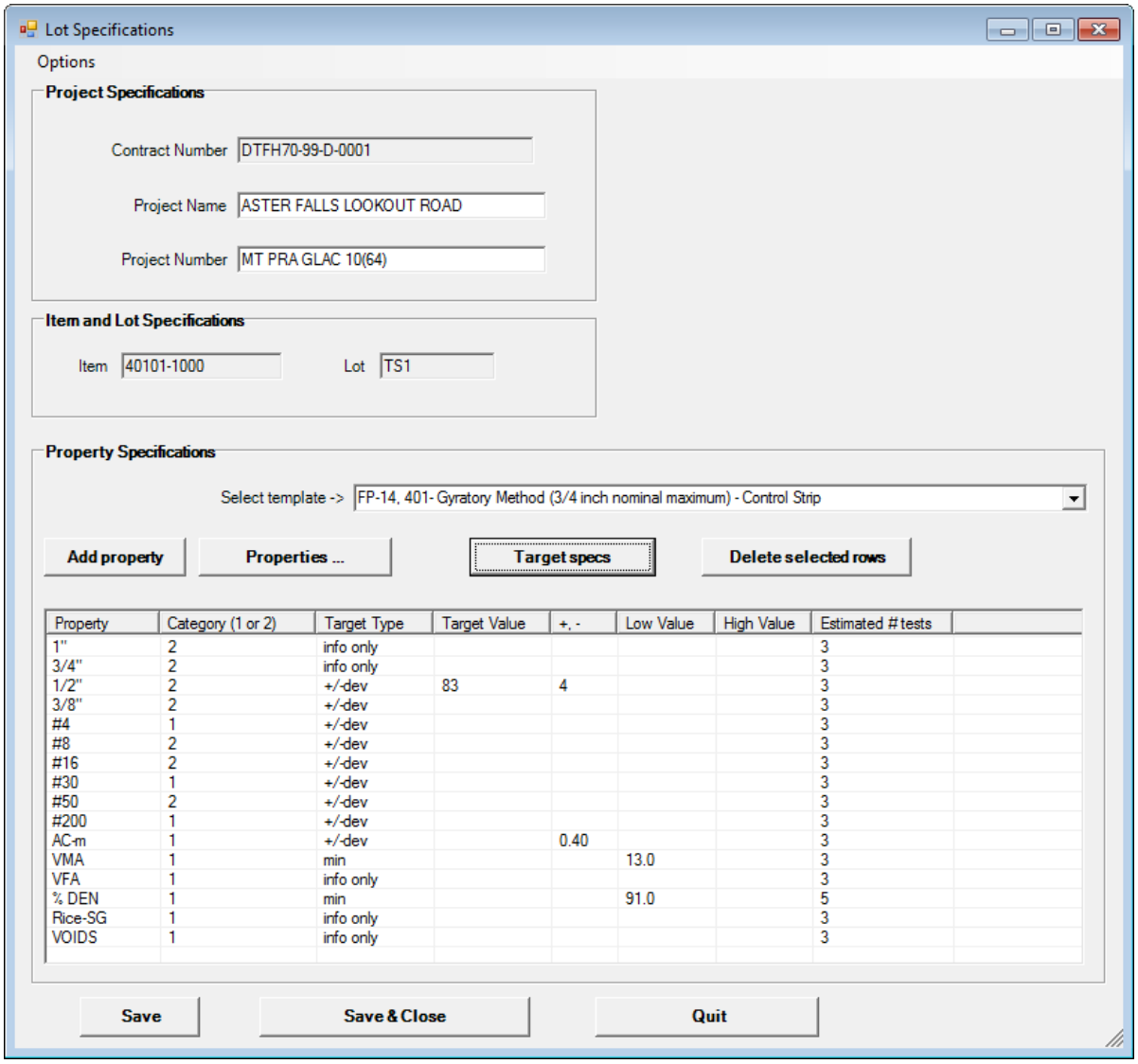


View of the target specifications window.

i. The criticality level is found in Example Table 401-2 under category. ½ inch gradation is a category 2.

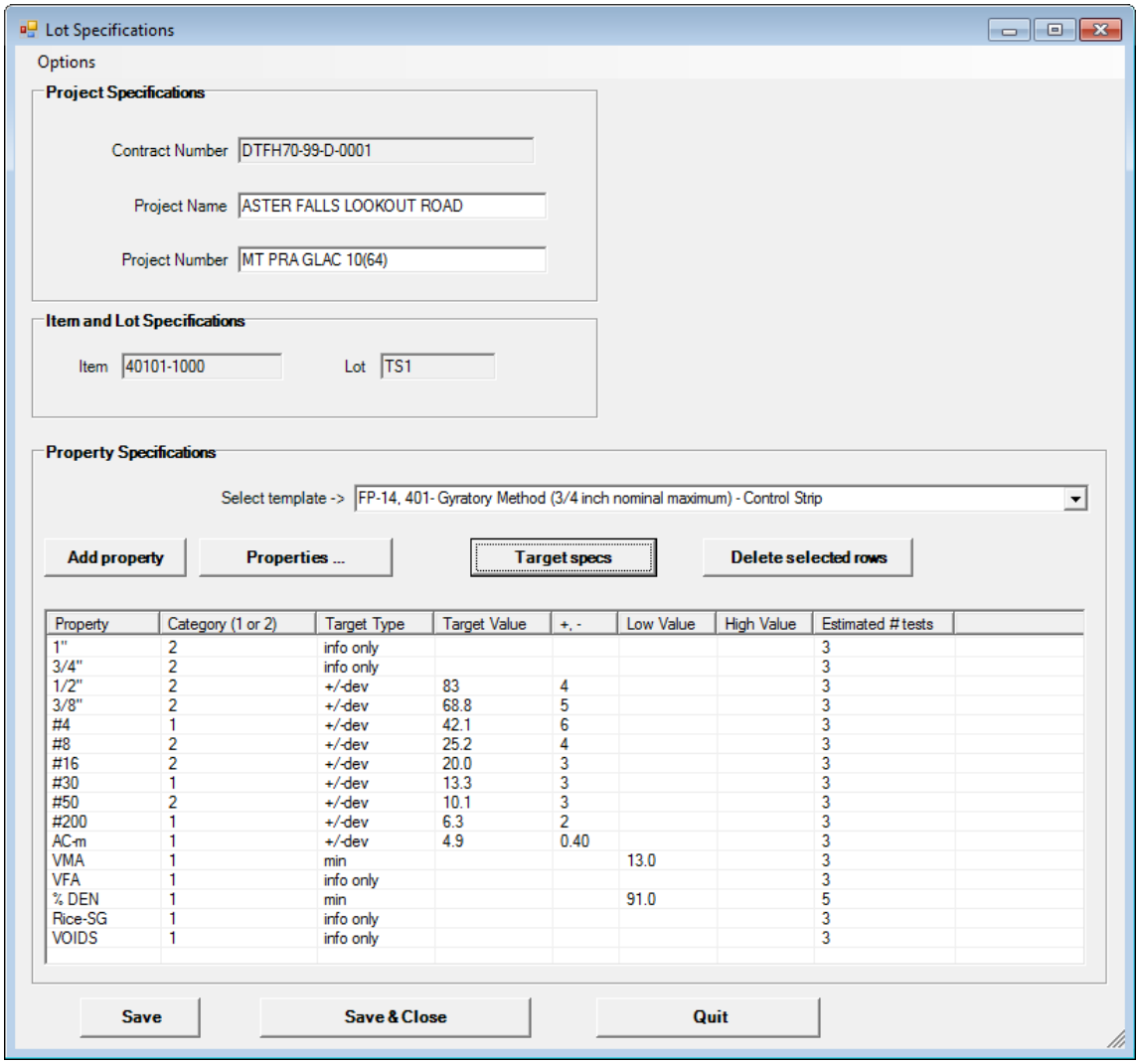
ii. The target specification for ½ inch gradation is +/- dev. The allowable deviation can be found in the Section 703. For this example, the values stated in the mix design will be assumed to be accurate. The target value will be the value stated in the mix design. In this case, using the mix design, the target value is 83.0 and the allowable deviation is 4.

c. The estimated number of tests is established in the specifications for the construction of the control strip. For a control strip, the specifications state there will be 3 mix samples and 5 core samples taken for evaluation.



½" entered target specs.

d. After the target specifications are entered, click "OK" and proceed to adjusting the remainder of the properties.



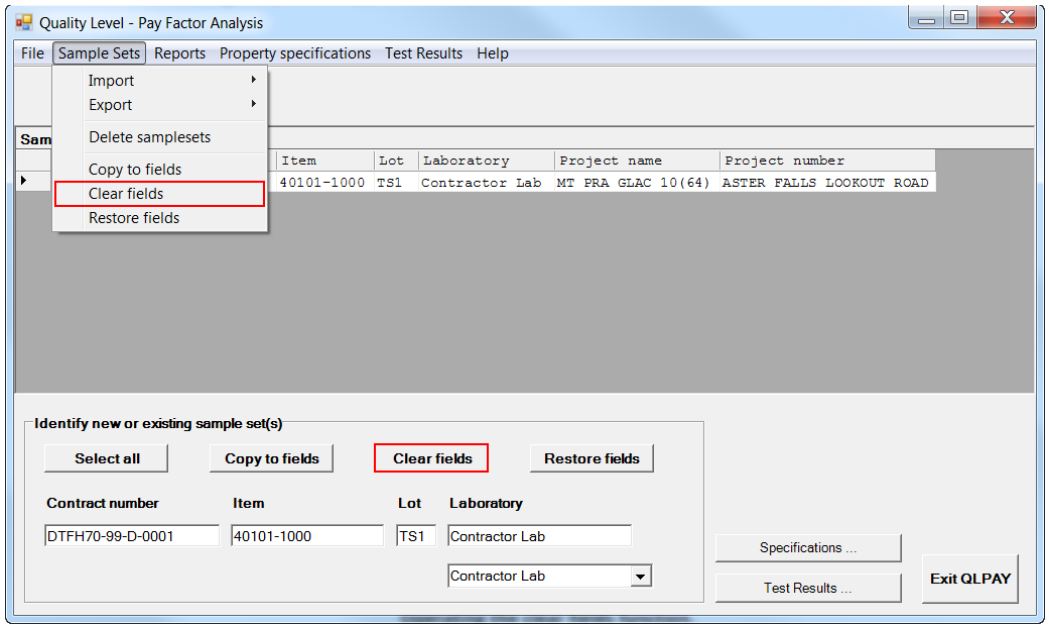
View of completed control strip target specifications.

e. When finished entering all of the properties, click “Save and Close.” If the user presses “Quit,” none of the changes made to the specifications will be saved and it will resort back to the data that was entered prior to opening the specification set.

D. Creating a Secondary Lab Sample Set in the same Lot

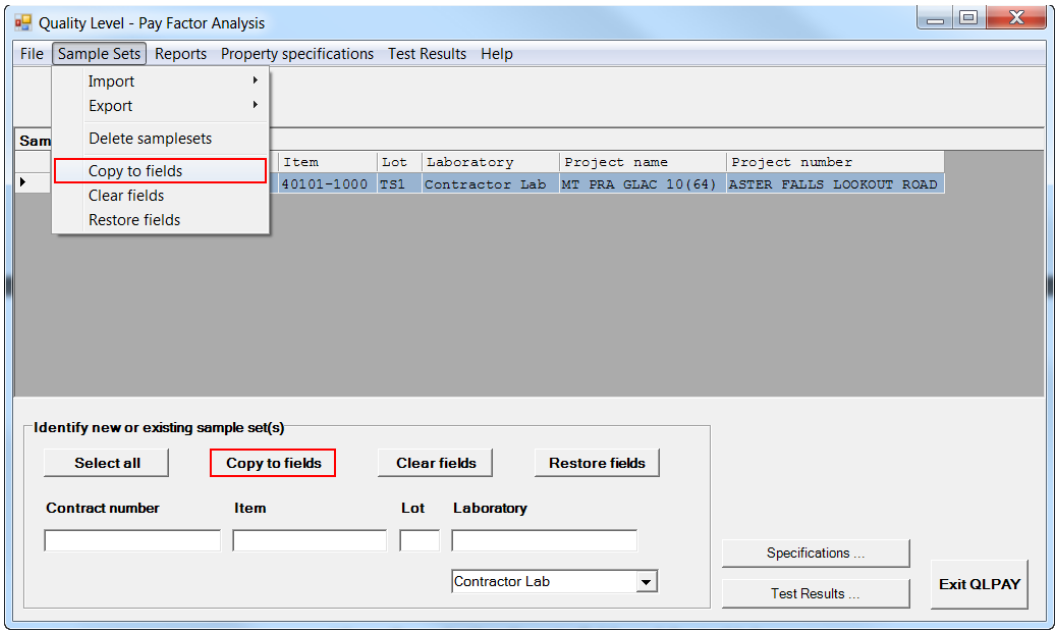
Note: *Depending on the project circumstances and timing, it may be difficult and/or unwarranted to obtain verification from a second lab prior to starting full production.*

a. From the home screen of the QL-PAY program, press the “Clear Fields” button located in the “Identify New or Existing Sample Set(s)” box or in the “Sample Sets” drop down menu. This is shown on the following page.



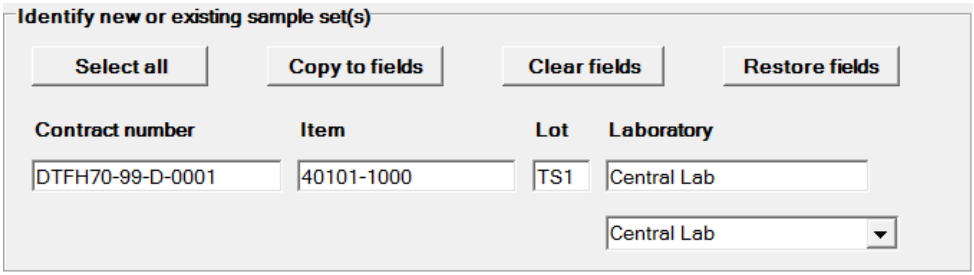
Operating the clear fields function.

b. Highlight the sample set to create a secondary lab and select the "Copy to Fields" button or in the "Sample Sets" drop down menu. This will copy the project information to be used for the new sample set.



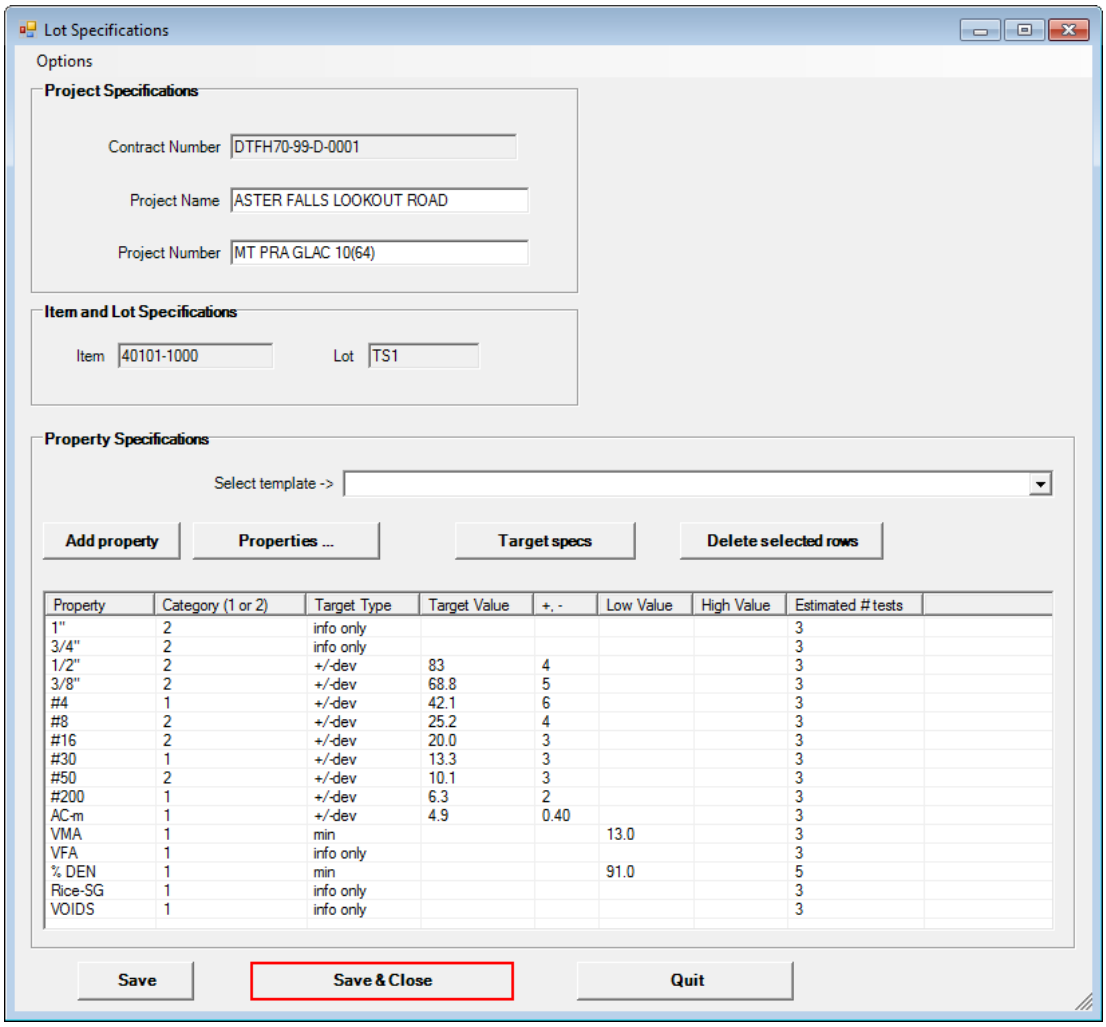
Select copy to fields after highlighting sample set.

c. In the "Laboratory" drop down menu, choose "Central Lab." This is shown on the following page.



View after selecting Copy to fields and Central Lab.

d. Click on "Specifications." The specifications should be identical to the original sample set. Once the property specifications have been reviewed for accuracy, select "Save and Close."



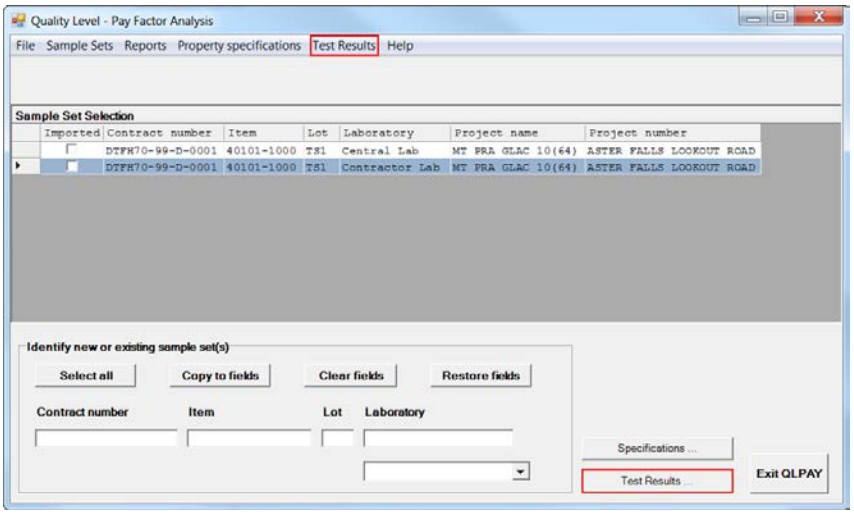
View of copied target specifications for the Central Lab.

e. QL-PAY is now set up to handle all of the 40101 sampling and testing for the project.

E. Entering Test Results

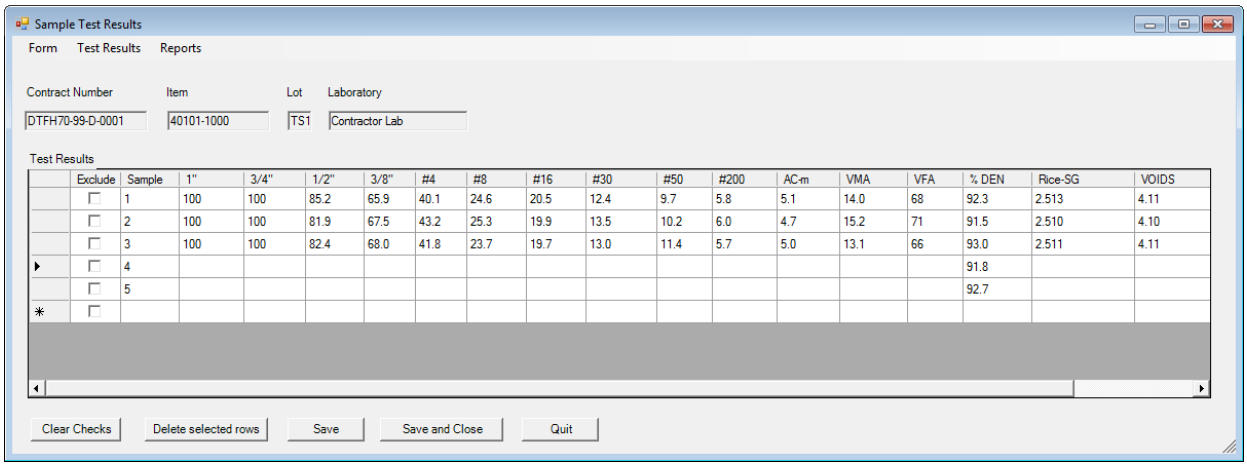
a. Highlight the sample set that the user has test results for.

b. Select the “Test Results” button at the lower right of the window or the “Test Results” drop down menu.



Locations that can be selected to enter test results.

c. Begin entering the test result data, starting with Sample #1. Make sure to include consecutive sample numbers when entering in the test result data, i.e. 1,2,3,4, etc.



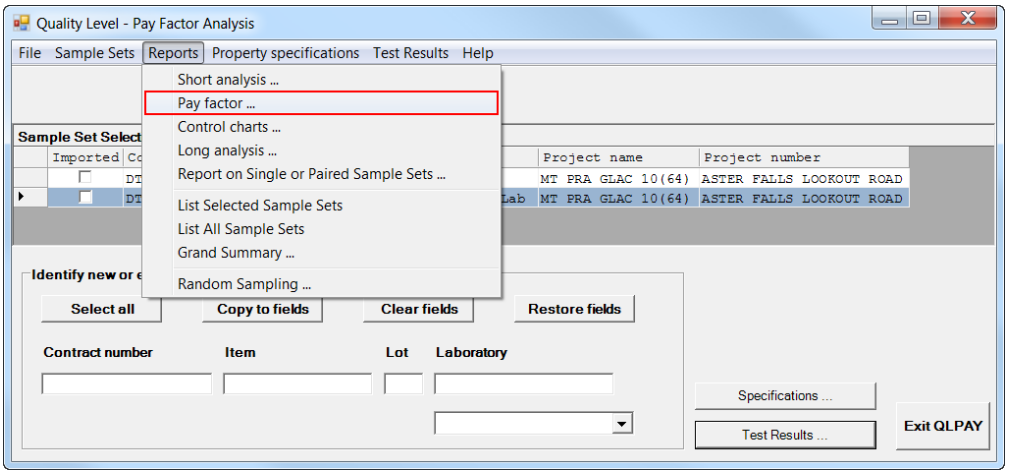
View of consecutive test results being entered.

d. Three test results are needed before a statistical analysis can be computed.

e. When entering test results for the central lab on split samples, make sure the test numbers match the corresponding contractor test result sample number or the analysis will not be valid.

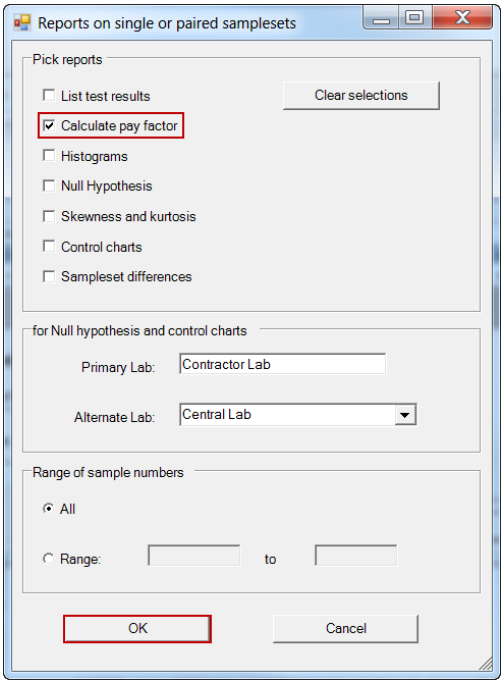
F. Calculating Pay Factor

a. Highlight the sample set for the contractor's lab and select the "Pay factor" under the reports drop down menu.



Selecting the pay factor report for the contractor's lab.

b. The reports menu will appear. By selecting the "Pay factor" report, the "Calculate pay factor" button should already be checked. If not, select only the pay factor button and then select "OK." See the next page for the pay factor report selection.



Pay factor report selection.

c. QL-PAY will produce a PDF report calculating the pay factor for the test results that have been entered under the sample set. When the estimated number of tests have been completed, QL-PAY will note that the testing has been completed and the final pay factor value.

The view below shows the final pay factor for the control strip on Aster Falls Lookout Road. When multiple quality characteristics are being evaluated, the lowest pay factor of the individual characteristics is the controlling pay factor. This is shown on the following page on the pay factor printout. The quality characteristics have a 1.00 and 1.01 for the pay factors in each category, thus the 1.00 is used for the overall final pay factor for the item.

Note: *The "Calculate Pay Factor" report was selected for example purposes only. For more information on other available reports see* ***Section 4 Reports.***

Western Federal Lands Highway Division

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: MT PRA GLAC 10(64)
Project ID: DTFH70-99-D-0001

Item Number: 40101-1000
Lot Number: TS1
Lab: Contractor Lab

Quality Levels and Pay Factors

Quality Characteristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
1"	info		100.00	0.000	---	---
3/4"	info		100.00	0.000	---	---
1/2"	83.00	+,- 4	83.17	1.779	100	1.00
3/8"	68.80	+,- 5	67.13	1.097	100	1.00
#4	42.10	+,- 6	41.70	1.552	100	1.01
#8	25.20	+,- 4	24.53	0.802	100	1.00
#16	20.00	+,- 3	20.03	0.416	100	1.00
#30	13.30	+,- 3	12.97	0.551	100	1.01
#50	10.10	+,- 3	10.43	0.874	100	1.00
#200	6.30	+,- 2	5.83	0.153	100	1.01
AC-m	4.90	+,- 0.40	4.93	0.208	100	1.01
VMA	13.00	min	14.10	1.054	86	1.00
VFA	info		68.33	2.517	---	---
% DEN	91.00	min	92.26	0.619	100	1.01
Rice-SG	info		2.511	0.002	---	---
VOIDS	info		4.11	0.006	---	---

TESTING COMPLETED
FINAL PAY FACTOR: 1.00

Pay factor report with item receiving contract price.

7.3. Section 401
Asphalt Concrete Pavement by Gyratory Mix Design Method – Full Production
Example

7.3. Section 401 Asphalt Concrete Pavement by Gyratory Mix Design Method – Full Production Example

This example will go through the process of setting up the sample sets for the main production of 401 Asphalt Concrete Pavement, Gyratory Mix.

TASK ORDER AWARD

Contract No. DTFH70-99-D-0001

Solicitation No. DTFH70-08-R-00021

River Contractors, Inc.
P.O. Box 223
West Glacier, MT 59936

MT PRA GLAC 10(64)
ASTER FALLS LOOKOUT ROAD

AWARD DATE: March 10, 2015

Pay Item No.	Item	Quantity	Unit	Unit Price	Amount
40101-1000	**Asphalt Concrete Pavement, Gyratory Mix, ¾" Nominal Max. Size Aggregate, 0.3 to < 3 Million ESAL**	**18,000**	**TON**	**$138.00**	**$2,484,000.00**

Example Section 401. — ASPHALT CONCRETE PAVEMENT BY GYRATORY MIX DESIGN METHOD

Material

401.02 Conform to the following Subsections:

Antistrip additive	702.05
Asphalt binder	702.01
Asphalt concrete aggregate	703.07
Mineral filler	725.05

401.17 Acceptance. See Table 401-8 for sampling, testing, and acceptance requirements.

Aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

Mineral filler, antistrip additives, and WMA additives will be evaluated under Subsections 106.02 and 106.03.

Asphalt content, VMA, and core density will be evaluated under Subsection 106.05. Pavement roughness will be evaluated under Subsection 106.04. Asphalt binder will be evaluated under Subsections 106.03 and 106.04. Evaluations will consider the following:

(a) Asphalt content. The upper and lower specification limits are the approved JMF target value plus or minus 0.4 percent;

(b) VMA. The lower specification limit is the value shown in Example Table 401-1. After the JMF has been verified according to Subsections 401.03 and 401.12, use the Contractor's combined coarse and fine bulk specific gravity of aggregate G_{sb} values to calculate VMA on field produced asphalt concrete mix samples;

(c) Density(core). The lower specification limit is 91.0 percent of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209.

The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day;

(d) Pavement roughness. The evaluation for pavement will be made after all defective areas are addressed. See Subsection 401.16(g); and

(e) Asphalt binder. The pay factor is determined from Table 401-7.

Construction of the HMA or WMA pavement course will be evaluated under Subsections 106.02 and 106.04.

Example Table 401-1
Gyratory Asphalt Concrete Mix Design Requirements, AASHTO R 35

Design ESAL (Million)	Gyratory Compaction Level (% Theoretical Maximum Specific Gravity, G_{mm}) AASHTO T 312			Minimum Voids-in-the Mineral Aggregate (VMA), %					Voids Filled with Asphalt (VFA), %	Dust-to-Binder Ratio	Minimum Tensile Strength Ratio, AASHTO T 283
				Nominal Maximum Size Aggregate							
	$N_{initial}$	N_{design}	N_{max}	1 inch (25mm)	¾ inch (19mm)	½ inch (12.5mm)	⅜ inch (9.5mm)	#4 sieve (4.75 mm)			
< 0.3	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	12.0–15.0	13.0-16.0	14.0-17.0	15.0-18.0	-	70.0 - 80.0	0.8 -1.6	0.80
0.3 to < 3	7 (≤90.5%)	75 (96.0%)	115 (≤98.0%)						65.0 - 78.0		
3 to 30	8 (≤89.0%)	100 (96.0%)	160 (≤98.0%)						65.0 - 78.0		
-	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	-	-	-	-	16.0 -19.0	76.0 – 80.0	0.6 – 2.0	

Example Table 401-8
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Production									
Asphalt concrete pavement	Statistical (106.05)	Asphalt content	I	AASHTO T 308	1 per 700 tons (650 metric tons)	Behind the paver before compaction	Yes	6 hours	-
		VMA	I	AASHTO R 35	"	"	"	"	-
		Density	I	AASHTO T 166	"	In-place after compacting	"	24 hours	Deliver cores to CO after testing is completed
	Measured and tested for conformance (106.04)	Placement temperature	-	-	First load and as determined by CO thereafter	Hauling vehicle before dumping, or windrow before pickup	No	Immediately upon completion of measurement	-
		Maximum specific gravity	-	AASHTO T 209	Minimum 1 per day	Behind the paver before compaction	Yes	24 hours	-
Asphalt binder (702.01)	Measured and tested for conformance (106.04)	Quality	See Table 401-7	AASHTO M 320	1 per 2000 tons (1800 metric tons) of mix	In line between tank and mixing plant	Yes, 2 1-quart (1-liter) samples	-	Test by Government

Example Table 401-7
Asphalt Binder Pay Factor Table

Tests on Original	Specifications	Pay Factor =					
		1.01	**1.00**	**0.95**	**0.90**	**0.75**	**Reject**
Dynamic shear rheometer, kPa	≥ 1.00	≥ 1.17	1.16 - 1.00	0.99 - 0.89	0.88 - 0.77	0.76 - 0.50	< 0.50
Tests after Rolling Thin Film Oven (RTFO)							
Dynamic shear rheometer, kPa	≥ 2.20	≥ 2.69	2.68 - 2.20	2.19 - 1.96	1.95 - 1.43	1.42 - 1.10	< 1.10
Tests on Pressure Aging Vessel (PAV)							
Dynamic shear rheometer, kPa	≤ 5,000	4,711 ≤	4,712 - 5,000	5,001 - 5,289	5,290 - 5,578	5,579 - 5,867	> 5,867
Bending beam rheometer, s, MPa	≤ 300	≤ 247	248 - 300	301 - 338	339 - 388	389 - 449	≥ 450
Bending beam rheometer, m-value	≥ 0.300	≥ 0.320	0.319 - 0.300	0.299 - 0.294	0.293 - 0.278	0.277 - 0.261	< 0.261

U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway

WORKSHEET FOR SUPERPAVE ASPHALT CONCRETE MIX DESIGN
AASHTO R 35

Project: MT PRA GLAC 10(64) Date: 3/15/2015

Contractor: River Contractors, Inc. Nominal Maximum Aggregate Size, in: 3/4"

Asphalt supplier: Hot Rock Asphalt Grade of asphalt: 58-34

Sources for: Aggregates: Snow Pack Quarry Mineral filler: Graymont Lime

Testing laboratory name: Slate Testing Phone:

Testing performed by: Mya Mixer

Testing reported by: Mya Mixer

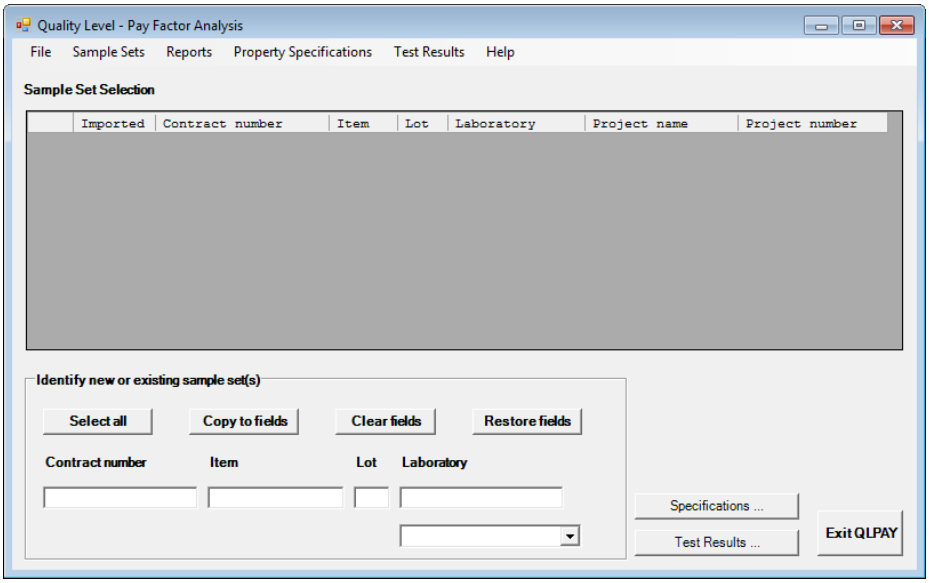
☑ English ☐ Metric **SUMMARY OF THE PROPOSED JOB-MIX-FORMULA**

1. Number of gyrations (N_{ini}/ N_{des}/ N_{max})	7/75/115	10. Specific gravity of binder (G_b)	1.024
2. Percent binder by mass of total mix (P_b)[1]	4.90	11. Recommended plant mixing temperature,°F (Attach Temperature Viscosity Curve)	309-324
3. Percent binder by mass of aggregate	5.14	12. Percent compaction at N_{max}	97.9
4. Air voids (V_a) at N_{des}	4.0	13. Hveem stabilometer value (If specified)	
5. Voids in mineral aggregate (VMA) at N_{des}	13.4	14. Moisture Susceptibility:	AASHTO T 283
6. Voids filled with asphalt (VFA) at N_{des}	70.4	a. Dry strength, psi	485.4
7. Maximum unit mass (G_{mm})	2.508	b. Wet strength, psi	438.0
8. Effective specific gravity of aggregate (G_{se})	2.710	c. Index of Retained Strength, %	90.20
9. Dust-to-Binder Ratio (DP)	1.6		

Is RAP included in Mix Design? ☐ Yes ☑ No

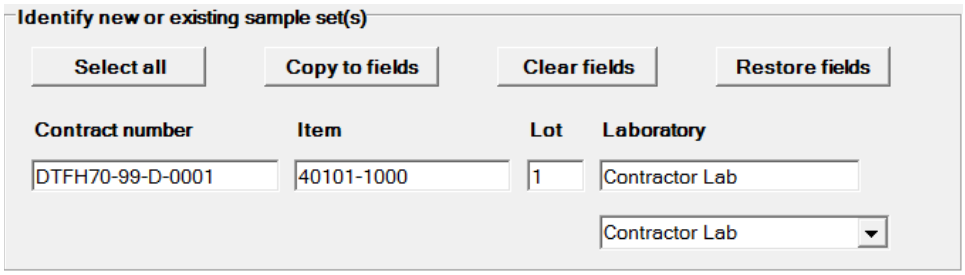
GRADATION TARGET VALUES AND ALLOWABLE DEVIATIONS			SPECIFIC GRAVITY AND ABSORPTION			
Sieve Sizes	Job Mix Formula Target Value[2]	Allowable Deviation[3] %		Fine Aggregate (AASHTO T 84)	Coarse Aggregate (AASHTO T 85)	Combined Aggregate
3/4 inch	99.5					
1/2 inch	83.0	4	Bulk SG (G_{sb})	2.608	2.669	2.643
3/8 inch	68.8	5				
No. 4	42.1	6	Bulk SSD SG	2.629	2.692	2.665
No. 8	25.2	4				
No. 16	20.0	3	Apparent SG (G_{sb})	2.662	2.732	2.703
No. 30	13.3	3				
No. 50	10.1	3	Absorption	0.80 %	0.90 %	0.86 %
No. 200	6.3	2				

Example 401 Superpave Hot Asphalt Concrete Mix Design.



Initial view when opening QL-PAY.

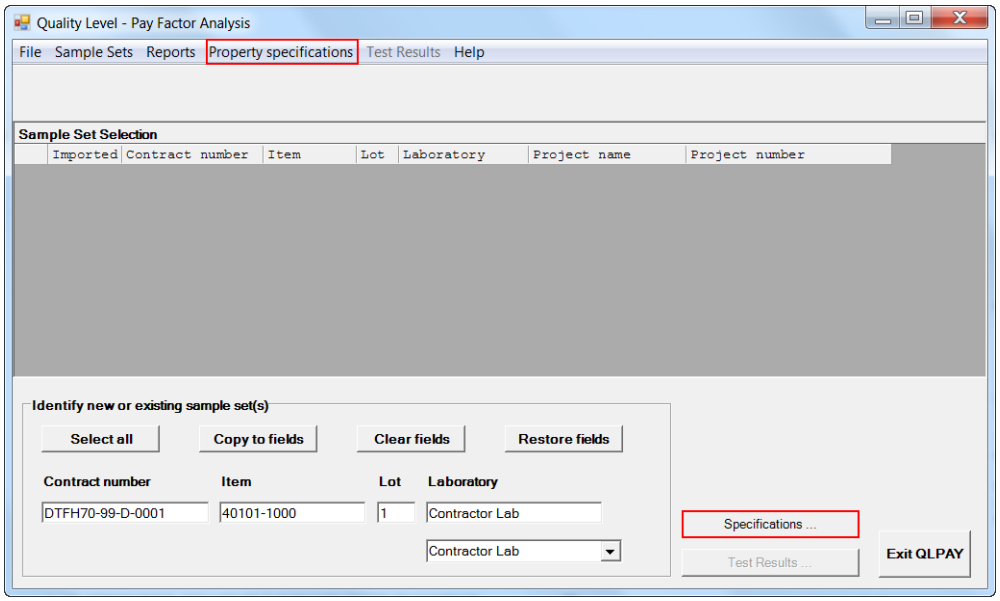
A. Enter data in the "Identify New or Existing Sample Set" fields
   a. Contract Number: This can be found on the front cover of the contract. For this example it is DTFH70-99-D-0001.
   b. Item: Place the Item Number in this field. This example will begin with 401 Asphalt Concrete Pavement, Gyratory Mix (40101-1000).
   c. Lot: Generally speaking, there is only one lot for each item; therefore, the full production sample sets will always begin with Lot "1."
   d. Laboratory: Determine the lab the user will be using for the test results. Typically, there will be a "Central Lab" and "Contractor Lab" sample set for each item.



View after entering data into the sample set box.

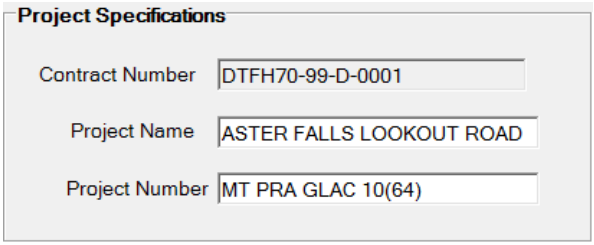
B. Specifications

a. Click on “Specifications.”



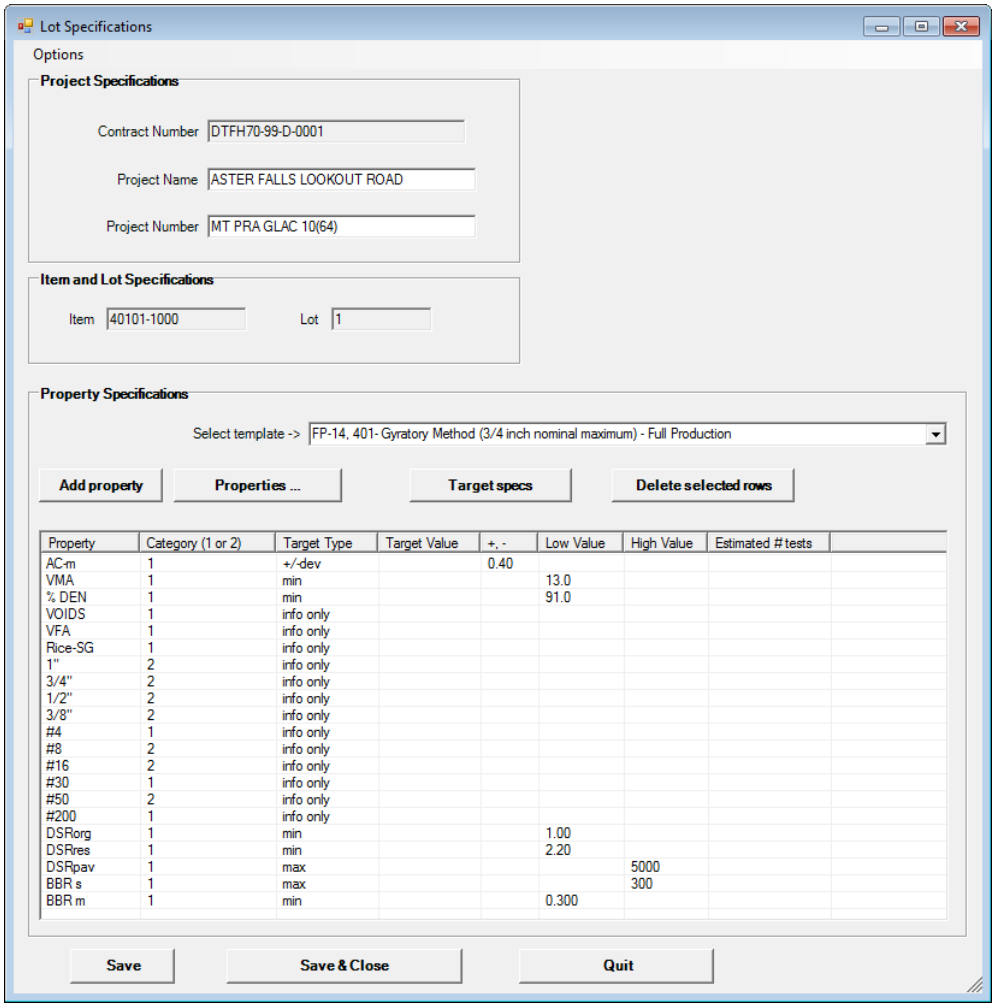
Selecting property specifications.

b. Enter the Project Name and Number from the contract cover page into the corresponding fields.



Project Name and Number under the specifications window.

c. Select the appropriate template from the drop down menu under “Property Specifications.” For this example, choose FP-14, 401 – Gyratory Method (3/4 inch nominal maximum) – Full Production. By selecting this template, the majority of the specification has already been entered into the program and only minor changes will need to be completed. The screen view of the template selection is shown below page.

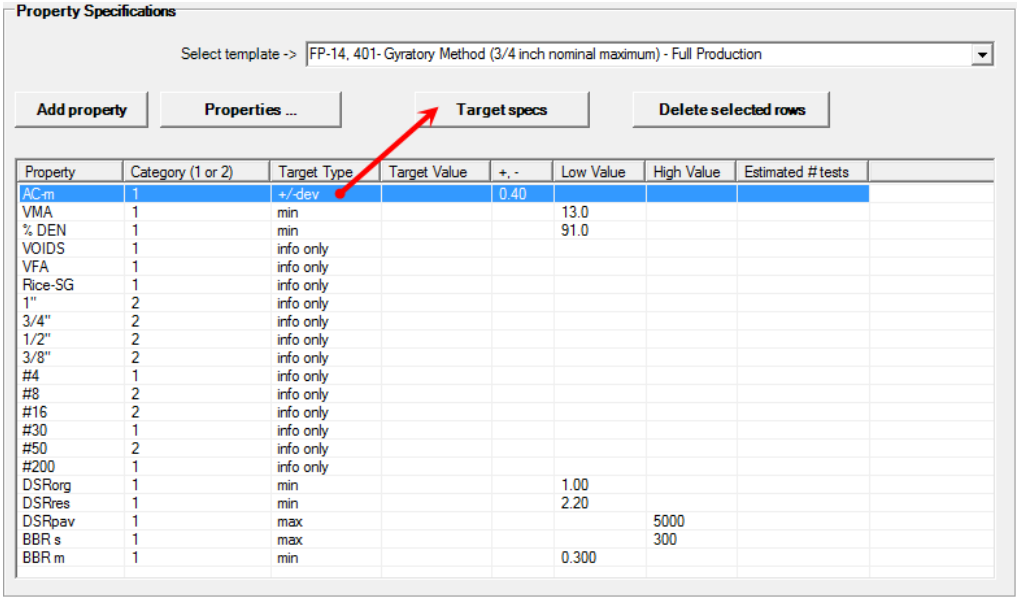


View after entering project name and number and selecting the template.

C. Adjusting Property Specifications to Match Contract

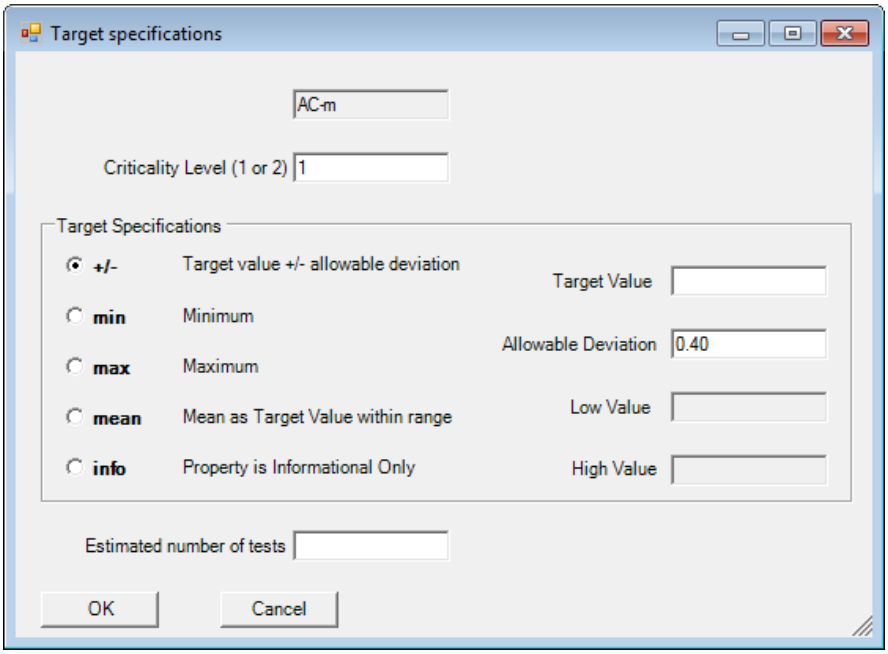
a. After opening the specifications dialog box and selecting a template, the Sampling, Testing, and Acceptance Requirements along with information from the asphalt mix design will be needed to finish inputting the correct data.

b. To adjust the properties, highlight the property in the lower table to adjust and click on the “Target Specs” button. This will bring up a new window to enter the testing parameters for the particular property. Determine the testing parameters for each property and select the appropriate target specifications, i.e. min, max, etc.



Highlight the property and select Target Specs.

In this example, highlight the "AC-m" property in the lower table and select "Target Specs." Each field that is not grayed out will need to be filled in with data from either the sampling and testing specification, material specification or the mix design.

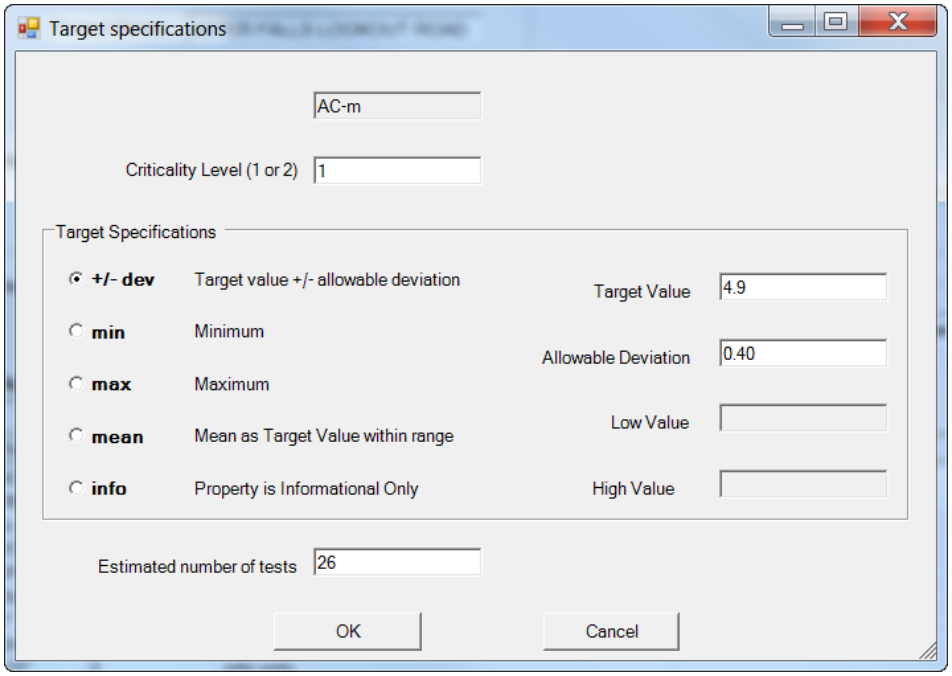


View of the target specifications window.

i. The criticality level is found in Example Table 401-8 under category. Asphalt Content is a category 1.

ii. The target specification for asphalt content is +/- dev. The allowable deviation can be found in Subsection 401.17 Acceptance within the Asphalt Concrete Pavement by Gyratory Mix Design Method specification. The target value will be the value stated in the mix design. In this case, using the mix design and 401.17, the target value is 4.9 and the allowable deviation is 0.4.

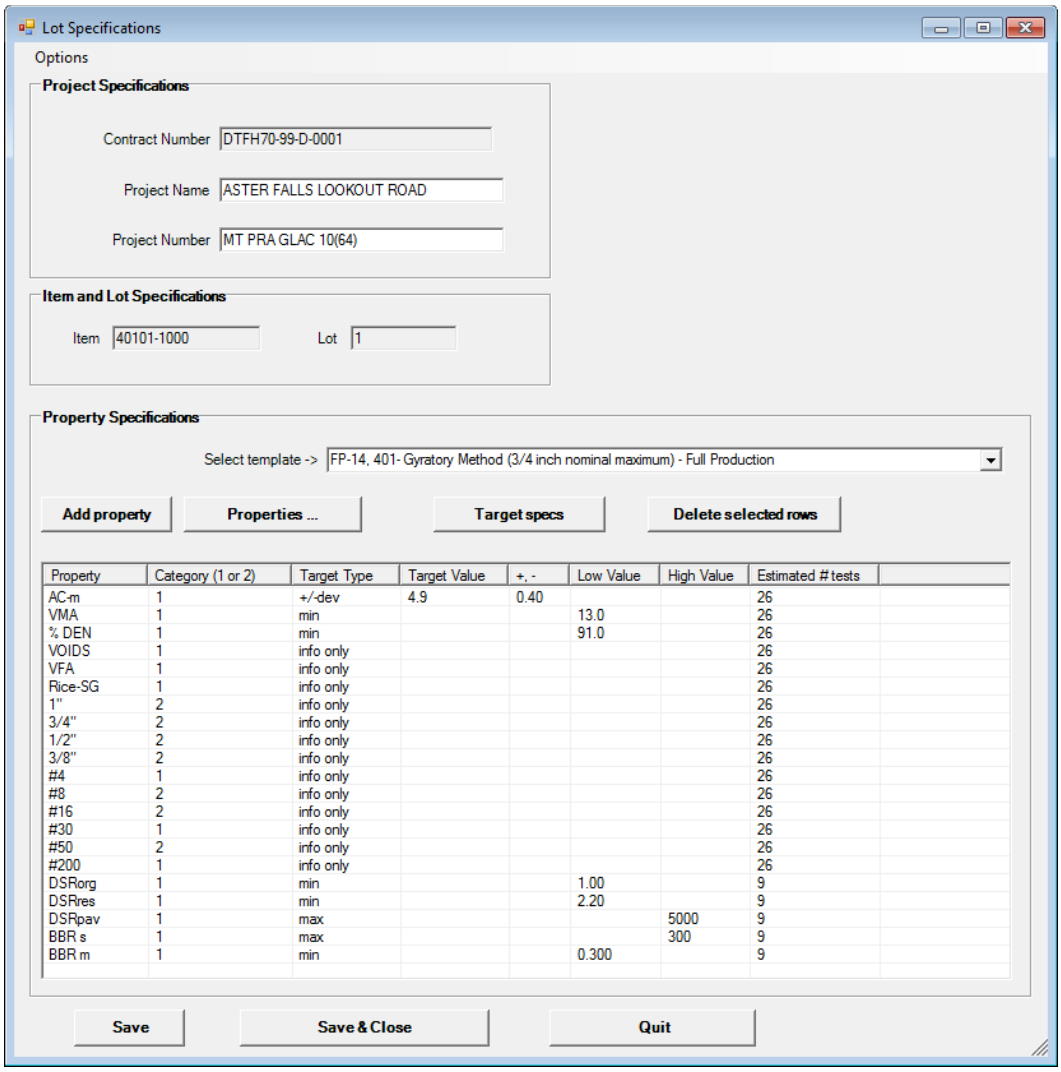
c. The estimated number of tests needs to be the actual number of tests that will be taken throughout the project. This number can be changed at a later date if the number of tests increases or decreases, but the final number of tests taken should be reflected under each property at the completion of the item. To determine the number of tests, divide the contract quantity for the item by the sampling frequency and use that value for all of the estimated number of tests. For this example, the contract requires 18,000 tons and the sampling frequency is 1 per 700 tons (from Example Table 401-8); therefore, the estimated number will be 26 tests for this project.



AC-m entered target specs.

d. After the target specifications are entered, click "OK" and proceed to adjusting the remainder of the properties.

e. The Asphalt Binder is tested at a frequency of 1 per 2000 tons of mix (Example Table 401-8). For this example, the contract requires 18,000 tons; therefore, the estimated number will be 9 binder tests for this project. Once all of the properties have been adjusted for the full production, the screen should be identical to the view on the following page.

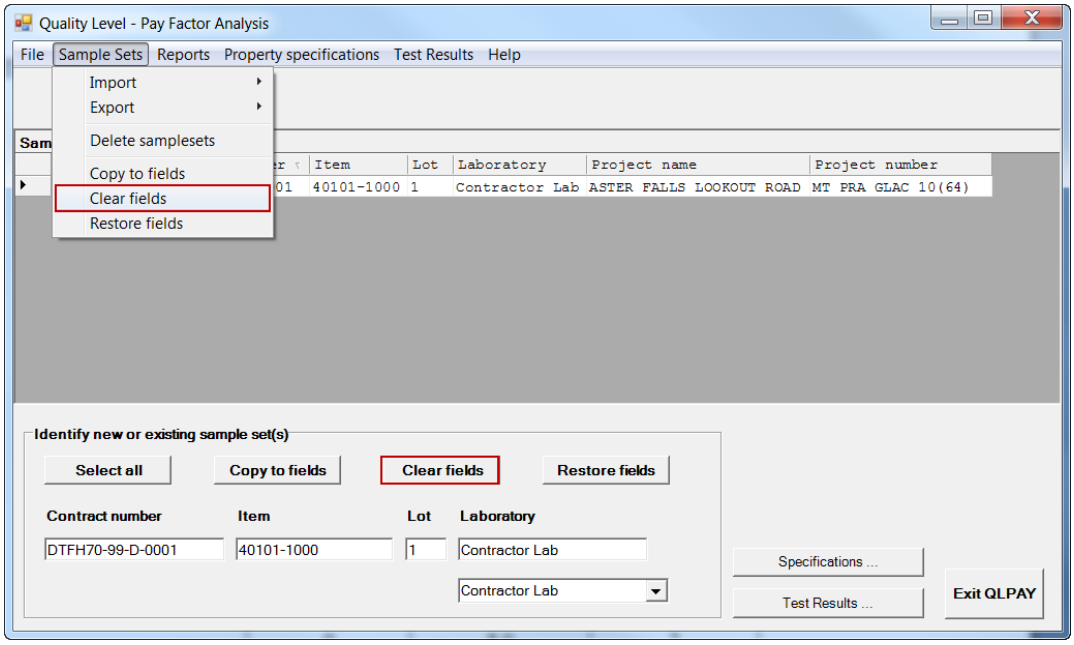


View of completed full production target specifications.

f. When finished entering all of the properties, click “Save and Close.” If the user presses “Quit,” none of the changes made to the specifications will be saved and it will resort back to the data that was entered prior to opening the specification set.

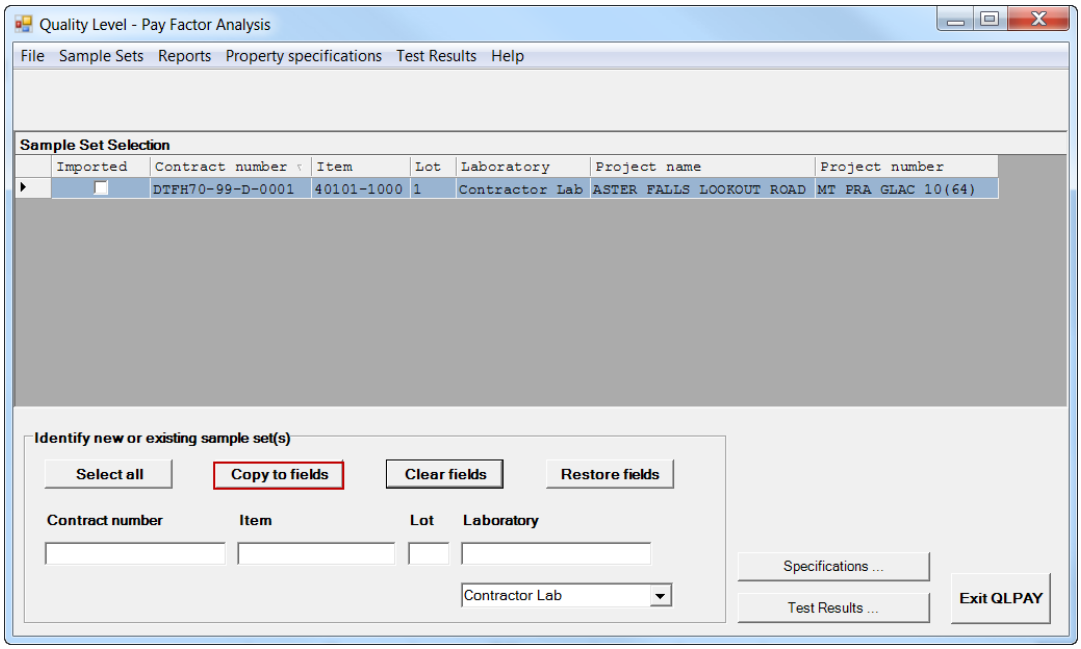
D. Creating a Secondary Lab Sample Set in the same Lot

a. From the home screen of the QL-PAY program, press the “Clear Fields” button located in the “Identify New or Existing Sample Set(s)” box or in the Sample Sets drop down menu.



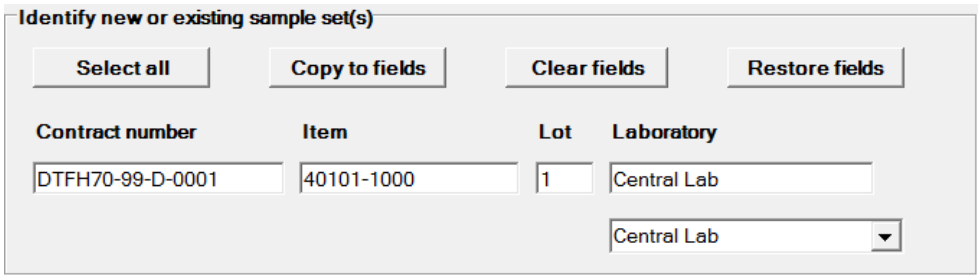
Operating the clear fields function.

b. Highlight the sample set to create a secondary lab and select the “Copy to Fields” button. This will copy the project information to be used for the new sample set.



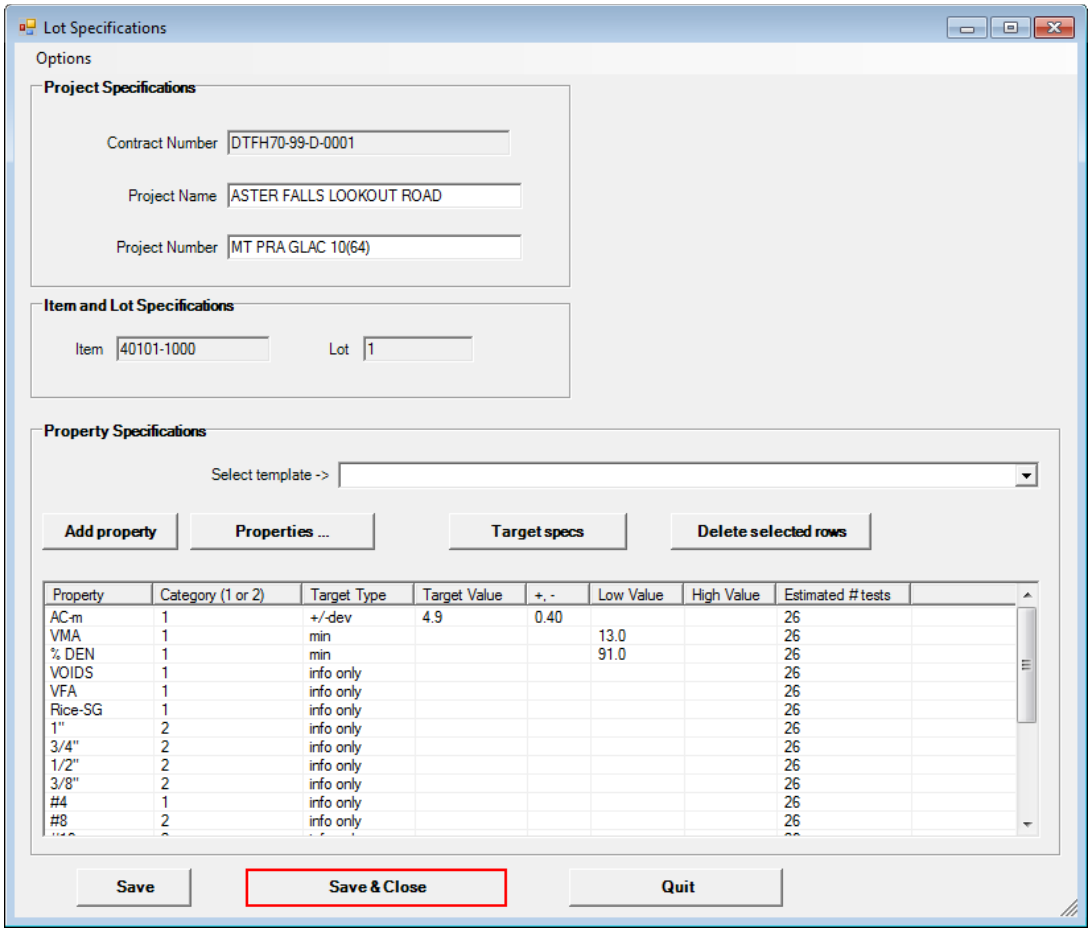
Select copy to fields after highlighting sample set.

c. In the “Laboratory” drop down menu, choose “Central Lab.”



View after selecting Copy to fields and Central Lab.

d. Click on “Specifications.” The specifications should be identical to the original sample set. Once the property specifications have been reviewed for accuracy, select “Save and Close.”



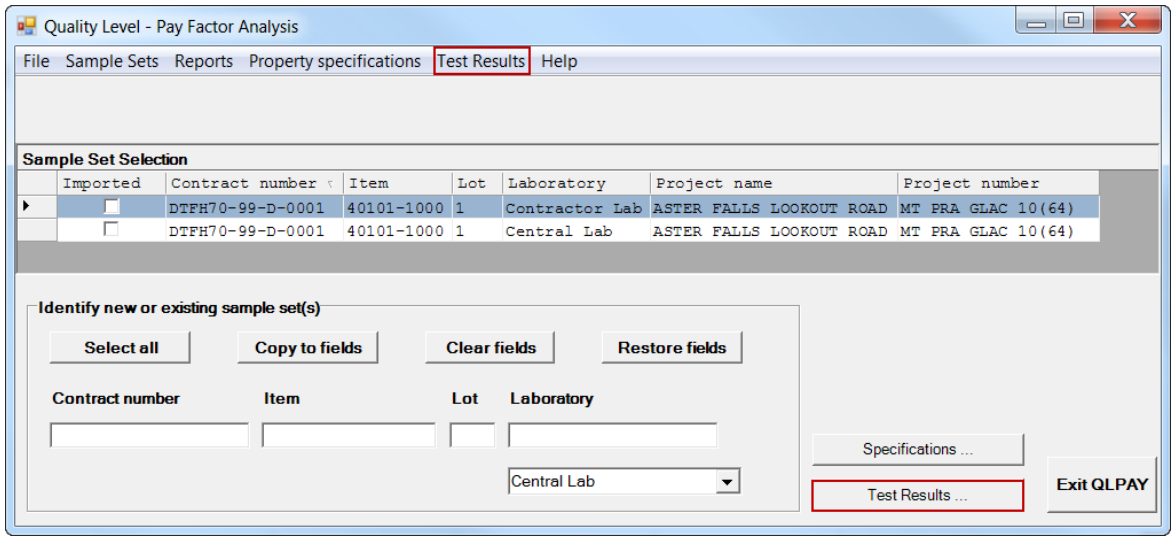
View of copied target specifications for the Central Lab.

e. QL-PAY is now set up to handle all of the 40101 sampling and testing for the project.

E. Entering Test Results

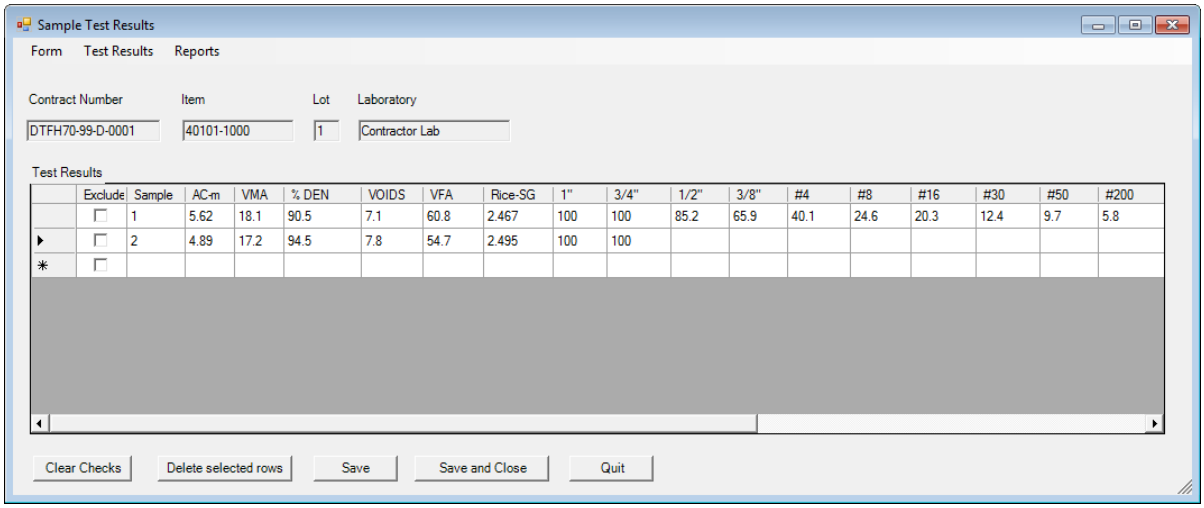
a. Highlight the sample set that the user has test results for.

b. Select the “Test Results” button at the lower right of the window or the “Test Results” drop down menu.



Locations that can be selected to enter test results.

c. Begin entering the test result data, starting with Sample #1. Make sure to include consecutive sample numbers when entering in the test result data, i.e. 1,2,3,4, etc.



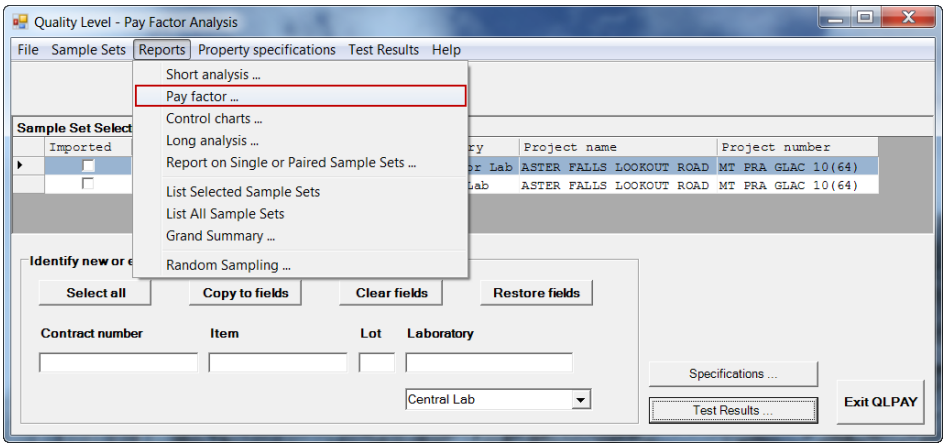
View of consecutive test results being entered.

d. Three test results are needed before a statistical analysis can be computed.

e. When entering test results for the central lab on split samples, make sure the test numbers match the corresponding contractor test result sample number or the analysis will not be valid.

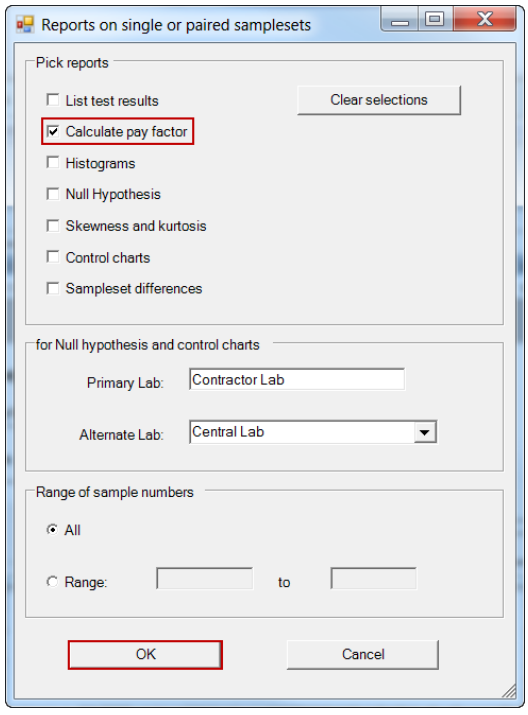
F. Calculating Pay Factor

d. Highlight the sample set for the contractor's lab and select the "Pay factor" under the reports drop down menu.



Selecting the pay factor report for the contractor's lab.

e. The reports menu will appear. By selecting the "Pay factor" report, the "Calculate pay factor" button should already be checked. If not, select only the pay factor button and then select "OK." See the next page for the pay factor report selection.



Pay factor report selection.

f. QL-PAY will produce a PDF report calculating the pay factor for the test results that have been entered under the sample set. When the estimated number of tests have been completed, QL-PAY will note that the testing has been completed and the final pay factor value.

The view below shows the final pay factor for Aster Falls Lookout Road. When multiple quality characteristics are being evaluated, the lowest pay factor of the individual characteristics is the controlling pay factor. This is shown on the following page on the pay factor printout. The quality characteristics have a 1.02, 1.05, and a 1.02 for the pay factors in each category, thus the 1.02 is used for the overall final pay factor for the item.

Note: *The "Calculate Pay Factor" report was selected for example purposes only. For more information on other available reports see* ***Section 4 Reports.***

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: MT PRA GLAC 10(64)
Project ID: DTFH70-99-D-0001

Item Number: 40101-1000
Lot Number: 1
Lab: Contractor Lab

Quality Levels and Pay Factors

Quality Characteristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
AC-m	4.90	+,- 0.40	5.03	0.203	91	1.02
VMA	13.00	min	15.98	1.270	100	1.05
% DEN	91.00	min	92.50	1.151	91	1.02
VOIDS	info		5.70	1.469	---	---
VFA	info		63.11	5.738	---	---
Rice-SG	info		2.482	0.009	---	---
1"	info		100.00	0.000	---	---
3/4"	info		100.00	0.000	---	---
1/2"	info		83.21	1.775	---	---
3/8"	info		68.31	1.582	---	---
#4	info		41.91	1.166	---	---
#8	info		25.11	1.767	---	---
#16	info		20.34	1.318	---	---
#30	info		13.42	1.120	---	---
#50	info		9.89	1.047	---	---
#200	info		6.29	0.423	---	---

TESTING COMPLETED
FINAL PAY FACTOR: 1.02

Pay factor report with item receiving a 2% bonus.

7.4. Section 552
Structural Concrete
Example

7.4. Section 552 Structural Concrete Example

This example will go through the process of setting up the sample sets for the sampling of 552 Structural Concrete.

TASK ORDER AWARD	Contract No. DTFH70-99-D-0001
_____ Solicitation No. DTFH70-08-R-00021	River Contractors, Inc. P.O. Box 223 West Glacier, MT 59936
MT PRA GLAC 10(64) ASTER FALLS LOOKOUT ROAD	AWARD DATE: March 10, 2015

Pay Item No.	Item	Quantity	Unit	Unit Price	Amount
55201-0800	**Structural Concrete, Class D (AE)**	**400**	**CUYD**	**$900.00**	**$360,000.00**

Example Section 552. — STRUCTURAL CONCRETE

552.20 Acceptance. See Example Table 552-9 for sampling, testing and acceptance requirements and the quality characteristic category.

Material for concrete will be evaluated under Subsections 106.02 and 106.03. Furnish production certifications with each shipment cementitious material.

The concrete mixture's slump, air content, density, and temperature will be evaluated under Subsections 106.02 and 106.04.

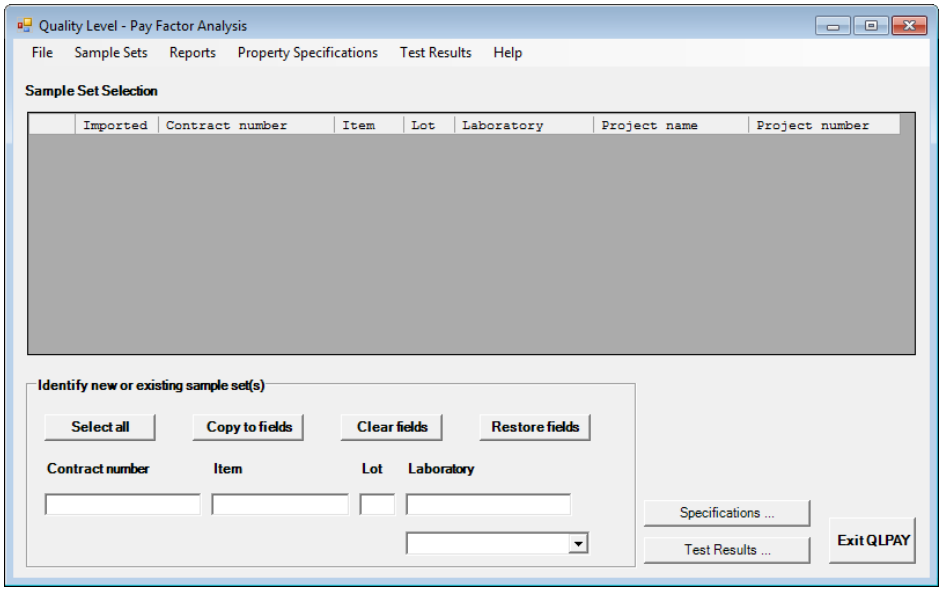
Concrete compressive strength will be evaluated under Subsection 106.05. The lower specification limit is the minimum required compressive strength at 28 days (f_c') specified in the contract. Remove and replace concrete represented by cylinders having a compressive strength less than 90 percent of the minimum 28-day strength (f'c).

Construction (including batching, placing, finishing, and curing concrete) of concrete structures will be evaluated under Subsections 106.02 and 106.04.

Falsework and forms will be evaluated under Section 562.

Example Table 552-9
Sampling, Testing, and Acceptance Requirements

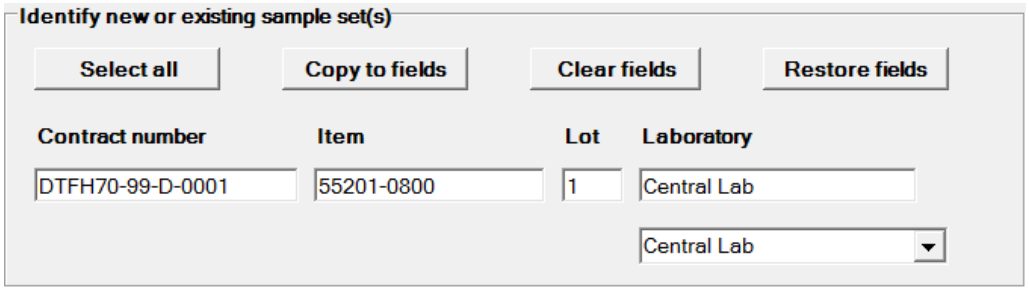
Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Concrete (552.09(b))	Measured and tested for conformance (106.04)	Density	-	AASHTO T 121	1 per load after at least 0.25 yd^3 (0.2m^3) is discharged	Point of discharge	No	Upon completing tests	-
		Air content	-	AASHTO T 152 or AASHTO T 196			No		-
		Slump	-	AASHTO T 119			No		-
		Temperature	-	Field measured			No		-
Concrete (552.09(b)	Statistical (106.05)	Compressive strength (28-day)	II	AASHTO T 23 & T 22	1 set per 30 yd^3 (25 m^3) but not less than 1 per day and not less than 5 sets total	Discharge stream at point of placing	Yes	28 days	Deliver verification cylinders to the CO or designated laboratory for scheduled testing



Initial view when opening QL-PAY.

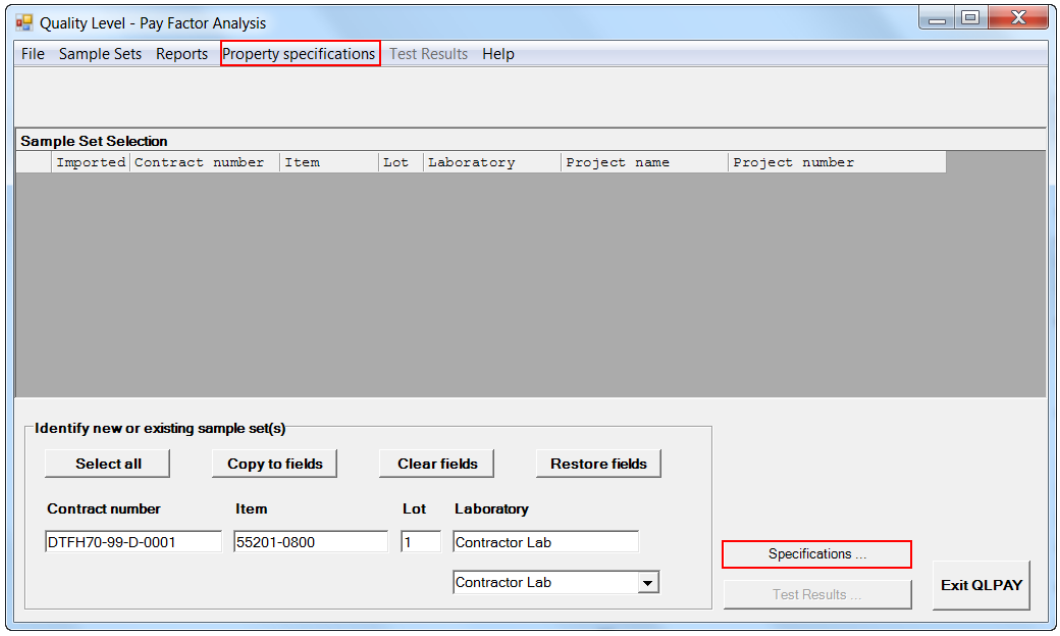
A. Enter data in the “Identify New or Existing Sample Set” fields.

a. Contract Number: This can be found on the front cover of the contract. For this example it is DTFH70-99-D-0001.
b. Item: Place the Item Number in this field. This example will begin with 552 Structural Concrete (55201-0800).
c. Lot: Generally speaking, there is only one lot for each item; therefore, the full production sample sets will always begin with Lot "1."
d. Laboratory: Determine the lab that will be providing the test results. Typically, there will only be one reporting laboratory for the structural concrete item. Determine from the contract who is responsible for testing the concrete cylinders for compressive strength. See Example Table 552-9 for the sampling and testing requirements.



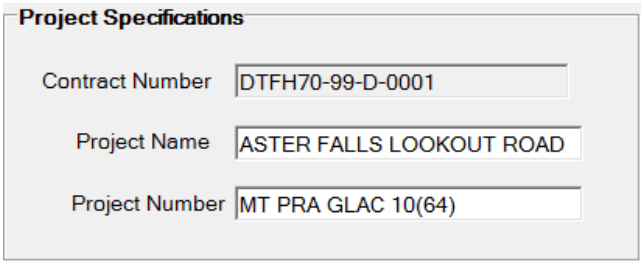
View after entering data into the sample set box.

B. Specifications
a. Click on "Specifications."



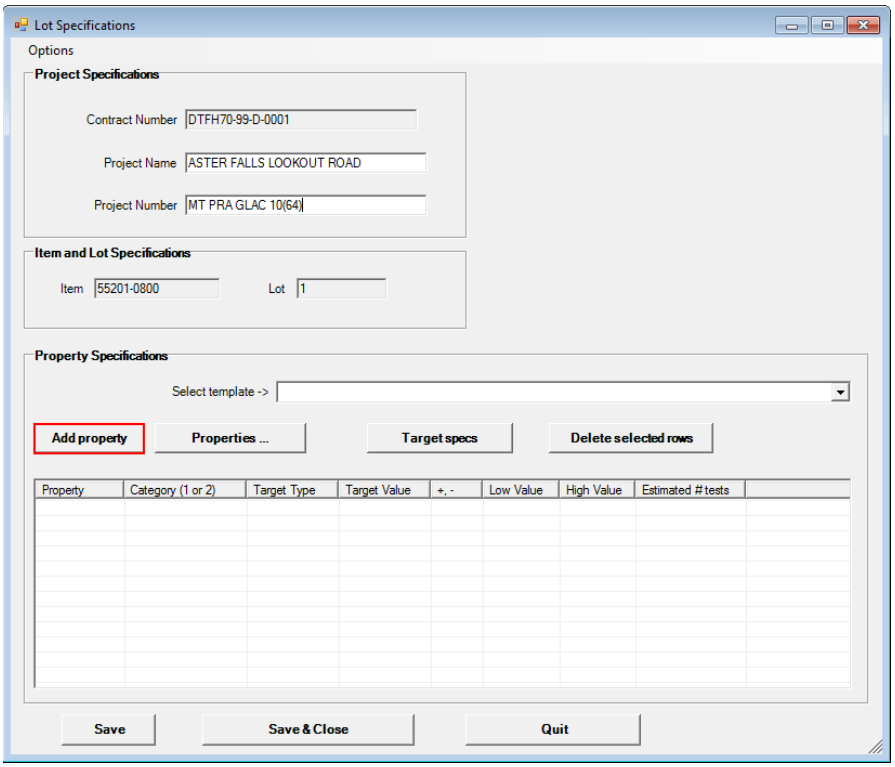
Selecting property specifications.

b. Enter the Project Name and Number from the contract cover page into the corresponding fields.



Project Name and Number under the specifications window.

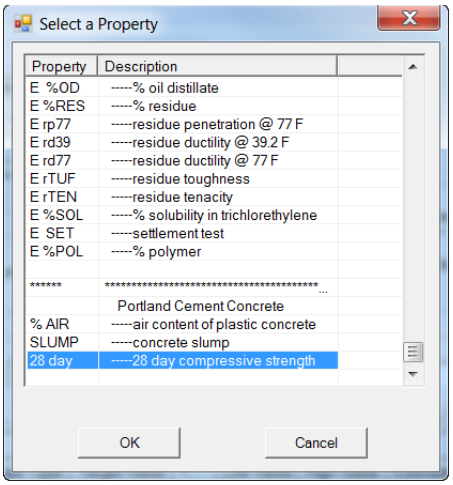
c. Since there is not a template created for structural concrete, click on the "add property" button under the "Property Specifications" section. See the next page for the "add property" location.



Add property tool under property specifications.

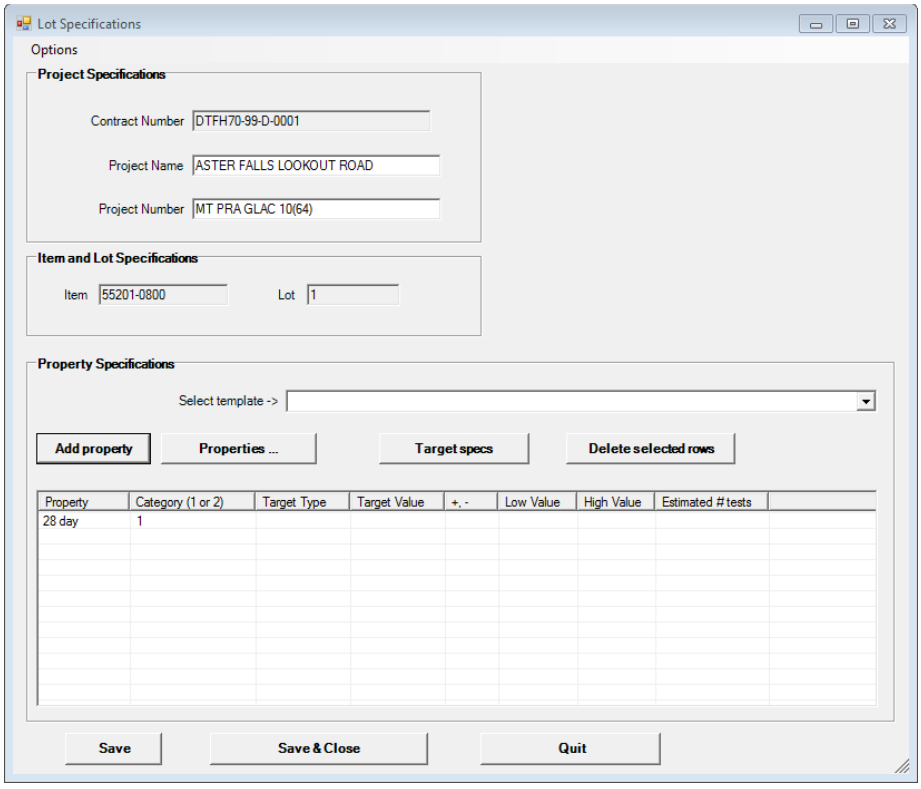
After reviewing the "Sampling, Testing, and Acceptance Requirements from Example Table 552-9," the only property that will be evaluated for 552 Structural concrete is the compressive strength.

In the "Select a Property window," scroll to the bottom of the window, select the "28 day" compressive strength property, and click "OK."



Selecting 28 day strength property.

The "28 day strength" property will now be displayed in the property specifications section.



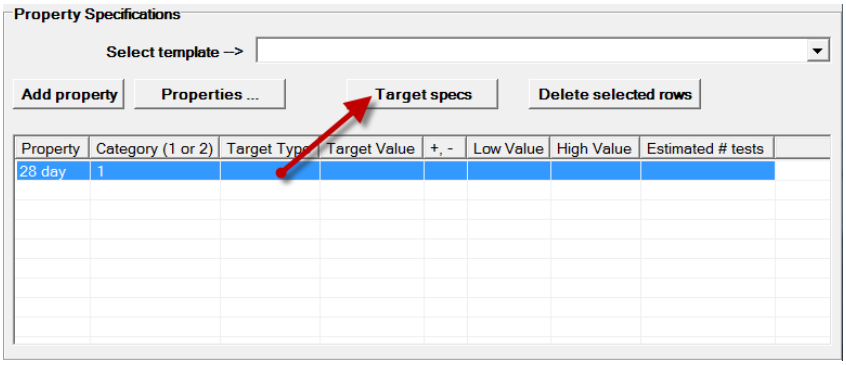
View after entering project name and number and selecting the properties.

C. Adjusting Property Specifications to Match Contract

a. After opening the specifications dialog box and selecting the properties, the Sampling, Testing, and Acceptance Requirements along with the concrete compressive strength from the contract will be needed to finish inputting the correct data.

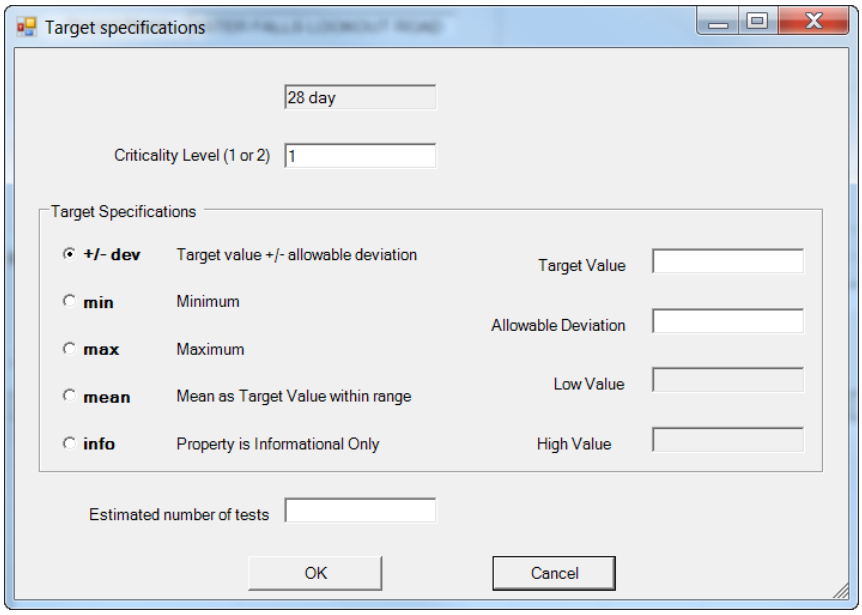
b. To adjust the properties, highlight the property in the lower table to adjust and click on the "Target Specs" button. This will bring up a new window to enter the testing parameters for the particular property. Determine the testing parameters for the property and select the appropriate target specifications, i.e. min, max, etc.

In this example, highlight the "28 day" property in the lower table and select "Target Specs." This is shown on the following page.



Highlight the property and select Target Specs.

Each field that is not grayed out will need to be filled in with data from either the sampling and testing specification or the contract.

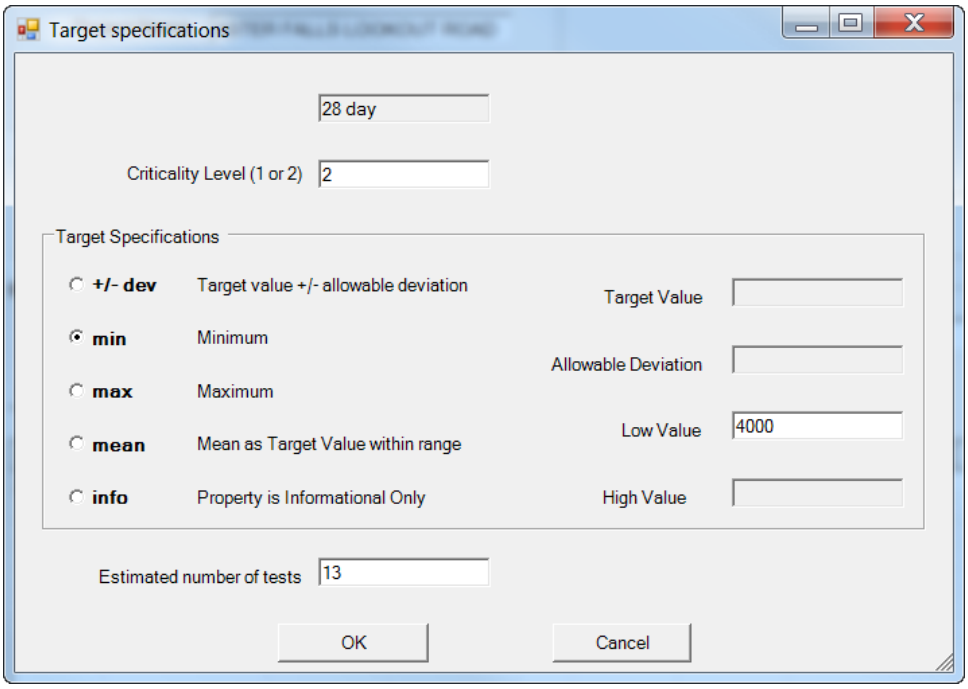


View of the Target Specifications window.

i. The criticality level is found in Example Table 552-9 under category. Compressive strength is a category 2.

ii. The target specification for compressive strength is “min.” When this button is selected the only changeable field in the target specifications subsection is the “low value.” The target value will be the value stated in the contract documents. In this case, using the contract, the minimum compressive strength is 4000 psi.

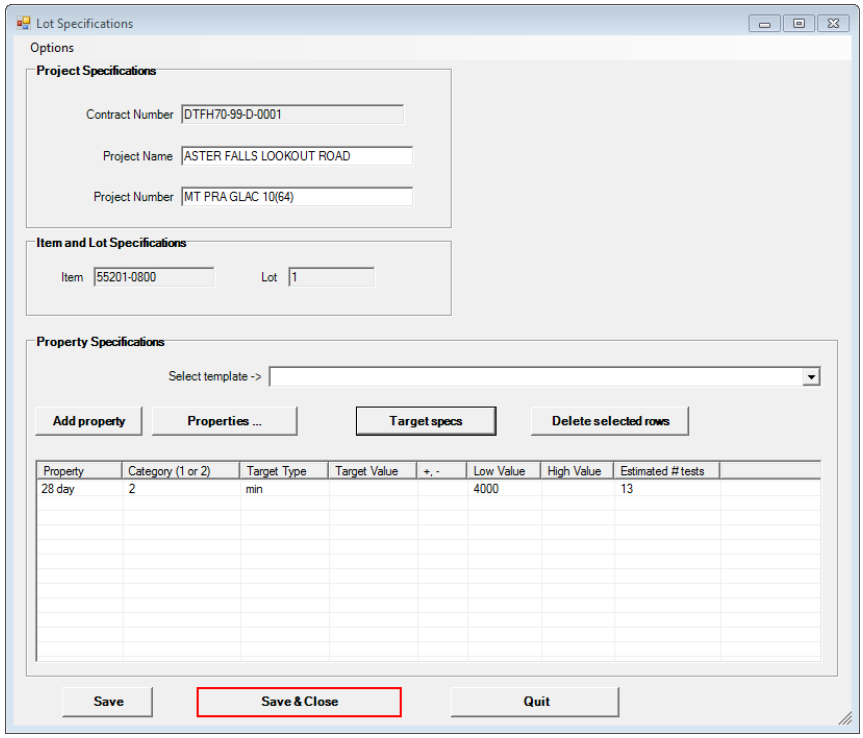
c. The estimated number of tests needs to be the actual number of tests that will be taken throughout the project. This number can be changed at a later date if the number of tests increases or decreases, but the final number of tests taken should be reflected under each property at the completion of the item. To determine the number of tests, divide the contract quantity for the item by the sampling frequency and use that value for all of the estimated number of tests. For this example, the contract requires 400 YD^3 and the sampling frequency is 1 per 30 YD^3 (from Example Table 552-9); therefore, the estimated number will be 13 tests for this project.



28 day entered target specifications.

d. After the target specifications are entered, click “OK.”

e. When finished entering all of the properties, click “Save and Close.” The completed property specifications window is shown on the next page.



Completed target specifications prior to selecting Save & Close.

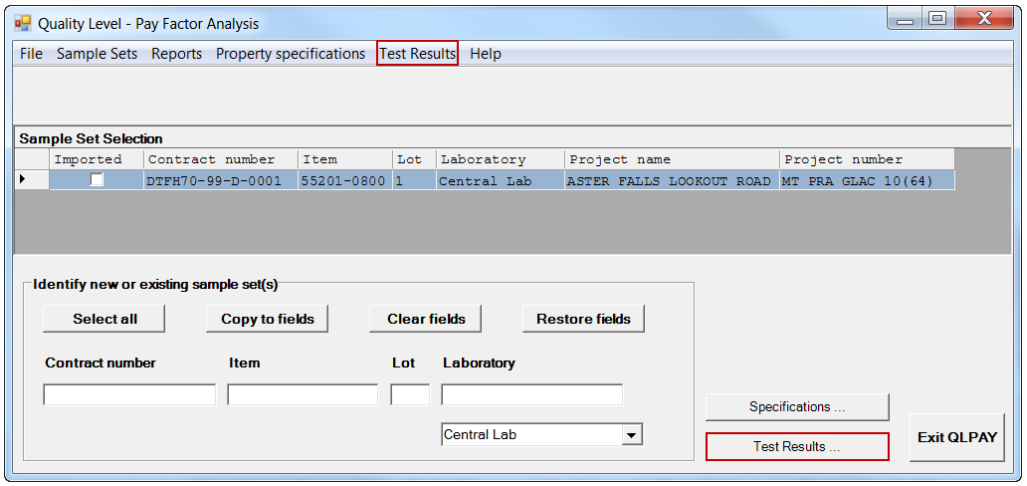
If the user presses "Quit," none of the changes made to the specifications will be saved and it will resort back to the data that was entered prior to opening the specification set.

f. QL-PAY is now set up to handle all of the 55201 sampling and testing for the project.

D. Entering Test Results

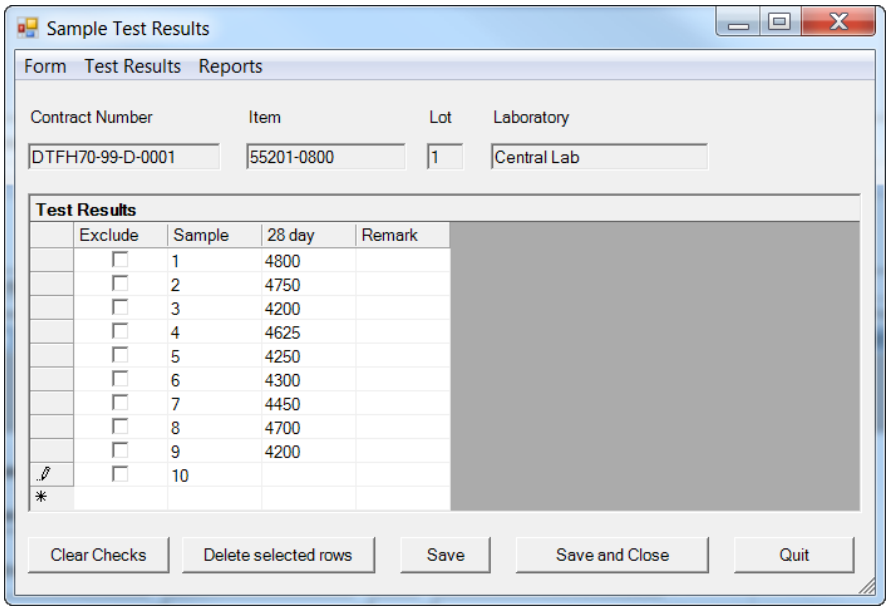
a. Highlight the sample set that the user has test results for.

b. Select the "Test Results" button at the lower right of the window or the "Test Results" drop down menu.



Locations that can be selected to enter test results.

c. Begin entering the test result data, starting with Sample #1. Make sure to include consecutive sample numbers when entering in the test result data, i.e. 1,2,3,4, etc.

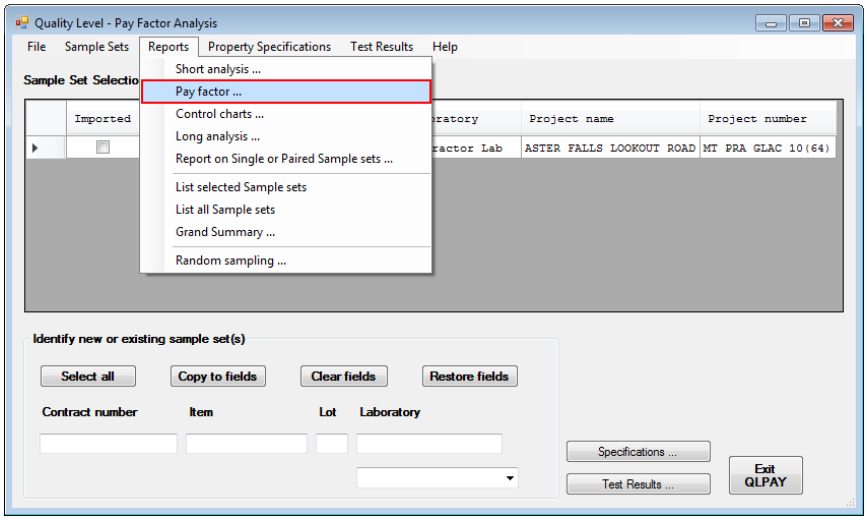


View of consecutive test results being entered.

d. Three test results are needed before a statistical analysis can be computed.

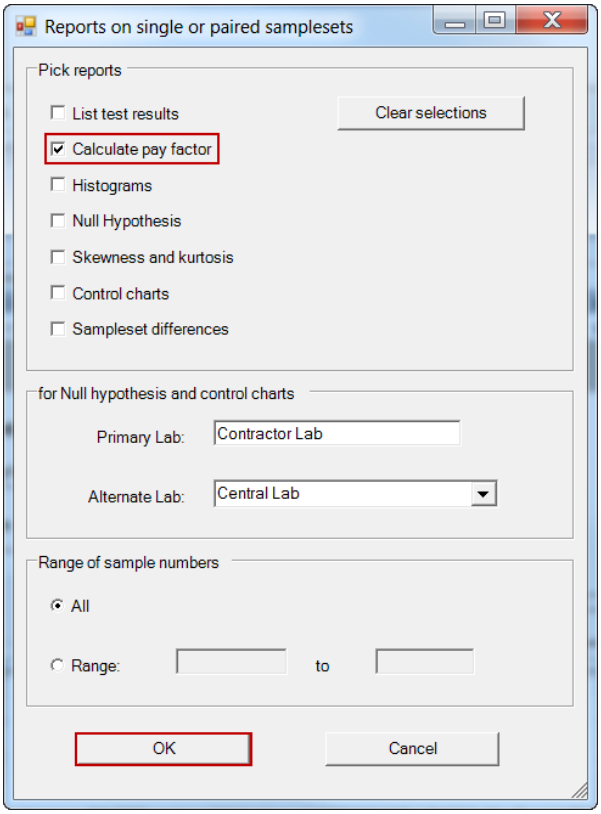
F. Calculating Pay Factor

a. Highlight the sample set for the contractor's lab and select the "Pay factor" under the reports drop down menu.



Selecting the pay factor report for the contractor's lab.

b. The reports menu will appear. By selecting the "Pay factor" report, the "Calculate pay factor" button should already be checked. If not, select only the pay factor button and then select "OK."



Pay factor report selection.

c. QL-PAY will produce a PDF report calculating the pay factor for the test results that have been entered under the sample set. When the estimated number of tests have been completed, QL-PAY will note that the testing has been completed and the what the final pay factor for the item is.

The view below shows the final pay factor for Aster Falls Lookout Road. When only using a category 2 property specification, the maximum pay factor is a 1.00 when the PWL is above 90. This is shown on the following page on the final pay factor report.

Note: *The "Calculate Pay Factor" report was selected for example purposes only. For more information on other available reports see* ***Section 4 Reports.***

QUALITY LEVEL ANALYSIS & PAY FACTOR COMPUTATIONS

Project Name: ASTER FALLS LOOKOUT ROAD
Project Number: MT PRA GLAC 10(64)
Project ID: DTFH7099D0001

Item Number: 55201-0800
Lot Number: 1
Lab: Central Lab

Specifications

Quality Characteristic: **28 day**
Category: 1
Number of Tests, actual: 9; estimated: 13
(min) Minimum: 4000

Quality Levels and Pay Factors

Quality Characteristic	Actual Target Value		Mean	Standard Deviation	PWL	Pay Factor
28 day	4000.00	min	4475.00	246.855	99	1.04

Current Pay Factor: 1.04
Projected Pay Factor Based On Quality Level: 1.04

Structural concrete pay factor resulting in a 1.00.

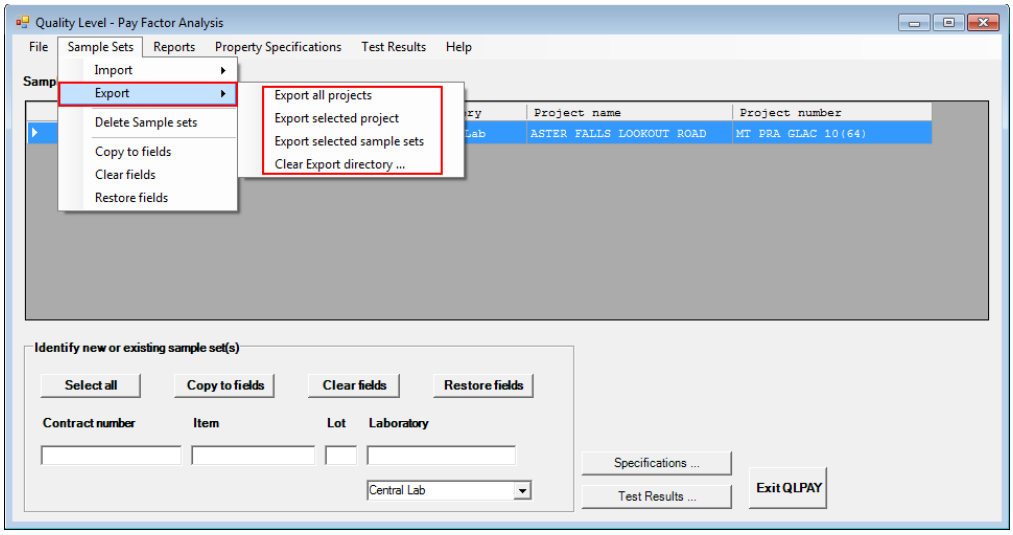
7.5. Exporting Data Example

7.5. Exporting Data Example

Sample sets can be exported from QL-PAY in three separate functions: by the selected project, all projects, or selected sample sets.

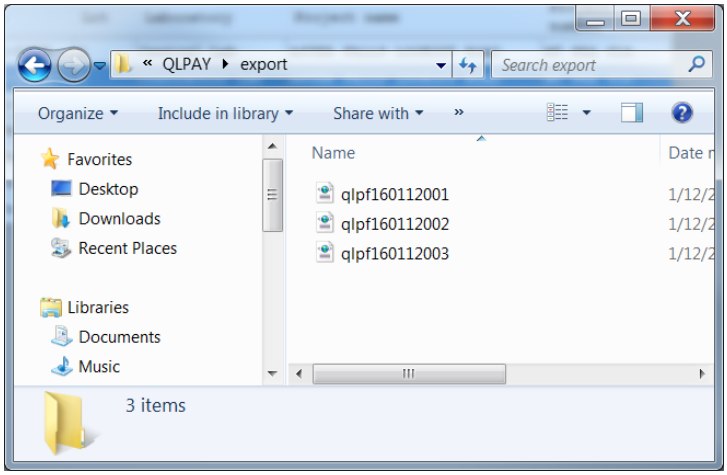
1. Selected Project: This will export any sample sets associated with the project that is currently highlighted.
2. All Projects: This option will export all projects within the QL-PAY window.
3. Selected Sample Sets: This will only export the individual sample set(s) the user has selected.

a. Select the appropriate exporting function needed by going to "Sample Sets" → "Export "→ "Export _____."



Exporting sample set functions.

b. The data set(s) will be saved in a single file and sent to the export directory. This file can now be stored on the computer or sent electronically to be used by others.



Exported file directory.