Statistical Analysis of Materials (SAM)

User Manual

Prepared by
The State Materials Lab

SAM Home Page

Type in this URL in the address bar in Internet explorer: https://business.WSDOT.wa.gov/materials/analysis/SAMUI. Then add this to your favorites for easy access.

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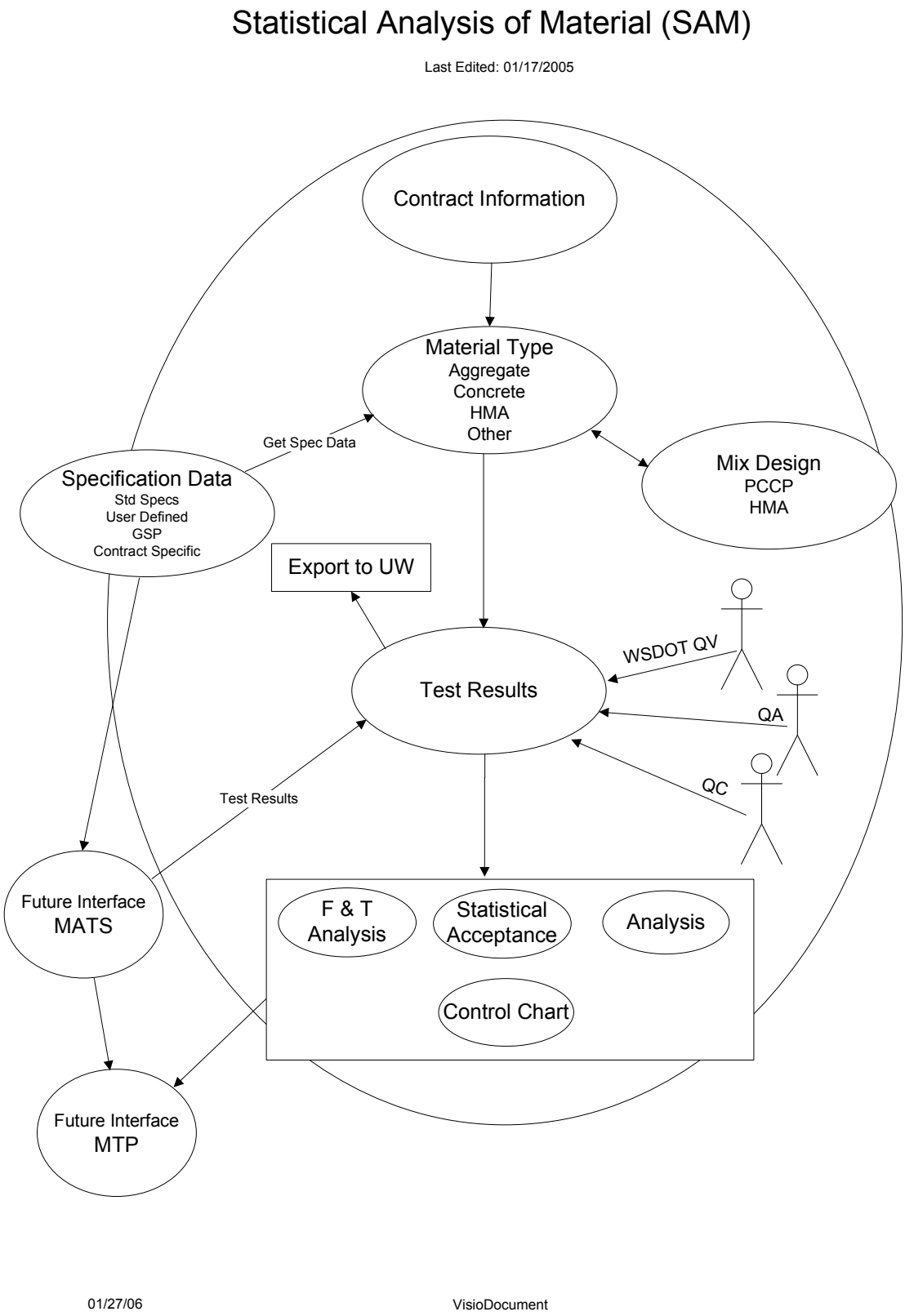
SAM CONTEXT Diagram



SAM Home Page

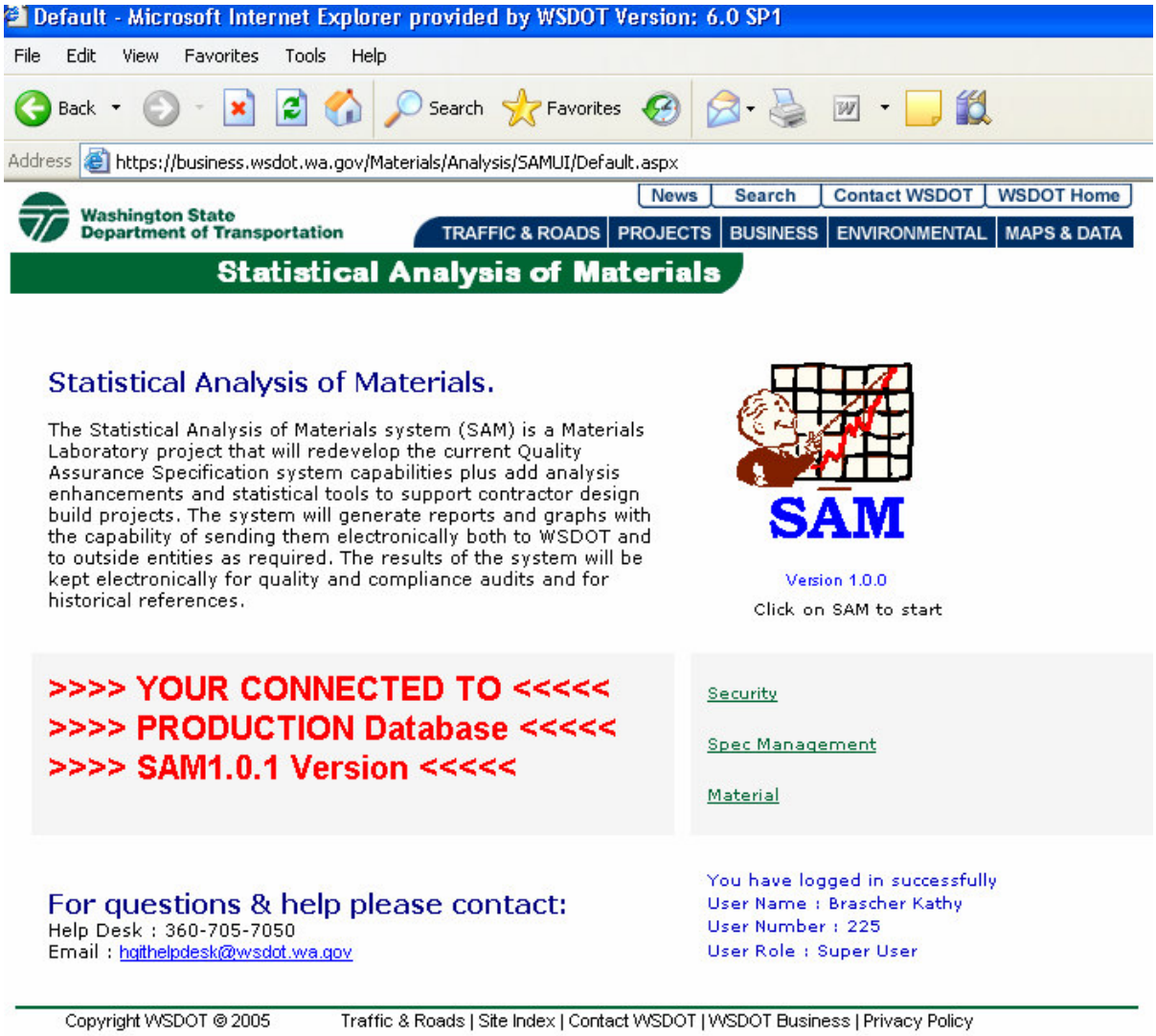


Fig 1-1 SAM Home page

Clicking on the SAM picture will connect you to the Contract Tab. (see Fig. 1-2)

Section 1. CONTRACT INFO

In this section you can establish the contract information. When this program is used for Design Build contracts, WSDOT will establish the contract information. The contractor will have the ability to view this information but will not be able to create a contract or edit any data.

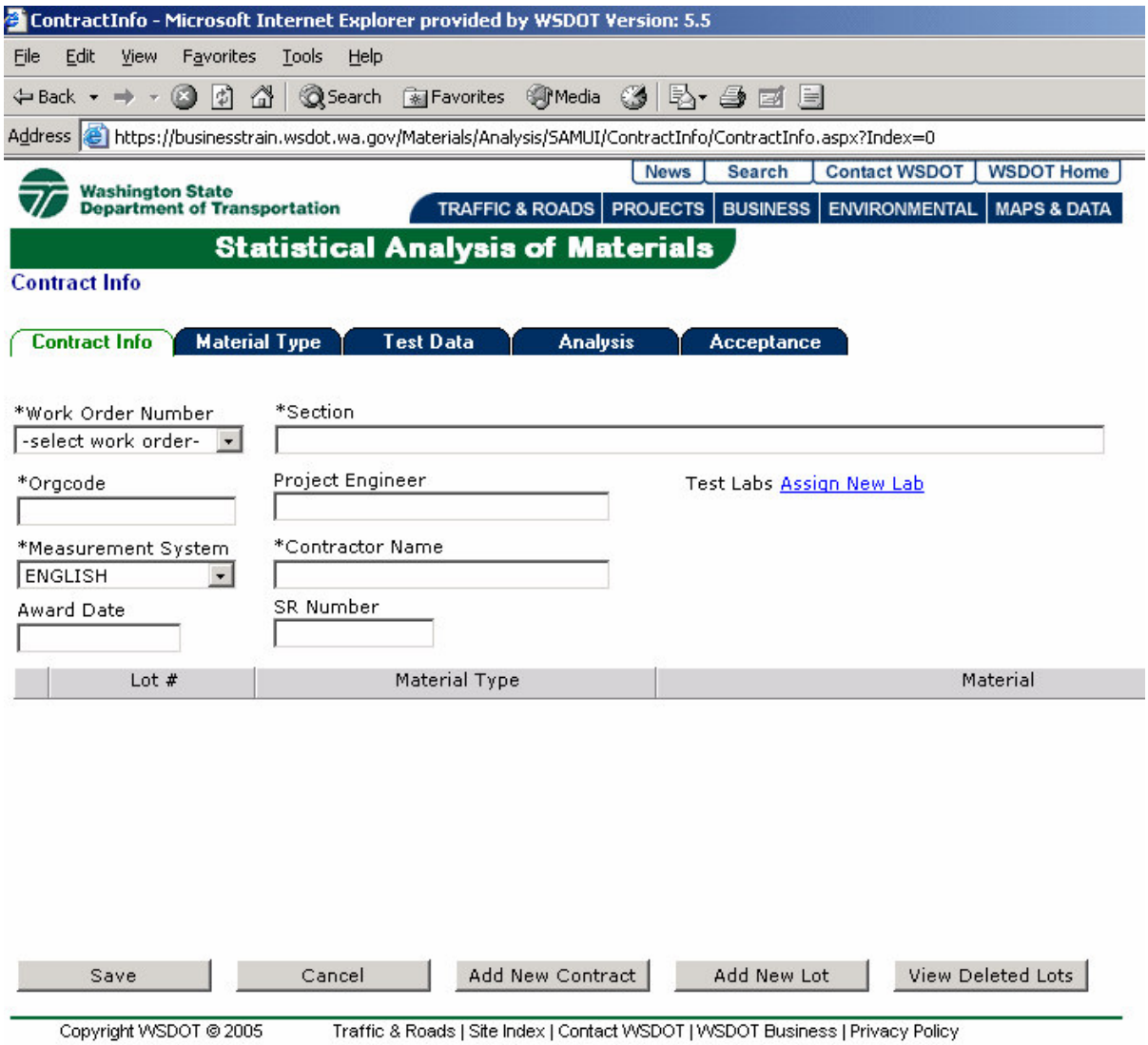


Fig. 1-2 Contract Information Page

With the Contract Info tab selected, you can select a work order number from the pull-down box in the upper left of the screen or add a new contract.

To start, you can select a work order number from the pull-down box in the upper left of the page. You will only see the work orders that have been assigned to your org code.

If you select an existing work order from the pull down box, the fields will automatically fill in with the information that is associated with that work order.

1.1 Add New Contract

If the work order that you're looking for is not available in the pull down-box, you can add it by clicking on the "add new contract" button [Add New Contract] at the bottom of the page. The program will only allow you to add contracts for your orgcode.

Once the new contract page opens, you will need to enter the work order number. Based on the work order number, the program will fill in all of the known information like Section, org code, PE Name, and SR Number. The program will not automatically fill in the contractor's name, measurement system, and award date. You will need to manually enter that information in. Anything with an asterisk (*) is a mandatory entry. Click the SAVE [Save] button after you finished. (see Fig. 1-3)

1.2 Assign Lab

Once you have entered the work order and saved it, the program will default to three labs, Field Lab, Region Lab, and HQ Lab. For each of these labs the testing type will default to Acceptance. This is typical for most of the DOT projects. If you are doing a Design Build project, the DOT will be doing the verification testing, and the contractor will be doing the acceptance testing. You will need to enter the contractor's laboratories, and the type of testing they will be doing, acceptance or quality control.

1.3 Lot Information

Material Type - On the Contract info page, you can see and access all of the material lots defined. You can edit any lot information from this page, or from the Material Type page. If no material lots have been defined, you need to either click on the "Add New Lot" or go to the Material Type Page.

1.4 Add New Lot

By clicking on the [Add New Lot] button at the bottom of the Contract Info page (Fig. 1-2), it opens up the Material Type page. On this page you can define the material lots. You have to define a materials lot before any testing data can be entered. See "Material Type"

1.5 Edit Lot

Fig. 1-3 . From the contract info page you can edit an existing lot by clicking on the lot number link, which will take you to the Material Type Page. See Material Type Page (Section 3).

1.6 Delete a Lot

This section is also the place where you can delete a material lot not used. The material lot that is deleted goes into an archived data area.

1.7 View Deleted Lot

At anytime you can view the deleted material lot be clicking on the "View Deleted Lot" button, but if you decide to reuse the lot, you will have to add a new materials lot and reenter the material lot information again. At anytime you can view the deleted material lot be clicking on the "View Deleted Lot"

[View Deleted Lots] button, but if you decide to reuse the lot, you will have to add a new materials lot and reenter the material lot information again.

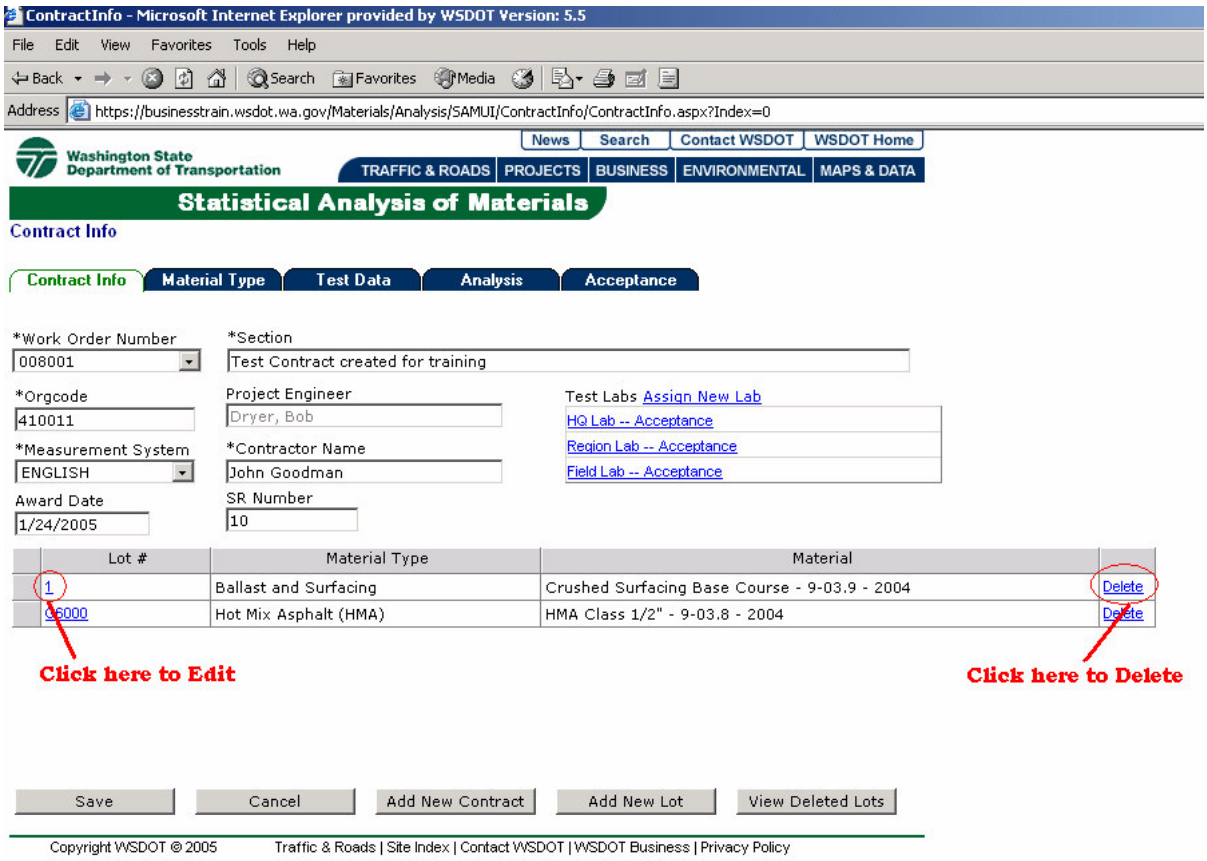


Fig. 1-3 Contract Info page - Work order with two lots defined.

Section 2. MATERIAL TYPE

This page is used to identify all of the material parameters for the material that is being evaluated. It also will identify the field that will need to be imputed for evaluation. When this program is used for Design Build contracts, the DOT will establish the material type and the lot information. The contractor will not have access to this page.

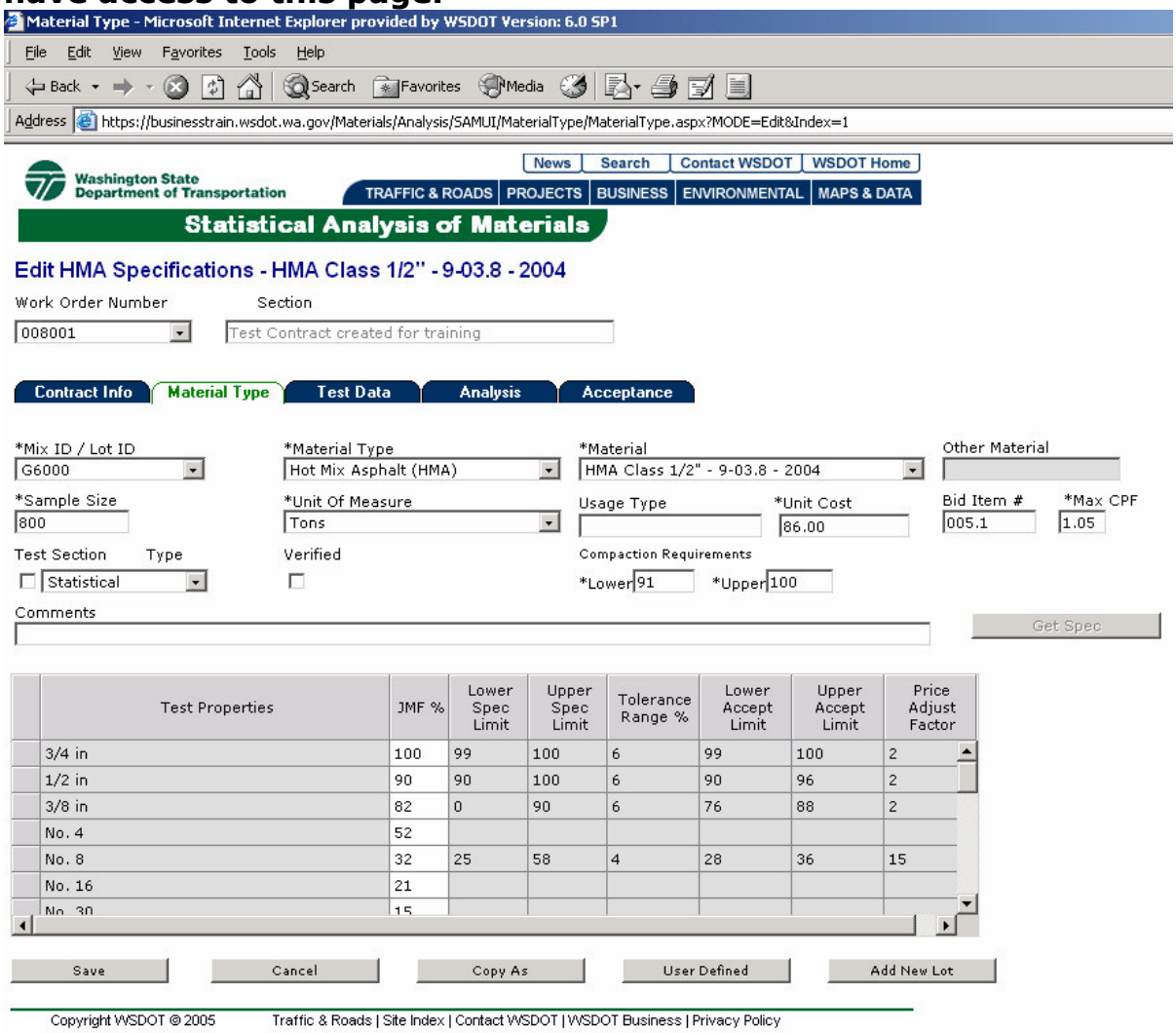


Fig. 2-1 You can access Material Type page by either choosing a lot number on the Contract Info page or by clicking Add New Lot at the bottom (refer to section 1.4, 1.5)

2.1 Edit exiting Lot

If you want to view or edit an existing materials lot; Select the mix id/lot id from the dropdown. The dropdown will have a listing of all of the lots defined for this project. Once you have selected your mix id the material type page will populate all the

information related to that mix or lot. From here you may edit any of the fields that are not grayed out. If there are test results entered for this mix id you cannot edit the specifications. You can only edit sample size, unit of measure, usage type, unit cost, bid item #, and Max CPF.

2.2 Add New Lot

To add a new Mix ID or Lot, click the Add New Lot button [Add New Lot]. This will clear the page and allow you to input your new Mix ID / Lot ID information. (Fig 2-2)

Mix ID/Lot ID – This is the number that you will use for inputting all data and for tracking all of the materials that you want to evaluate. For HMA, it is on the Mix Design. For other materials, you can define your own ID number. This is a mandatory field. Note; the program will not allow you to use duplicate ID numbers, even if you are using different materials type and materials.

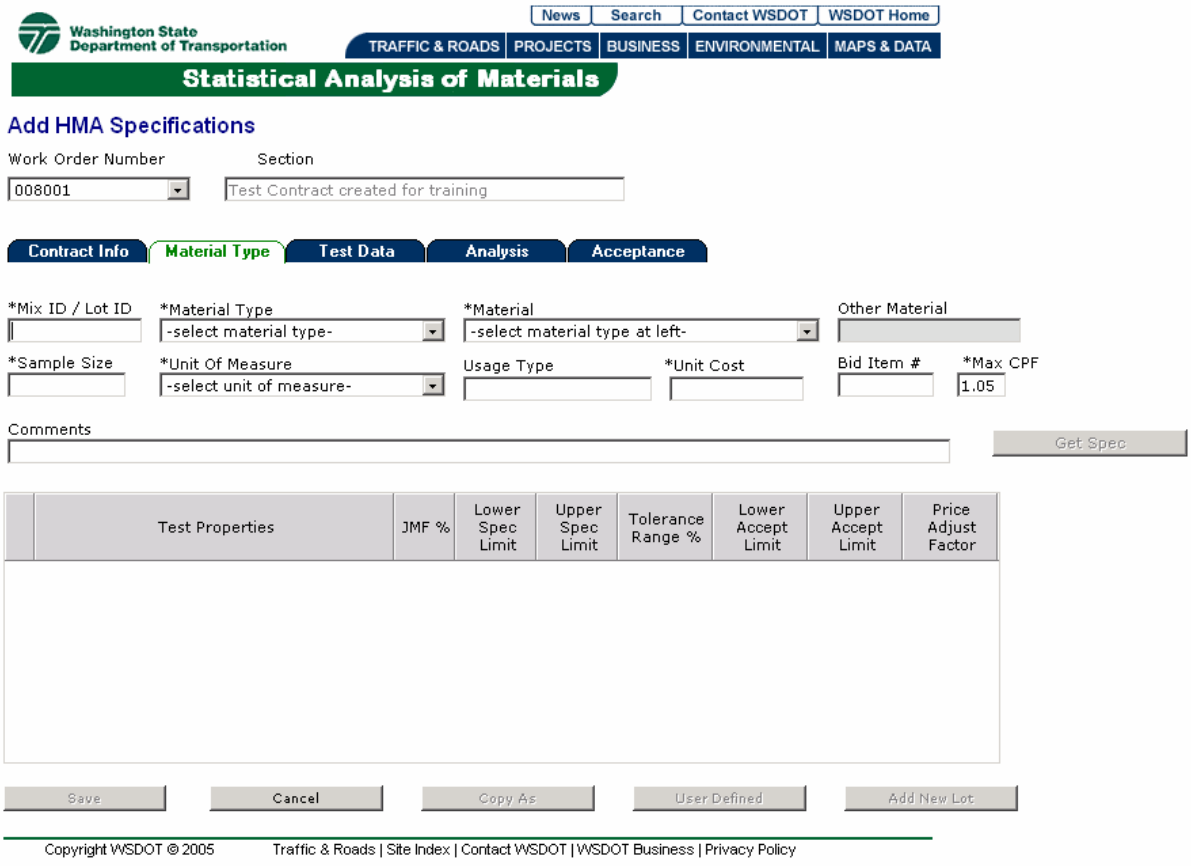


Fig 2-2 This is the page where you can enter a new mix ID/lot ID.

Material Type – This dropdown contains the listing of all the different material types found in the WSDOT Standard Specifications; i.e. HMA, Surfacing Aggregate, Concrete Aggregate, Pipe Bedding Material, etc. By selecting Material Type it will filter the materials based on material type. For example selecting HMA in Material type drop down, the material drop down will list HMA Class ½, etc. This is a mandatory field.

Material – It lists all of the materials found in the WSDOT Standard Specifications. This dropdown populates based on the Material Type Selection. This is a mandatory field.

The Material Type and Material are needed to establish the specifications that the material will be evaluated against and what is needed for the test data input.

Other Material – This allows you to input a non standard material that has been established by a special provision, or a change order to the contract.

Sample Size – Based on the specification, specify the maximum sample size, or lot size required for acceptance. This is a mandatory field.

Unit of Measure – This defines how you will be measuring the quantity of material used. This is a mandatory field.

Unit Cost – This is the cost for the material being evaluated. For aggregate, it can be found in the special provision, for HMA it is the unit bid price, and for concrete, it is stated in the Standard Specifications. This is a mandatory field.

Bid Item – This is the contract bid item associated with the material. If there is more that one bid item, list the bid item with the most material. If there are different unit costs associated with the different bid items, then they should be defined as different lots.

Maximum Composite Pay Factor – Certain materials have a maximum pay factor based on specifications. The maximum pay factor will default to specification requirements. This is a mandatory field.

Get Specifications – When you press the Get Spec [Get Spec] **button. The specifications for the material defined will appear on bottom half of the page. The Upper spec limit, the Lower spec limit, tolerance, and the Price adjustment factor will appear. See figure 2.3. The Lower Acceptance Limit and the Upper Acceptance Limit will be calculated based on the JMF and the tolerance limits.**

Enter JMF – Enter the JMF from the mix design. This will calculate the upper and lower acceptance limits.

In the future, for HMA, when you input the Mix ID number, the program will input the JMF from the MATS program.

If no specifications are retrieved make sure that you have selected whether it is a verified mix design, test section or

selected the appropriate HMA Material type. For example: there is no specification for a commercial test section verified.

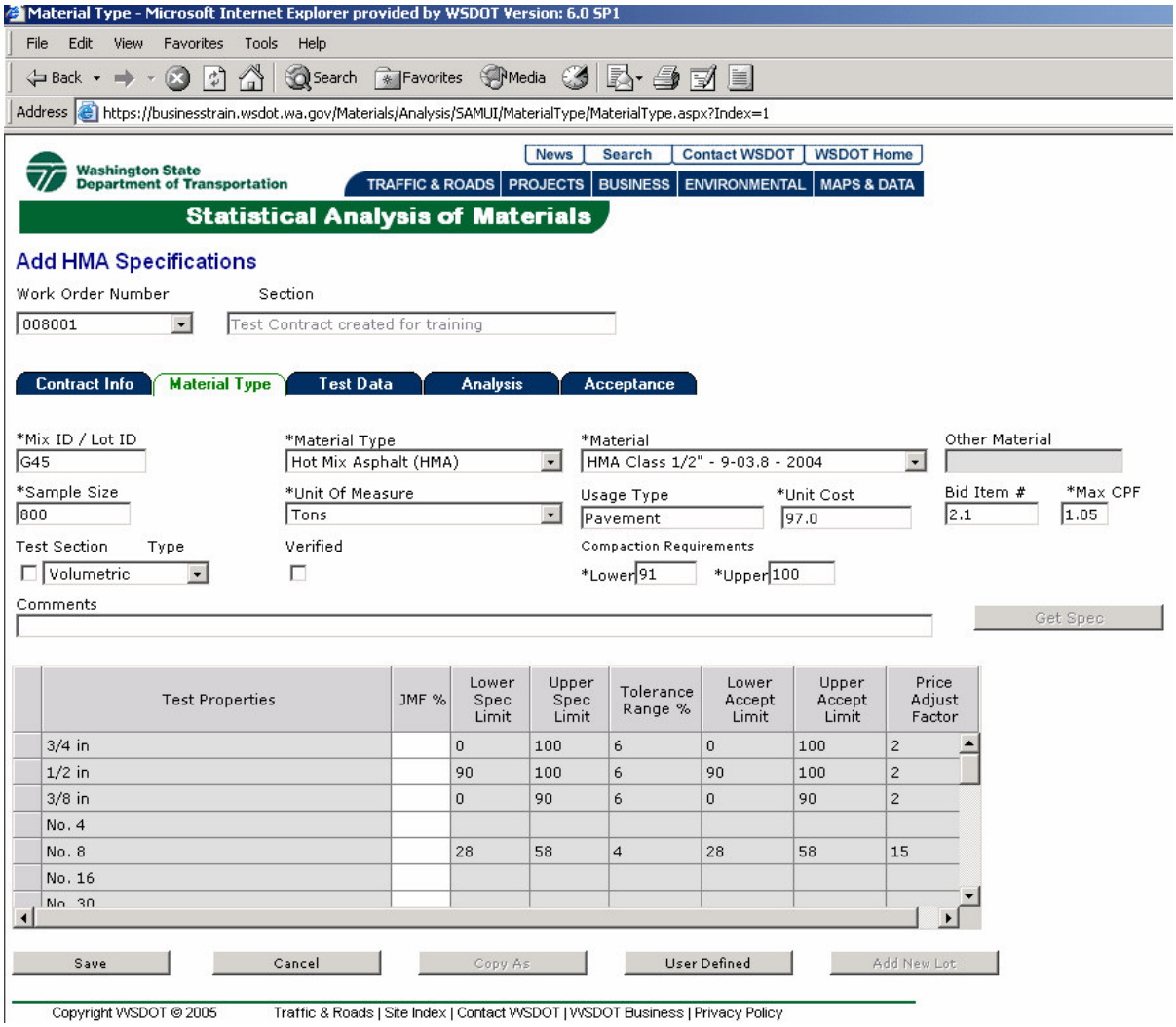


Figure 2.3 The specifications for your material will appear after you click the get spec button.

Copy As – This allows you to copy a defined HMA material lot, make the adjustment to the JMF. When you do this, the Mix ID will automatically change be adding a dash and a 1, or 2 to the original Mid ID. This was we will always be able to track the original mix ID.

User Defined – This feature allows you to edit the specifications due to a change order or special provision. After you have established the material and retrieved the specifications, you have the option to have a "user defined" lot. When you click this

button User Defined it opens up the specifications to be edited. The advantage is start with similar specifications instead of manually adding each specification. You may edit the Upper spec limit, the Lower spec limit, tolerance and the Price adjustment. This also allows you delete or add a test property and enter the specifications for that test property see fig 2.4.

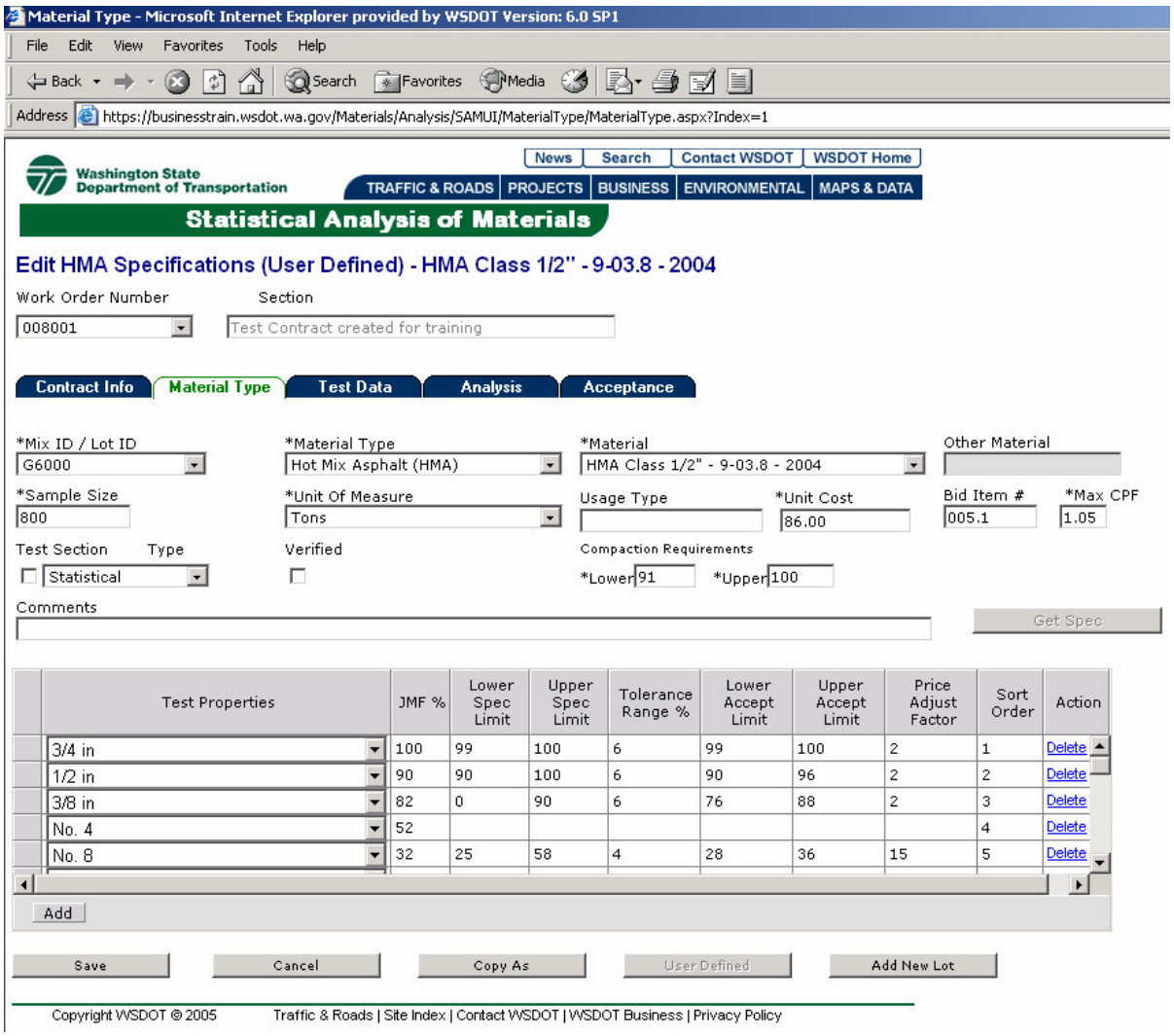


Figure 2.4 After the user defined button is clicked you may edit the specifications. Make sure you click the save button when you are done.

HMA Lot

For HMA, besides the information listed above, there is other information required: Test Section, Verified Mix Design, and HMA Material type.

Test Section – All test sections will need to be listed as a separate lot of material. You will be able to click the "Test Section" check box

when it is a test section. This will establish the appropriate acceptance criteria.

Verified Mix Design – Besides the Test Section, you will need to know if it is a verified or non-verified mix design. This also establishes the appropriate acceptance criteria.

HMA Material Type – This has to be defined to establish the appropriate acceptance criteria. You have the choice of Commercial, Non-statistical, Statistical, and Volumetric. This is a mandatory field.

Compaction Requirements – This allows you to adjust the compaction requirements based on the specification. This is a mandatory field.

Section 3. TEST DATA

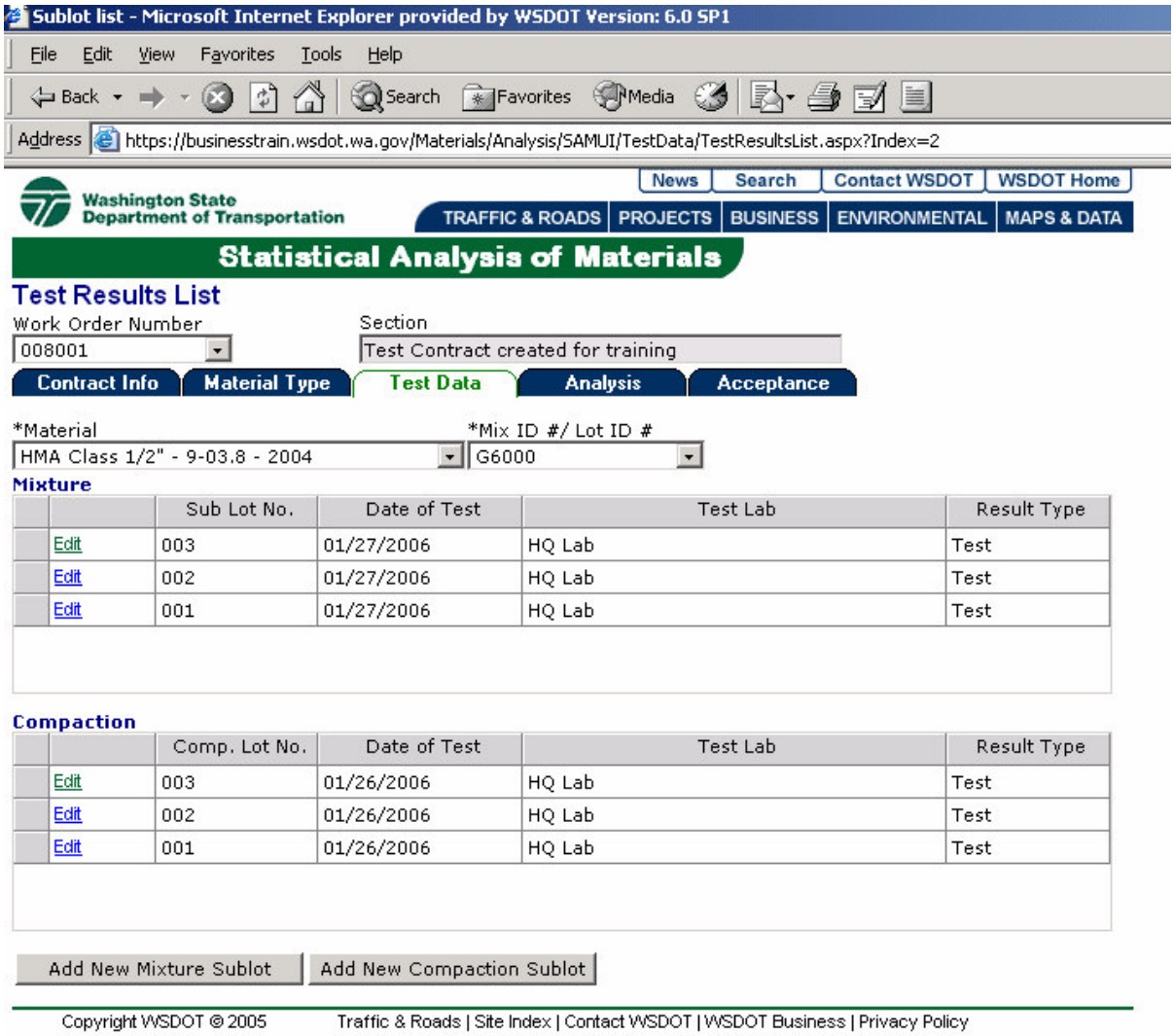


Fig. 3-1 This screen allows you to enter test data for gradation and compaction.

This page displays all the test data. The Mixture Grid will display all the gradation test data entered. The Compaction grid will display all the compaction test data.

Material - Mix ID # / Lot ID

Before any test data can be entered, the material type has to be defined. You need to pick either a Mix ID or Lot ID, or a Material before entering any test data. This is a mandatory field.

Add Mixture – Click on the Add new Mixture sublot button

to add gradation test data.

Add Compaction – Click on the Add new Compaction sublot button Add New Compaction Sublot **to add gradation test data**

Edit test data – The test data can be edited by clicking on the EDIT link

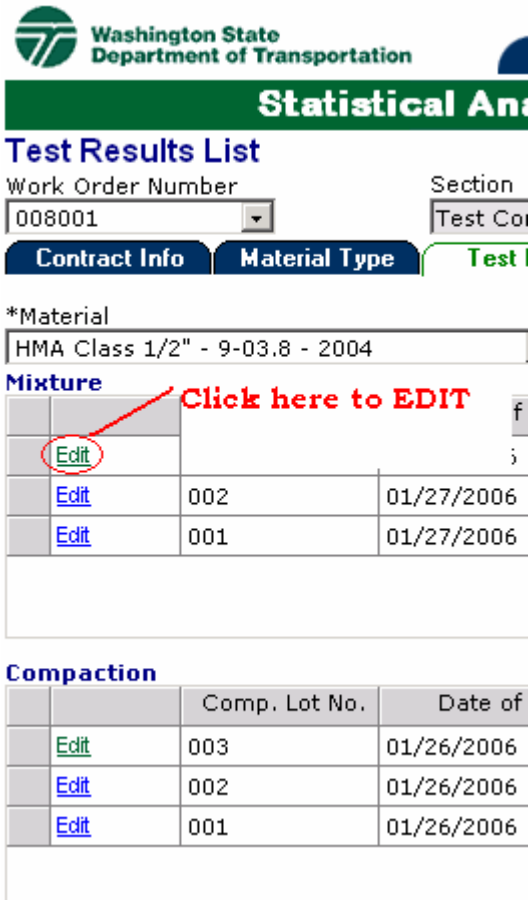


Fig 3-2 Click edit link to modify/view the test results for the sublot

3.1 Test Data for Gradation

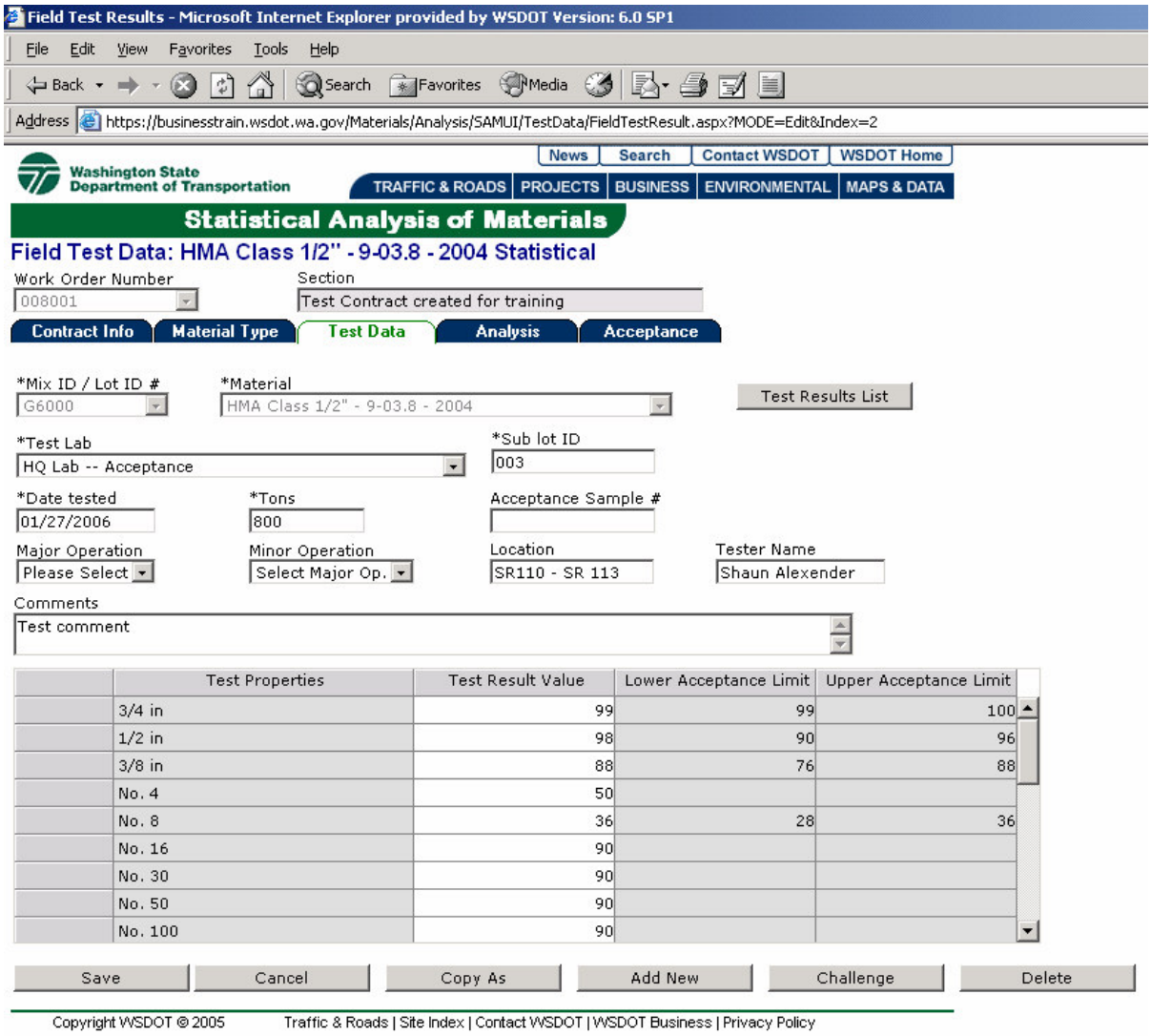


Fig 3-3 Gradation test data entry

Test Results List (button) Test Results List **This shows a list of all the test data defined for a Mix ID or Lot ID.**

Test Lab - The laboratory doing the testing will have to be selected. WSDOT will only be able to enter the WSDOT test data. If this program is used for Design Build contracts, the contractor will only be able to enter data for their laboratory. This is a mandatory field.

Sublot ID – This is the sublot number. This is a mandatory field.

Date Tested – This is the date of the testing. This is a mandatory field.

Unit of Measure – This is the sublot size. It will default to the maximum sublot size. If the sublot is smaller than the maximum, this will have to be changed to represent the sublot size. This is a mandatory field.

Acceptance Sample Number – This is your acceptance number that you use for tracking the acceptance samples.

Major Operation - Minor Operation – Location – These are fields that you can use to define where the sample was used. The major operations and minor operations dropdown come from a table that you maintain under the maintenance tab. The location can be entered for where the sample was taken or used.

Tester Name – This is the name of the qualified tester who did the testing.

Test Data – This is the location where you can input the test data. Press "Add New" to allow you to add testing data. When you are finished press the "Save" button to save the data. A new feature is "Copy AS" button. This allows you to copy a record, give it a new sublot number, just change appropriate data and save. This wills you to put in multiple records when there are only slight changes to the test data.

Challenge – This feature was added in the case of the contractor challenging the results of a sample. You can go back to the tests results screen and add the challenge sample data at a later date. Just press the "Challenge" button. This will open another column to allow you to the new challenge test results. You will have to pick the testing data that you want to use for acceptance, either the original sample or the challenge sample.

Used For Calculation ○ Test Result Value ◉ Challenge Value

Test Properties	Test Result Value	Challenge Value	Lower Acceptance	Upper Acceptance
3/4 in	100		94	100
1/2 in	98		91	100

Fig 3-4 Compaction challenge test data entry

Delete – This allows you to delete a record.

3.2 Test Data for Compaction

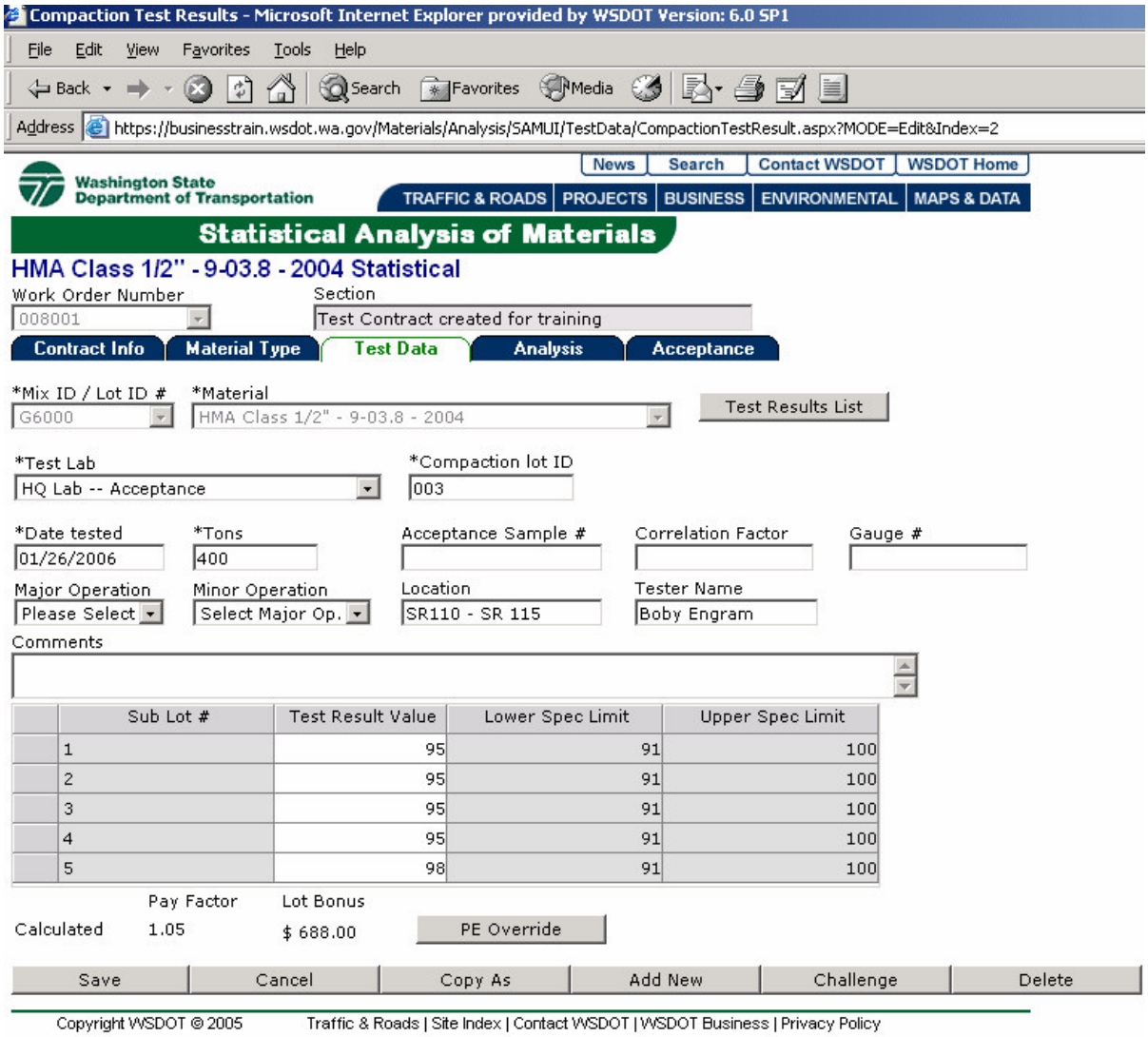


Fig 3-5 Compaction test data entry

Test Results List (button) Test Results List **this shows a list of all the test data defined for a Mix ID or Lot ID.**

Test Lab - The laboratory doing the testing will have to be selected. WSDOT will only be able to enter the WSDOT test data. If this program is used for Design Build contracts, the contractor will only be able to enter data for his laboratory. This is a mandatory field.

Compaction Lot ID – For HMA, when you press the "Compaction" button (see Fig 3-1) it open the compaction sublot

input screen. This allows you to enter the testing data. You also have the challenge option as stated above.

Date Tested – This is the date of the testing. This is a mandatory field.

Unit of Measure – This is the sublot size. It will default to the maximum sublot size. If the sublot is smaller than the maximum, this will have to be changed to represent the sublot size. This is a mandatory field.

Acceptance Sample Number – This is your acceptance number that you use for tracking the acceptance samples.

Major Operation - Minor Operation – Location – These are fields that you can use to define where the sample was used. The major operations and minor operations dropdown come from a table that you maintain under the maintenance tab. The location can be entered for where the sample was taken or used.

Tester Name – This is the name of the qualified tester who did the testing.

Test Data – This is the location where you can input the test data. Press "Add New" to allow you to add testing data. When you are finished press the "Save" button to save the data. A new feature is "Copy AS" button. This allows you to copy a record, give it a new sublot number, just change appropriate data and save. This wills you to put in multiple records when there are only slight changes to the test data.

Challenge – This feature was added so if the contractor challenges a sample, you can go back and add the challenge sample data at a later date. Just press the "Challenge" button. This will open another column to allow you to the new challenge test results. You will have to pick the testing data that you want to use for acceptance, either the original sample or the challenge sample.

Delete – This allows you to delete a record.

Correlation Factor – You can enter the nuclear gauge correlation factor. This will help to track the density results.

Gauge Number – You can enter the nuclear gauge number. This will help to track what nuclear gauges were used.

PE Overide (Button) – This function will override the calculated pay Factor.

	Pay Factor	Lot Bonus	
Calculated	1.05	$ 688.00	PE Override

Fig 3-6

Once you click on the button it will open up the Pay Factor field for editing and you will have to enter a comment. The comment field is mandatory if you are overriding a pay factor.

	Pay Factor	Lot Bonus		
Calculated	1.05	$ 688.00		
*Override	1.00	$ 0.00	*Comments	This is a test section

Fig 3-7

Section 4. ANALYSIS

This page allows you to perform a variety of analysis operations on testing data. You will be able to look at the statistical analysis of a material, plot a control chart, or perform comparison for two sets to testing data.

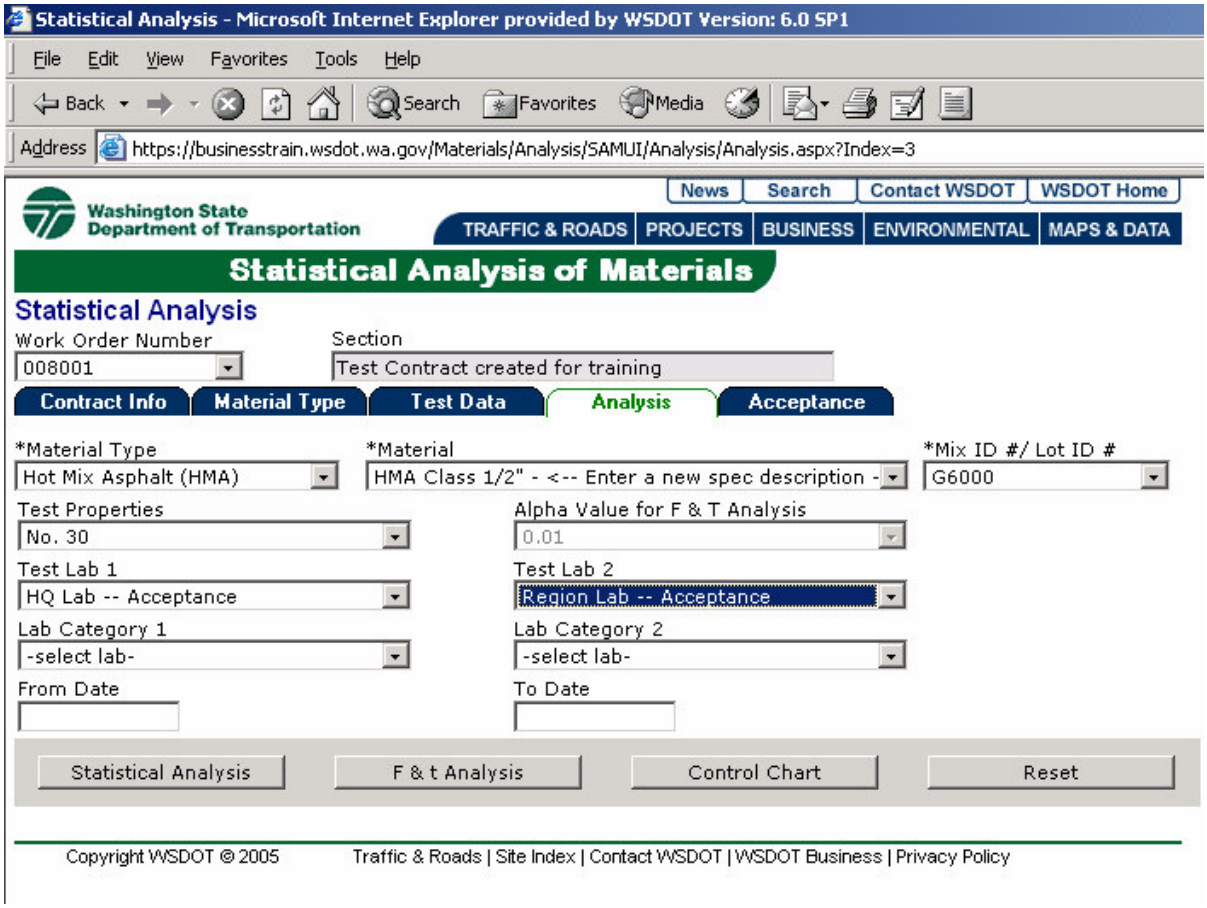


Fig 4-1 Analysis screen

Analysis – This page allows you to perform a verity of analysis operations on testing data. You will be able to look at the statistical analysis of a material, plot up a control chart, or perform comparison for two sets to testing data. When this program is used for Design Build contracts, the contractor will be able to see and evaluate all test date.

Mix ID – Lot ID – Material – Before you can evaluate any material, you need to pick the material to be evaluated. You need to pick either a Mix ID or Lot ID, or a Material before entering any test data.

From Date – To Date – This allows you to pick the dates for the material that you want to evaluate.

Test Properties – This allows you to pick the test property for the material that you want to evaluate. You can pick a single property, or all the properties that the material was tested for.

Tester Name – You can evaluate the test data from an individual tester.

Test Lab – You can evaluate the test data from an individual test lab, or lab category. For the F and t evaluation, you need to enter two laboratories for the evaluation.

Number of Samples – This displays the number of samples that will be evaluated.

Major Operation - Minor Operation – Location – These are fields that you can use to define your parameters for the evaluation.

Alpha Value – This will default to 0.01. It is used to define the risk for the acceptance of material.

Statistical Analysis – This is used to statistically evaluate a material. You can evaluate the material based on a material property, or all properties. The report will give you the number of samples evaluated, the Average, the High test result, the Low test result, and the Standard Deviation.

Control Chart – This is used to develop a control chart by plotting each test point. The chart will also plot the upper and lower spec limit. You can see trends in the material.

F and t Analysis – This allows you to compare two data sets for determining if they are from the same data population. The program will give you the same information as the statistical analysis above, and the F and t comparison. You will need to enter two laboratories to be compared. You can compare a single test property, or all test properties.

F calculation – This calculation compares the mean of the two data sets. If the mean are the same, then the data is considered

to be from the same population. If the mean is different, then the data is considered to be from different data sets.

t calculation – This calculation compares the variance of the two data sets. If the variance are the same, then the data is considered to be from the same population. If the variance is different, then the data is considered to be from different data sets.

Send Report – To send a report to the printer, just click on the print button. This will print the PDF report. To send an electronic report, click on the send button and a PDF file of the report will be sent to you email, so you can email it to the contractor.

Section 5. ACCEPTANCE

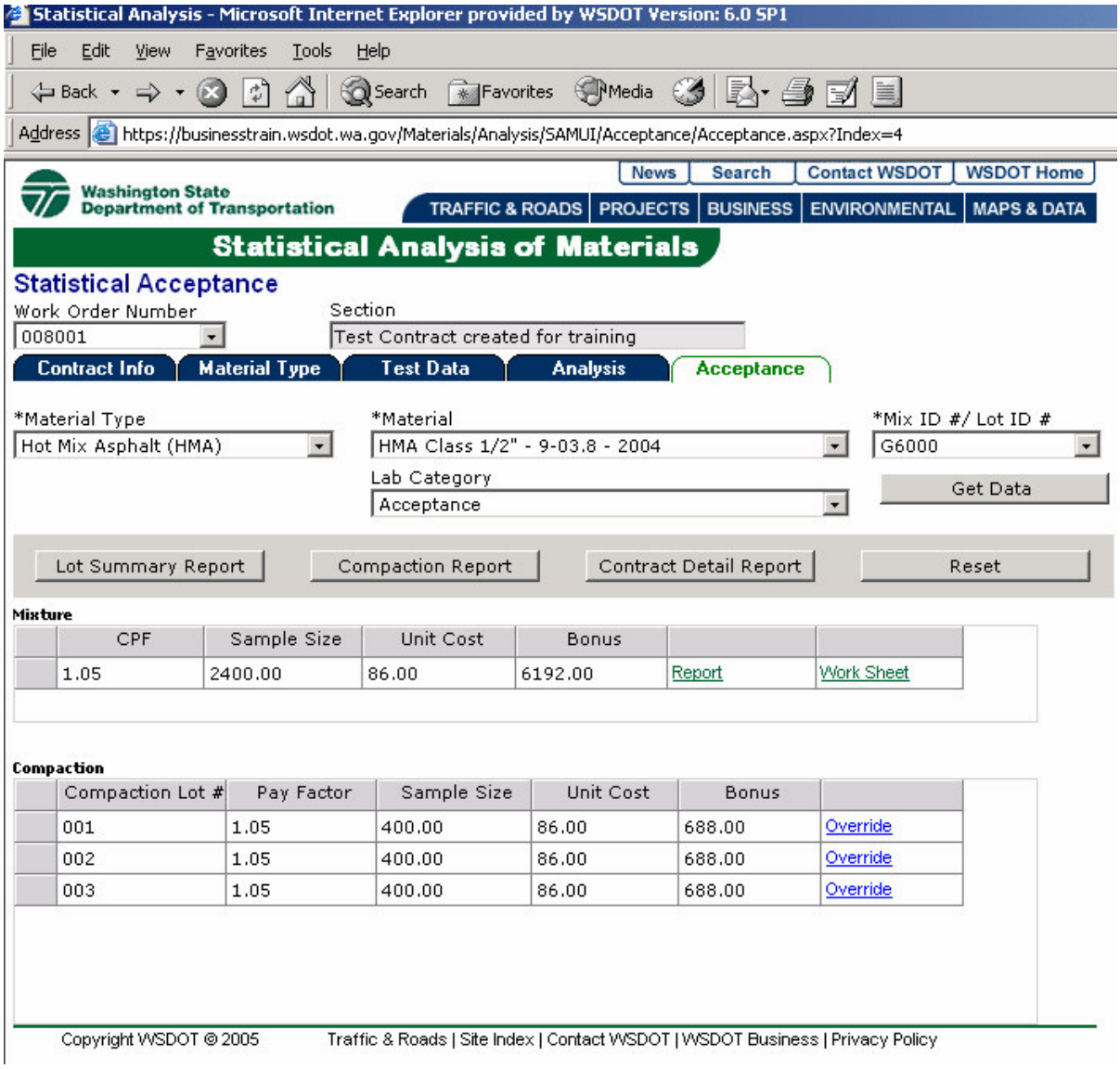


Fig 5-1 Acceptance page.

Acceptance – This page allows you to statistically accept materials according to section 1.06 of the Standard Specifications.

Mix ID – Lot ID – Material – Before you can evaluate any material, you need to pick the material to be evaluated. You need to pick either a Mix ID or Lot ID, or a Material before entering any test data.

Lab Category – This will default to the laboratory performing acceptance testing. In cases of design build, the DOT has the option to use the verification testing as acceptance.

Get Data – By pressing this button, you will see a listing of all of the data for that material that you want evaluated.

Lot Summery Report – This report shows the acceptance data and composite pay factor for the Lot of material that you are evaluating.

Contract Detail Report – This report shows the detail of how the calculations was performed, all of the factors, and the final results.

Compaction Report – This report shows the compaction acceptance data and composite pay factor for the material that you are evaluating.

Report Link/Worksheet Link – If you click on the report link it will open up the gradation acceptance report for that lot. The report opens in adobe acrobat and can be saved and sent in an email.

Mixture

	CPF	Sample Size	Unit Cost	Bonus		
	1.05	2400.00	86.00	6192.00	Report	Work Sheet

Fig 5-1 Gradation/lot report and worksheet information. This also displays the CPF and Bonus.

For a preview of the worksheet you just click the worksheet link. See fig 5-2 below.

Washington State Department of Transportation

Worksheet report

Contract Number: 008001 , Test Contract created for training

Mix ID # / Lot ID # : G6000

No. of Samples: 3 Total Quantity : 2400.00

Unit Cost : 86.00 CPF : 1.05

Gradation Bonus : 6192.00

Pay Factor Calculations For Test Property

Test property Description	Mean	Upper Limit	Lower Limit	Standard Deviation	QU	QL	PU	PL	Quality level	pay factor	price adjustment factor
3/4 in	99	100	99	0	100.00	100.00	100	100	100	1.05	2
1/2 in	98	96	90	0	100.00	100.00	100	100	100	1.05	2
3/8 in	88	88	76	0	100.00	100.00	100	100	100	1.05	2
No. 4	50			0	100.00	100.00	100	100	100	1.05	

Fig 5-2 Worksheet Report

Override Link – The override link will take you to the compaction test results page where you can enter a PE Override value. See fig 3-5 and 3-6.

Compaction

	Compaction Lot #	Pay Factor	Sample Size	Unit Cost	Bonus	
	001	1.05	400.00	86.00	688.00	Override
	002	1.05	400.00	86.00	688.00	Override
	003	1.05	400.00	86.00	688.00	Override

Send Report – To send a report to the printer, just click on the print button. This will print the PDF report. To send an electronic report, click on the send button and a PDF file of the report will be sent to you email, so you can email it to the contractor.

Section 6. Security

There are six levels of security for SAM:

Documentation Engineer
Office Adminstrator
Read only Statewide
Ready only Orgcode
Contractor
Superuser

There will be new security levels added for the next release of SAM. A new level will be created for Local Agencies so they will be able to administer their own contracts. Also, a new level will have to added for trainers.

Documentation Engineer – This level allows the user to have read/write permissions to all the information related to their contracts.

Office Administrator – This level allows the user to administer all the security for users under the same org code. They can access the security module from the SAM Home Page. They also have all the same permissions as Documentation Engineer.

Read only Statewide – This level allows the user to view all the information for state contracts.

Read only Orgcode – This level allows the user to view all the information for contracts within their org code.

Contractor – This level was created for Design Build contracts. The contractor level may input test data associated with their assigned lab and view all the reports.

To use the security module you must have office administrator level access. Click on the security link on the SAM Home Page see fig 6-1. If you need to be office administrator please call the HQ Help Desk at 360-705-7050.

Fig 6-1 Office Administrator will see the Security link on the SAM Home Page

This will bring you to the Mats Lab Security Module see fig 6-2.

Fig 6-2 Click on the User Information Link.

This loads the user information page. Select a user for the drop down box. Note: if the name of the user isn't there, please call the

HQ Help Desk to have the Materials Lab add that user for you. Select the user from the drop down box. This brings you to the user record. This page displays all the applications the user has permissions to as well as additional information like userid and org code. See Fig 6-3.

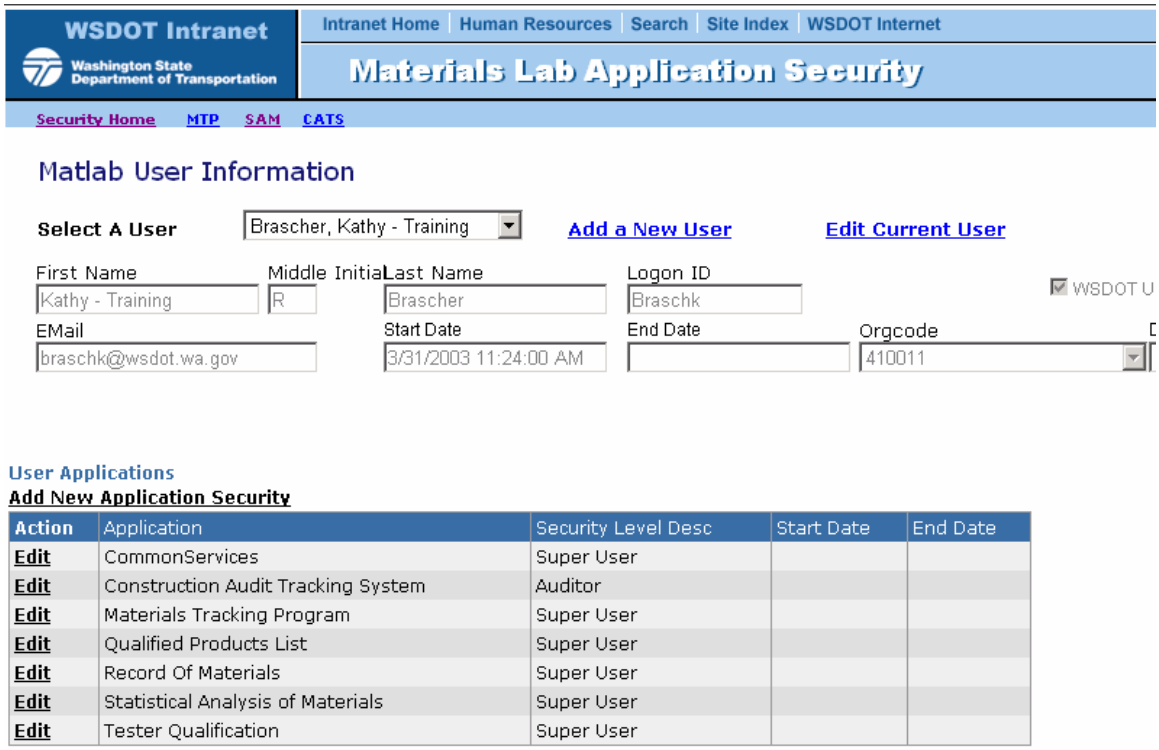


Fig 6-3 Mat Lab User Information Page

To add the user to SAM, click on "Add New Application Security". This brings you to the Add New Security Page See Fig 6-4

Fig 6-4 Add the User to the SAM application

Select the appropriate Security Level and make sure that the security status is active, if you need to change their status to inactive, this is the place. Click the Save button.

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